123 Doc EDUCATION

CORE SURGERY JOURNAL

Volume 1, Issue 2

JANUARY 2011

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

Contents

You can email us at info@123doc.com or visit us online at www.123doc.com. Alternatively, call 0207 253 4363.
123 Doc.

CORE SURGERY JOURNAL

Volume 1, Issue 2

Editorial Committee

Darryl Ramoutar
ST3 Trauma and Orthopaedics
Queen's Medical Centre
Nottingham

Conal Quah
ST3 Trauma and Orthopaedics
Royal Derby Hospital
Derby

Jeremy Rodrigues
ST3 Plastics and Reconstructive Surgery
Bradford Royal Infirmary
Bradford

Andrew Titchener
SpR Trauma and Orthopaedics
Royal Derby Hospital
Derby

James Risley
CT2 Otorhinolaryngology and Neck Surgery
Royal Derby Hospital
Derby

Vishal Patel
ST3 Trauma and Orthopaedics
Pilgrim Hospital
Boston

Editor in Chief

Mr. D. P. Forward
Queen's Medical Centre

Consultant Reviewers

Trauma & Orthopaedic Surgery	
Mr. D.P. Forward	Queen's Medical Centre
Mr. J. Geoghegan	Queen's Medical Centre
Mr. A. Patel	Hinchingbrooke Hospital
Mr. D. Rajan	Hinchingbrooke Hospital
Mr. T. Westbrook	Queen's Medical Centre
Mr. A. Tambe	Royal Derby Hospital
Mr. J. Hutchinson	Royal Derby Hospital
Mr. A. Stephen	Royal Derby Hospital
Mr. S. Auplish	Queen's Hospital Romford
General Surgery	
Mr. K. Rigg	Nottingham City Hospital
Prof. A. Acheson	Queen's Medical Centre
Mr. B. Braithwaite	Queen's Medical Centre
Mr. W. Tennant	Queen's Medical Centre
Mr. P. Driscoll	Queen Margaret Hospital
ENT	
Mr. J. Sharp	Royal Derby Hospital
Prof. N. Jones	Queen's Medical Centre
Mr. A. Sama	Queen's Medical Centre
Mr. De	Royal Derby Hospital
Mr. M. Johnston	Royal Derby Hospital
Paediatric Surgery	
Mr. A. Williams	Queen's Medical Centre
Mr. M. Shenoy	Queen's Medical Centre
Mr. N. Patwardhan	Leicester University Hospital
Urology	
Mr. D. Shipstone	Chesterfield Hospital
Mr. D. Bodiwala	King's Mill Hospital
Mr. H. Ratan	Royal Derby Hospital
Cardiothoracic Surgery	
Mr. E. Black	John Radcliffe Hospital
Mr. D. Jenkins	Papworth Hospital
Mr. M. Codispoti	Papworth Hospital
Mr. P. Catarino	Papworth Hospital
Neurosurgery	
Mr. L. Thorne	Royal Free Hospital
Ms. M. Murphy	Royal Free Hospital
Mr. G. Dow	Queen's Medical Centre
Mr. A. Helmy	Addenbrookes Hospital
Plastic & Reconstructive Surgery	
Mr. T. Rasheed	Nottingham City Hospital
Mr. P. Russell	Royal Derby Hospital
Ms. A. Raurell	Nottingham City Hospital
Mr. P. Brooks	Nottingham City Hospital
Professor P. McArthur	Whiston Hospital
Mr. I. Mackie	Royal Adelaide Hospital
Mr. J. Neil-Dwyer	Nottingham City Hospital
Allied Specialties	
Prof. S. Maxwell	Professor of Clinical Pharmacology, University of Edinburgh
Dr. J. Davies	Consultant Anaesthetist, Nottingham City Hospital

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

CORE SURGERY JOURNAL

Volume 1, Issue 2

Prospective Authors

Thank you for considering the submission of an article to 'Core Surgery'. This is a new journal aiming to educate and inform junior surgical trainees about relevant 'core' subject topics. Each issue will cover a topic from each of eight selected subspecialty fields; General Surgery, Orthopaedics and Trauma, Plastic Surgery, Ear Nose and Throat Surgery, Neurosurgery, Urology and Paediatric Surgery. Articles are not only broad enough to help in the preparation for the intercollegiate MRCS examination, but also focus on key hints and tips to facilitate in becoming a higher surgical trainee. A list of core topics in each subspecialty has therefore been agreed by the editors based on a selection of key topics in the MRCS curriculum. Articles will be commissioned from this list, and authors are advised to agree on a topic before writing an article.

Types of Article

Manuscripts are considered under the following sections:

1) Case-based discussions
2) Practical procedures
3) Audit
4) Review articles
5) Course reviews
6) Research papers

Submission of Manuscript

Submissions will only be accepted via email and must be accompanied by a covering letter. Please submit your article to **coresurgicaltrainee@googlemail.com.** The covering letter must include a statement that all authors have contributed significantly and accept joint responsibility for the content of the article. In addition any financial or other conflict of interest must be declared.

Manuscript Style

Submissions should follow the style of the Vancouver agreement detailed in the International Committee of Medical Journal Editors' revised 'Uniform Requirements for Manuscripts Submitted to Biomedical Journals: Writing and Editing for Biomedical Publication', as found at **http://www.ICMJE.org/**

References

All articles must be referenced appropriately. The Vancouver system of referencing should be used. References should be cited using superscript numerals in the order in which they appear. The list of references should reflect this order, and names of journals should be abbreviated in the style used in Index Medicus **ftp://nlmpubs.nlm.nih.gov/online/journals/ljiweb.pdf.**

Copyright

Articles accepted for publication become copyright of Core Surgery, and authors will be asked to sign a transfer of copyright form. In signing the transfer of copyright, it is assumed that authors have gained permission to use any copyrighted or previously published material. This includes all images taken or copied from books, articles, websites etc. All authors must read and agree to the conditions in the copyright agreement form and either sign the form or agree that the corresponding author can sign on their behalf. The copyright form will be issued on acceptance of the article.

Format of Articles

Guidelines for the format of respective article types are given below.

Case-based discussions

The discussions should be about 1000-1500 words long and should focus on clinical assessment, differential diagnosis or treatment. The basic structure should be as follows:

Abstract: The salient points of the case and discussion.

Case history: Including the initial presentation, clinical setting and problem, investigation and treatment.

Discussion: Covering the critical aspects of the management and the treatment options.

Practical Procedures

The procedures should be about 1000-1500 words long. Although not essential it is highly advantageous if pictures and diagrams are supplied to illustrate the most salient points. Articles should be set out as follows:

- History and pathology
- Indications and contraindications
- Gaining informed consent/explaining procedure to patient
- Equipment required
- Draping / sterile field preparation
- Patient positioning and relevant anaesthetic points
- Documentation of procedure
- Recording of complications and management of such

Audit

Articles should be 1000-1500 words long and of high quality. Completed audit cycles are strongly preferred as are audits which have led to guideline development.

CORE SURGERY JOURNAL

Volume 1, Issue 2

Review articles

The topic should be relevant to core surgical trainees, and a maximum of 2500 words long. The review should include an abstract, and a clinical vignette of a case relevant to the topic. The aim of including a clinical case is to provide a focus for discussion, and to ensure that the review is relevant and useful to our readership.

Course reviews

Should be a maximum of 1000 words and review a course which is either mandatory or desirable for core trainees and junior higher surgical trainees.

Research papers

Although the publication of research articles is not a core aim of the journal, Core Surgery welcomes research submissions if thought to be of interest to the readership. Articles should be written using the following headings (title page, abstract, introduction, methods, results, discussion, references). They should be a maximum of 2500 words of text including abstract, 30 references, 3 illustrations or figures. The abstract should be a maximum of 250 words and use the following headings (introduction, methods, results, conclusion). The title page should contain the title of the paper, the full names of the authors, the addresses of the institutions at which the research was carried out and the full postal address, email address and telephone number of the corresponding author.

MCQs / EMQs (All Articles)

Please note that all articles should be submitted with five multiple choice questions (MCQs) or extended matching questions (EMQs) attached, in the style of the Member of the Royal College of Surgeons (MRCS) 'Part A' examination. These questions should have answers and brief teaching notes/discussion included. Examples of the requirements for question style can be found here: **http://www.intercollegiatemrcs.org.uk/old/pdf/samplequestions_MCQ.pdf**

Summary

Articles considered for publication will be sent for review by our panel of consultants and junior surgical trainees. We wish you every success with your submission. Please contact the editorial team with any questions.

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

SURGICAL DIATHERMY

N Campaign

Electrosurgery is the application of a high-frequency electric current to biological tissue in order to cut, coagulate, dessicate or fulgurate tissue[1,7]. Back to Basics.

History of Electrosurgery

Electrosurgery is the application of a high-frequency electric current to biological tissue in order to cut, coagulate, dessicate or fulgurate tissue[1,7]. Diathermy was first used for therapeutic benefit when Pozzi demonstrated 'fulguration' (superficial carbonisation) as a cure for malignant disease to the Paris Academy of Medicine in 1907[2]. The first commercial electrosurgical device was developed by Dr. William T Bovie at Harvard and was used in an operating theatre in 1926 by the eminent neurosurgeon Harvey Cushing[3]. Since then electrosurgery has evolved and is used in a wide range of surgical disciplines from dermatology and urology to cardiac, plastic and general surgery.

General Principles

Diathermy is based on the principle of an electric current passing through a conductor with its energy dissipating as heat. In biological tissue the electrical conduction is primarily through interstitial fluid; however, the heat generated is dependent upon the resistance of the tissue (the conductor) and the density of the current flow, which is a phenomenon recognised as Ohm's law (the value of the electric current is equal to applied voltage over the resistance of the material - tissue)[4]. In surgery this translates to a useful effect when a large amount of electric current is passed through tissue, thus generating a rise in temperature that can be used for a practical benefit. The heat generated by the passage of a high-frequency alternating current can therefore be used for cutting tissue and as well as haemostasis.

The use of a high-frequency alternating current ensures diathermy to be safe when used properly. Low-frequency alternating current stimulates nerves and muscles (an effect called faradism) which can potentially kill a person when connected to the mains current (a low-frequency current of 1 mA can cause fatal stimulation of the heart). In addition dangerous neuromuscular effects are avoided by using high radiofrequency currents up to 2 A, which have a frequency of more than a million times than the mains current[4].

Monopolar vs Bipolar

In monopolar diathermy an active electrode with a tip of small surface area is used to concentrate heat on the operative site. A high power unit of 400W generates a high-frequency current with high power density, which then travels from the tip of the electrode through the body to a large return electrode plate. This large return electrode spreads the current out over a wider area with a low power density – thus producing little heat – before it is returned to the generator. Locally concentrated high-density currents can generate temperatures over up to 1000DC[4].

Bipolar diathermy is a low powered unit (50W) with a current passing between two small active electrodes, thereby heating the material between them. This obviates the need for a patient electrode with both the active and passive electrodes being the two poles of the forceps. Bipolar diathermy is therefore considered to be safer by not allowing the entire current to pass through the body to a passive electrode (diathermy pad). However, there are of course limitations which include the inability to transfer current to another instrument by touching it or to 'cut' tissue[5].

Diathermy Settings

Cutting is achieved by applying sufficient heat to tissue causing cell water to vaporise with the disruption of cell architecture. This occurs by using a continuous waveform to generate a high local temperature. Cutting with monopolar diathermy generally works best when the tip of the instrument (electrode) is held a small distance from the tissue causing sparks of electrical discharge to jump across the air gap and generate high temperatures to enable cutting. If the electrode is held in contact with tissue, the main resistance to flow is the tissue/instrument interface that varies depending on the tissue type. Adipose tissue has higher impedance, so diathermy will not work as effectively as higher current settings are required. When the tissue dries out and becomes dessicated the resistance also increases – making cutting less effective[4,5].

For coagulation to work, dehydration and protein denaturation must distort blood vessel walls and thereby stimulate clotting mechanisms which lead to dry and shrunken dead tissue. Intracellular temperatures do not reach boiling point thus avoiding inadvertent cutting. This is achieved because the 'COAG' setting uses a sine-wave current with pulsed, high-frequency bursts. Since the current is turned off most of the time, the current can have higher peak voltages yet apply less electrical energy – leading to a less aggressive and more continuous effect, enabling coagulation and haemostasis.

SURGICAL DIATHERMY

N Campaign

The 'COAG' setting enables the surgeon to 'fulgurate' tissue as the higher voltage enables sparks to jump across an air gap to tissue. This higher voltage property also allows fulgarisation to continue as it can drive electrical current to depth through dessicated tissue that has higher impedance (resistance).

It is also possible to 'blend' by using a continuous sine-wave with added higher intensity bursts to make a blended current for a combination of coagulation and cutting[4,5].

The amount of heat ('thermal spread') is therefore dependant on the type of instrument used, the power setting and the application time – with monopolar diathermy producing the highest temperatures and the greatest amount of lateral thermal spread[6].

Diathermy – Key Points for the Surgical Trainee

- Ensure patient plate electrode is placed on dry, shaved skin
- Contact surface area of at least 70cm^2 (usually thigh or back)
- Avoid metal prostheses, bony prominences and scar tissue
- Place dispersive electrode plate as near to operative site as possible
- Place plate as far as possible from other potential current paths to the ground (for example a drip-stand or metal part of the operating table)
- It is the responsibility of both the surgeon and the theatre nurse to ensure correct placement of electrode plate
- Use lowest practical power setting – start low and increase power as necessary
- Always keep active electrode in view
- Ensure electrodes stored in insulated container when not in use
- Avoid use near important anatomical structures
- Avoid use distal to tourniquets
- Avoid monopolar on narrow pedicles (digits, penis, spermatic cord)
- Avoid pooling of inflammable agents and alcohol
- Check different machine/manufacturer settings

Most diathermy burns are due to incorrect placement of the patient electrode[5].

Hazards of Electrosurgery[4]

There are several hazards to surgical diathermy – the risk of which can be minimised by proper placement of patient electrodes and an understanding of proper technique. There are numerous reports in the literature of examples of injuries sustained from the use of electrocautery. A case report of a neurosurgical operation on a 14-year-old girl with a previously placed indwelling titanium plate in the frontal bone highlights the dangers of "capacitative coupling" burns. After operation in the prone position the patient was found to have an area of full thickness skin necrosis over the right forehead from an aberrant circuit generated using the titanium plate as an alternative grounding electrode[8]. A recent national survery of higher surgical trainees demonstrated that only 50.8% had received formal training in the use of diathermy, 90% did not place diathermy pads themselves and 68.3% did not routinely check diathermy equipment before an operation, which may lead to an increased risk of adverse events, along with medico-legal consequences[11].

Burns

- The most common type of diathermy accident
- Superficial burns can result from alcohol-based skin preparations – ensure excess liquid removed before commencing
- Diathermy burns under patient electrode if not applied properly
- Avoid inflammable gases (including those present in the colon)

Neuromuscular Stimulation

- Sparks may invoke secondary circuits which can cause activation of nerves or skeletal muscle
- Commonly seen when used near the ureteric orifice to produce an 'obturator kick' due to stimulation of the psoas muscle via the obturator nerve.
- Also observed when dissecting through platysma muscle in operations on the neck.

Pacemakers

- High-frequency interference may inhibit or interfere with pacemakers
- Anaesthetist should have magnet available in case pacemaker needs to be reset, monitor heart rate and have defibrillator available
- Place patient electrode plate so that current path does not pass through the heart

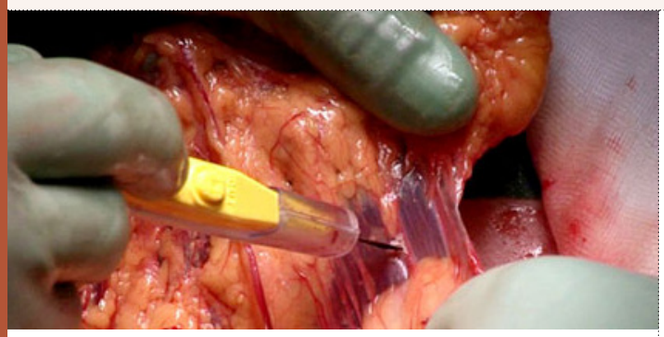
Damage to Other Structures

- Can occur due to a high heating effect on structures attached by a small pedicle, such as the appendix or gall bladder
- Due to a low cross-sectional area generating high current density, leading to tissue necrosis (for example when performing infantile circumcision)

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

SURGICAL DIATHERMY

N Campaign



Fires

- Diathermy is the most common ignition source for intraoperative fires
- Majority of fires happen during head and neck surgery due to the presence of oxygen and extensive use of lasers, which carry a relatively greater risk[10].

'Surgical smoke'

- There is some evidence that diathermy smoke produced by thermal destruction of tissues may have a hazardous effect to the health of operating theatre personnel. A recent survey showed that the majority of respondents felt inadequate measures were taken to protect staff and patients and very few surgeons used dedicated smoke extraction equipment[12].

Laparoscopic Diathermy

Laparoscopic surgery presents unique challenges for surgeons and as such has several associated risks with the use of diathermy. The incidence of recognised injuries during laparoscopic surgery is between 1 and 2 patients per 1000 operations, most of which go unrecognised at the time of surgery[9]. Difficult visualisation of anatomy can lead to diathermy being applied incorrectly or electrodes left in a body cavity may be activated by inadvertently applying a current (for example, standing on a foot switch). For this reason it is important to try and keep instruments within the field of view even when not being used.

Regular maintenance of equipment is imperative for all electrosurgical equipment, but is particularly relevant for laparoscopic procedures where a defect in the insulating sheath of an instrument may allow current to be applied to other unintended tissues.

It is important to be aware of the phenomonen of 'direct' or 'instrument-to-instrument' coupling[4] where a current path can be set up between the electrode and another conducting instrument. This is more likely to be seen when using the 'COAG' or 'BLEND' settings due to the higher voltages involved, and may occur between instruments outside of the field of view. A warning sign that this may be occurring is when the diathermy does not function as expected at the site of application or is requiring larger amounts of power.

'Capacitative coupling' is also a concept to be aware of, which occurs when an insulated instrument acts as an electrode and the laparoscopic port as another electrode, allowing current to flow to structures in contact with the port itself. There is some debate as to how often damage to tissues occurs in this way but it emphasises the importance of maintaining a good operative field of vision and the need to remove electrodes when not in use.

The main cause of electrosurgical injuries are inadvertent touching of tissues during current application, direct coupling between a portion of intestine and a metal probe touching the activated probe, insulation breaks in the electrodes, direct sparking to the intestine from the diathermy probe, and current passage to the intestine from recently coagulated, electrically isolated tissue[9].

Developments

Diathermy is used in almost all surgical specialties and there continue to be developments for its application. For example, micro-needle electocautery (MES) scalpel can be used in neurosurgery, for skin incisions and has shown 3-5 times less blood loss compared to using a scalpel[13] and the development of argon plasma coagulation (APC) has been used in the treatment of a wide range of conditions including Barrett's oesophagus[14], perennial allergic rhinitis[15] and rectal ulcers, and bleeding[16]. By understanding the principles behind electrosurgery and being aware of the pitfalls when activating 'COAG' or 'CUT' in theatre the potential hazards of diathermy can be avoided and it can continue to be an indispensable tool for the surgical trainee.

MCQs – Diathermy

Question 1

True/False: If the patient has a pacemaker in-situ monopolar diathermy is most appropriate for achieving haemostasis?

Question 2

True/False: A diathermy probe should be applied near the tip of a surgical instrument, distal to the surgeons hands to avoid aberrant conduction?

Question 3

True/False: Most diathermy-related injuries are not noticed at the time of operation and may present clinically 3 -5 days after surgery?

Question 4

True/False: Bipolar diathermy uses a low current at a high frequency and low voltage to pass a current through tissue between two electrodes?

Question 5

True/False: A metal conductive sheath around an electrode has a lower risk of causing burns than a non-conductive protective sheath in laparoscopic surgery?

SURGICAL DIATHERMY

N Campaign

Answers to MCQs

Answer 1

A: False – bipolar diathermy should be used as it avoids the possibility of current travelling through the patient to an electrode plate, thus reducing risk of interference with a pacemaker

Answer 2

A: False – a diathermy probe can be applied to any part of a surgical instrument

Answer 3

A: True

Answer 4

A: False – bipolar diathermy uses a low current at a high frequency and high voltage.

Answer 5

A: True – the induced current is conducted via the metal protective sheath and is allowed to dissipate where there is contact at the port site with the abdominal wall, reducing the risk of burns or tissue injury. Most injuries occur with monopolar diathermy? It is the surgeons responsibility legally to ensure safety (or nursing staff)

References

1. Hainer, B. L., Fundamentals of electrosurgery. Journal of the American Board of Family Practice. 1991. Nov-Dec;4(6):419-26
2. Robins, R., Rusciani, R., Robins, P., Textbook of Dermatologic Surgery. 2nd ed. Padova: Piccin Nuova Libraria. 2008. p. 505
3. McCauley, G., Understanding Electrosurgery. St. Petersburg, FL. Bovie Aaron Medical. 2003.
4. Thomas, B., McCloy, C., Backhouse, C., Gillham, N., Monk, D., Underwood, J. W., Intercollegiate Basic Surgical Skills course participant handbook. Royal College of Surgeons of England. 2007. p.41-47
5. Chalmers, C. R., Andrews, S., Parchment Smith, C., Essential Revision Notes for Intercollegiate MRCS Book 1. 2006. p. 497-498
6. Sutton, P., Awad, S., Perkins, A., Lobo, D. Comparison of lateral thermal spread using monopolar and bipolar diathermy, the Harmonic Scalpel(TM) and the Ligasure(TM). British Journal of Surgery. 2010. March; 97(3):428-433.
7. Mitchell, J. P., Lumb, G. N., The principles of surgical diathermy and its limitations. British Journal of Surgery. 1962. 50(221):314 – 320
8. Mundinger, G. S., Rozen, S. M., Carson, B., Greenberg, R. S., Redett, R. J., Case report: full-thickness forehead burn over indwelling titanium hardware resulting from an aberrant intraoperative electrocautery circuit. Eplasty. 2007. Nov 20;8:e1.
9. Nduka, C. C., Super, P. A., Monson, J. R., Darzi, A. W., Cause and prevention of electrosurgical injuries in laparoscopy. J Am Coll Surg. 1994. 179(2): 161-70.
10. Yardley, I. E., Donaldson, L. J., Surgical fires, a clear and present danger. Surgeon. 2010. Apr;8(2):87-92. Epub 2010 Feb 18.
11. Assiotis, A., Christofi, T., Raptis, D. A., Engledow, A., Imber, C., Huang, A., Diathermy training and usage trends among surgical trainees – will we get our fingers burnt?. The Surgeon. June 2009. Vol 7(3): 132-136
12. Spearman, J., Tsavellas, G., Nichols, P., Current attitudes and practices towards diathermy smoke. Ann R Coll Surg Engl. 2007. 89:162-165
13. Sheikh, B., Safety and efficacy of electrocautery scapel utilization for skin opening in neurosurgery. Br J Neurosurg. 2004. Jun:18(3):268-72
14. Rees, J.R, Lao-Sirieix, P., Wong, A., Fitzgerald, R. C., Treatment for Barrett's oesophagus. Cochrane Database Syst Rev. 2010. Jan 20;(1):CD004060.
15. Iwasaki, A., Tokano, H., Kamiyama, R., Suzuki, Y., Kitamura, K. A 24-month-follow-up study of argon plasma coagulation of the inferior turbinate in patients with perennial nasal allergy. J Med Dent Sci. 2010. Mar:57(1):11-5
16. Somani, S. K., Ghosh, A., Avasthi, G., Goyal, R., Gupta, P., Healing of a bleeding solitary rectal ulcer with multiple sessions of argon plasma. Gastrointest Endosc. 2010. Mar:71(3):578-82.

Author

Nicholas Campaign
Foundation Year Two
General Surgery
Royal Derby Hospital
email: ncampain@doctors.org.uk

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

DYNAMIC HIP SCREW INSERTION: A STEP-BY-STEP GUIDE

A Titchener, S Kumar, T Nanjayan

Dynamic Hip Screw Insertion: A Step-by-Step Guide. Featured Specialty: Trauma & Orthopaedic Surgery.

History and pathology

Overview

Sliding hip screw insertion is a common trauma surgery procedure and is often an index training case for junior surgical trainees. However the patients who undergo this procedure are often elderly and have multiple medical co-morbidities. It is essential therefore that if the most is to be made of performing this operation as a training case, then the trainee surgeon is adequately supervised and is familiar with all steps involved. Individual variations will occur between surgeons according to the requirements of the patient. However, this article will provide an overview of the procedure suitable for the junior surgeons.

Terminology

The operation is often termed a 'Dynamic Hip Screw' or 'DHSTM'. But this is also a trade name and there are a number of other terms in use for the technique; sliding hip screw or compression hip screw being commonly used descriptions. 'DHS' will be the abbreviation adopted in this article.

It should be noted that a DHS is different to an Intramedullary Hip Screw (IMHS), which is a cephalomedullary implant used for low trochanteric and reverse oblique fractures amongst other indications.

Anatomy

Blood Supply

The blood supply to the femoral neck consists of an ascending flow of blood via the capsular retinacular vessels, a supply from the intramedullary circulation, and a minor contribution from the ligamentum teres which is more relevant in children. The capsular supply originates from the medial and lateral circumflex branches of the profunda femoris artery, the posterior ascending branch of the medial circumflex usually being dominant.

Joint Capsule

The capsule attaches at the intertrochanteric line anteriorly, but posteriorly it attaches slightly more cranially and medially than this.

Preoperative Assessment and Management

Hip fractures are predominantly a disease of the elderly, and as the UK population is aging the prevalence of this fracture is increasing.

Initial assessment should include a full history and examination, and the patient should be managed according to Advanced Trauma Life Support (ATLSTM) principles. The neurovascular status of the affected limb should be documented. An Antero-Posterior (AP) and a lateral plain X-Ray of the hip are required to assess the fracture configuration.

Attention should be paid to medical comorbidities and the patient optimised for surgery as appropriate. Consideration should also be given to the underlying cause of the fracture e.g. the cause of collapse or syncopal episode, or of pathological conditions affecting the bone itself. Osteoporosis is a common cause of hip fractures[1], especially in the elderly, and NICE have issued guidance for primary and secondary prevention[2,3].

Indications

This technique is appropriate for pertrochanteric, intertrochanteric fractures and under certain circumstances for undisplaced intracapsular fractures. AO classifications 31-A1 and 31-A2 are most suited to DHS fixation. 31-A3 may be fixed using a DHS under certain circumstances. But the biomechanics of the fracture mean that this is usually not ideal. The general principle is that the line of the fracture should not lie parallel to the hip screw. This is because the screw is designed to allow collapse and impaction of fracture lines lying perpendicular to the barrel of the screw and it is unable to neutralise the shearing forces of a parallel fracture. Some 31-B type fractures may be addressed with a DHS if the fracture is undisplaced and the retinacular blood supply is thought to be uninterrupted. However care must be taken whilst reaming and a derotation wire utilised; (see operative technique section).

DYNAMIC HIP SCREW INSERTION: A STEP-BY-STEP GUIDE

A Titchener, S Kumar, T Nanjayan

Contraindications

Fractures which are unsuitable for fixation with a DHS include subtrochanteric fractures and reverse oblique fractures. In these cases the biomechanics of the defect are usually best addressed with other prostheses.

The technique is also not appropriate where malignancy is suspected. In this case long femur views should be obtained as a minimum, and arthroplasty considered. It should also not be used where there is a known or suspected allergy to the material used in the implant. Obesity may create excessive loads causing the implant to fail. Therefore, this is a relative contraindication. In this case an IMHS may be more appropriate.

Gaining informed consent /explaining procedure to patient

The patient should be fully counselled regarding the proposed procedure and the risks and benefits discussed in accordance with the General Medical Council guidelines on consent[4]. Discussion of the following points should be included and documented:

- **Details of operation, implant and location of incision**
- **Risk of infection and bleeding**
- **Possible need for blood transfusion**
- **Risk of non-union/malunion**
- **Risk of implant cut-out or failure requiring revision surgery**
- **Risk of damage to blood vessels and nerves**
- **Risks of anaesthetic technique**
- **Risk of death**
- **Alternatives to operation the risks and benefits of this**

Equipment required (not exhaustive)

Please note that as a junior trainee the importance of familiarity with the DHS equipment should not be underestimated.

Operating theatre with laminar air flow.
Radiolucent Fracture table – with traction (Fig. 1).

Figure 1. Fracture table showing position of the post which should rest on the ipsilateral ischial tuberosity.

Compression Hip Screw instrumentation set and complete set of implants and screws. Image intensifier. Diathermy and suction.

Patient positioning and fracture reduction

The patient is positioned supine on a radiolucent fracture table with the contralateral leg flexed at the hip and knee, abducted and internally rotated to allow access for the image intensifier (Fig. 2). Extra care should be taken if the patient has contralateral joint prostheses. The operative leg should be secured by a padded post resting on the ischial tuberosity of the ipsilateral pelvis, and the foot secured using the table boot, if necessary reinforced using wool and tape around the ankle. A prophylactic dose of intravenous antibiotics should be administered prior to the procedure[5].

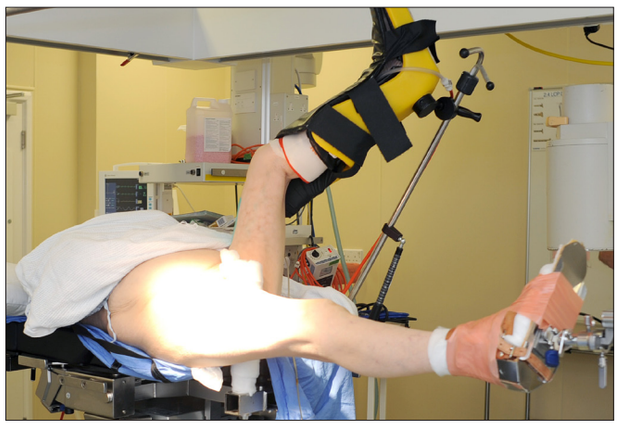


Figure 2. Patient in position for image intensifier screening and fracture reduction prior to draping.

Prior to draping the fracture position should be confirmed using an image intensifier, and good reduction obtained (Fig. 3).

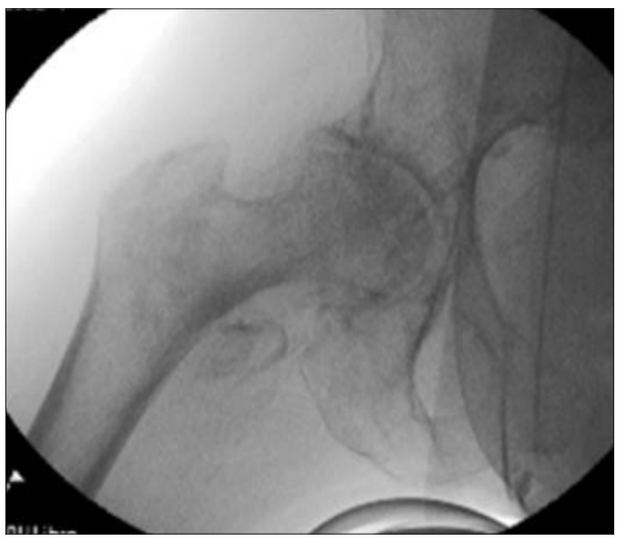


Figure 3. Reduction confirmed on Image Intensifier AP image.

DYNAMIC HIP SCREW INSERTION: A STEP-BY-STEP GUIDE

A Titchener, S Kumar, T Nanjayan

This can usually be achieved with gentle traction and internal rotation. Adequacy of reduction can easily be assessed by examining the cortex medially and posteriorly. The limb to be operated on should be parallel to the floor or slightly flexed, but not extended. Extra traction can be applied to correct the neck-shaft angle. A good tip when setting up is to ensure that the image intensifier can be easily moved in AP and lateral planes to get consistently good images. In comminuted fractures where the femoral shaft sags posteriorly, it can be a challenge to obtain and maintain closed reduction and open reduction may be required. In this case, an assistant can maintain reduction by pushing up on the femoral shaft.

Good reduction is the key to DHS surgery and is one of the important factors that the surgeon can control and influence. Poor reduction can turn what may otherwise have been a straightforward operation into a very difficult one.

Draping/sterile field preparation

The operative site is then cleaned using skin preparation such as chlorhexadine or povidone-iodine (Fig. 4).

Figure 4. Skin preparation.

A standard clear plastic screen drape is used, hung from a horizontal bar, or from a dedicated bar built into the laminar flow hood. Care should be taken to leave enough slack in the drape above the operative site so that the image intensifier can rotate over the hip to provide a lateral view (Fig. 5).

Figure 5. Preparation and draping.

Procedure

Following fracture reduction and draping, a direct lateral approach to the femur is employed, starting at the greater trochanter and extending distally. Image the hip before skin incision to get an idea of entry point for the guide pin. This will ensure that the skin incision does not extend proximally unnecessarily. The fascia lata is divided along the axis of the skin incision. The proximal femur is then exposed by either splitting vastus lateralis along the line of it's fibres or by retracting it anteriorly. If retracting be aware of the perforating vessels which pierce the lateral intermuscular septum.

A 3.2mm guidewire is then passed under image intensifier guidance (Fig. 6); the level of the lesser trochanter marks the approximate level of entry for a 135° plate (Fig. 7). The 135° guide is used ensuring that the base plate is flush to the femur. The wire is advanced under guidance towards the apex of the femoral head. A central position of the guide pin in AP and Lateral planes should be the aim. Before the fracture line is crossed, confirm the position on the lateral X-Ray and adjust appropriately. Advance until the wire is positioned in the subchondral bone (Fig. 8); the tip – apex distance should be less than 25mm[6] (this is the combined distance from the tip to the apex on an AP and lateral view).

Figure 6. Advancing the guidewire.

DYNAMIC HIP SCREW INSERTION: A STEP-BY-STEP GUIDE

A Titchener, S Kumar, T Nanjayan

Figure 7. Identification of the level of the lesser trochanter to guide placement of the incision.

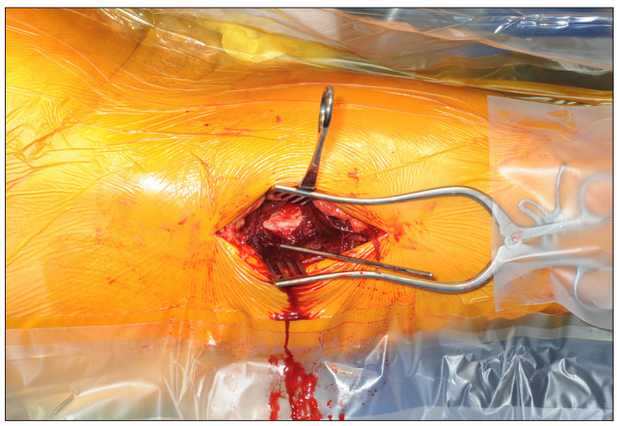


Figure 8. Guidewire insertion. The wire is measured using the depth gauge (Fig. 9) and the triple reamer used to ream a hole in the head and neck of the femur; typically the reamer is set to 5mm shorter than the measured length.

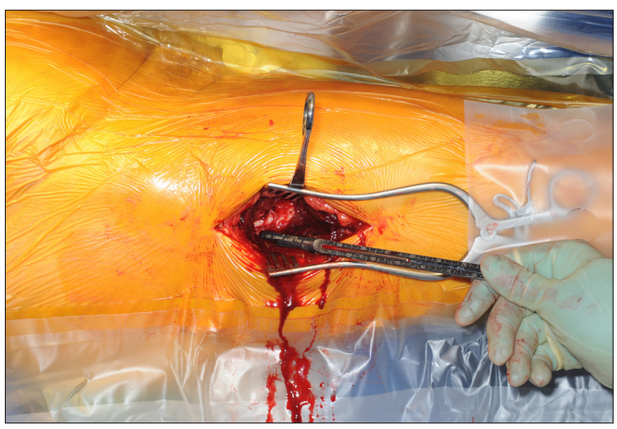


Figure 9. Measurement of the guidewire length.

The triple reamer is named as such as it reams to three diameters for the screw, the barrel of the plate and for the lateral entry point. As noted above, for basicervical fractures which are at risk of engaging with the reamer and spinning, a de-rotation wire must be passed before reaming to avoid rupture of the retinacular blood supply and devascularisation of the femoral head. While reaming the image intensifier should be used to check the wire is not advancing into the pelvis or is being pulled out. If the guide wire is accidentally pulled out, use the wire centring device in the set or a hip screw inserted with the smooth barrel into the reamed hole. Generally the hole should be tapped and the lag screw inserted paying attention to the tip-apex distance. The handle of the introducer should be left running parallel to the femur in most prostheses (Fig. 10).

Figure 10. Hip Screw insertion; the handle of the introducer is left running parallel with the femur in this prosthesis.

The plate should be advanced over the screw and impacted. The plate may then be secured to the femur using a Haygroves clamp and 4.5mm screws applied (Fig. 11).

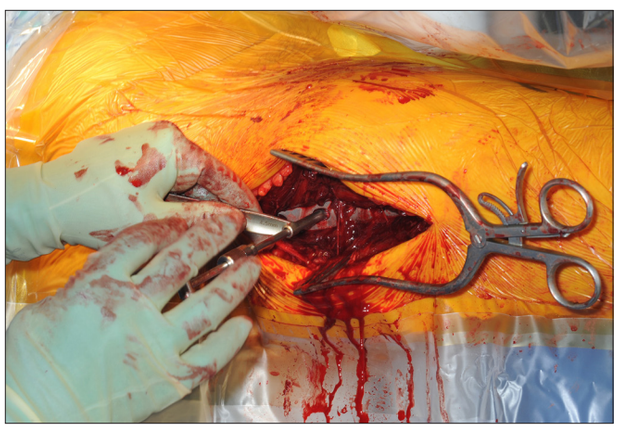


Figure 11. Placement of plate and insertion of screws.

DYNAMIC HIP SCREW INSERTION: A STEP-BY-STEP GUIDE

A Titchener, S Kumar, T Nanjayan

Compression can be achieved at the fracture site in stable intertrochanteric fractures by using the compression nut. Final X-Rays should be obtained of the plate and the screw in the AP (Fig. 12) and lateral positions.

Figure 12. AP image of the plate in-situ.

Closure is performed following wound irrigation using continuous absorbable sutures to fascia lata (e.g. loop PDSTM) and interrupted absorbable sutures to fat layer as appropriate (e.g. VicrylTM). Continuous absorbable suture to subcutaneous layer. Continuous subcuticular absorbable suture (undyed e.g. Vicryl rapideTM) or clips to skin.

It should be noted that each implant has subtle differences and specific guidance notes can often be obtained from the manufacturer[7,8,9].

Documentation of procedure

A full description of the procedure should be written in the patient notes including the following points:

- **Date/time**
- **Operation performed**
- **Indication for operation**
- **Surgeon/assistant/anaethetist**
- **Anaesthetic technique**
- **Patient positioning and reduction of fracture: noting the difficulty of reduction**
- **Draping**
- **Incision**
- **Procedure**

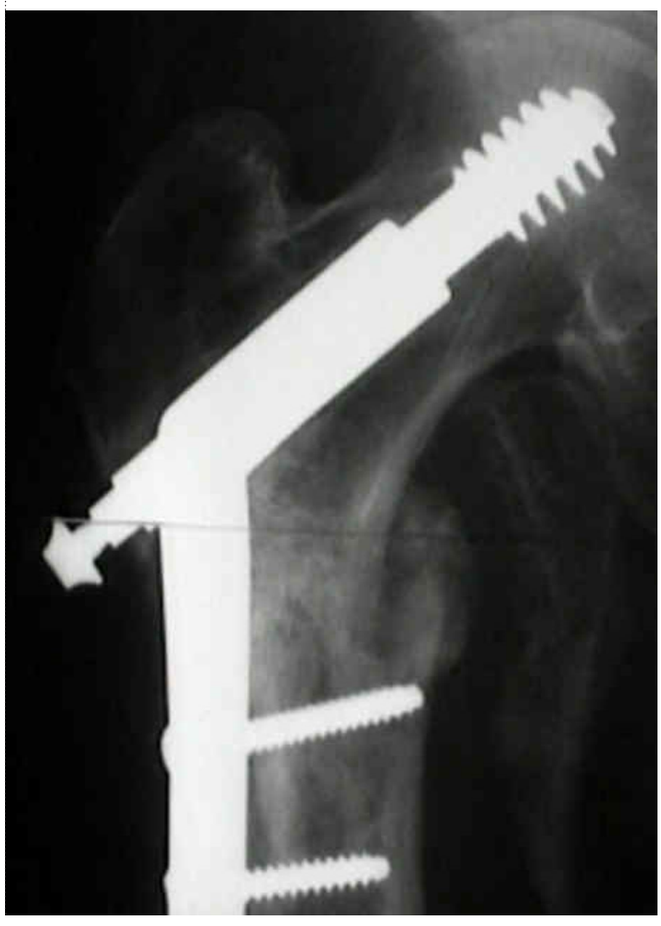
Use of image intensifier control. Measured length and length reamed. Tapping if used. Size of lag screw inserted. Plate angle and number of holes. Check X-rays performed on table.

- **Closure**
- **Immediate complications (if any)**
- **Post-operation plan to include**

Check of full blood count, urea and electrolytes and other appropriate blood tests. Check X-Ray if required. Two further doses of intravenous antibiotics if using cefuroxime prophylaxis. Thromboprophylaxis. Plan for drain removal. Full weight bearing with physiotherapist if appropriate. Outpatient follow-up plans.

Summary

Dynamic Hip Screw insertion is a core procedure for the junior orthopaedic trainee, but the potential complexity of the procedure should not be underestimated. Good reduction of the fracture is the key to making the remainder of the procedure straightforward. A comprehensive understanding of fracture configurations and reduction technique, as well as familiarity with the instruments and implants is key to obtaining good results of DHS insertion.



DYNAMIC HIP SCREW INSERTION: A STEP-BY-STEP GUIDE

A Titchener, S Kumar, T Nanjayan

Acknowledgements

There are no conflicts of interest to report. No funding was received for the preparation of this paper.

References

1) Lorich DG, Geller DS, Nielson JH. Osteoporotic pertrochanteric hip fractures – management and current controversies. Journal of Bone & Joint Surgery America 2004;86: pp. 398-410.

2) Alendronate, etidronate, risedronate, raloxifene and strontium ranelate for the primary prevention of osteoporotic fragility fractures in postmenopausal women (amended). NICE technology appraisal guidance 160 (2008; amended 2010) [Online]. Available from: **http://www.nice.org.uk/TA160** [Accessed 5th May 2010].

3) Alendronate, etidronate, risedronate, raloxifene, strontium ranelate and teriparatide for the secondary prevention of osteoporotic fragility fractures in postmenopausal women (amended). NICE technology appraisal guidance 161 (2008; amended 2010). [Online]. Available from: **http://www.nice.org.uk/TA161** [Accessed 5th May 2010].

4) General Medical Council. Consent: Patients and Doctors taking decisions together. (2008) [Online]. Available from: **http://www.gmc-uk.org/guidance** [Accessed 5th May 2010].

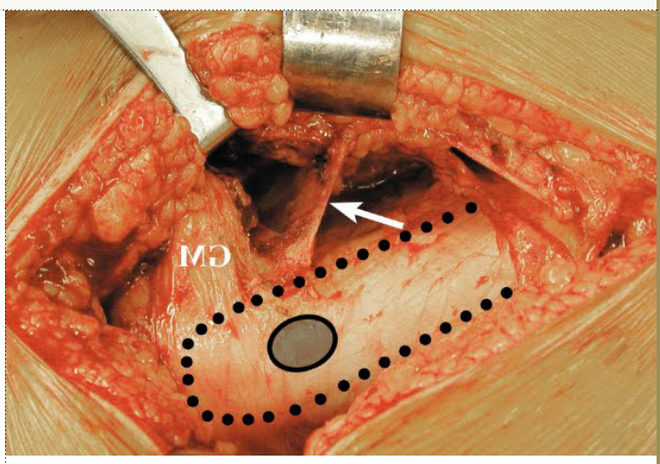
5) Bodoky, A., Neff, U., Heberer, M., Harder, F. Antibiotic prophylaxis with two doses of cephalosporin in patients managed with internal fixation for a fracture of the hip. Journal of Bone and Joint Surgery of America. 1993;75: pp. 61-65.

6) Baumgartner, M.R., Curtin, S.L., Lindskog, D.M., Keggi, J.M. The value of the tip-apex distance in predicting failure of fixation of pertrochanteric fractures of the hip. Journal of Bone & Joint Surgery Am. 1995;77: pp. 1058-64.

7) Smith and Nephew. Compression Hip Screw, Plates and Nails: Surgical Technique. [Online]. Available from: **http://ortho.smith-nephew.com/** [Accessed 5th May 2010]

8) Synthes. DHS/DCS System: Technique Guide. [Online]. Available from : **http://products.synthes.com/** [Accessed 5th May 2010]

9) Stryker. Omega 3 System. Compression Hip Screw. [Online]. Available from: **http://www.osteosynthesis.stryker.com/medias/** [Accessed 5th May 2010].



Authors

Andrew G. Titchener*, Shashi Kumar, T Nanjayan
Royal Derby Hospital

Corresponding author details

Mr. Andrew Gordon Titchener
1 Oaklands Crescent
Tattenhall
Chester
Cheshire
CH3 9QT UK

T: +44 (0)7813 672835
E: andytitch@googlemail.com

No funding was received for the preparation of this paper.

MANAGEMENT OF GALLSTONE DISEASE

SW Tang & P Thomas

Case Vignette

45-year-old Caucasian female, who was previously fit and well, presented to the accident and emergency department with a one-day history of right upper quadrant pain. She describes a colicky pain, which started two hours after dinner, and was associated with fever, nausea and two episodes of vomiting. There was no history of a similar pain previously and had no change in colour of her urine and stools.

On admission, she was found to be tachycardic (pulse – 105) and pyrexial (temperature – 38.6). On examination, she had no jaundice. Her abdomen was soft, but tender in the right upper quadrant, with a positive Murphy's sign. Blood tests showed a raised white cell count and deranged liver function tests. Ultrasound of the abdomen revealed a gallbladder containing multiple small stones, with a thickened wall. The common bile duct was not dilated. A diagnosis of acute cholecystitis was made and antibiotics were commenced. She underwent an urgent laparoscopic cholecystectomy the following day and made a good recovery from the operation. She was discharged home the next day.

Introduction

Gallstone disease is a very common condition. It affects about 10-30% of the adult western population [1, 2]. This translates to over 20 million people in the United States and 50 million patients in Europe, with about 1 million newly diagnosed patients annually[3, 4]. Gallstones are one of the commonest gastrointestinal causes of hospitalisation, and the most costly, with an annual estimated overall cost of over $5 billion dollars in the United States[5].

Pathophysiology

The gall bladder functions as an optional store and concentrator for bile. The liver secretes cholesterol, bilirubin and bile acids which are important in rendering the fats in the intestine soluble for their digestion and absorption. The formation of gallstones is the result of: (1) supersaturation of bile with cholesterol, (2) a decrease in bile salts that act to dissolve the cholesterol vesicles and (3) stasis of bile flow.

The commonest form of gallstones is cholesterol stones (80%), followed by pigment or calcium stones (20%). They can vary in size from a small grain of sand up to as large as a golf ball. Sometimes, the gallbladder only consists of microscopic stones or crystals, which is known as biliary sludge. Gallstones can migrate from the gallbladder into the cystic duct or common bile duct (CBD). It is thought that the prevalence of CBD stones in patients with symptomatic gallstones is 10%-20%[6].

Gallstones disease is becoming increasingly prevalent in the UK[7, 8]. This may be related to the aging population or increasing obesity[9]. Multiple studies have shown an association between raised serum triglycerides and cholesterol with the presence of gallstones[10-12]. However, rapid weight reduction also increases the risk of gallstones[13]. The prevalence of gallstones is higher in females, during pregnancy and in certain ethnic groups. Drugs, like hormone replacement therapy, the oral contraceptive pill and octreotide can increase the risk of gallstones. Patients with diabetes, Crohns disease, haemolytic disease and cirrhosis are also more likely to develop gallstones[14].

Clinical features

Most patients with gallstones remain asymptomatic, with only 1%-4% of them becoming symptomatic in a year[5, 15]. However, the onset of pain heralds the beginning of recurrent symptoms and identifies those at risk from complications[16]. The commonest clinical manifestations of gallstones include biliary colic and acute cholecystitis (right upper quadrant pain and tenderness with pyrexia). Other clinical presentations of gallstone disease are shown in Fig. 1.

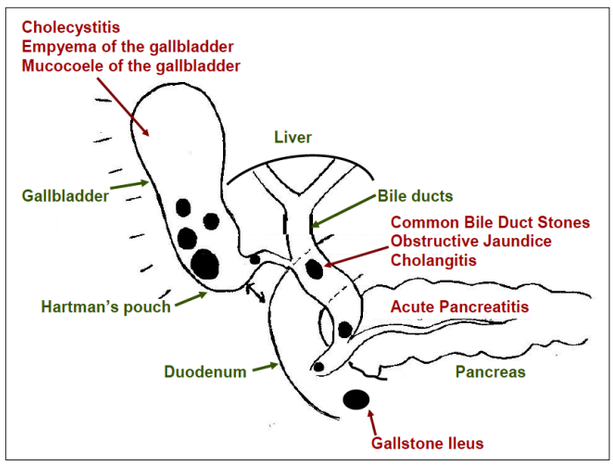


Figure 1. Clinical presentations of gallstone disease.

MANAGEMENT OF GALLSTONE DISEASE

SW Tang & P Thomas

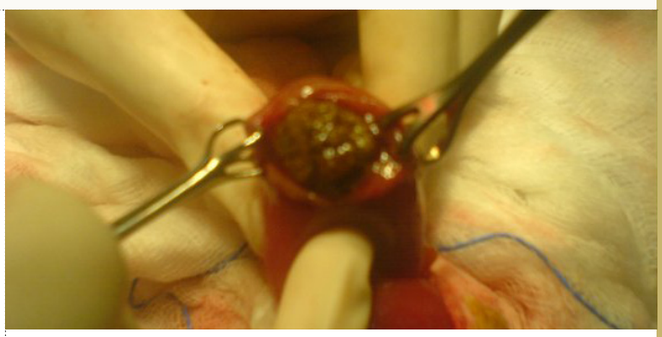
Biliary colic typically presents as a relatively severe, epigastric or right upper quadrant pain, lasting 1 to 5 hours, often waking the patient at night and sometimes provoked by meals[5]. However, gallstones are often over-diagnosed as a cause for upper gastro-intestinal (GI) symptoms, and misdiagnosed as the cause of dyspepsia, belching, flatulence or intolerance to fatty foods due to an incidental finding of gallstones during abdominal ultrasound. Rarely, it can cause Mirizzi's syndrome, where the gallstone is lodged in the cystic duct or Hartman's pouch, causing extrinsic compression of the common hepatic duct and obstructive jaundice (jaundice with associated pale stools and dark urine)[17].

The clinical history and physical examinations are crucial in making the diagnosis of gallstones disease. Initial investigations include serum liver function tests and abdominal ultrasound. Deranged serum liver function tests may suggest obstruction or inflammation in the biliary tree. Abdominal ultrasound is the most sensitive and specific test for gallstones. It identifies up to 97% of gallstones in the gallbladder and is able to characterize a thickened gallbladder wall. However, it can only identify stones above 4-5mm in diameter and is poor in identifying stones in the bile ducts. Plain Abdominal X-rays (AXR) are rarely required to diagnose gallstones, as only 10-20% of gallstones are radio-opaque. Rarely, the gallbladder may be calcified after repeated episodes of cholecystitis, which may be identified on AXR. It is only indicated if gallstone ileus is suspected, as it may show small bowel dilatation with air in the biliary tree.

The use of computerized tomography (CT) scan is limited in the diagnosis of gallstones. However, they may be carried out to identify possible complications of gallstones – i.e. perforated gallbladder, common bile duct stones or pancreatitis. The magnetic resonance cholangiopancreatography (MRCP) has emerged as a useful non-invasive modality for evaluating the biliary tree. It produces excellent views of the intra- and extrahepatic bile ducts, common bile duct and pancreatic duct, which helps identify obstruction or gallstones in the bile ducts or bile leaks. It has largely replaced the older forms of imaging of cholescintigraphy (hepatobiliary iminodiacetic acid (HIDA)) scan and oral cholecystography. Endoscopic ultrasound (EUS) combines endoscopy and ultrasound to provide high resolution images of the pancreatico-biliary system. It is much more accurate in diagnosing common bile duct stones, with a sensitivity of 95% and specificity of 98%[18]. However, it involves an invasive procedure.

Management

Patients with the incidental finding of gallstones, who are asymptomatic, should be managed expectantly as the risks of surgical and nonsurgical treatments outweigh the benefits[19, 20]. The only exception is in patients with calcified (porcelain) gallbladder, which even in the absence of gallstones should be removed given its strong association with gallbladder cancer[21]. Patients presenting with biliary symptoms require initial management of their symptoms. Biliary colic will respond to oral analgesics (opiates or non-steroidal anti-inflammatory drugs (NSAIDS)) with an antispasmodic. Patients with clinical signs and symptoms of acute cholecystitis should be treated with a broad-spectrum antibiotic and providing gallstones are identified, a cholecystectomy would be recommended.



Surgical management

Cholecystectomy has been the standard treatment for gallbladder stones. The removal of the gallbladder and gallstones removes the possibility of further acute cholecystitis, reduces the risk of acute pancreatitis and should cure biliary colic (unless stones are retained in the ducts). Symptom relief post-cholecystectomy varies from 53% to 96.8%, with significant reductions in biliary pain[22-25]. However, up to 50% of patients may have a degree of persistent symptoms, including dyspepsia, flatulence, non-specific abdominal pain and diarrhoea[22-24, 26], whilst 10% of patients report no improvement or worsening of symptoms after surgery[14]. As such, accurate diagnosis and careful patient selection is crucial, as well as ensuring realistic patient expectations prior to cholecystectomy.

Endoscopic management

Endoscopic retrograde cholangiopancreatography (ERCP) plays a crucial role in the management of common bile duct stones. It can be used to perform an endoscopic sphincterotomy and retrieve the stones by balloon catheter or basket during ERCP[27]. If the stones are too large, they can be crushed with a mechanical basket lithotripter or smashed using contact laser lithotripsy. Failing which, a biliary drainage stent can be positioned as a temporary procedure to relieve the obstruction until a definitive surgical procedure. There is a role for emergency ERCP (<24 hours) in patients with acute cholangitis or acute severe gallstone pancreatitis due to CBD stones, where sphincterotomy with stone removal is required for urgent decompression of the billiary tree[28].

Conservative Management

Acute cholecystitis may present in patients who are elderly with multiple co-morbidities, or in critically ill patients who are unfit for surgery under general anaesthesia. Although laparoscopic cholecystectomy remains the treatment of choice for cholecystitis, it carries a significant morbidity and mortality rate in these groups of patients[29, 30]. Therefore, these patients are usually treated conservatively initially with intravenous (IV) fluids and antibiotics. However, some patients may not respond to conservative treatment, and remain septic, with a risk of gallbladder perforation. Radiologically guided percutaneous cholecystostomy is a safe and viable treatment option in these patients in the acute phase, with a complete response rate of 94-100%[31, 32]. When the acute phase of cholecystitis and any associated septic complications have resolved, definitive elective surgery can then be planned with the patient in better health. In patients who are at very high operative risk, percutaneous cholecystostomy may be the single definitive treatment[33].

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

MANAGEMENT OF GALLSTONE DISEASE

SW Tang & P Thomas

Medical management

Non-surgical management is only appropriate in selected cases, where patients refuse surgery or are not fit to undergo an operation; and are only suitable for cholesterol stones.

Oral dissolution therapy utilizes bile acids to dissolve gallstones. Ursodiol (ursodeoxycholic acid, Actigal) and chenodiol (Chenix) work best for small gallstones (<0.5cm) with a high cholesterol content in patients with preserved gallbladder function[34]. They are unsuitable for those with severe recurrent symptoms and are not effective in calcified or pigment stones. They require a long course of treatment which can take up to 2 years. It may play a role in prevention of gallstone formation in very high risk groups – patients who have rapid weight reduction after bariatric surgery or patients taking octreotide. Recurrence of stones after treatment can be expected within 5 years in about 40% of patients, who may then require further treatment[35]. Contact dissolution therapy involves injecting methyl tert-butyl directly into the gallbladder to dissolve cholesterol stones. It can dissolve small stones in 1 to 3 days, but has been reported to cause irritation and severe burning pain[36]. However, up to 70% of the patients will develop recurrent stones in 4 years, which will require further treatment [37].

Extra-corporeal Shock Wave Lithotripsy (ESWL)

ESWL was initially introduced in the 1980s for the management of gallstones. It has been shown to be effective in patients with a functioning gallbladder with up to 3 cholesterol stones (<30mm), with gallstone clearance in up to 91% of patients at 18 months[38]. Best results were achieved in patients with a solitary stone which is less than 20mm. It is thought that up to 16% of patients with symptomatic gallstones may fall into the above category[5]. Treatment with ESWL requires adjuvant oral dissolution therapy for complete resolution of gallstones[39]. Complications include biliary colic, cholangitis, pancreatitis and haematuria. However, as the gallbladder remains in-situ, there is a high risk of recurrence of gallstones with up to 54% recurrence rate at 10 years[40]. As such, ESWL should only be offered in selected cases.

Laparoscopic Cholecystectomy

Previously, patients had to undergo an open procedure, which involved an oblique subcostal or upper-midline abdominal incision to remove the gallbladder. Although the surgical mortality was relatively low (0.05%), it involved a 5-day hospital stay with a 3-6 week convalescence period[4, 5]. To decrease post-operative pain and convalescence period, small-incision cholecystectomy was developed in the 1970s where a 3-6cm subcostal incision was utilised[41-43].

The introduction of laparoscopic cholecystectomy in the 1980s has revolutionized surgical practice in the management of gallstones disease (figure 2). The first laparoscopic cholecystectomy was performed by Erich Mühe in Germany in 1985[44]. It was further developed and refined by Dubois et al[45] and Perissat et al[46] in France and Reddick et al[47] in the United States which led to its rapid acceptance and popularisation throughout the world. The operation is performed under general anaesthesia and has similar risks and complications as open cholecystectomy (bleeding, bile leak or common bile duct injury (1%) and bile leak (3%))[48, 49].

However, with only 4 small (5-10mm) incisions, post-operative pain is much reduced with short inpatient stay (or day-case procedure) and shorter convalescence period (1-2 weeks)[5, 48, 50]. In case of difficulty, it can still be converted to mini-incision cholecystectomy or the traditional open cholecystectomy.

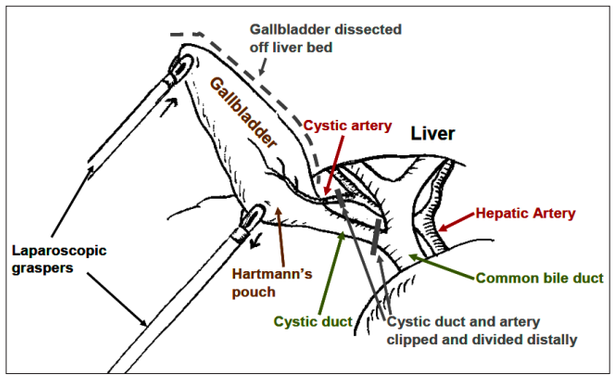


Figure 2. Displaying the Calot's triangle during laparoscopic cholecystectomy.

The superiority of the laparoscopic approach was considered obvious and it was deemed unethical to compare it with conventional open cholecystectomy in large randomised trials. The perceived decrease in surgical risk of the procedure has widened the indications and made it feasible to consider operating on patients that might not have otherwise tolerated an open cholecystectomy - i.e. elderly patients, patients with relative co-morbidities. The has led to an increased rate of cholecystectomies[51, 52], with over 600,000 laparoscopic cholecystectomies performed annually in the United States[5] and 50,000 in England[53]. Within 5 years of its introduction, it was considered the gold-standard treatment for gallstones. Operative cholangiogram can be done during the procedure to confirm the anatomy and to exclude CBD stones. Laparoscopic cholecystectomy can also be combined with laparoscopic CBD exploration to remove ductal stones.

Recently the Cochrane hepato-biliary group published a review comparing open, small-incision and laparoscopic cholecystectomy in patients with symptomatic gallstones which showed that patients who underwent laparoscopic cholecystectomy had a significantly shorter hospital stay and convalescence period compared to patients who had open cholecystectomy, but did not differ significantly in operative time, complications and mortality. However, there was no significant difference between hospital stay, convalescence period, complications and mortality when comparing laparoscopic cholecystectomy with small-incision cholecystectomy[48]. This reiterates the benefits of laparoscopic cholecystectomy over open cholecystectomy; and presents small-incision cholecystectomy as a suitable alternative to the laparoscopic technique.

MANAGEMENT OF GALLSTONE DISEASE

SW Tang & P Thomas

Early versus delayed laparoscopic cholecystectomy in acute cholecystitis

The optimal timing for cholecystectomy in a patient with acute cholecystitis has long been an area of controversy. Early operation during the acute phase (<7 days from onset of symptoms) may be technically more difficult with higher rates of complications, but delaying surgery increases the risk of gallstones related morbidity[54]. Early open cholecystectomy was shown to have no increase in morbidity and mortality than delayed open cholecystectomy[55].

During the initial introduction of laparoscopic cholecystectomy in the early 1990s, acute cholecystitis was noted to be a relative contraindication to the procedure due to a higher rate of operative morbidity[56, 57] and conversion to open cholecystectomy[58-60]. In early laparoscopic cholecystectomy, severe inflammation increases the risk of bile duct injury[61] and may obscure the view of Calot's triangle necessitating conversion to open surgery[62]. As such, patients with acute cholecystitis would be admitted into hospital for intense medical management with analgesia and antibiotics. Delayed elective laparoscopic cholecystectomy would then be scheduled a few weeks later after the acute phase of illness. However, with growing experience and skill, it has become safer to perform laparoscopic cholecystectomy in the acute phase[55].

A recent Cochrane review by Gurusamy and Samraj compared the outcomes between early (<7 days from onset of symptoms) versus delayed (more than 6 weeks after index admission) laparoscopic cholecystectomy in patients with acute cholecystitis[63]. A total of 5 trials were included where 451 patients were randomised into having early or delayed laparoscopic cholecystectomy. No significant difference was found between both groups in all outcomes measured, including bile duct injury and conversion to open procedure. Of the 216 patients in the delayed group, 40 patients required emergency laparoscopic cholecystectomy during the interim period due to non-resolving or recurrent cholecystitis. Moreover, 18 (45%) of these patients had to undergo conversion to open procedure. Though the procedures were carried out by more experienced surgeons, early laparoscopic cholecystectomy took an average of 10-30 minutes longer than delayed surgery. Total hospital stay was 4 days shorter in the early group compared to the delay group. As such, early laparoscopic cholecystectomy for acute cholecystitis was deemed to be safe, and reduced the total hospital stay[63]. Despite this evidence, a postal questionnaire survey amongst 308 consultant general surgeons showed that only 11% of patients with acute cholecystitis are routinely treated by early cholecystectomy in the UK[64]. It is thought that the lack of appropriately experienced surgeon and problems with availability of radiological investigations, surgeon availability and emergency theatre time are contributing factors.

Future directions

Recent developments in the management of gallstones disease largely revolve around ways to develop more minimally invasive techniques in cholecystectomy. This has led surgeons to seek to minimize the number and the size of incisions, or to utilize natural orifices to eliminate skin incision(s) altogether. It is hoped that less invasive techniques may have minimal or no post-procedural pain, shorten the recovery time, whilst improving cost effectiveness and patient safety.

Single-incision laparoscopic (SILS) cholecystectomy was first performed by Navarra et al. in 1997 using two 10-mm trocars and three transabdominal stay sutures to aid in gallbladder retraction[65]. Since then, various groups of surgeons has tried different methods of refining this technique of minimally invasive cholecystectomy whilst surgical companies race to develop newer equipments within this field[66]. In all cases where it has been performed, patients are meticulously chosen who did not have complications from gallstones disease. Where there are complications intraoperatively, it can be converted to a standard four-port laparoscopic cholecystectomy to complete the procedure.

Natural Orifice Transluminal Endoscopic (NOTES) Cholecystectomy is currently still in the experimental stage, where it is only performed in specialist centres which are researching this technique. The 'natural orifice' used in this procedure is preferably the vaginal vault, as transgastric and transcolonic routes are not sterile and the defects are difficult to close securely[66]. As with SILS, patients who undergo NOTES have to be carefully chosen to avoid any risk of iatrogenic visceral injury.

Though SILS and NOTES seem to be promising techniques in the field of minimally invasive cholecystectomy, their promise currently remains unfulfilled as significant ethical, technological and procedural questions remain. The fewer incisions restrict the surgeon's field of view and limit the instrumentation and movement of operative instruments, which increases the operating time. Whilst NOTES offers surgery without a visible scar, the increased risk of intra-abdominal injuries far outweighs the purported benefits of better cosmesis[66]. Also, the presumed lower post-operative pain from fewer incisions in SILS and NOTES has been a subjective conclusion which has yet to be objectively assessed in a randomised controlled trial. Furthermore, the potential added costs for advanced specialist instruments required are unknown for a technique which has not had significant demonstrable benefit. However, this is only the beginning of the development of this new technique. As modifications are made to the technological aspects of these procedures, along with increasing surgical expertise and experience, these procedures will likely yield better outcomes. Further randomised studies comparing these new techniques in cholecystectomy (NOTES and SILS) with traditional laparoscopic cholecystectomy are required to evaluate the safety, efficacy, and potential benefits (if any) that these innovative techniques may provide.

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

MANAGEMENT OF GALLSTONE DISEASE

SW Tang & P Thomas

MCQs

1. Which of the following stones occurs most commonly in the gallbladder?

A. Pigment stones
B. Cholesterol stones
C. Calcium oxalate stones
D. Uric acid stones

2. The following are clinical presentations of Raynaud's pentad, except:

A. Tachycardia
B. Hypotension
C. Abdominal pain
D. Jaundice

3. Which of the following statements is true?

A. Pigment stones are due to increased excretion of polymerised conjugated bilirubin.
B. Gallbladder epithelium is lined by simple columnar cells with brush border.
C. Common bile duct diameter of >9 mm suggests likely obstruction with common bile duct stones.
D. Gallstones are not a risk factor for the development of gallbladder carcinoma.

4. Regarding laparoscopic cholecystectomy, the following are true except

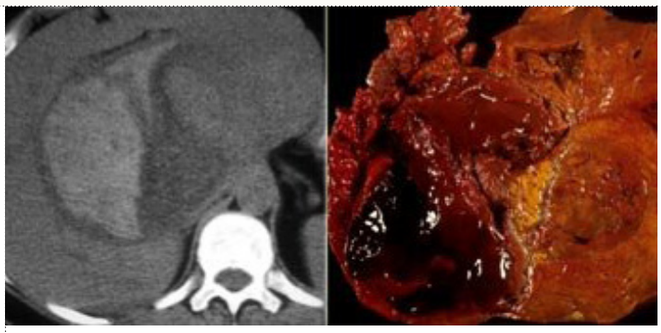
A. The veress needle is a safe technique for introducing pneumoperitoneum.
B. Previous abdominal surgery is an absolute contraindication to laparoscopic cholecystectomy
C. Dissection of Calot's triangle should be performed before the cystic artery is clipped
D. Can be performed using a three-port technique.

5. Which of the following statements regarding the management of gallstones are true?

A. All patients diagnosed to have gallstones require a cholecystectomy.
B. There is no evidence for medical management in the treatment of cholesterol gallstones.
C. Laparoscopic cholecystectomy should be delayed until 6 weeks after the acute presentation of cholecystitis.
D. There is a role for endoscopic retrograde cholangiopancreatography (ERCP) in the management of acute cholangitis

Answers

1. B 2. A 3. C 4. B 5. D

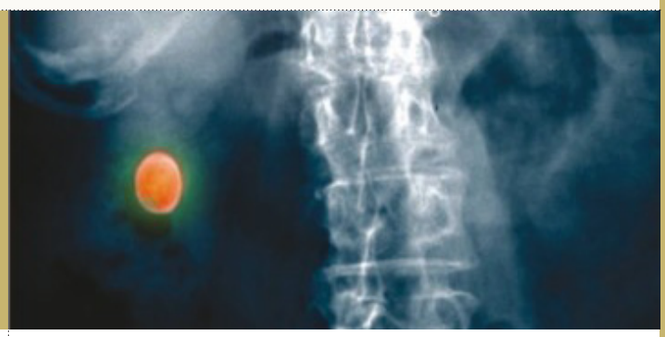


Bibliography

[1] Jorgensen T. Prevalence of gallstones in a danish population. American Journal of Epidemiology. 1987;126(5):912-21.
[2] Khan HN, Harrison M, Bassett EE, Bates T. A 10-year follow-up of a longitudinal study of gallstone prevalence at necropsy in south east england. Digestive Disease and Sciences. 2009;54(12):2736-41.
[3] Everhart JE, Khare M, Hill M, Maurer KR. Prevalence and ethnic differences in gallbladder disease in the United States. Gastroenterology. 1999;117:632-9.
[4] Keus F, Broeders IAMJ, van Laarhoven CJHM. Surgical aspects of symptomatic cholecystolithiasis and acute cholecystitis. Best Practice & Research Clinical Gastroenterology. 2006;20(6):1031-51.
[5] NIH. NIH Consensus conference - Gallstones and laparoscopic cholecystectomy. JAMA. 1993;269(8):1018-24.
[6] Williams EJ, Green J, Beckingham I, Parks R, Martin D, Lombard M. Guidelines on the management of common bile duct stones (CBDS). Gut. 2008;57:1004-21.
[7] Bates T, Harrison M, Lowe D, Lawson C, Padle N. Longitudinal study of gallstone prevalence at necropsy. Gut. 1992;33(103-107).
[8] Bateson MC. Gallbladder disease and cholecystectomy rates are independently variable. Lancet 1984;324(8403):621-4.
[9] Maclure KM, Hayes KC, Colditz GA, Stampfer MJ, Speizer FE, Willett WC. Weight, diet and the risk of symptomatic gallstones in middle-aged women. New England Journal of Medicine. 1989;9:563-9.
[10] Chapma BA, WIlson IR, Frampton CM. Prevalence of gallbladder disease in diabetes mellitus. Digestive Disease and Sciences. 1996;41(11):2222-8.
[11] Chen CY. The risk factors for gallstone disease among senior citizens: An oriental study. Hepato-Gastroenterology. 1999;46(27):1607-12.
[12] Devesa F. Cholelithiasic disease and associated factors in a Spanish population. Digestive Disease and Sciences. 2001;46(7):1424-36.
[13] Liddle RA, GOldstein RB, Saxton J. Gallstone fomration during weight reduction dieting. Archives of Internal Medicine. 1989;1989(149).
[14] Bateson MC. Gallbladder disease. BMJ. 1999;318:1745-8.
[15] Halldestam I, Enell EL, Kullman E, Borch K. Development of symptoms and complications in individuals with asymptomatic gallstones. British Journal of Surgery. 2004;91:734-8.
[16] Lund J. Surgical indication in cholelithiasis: prophylactic cholecystectomy elucidated on the basis of long-term follow up on 526 non-operated cases. Annals of Surgery. 1960;151:153-62.
[17] Mirizzi PL. Syndrome del conducto hepatico. J Int de Chir. 1948;8:731-77.

MANAGEMENT OF GALLSTONE DISEASE

SW Tang & P Thomas



Management of gallstone disease.
Surgical Specialties: General Surgery.

[18] Tse F, Barkun JS, Romagnuolo J, Friedman G, Bornstein JD, Barkun AN. Nonoperative imaging techniques in suspected biliary tract obstruction. HPB (Oxford). 2006;8(6):409-25.
[19] Gurusamy KS, Samraj K. Cholecystectomy versus no cholecystectomy in patients with silent gallstones. Cochrane Database of Systematic Reviews. 2007(1):CD006230.
[20] Portenier DD, Grant JP, Blackwood HS, Pryor A, McMahon RL, DeMaria E. Expectant management of asymptomatic gallbladder at Roux-en-Y gastric bypass. Surgery for Obesity and Related Diseases. 2007;3(4):476-9.
[21] Stephen AE, Berger DL. Carcinoma in the porcelain gallbladder: a relationship revisited. Surgery. 2001;129(6):699-703.
[22] Gui GPH, Cheruvu CVN, West N, Sivaniah K, Fiennes AGTW. Is cholecystectomy effective treatment for symptomatic gallstones? Clinical outcome after long term follow up. Annals of Royal College of Surgeons of England. 1998;80:25-32.
[23] Ros E, Zambon D. Postcholecystectomy symptoms. A prospective study of gallstone patients before and two years after surgery. Gut. 1987;28:1500-4.
[24] Ure BM, Troidl H, Spangenberger W, Lefering R, Dietrich A, Eyspasch EP, et al. Long-term results after laparoscopic cholecystectomy. British Journal of Surgery. 1995;82(2):267-70.
[25] Rusello D, Stefano AD, Scala R, Favetta A, Emmi S, Guastella T, et al. Does cholecystectomy always resolve biliary disease? Minerva Chirurgica. 1997;52(12):1435-9.
[26] Bates T, Ebbs SR, Harrison M, A'Hern RP. Influence of cholecystectomy on symptoms. British Journal of Surgery. 1991;78(8):964-7.
[27] Tham TCK, Carr-Locke DL. Endoscopic treatment of bile duct stones in elderly people. Consider cholecystectomy unless patient is unfit. BMJ. 1999;318:617-8.
[28] NIH. NIH state-of-the-science statement on endoscopic retrograde cholangiopancreatography (ERCP) for diagnosis and therapy. NIH Consensus and state-of-the-science statements. 2002 Jan 14-16;19(1):1-26.
[29] Edlund G, Ljungdahl M. Acute cholecystitis in the elderly. American Journal of Surgery. 1990;159:414-6.
[30] Houghton PW, Jenkinson LR, Donaldson LA. Cholecystectomy in the elderly: a prospective study. British Journal of Surgery. 1985;72:220-2.
[31] Borzelino G, Manzoni Gd, Ricci F, Castaldini G, Guglielmi A, Cordiano C. Emergency cholecystostomy and subsequent cholecystectomy for acute gallstone cholecystitis in the elderly. British Journal of Surgery. 1999;86:1521-5.
[32] Teoh WMK, Cade RJ, Banting SW, Mackay S, Hassen AS. Percutaneous cholecystostomy in the management of acute cholecystitis. ANZ Journal of Surgery. 2005;75:396-8.
[33] Griniatsos J, Petrou A, Pappas P, Revenas K, Karavokyros I, Michail OP, et al. Percutaneous cholecystostomy without interval cholecystectomy as definitive treatment of acute cholecystitis in elderly and critically ill patients. Southern Medical Journal. 2008;101(6):586-90.
[34] Neligan P, Bateson MC, Trash DB, Ross PE, Bouchier IAD. Ursodeoxycholic acid for the dissolution of radiolucent gallbladder stones. Digestion. 1983;28:225-33.
[35] Hood KA, Gleeson D, Ruppin DC, Dowling RH. Gallstone recurrence and its prevention: the British/Belgian Gallstone study group's post-dissolution trial. Gut. 1993;34:1277-88.
[36] Hellstern A, Leuschner U, Benjaminov A, Ackermann H, Heine T, Festi D. Dissolution of gallbladder stones with metyle tert-butyl ether and stone recurrence: a European study. Digestive Disease and Sciences. 1998;43:911-20.
[37] Pauletzki J, Holl J, Sackmann M, Neubrand M, Klueppelberg U, Sauerbruch T, et al. Gallstone recurrence after direct contact dissolution with metyltert-butyl ether. Digestive Disease and Sciences. 2005;40(8):1775-81.
[38] Ferrucci JT. Gallstone ESWL - The First 175 patients. American Journal of Roentgenology. 1988;150(6):1231-3.
[39] Torres WE, Baumgartner BR, Nelson RC, Morris SJ. Shock Wave Lithotripsy of Gallstones: Results and 12-month follow-up in 174 patients. Radiology. 1991;179:699-701.
[40] Carrilho-Ribero L, Pinto-Correia A, Velosa J, Carneiro-De-Moura M. A ten-year prospective study on gallbladder stone recurrence after successful extracorporeal shock-wave lithotripsy. Scandinavian journal of Gastroenterology. 2006;41(3):338-43.
[41] Dubois F, Berthelot B. Cholecystectomy throguh minimal incision. La Nouvelle presse medicale. 1982;11(15):1139-41.
[42] O'Dwyer PJ, Murphy JJ, O'Higgins NJ. Cholecystectomy through a 5cm subcostal incision. British Journal of Surgery. 1990;77(10):1189-90.
[43] Olsen DO. Mini-lap cholecystectomy. American Journal of Surgery. 1993;165(4):440-3.
[44] Mühe E. Die erste Cholecystektomie durch das laparoskop. Langenbecks Archiv für Chirurgie. 1986;369:804.
[45] Dubois F, Berthelot G, Levard H. Cholecystectomy with celioscopy. 330 cases. Chirurgie. 1990;116(3):248-50.
[46] Perissat J, Collet D, Belliard R, Dost C, Bikandou G. Laparoscopic cholecystectomy. Surgical technique and results of the first 100 operations. Der Chirurg. 1990;61(10):723-8.
[47] Reddick EJ, Olsen DO. Laparoscopic laser cholecystectomy. Surgical Endoscopy. 1989;3:131-3.

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

MANAGEMENT OF GALLSTONE DISEASE

SW Tang & P Thomas

[48] Keus F, Gooszen HG, Laarhoven CJHMv. Open, small-incision, or laparoscopic cholecystectomy for patients with symptomatic cholecystolthiasis. An overview of Cochrane Hepato-Biliary Group reviews (Review). Cochrane Database of Systematic Reviews. 2010(1):Art. No.: CD008318.
[49] Lee SK, Kim MH. Updates in the treatment of gallstones. Expert review of Gastroenterology & Hepatology. 2009;3(6):649-60.
[50] Gurusamy KS, Junnarkar S, Farouk M, Davidson BR. Day-case versus overnight stay in laparoscopic cholecystectomy. Cochrane Database of Systematic Reviews. 2008 Jan 23(1):CD006798.
[51] Lam CM, Murray FE, Cuschieri A. Increased cholecystectomy rate after the introduction of laparoscopic cholecystectomy in Scotland. Gut. 1996;38:282-4.
[52] Legoretta AP, Silber JH, Constantino GN, Kobylinski RW, Zata SL. Increased cholecystectomy rate after the introduction of laparoscopic cholecystectomy. JAMA. 1993;270:1429-32.
[53] NHS Institute for Innovation and Improvement. Cholecystectomy (removal of the gallbladder). 2007 [cited; Available from: http://www.institute.nhs.uk/quality_and_value/high_volume_care/cholecystectomy_%28removal_of_the_gall_bladder%29.html
[54] Lawrentschuk N, Hewitt PM, Pritchard MG. Elective laparoscopic cholecystectomy: implications of prolonge waiting times for surgery. ANZ Journal of Surgery. 2003;73:890-3.
[55] Papi C, Catarci M, D'Ambrosio L, Gili L, Koch M, Grassi GB, et al. Timing of cholecystectomy for acute calculous cholecystitis: a meta-analysis. American Journal of Gastroenterology. 2004;99(1):147-55.
[56] Cuschieri A, Dubois F, Mouiel J, Mouret P, Becker H, Buess G, et al. The European experience with laparoscopic cholecystectomy. American Journal of Surgery. 1991;161(3):385-7.
[57] Kum CK, Eypasch E, Lefering R, Paul A, Neugebauer E, Troidl H. Laparoscopic cholecystectomy for acute cholecystitis: is it really safe? World Journal of Surgery. 1996;20(1):43-8.
[58] Cheema S, Brannigan AE, Johnson S, Delaney PV, Grace PA. Timing of laparoscopic cholecystectomy in acute cholecystitis. Irish Journal of Medical Science. 2003;172(3):128-31.
[59] Livingston EH, Rege RV. A nationwide study of conversion from laparoscopic to open cholecystectomy. American Journal of Surgery. 2004;188(3):205-11.

[60] Singer JA, McKeen RV. Laparoscopic cholecystectomy for acute or gangernous cholecystitis. American Surgeon. 1994;60(5):326-8.
[61] Richardson MC, Bell G, Fullarton GM. Incidence and nature of bile duct injuries following laparoscopic cholecystectomy: an audit of 5913 cases. British Journal of Surgery. 1996;83(10):1356-60.
[62] Peng WK, Sheikh Z, Nixon SJ, Paterson-Brown S. Role of laparoscopic cholecystectomy in the early management of acute gallbladder disease. British Journal of Surgery. 2005;92(5):586-91.
[63] Gurusamy KS, Samraj K. Early versus delayed laparoscopic cholecystectomy for acute cholecystitis. Cochrane Database of Systematic Reviews. 2006(4):CD005440.
[64] Cameron IC, Chardwick C, Phillips J, Johnson AG. Management of acute cholecystitis in UK hospitals: time for a change. Postgraduate Medical Journals. 2004;80:292-4.
[65] Navarra G, Pozza E, Occhionorelli S, Carcoforo P, Donini I. One wound laparoscopic cholecystectomy. British Journal of Surgery. 1997;84:695.
[66] Chamberlain RS, Sakpal SV. A comprehensive review of Single-Incision Laparoscopic Surgery (SILS) and Natural Orifice Transluminal Endoscopic Surgery (NOTES) Techniques for Cholecystectomy. Journal of Gastrointestinal Surgery. 2009;13:1733-40.

Authors

SW Tang, P Thomas
Division of General Surgery
King's Mill Hospital
Sherwood Forest Hospitals NHS Foundation Trust
UK

Corresponding author

Miss Siau-Wei Tang
Flat 524, Litmus Building,
195 Huntingdon Street,
Nottingham NG1 3 NX
Email: siauwei@gmail.com

BURNS: ASSESSMENT AND MANAGEMENT IN THE MODERN PLASTIC SURGICAL SETTING

C Davis

Burns: assessment and management in the modern plastic surgical setting. Plastic and Reconstructive Surgery.

Introduction

Burns-related injuries are a global healthcare issue with 322,000 fatalities per annum.[1] In the UK, burns are common and responsible for 175,000 accident and emergency admissions each year.[2] Ten percent of these patients are transferred to a burns unit for specialist assessment and multidisciplinary management.[3] The evolution of modern tertiary referral burns services has lead to a reduction in morbidity and mortality for burns patients. Despite this, the UK mortality rate from burns-related injuries is 300 patients per annum. According to data from the World Health Organisation, those at greatest risk of burn injuries are women, children under twelve years, workers in high risk industries, and individuals with low socioeconomic status.[1] Elderly are at particular risk of burns at home, whilst in many parts of Asia, mothers and children are at risk of burns from open fires. There are also reported cases of women sustaining burn injuries following being assault via acid.[1]

This review focuses on the initial assessment and management of a patient with burns, where prompt and accurate decision-making improves both the short-term and long-term clinical outcomes of affected patients.

Burns Pathophysiology

Burn injury is a spectrum: tissue closed to the heat source is more severely damaged than peripheral tissue. These principles were first described by Jackson et al by considering the concept of three concentric zones of burn injury.[4] The irreversibly damaged zone of coagulative necrosis is surrounded by a threatened yet viable zone of stasis, which is surrounded by inflammatory tissue referred to as the zone of hyperaemia. This is important from a clinical perspective, as the middle zone of stasis can become necrotic if poorly managed, or hyperaemic and viable if well managed, akin to an ischaemic penumbra. This principle is analogous to a traffic light system, whereby the amber light may be influenced into change to green or red, depending on the quality of burns management (Fig. 1).

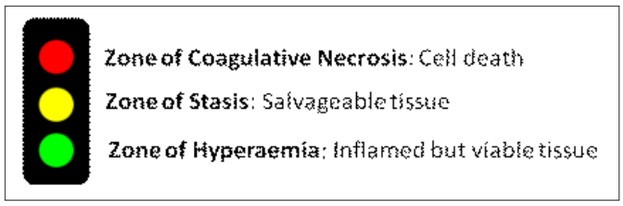


Figure 1. Traffic Light System for management of burns.

Type of burn

Burns may be caused by flames, steam, chemicals, electricity, abrasions or direct contact with a heat source. It is important to gain an accurate and exhaustive history of the precise mechanism of injury, timing and pre-hospital management. Consider the whether the activity is consistent with the physical capabilities of the child or adult, whether the pattern of injury is appropriate and what clothing they were wearing at the time. What first aid was given and how and when the patient presented to healthcare services are all relevant. Be suspicious of non-accidental injury in children who present with burns inconsistent with the history of the mechanism or with the physical ability of the child. Also consider whether the history might be neglectful, e.g. with an unexplained delay in presentation.

When chemicals, radiation or electricity are involved in the mechanism, the details should be established, e.g. the chemical constituency of the substance, the voltage involved. Certain subtances need specific treatments; for example, hydrofluoric acid which is found in glass etching substances can cause life-threatening hypocalcaemia if not identified and treated with calcium replacement as an emergency. It is therefore critical to determine exactly what the substance was and what it consists of chemically. The internet is an excellent resource to aid in this.

Document fully, obtain formal photographs via medical illustration and discuss with a senior colleague. The initial documentation will often be referred to ensure the consistency of the history and so it is essential that it is legible and complete.

Examining burns

ATLS® protocols should always be followed when assessing burns injuries, just like any other trauma. It may seem easy to be distracted by the visually-apparent nature of many burns, but straying from the primary and secondary surveys may result in life-threatening injuries being missed initially, or underlying fractures etc not being identified till well into the hospital stay.

When assessing the burn itself, there are two main parameters to determine: the area of the burn and its depth.

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

BURNS: ASSESSMENT AND MANAGEMENT IN THE MODERN PLASTIC SURGICAL SETTING

C Davis

Size of burn

Quantifying the area (percentage total body surface, % TBSA) of the affected tissue is paramount in the accurate assessment of the burns patient. Only partial thickness (superficial dermal through to deep dermal) and full thickness burns are counted (i.e. sunburn with erythema is not counted when estimating the area). There are three main methods to achieve this:

1. Lund and Browder Chart

These charts are commonly used when assessing the extent of a burn and are particularly useful in children. Inter-observer reliability is high[5], with many burns centres incorporating a proforma of the charts within their initial assessment on admission (Fig. 2).

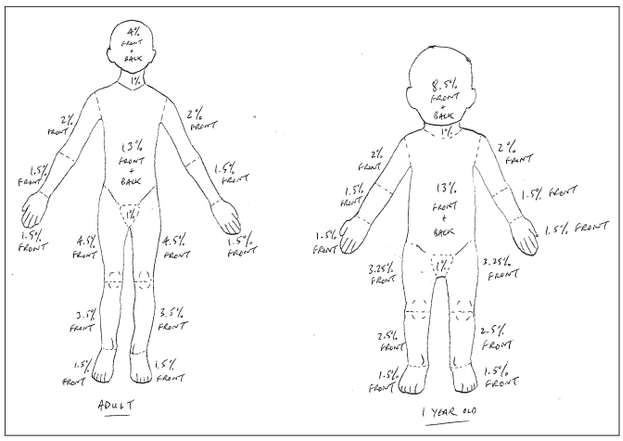


Figure 2. Adaptation from Lund and Browder charts for adults and babies used in Nottingham.

2. Wallace's Rule of Nines

An adult's body can be divided into eleven areas of 9%.. Each area of burns can be quantifiably combined as follows in adult patients: Four on the abdomen (36%); two on each lower limb (18% and 18%); one on each upper limb (9% and 9%); one for the face (9%). This can be further subdivided, for example if just the anterior surface of an anatomical region is involved, the figure is halved. The remaining one percent is related to the perineum. Children typically have larger heads relative to the their body size, and as such an adapted Rule of Nines can be applied (Fig. 3).

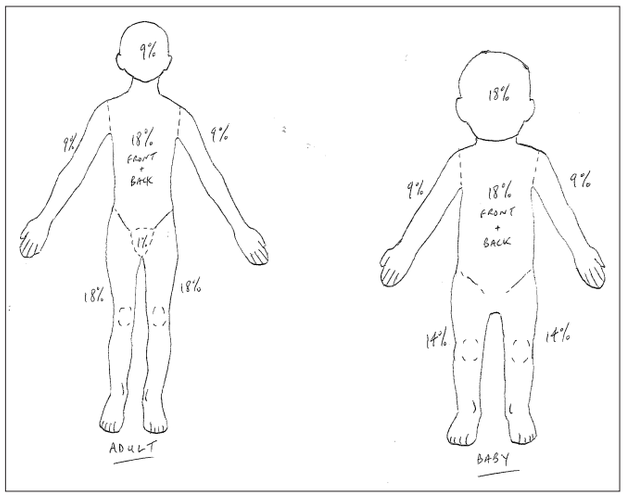


Figure 3. Wallace's Rule of Nines as applied to adults and babies.

3. Palmar surface

The patient's palm (not yours!), including fingers extended, represents around 1% of the patient's total body surface area (TBSA). This principle can be applied to assess the size of burns, and is of particular benefit when assessing burns of less than 20% TBSA by using an addition method, or greater than 80% TBSA by using as a subtraction method, and also in children. Note, however, that there may be wide inter-subject variability when using this method.[6]

Depth of burn

Burns can be classified according to depth (Table 1). It is important to appreciate that a single burn may be of variable de pth and also to consider the burn to be a complex and dynamic process that may evolve since the time of injury. There is a low inter-observer reliability between clinicians when assessing the depth of burns.[7] It is therefore imperative to take time to accurately assess a burn if transferring of receiving a patient with burns. Put most simply, superficial or epidermal burns consist solely of erythema with no skin break. The hallmark of the partial thickness burn has traditionally been considered to be the blister. Bear in mind that blisters will burst and the superficial layer may be lost. Full thickness burns are typically dry and leathery. Some burns services use Laser Doppler imaging to assist in quantifying burn depth.

	Epidermal	Superficial dermal/ superficial partial thickness	Deep dermal	Full thickness
Appearance	Red; Shiny	Pink	Cherry red; Dry	White; Dry
Sensation	Painful	Painful	Dull/absent pain	Pain-free eschar
Blisters	None	Small	May be present	None
Capillary refill	Brisk	Brisk	Absent	Absent
Histological depth of burn	Confined to epidermis	Deep to epidermis involving superficial dermis	Deep to epidermis involving deep dermis	Deep to dermis involving sub-cutaneous tissue

Table 1. How to determine burn depth (Adapted from Enoch[11])

BURNS: ASSESSMENT AND MANAGEMENT IN THE MODERN PLASTIC SURGICAL SETTING

C Davis

Referral criteria to a specialist burns unit

Most burns patients can be safely managed in the community without admission to a burns centre. However, the following are indications for referral to a burns service from the National Burn Injury Guidelines[2]:

- **Age (<5 years; >60 years)**
- **Site of injury**
  (face, hands, feet, genitalia, perineum, crossing major joints)
- **>5% TBSA**
- **Any full thickness injury**
- **Circumferential burns (limb, torso, neck)**
- **Inhalation injury**
- **Electrical burns**
- **Chemical burns**
- **Suspected non-accidental injury in a child**
- **Coexisting conditions**
  (fractures, head injury, crush injuries, pregnancy, immunosuppression)
- **Any burn that the referring unit is unhappy to manage**

If in doubt, discuss it with your local burns service.

Management

Initial management of the burns patient follows the same approach as all trauma patients, with strict and sequential Advanced Trauma Life Support (ATLS)® management. Interventions should be instigated according to the ATLS® algorithm.[8] First stages in the acute management include universal precautions and an appreciation for personal risk, especially if in close proximity to the source of burn and in patients with possible transmittable diseases. It is also important to stop the burning process by removing clothing if safe to do so for patient and clinician, and usually applying cool (not cold) water.

Always bear in mind that early referral to your local burns service will aid in optimising initial management and arranging a burns bed for the patient (burns beds are coordinated with the aid of the National Burns Bed Bureau and liaison between burns services at different sites).

ABCDE

Specific considerations in burns include airway management, which is of particular pertinence in inhalation injury. Early intubation is advised with airway injury above the larynx, where soft tissue swelling is likely to occur with airway compromise as the injury evolves. Anaesthetic colleagues should be involved immediately in such circumstances, where intubation is often advisable if transfer to a burns unit is impending. High-flow oxygen delivery is essential in all patients, and one should be alert to signs of inhalation injury (Box 1). If suspected, serial examination should be performed to assess airway patency, with a low threshold for intubation.

History
- Location of injury e.g. closed space
- Duration of time inside burning building/area of limited ventilation
- Extent of injury to other patients at scene
- Unconsciousness
- Noxious chemicals

Examination
- Singed nasal hair
- Facial burns
- Carbonaceous sputum
- Black carbon deposits in the oropharynx
- Signs of hypoxaemia e.g. agitation, anxiety, cyanosis
- Respiratory distress e.g.
  Nasal flaring, accessory muscles of respiration, intercostals recession
- Hoarse voice
- Dysphagia

Box 1. Assessment of potential Inhalation injury[10]

Circulatory assessment and prompt fluid replacement is imperative in large burns, as fluid losses via burned tissue can be extensive. Catheterise early, send samples for urinalysis and record hourly urine output. Assess fluid requirements using the Parkland Formula (Box 2).[9] The percentage surface area burn at which formal resuscitation becomes necessary typically is 15% for adults and 10% for children, though advice should always be sought from your local burns service as this may vary. Oliguria is likely to indicate hypovolaemia and inadequate fluid replacement whilst polyuria may reflect overly aggressive fluid resuscitation which may cause circulatory overload and pulmonary oedema in elderly patients in particular. Fluid administration should be administered in a dynamic manner by meticulously assessing the patient, using the previous hour's urine output as a gauge for subsequent rate of fluid administration. Ideally, fluid resuscitation should commence at (or be calculated from) the time of injury by the arriving paramedic teams (this may require a bolus to catch up). Patients arriving fluid depleted may be managed with prompt administration of fluid boluses and keeping close attention to the urine output and signs of volume status over the next hour.

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

BURNS: ASSESSMENT AND MANAGEMENT IN THE MODERN PLASTIC SURGICAL SETTING

C Davis

Step One: Calculate the total fluid requirement (TFR) in 24 hours
TFR = (3 - 4 mls) x (total burn surface area, %) x (body mass/kg)

Step Two: Administer Ringers Lactate solution (or Hartmann's Solution)
TFR/2: Administer in the first 8 hours following the burn injury
TFR/2: Administer over the next 16 hours.

Step Three: For children, administer supplementary maintenance fluid as follows: mention what type of fluid needs to be given
4 ml/kg for first 10 kg of body weight plus
2 ml/kg for second 10 kg of body weight plus
1 ml/kg for >20 kg-of body weight

Step Four: Monitor urine output and adjust fluids accordingly
Adults: 0.5-1.0 ml/kg/hour
Children: 1.0-1.5 ml/kg/hour

Box 2. Modified Parkland's Fluid Resuscitation formula

Children will require fluid resuscitation after a smaller burn than an adult, and children also require maintenance IV fluids IN ADDITION to the resuscitation volumes calculated.

The patient will need to be exposed to assess the burn, but remember that patients with burns are at risk of hypothermia. Convective heat losses occur through exposed burnt skin and dilutional conductive cooling occurs after administering intravenous fluids at sub-therapeutic temperatures. Furthermore, local measures to cool the site of burnt tissue may also result in a cold patient. It is therefore imperative that warmed fluids are administered, the time a patient is exposed during assessment in limited, and warming adjuncts such as forced air flow blankets are applied in order to maintain normothermia. The assessing clinical should also be aware of the potential sequelae from hypothermia, including cardiovascular, respiratory and coagulopathic effects. Electrocardiograms should be recorded, clotting factors measured and replaced if necessary.

Once assessed, the patient will need appropriate dressings to the burns before transfer to the burns service. The burns team will advise you on suitable choices. Whilst in A&E, cling film provides a temporary dressing that is clean and reduces moisture loss and can be easily removed to allow for reassessment. If a lengthy transfer is required to reach a burns service, other dressings are likely to be necessary to prevent hypothermia.

In the secondary survey, history should follow the ATLS 'AMPLE' mnemonic, and focus on the following:

- Allergies
- Medications including tetanus status
- Past medical history (including diabetes, hypertension, cardiorespiratory disease, renal impairment); pregnancy status
- Last food/drink
- Events leading up to incident, including treatments received and outcome of other patients involved from the same burns scene if appropriate

It may also be appropriate to insert a nasogastric tube, as burns patients are at risk of gastric dilatation, ileus, and may require a general anaesthetic. Analgesia is also required. Intravenous morphine is typically an appropriate agent, as impaired fluid status and fluid redistribution results in unpredictable subcutaneous or intramuscular absorption.

Additional areas of consideration

Acute renal failure: Burns, particularly electric burns, may cause release of myogobin into the circulation. This can cause congestion of the microvasculature of the glomerulus, resulting in myoglobin-induced renal failure. Urine may appear blood stained and the patient may be oliguric. Patients in this category should be aggressively fluid resuscitated to maintain a urine output of 1-2ml/kg/hr.[10]

Carbon Monoxide poisoning:
Carbon Monoxide (CO) has an affinity for haemoglobin 240 times that of oxygen. Once bound, carboxyhaemoglobin dissociates with a half-life of four hours in atmospheric air. However, when breathing 100% oxygen, the half-life is reduced to forty minutes, thus promoting reconfiguration of oxyhaemoglobin. Initial management of patients with suspected CO poisoning therefore includes administration of high flow oxygen. This may need to be delivered via a definitive airway. Hyperbaric facilities can be used if available.

Surgical intervention:
Partial thickness burns should heal spontaneously, and as such require no surgical intervention. Full thickness burns, however, typically require operative intervention after the patient has been adequately resuscitated and is safe to go to theatre. In such circumstances, debridement is required to remove all necrotic tissue and foreign bodies, with application of skin grafting. In smaller burns, this may be in the form of an autologous split thickness skin graft, typically from the lateral thigh. In larger burns where donor tissue is not available, donor skin can be applied if available from local skin banks. Skin substitutes are also used in some burns units when autologous or donor tissue is not available, or as an adjunct to concurrent skin grafts. Healing typically occurs within two to three weeks.

BURNS: ASSESSMENT AND MANAGEMENT IN THE MODERN PLASTIC SURGICAL SETTING

C Davis

Surgical intervention is also required in the emergency situation. For example, full thickness circumferential burns to the chest may result in respiratory compromise. In such circumstances, prompt escharotomies are required. In peripheral circumferential burns, the assessing clinical should be alert to consequences of external compression, resulting in impaired venous return. Signs include severe and relenting pain out of the context of the injury, progressive paraesthesia, cyanosis, and, in later stages, absent pulses. When signs indicate a likely compartment syndrome, escharotomies and faciotomies are indicated to preserve the limb.

Test yourself

You are the Core Surgical Trainee on call at the Burns Centre. It is 5th November, and at 10pm a father and son are referred to your burns unit having after attending a bonfire party. The son, 10 years old, was playing with a sparkler without gloves, and sustained a painful, red, superficial burn to his right palm. The father, weighing 70 Kg, reached for the sparkler, which inadvertently ignited his faux leather jacket. The event occurred at 7pm. On admission, the nurse removed the father's clothing to display full thickness burns to the anterior surface of his left arm and chest.

What is your fluid management?

Boy: This child has sustained a partial thickness burn to the palm of approximately 1% TBSA. Intravenous fluid resuscitation is therefore not required. However, the child should be fully assessed on arrival to exclude any signs of inhalation injury.

Adult: A full-thickness burn has been sustained with a size of 22.5% (arm = 4.5%, chest = 18%). TFR is 6300 ml (4 x 22.5 x 70). 3150ml of Hartmann's solution should be administered prior to 03:00; with a further 3150ml administered between 03:00 and 19:00. Fluid should be titrated to maintain a urine output of 35-70ml/hour.

MCQ - Questions

1. Which of the following are appropriate first line investigations when assessing a patient with 20% TBSA burns?

A: Head CT
B: Full blood count
C: Chest X-ray
D: Glycosylated haemoglobin
E: Arterial blood gas

2. Identify the correct statement(s):

A: Partial thickness burns may be red in colour
B: Full thickness burns have a pain-free blistered eschar
C: A patent airway on admission always remains patent
D: Pulse oximieters are able to account for carboxyhaemaglobin formation
E: The 'Rule of Nines' is a useful means of assessing burn depth

3. Full thickness burns may cause:

A: Hypothermia
B: Hypoalbuminaemia
C: Hypovolaemia
D: Acute Respiratory Distress Syndrome
E: Gastric dilatation

4. Referral criteria to a burns unit includes:

A: All chemical burns
B: All electrical burns
C: Partial thickness burns to the anterior surface of the dominant upper limb
D: All victims involved in a house fire
E: All full thickness burns

5. Identify the correct statement(s):

A: Red coloured urine can occur in burns patients
B: Cherry red skin discolouration suggests carbon monoxide intoxication
C: ATLS guidelines recommend assessment of burn area before assessment of breathing status
D: A patient with facial burns and stridor requires immediate transfer to a burns service if an anaesthetic opinion cannot be obtained easily in A&E at the referring hospital.
E: A child with a 12% TBSA erythema from sunburn must receive resuscitation calculated using the Parkland formula.

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

BURNS: ASSESSMENT AND MANAGEMENT IN THE MODERN PLASTIC SURGICAL SETTING

C Davis

MCQ - Answers

1. True = B, C, E.

It is imperative that the patient is continuously reassessed, and investigations repeated as appropriate to gauge progress. Urinalysis and renal function tests are also appropriate first-line investigations

2. True = A.

Full thickness burns are pain-free eschars, but are dry and do not typically blister. Never assume airway patency will remain. Burns evolve and the inflammatory may result in delayed airway compromise. If in doubt, intubate. Pulse oximieters are not able to distinguish carboxyhaemaglobin from oxyhaemaglobin. Therefore, interpret oxygen saturation probe readings with caution. Wallace's 'Rule of Nines' assesses burn area, not depth.

3. All True.

Be alert to the secondary effects from these conditions eg. coagulopathy and cardiac arrhythmia following hypothermia; ileus following gastric dilatation

4. True = A, B, E.

A partial thickness burn to the anterior surface of an upper limb is equivalent to 4.5%, therefore does not conform to the referral guidelines of burns >5%. All victims in a house fire should be thoroughly assessed for burns and signs of inhalation injury. However, a house fire in itself is not an indication for referral.

5. True = A, B.

Red-coloured urine may be secondary to myoglobin deposits in the proximal convoluted tubule. Treatment options include high volume IV fluids to increase urine output, Mannitol and sodium bicarbonate to alkalinise the urine.

Further information

British Burns Association: **http://www.britishburnassociation.org**

References

1. WHO. Facts about injuries: **www.who.int/violence_injury_prevention/publications/other_injury/en/burns_factsheet.pdf**

2. National Burn Care Review. National burn injury referral guidelines. In: Standards and strategy for burn care. London: NBCR, 2001:68-9.

3. Wilkinson E. The epidemiology of burns in secondary care, in a population of 2.6 million people. Burns 1998;24:139-43.

4. Jackson DM. The diagnosis of the depth of burning. Br J Surg. 1953;40:588–596.

5. Wachtel TL, Berry CC, Wachtel EE, Frank HA. The inter-rater reliability of estimating the size of burns fromvarious burn area chart drawings. Burns 2000;26:156-70.

6. Perry RJ, Moore CA, Morgan BDG, Plummer DL. Determining the approximate area of a burn: an inconsistency investigated and re-evaluated. Br Med J. 1996;312:1338

7. La Hei ER, Holland AJA, Martin HCO. Laser Doppler imaging of paediatric burns: burn wound outcome can be predicted independent of clinical examination. Burns 2006;32:550-3.

8. Advanced Trauma Life Support. American College of Surgeons. 7th Edition. 2004.

9. Baxter CR, Shires T. Physiological response to crystalloid resuscitation of severe burns. Ann N Y Acad Sci. 1968;150(3):874-94.

10. Emergency management of severe burns. Australia and New Zealand Burn Association Limited. 8th Edition. 2004

11. Enoch S, Roshan A, Shah M. Emergency and early management of burns and scalds. Br Med J. 2009;338:937-941.

Author

Christopher R Davis
Core Surgical Trainee
Department of Plastic Surgery
St Thomas' Hospital
London UK
chrisdavis959@hotmail.com

PNEUMOTHORAX

JM Findlay

Definition and classification

Pneumothorax is defined as the presence of air in the pleural cavity (1), originally described by Itard and Laennec in the early 19th century within the context of pulmonary tuberculosis (2). It can be classified as spontaneous, or traumatic, with spontaneous either primary or secondary to underlying lung pathology, and traumatic either iatrogenic or non-iatrogenic (see table 1) (3). Primary spontaneous pneumothorax (PSP) occurs in the absence of underlying lung disease or an identifiable precipitant. Secondary pneumothorax may be spontaneous, in those with underlying pulmonary disease, iatrogenic, due to medical intervention breaching the pleura, or due to blunt or penetrating trauma. Pneumothorax can also be classified clinically as simple or tension.

Spontaneous
Primary
Secondary
Traumatic
Iatrogenic
Non-iatrogenic

Table 1 — A classification of pneumothorax

Epidemiology

Approximately one-half of pneumothoraces are spontaneous, with the other half traumatic[1]. Both are more common in males, with an overall incidence of 24.0/100,000 in men, and 9.8 / 100,000 in women and mortality rates of 1.26 and 0.62/1,000,000. respectively[4]. Pneumothorax has a bimodal age distribution, being most common between the ages of 20-34 and 70-84 in men; mortality is most common in the elderly[4]. Whether a seasonal distribution, related to atmospheric conditions, exists is unclear[4,5]. Spontaneous pneumothorax recurs in approximately 54% within 4 years, and is predisposed to by smoking, age, pulmonary fibrosis and chronic obstructive airways disease[6-8].

Causes

Unlike bison, which are unique among mammals by having an incomplete mediastinum, the human pleural cavities are separate. Consequently, air must enter the pleural cavity from either the bronchoalveolar space, the atmosphere via the chest wall, or produced in situ by gas-forming organisms.

Primary spontaneous pneumothorax (PSP) classically occurs in tall young men[7]. Whilst it occurs by definition in the absence of diagnosed lung disease, PSP is strongly associated with parenchymal abnormalities such as subpleural blebs and bullae. Such abnormalities, also known as emphysematous-like changes, can be found in up to 90% of patients at operation[9], and 80% on CT scanning[10]. Contralateral emphysematous-like changes are present in 80%[3], and so PSP may be bilateral[11]. However, similar changes are present in up to 15% of normal subjects[12].

Although the precise pathophysiology remains unclear, PSP is strongly associated with smoking[13,14]. 90% of those with PSP smoke, and lifetime risk of pneumothorax is up to 120 times in smokers compared with non-smokers[14]. This association is due, in part, to oxidative stress and inflammatory changes driving enzymatic disequilibrium enzymes[15]. Mechanical forces may also contribute and underlie the association with height. As the gradient of pleural pressure increases towards to lung apex, increased vertical thoracic size may affect shear stresses and predispose to the development of emphysematous-like changes[16]. Reduced intra-pleural pressures have also been postulated[17]. Other risk factors for PSP include pregnancy[18], a positive family history[19] and genetic and connective tissue disorders such as Marfan and Birt-Hogg-Dube syndromes, and homocysteinuria[20].

Secondary spontaneous pneumothorax occurs in the presence of demonstrable lung disease. Whilst almost all pulmonary pathology can be responsible, the commonest conditions are COPD and asthma[21]. Also causative are cystic fibrosis, fibrotic lung disease[22], infection, structural abnormalities such as malignancy, sarcoidosis, thoracic endometriosis (catamenial pneumothorax) [23], and ARDS[3, 21, 24].

Iatrogenic traumatic pneumothorax may complicate a number of commonly performed procedures. Most common is transthoracic needle biopsy, which accounts for 24%[25]. Due to the extension of the pleura medially beyond the clavicle, pneumothorax may complicate central venous catheter insertion, the second commonest cause[25] accounting for 22%. The pleura may inadvertently be breached in insertion of intercostal nerve blocks and catheters, and procedures such as rib resections. Extension of the pleura below the 12th rib posteriorly puts it at risk during renal and adrenal surgery. Also common is barotrauma secondary to positive pressure ventilation. Whilst temporary pneumothorax is an inevitable consequence of thoracic surgery, it may be perpetuated by air leak (and rarely a bronchopleural fistula) following lung resection.

Non-iatrogenic traumatic pneumothorax may be caused by both blunt and penetrating trauma, and may isolated or associated with other injuries. It is often occult, occurring in up to 50% of patients with chest trauma[26]. Intimate association of the ribs with the pleura makes rib fracture a common culprit. High energy deceleration injuries may avulse the bronchi, whilst penetrating trauma may bring the pleural cavity into contact with the atmosphere directly. This may be self-limiting, or persist as an open pneumothorax. Barotrauma due to the primary phase of blast injuries may also cause pneumothoraces.

Tension pneumothorax occurs when air within the pleural cavity becomes trapped by a valve mechanism under positive pressure. Progressively positive pressure increases pleural volume, resulting in displacement of the mediastinum, and cardio-respiratory embarrassment due to contralateral lung compression and impeded venous return.

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

PNEUMOTHORAX

JM Findlay

Clinical

Symptoms of pneumothorax are variable. In general, the magnitude of symptoms does not correlate with size of pneumothorax (27). Whilst many patients present immediately, a significant minority may delay for a number of days[3, 27]. Classical symptoms comprise acute dyspnoea and pleuritic chest pain. However, more indolent symptoms such as cough and fatigue may be the presenting feature[27]. Secondary spontaneous pneumothorax may compound an acute exacerbation of a chronic lung condition, with symptomatic and hypoxic deterioration more marked due to reduced underlying lung reserve[28, 29].

Signs

General — patients may be unwell and uncomfortable.

Respiratory — signs of respiratory distress (tachypnoea, use of accessory intercostal muscles, tracheal tug) may be present. Classic signs include ipsilateral reduced lung expansion, breath sounds, tactile fremitus and vocal resonance, and increased resonance of the percussion note. Tracheal and mediastinal deviation indicate tension pneumothorax.

Cardiovascular — patients may be tachycardic due to pain and hypoxia, or may exhibit signs of cardiovascular decompensation with hypotension and neck vein distension due to tension.

Neurological — patients may agitated, confused or obtunded due to hypoxia or cardiovascular compromise.

Signs in the ventilated patient — sedated patients receiving ventillatory support require a high index of suspicion for pneumothorax. This may manifest as abrupt and progressive difficulty in ventilation. A reduction in tidal volumes for those on pressure-controlled ventilation, and an increase in pressure required to ventilate those on volume-controlled ventilation are highly suspicious. Unexplained hypotension may be a manifestation of tensioning.

Differential diagnosis of pneumothorax is wide. Clinically, pneumothorax may be similar to other intrathoracic conditions such as simple exacerbations of underlying lung disease, pneumonia, pulmonary embolism, myocardial ischaemia, pericarditis and oesophageal spasm. Radiological confusion can arise with film artefact and bullous lung disease (See Fig. 1) [30, 31].

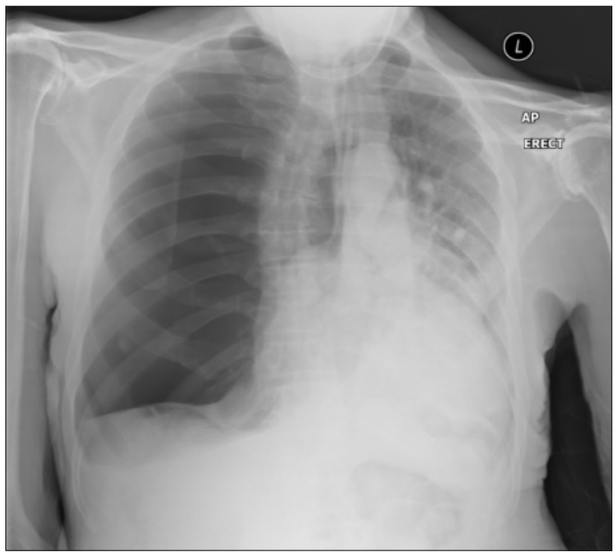


Figure 1 — A giant middle lobe bulla mimicking tension pneumothorax.

Investigations

Laboratory investigations are limited, but include baseline blood tests for contributing factors such as pulmonary infection. Arterial blood gases are frequently abnormal, with hypoxia a common finding due to shunting of blood through hypoventillated lung, which manifests in an increased alveolar-arterial oxygen gradient. The degree of hypoxia correlates with both size of pneumothorax and the extent of underlying disease[29]. Pulmonary function tests are not a valid diagnostic tool[27].

Radiological investigations are crucial in the diagnosis of pneumothorax, and plain chest radiograph is usually sufficient[27]. The pleura is often visible as a thin linear shadow, with an absence of lung markings beyond. However, the diagnosis may be complicated by loculated secondary pneumothoraces, absence of a distinct pleural outline in supine patients, and the presence of bullae[30, 31]. In supine patients, radiolucency in the costophrenic angle is suggestive, whereas in the latter CT scanning is advocated to differentiate bullae and pneumothoraces[30]. Any mediastinal or tracheal deviation is suggestive of tensioning. Expiratory films are no longer recommended[27, 32], however, lateral decubitus films (with the suspected hemithorax lying uppermost) identify approximately 15% of occult pneumothoraces[33]. In addition to its use in differentiating pneumothoraces from bullae, volume estimation and assessment of pneumothorax in the presence of significant surgical emphysema CT scanning also has an important role in suspected traumatic pneumothorax, but is not advocated in primary spontaneous pneumothorax[27].

FOR MORE INFORMATION, EMAIL INFO@123DOC.COM

PNEUMOTHORAX

JM Findlay

Pneumothorax volume is notoriously difficult to estimate from plain film appearances[34]. Volume is estimated as the ratio of the cube of the pneumothorax diameter to the cube of the hemithorax diameter[27], and has traditionally been stratified by its depth from the chest wall in centimetres. Consequently, a 1cm 'rim' represents a pneumothorax occupying 27% of lung volume, whilst a 2cm rim equates to 49%[27]. Due to this inherent difficulty, the British Thoracic Society has revised its guidance, to advise that (spontaneous) pneumothoraces should be classified radiologically as 'small' (<2cm) or 'large' (>2cm). This classification is driven by management, with a 'large' (50% volume) pneumothorax amenable to safe drainage[27].

As technology advances, and availability of portable machines and training improves, ultrasound has proven an increasingly useful tool in acute care settings. Whilst inherently operator-dependent, absence of the 'sliding' seen on normal lung views is 100% specific and 81% sensitive for pneumothorax[35]. Whilst ultrasound lacks discrimination between bullae and pneumothorax, its sensitivity has otherwise been shown to approach that of CT scanning (100% specific, 96% sensitive)[36]

Management

Management of pneumothorax is that of the pneumothorax itself and any associated complications (table 2).

Complications of pneumothorax
Recurrence
Haemothorax
Persistent pneumothorax/air leak
Bronchopleural fistula
Respiratory failure
Cardiovascular insufficiency (tension)

Table 2 — Complications of pneumothorax

Whilst this article focuses on British Thoracic Society guidelines, international guidelines may differ in certain scenarios[37]. However, there is largely consensus overall and common to all approaches is a process of risk stratification of symptoms and recurrence. Management options comprise conservative (observation), medical (supplemental oxygen), interventional (aspiration, intercostal drainage and pleurodesis) and surgical (open or video-assisted thoracoscopic surgery).

Management of spontaneous pneumothorax

Primary spontaneous pneumothorax with minimal symptoms may be managed conservatively, as only a small minority will exhibit persistent air leak[27]. Indeed, recurrence is greater in those undergoing intervention[38]. Those with 'small' pneumothoraces may be discharged home for outpatient review if they are capable of rapid return should their symptoms worsen. Resolution of spontaneous pneumothoraces occurs approximately 1.8% of volume per 24 hours[39]. However, administration of supplemental high flow (10 litres per minute) oxygen facilitates this process by a factor of four, by driving a reduction in the partial pressure of nitrogen[40].

Secondary spontaneous pneumothorax with minimal symptoms. Due to the default presence of underlying lung pathology, all patients should be admitted to hospital. Those with pneumothoraces smaller than 1cm can be observed; otherwise intervention via aspiration or formal drainage is necessary. Significantly symptomatic spontaneous pneumothoraces mandate intervention, as symptoms may be harbingers of deterioration or impending complications[27]. All pneumothoraces with cardiorespiratory compromise must be urgently drained.

Intervention in spontaneous pneumothorax

Simple aspiration is likely to successfully re-expand lungs in approximately 70% of PSP patients[27] and is consequently recommended as first line intervention by a number of studies and bodies[41]. Indeed, aspiration is as efficacious as formal tube intercostal drainage and may be associated with fewer recurrences and complications[41, 42]. However, simple aspiration is less successful in SSP, and should therefore be undertaken only in those under the age of 50 with 'small' pneumothoraces (<2cm). In the third of PSP patients in which this is unsuccessful (i.e. persistent pneumothorax and symptoms) a second attempt, potentially via catheter aspiration of pneumothorax (CASP, employing a one-way Heimlich valve) is permitted[27]. In contrast to the BTS guidelines, in the case of PSP the American College of Chest Physicians (ACCP) recommend intercostal drainage in place of aspiration[37].

Intercostal tube drainage should be employed for spontaneous pneumothoraces unsuccessfully managed by the above, and for SSP not suitable for aspiration. It can be performed by traditional surgical means, or via the Seldinger technique. Complications, including visceral injury, haemorrhage and infection occur in an estimated 18%[43], although one study found that those inserted via the less-invasive Seldinger approach were associated with considerably fewer complications [2%; 44]. Calibre of tube is not important[45]. Although underwater bottle seals remain the traditional standard, a number of studies have demonstrated that judicious application of closed ambulatory systems connected to one-way Heimlich valves are as effective as underwater seals, but significantly reduces length of hospital stay and cost[46]. Application of suction to persistent pneumothoraces may be appropriate, which aims to reduce intra-pleural pressure and therefore expedite air absorption and subsequent lung re-expansion. However, this may predispose to re-expansion pulmonary oedema, and perpetuation of underlying air leak[47]. The clamping of intercostal drains is contentious, but may be performed as a diagnostic trial to prior to removal of the drain in case of an underlying air leak. However, such a leak may result in a tension pneumothorax and therefore should only be performed in areas with appropriate nursing and medical expertise[27].

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

PNEUMOTHORAX

JM Findlay

Definitive management of spontaneous pneumothorax

Pneumothoraces failing to resolve within 48 hours should be referred to a respiratory physician, and thereafter a thoracic surgeon after 3-5 days (27). Those successfully treated recur in approximately one-third, with further likelihood increasing with each subsequent recurrence (48). Consequently, definitive intervention should be considered in such patients, especially in those at particularly increased risk (for example pilots and divers, in which with prophylactic contralateral procedures may be appropriate).

In those unwilling or unfit for surgery, chemical pleurodesis can be performed by administering a sclerosant via a chest drain (such as talc or tetracycline) (27, 49). However, whilst the optimum time for surgical intervention is contentious (27, 50), the British Thoracic Society recommends a surgical referral for failure of lung re-expansion or persistent air leak after 3-5 days (27), albeit without definitive evidence. Indications for surgery are given in table 3.

Indications for surgery in spontaneous pneumothorax (Henry et al, 2003)
Second ipsilateral pneumothorax
First contralateral pneumothorax
Bilateral spontaneous pneumothorax
Persistent air leak/failure to re-expand after 5 days of intercostal drainage
At risk professions (pilots, divers)

Table 3—Indications for surgery in spontaneous pneumothorax (Henry et al, 2003)

Operative intervention for pneumothorax seeks to deal with the any underlying abnormalities (resection or ligation of apical blebs, and suturing, cauterisation or gluing of perforations), and prevent recurrence via abolition of the pleural cavity (chemical or abrasive pleurodesis, or pleurectomy). Performing the former without abolishing the pleural cavity results in unacceptable rates of recurrence (51). The British Thoracic Society advocates open thoracotomy as the 'gold standard', and recommends that alternative interventions should yield comparable outcome (15% morbidity and 1% recurrence rates) (27). Open procedures in general may be more successful than minimally-invasive alternatives (52), but at a higher cost of morbidity (53). Consequently, the trend is towards minimally-invasive Video Assisted Thoracoscopic (VATS) Surgery, particularly as the field advances with the advent of single-port VATS (54, 55), although in patients with complicated and extensive disease open thoracotomy remains the procedure of choice (27).

Iatrogenic pneumothorax

Practice varies within specialties, but when recurrence is not expected to be likely simple aspiration may suffice. Very small asymptomatic pneumothoraces may be left to reabsorb. Chest drain insertion is reserved for those with cardiorespiratory compromise, significant symptoms, likelihood of recurrence or positive pressure ventilation.

Traumatic pneumothorax

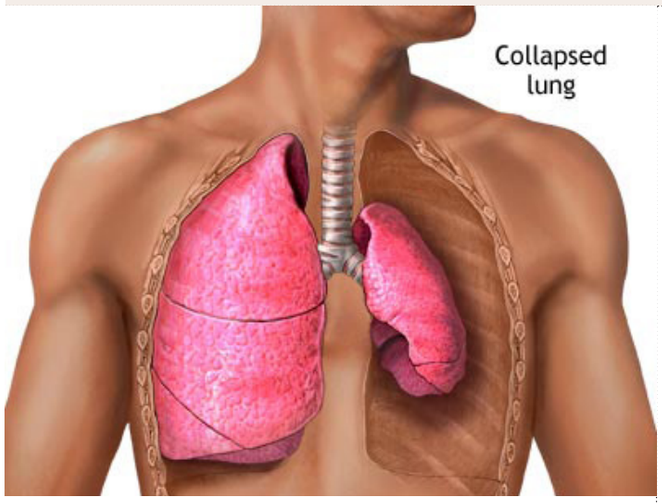
Although some studies suggest that only a minority of traumatic pneumothoraces mandate chest drain insertion (56), in practice most clinicians will insert a drain, with traditional surgical techniques favoured as they allow a finger-sweep to identify any hazards to drain insertion.

Conclusion

Pneumothorax remains a common condition, with considerable morbidity and mortality. This article has highlighted the availability of robust guidelines for investigation and management. However, as the availability of diagnostic tools such as computed tomography and fluorescein-enhanced autofluorescence thoracoscopy increases, and treatment modalities such as minimally invasive surgical techniques and catheter-aspiration and valve-kits continue to evolve, a great deal of future research in this field is yet to be undertaken.

PNEUMOTHORAX

JM Findlay



Vignette

A 21-year-old student presented to the Emergency Department with sudden onset pleuritic right sided anterior chest wall pain whilst hill walking. This did not radiate, but was associated with shortness of breath on exertion and a non-productive cough. He denied any other cardiorespiratory symptoms or past medical history.

On examination, he was apyrexial, well but uncomfortable. Cardiovascular examination was unremarkable (pulse 78, blood pressure 128/74, good peripheral perfusion). Respiratory examination revealed reduced right-sided chest expansion, (vesicular) breath sounds and vocal resonance. Ipsilateral percussion note resonance was increased. Respiratory rate was 18 and oxygen saturations were 96% on air; there were no signs of respiratory distress.

Erect chest radiograph demonstrated a 3cm rim of pneumothorax on the right without mediastinal shift. Aspiration in the Emergency Department was unsuccessful (with recurrent pneumothorax on repeat radiograph), and so a further attempt was made. However, his symptoms and pneumothorax persisted so a Seldinger intercostal drain was inserted.

Following admission under the respiratory physicians, there was evidence of ongoing air leak via his chest drain. After 4 days, he was transferred to the regional thoracic unit and underwent successful Video Assisted Thoracoscopic (VATS) talc pleurodesis, to be discharged the following day.

Questions

1.True or false: Regarding pneumothorax:

a. Two-thirds of pneumothoraces are spontaneous
b. Pneumothorax is more than twice as common in males than females
c. Pneumothorax has a bimodal age distribution (between 16-30 and 60-70)
d. Mortality is commonest in the elderly
e. Symptoms correlate with volume of pneumothorax

2. Which of the following are risk factors for primary spontaneous pneumothorax?

a. Smoking
b. Height
c. Pregnancy
d. Loud music
e. All of the above

3. True or false: Regarding chest trauma:

a. Expiratory chest radiographs are a useful diagnostic test
b. Pneumothorax occurs in 50% of patients with chest trauma
c. 25% of chest trauma patients have an occult pneumothorax
d. All traumatic pneumothoraces require chest drainage
e. 20% of pneumothoaces have an associated haemothorax

4. Rank the following common causes of iatrogenic pneumothorax

a. Thoracocentesis
b. Transthoracic needle biopsy
c. Positive pressure ventilation
d. Pleural biopsy
e. Sublavian vein catheterisation

5. True or false: Regarding primary spontaneous pneumothorax (PSP)

a. Recurrence rates of aspiration are worse than tube drainage
b. Simple aspiration of PSP is successful in 50-80% of patients
c. Primary spontaneous pneumothorax recurs in 50% of patients
d. Prophylactic surgery is indicated following the first episode of (PSP)
e. Pilots and professional scuba divers should undergo unilateral surgery after the first episode of PSP

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

PNEUMOTHORAX

JM Findlay

Answers

Question 1:

a. False – 50% b. True c. False: 20-34 and 70-84
d. True e. False

Question 2: E

Question 3:

a. False b. True c. True
d. False e. True

Question 4:

b, e, a, d, c

Question 5:

a. False b. True c. False- 30%
d. False- after first recurrence e. False- bilateral

References

1. Light RW (1995) Pneumothorax. In: Pleural diseases. 3rd edn. Baltimore: Williams & Wilkins 242–77.
2. Laennec RTH (1819) Trait de l'auscultation mediate et des maladies des poumons et du coeur. Tome Second. Paris.
3. Sahn SA, Heffner JE (2000) Spontaneous pneumothorax. N Engl J Med 342(12):868-74.
4. Gupta D, Hansell A, Nichols T, et al (2000) Epidemiology of pneumothorax in England. Thorax 55:666–71
5. Ozenne G, Poignie P, Lemercier JP, et al. Meteorological conditions and spontaneous pneumothorax. Retrospective study of 165 cases in Rouen area. Rev Pneumol Clin 1984; 40:27–33.
6. Lippert HL, Lund O, Blegrad S, et al(1991) Independent risk factors for cumulative recurrence rate after first spontaneous pneumothorax. Eur Respir J 4:324–31.
7. Sadikot RT, Greene T, Meadows K, et al (1997) Recurrence of primary pneumothorax. Thorax 52:805–9.
8. Smit HJM, Chatrou M, Postmus PE (1998) The impact of spontaneous pneumothorax and its treatment on the smoking behaviour of young adult smokers. Respir Med 92:1132–6.
9. Donahue DM, Wright CD, Viale G, et al (1993) Resection of pulmonary blebs and pleurodesis for spontaneous pneumothorax. Chest 104:1767–9.
10. Lesur O, Delorme N, Frogamet JM, et al (1990) Computed tomography in the aetiological assessment of idiopathic spontaneous pneumothorax. Chest 98:341–7.
11. Huang TW, Lee SC, Cheng YL, Tzao C, Hsu HH, Chang H (2007) Contralateral recurrence of primary spontaneous pneumothorax. Chest 132(4):1146-50.
12. Amjadi K, Alvarez GG, Vanderhelst E, Velkeniers B, Lam M, Noppen M (2007) The prevalence of blebs and bullae among young healthy adults: a thoracoscopic evaluation. Chest 132:1140-1145.
13. Jansveld CA, Dijkman JH. Primary spontaneous pneumothorax and smoking (1975) BMJ 4:559–60.
14. Bense L, Eklund G, Odont D, et al (1987) Smoking and the increased risk of contracting pneumothorax. Chest 92:1009–12.
15. Haraguchi S, Fukuda Y (1993) Histogenesis of abnormal elastic fibers in blebs and bullae of patients with spontaneous pneumothorax: ultrastructural and immunohistochemical studies. Acta Pathol Jpn. 43(12):709-22.
16. West JB (1971) Distribution of mechanical stress in the lung, a possible factor in localisation of pulmonary disease. Lancet i:839–41.
17. Fujino S, Inoue S, Tezuka N, Hanaoka J, Sawai S, Ichinose M, Kontani K (1999) Physical development of surgically treated patients with primary spontaneous pneumothorax. Chest116:899-902.
18. Lal A, Anderson G, Cowen M, Lindow S, Arnold AG (2007) Pneumothorax and pregnancy. Chest 132(3):1044-8.
19. Chiu HT, Garcia CK (2006) Familial spontaneous pneumothorax. Curr Opin Pulm Med 12(4):268-72
20. Neptune ER, Frischmeyer PA, Arking DE, Myers L, Bunton TE, Gayraud B, Ramirez E, Sakai LY, Dietz HC: Dysregulation of TGF-beta activation contributes to pathogenesis in Marfan syndrome. Nat Genet 2003;33:407-411
21. Noppen M, De Keukeliere T (2008) Pneumothorax. Respiration 76 :121-127
22. Lee CC, Lee SH, Chang IJ, et al (2005) Spontaneous pneumothorax associated with ankylosing spondylitis. Rheumatology (Oxford) 44(12):1538-41.
23. Korom S, Canyurt H, Missbach A, et al (2004) Catamenial pneumothorax revisited: clinical approach and systematic review of the literature. J Thorac Cardiovasc Surg 128(4):502-8.
24. de Lassence A, Timsit JF, Tafflet M, et al (2006) Pneumothorax in the intensive care unit: incidence, risk factors, and outcome. Anesthesiology 104(1):5-13.
25. Baumann MH, Noppen M (2006) Pneumothorax. Respirology 9: 157–164.
26. Bridges KC, Welch G, Silver M, Schinco MA, Esposito B (1993) CT detection of occult pneumothorax in multiple trauma patients. J Emerg Med 11: 179–186.
27. Henry M, Arnold T, Harvey J (2003) BTS guidelines for the management of spontaneous pneumothorax. Thorax 58;ii39-ii52.
28. Wait MA, Estrera A (1992) Changing clinical spectrum of spontaneous pneumothorax. Am J Surg 164:528–31.
29. Norris RM, Jones JG, Bishop JM (1968) Respiratory gas exchange in patients with spontaneous pneumothorax. Thorax 23:427–33.
30. Ng CS, Sihoe AD, Wan S, Lee TW, Arifi AA, Yim AP (2001) Giant pulmonary bulla. Can Respir J. Sep-Oct;8(5):369-71.
31. Chen CK, Cheng HK, Chang WH, Lai YC, Su YJ (2009) Giant emphysematous bulla mimicking tension pneumothorax. Am J Med Sci 337(3):205.
32. Bradley M, Willams C, Walshaw MJ (1991) The value of routine expiratory films in the diagnosis of pneumothorax. Arch Emerg Med 8:115-116.
33. Glazer H, Anderson DJ, Wilson BS, et al (1989) Pneumothorax: appearances on lateral chest radiographs. Radiology 173:707–11.
34. Engdahl O, Toft T, Boe J (1993) Chest radiograph: a poor method for determining the size of a pneumothorax. Chest 103:26–9.
35. Sartori S, Tombesi P, Trevisani L, Nielsen I, Tassinari D, Abbasciano V (2007) Accuracy of transthoracic sonography in detection of pneumothorax after sonographically guided lung biopsy: prospective comparison with chest radiography. AJR Am J Roentgenol188(1):37-41.
36. Lichtenstein D, Meziere G, Biderman P, Gepner A (2000) The "lung point": an ultrasound sign specific to pneumothorax. Intensive Care Med 26(10):1434-40.

FOR MORE INFORMATION, EMAIL INFO@123DOC.COM

PNEUMOTHORAX

JM Findlay

37. Baumann MH, Strange C, Heffner JE, Light R, Kirby TJ, Klein J (2001) Management of spontaneous pneumothorax: an American College of Chest Physicians Delphi consensus statement. Chest 119(2):590-602.
38. O'Rourke JP, Yee ES (1989) Civilian spontaneous pneumothorax: treatment options and long term results. Chest 96:1302–6.
39. Flint K, Al-Hillawi AH, Johnson NM (1984) Conservative management of spontaneous pneumothorax. Lancet ii: 687–8.
40. Northfield TC (1971) Oxygen therapy for spontaneous pneumothorax. BMJ 4:86–8.
41. Wakai A, O'Sullivan RG, McCabe G (2007) Simple aspirations versus intercostal tube drainage for primary spontaneous pneumothorax in adults. Cochrane Database Syst Rev;CD004479.
42. Noppen M, Alexander P, Driesen P, et al (2002) Manual aspiration versus chest tube drainage in first episodes of primary spontaneous pneumothorax. Am J Respir Crit Care Med 165:1240–4
43. Chan L, Reilly KM, Henderson C, et al (1997) Complication rates of tube thoracostomy. Am J Emerg Med 1997;15:368–70.
44. Horsley A, Jones L, White J, Henry M (2006) Efficacy and complications of small-bore, wire-guided chest drains. Chest 130(6):1857-63.
45. Tattersall DJ, Traill ZC, Gleeson FV (2000) Chest drains: Does Size Matter? Clin Radiol 55:415–21.
46. Ponn RB, Silverman HJ, Frederico, JA (1997) Outpatient chest tube management. Ann Thoracic Surgery 641437-1440.
47. Mafhood S, Hix WR, Aaron BI, et al (1988) Re-expansion pulmonary edema. Ann Thorac Surg 45:340–5.
48. Schramel F, Postmus PE, Vanderschueren RG (1997) Current aspects of spontaneous pneumothorax. Eur Respir J 10:1372-1379.
49. Tschopp JM, Rami-Porta R, Noppen M, Astoul P: (2006) Management of spontaneous pneumothorax: state of the art. Eur Respir J 28: 637–650.
50. Schonenberger RA, Haefeli HA, Weiss P, et al (1991) Timing of invasive procedures for primary and secondary spontaneous pneumothorax. Arch Surg 126:764–66.
51. Korner H, Andersen KS, Stangeland L, Ellingsen I, Engedal H (1996) Surgical treatment of spontaneous pneumothorax by wedge resection pleurodesis or pleurectomy. Eur J Cardiothorac Surg 10: 656–659.
52. Barker A, Maratos EC, Edmonds L, Lim E (2007) Systematic literature review shows fourfold increase in recurrence rate when similar pleurodesis procedures are performed with a video-assisted approach compared to open approach. Lancet 370: 329–335.
53. Baldwyck B, Hendricks J, Lauwers P, Van Schil P (2008) Quality of life evolution after surgery for primary and secondary spontaneous pneumothorax: a prospective study comparing different surgical techniques. Interact Cardiovasc Thorac Surg 7: 45–49.
54. Salati M, Brunelli A, Xiumè F, Refai M, Sciarra V, Socetti A, Sabbatini A (2008) Uniportal VATS for primary spontaneous pneumothorax: clinical and economical analysis in comparison to the traditional approach. Interact Cardiovasc Thorac Surg 7: 63–66.
55. Treasure T (2007) Minimally invasive surgery for pneumothorax: the evidence, changing practice and current opinion J R Soc Med 100: 419–422.
56. Johnson G (1996) Traumatic pneumothorax: is a chest drain always necessary? J Accid Emerg Med 13: 173–174.

Author
JM Findlay
Core Surgical Trainee 1
Department of Cardiothoracic Surgery
John Radcliffe Hospital
Oxford, OX3 9DU

Correspondence
Mr JM Findlay
johnfindlay@doctors.org.uk

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

REVIEW - UROLITHIASIS FOR THE SURGICAL TRAINEE

W Green

Review - Urolithiasis for the Surgical Trainee. Urology.

Introduction

Stone disease refers to symptoms caused by the accumulation of crystals formed from ions normally dissolved in urine forming anywhere in the urinary tract. In practice stones can be divided into three groups, depending on their location: renal, ureteric and bladder. Each group characteristically presents with different symptoms and signs, although of course there will be some overlap. Additionally the stones can be classified by the composition of the ions that form them and sometimes by underlying disease processes and dietary imbalances that predispose a patient to develop them.

This article discusses the pathophysiology behind stone formation, an important consideration that influences long-term management of the disease. It also describes the most common presentation of patients with stone disease, renal colic and how best a surgical trainee can manage those patients in the initial stages, appropriate investigation and definitive treatment options.

Figure 1: Examples of kidney stones. From top left clockwise: cysteine stone, struvite stones, calcium oxalate stones, uric acid stone.

Pathophysiology

The formation of stones in the renal tract is dependent on the balance of certain factors, some that predispose to crystal development and some that restrict it. A common theory proposed to explain stone formation is that of 'supersaturation' [1,2,3], whereby the concentration of stone forming ions in the urine exceed their maximum solubility, causing precipitation of small amounts of crystal that subsequently act as a nidus for larger stone formation. While this process certainly occurs, especially in those patients who have metabolic or dietary abnormalities, many studies have shown supersaturation of crystal forming ions in the urine of people who never go on to develop stones, and lower than average concentrations in some who repeatedly form stones [3,4].

Research has demonstrated that there are other important processes involved in altering the likelihood of crystal formation:

1) Urinary pH

The pH of urine alters the solubility of various stone forming ions[5]. For example, as the urine becomes more acidic the solubility of calcium oxalate, uric acid and cysteine decreases and thus the likelihood of stones formed from any of these compounds increases. Paradoxically as the urine becomes more alkali the solubility of calcium phosphate and struvite crystals decreases and they become the more likely precipitants of stone formation.

2) Concentration of ions

As described in the supersaturation theory, an unusually high concentration of stone forming ions such as calcium, uric acid, oxalate, phosphate and cysteine will increase the likelihood of crystal precipitation[1,2,3]. An important consideration in analysing ion concentration is the volume of urine they are dissolved in. As you would expect, dehydration results in concentrated urine with higher than average proportions of stone forming ions, and can therefore increase the likelihood of stone disease. Most recurrent stone formers should therefore be encouraged to drink more fluids.

3) Inhibitors of crystal formation

It is becoming increasingly clear that there are a large number of compounds present in the urine that actively prevent stone formation[6]. These include citrate, pyrophosphate, osteopontin and hyaluronic acid.

REVIEW - UROLITHIASIS FOR THE SURGICAL TRAINEE

W Green

4) Urinary tract infection

Urease forming bacteria are able to convert uric acid to ammonia and CO^2, which raise the urinary pH and form calcium carbonate. This then combines with struvite (a mixture of magnesium, ammonium and phosphate) to form large calculi commonly found in the pelvicalyceal system and known as 'staghorn calculi [7]. The most common bacteria associated with this are Proteus, Klebsiella and Pseudomonas.

Figure 2: A Staghorn calculus. The outline of the pelvicalyceal system can clearly be seen in this example.

Presentation of stone disease

The presentation of stones in the renal tract depends largely on where they are situated. The majority form in the kidney and while they are there tend not to cause the patient too much trouble. Indeed many people are found to have incidental renal stones that are completely asymptomatic. It is when the stone migrates to the ureter that the most commonly experienced symptoms develop. The most widely used term to describe such symptoms is 'renal colic'.

1) Pain – This is the most consistent symptom in renal colic. It is usually excruciating and the patient will tend to be restless, moving around to try and find a position that relieves it. This is quite different to a patient with an acute abdomen who will try and lie still, and can be a useful, but not infallible way to differentiate the two.

The pain is caused by spasm and irritation as the peristaltic mechanism attempts to move the stone along the ureter, as well as distension of the renal tract proximal to the blockage (8). It tends to be relatively swift in onset, reaching its maximum intensity within 2 hours, although this is not always the case. An important feature to note is that despite its name the pain in renal colic is usually constant in nature, unlike biliary colic for example.

Renal colic pain is frequently described as 'loin to groin' and this is generally accurate, although pain is not always felt over the whole of this area at the same time, and the location of maximum intensity can be used as a guide to the location of the stone. Pain felt in the flanks is likely to be caused by a stone in the renal pelvis or upper ureter. Pain in the iliac fossa may be mid-ureteric and pain in the groin or genitals may be caused by a distal ureteric stone.

2) Haematuria – Blood in the urine may be frank or microscopic and is present in at least 85% of presentations of renal colic (9). It is caused by irritation and direct trauma to the renal tract. While it is possible to have renal colic in the absence of haematuria, a negative urine dip stick should trigger a careful review of alternative causes for the patient's symptoms.

3) Nausea and Vomiting – These are extremely common symptoms in renal colic. The likely mechanism is a shared innervation of the renal pelvis and gastrointestinal system through the coeliac plexus, with efferent nerves from the renal pelvis triggered on distension secondary to urinary obstruction (10). Latrogenic causes are also very important. Opioids are widely used in the treatment of renal colic and commonly cause nausea and vomiting. In addition, NSAIDs can cause gastric irritation, particularly in a patient who has an empty stomach secondary to poor appetite from their renal colic.

4) Fever and Sepsis – While certainly not the most common symptoms of renal colic, an obstructed renal tract can easily become infected, and any signs of systemic infection should be investigated thoroughly and supportive treatment initiated.

Initial Management

1) Pain Relief

The most important initial management is pain control, as quite apart from the humanitarian aspect much of the subsequent investigation cannot be done on a patient unable to lie still.

A great deal of research has examined the efficacy and mechanism of various analgesics in renal colic, particularly NSAIDS and opiates and there are now widely accepted guidelines relating to the initial management of pain in stone disease.

REVIEW - UROLITHIASIS FOR THE SURGICAL TRAINEE

W Green

Below can be found a summary of the recommendations of the American Association of Urologists (ASU) and the European Association of Urology (EAU) on the initial pain control in renal colic (11):

Preference	Pharmacological Agent	Grade of Evidence (GE)	Grade of Recommendation (GR)
1	Diclofenac*	1B	A
1	Indomethacin or Ibruprofen		
2	Morphine + Antiemetic or Tramadol + Antiemetic	4	C

Table 1: Initial pain relief in Renal Colic

** While diclofenac is the recommended 1first-line treatment, Indomethacin or Ibruprofen have been shown to be equally effective.*

The available evidence suggests that not only do NSAIDs provide moderate improvements in pain scores compared to opiates, they also reduce the likelihood of further analgesia being required in the short term and are associated with fewer side effects [12, 13, 14]. In addition, Diclofenac has been shown to be extremely effective at preventing recurrent pain in the first 7 days post presentation of acute renal colic [11].

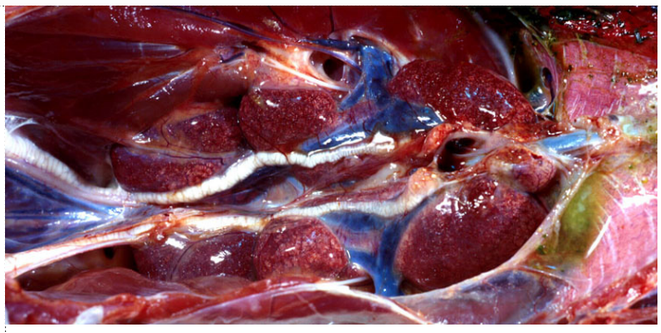
2) Antiemetics

There are no specific guidelines available for the use of antiemetics in renal colic. The condition is frequently associated with nausea and vomiting, so care should be taken to ensure antemetics are prescribed PRN for all patients. While it is unclear if any particular class of antiemetic is superior, there is some evidence to suggest that ondansetron and certain histamine receptor blockers not only reduce the incidence of nausea and vomiting, but also have a direct effect on pain reduction in renal colic [15, 16].

3) Treatment of Infection

If there is any evidence that the patient has developed urosepsis from bacterial overgrowth in the obstructed renal tract then these patients should be considered a surgical emergency and will require intravenous antibiotics and urgent drainage of the obstructed kidney as well as appropriate supportive management [11].

The EAU guidelines on urosepsis suggest a third-generation cephalosporin would be appropriate in this situation [17], however local antimicrobial guidelines should be reviewed and it is always good practice to discuss the patient with a consultant microbiologist.



Symptoms suggestive of sepsis include but are not limited to (18):

1) Temperature >38°C or <36°C 2) Heart rate >90
3) Respiritory Rate >20 4) White cell count >12
5) Oliguria
6) Systolic Blood Pressure <90
7) Altered mental status

Investigation

While the diagnosis of renal colic can often be made with reasonable confidence from the presenting symptoms and signs, clinical assessment alone is not infallible and the surgical trainee should perform a number of investigations to not only confirm the diagnosis, but also aid treatment decisions.

Below is a list of investigations and the reason for them:

Investigation	Indication
Urine dipstick + culture.	Haematuria is present in at least 85% of renal colic [9]. If it is negative then reconsider diagnosis although remember that a negative test does NOT rule out stone disease. If nitrite + and white cell + then urinary infection likely. Urinary pH may indicate the likely stone composition (see above.)
FBC, U&E, CRP, Calcium, Uric acid, G&S	A high white cell count and CRP will indicate systemic infection. If the creatinine is high and/or the eGFR low then impaired renal function indicated. This has implications for choice of imaging modality (see below) and choice of treatment option (see below). Serum calcium and uric acid levels will not affect immediate management, but may be helpful in determining any predisposing factors for stone formation. A G&S should be performed in case the patient should need to go to theatre.
Stone analysis	If the patient passes a stone (the patient should be asked to sieve their urine) then it requires biochemical analysis to determine its composition and hence recommendations on dietary changes can be made or further investigations requested.
Blood Culture if temp >38°C	If the patient is pyrexial or you have any other reason to suspect systemic infection blood cultures must be performed to assist appropriate antibiotic therapy.

Table 2: Investiagtions in renal colic

REVIEW - UROLITHIASIS FOR THE SURGICAL TRAINEE

W Green

Imaging

In practice all patients presenting with suspected stone disease require imaging, particularly if they are febrile or only have one kidney [11].

Over the last few years the mainstay of diagnostic imaging has been the intravenous urogram (IVU, also known as the intravenous pyelogram, IVP). This is a technique that uses a radio-opaque contrast medium that is excreted through the kidneys into the urine. Any obstruction or filling defects can then be seen on subsequent radiographs taken at intervals after injection of the IV contrast. This investigation is widely available but has certain drawbacks. Patients can develop a serious allergy to the contrast medium, including full anaphalaxis, and the contrast is also nephrotoxic meaning that it cannot be used in patients with significant renal impairment (11). In addition, patients who are on metformin cannot have contrast if they have any renal impairment at all, and even those with normal renal function must stop their metformin for 48 hours post IVU to prevent lactic acidosis (19).

Figure 3: An intravenous urogram (IVU) taken 40 minutes post-contrast injection. This film demonstrates an obstructed left system with moderate calyceal clubbing. A standing column of contrast is also visible, suggesting the obstruction is located at the left vesico-ureteric junction (VUJ).

However, over the last few years the non-contrast CT scan has become more common and has the advantage of no contrast complications, greater speed, and can also detect other structural abnormalities that would not be seen on IVU. It does expose the patient to a moderately higher radiation dose however. The EAU has examined the relevant data on IVU and CT in suspected renal colic and has produced the following guidance [11]:

Preference	Examination	Grade of Evidence (GE)	Grade of Recommendation (GR)
1	Non-contrast CT	1	A
1	IVU	Standard Procedure	
2	KUB* + ultrasound	2a	B

Table 3: Imaging modalities in suspected renal colic
** KUB = plain film of kidneys, ureter and bladder*

A great deal of research has shown that the sensitivity and specificity of CT is similar or moderately better than IVU [20, 21] and recent papers published since the EUA guidance on imaging have shown a widespread trend to CT becoming the imaging modality of choice among uroradiologists [22, 23].

Definitive Treatment

Stones up to 7mm in diameter may pass spontaneously, so accurate assessment of stone size is crucial in determining need for surgical intervention. In addition, the location of the stone determines whether or not it is likely to pass spontaneously, with stones in the renal pelvis or proximal ureter much less likely to pass than those in the distal ureter.

The EUA and AUA have published guidelines demonstrating when active stone removal is necessary (11):

Indication for considering active stone removal	Grade of Evidence (GE)	Grade of Recom-mendation (GR)
Stone diameter = 7mm as chances of spontaneous passage very low	2A	B
Unable to achieve adequate pain relief	4	B
Stone obstruction associated with infection*	4	B
Risk of pyelonephritisor urosepsis*	4	B
Single kidney with obstruction*	4	B
Bilateral obstruction*	4	B

Table 4: Indications for active stone removal

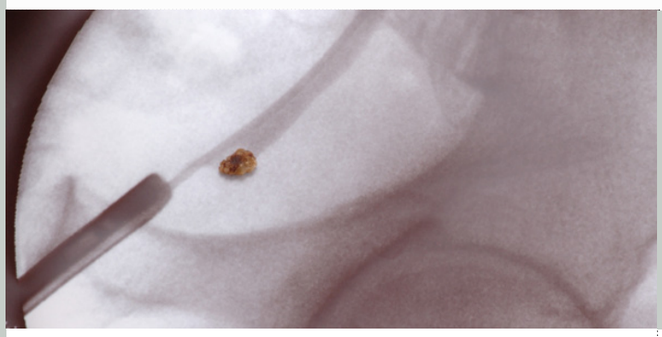
*Diversion of urine with a percutaneous nephrostomy catheter or bypassing the stone with a stent are minimal requirements in these patients.

The choice of stone removal technique is extremely complicated, and a detailed description of each procedure and its indications is beyond the scope of this article. However, below is a overview of some of the more common methods.

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

REVIEW - UROLITHIASIS FOR THE SURGICAL TRAINEE

W Green



Review - Urolithiasis for the Surgical Trainee. Urology.

1) Renal stones

These may be managed by various techniques. Extra-corporeal shock wave lithotripsy (ESWL) is widely considered the intervention of choice, particularly if the stone is <20mm in diameter [11, 24]. If the stone is larger then the fragments left over can cause obstruction themselves, so it is recommended that a ureteric stent is inserted prior to ESWL of stones >20mm in diameter. ESWL is contraindicated in pregnant women, patients with abdominal aortic or renal artery aneurysms, very obese patients, in uncontrolled UTIs and people with bleeding disorders [24].

Percutaneous nephrolithotomy is another treatment choice for renal stones, and has very high success rates [11]. It is commonly used if the renal stone has a diameter of >20mm or ESWL is not available or contraindicated. It involves making a small incision in the loin and inserting a guidewire into the renal pelvis, over which larger and larger dilators are passed until a nephroscope can be inserted to remove the renal stones. A balloon catheter can be inserted up the ureter to dilate the renal pelvis to assist surgery and to stop stone fragments falling down the ureter.

Open surgical removal of extremely large or complicated stones is also an option, however this technique is becoming less and less common as minimally invasive therapies continue to be improved.

2) Ureteric stones

The EAU and AUA have conducted an analysis of the available data with regard to treatment of ureteric stones and have suggested the following options [11]:

In stones of <10mm in diameter where symptoms are controlled a trial of observation may be appropriate. These patients may also be offered medical expulsion therapy such as alpha blockers or nifedipine, which have both been shown to facilitate stone passage.

For patients with stones >10mm in diameter surgical intervention is nearly always required. The EAU and AUA suggest that both ESWL and reterograde ureteroscopy are first choice therapies [11].

In certain situations, for example stones in the upper ureter, or in cases where other techniques have failed or there are stones in the renal pelvis that need removing at the same time percutaneous anterograde ureteroscopy may be appropriate.

Summary

Stone disease is a common acute presentation in the emergency department and surgical assessment units. The management of the initial intense pain is paramount as it relieves the patient's suffering and allows subsequent investigations to be undertaken. Surgical trainees must be aware of the appropriate steps to be taken when they suspect renal colic, to allow prompt diagnosis and treatment of this important group of patients.

Clinical Vignette

A 45-year-old woman presented to the Emergency Department with left sided loin to groin pain, high temperature and a tachycardia. A detailed history was not possible as the patient was unable to communicate clearly or move her limbs because of severe multiple sclerosis. However, her husband stated she has had renal and ureteric calculi before, and was once admitted to ITU after presenting with similar symptoms.

Initial ABC assessment and management was carried out to stabilise the patient. Analgesia was given, bloods were taken and good IV access obtained. IV fluids were started and a start dose of IV Augmentin and Gentamicin were administered. A likely diagnosis was made of renal colic and an emergency CT KUB carried out to ascertain whether the left renal tract was obstructed and infected.

The CT revealed an obstructed system with a left-sided mid-ureteric calculus. The Consultant radiologist on call agreed to carry out an emergency nephrostomy, which was performed without complication within an hour of the diagnosis.

The patient subsequently became more tachycardic and developed significant hypotension refractory to IV fluid challenge. An ITU referral was made and the patient was transferred to the ITU where she required maximum inotrope support. After an initial deterioration the patient rallied and a week later was transferred back to the ward.

REVIEW - UROLITHIASIS FOR THE SURGICAL TRAINEE

W Green

Multiple True/False Questions

1) Renal Calculi:
a) Are more common in men than women
b) Are more common in the elderly
c) Will affect 10% of the population in their lifetime
d) Are more common in White and Asian racial groups
e) Are often seen in children

2) Differential Diagnoses of Stone Disease include:
a) Abdominal aortic aneurysm
b) Appendicitis
c) Gastroenteritis
d) Biliary colic
e) Diverticular disease

3) Appropriate Investigations of Renal Colic include:
a) A KUB xray as initial imaging
b) Thyroid function tests (TFTs)
c) Intravenous Urogram
d) Ultrasound scan within 24 hours
e) Urine dipstick

4) Initial Management of Renal Colic Includes:
a) Pethidine
b) Antiemetics
c) Oral antibiotics
d) PR diclofenac
e) IV access

5) Treatment options of Stone Disease include:
a) ESWL for ureteric calculi
b) Alpha blockers for stones <10mm in diameter
c) Percutaneous nephrolithotomy for renal calculi
d) Ureteroscopy and lasertripsy for ureteric calculi
e) Nephrostomy insertion for an obstructed, infected system

Answers

1 a) T b) F c) T d) T e) F
Renal calculi are more common in men regardless of age, and peak in the 3rd and 4th decades of life. They are very rare in children. More than 10% of the population in Western societies will develop renal calculi in their lifetime. White and Asian people develop renal calculi more frequently than those of African origin.

2 a) T b) T c) T d) T e) T
Renal colic can present in a variety of ways, and can be confused with many other abdominal pathologies. It is extremely important to have an open mind when assessing a person presenting with symptoms of renal colic, as an undiagnosed abdominal aortic aneurysm or perforated viscus could potentially be fatal.

3 a) F b) F c) T d) F e) T
As explained in the article above there are clear guidelines regarding the initial investigation of renal colic. A KUB x-ray would not be sufficient and an IVU or CT KUB would be far more appropriate. Blood tests should be carried out, but TFTs are not necessary in the initial investigation of renal colic. Ultrasound can be useful in identifying an obstructed renal tract, but cannot provide as much detail as an IVU or CT. In addition ultrasound can often be obscured by overlying bowel gas and is difficult in overweight patients. A urine dipstick should be performed on all patients presenting with renal colic.

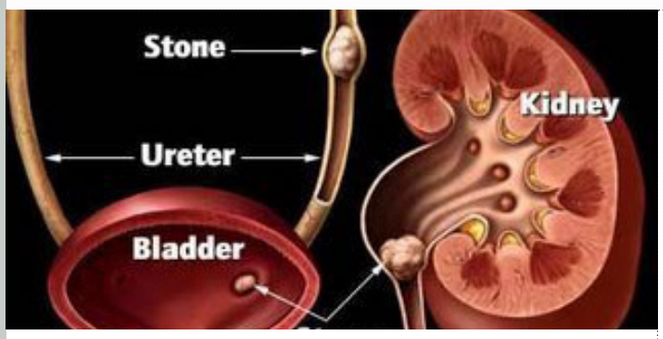
4 a) F b) T c) F d) T e) T
Analgesia is the mainstay of initial management in renal colic. Pethidine is no longer considered a first line treatment. Diclofenac (which is commonly given PR, especially if the patient is vomiting) and morphine would be more effective. IV access should be obtained in all patients with renal colic, as blood can be taken on insertion and IV fluids can be given should the patient become hypotensive or show signs of dehydration from vomiting. Antibiotic therapy is necessary should the patient exhibit any signs of systemic infection. However, as urosepsis can be extremely serious and patients can deteriorate suddenly, IV antibiotics are commonly prescribed.

5 a) F b) T c) T d) T e) T
ESWL is an effective treatment for renal and ureteric calculi, most commonly for upper and middle ureteric stones. Increasingly however, studies indicate similar success rates for lower ureteric stones. Alpha blockers relax the ureter and have been shown to facilitate stone passage, particularly those less than 10mm in diameter and in the distal ureter. Percutaneous nephrolithotomy is often carried out for large renal calculi and ureteroscopy and lasertripsy is an effective treatment option for most ureteric and some renal calculi. Nephrostomy insertion is an appropriate emergency treatment for patients with an obstructed renal tract and subsequent sepsis. It allows drainage of the effective kidney and stabilisation of the patient before a definitive treatment is considered.

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

REVIEW - UROLITHIASIS FOR THE SURGICAL TRAINEE

W Green



Reference

(1) Asplin JR, Bushinsky DA, Singharetnam W, Riordon D, Parks JH, Coe FL. Relationship between supersaturation and crystal inhibition in hypercalciuric rats. Kidney Int. 1997 Mar;51(3):640-5. [PubMed: 9067894]
(2) Bushinsky DA, Parker WR, Asplin JR. Calcium phosphate supersaturation regulates stone formation in genetic hypercalciuric stone-forming rats. Kidney Int. 2000 Feb;57(2):550-60. [PubMed: 10652032]
(3) Kavanagh JP. Supersaturation and renal precipitation: the key to stone formation? Urol Res. 2006 Apr;34(2):81-5. Epub 2006 Jan 26. Review. [Pubmed: 16437224]
(4) Lingeman J, Kahnoski R, Mardis H, Goldfarb DS, Grasso M, Lacy S, Scheinman SJ, Asplin JR, Parks JH. Divergence between stone composition and urine supersaturation: clinical and laboratory implications. J Urol. 1999 Apr;161(4):1077-81. [Pubmed: 10081841]
(5) Parks JH, Coe FL, Evan AP, Worcester EM. Urine pH in renal calcium stone formers who do and do not increase stone phosphate content with time. Nephrol Dial Transplant. 2009 Jan;24(1):130-6. Epub 2008 Jul 28. [PubMed: 18662977]
(6) Edyvane, KA, Hibberd, CM, Harnett, RM, Marshall, VR, Ryall, RL: Macromolecules inhibit calcium oxalate crystal growth and aggregation in whole human urine. Clin Chim Acta 1987 167: 329–338 [PubMed: 3621616]
(7) McAleer IM, Kaplan GW, Bradley JS, Carroll SF. Staghorn calculus endotoxin expression in sepsis. Urology. 2002 Apr;59(4):601. [PubMed: 11927328]
(8) Esquena S, Millán Rodríguez F, Sánchez-Martín FM, Rousaud Barón F, Marchant F, Villavicencio Mavrich H. Renal colic: revision of literature and scientific evidence. Actas Urol Esp. 2006 Mar;30(3):268-80. [PubMed 16749583]
(9) Argyropoulos A, Farmakis A, Doumas K, Lykourinas M. The presence of microscopic hematuria detected by urine dipstick test in the evaluation of patients with renal colic. Urol Res. 2004 Aug;32(4):294-7. Epub 2004 Mar 26. [PubMed: 15045479]
(10) Shafik A. Demonstration of a "renogastric reflex" after rapid distension of renal pelvis and ureter in nonanesthetized patients. Urology. 1999 Jan;53(1):38-43. [PubMed: 9886585]
(11) Preminger GM, Tiselius HG, Assimos DG, Alken P, Buck AC, Gallucci M, Knoll T, Lingeman JE, Nakada SY, Pearle MS, Sarica K, Türk C, Wolf JS Jr; American Urological Association Education and Research, Inc; European Association of Urology. 2007 Guideline for the management of ureteral calculi. Eur Urol 2007;52(6):1610-31. [PubMed: 18074433] (Updated 2009)
(12) Holdgate A, Pollock T. Systematic review of the relative efficacy of non-steroidal anti-infllammatory drugs and opioids in the treatment of acute renal colic. BMJ 2004;328:1401. [PubMed: 15178585]
(13) Shokeir AA, Abdulmaaboud M, Farage Y, Mutabagani H. Resistive index in renal colic: the effect of nonsteroidal anti-inflammatory drugs. BJU Int 1999;84(3):249-51. [PubMed: 10468715]
(14) Walden M, Lahtinen J, Elvander E. Analgesic effect and tolerance of ketoprofen and diclofenac in acute ureteral colic. Scand J Urol Nephrol 1993;27(3):323-5.[PubMed: 8290910]
(15) Yilmaz E, Batislam E, Deniz T, Yuvanc E. Histamine 1 receptor antagonist in symptomatic treatment of renal colic accompanied by nausea: two birds with one stone? Urology 2009 Jan;73(1):32-6. Epub 2008 Oct 11 [PubMed: 18849063]
(16) Ergene U, Pekdemir M, Canda E, Kirkali Z, Fowler J, CoÐkun F. Ondansetron versus diclofenac sodium in the treatment of acute ureteral colic: a double blind controlled trial. Int Urol Nephrol. 2001;33(2):315-9 [PubMed: 12092646]
(17) Grabe M, Bishop MC, Bjerklund-Johansen TE, Botto H, Çek M, Lobel B, Naber KG, Palou J, Tenke P, Wagenlehner F. Guidelines on Urological Infections. European Association of Urology 2009.
(18) Lever A, Mackenzie I. Clinical Review. Sepsis: definition, epidemiololgy and diagnosis. BMJ 2007;335:879-883 [PubMed 17962288]
(19) Thomsen HS, Morcos SK. Contrast media and the kidney: European Society of Radiology (ESUR) guidelines. Br J 2003;76(908):513-8. [PubMed:12893691]
(20) Dhar M, Denstedt JD. Imaging in diagnosis, treatment, and follow-up of stone patients. Adv Chronic Kidney Dis. 2009 Jan;16(1):39-47. [PubMed: 19095204]
(21) Worster A, Preyra I, Weaver B, Haines T. The accuracy of noncontrast helical computed tomography versus intravenous pyelography in the diagnosis of suspected acute urolithiasis: a meta-analysis. Ann Emerg Med 2002;40(3):280-6. [PubMed: 12192351]
(22) Alshamakhi AK, Barclay LC, Halkett G, Kukade G, Mundhada D, Uppoor RR, Gawai P. CT evaluation of flank pain and suspected urolithiasis Radiol Technol. 2009 Nov-Dec;81(2):122-31 [PubMed: 19901350]
(23) Townsend BA, Silverman SG, Mortele KJ, Tuncali K, Cohan RH. Current use of computed tomographic urography: survey of the society of uroradiology. J Comput Assist Tomogr. 2009 Jan-Feb;33(1):96-100. [PubMed: 19188794]
(24) Tombolini P, Ruoppolo M, Bellorofonte C, Zaatar C, Follini M. Lithotripsy in the treatment of urinary lithiasis. J Nephrol. 2000 Nov-Dec;13 Suppl 3:S71-82. Review. [PubMed: 11132037]

Author

Will Green
Foundation Year 2
Department of Urology
Royal Derby Hospital
Derby
Email: willgreen28@hotmail.com

NASOPHARYNGEAL CARCINOMA

T Wiggins, R Sahota & F Javed Uddin

Nasopharyngeal Carcinoma.
Otorhinolaryngology & Neck Surgery.

Introduction

Although nasopharyngeal carcinoma (NPC) is relatively rare in Western populations, it is commonly overlooked with 73% of cases being previously misdiagnosed in one study[1]. Clinical knowledge of this condition and a high index of suspicion can aid prompt investigation and treatment.

Case Presentation (Section 1)

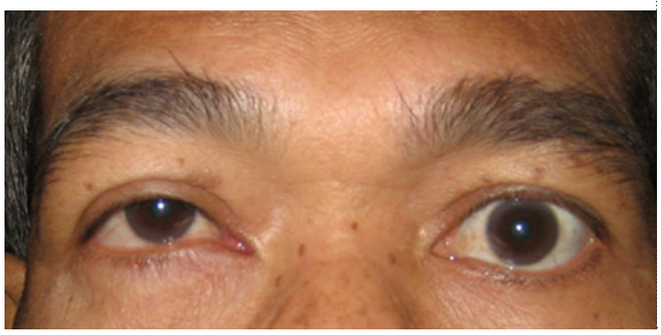
A 38-year-old oriental gentleman (Mr. G) presents to your outpatients clinic with a history of recurrent right-sided epistaxis. He has had two previous attempts of nasal cautery performed by his general practitioner, but these have been unsuccessful and bleeding has recurred. Flexible nasoendoscopy has not been performed previously. Mr. G has no other relevant medical history and no allergies.

Epidemiology

Nasopharyngeal carcinoma is most common within populations from South East Asia, in particular Southern China, Hong Kong, Singapore, Malaysia and Taiwan. In Southeastern China the reported incidence rates are 20-30 per 100,000 for males, and 7-13 per 100,000 for females[2]. In Southern China and Hong Kong nasopharyngeal carcinoma forms 20% of all malignancies and 80% of all head and neck cancer[3]. Although incidence is considerable lower in western populations (1 case per 100,000 persons[4]) it can pose a significant health problem in Western countries with large Asian populations.

Aetiology

The precise aetiology for NPC is still unclear. In general NPC is thought to result from a combination of genetic susceptibility and environmental factors[5]. One environmental factor strongly related to risk of NPC is consumption of Chinese-style salted fish, which contains carcinogenic nitrosamines[6-7]. A further environmental risk factor is latent Epstein-Barr virus (EBV) infection, and circulating levels of EBV DNA are positively correlated with disease stage and prognosis[8-9].



Pathophysiology

Nasopharyngeal carcinoma is divided into three subtypes based on the World Health Organisation classification[3].

- **WHO type 1 is keratinizing squamous cell carcinoma (10%).**
- **WHO type 2a is non-keratiniszing squamous cell carcinoma (20%).**
- **WHO type 2b is undifferentiated carcinoma (70%)**

NPC has been shown to have the highest rate of distant metastases amongst all head and neck cancers[10-11]. Bone metastasis is the most common metastasic site followed by pulmonary disease[1].

Relevant Anatomy

The nasopharynx is defined anteriorly by the posterior conchae, posteriorly by the clivus and the first two cervical vertebrae, superiorly by the base of skull specifically the floor of the sphenoid, and inferiorly by the level of the free border of the soft palate at C2[5]. The fossa of Rosenmuller is a groove posterior to the opening of the Eustachian tube, at the junction between the lateral and posterior walls of the nasopharynx. This fossa is the most common site for NPC to develop.

Clinical Presentation

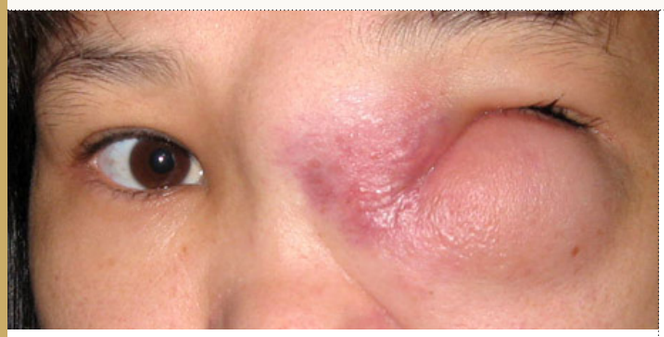
In one study by Cannon et al[1] 60% of patients presented with either a neck lump or weight loss. Common nasal symptoms can include epistaxis, post-nasal drip or nasal obstruction. More unusual presentations include unilateral or retro-orbital headache, referred otalgia and cranial nerve palsies.

Many of these symptoms can often be attributed to benign nasal pathology. It is therefore important to maintain a high index of clinical suspicion for NPC in patients with persistent symptoms which are refractory to medical therapy.

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

NASOPHARYNGEAL CARCINOMA

T Wiggins, R Sahota & F Javed Uddin



From the fossa of Rosenmuller, NPC can spread by direct invasion to involve numerous surrounding structures causing additional symptoms[3]:

- Invasion anteriorly to the Eustachian tube causing serous otitis media.
- Postero-lateral spread through the pharyngobasilar fascia to the parapharyngeal and retrostyloid space.
- Involvement of the parapharyngeal space can cause mandibular nerve paralysis. This gives partial loss of facial, palatal and pharyngeal sensation, and involvement of the pterygoid musculature causing trismus.
- Involvement of the retrostyloid space containing the cervical sympathetic trunk and cranial nerves IX-XII causes Horner's syndrome, vocal cord, pharyngeal, palatal, shoulder and tongue paralysis and pain.
- Superior invasion through the foramen lacerum to cause paralysis of the cranial nerves III, IV, and upper two divisions of V causing diplopia, facial hypoaesthesia and headaches.

Case Presentation (Section 2)

On further questioning Mr. G mentions that he has also noticed a feeling of long-standing right-sided nasal obstruction. This sensation has increased over the past few months. He has also lost around half a stone in weight.

Physical examination shows no obvious abnormality on anterior rhinoscopy with a nasal speculum. There are no prominent blood vessels over Little's area. Oropharynx appears normal. Examination of the neck reveals a 3cm palpable lymph node in the right posterior triangle, as well as some other smaller palpable lymph nodes. You perform flexible nasoendoscopy in clinic and your concerns are confirmed by a visible mass in the right nasopharynx.

Investigation

Diagnosis of NPC is made using a combination of history, physical examination and special investigations. The nasopharynx can be visualised most easily and reliably using fibreoptic nasoendoscopy (Fig. 1), and can be used if a biopsy of the fossa of Rosenmuller is to be taken. Transnasal biopsy of a pharyngeal mass can be undertaken in order to obtain tissue for histological analysis. This can be performed under local anaesthetic but in the UK is usually undertaken using a general anaesthetic.

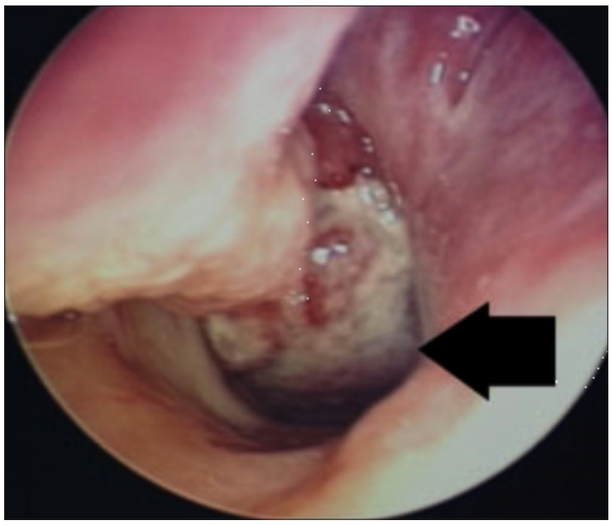


Figure 1: Fibreoptic Nasoendoscopy

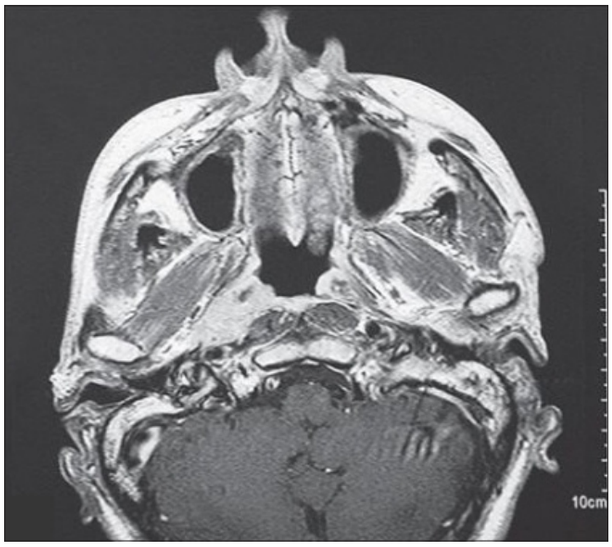


Figure 2: MRI of right-sided NPC (from Scott-Brown's Otorhinolaryngology, Head and Neck Surgery, 7th edition Chapter 188, Page 2451)

NASOPHARYNGEAL CARCINOMA

T Wiggins, R Sahota & F Javed Uddin

Distant metastatic disease can be detected by CT scanning or 18F-FDG positron emission tomography (PET). In one study of 78 patients PET-CT scan was more sensitive and specific than CT scanning in assessing for distant metastasis to lungs, liver and bones[12].

Fine needle aspiration of a neck mass can be used for detection of an occult nasopharyngeal tumour. The polymerase chain reaction can be used to assess the aspirate for presence of EBV-DNA. This has a sensitivity of 90.7%, and specificity of 88.5%[5,13]. In situ hybridization can also be used and has a higher sensitivity of 98.1% and specificity of 100%[5,13].

Case Presentation (Section 3)

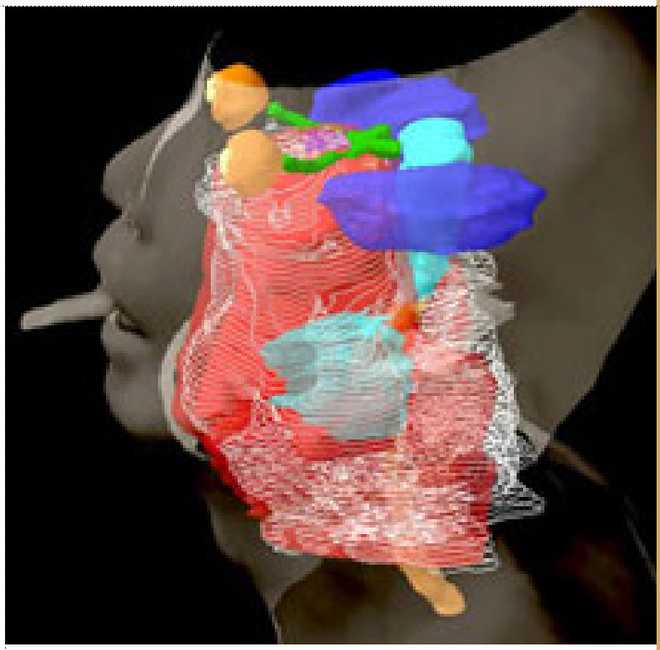
After your initial assessment you ask your registrar to review the patient. He agrees that there is a visible mass on flexible nasoendoscopy, and is also very concerned regarding the possible diagnosis of nasopharyngeal carcinoma. He performs fine needle aspiration cytology of the neck lump, and asks you to arrange an MRI scan. The patient is also listed for examination of the nasopharynx and upper aerodigestive tract under general anaesthesia plus biopsy. Follow-up is arranged for the next head and neck oncology multidisciplinary meeting.

Staging

Nasopharyngeal carcinoma is staged according to the TNM classification as detailed in Fig. 2[5].

TX	Primary tumour cannot be assessed.
T0	No evidence of primary tumour.
Tis	Carcinoma in situ.
T1	Tumour confined to the nasopharynx
T2	Tumour extends to soft tissue of oropharynx and/or nasal fossa.
T2a	T2 without parapharyngeal extension.
T2b	T2 with parapharyngeal extension.
T3	Tumour invades bony structures and/or paranasal sinuses.
T4	Tumour with intracranial extension and/or involvement of cranial nerves, infratemporal fossa, hypopharynx or orbit
NX	Regional lymph nodes cannot be assessed.
N0	No regional lymph node metastasis.
N1	Unilateral metastasis in lymph node(s) measuring 6cm or less in greatest dimension above the supraclavicular fossa.
N2	Bilateral metastasis in lymph node(s) measuring 6cm or less in greatest dimension above the supraclavicular fossa.
N3a	Metastasis in lymph node(s) greater than 6cm in diameter.
N3b	Metastasis in lymph node(s) with extension into the supraclavicular fossa.
MX	Distant metastases cannot be assessed.
M0	No distant metastasis.
M1	Distant metastasis.
Stage I	T1, N0, M0
Stage IIA	T2a, N0, M0
Stage IIB	T1/T2a, N1, M0; T2b, N0/N1, M0
Stage III	T1/T2a/T2b, N2, M0; T3, N0/N1/N2, M0
Stage IVA	T4, N0/N1/N2, M0
Stage IVB	Any T, N3, M0
Stage IVC	Any T, any N, M1

Figure 2: TNM classification of nasopharyngeal carcinoma. (Taken from http://emedicine.medscape.com/article/848163-diagnosis)



Management

Primary management of nasopharyngeal carcinoma is via external beam radiation. This is effective both at the primary site of the tumour and also at any involved neck nodes. These tumours are highly sensitive to radiation and radiation therapy alone can be highly effective particularly for stage I and II disease.

It is generally felt that for more advanced stages of nasopharyngeal carcinoma, a combination of chemotherapy and radiotherapy can help improve survival. Al-Saraaf et al[14] demonstrated that concomitant chemoradiation with cisplatin, followed by adjuvant chemotherapy with cisplatin and 5-FU improved overall survival rate at 3 years for patients with advanced stage NPC over radiation therapy alone (75% vs 46%).

Possible side effects of radiation therapy to the nasopharynx and neck include pituitary dysfunction, temporal lobe necrosis, cranial nerve palsy, sensorineural hearing loss, ischaemic retinopathy, hypothyroidism, oesophageal stricture, trismus, and stenosis of the common carotid or internal carotid artery[5].

Surgical therapy with nasopharyngectomy is usually reserved for recurrent cases of NPC following failure of radiation therapy. This surgery is complicated by the anatomical constraints for surgical access to this region.

Numerous surgical approaches are available. Fee describes a transpalatal, transmaxillary, and transcervical approach. These approaches provided a 5-year disease-free survival rate of 52%[5,15].

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

NASOPHARYNGEAL CARCINOMA

T Wiggins, R Sahota & F Javed Uddin

With the advent of minimally invasive surgery Chan et al have described an endoscopic approach to nasopharyngectomy[16]. The posterior part of the nasal septum, vomer, and inferior turbinates are removed to create a working space. The widely exposed tumour is then excised with an adequate mucosal surgical margin. The lateral wall, roof and posterior wall are resected and surgical margins are sent for frozen section to evaluate the need for further resections. Finally the wound surface is covered with a free mucosal flap harvested from the inferior turbinate. Patients were discharged 3-5 days following surgery. Of the six patients undergoing this technique between 2001 and 2005 all operations were successfully performed with no conversions to open procedure. At a mean follow-up of 29 months 83.3% of patients remained disease-free.

Case Presentation (Section 4)

Following the MRI scan the images are reviewed at the next head and neck multidisciplinary team meeting. This confirms that there appears to be a mass in the right nasopharynx with no obvious local tumour invasion. However the MRI also confirms the presence of a 3-cm lymph node in the right neck, which is believed to represent metastatic disease. Results of the FNAC are now available and confirm that this lymph node contains metastatic carcinoma cells from the nasopharynx. Results of the nasal biopsy confirm a diagnosis of nasopharyngeal carcinoma. Following discussion it is recommended that this gentleman will undergo an initial course of radiotherapy followed by repeat MRI scan to assess response. Your consultant thanks you for your prompt initial diagnosis allowing this gentleman to receive appropriate therapy so promptly.

Conclusion

Nasopharyngeal carcinoma is uncommon in western populations, however its symptoms can be non-specific, and high index of clinical suspicion is key to early diagnosis and treatment. Primary treatment method is radiotherapy with adjuvant chemotherapy in more advanced disease. Surgery is reserved for recurrent cases, and minimally invasive surgical techniques are being developed.

Multiple Choice Questions

Please select all correct answers (more than one per MCQ):

Q1: Common clinical presentations of nasopharyngeal carcinoma can include.

a) Nasal obstruction.
b) Recurrent epistaxis.
c) Neck lump
d) Arm paraesthesia
e) Retro-orbital headache

Q2: Risk factors for nasopharyngeal carcinoma

a) Afro-Caribbean origin.
b) History of woodworking.
c) Consumption of salted fish.
d) Latent infection with Epstein Barr Virus.
e) Recurrent sinusitis

Q3: Regarding the anatomy of the nasopharynx:

a) The inferior border of the nasopharynx is formed by upper edge of the epiglottis.
b) The Fossa of Rosenmuller lies posterior to the opening of the maxillary sinus.
c) The nasopharynx is defined posteriorly by the clivus and the first two cervical vertebrae.
d) The fossa of Rosenmuller is a common site for the development of NPC.
e) The opening of the sphenoid sinus is in the anterior part of the middle nasal meatus.

Q4: Regarding investigation of nasopharyngeal carcinoma:

a) Nasopharyngeal carcinoma may not be visible via flexible nasoendoscopy despite metastatic lymph node disease.
b) Fine needle aspiration of a neck mass is unhelpful in the diagnosis of NPC.
c) MRI is the radiologic modality of choice for assessing tumour stage.
d) Biopsy of a nasopharyngeal mass always requires a general anaesthetic.
e) PET-CT can be helpful in identifying distant metastases.

Q5: Regarding the management of nasopharyngeal carcinoma:

a) Surgical intervention is usually the initial treatment of choice.
b) Early disease stages are highly sensitive to radiotherapy.
c) Possible complications of radiotherapy include pituitary dysfunction, sensorineural hearing loss, and cranial nerve palsy.
d) Surgical approaches include the transpalatal, transmaxillary, and transcervical approach.
e) Minimally invasive surgery is not possible for NPC due to difficulties with access to the nasopharynx.

Answers

A1: a, b, c, e

Although arm paraesthesia is not a common symptom of NPC. However nasal obstruction, epistaxis, neck lump and retro-orbital headache are all common clinical presentations.

A2: c, d.

Oriental origin and consumption of Chinese-style salted fish are known risk factors for NPC. Latent infection with EBV is also known to contribute but there is no evidence that recurrent sinusitis can cause NPC. A history of woodworking is a risk factor for sinonasal tumours rather than nasopharyngeal carcinoma. Hard wood exposure is associated with sinonasal adenocarcinoma, and soft wood dust with squamous carcinoma.

NASOPHARYNGEAL CARCINOMA

T Wiggins, R Sahota & F Javed Uddin

A3: c, d.

The inferior border of the nasopharynx is formed by the free border of the soft palate. The upper edge of the epiglottis forms the inferior border of the oropharynx. The Fossa of Rosenmuller lies just posterior to the opening of the Eustachian tube. The sphenoid sinus drains above the superior concha (the sphenoethmoidal recess).

A4: a, c, e.

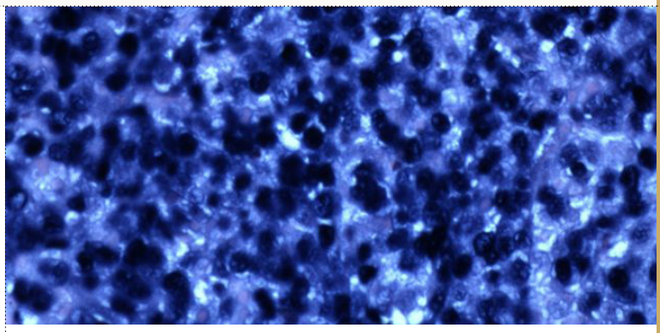
Submucosal spread means that NPC may not be visible via flexible nasal endoscopy despite metastatic disease. MRI is usually the investigation of choice, and FNAC is often helpful in forming a diagnosis. Biopsy can sometimes be undertaken under local anaesthetic.

A5: b, c, d.

Radiotherapy is usually the initial treatment of choice for NPC, and early stages of disease are usually highly sensitive. Minimally invasive surgical techniques are now possible via nasal access.

References

1. Cannon T, Zanation AM, Lai V, Weissler MC. Nasopharyngeal Carcinoma in Young Patients: A Systematic Review of Racial Demographics. The Laryngoscope, 2006; 116:1021-1026.
2. Jia WH, Huang QH, Liao J et al. Trends in Incidence and Mortality of Nasopharyngeal Carcinoma over a 20-25 year period (1978/1983-2002) in Sihui and Cangwu counties in southern China. BMC Cancer, 2006; 6: 178.
3. Roland N.J; McRae R.D.R; McCombe A.W; Key topics in otolaryngology and head and neck surgery; Second Edition 2001; BIOS Scientific Publishers Limited, Oxford. Pages 180-184.
4. Ong YK, Tan HKK. Nasopharyngeal carcinoma in children. Int J Pediatric Otorhinolaryngol, 2000; 55:149-154.
5. Lin HS, Fee W Jr; Malignant nasopharyngeal tumours; Oct 16 2009: Accessed via **http://emedicine.medscape.com/article/848163-overview. Last accessed 27/12/09.**
6. Yu MC, Ho JH, Lai SH, Henderson BE. Cantonese-style salted fish as a cause of nasopharyngeal carcinoma: report of a case-control study in Hong Kong. Cancer Res, 1986; 956-961.
7. Sriamporn S, Vatanasapt V, Pisani P et al. Environmental risk factors for nasopharyngeal carcinoma: a case-control study in northeastern Thailand. Cancer Epidemiol Biomarkers Prev. 1992; 1: 345-348.
8. Lin JC, Chen KY, Wang WY et al. Detection of Epstein-Barr virus DNA in the peripheral-blood cells of patients with nasopharyngeal carcinoma: relationship to distant metastasis and survival; J Clin Oncol, 2001; 19: 2607-2615.
9. Lin JC, Wang WY, Chen KY et al. Quantification of plasma Epstein-Barr virus DNA in patients with advanced nasopharyngeal carcinoma. N Engl J Med, 2004; 350: 2461-2470.
10. Chen WZ, Zhou DL, Luo KS. Long-term observation after radiotherapy for nasopharyngeal carcinoma (NPC); Int J Radiat Oncol Biol Phys, 1989; 16: 311-14.
11. Vikram B, Mishra UB, Strong EW, Manolatos S; Patterns of failure in carcinoma of the nasopharynx: Failure at distant sites; Head Neck Surg, 1986; 8: 276-9.
12. Chua ML, Ong SC, Wee JT, et al. Comparison of 4 modalities for distant metastasis staging in endemic nasopharyngeal carcinoma. Head Neck, 2009; 31 (3): 346-54.



13. Tsai ST, Jin YT, Mann RB, Ambinder RF; Epstein-Barr virus detection in nasopharyngeal tissues of patients with suspected nasopharyngeal carcinoma. Cancer, 1998; 82 (8): 1449-53.
14. Al-Saraaf M, LeBlanc M, Giri PG, Fu KK, Cooper J, Vuong T. Chemoradiotherapy versus radiotherapy in patients with advanced nasopharyngeal cancer: Phase III randomized Intergroup study 0099. J Clin Oncol, 1998; 16 (4): 1310-7.
15. Fee WE Jr. Nasopharynx. Taken from: Close LG, Larson DL, Shah JP. Essentials of Head and Neck Oncology. New York, NY: Thieme; 1998: 205-210.
16. Chen MK, Lai JC, Chang CC, Liu MT; Minimally invasive endoscopic nasopharyngectomy in the treatment of recurrent T1-2a nasopharyngeal carcinoma; The Laryngoscope, 2007; 117: 894-896.

Authors

Mr Tom Wiggins
CT1 ENT
St Bartholomews Hospital

Mr Raguwinder Sahota
Clinical Research Fellow in ENT
Leicester Royal Infirmary

Mr F Javed Uddin
Specialist Registrar
Leicester Royal Infirmary

Correspondence

Tom Wiggins
ENT Department
St Bartholomews Hospital
West Smithfield
London
EC1 7BE

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

TOPIC SUMMARY: VESICO-URETERIC REFLUX & URINARY TRACT INFECTION IN CHILDREN

L Adamson[1], P Spreadborough[2]

Topic summary: Vesico-ureteric reflux and urinary tract infection in children. Paediatric Surgery.

Introduction

You are an SHO in clinic. A 5-year-old boy has been referred by his GP with a history of two urinary tract infections in the last 3 months. His mother wants to know if his kidneys have been damaged by the infections, and if he needs any treatment to prevent future infections. What else do you need to know? How will you investigate and manage this boy and what will you tell his mother?

Urinary tract infections are one of the commonest bacterial infections in children[1,2,] affecting one in 10 girls and one in 30 boys before the age of 16 years[3]. Three-quarters of infants under 1 year presenting with UTI will have a recurrence. In most cases it is mild and self-limiting, however a proportion of children will go on to develop renal scarring, and the potential for hypertension or renal insufficiency. It is therefore vital that those children at high risk of complications of UTI are identified and managed appropriately. Vesico-ureteric reflux (VUR) is the retrograde movement of urine from the bladder into the ureter and upper urinary tract. It is the most common structural abnormality found in children investigated for UTI, occurring in almost a third[4,] as well as in 1-3% of normal children[5]. It is known that VUR, in the presence of UTI, may allow the passage of infected urine up to the kidney, predisposing to renal scarring. However, sc arring can occur without infection, and reflux of sterile urine does not necessarily cause scarring, so there is much controversy regarding when and how to investigate and treat children with reflux. Recurrent UTI and VUR is an important problem, encountered frequently in Paediatric Urology clinics. This article aims to provide an overview of the presentation and diagnosis, and to discuss management options for children with VUR.

VUR – an inherited or acquired problem?

Vesico-ureteric reflux can occur primarily as a congenital problem with the valve at the vesico-ureteric junction, or can be secondary to physical or functional problems with bladder emptying. In the normal bladder, the entrance of the ureter to the bladder is along a tunnel between the muscular bladder wall and the urothelium (Fig. 1). Thus it allows urine to drain from the ureter, but once the bladder becomes full and the pressure rises, the tunnel is compressed such that urine cannot flow back into the ureter.

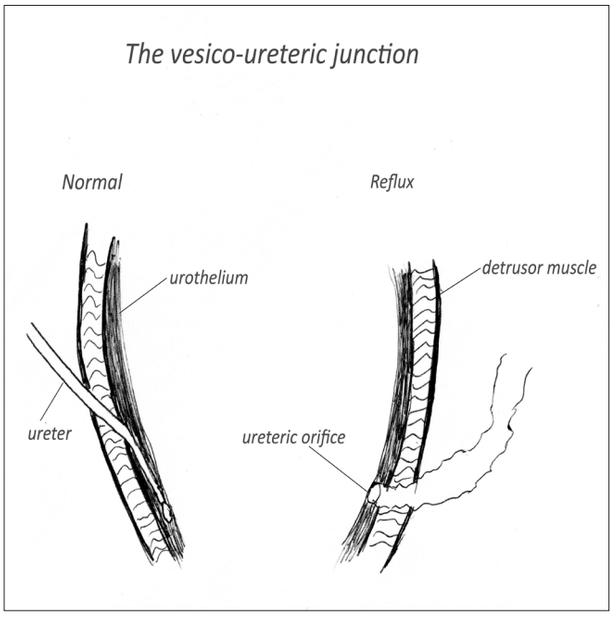


Figure 1

If the tunnel is too short, this one-way valve mechanism fails, and reflux can occur. Conversely if the tunnel is too long, the sub-mucosal tunnel is compressed too easily and can obstruct. Primary (congenital) VUR may be due to a short intramural course of the ureter. With age, the relative growth of bladder and ureter cause the shape to alter, and most cases of VUR resolve spontaneously as the child grows.

Secondary VUR can occur at a previously normal vesico-ureteric junction if there is an obstruction to normal bladder outflow. This causes bladder pressures to rise to a level which distorts the normal anatomy of the VUJ and allows urine to reflux up into the ureters. Causes include physical obstructions (which may or may not be congenital) for example posterior urethral valves or meatal stenosis; as well as functional issues with voiding, such as neurogenic bladder or dysfunctional elimination syndrome. It is increasingly thought that VUR, rather than being a disease in its own right, is better considered as a risk factor for UTI.

TOPIC SUMMARY: VESICO-URETERIC REFLUX & URINARY TRACT INFECTION IN CHILDREN

L Adamson[1], P Spreadborough[2]

The history and examination

To refer back to the case – a 5-year-old boy has been referred with two urinary tract infections. What information do we need to gather from the history, examination and investigations?

A full history of the presentation of the UTIs should be taken, including the symptoms, taking special care to elicit history of fevers, back pain and systemic features such as vomiting, as well as treatment of the acute episodes. A detailed record should be made of the findings of antenatal scans, perinatal problems, previous UTIs, how much the child drinks and how often they pass urine each day. The child should be examined for any renal masses or tenderness, a palpable bladder, and any external genital abnormalities as well as an examination of the spine for evidence of cutaneous manifestations of spinal dysraphism such as hairy patch, lipoma or haemangioma. Blood pressure should be measured and urine dipstick analysis undertaken. Microbiological results from the two episodes should be sought, specifically looking at the organism(s) cultured and their sensitivities.

Family history is also relevant. A French study[6] found a significant prevalence (26%) of reflux in asymptomatic siblings of children with VUR. It was not found to be beneficial to screen siblings for reflux, but a positive family history has an impact on the assessment of risk when deciding whether a child needs further investigation for their UTI.

To scan or not to scan?

There are several modalities of imaging which have been used to varying extents to investigate children with UTI for the presence of reflux and renal scarring. There is no evidence to support routine investigation of all children with UTI[7] so judicious requesting of often expensive and invasive tests is necessary.

• Renal tract ultrasound is a simple, non-invasive technique which provides useful information on the presence of renal scarring and the structure of the renal tract. Although ultrasound is less useful for detecting reflux, a "golf-hole" ureter may be significant.

• Micturating cystourethrogram (MCUG) is the gold standard investigation for demonstrating reflux. This involves catheterisation of the bladder, injection of contrast and screening performed while the child voids. Although easy to perform in infants, this technique requires radiation, is invasive and uncomfortable. One benefit is that it allows accurate grading of reflux (Fig. 2), which has significance in terms of likelihood of spontaneous resolution.

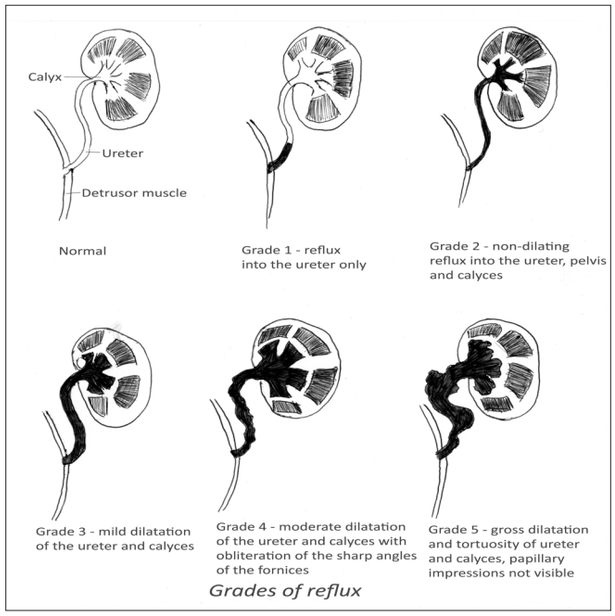


Figure 2

• Tc99m Dimercaptosuccinic acid (DMSA) scan is a nuclear medicine technique. It involves injection of radio-labelled isotope and renal uptake measurement to produce a renogram. This allows renal scars to be identified but provides no excretion or functional information. It is very useful in assessing differential function and so for determining the progression of scars. DMSA scanning has been used in the diagnosis of acute pyelonephritis as a method of assessing the need for further investigation: if the acute scan is normal, the kidneys have not been damaged and thus there should be no late sequelae[8]. It is also useful in the assessment of renal damage in reflux nephropathy. If an acute scan is not undertaken, post-infective scan should be delayed for at least 3 months to avoid false positive areas of photopenia to be labelled as "scars".

NICE have produced guidelines[3] on the management of UTI in children, thus comprehensive pathways and flowcharts are available to direct the appropriate tests and timing of tests in the investigation of these patients; depending on age, whether there are any "atypical" features of UTI, whether they respond to treatment and whether they have recurrence of infection. Table 1 is a summary of investigations as recommended by the guideline.

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

TOPIC SUMMARY: VESICO-URETERIC REFLUX & URINARY TRACT INFECTION IN CHILDREN

L Adamson[1], P Spreadborough[2]

Test	Age	Responding to treatment within 48 hrs	Atypical UTI[1]	Recurrent UTI
Ultrasound during acute infection	Under 6 months	No	Yes[2]	Yes
	6 months to 3 years			No
	3 years and older			
Ultrasound with 6 weeks	Under 6 months	Yes (if abnormal consider MCUG)	No	No
	6 months to 3 years	No		Yes
	3 years and older			
DMSA scan at 4-6 months	Under 6 months	No	Yes	Yes
	6 months to 3 years			
	3 years and older		No	
MCUG	Under 6 months	No	Yes	
	6 months to 3 years		No	
	3 years and older			

Table 1: Recommended investigations

1. An atypical infection includes all non *E. Coli* infections and also those infections which present with severe illness, renal impairment, the presence of a bladder mass, septicaemia or failure to respond to antibiotics within 48hrs.

2. In a non E. Coli infection, responding well to antibiotics this can be requested within 6 weeks.

In the case of our 5-year-old patient, given that his UTI was recurrent, it would be appropriate to request an ultrasound scan to be performed within 6 weeks, and a DMSA scan within 4-6 months of the acute infection, according to the NICE guidance. MCUG would not routinely be required.

When to treat

The consensus on treatment for vesico-ureteric reflux has shifted considerably over the last few years. In the past, due to the belief that VUR directly caused renal scarring, any child diagnosed with reflux would undergo reimplantation surgery to correct it[3]. However, research has shown that even those patients successfully treated by reimplantation surgery during childhood remained prone to recurrent UTIs, progressive renal scarring and hypertension[9] suggesting that the nephropathy associated with reflux may actually occur in the same system as part of the same disease, rather than as a direct consequence of the reflux. It is therefore vital that treatments for reflux (as for investigations, above) are considered carefully and used only in the right patient, at the right time.

It is now known that a significant proportion of VUR spontaneously resolves with age[10], particularly reflux at the lower grades, so selecting the individual patient likely to need treatment is not straightforward. Nevertheless, all patients and their parents should be provided with advice regarding increasing fluid intake, toileting regularly and maintenance of perineal hygiene to minimise risk of further UTIs.

The use of antibiotic prophylaxis for UTIs is a divisive issue. The 1991 Royal College of Physicians guideline on UTI in children recommended that antibiotic prophylaxis be commenced after a first UTI, at least until imaging was completed[11]. On review of recent evidence, NICE[3] now recommend that antibiotics are only considered in recurrent UTI. The research relating to the use of antibiotic prophylaxis in children with VUR is incomplete, however one Australian study group[12] recommend the prescription of low dose prophylactic antibiotics to all infants with reflux after their first UTI, at least until they are able to void reliably and provide mid-stream urine samples to allow early detection of infection.

Surgical management for reflux is reserved for those children who have breakthrough infections despite maximal lifestyle and medical management. The aim of reflux surgery is to prevent the reflux of urine into the ureter. This can be achieved either by a cystoscopic procedure or by open ureteric reimplantation. In some cases, if urine is refluxing into a non-functioning dysplastic kidney it may be appropriate to perform nephro-ureterectomy to prevent serious morbidity from infection. Cystoscopic treatment for reflux can be performed as a day case procedure. It involves the injection of a substance, commonly "Deflux" (a polymer of dextran) into the mucosa at the base of the ureteric orifice to create an effective valve. This technique has a reported success rate of 75% from a single injection[13,14].

TOPIC SUMMARY: VESICO-URETERIC REFLUX & URINARY TRACT INFECTION IN CHILDREN

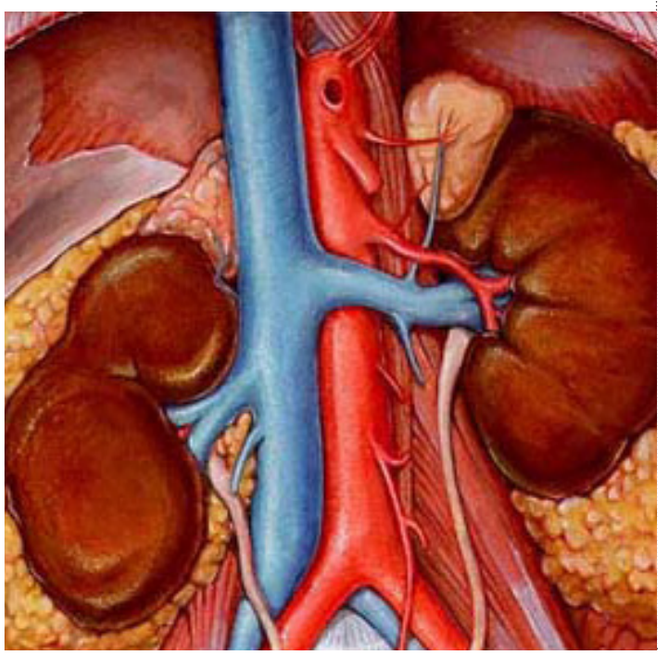
L Adamson[1], P Spreadborough[2]

Several methods of open reimplantation surgery have been described but in principle require the detachment of the ureter from the bladder and the formation of a submucosal tunnel opening at a neo-ureteric orifice. The success of this procedure at curing reflux is in the region of 95%[3] but is a major undertaking requiring a prolonged hospital stay.

Circumcision, independent of other medical or surgical interventions, has been shown to reduce risk of UTI[15]. In normal boys, the number needed to treat to prevent one UTI is 111. In boys with reflux, the background risk of UTI is much higher (approximately 30%) and the number needed to treatto prevent an incidence of UTI just 4, hence this is a useful option in reducing risk of infection and subsequent renal scarring.

The patient in our case provides us with a multitude of management options. At a first clinic appointment, before investigations have been undertaken, it may be proposed that he be given prophylactic antibiotics as he has had a recurrence of his UTI. Alternatively many clinicians would advocate simple lifestyle measures while investigation results were awaited. The parents and child would be advised of the symptoms and signs of UTI and asked to seek medical attention if a further episode occurred in the interim. Further management would very much depend on findings of ultrasound and DMSA scan. Only a minority of patients such as this would go on to require anti-reflux surgery.

If imaging in this patient was normal, he could reasonably be discharged from follow up with simple voiding advice. Presence of scarring would mandate follow up with regular assessment of height, weight, blood pressure and urine protein testing. In cases of bilateral renal parenchymal defects, impaired renal function or hypertension, specialist paediatric nephrology management is necessary to monitor and slow progression of chronic kidney disease.



In summary

The assessment and management of children with urinary tract infection and vesico-ureteric reflux continues to pose important clinical questions and opinions are changing as further evidence becomes available. An awareness of the presentation, available investigations and management options are fundamental in the approach to a child and his parents in the outpatient clinic.

We have discussed a "typical" patient presenting to a Paediatric Urologist and we are now able to elicit a pertinent history, suggest appropriate investigations and discuss further management. This approach should be applicable to any child presenting with recurrent UTI and VUR that may be encountered in clinical practice.

EMQs

Options:

a) Urgent inpatient ultrasound
b) Urgent inpatient ultrasound and arrange DMSA and MCUG
c) Outpatient ultrasound within six weeks of acute infection
d) Discharge with advice to optimise voiding
e) MCUG
f) Outpatient ultrasound within six weeks of acute infection and DMSA within four to six months

For each of the patients described below, select the single most appropriate line of management from the options listed above. Each option may be used once, more than once or not at all.

1) A 4-month-old previously well boy with 3 days of vomiting, fever and a proven E. Coli UTI on urine culture is recovering well after 48 hours antibiotic treatment.

2) A 6-year-old girl with dysuria, fever and a proven Proteus sp. UTI on urine culture is recovering well after 48 hours antibiotic treatment. She has had no previous similar episodes.

3) A 5-year-old boy with fever, vomiting and a proven E. Coli UTI on urine culture and a positive blood culture remains pyrexial after 72 hours antibiotic treatment.

4) A 2-year-old girl with two episodes of UTI treated with antibiotics in the community has been referred to clinic. Urine microscopy and culture demonstrated E. Coli on both occasions. Most recent episode was two weeks ago.

5) A 3-month-old girl is admitted to the ward seriously unwell with high fevers, a raised creatinine and gram negative rods on urine microscopy.

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

TOPIC SUMMARY: VESICO-URETERIC REFLUX & URINARY TRACT INFECTION IN CHILDREN

L Adamson[1], P Spreadborough[2]

Answers:

Question 1
C

Question 2
C

Question 3
A

Question 4
F

Question 5
B

Recommended further reading

1. Hutson JM, O'Brien M, Woodward A, Beasley S (eds). (2008)Vesico-Ureteric Reflux. In Jones' Clinical Paediatric Surgery – Diagnosis and Management, 6th Edn. Blackwell, Massachusetts, p193-197

2. National Institute for Health and Clinical Excellence. Urinary tract infection in children. London: NICE, 2007. (http://guidance.nice.org.uk/CG054)

3. Lebowitz RL, Olbing H, Parkkulainen KV, Smellie JM, Tamminen-Mobius TE. (1985) International system of radiographic grading of vesicoureteric reflux. Pediatr Radiol; 15:105-109

References

1. Twaij M. (2000) Urinary tract infection in children: a review of its pathogenesis and risk factors. J R Soc Promot Health; 120(4):220-226
2. Hoberman A, Chao HP, Keller DM, et al (1993). Prevalence of urinary tract infection in febrile infants. J Pediatr; 123(1):17–23
3. National Institute for Health and Clinical Excellence. Urinary tract infection in children. London: NICE, 2007.
4. Sargent M. (2000) What is the normal prevalence of vesicoureteral reflux? Pediatr Radiol; 30:587-593
5. Craig C. (2001)Urinary tract infection: new perspectives on a common disease. Curr Opin Infect Dis;14:309–13
6. Bonnin F, Lottmann H, Sauty L, Garel C, Archambaud F, Baudouin V, El Ghoneimi A, Loirat C, Bok BD, Aigrain Y (2002) Scintigraphic screening for renal damage in siblings of children with symptomatic primary vesico-ureteric reflux. BJU Int; 87(6):463-466
7. Westwood ME, Whiting PF, Cooper J, Watt IS, Kleijnen J. (2005) Further investigation of confirmed urinary tract infection (UTI) in children under five years: a systematic review. BMC Pediatr;5(1):2
8. Rossleigh MA. (2007) Renal infection and vesico-ureteric reflux. Semin Nucl Med; 37(4):261-268
9. Mor Y, Leibovitch I, Zalts R, Lotan D, Jonas P, Ramon J. (2003) Analysis of the long-term outcome of surgically corrected vesico-ureteric reflux. BJU Int; 2(1):97-100
10. Esbjorner E, Hansson S, Jakobsson B. (2004) Management of children with dilating vesico-ureteric reflux in Sweden. Acta Paediatrica; 93(1):37-42
11. Anonymous. (1991) Guidelines for the management of acute urinary tract infection in childhood. Report of a Working Group of theResearch Unit, Royal College of Physicians. J R Coll Physicians Lond; 25(1):36–42
12. Jones CL, Walker RG, Powell HR. (1993) Recent advances in the management of vesico-ureteric reflux. J Paediatr Child Health; 29(5):325-7
13. Bergman DA, Baltz RD, Cooley JR. (1999) Practice parameter: The diagnosis, treatment, and evaluation of the initial urinary tract infection in febrile infants and young children. Pediatrics; 103(41):843–52
14. Hoberman A , Wald ER. (1997) Urinary tract infections in young febrile children. Pediatr Infect Dis J; 16(1):11–17
15. Singh-Grewal D, Macdessi J, Craig J. (2005) Circumcision for the prevention of urinary tract infection in boys: a systematic review of randomised trials and observational studies. Arch Dis Child; 90(8):853-858

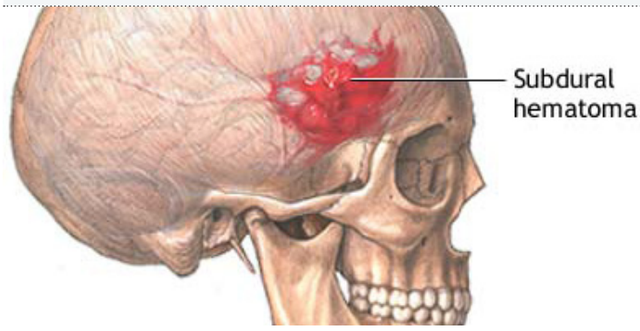
Authors

Miss Louise Adamson
CT2, Department of Paediatric Surgery
Nottingham University Hospitals

Surg Lt Philip Spreadborough
Medical Officer
Royal Navy

HEAD INJURY: SUBDURAL & EXTRADURAL HAEMATOMA

M Hughes



A 34-year-old man falls 5 metres from a ladder whilst working on a building site. At the scene, ambulance crew calculate his GCS to be 8. He is therefore intubated and transferred to hospital. ATLS protocols are followed in the emergency department: he remains intubated and ventilated, there is no evidence of haemodynamic instability, pupils are now noted to be unequal. Trauma series x-ray do not demonstrate additional significant injury.

CT scans of the head and neck illustrate a large left-sided acute subdural haematoma with underlying temporal contusions and evidence of basal skull fractures. The C-spine is cleared radiographically. The patient is transferred to the regional neurosurgical unit and undergoes emergency craniotomy to evacuate the clot.

Abstract

Head injury (HI) accounts for over 750,000 emergency department attendances per year in the UK. Of these, approximately 150,000 are admitted to hospital[1] and in the region of 4000 require neurosurgical intervention[2]. Although incidence is high, the mortality is low; 0.2% of those who attend the ED with a HI will die[3]. The challenge is therefore to identify the small numbers of patients with serious acute intracranial pathology early and to optimize their treatment. This review article focuses on initial assessment and investigation of HI (based on current NICE guidelines) with a more detailed discussion of relevant anatomy, pathophysiology, and management of subdural and extradural haematomata.

Initial assessment in HI

Adults who have sustained a HI should initially be assessed and managed according to ATLS principles with stabilization of airway, breathing, and circulation (ABC) before attention to other injuries. Patients who present with any of the following features should have full cervical spine immobilization:

- **GCS <15**
- **Neck pain/tenderness**
- **Focal neurological deficit**
- **Paraesthesia in extremities**
- **Any other clinical suspicion of cervical spine injury**

Assessment and classification of HI should be guided by the adult and paediatric versions of the Glasgow Coma Scale (GCS, see table 1). Based on GCS, HI can be categorized into mild, moderate, or severe (see table 2). The majority of fatalities occur in the moderate or severe categories.

Head Injury: Subdural & Extradural Haematoma. Neurosurgery.

	1	2	3	4	5	6
EYES	Does not open eyes	Eyes open in response to pain	Eyes open in response to voice	Eyes open spontaneously	N/A	N/A
MOTOR	No movement	Extension to painful stimuli	Abnormal flexion to painful stimuli	Flexion/withdrawal to painful stimuli	Localizes painful stimuli	Obeys commands
VOICE	No sounds	Incomprehensible sounds	Inappropriate words	Confused, disorientated	Converses normally	N/A

Table 1: Glasgow Coma Scale.

Degree of HI	GCS
Mild	13-15
Moderate	9-12
Severe	8 or less

Table 2: Categorization of head injuries according to GCS score.

If the GCS is less than or equal to 8, early involvement of anaesthetic/critical care staff is a requirement for airway management. Until a significant brain injury has been excluded, attributing decreased consciousness to intoxication is unacceptable. Additionally, pain leads to increased intracranial pressure and should always be managed effectively.

After ABC, the main goal of assessment of the head injured patient is to identify clinically important brain injury. Some brain injuries require early neurosurgical intervention (e.g. evacuation of intracranial haematoma) and are potentially life threatening if not detected and managed early.

Investigation

The primary investigation for detect ion of clinically relevant brain injuries is CT. MRI is not indicated in the context of HI for safety, logistics, and resource reasons. Adults who have suffered a HI should have CT scanning of the head requested immediately (and performed and reported within one hour) if any of the following risk factors are present[4]:

- **GCS<13 on initial assessment in the ED**
- **GCS<15 on re-assessment 2-hours post-injury**
- **Suspected open or depressed skull fracture**
- **Any sign of basal skull fracture (CSF rhinorrhoea/otorrhoea, Battle's sign, 'panda' eyes, haemotympanum)**
- **Post-traumatic seizure**
- **Focal neurological deficit**
- **More than one episode of vomiting**
- **Amnesia for events more than 30 minutes before impact**

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

HEAD INJURY: SUBDURAL & EXTRADURAL HAEMATOMA

M Hughes

CT should also be requested immediately if any of the following risk factors are present in the context of an episode of loss of consciousness or amnesia since injury:

• Age 65 or older
• Coagulopathy (innate or imposed by anticoagulants)
• Dangerous mechanism of injury (pedestrian/cyclist struck by motor vehicle, passenger ejected from motor vehicle, fall from greater than 1 metre or five stairs)

If an urgent CT head is indicated, CT imaging of the spine should also be undertaken. Clinical and radiographic assessment of the cervical spine is summarized in table 3.

If a patient is fully alert, it is safe to fully examine the neck if: • Simple rear-end motor vehicle collision • Patient has been ambulant at any time since injury and there is no midline neck tenderness • Patient can sit comfortably in emergency department • Patient presents with delayed onset of neck pain
Cervical spine radiographs are required in the following circumstances: • Not safe to assess neck (see above) • Active neck rotation limited to <45° to the left and right • Neck pain/midline tenderness and age > 65years • Neck pain/midline tenderness and dangerous mechanism (fall >1 metre or 5 stairs, axial load, high speed RTA, ejection from vehicle)
CT of the cervical spine should be requested in the following circumstances: • GCS<13 at initial assessment • Intubated patient • Inadequate plane radiographs • Clinical suspicion persists despite normal plain radiographs • If undertaking scans for multi-region trauma or urgent CT head

Table 3: Cervical spine clearance.

When to involve a neurosurgeon

Brain injury results from two discrete processes:

• Primary injury – includes cortical contusions, lacerations, diffuse axonal injury, bone fragmentation, and brainstem contusion.
• Secondary injury – occurs after the primary injury and includes oedema, hypoxaemia, ischaemia (related to raised intracranial pressure), and intracranial haematomas.

Primary injury occurs at the moment of impact and there is therefore no therapeutic opportunity. Consequently, prevention and minimization of secondary injury is the core goal of severe HI management. With this in mind, all severe HI (GCS 3-8) should be transferred to a neurosciences unit. If resources/logistics prevent this, ongoing liaison with a neurosciences unit regarding care is essential. If a patient has sustained polytrauma, admission should be under the team who is dealing with the most severe and urgent clinical problem. Although transfer is often urgent, this should not take place until initial resuscitation and stabilization of the patient has been achieved.

In addition to severe HI, the following should also prompt involvement of a neurosurgeon:

• All mass lesions visualized on CT
• Unexplained confusion >4 hours
• Deterioration in GCS after admission
• Progressive focal neurological signs
• Seizure without full recovery
• Evidence of CSF leak
• Definite or suspected penetrating injury

Anatomical concepts important in HI

The scalp is composed of five-layered structures (see Fig. 1). Scalp vessels bleed profusely due to a rich anastamosis that results in bleeding from both cut ends and also because vasospasm is impeded by the connective tissue the vessels course. Scalp wounds should be closed to achieve haemostasis prior to patient transfer. Deaths have occurred due to uncontrolled scalp bleeding[5]. Each side of the scalp receives blood via 5 arteries: supra-orbital and supra-trochlear arteries (branches of the ophthalmic artery from the internal carotid); occipital, posterior auricular, and superficial temporal arteries (branches of the external carotid). Cutaneous innervation derives from the ophthalmic division of the trigeminal nerve together with C2 and C3 branches.

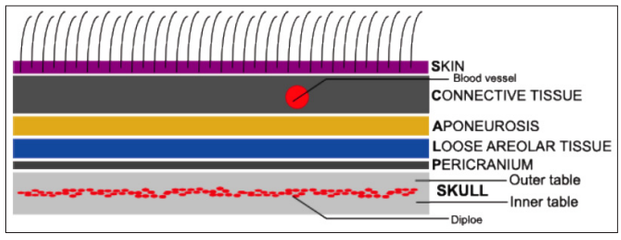
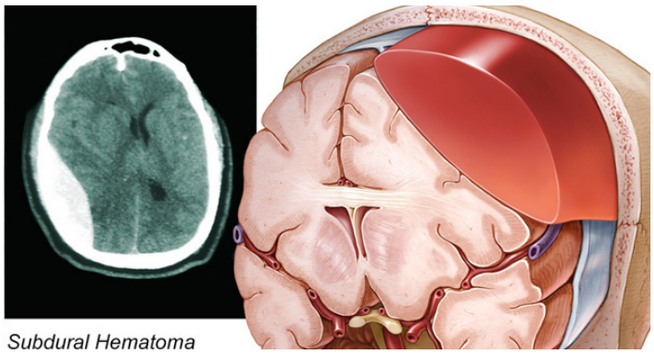


Figure 1: The layers of the scalp and skull.

The skull vault is composed of a number of flat bones of variable depth, each consisting of two layers of compact bone (inner and outer table) separated by a medullary cavity containing red bone marrow (the diploë). The adherent outer periosteal layer of the skull vault is termed pericranium. Blood vessels supplying the meninges lie in the extradural space between the inner table and dura, at times grooving the inner aspect. The middle meningeal vessels are clinically important due to their vulnerability to damage as a result of trauma in the region of the pterion (the site of union of the parietal, frontal, temporal, and sphenoid bones).

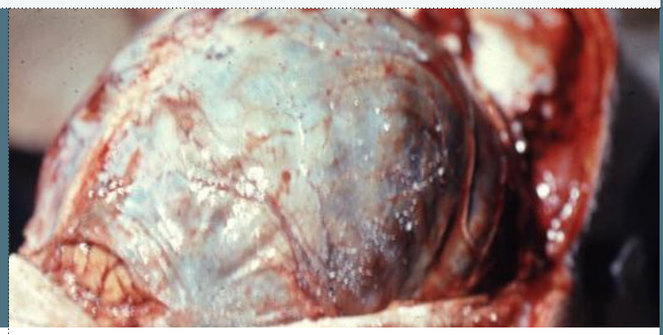


Subdural Hematoma

HEAD INJURY: SUBDURAL & EXTRADURAL HAEMATOMA

M Hughes

Head Injury: Subdural & Extradural Haematoma.
Neurosurgery.

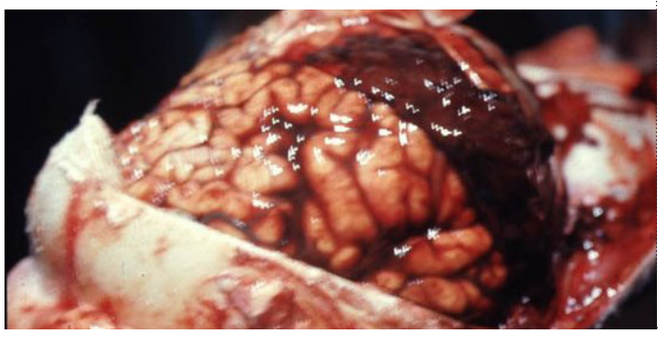


The meninges have three layers: dura, arachnoid, and pia mater. The dura is a tough outer fibrous sheet comprising two layers (endosteal and meningeal). The endosteal layer is adherent to skull vault along suture lines. The two layers are fused except in regions where they part to form venous sinuses and where the inner layer invaginates (to form structures including the falx cerebri and tentorium cerebelli). The arachnoid is an avascular membrane that lies deep to dura. The pia is a delicate highly vascular layer that lies innermost and is adherent to underlying cortex. The subarachnoid space, between pia and arachnoid, contains cerebrospinal fluid and the major blood vessels of the brain. Bridging veins drain the cortex and traverse the subdural space on their way to intradural venous sinuses.

Extradural haematoma (EDH)

EDH occurs in men more than women (4:1) and usually occurs in young adults. A total of 70% of cases occur laterally over the hemispheres, centred under the pterion. A proportion of EDH is caused by temporoparietal skull fracture and consequent middle meningeal artery damage. Arterial bleeding is thought to dissect the endosteal dural layer from the inner table. This plane is limited by suture lines and this results in the classical biconvex appearance on axial CT (see Fig. 3). However, EDH may also result from dural sinus damage, a bleeding middle meningeal vein, or ooze from the diploë and bone of an associated fracture.

The classical presentation of EDH involves a transient post-traumatic period of loss of consciousness followed by a 'lucid interval' for several hours. Subsequently, GCS falls, a contralateral hemiparesis manifests, and the ipsilateral pupil dilates. However real-life presentation varies; contralateral hemiparesis is not universal and shift of the brainstem away from the clot may result in compression of the contralteral cerebral peduncle producing an ipsilateral hemiparesis (Kernohan's phenomenon). Other presenting features include headache, vomiting and seizures.



The typical CT appearance of EDH (Fig. 2) is a high-density biconvex mass adjacent to the inner table compressing neighbouring brain. EDH usually has a homogenous density with well-defined edges.

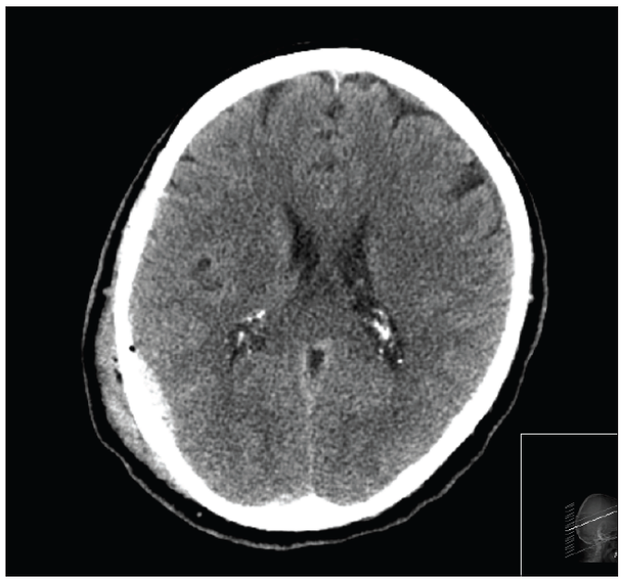


Figure 2: Small acute extradural haematoma containing small bubbles of intracranial air in right posterior temporoparietal region.

Treatment may be medical or surgical and depends upon both the clinical status of the patient and CT characterstics of the haematoma (clot thickness, haematoma volume, and extent of midline shift)[6]. For some small EDHs (<10mm maximal thickness), non-surgical management with admission, neuro-observations, and follow-up CT in one week may be appropriate. However, in most cases EDH is an emergent neurosurgical condition. Clot removal lowers intracranial pressure and aims to eliminate focal mass effect. Haemostasis is achieved by coagulating responsible arteries or veins and applying bone wax to intra-diploic bleeders. Placement of dural hitch stitches (which aim to mechanically limit the extradural potential space) may decrease incidence of clot re-accumulation.

Mortality with EDH ranges between 9 and 25%[7,8]. Early diagnosis and treatment reduces mortality. Death usually results from uncal herniation causing midbrain compression and subsequent respiratory arrest.

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

HEAD INJURY: SUBDURAL & EXTRADURAL HAEMATOMA

M Hughes

Acute subdural haematoma (ASDH)

The extent of primary injury is normally greater in ASDH than in EDH. Underlying parenchymal brain injury and oedema is more common and results in higher morbidity and mortality. Two primary mechanisms cause ASDH:

- **Clot accumulation around a parenchymal laceration (usually frontal or temporal)**
- **Shearing of bridging vessels from cortex to dura secondary to cerebral acceleration-deceleration forces**

CT appearance of ASDH (see Fig. 3) is a crescentic high-density mass adjacent to the inner table. It is usually sited over the convexity of the brain but may be found peri-tentorial or peri-falcine. Compared with EDH, the lesion is more diffuse, heterogenous, and usually concave with respect to the cortical surface.

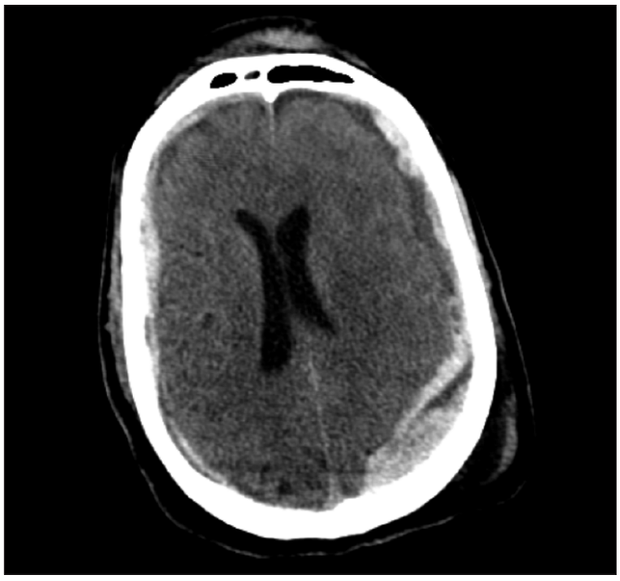


Figure 3: Bilateral acute subdural haemorrhages; low attenuation fluid within the subdural collections may represent hyperacute haemorrhage (unclotted blood). There is marked mass effect but midline shift is reduced because there are bilateral subdural collections.

Emergent surgical evacuation is indicated for symptomatic ASDH that are greater than 10mm at maximal depth[9]. Operating on smaller subdurals is often not required and may cause increased secondary brain injury (due to parenchymal oedema and herniation through the craniectomy defect). Mortality from ASDH ranges from 50 to 90% and increases from 90 to 100% for patients on anticoagulants.

Chronic subdural haematoma

CSDH occurs more commonly in the elderly population. A history of head injury (often trivial) is recognized in ~50%. Other important risk factors include alcohol abuse, coagulopathy[10], seizures, and presence of CSF shunting devices. CSDH tend to be more extensive in older patients as result of the increase in size of subdural space due to age-related brain atrophy. The pathophysiology of CSDH is not fully understood. Many CSDH probably begin as ASDH. The abnormal presence of blood causes an inflammatory response with formation of neomembranes on the cortical and dural surface of the clot. Liquefaction of the clot results in the classical operative finding of dark 'motor oil' fluid that does not clot. Plasma effusion and re-bleeding from neomembranes competes with fluid reabsorption; resulting in either persistence/extension of the CSDH or spontaneous resolution.

CSDH presentation is variable and may include headache, confusion, TIA-like symptoms, and speech difficulties (with dominant hemisphere CSDH). Hemiplegia, decreased GCS, or seizures may occur. Some are apparently asymptomatic. Classic CT appearance of CSDH (see Fig. 4) is a low-density crescentic mass adjacent to the inner table.

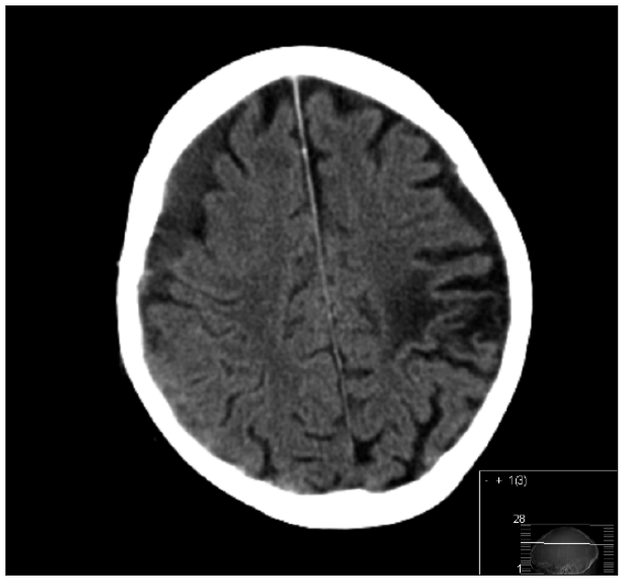


Figure 4: There is a moderate sized, approximately 8 mm in maximum depth, right hemispheric subdural collection of intermediate density. Note also: mature left MCA territory infarct.

Surgical evacuation of CSDH is indicated for symptomatic lesions or when the maximum depth exceeds ~10mm. There is no accepted best method for surgical evacuation; options range from one or two burr holes (with or without a subdural drain) to formal craniotomy[11]. In addition, coagulopathy should be reversed and some advocate seizure prophylaxis[12].

HEAD INJURY: SUBDURAL & EXTRADURAL HAEMATOMA

M Hughes

Clinical improvement occurs due to reduction in subdural pressure; those with high subdural fluid pressure tend to exhibit more rapid brain expansion and symptomatic improvement than those with low pressure. Residual CSDH is common after treatment (persisting for up to 6 months) and generally does not require intervention unless its size increases or the patient deteriorates or shows no sign of recovery.

CSDH should not be underestimated. Significant complications may occur as result of the primary pathology or secondary to surgical intervention. These include seizures, intracerebral haemorrhage, re-accumulation of subdural fluid, tension pneumocephalus, and subdural empyema. 6-month mortality is of the order of 20-30% following surgery for CSDH, though it is likely that an element of this is due to the demographic group (i.e. elderly) in which this condition tends to occur.

5 MCQs

1. During a road traffic accident, a pedestrian is struck at 40mph and is knocked to the ground, hitting his head. In A+E, the FY2 has to resort to applying supra-orbital pressure with a fingernail before the patient opens his eyes. As they do so, his right arm reaches up and pushes the doctor away. He makes groaning sounds intermittently. Their GCS is:

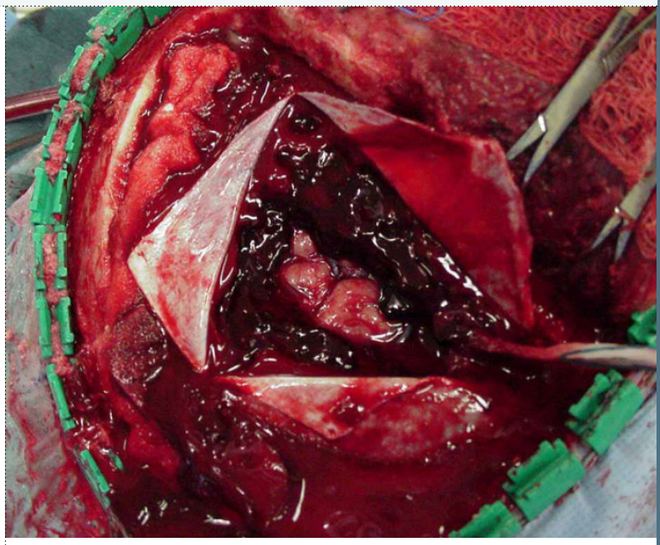
A – 5 B – 9 C – 8 D – 10 E – 2

Answer: B – 9. This is composed of E2 (opens eyes to pain), V2 (incomprehensible sounds), M5 (localizes to pain).

2. A 25-year-old man is brought to a district general hospital A+E following an assault during which his was struck in the head by a baseball bat and stabbed in the chest. Chest x-ray shows a large right haemothorax. CT head illustrates a large extradural haematoma. He now has a blood pressure of 70/40, heart rate 150, and GCS of 3 with asymmetric pupils (left > right). The best next course of action is:

A – Discuss the case with the local neurosurgical unit and transfer immediately for emergency craniotomy.
B – Secure IV access, resuscitate with fluids, then transfer to the local neurosurgical unit.
C – Perform a right-sided exploratory burr-hole in the A+E department.
D – Enroll anaesthetic help to intubate and ventilate, gain IV access and begin fluid resuscitation, then place a right-sided chest drain.
E – Perform an emergency thoracotomy in the A+E department.

Answer: D. This patient is highly unstable and must be treated according to ATLS principles and stabilized before transfer. This includes treatment of other lifethreatening injuries (the haemothorax). The EDH is left-sided so a right-sided burr hole is preposterous. Emergency thoracotomy is not indicated in this scenario.



3. A 30-year-old women walks into A+E. She has just been involved in a car accident in which her boyfriend, the driver, was thrown from the car and found dead on the scene. She was found crying in the passenger seat and was brought in by police. She is anxious but has a GCS of 15, BP 120/70, HR 95 and no external evidence of injury. The best next course of action is:

A – Discharge her home immediately after reassurance.
B – Ensure that there is someone sensible to monitor her at home, then discharge with HI advice.
C – Admit for 4 hours of neuro-observations and then discharge.
D – Assess per ATLS guidelines, perform the full trauma series of x-rays and request a CT head.
E – Perform no imaging but admit overnight for neuro-observations with a view to discharge in the morning.

Answer: D. Do not be falsely reassured by her apparent lack of injury. The reported mechanism (resulting in death of the driver) demands that she be managed according to ATLS guidelines even if apparently well. CT head is also indicated, again given the mechanism of injury.

4. With regards to cerebral vascular anatomy, the following statement is true:

A – The anterior communicating artery forms an anastamosis between the middle cerebral artery and posterior communicating artery.
B – The middle meningeal artery is a supplied by an external carotid artery source.
C – The ophthalmic artery is a branch of the anterior cerebral artery.
D – The labyrinthine artery is a branch of the posterior communicating artery.
E – The scalp is supplied by 8 paired arteries.

Answer: B. The middle meningeal artery is a branch of the maxillary artery which itself is one of the terminal branches of the external carotid artery.

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

HEAD INJURY: SUBDURAL & EXTRADURAL HAEMATOMA

M Hughes

5. With regards to venous drainage of the brain, the following statement is true:

A – The torcula herophili (confluence of the sinuses) is roughly landmarked externally by the external occipital protuberance.
B – The superior sagittal sinus is found in the inferior aspect of the falx cerebri.
C – The sigmoid sinus becomes the external jugular vein on leaving the cranium.
D – It is anatomically impossible for soft tissue infections of the face to spread to involve intracranial structures.
E – Dural venous sinuses are formed within the pial layers of the meninges.

Answer: A. The torcula corresponds approximately to the external occipital protuberance. It is formed by the union of superior sagital sinus above, the straight sinus anteriorly, and the transverse sinuses laterally.

References

1 Department of Health. *Hospital episode statistics 2000- 2001.* London: Department of Health. 2001.
2 Society of British Neurological Surgeons. *Safe Neurosurgery 2000. London: Society of British Neurological Surgeons.* 1999.
3 Kay A, Teasdale G. Head injury in the United Kingdom. *World Journal of Surgery* 2001;25(9): pp.1210-20.
4 NICE guideline CG56. *Head injury: triage, assessment, investigation and early management of head injury in infants, children and adults.* 2007. **http://www.nice.org.uk/nicemedia/pdf/CG56NICEGuideline.pdf5.**
5 Hamilton J, Sunter J, Cooper P. Fatal haemorrhage from simple lacerations of the scalp. *Forensic Science, Medicine and Pathology* 2005;1(4): pp.267-271.
6 The Brain Trauma Foundation and The Congress of Neurological Surgeons. Guidelines for the Surgical Management of Traumatic Brain Injury. *Neurosurgery Supplement* 2006; 58(S2):1.
7 Le Roux A, Nadvi S. Acute extradural haematoma in the elderly. *Br J Neurosurg* 2007; 21(1): pp.16-20.
8 Baykaner K, Alp H, Çeviker N, Keskil S, Seçkin Z. Observation of 95 patients with extradural hematoma and review of the literature. *Surg Neurol* 1988; 30(5): pp. 339-341.
9 Bullock MR, Chesnut R, Ghajar J, Gordon D, Hartl R, Newell DW, Servadei F, Walters BC, Wilberger JE. Surgical management of acute subdural hematomas. *Neurosurgery* 2006; 58(3): pp. S16-24.
10 Lindvall P, Koskinen LO. Anticoagulants and antiplatlet agents and the risk of development and recurrence of chronic subdural haematomas. *J Clin Neurosci* 2009; 16(10): pp. 1287-90.
11 Lega BC, Danish SF, Malhotra NR, Sonad SS, Stein SC. Choosing the best operation for chronic subdural hematoma: a decision analysis. *J Neurosurg.* 2009 30 Oct [Epub ahead of print].
12 Grobelny BT, Ducruet AF, Zacharia BE, Hickman ZL, Andersen KN, Sussman E, Carpenter A, Connolly ES. Preoperative antiepileptic drug administration and the incidence of postoperative seizures following burr hole-treated chronic subdural hematoma. *J Neurosurg.* 2009 Jun 26 [Epub ahead of print].

Authors

Mr Mark Hughes
ST2 Neurosurgery
Royal Free Hospital, London.
hughes81@gmail.com

THE SURGICAL CV

D Gomez

The Surgical CV.
Current Training Issues.

Introduction

As a career, surgery is arguably the most competitive speciality to obtain career progression. A spiring surgical trainees are faced with stiff competition for limited training posts and a significant amount of persistent dedication is required to continue building a competitive curriculum vitae (CV), irrespective of the surgical speciality. There are various hurdles at different stages of a surgical career, but in general, a surgical CV comprising of publications, presentations, courses and administrative commitments is likely to lead to career progression. It is in the interest of all surgical trainees to keep abreast with current changes or updates with regards to training posts and job applications. In this article, selected important sections of the surgical CV are emphasised.

Presentations and Abstracts

It is crucial to submit research/clinical projects or audits to meetings. This is not only to gain more lines on in the CV, but also helps develop presentation skills and gain knowledge from research meetings. In general, there are local (regional), national and international meetings. It is important to keep up to date with submission deadlines of meetings. Local meetings are usually represented by surgeons from hospitals confined to a specific deanery. National meetings are usually attended by surgeons throughout the United Kingdom and Ireland. One such example; The Annual Congress of the Association of Surgeons of Great Britain and Ireland (ASGBI) and The Association of Upper Gastro-intestinal Surgeons for Great Britain and Ireland (AUGIS) Annual Meeting. International meetings tend to be speciality specific, and are represented by surgeons from various speciality and well-known academic centres; for example, the World Congress of the International Hepato-Pancreato-Biliary Association (IHPBA). For presentations accepted in large national and international meetings, the abstract is published in a surgical journal, such as presentation at AUGIS is published in the British Journal of Surgery. Conference dates and submission deadlines can be found in the official websites for these meetings.

Publications

Publications are the single most important section of a trainee's CV. When seeking advice from Educational Supervisors, almost certain one of the first questions that will be asked is: "How many publications do you have?" Remember, the more publications the better. There are a few tips to maximising your success in publishing papers. There are various types of categories in publishing which include: review articles; original papers; meta-analysis; case reports; etc. When starting, take on a "case report" or "image of the month" sections in certain journals. Following completion of a research or clinical project, it should be written as an original article. In addition, all presentations in meetings should be published, as it shows successful completion of a project. A review article is also another avenue to consider. It is worth enquiring from senior colleagues for ideas. Another important aspect is to start early. It can take months from writing a draft to final publication in a journal. Know the impact factor of the journal the manuscript is being submitted to. Getting a paper published in a high impact factor journal will only further enhance the CV.

Audits

In the current NHS system, audits play an important role. It is also an important tick box for job applications; hence it is worth investing time in performing a good clinical audit and understand the principles of an audit process for interview purposes. In addition, all audits should be presented in a meeting and some audits are suitable for publication.

Courses

Courses are the in-thing at the moment. The advantages of attending courses are they can be highly educational and provide important practical experiences. However, courses are most beneficial when it is catered for the level of training for the trainee. There are three essential courses to attend prior to applying for speciality training (ST3 level) which are: Basic Surgical Skills (BSS) course, Advanced Trauma Life Support (ATLS) course and Care of the Critically Ill Surgical Patient (CCrISP) course. Besides these courses, there are other courses which include laparoscopic-based training, AO orthopaedic courses and management / teaching courses. For more information, please refer to the Royal College websites. All these courses cost a fair amount and do make enquiries regarding your study budget.

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

THE SURGICAL CV

D Gomez

Research

Research will definitely give trainees the edge against their competitors. Based on personal and general experience, trainees doing research develop many generic skills and have a far better all-rounded CV. However, it is important to be involved in a good research project that is likely to yield results in 2 to 3 years and lead to a higher degree such as Medicinæ Doctor (MD) or Philosophiae Doctor (PhD). Prior to embarking in a research project it is important to discuss the project with the relevant supervisors. Remember, most research posts come with a pay cut and no clinical commitments. However, with research, comes all the "right stuff": higher degree; presentations; publication; etc.

Administrative experience

To complete an all-rounded surgical CV, administrative experience is important. This includes: rota-coordinator; co-organiser of a course; running a journal club; member of a committee; etc.

The training years

Foundation Year-2 to Core Training 1/2

Prior to applying for a core training post, it is important to have at least done the first section of the intercollegiate examination (MRCS) and attended the BSS. Performing an audit, a few presentations and/or publications will enhance the trainee's CV and chances to obtain a good Core Training programme.

Core Training 1/2 to Speciality Training

This is the most competitive entry to break into. Due to the current competition, the chances of getting into a run-through surgical training programme without a higher degree or registrar-level experience is slim. To be taken as a serious candidate, trainees should have passed all the sections of the MRCS and done all the basic courses (BSS, ATLS, CCrISP). In addition, it is crucial to have some presentations and publications by this stage. Even if unsuccessful in obtaining a Speciality Training post, having a CV with presentations and publications will help secure research-based posts. Hence, during your core training programme, it is important to scout around for research posts.

Conclusion

It is not "impossible" to fulfil your ambition to be a surgeon. No doubt that surgery is a competitive speciality and it requires dedication, hard-work and a strong character to break in a surgical training programme and be successful. It is important that the CV demonstrates an all-rounder trainee. Best of luck.

Useful links:

www.rcsed.ac.uk
www.rcseng.ac.uk
www.mmc.nhs.uk
www.medicalcareers.nhs.uk
www.surgical-tutor.org.uk

Correspondence

Mr. D. Gomez
Department of General Surgery
Queen's Medical Centre,
Derby Road
Nottingham
NG7 2UH
Tel: 0115 9249924
Email: dhannygomez@hotmail.com

MAKUNDUCHI PROJECT (21st–29th MARCH 2009)

T Westbrook

Makunduchi Project (21st–29th March 2009). Charitable Experience.

Zanzibar is known as the 'Spice Island' and lies in the Indian Ocean, 6 degrees south of the equator. Average life expectancy is a staggering 47 years. One in 180 women die during delivery of their child and 1 in 6 children die under the age of 7 with the majority dying when aged less than 2 years.

The Makunduchi Project set about trying to change this. Ru MacDonagh and John McGrath are both consultant surgeons in the UK and have worked for many years in Zanzibar and Tanzania establishing strong links with the Health Sector and the government over this time. The island has one main hospital (Mnazi Mmoja), which acts as a referral centre for a population in excess of 1 million people. There are two smaller district hospitals – one in the north (Kivunge) and another in the south (Makunduchi).

HIPZ (Health Improvement Project Zanzibar) was registered as a charity in 2006 with the primary aim of establishing a unique public/private partnership with the Zanzibar Government to improve healthcare in Zanzibar, through fundraising and professional support in the UK. Zanzibar is well contained. Local residents are unlikely to seek public healthcare elsewhere although there are several other facilities which provide healthcare in a cleaner, more acceptable environment but at a significant cost.

The flagship project is to renovate, equip and run the hospital in Makunduchi in southern Zanzibar, where many of the 60,000 or so locals have little or no access to healthcare. This initiative is now called the Makunduchi Project. We often live life in our comfort zone but here was an opportunity as personal friends of John McGrath to support this charity with our time, experience, clinical skills and the challenge was to have a better understanding of healthcare in the third world. There are frequent images portrayed in the media of the third world but the realisation is something else. We visited Makunduchi between 21st and 29th March 2009.

The team consisted of:

Dr Tony Westbrook
(Orthopaedic Consultant Surgeon, University Hospitals Nottingham)

Dr Martin James
(Consultant Gastroenterologist & Hepatologist, University Hospitals Nottingham)

Miss Emily Penny
(Physiotherapist, University Hospitals Nottingham)

Mr Daniel Sturt
(Physiotherapist, University Hospitals Nottingham)

The trip was divided into two visits. The first half of the week was spent at Mnazi Mmoja Hospital. This hospital is very well located for the capital Stone Town with easy access along the major roads. There is a large campus of separate buildings with reasonable capacity for both inpatient and outpatient work.

There seemed to be clear management lines of responsibility and excellent links to Zanzibar Ministry for Health and the potential for significant equipment funding coming on stream. Staff originate from a wide source including Cuba for periods of two years at a time, mainland Tanzania, China and in some instances Russia. There is an active presence of medical elective students, mostly funded through The World Company which charges approximately £1300 to £1600 for a six-week attachment providing accommodation and access to the hospital and facilities

The volume and burden of referrals is large and from all over the island. The plans for timing of routine follow-ups for conditions such as diabetes and hypertension seem erratic with weekly or two weekly appointments for a majority of patients. This reduces efficiency and increasing the volume of work often unnecessarily. The orthopaedic service appeared reactive to trauma with no obvious fracture clinic follow-up. The inpatient wards were generally of a low hygiene standard with overcrowding. The clinical skills amongst clinical officers and attending physicians seemed modest and they were poorly supervised, but they were understandably under a significant time constraint.

MAKUNDUCHI PROJECT (21st–29th MARCH 2009)

T Westbrook

Diagnostics including the quality of radiology taken, the availability and accuracy of blood testing was also very poor. A visit to the laboratories demonstrated that approximately 10 to 15 liver and renal biochemistry tests were ordered each day with an inpatient volume of 2 to 400 patients on average. There was inactivity in the laboratories from around 10.00 a.m. and malaria testing was not by rapid diagnostic testing but by light microscopy with no positive results recorded since November 2008. This seemed at odds with the observation of a patient with a clinical diagnosis of cerebral malaria dying on the intensive care ward!

Medical records and statistics were in disarray. There was an overwhelming mountain of files in the office with no clear file system and a single computer. The medical records officer was simply overwhelmed by the volume and complexity of the tasks.

There seemed to be a focus on needing high level equipment such as CT scanning and C-arm image intensifier, for example, without adequate basic testing such as screening for malaria, viral hepatitis and performing accurate biochemistry and haematology analysis. There was also a request made for a camera stack to perform uro, gynae, ortho and gastro endoscopic procedures yet the realisation is there is a lack of theatre etiquette, clothes and basic scrub trays.

There has been a new therapy building developed including physiotherapy and occupational therapy. The occupational therapy room is probably the most impressive and clean area in the hospital, together with adequately resourced facilities for OT. Physiotherapy facilities seemed equally well supported by an excellent appliances technician, although he had limited facilities and equipment.

This hospital, as the flagship, should provide a strong tertiary referral link for cases that can't be managed regionally but also encourage devolution of cases to be managed at Makunduchi district hospital such as simple fractures, infections, therapy and primary healthcare. Currently these referrals appear to be streaming to Mnazi Mmoja rather than being seen locally. With increased equipment funding available this should be focused initially on getting the basics right but also take the opportunity to purchase useful and serviceable equipment such as static mobile x-rays rather than a C-arm and service contracts for ultrasound machines rather than a CT radiology, the results of which may not be easily interpretable or be able to guide them therapeutically.

We visited Makunduchi Hospital from Wednesday 25th March to Friday 27th March 2009. It is clear that there has been a significant investment in the last two years including the construction of a new outpatient building.

After visiting Mnazi Mmoja this felt a very much more confined, manageable healthcare facility both organisationally and geographically. Visits were made to all ward areas, operating theatres, pharmacy dispensary, vaccination store, staff kitchens and quarters and the mortuary/mosque.

There seemed a very clear leadership with daily team meetings. There also appeared to be in place a clear structure of hierarchy with nurse, matron, administration, finance, outpatients and caretaking leaders all feeding back to the hospital manager.

The mood amongst the staff generally appeared positive, friendly and very welcoming. Outpatients were busy and well attended with local patients and their families who seem to appreciate the new facilities and increased interest in funding. There were also some clinical officer students training from Stone Town for one day of our visit. There were also visiting physicians from Mnazi Mmoja including Dr. Faiser (Diabetes) for one clinic each month, Dr. Mkoko (physician from Mnazi Mmoja) one visit each month as well as a visiting surgical team who operated on five cases such as inguinal hernia, haemorrhoids and chronic appendicitis during our visit. This was supported by a visiting anaesthetist.

There are still significant material needs to fully equip the operating theatre with hardware such as gowns, swabs, blues, shoes, mattresses, the operating table, operating surgical equipment and surgical and anaesthetic staff and support. There was no x-ray film available and after assessment of the need, approximately 600 films per year would need to be sourced to support this. A lab technician requested a further microscope but perhaps rapid diagnostic kits for malaria (if demonstrated to be superior to a blood film) may be preferable. The follow up for clinics, as in Mnazi Mmoja, could be better organised for follow up frequency of patients with hypertension or diabetes. Ongoing maintenance of the physical structure of the building should be planned and costed for.

MAKUNDUCHI PROJECT (21st–29th MARCH 2009)

T Westbrook

With regards to neonatal care, no vitamin K injections or oral therapy are given to prevent haemorrhagic disease in the newborn and this would appear relatively safe, cheap and efficacious and should be considered.

There is obviously a conflict of work patterns amongst the staff who work from 7.30 a.m. but with much less activity from lunchtime onwards and I understand several staff members juggle multiple employment to achieve a sustainable wage despite the option for top ups. The best approach is uncertain but may include a staff member of the month award.

Encouraging staff to multitask would be extremely beneficial. For example, there may be only three X-rays taken per day but a radiographer spends a large time relatively inactive even when films are available. Encouraging further specialisation in other areas may increase staff resource utilisation.

Obviously ongoing funding for staff, hardware, drugs and other services is difficult. The Makunduchi project manager relies on direct funding from the Makunduchi project. Staff can be trained at Mnazi Mmoja or organisations outside of Zanzibar (e.g. UK) but the retention of staff is then difficult especially when salaries on the mainland or elsewhere in Africa can be elevated and more attractive once trained up. Motivating local trainees and staff to want to stay is a major challenge.

Elective programs for Makunduchi including medical students, therapy, pharmacy and GPs post qualification would all be attractive to both parties and should be supported. Links could be made to regional centres including the South West, Bristol and Nottingham.

Summary

Makunduchi hospital provides a contained and exciting opportunity to improve and influence local healthcare provision and reduce the need for a referral to central hospital benefiting the local population further.

The challenges are not unique to Zanzibar but represent the challenges in healthcare in the Third World. Funding, staff retention and increased training appear to be the main challenges. Multitasking and motivation for the resident and future staff remains a key to strengthening the organisation, which will have an obvious impact on healthcare delivery. Visits and training from other relevant staff such as infectious diseases and general practitioners may be extremely worthwhile. Intermittent visits from overseas operating teams for example with surgeons and anaesthetists could benefit not only Mnazi Mmoja hospital but also Makunduchi where demand for paediatric and general surgery appears high.

It is difficult to know whether our trip made a difference to the local community. It hopefully makes them feel supported, and not isolated, and if any suggestion is acted upon then some thing has been gained. Money is not the answer as any plan has to be sustainable, and this involves a desire for the local population to drive the process. We fixed the roof on the outpatient veranda and that was a personal triumph! More importantly the trip has made a difference to my outlook on life and work. Back home, I never take for granted the ability to order blood tests, perform X-rays and treat patients in a safe environment. We think the NHS is going through challenging times but this is nothing compared to the reality of a third world country. However, the local children still laugh and smile as they kick the footy on the beach alongside the beautiful setting sun.

Author

Mr. Tony Westbrook
Consultant Orthopaedic Surgeon,
Queens Medical Centre, Nottingham
tony.westbrook@nuh.nhs.uk

123Library

www.123Library.org

Sharing **more** knowledge



What is 123Library?

FREE TRIAL from 123Library.org

123Library is a fast-growing and innovative eBook and **digital content provider** in the field of health-care.

What are the benefits for your 123Library.org?

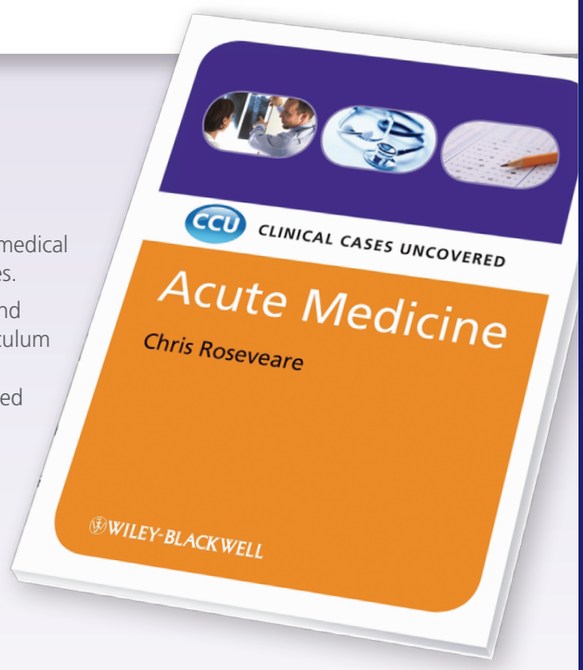
1. Over 2,000 eBooks ✔
2. Access from any PC ✔
3. Collections available ✔
4. Pick and choose ✔
5. Secured ✔
6. Customer care ✔
7. Save money ✔
8. Available 24/7 ✔
9. Easy to use ✔

Benefit today, visit **www.123Library.org**

Acute Medicine

CLINICAL CASES UNCOVERED

Chris Roseveare,
Southampton General Hospital



Acute Medicine is the central part of foundation and specialist general medical training and is one of the most rapidly expanding UK hospital specialities.

Acute Medicine: Clinical Cases Uncovered combines patient cases and outcomes, drawn from real-life experiences, with reference to the curriculum for Training in General (Acute) Medicine. It provides self-assessment MCQs, EMQs and SAQs to give Foundation Programme doctors and allied healthcare professionals the perfect preparation for life on the wards.

"Easy to read, excellent level of information and suitable to take on the wards for quick reference."
FINAL YEAR STUDENT, UNIVERSITY OF LIVERPOOL MEDICAL SCHOOL

"This is an excellent book! It illustrates key concepts in acute medicine through clearly laid out case studies that clinical students will commonly see while "on take" as part of their medical training… I would definitely use this book to study for my medical finals!"
4TH YEAR STUDENT, BRIGHTON AND SUSSEX UNIVERSITY

ISBN 9781405168830
FEBRUARY 2009 • Paperback • 256 pages

CONTENTS

WILEY-BLACKWELL

GET PUBLISHED!

Get Your Article Published
in The Foundation Years Journal

123 Doc EDUCATION

Article guideline:

- Articles written by an FY doctor should be co-signed by a consultant or an SpR
- Each article should relate to a specific medical speciality
- Articles should comply with Authors' Guidelines

In particular:

- Discuss a clinical case
- Include 5 multiple-choice questions with teaching notes at the end for testing purposes
- Be concise and discuss one of the key topics highlighted by the MMC Curriculum

For more information and authors guidelines,
write to agnesg@123doc.com

ORDER FORM

HOW TO ORDER (PLEASE WRITE IN BLOCK CAPITALS)

Call us on: **+44 (0) 207 253 4363**
Scan and email the form to: **subscriptions@123doc.com**
Through our website at: **www.123doc.com**
Post this form to: **123Doc, 72 Harley Street, London, W1G 7HG**

CUSTOMER (PLEASE TICK ✓ APPROPRIATE BOX)	TYPE OF SUBSCRIPTION	PRICE
❑ INDIVIDUAL CUSTOMER	ONLINE COPY	£59
❑ INDIVIDUAL CUSTOMER	PRINT + ONLINE COPY	£159
❑ INSTITUTION	ONLINE COPY	£299
❑ INSTITUTION	PRINTED COPY ONLY	£399
❑ INSTITUTION	PRINT + ONLINE COPY	£499

YOUR DETAILS (PLEASE TICK ✓ APPROPRIATE BOX)

❑ DR	❑ MR	❑ MRS	❑ MS	ORGANISATION
FIRST NAME				EMAIL
SURNAME				TELEPHONE
JOB TITLE				MOBILE
DEPARTMENT				FAX

PAYMENT BY CHEQUE (PLEASE MAKE CHEQUES PAYABLE TO 123DOC MEDICAL EDUCATION)

A CHEQUE FOR £ _ _ _ . _ _ IS ENCLOSED

PAYMENT BY INVOICE (PLEASE SEND INVOICE TO)

PURCHASE ORDER NUMBER (IF AVAILABLE)

NAME

ORGANISATION

ADDRESS

POST CODE

PAYMENT BY CREDIT CARD (PLEASE DEBIT MY VISA/MASTERCARD/SWITCH)

CARDHOLDER'S NAME

CARD NUMBER _ _ _ _ | _ _ _ _ | _ _ _ _ | _ _ _ _

VALID FROM _ _ | _ _ | EXPIRY DATE _ _ | _ _

SECURITY CODE _ _ _ | ISSUE NUMBER _

SIGNATURE

CARD BILLING ADDRESS (IF DIFFERENT)

POST CODE

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT WWW.123DOC.COM

SUBSCRIBE TO AN ONLINE E-COURSE, VISIT **WWW.123DOC.COM**
FOR MORE INFO CALL **0207 253 4363** OR EMAIL **INFO@123DOC.COM**

Volume 1, Issue 2

How We Can Help You Succeed?

To find out how 123Doc can help you dramatically increase your medical knowledge, register your interest on our website.

123Doc Education
72 Harley Street
London
W1G 7HG

Tel: +44 (0) 207 253 4363
Web: www.123doc.com
Email: info@123doc.com

ISSN Number 2046-0198

Designed by Tim Lawrenson Creative.
Please visit www.pure-tlc.com.