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Editorial

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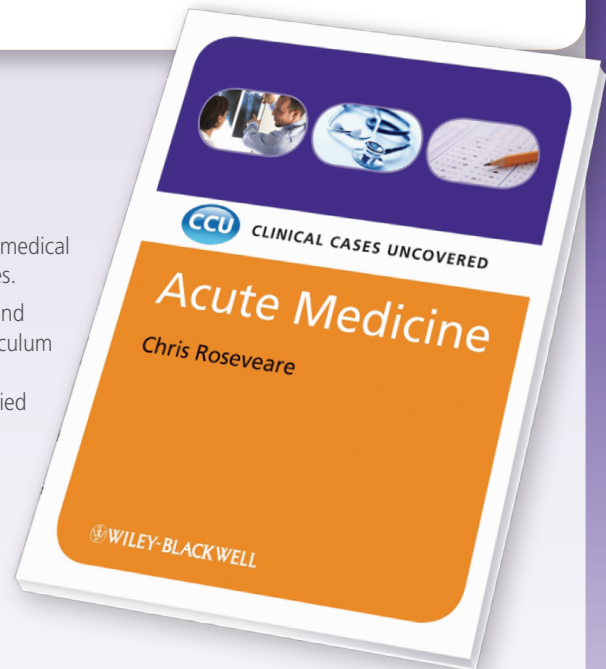
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IMMUNOSUPPRESSION IN RENAL TRANSPLANTATION: A PRICE TO PAY

M Jameel, L Szabo & R Chavez



Immunosuppression in renal transplantation: A price to pay Good Clinical Care

Abstract

Introduction

Kidney transplant is the best available treatment for end-stage renal disease. It leads to improved quality of life, prolonged survival and is cost effective compared to dialysis. Despite the above advantages it is related to significant morbidity and mortality due to opportunistic infection and other complications as a consequence of immunosuppression. Here we discuss three renal transplant cases that illustrate some of these complications.

Cases

1. A 25 year old patient presents with respiratory symptoms and sepsis. A prompt diagnosis and effective treatment lead to the cure of pneumocystis carinii pneumonia which otherwise could have been fatal.
2. A 37 year old patient presents with respiratory symptoms and no sepsis. Careful investigation leads to the conclusion that this is due to a side effect of the immunosuppressive drug sirolimus and discontinuation leads to full recovery.
3. A 69 year old patient presents with pneumonia. He was diagnosed promptly with a dual fungal and bacterial infection but despite of optimum treatment he did not survive.

Conclusion

Opportunistic infection is an uncommon condition and can be rapidly fatal. A prompt diagnosis, early treatment on suspicion and help from an expert centre is necessary for the best outcome. Differential diagnosis has to be kept in mind.

Introduction

Kidney transplantation is the best way to treat the majority of people with end stage renal disease. It helps to improve the quality of life and prolong the survival in certain groups of patients. It is also cost effective in comparison to dialysis, with reported savings of more than £50m in nearly 2,500 kidney transplants performed in UK in 2008-09¹.

The history of renal transplantation is almost a century old. In the first half of the 20th century there were attempts of transplantation using the organs from animals and subsequently from other humans but without any significant graft survival. Although the attempts were unsuccessful, they gave rise to question what was causing the failure. The immunologic basis for the failure was recognised later.

It was in 1954 when the first successful transplant took place between identical twins. In the subsequent years there were some more successful transplants using total body irradiation as a means to defeat the immune system and prevent rejection of the graft².

In early 1960s, Calne and Murray demonstrated the effectiveness of azathioprine as a potent immunosuppressant. Along with corticosteroids, azathioprine remained the drug of choice for immunosuppression for decades^{3,4}. Nowadays a number of other agents are available to induce and maintain immunosuppression with lesser side effects, as listed in table 1.

Drug Category	Agents
Antiproliferatives	Azathioprine, Mycophenolate Mofetil
Calcineurin inhibitors	Ciclosporin, Tacrolimus
Corticosteroids	Prednisolone, Methyl prednisolone
Monoclonal antibodies	Alemtuzumab, Basiliximab, Rituximab
Polyclonal antibody	Anti-thymocyte immunoglobulin
m-TOR inhibitor	Sirolimus

Table 1: Commonly used immunosuppressants for solid organ transplantation.

IMMUNOSUPPRESSION IN RENAL TRANSPLANTATION: A PRICE TO PAY

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The successes in suppressing the immune system lead to the increased risk of infection and certain cancers in the transplant population. Transplant patients have a higher chance of having common infections which an immune-competent patient may have, such as urinary tract infection, pneumonia in the community or wound and line associated infection in the hospital. However, opportunistic infections are a major cause of morbidity and mortality in transplant patients. A large number of organisms can cause these infections. Some are listed in table 2.

Class	Pathogens
Bacteria	<i>Clostridium difficile</i> , <i>Legionella pneumophila</i>
Fungi	<i>Candida</i> , <i>aspergillus</i> , <i>Mucor</i> , <i>Cryptococcus neoformans</i> , <i>pneumocystis carinii</i> (pcp)
Protozoa	<i>Cryptosporidium</i> , <i>toxoplasma gondii</i>
Viruses	Cytomegalovirus (CMV), Polyoma virus, BK virus

Table 2: Some common opportunistic organisms.

Case 1: *Pneumocystis carinii* pneumonia (PCP)

A 25 year old patient presented with fever, generally unwell and slight dry cough. He had had a renal transplant about six months before. On examination he was breathless with an oxygen saturation of 91% and a temperature of 38.5°C. His CRP was 140 mg/L and the white cell count was 3.7×10^9 .

A chest X-ray showed bilateral pulmonary infiltrates. His blood and urine cultures were taken and serology was sent for respiratory viruses including CMV. Broad spectrum antibiotics were started with no improvement.

He was then started on intravenous co-trimoxazole and urgent broncho-alveolar lavage was done and fluid sent for microbiological studies. This confirmed the diagnosis of PCP. The patient responded promptly to antibiotics and subsequent chest X-rays showed a rapid resolution of the infection (figure 1).

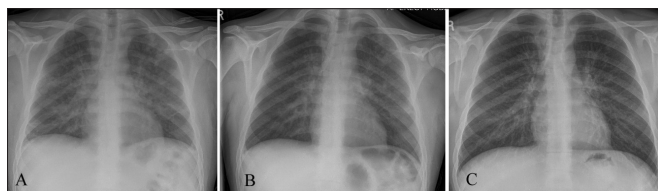
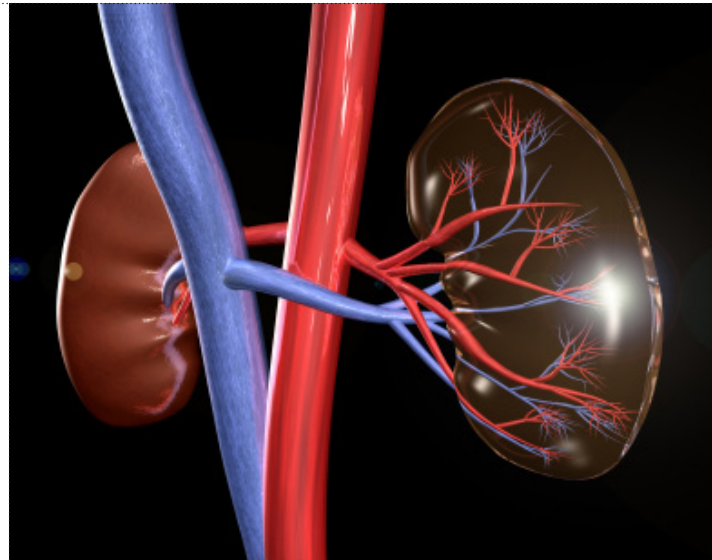


Figure 1. *Pneumocystis Carinii* pneumonia (PCP). Chest x-ray (A) on admission showing widespread bilateral patchy airspace opacification. On day 4 (B) some clearing of the lung fields but as yet it is incomplete. On day 9 (C) the infection has almost completely resolved.



Case 2: Sirolimus pneumonitis

A conflicting situation: A 37 year old lady presented 7 weeks following a cadaveric renal transplant with progressive resting and exertional dyspnoea. She also had a persistent serous discharge from her surgical site since operation. She was on prophylactic co-trimoxazole for PCP. On examination she was apyrexial with an oxygen saturation of 92% on air. Chest examination showed few crackles on both sides. A chest X-ray showed bilateral infiltrates. Her CRP was 31 mg/L and white cell count was 6.8×10^9 . Her routine cultures and viral serology was sent. A CT chest scan showed extensive lung parenchymal inflammatory change, which were nonspecific. She had Broncho-alveolar lavage which was negative for any organism. With a view to possible pneumonitis due to sirolimus, in the absence of any sign and symptoms of sepsis, sirolimus was replaced with tacrolimus and she was treated with oxygen and close observation. Following a few days her dyspnoea started settling and a repeat chest X-ray showed gradual resolution (Figure 2).

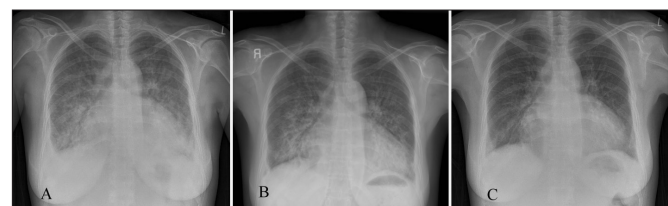
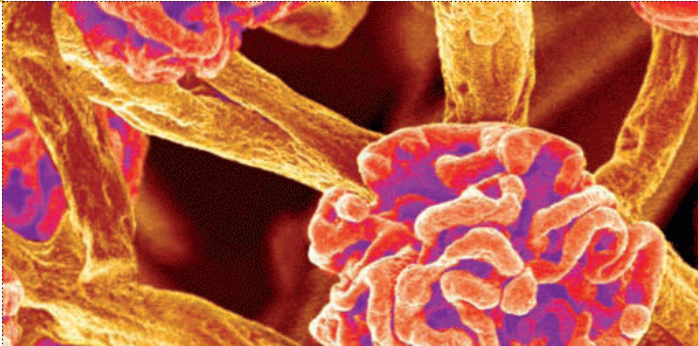


Figure 2. Sirolimus pneumonitis: Chest x-ray on admission (A) bilateral widespread air space shadowing, pleural effusion and cardiomegaly. On day 4 (B) persistent widespread consolidation particularly in the mid and lower zones and (C: 2 weeks after cessation of Sirolimus) small bilateral pleural effusions are now.

IMMUNOSUPPRESSION IN RENAL TRANSPLANTATION: A PRICE TO PAY

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Immunosuppression in renal transplantation: A price to pay Good Clinical Care

Case 3: Aspergillosis pneumonia

A 69 year old patient admitted six weeks post transplant with fever, productive cough and rigors. His white cell count was 14×10^9 and CRP was 170 mg/L. His chest X-ray showed opacification on the left side (Figure 3). He was started on broad spectrum antibiotics. His sputum later showed coliforms and heavy growth of *aspergillus fumigatus*. Systemic antifungal treatment was added but the patient didn't survive.

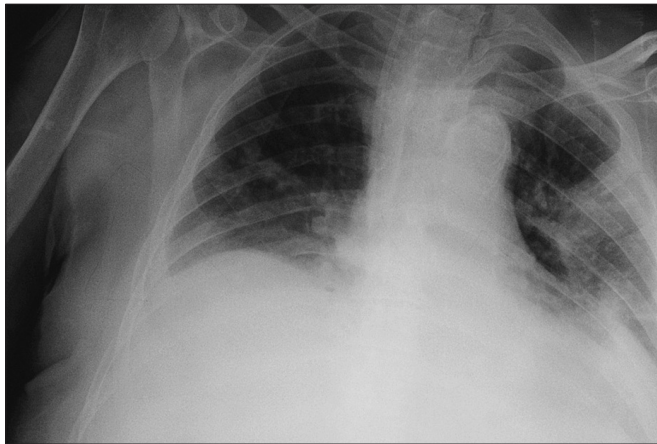


Figure 3. Aspergillosis pneumonia: Chest x-ray showing opacification in left lower and middle zone.

Discussion

Although transplant patients lead a fairly normal life, they are more susceptible to infectious diseases like other immunocompromised patients and 45-80% develop infections^{5,6}. The risk of infection is dependent on the degree of immunosuppression⁷. Chest infections are common and the most feared, often life-threatening after transplantation.

In this paper we presented 3 transplant recipients with lung problems.

1. *Pneumocystis pneumonia* (PCP) which is very rare in non-immunocompromised patients but one of the most common infections in transplant recipients. The pathogen is *Pneumocystis jirovecii*, a yeast-like fungus (previously classified as protozoa). *Pneumocystis* can be found in the lungs of healthy people without causing pneumonia. PCP manifests as fever, cough (usually non-productive), hypoxaemia and dyspnoea. The diagnosis can be confirmed by the characteristic perihilar and interstitial ground-glass infiltrates on the chest X-ray and broad alveolar-arterial oxygen gradient. Histological or PCR analysis of broncho-alveolar lavage gives definitive and fast diagnosis. The first choice antibiotic for PCP is co-trimoxazole which is normally used for prophylaxis in the first 3-6 months after transplantation.

2. Sirolimus pneumonitis is an infection-like side effect of an immunosuppressive drug. Given that signs and symptoms are the same as of an acute bacterial pneumonia, sirolimus pneumonitis represents a differential diagnostic problem.

Symptoms include shortness of breath, dry cough, and the pneumonitis may progress to respiratory failure. A chest X-ray or CT scan reveals bilateral diffuse pulmonary infiltrates. Bacterial, fungal, protozoa infections should be excluded with microbiological, histological analysis of the sputum or broncho-alveolar lavage. Pneumonitis is reversible with the immediate discontinuation of sirolimus.

3. Fungal pneumonia is very uncommon in patients with a normal immune system and responds well to antifungal therapy, but in immunosuppressed patients it causes serious disease and mortality can reach 90%. Signs and symptoms are usually less pronounced and include fever, chills and fatigue. Diagnosis is often difficult and takes time. Chest X-rays and CT scans can confirm the pneumonia but are rarely informative on the possible pathogen. Culture and histological analysis of sputum, tracheal suction or broncho-alveolar lavage will give definitive diagnosis. Transthoracic or thoracoscopic biopsy of distinct lung lesions can also help the diagnosis. Systemic antifungal therapy is needed.

Apart from the most common pathogens of the normal population, the opportunistic pathogens represent a big burden for transplant patients.

IMMUNOSUPPRESSION IN RENAL TRANSPLANTATION: A PRICE TO PAY

M Jameel, L Szabo & R Chavez

The differences between immunocompromised and immune-competent patients include:

- Presentation of infection either may be less obvious or very severe.
- Opportunistic infections are very uncommon and the attending doctor may not have experience in peripheral hospitals.
- The diagnosis and confirmation of the exact pathogen are often difficult and time-consuming.
- The delayed diagnosis and therapy may result in serious infection, high morbidity and mortality.
- Early referral to a centre experienced with transplant recipients can help early diagnosis and therapy.
- To avoid delay, start empirical therapy according to the most likely pathogen before having the final diagnosis.
- Urgent chest X-ray, CT scan, broncho-alveolar lavage, sputum, blood cultures, sometimes lung biopsy are needed for correct diagnosis. Early referral to a centre experienced with transplant recipients can help early diagnosis and therapy.

Multiple choice questions

1. What is *Pneumocystis jirovecii*?

- Bacterium
- Virus
- Fungus
- Protozoa
- Mycobacterium

2. What is the first choice antibiotic for *Pneumocystis Pneumonia*?

- Augmentin
- Ciprofloxacin
- Clarithromycin
- Co-trimoxazol
- Sirolimus

3. What is the characteristic lesion on chest X-ray in PCP?

- Lung abscess
- one sided small basal infiltrates
- Diffuse perihilar or interstitial ground-glass infiltrate
- Pleural effusion
- Hydro-pneumothorax

4. If you see a patient presenting with fever, cough, dyspnoea, what should you do?

- Start oral clarithromycin
- Consult with a Transplant Centre.
- Do lung biopsy.
- Stop all immunosuppressive medications
- Arrange urgent intubation



5. Compared to dialysis, which of the following is true?

- Kidney transplantation is more expensive on the long term.
- Patient survival is better after kidney transplantation.
- Quality of life is worse after transplantation.
- Kidney transplantation only gives better quality of life.
- None of above

Answers

1. C:

Yeast-like fungus, which was previously erroneously classified as protozoa.

2. D:

The first choice antibiotic for PCP is co-trimoxazole. It is effective, cheap and well tolerated by patients. It does not interact with immunosuppressive drugs.

3. C:

Diagnosis can be confirmed by the characteristic perihilar and interstitial ground glass infiltrates on the chest X-ray.

4. B:

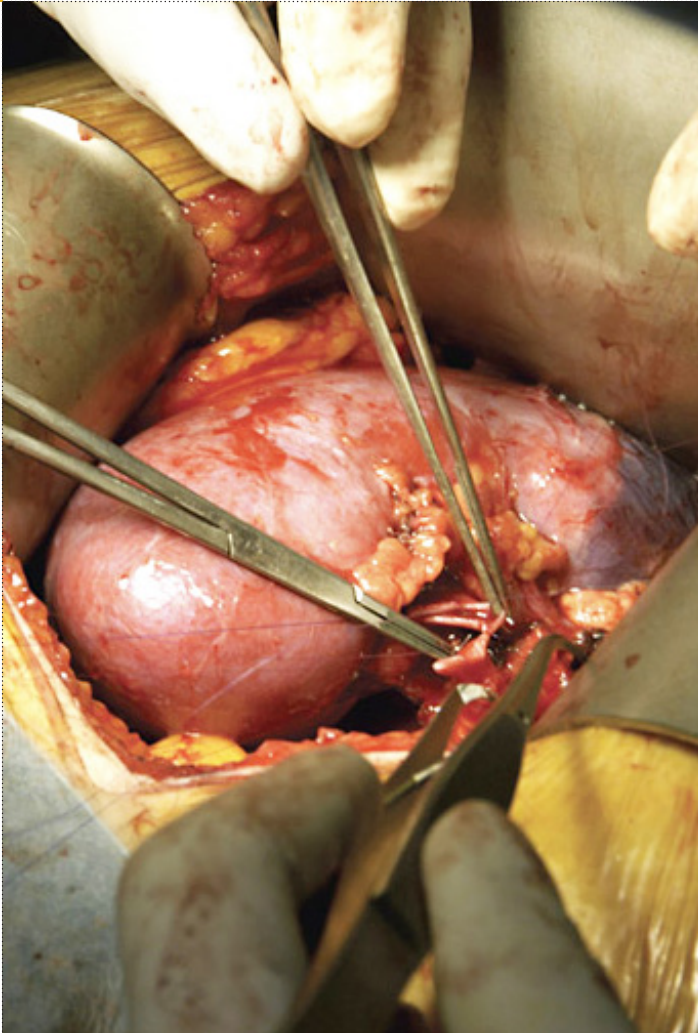
Early consultation with an expert in the field of transplantation can help in the proper management of transplant recipients presenting with symptoms of chest infection.

5. B:

Kidney transplantation not only gives better quality of life, but also results in survival benefit, compared to dialysis.

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Immunosuppression in renal transplantation: A price to pay Good Clinical Care

1. Starzl TE, Marchioro TL, Waddell WR. The reversal of rejection in human renal homografts with subsequent development of homograft tolerance. *Surg Gynecol Obstet.* 1963;117:385-395.
2. Veroux M, Giuffrida G, Corona D, et al. Infective complications in renal allograft recipients: epidemiology and outcome. *Transplant Proc.* 2008;40:1873-1876.
3. Charfeddine K, Zaghden S, Kharrat M, et al. Infectious complications in kidney transplant recipients: a single-center experience. *Transplant Proc.* 2005;37:2823-2825.
4. Fishman J, Rubin R. Infection in organ-transplant recipients. *N Engl J Med.* 1998;338:1741-1750.

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References

1. Black H. Generic versus branded medication in transplantation. *British Journal of Renal Medicine.* 2011; 16(3):4-6
2. Murray JE, Merrill JP, Dammin GJ, et al. Study of transplantation immunity after total body irradiation: clinical and experimental investigation. *Surgery.* 1960; 48:272-284.
3. Calne RY, Alexandre GP, Murray JE. A study of the effects of drugs in prolonged survival of homologous renal transplantation in dogs. *Ann N Y Acad Sci.* 1962;99:743-761.

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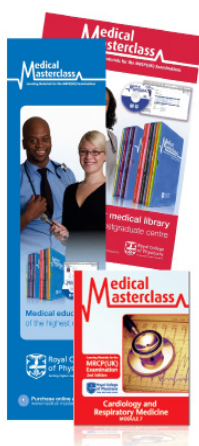
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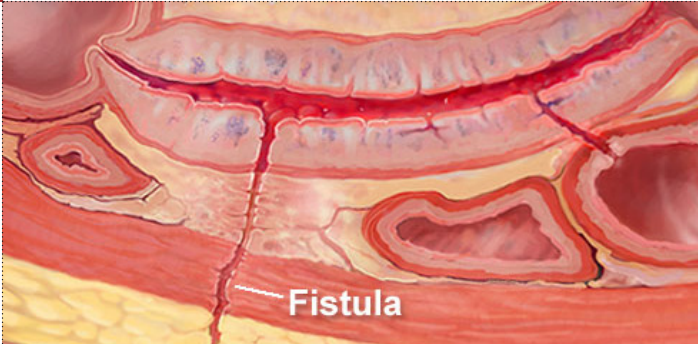
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BOWEL FISTULA

F Conway, M Thornton



Bowel Fistula Patient Management

Abstract

Gastrointestinal internal fistulae are abnormal passages or openings that connect the gastrointestinal (GI) tract with another organ or space caused by trauma, disease or congenital anomaly. In relation to Crohn's disease they specifically exclude perianal fistulae. Internal fistulae occur in 5-15% of patients with Crohn's Disease and approximately one-third of these patients require surgery. There is a paucity of controlled data on which to base recommendations for the treatment of internal fistulae in Crohn's Disease. We discuss GI fistula secondary to Crohn's Disease with a brief overview in this article.

Case Presentation

A 21 year old Caucasian woman was admitted with severe diarrhoea and vomiting with a background of chronic symptoms of nausea, early satiety, abdominal pain, recurrent diarrhoea and weight loss. Infective and non-gastrointestinal causes were excluded. Coeliac serology was negative. CRP (C-Reactive Protein) continued to be mildly elevated and she was referred for an upper endoscopy which was normal and a colonoscopy.

This patient suffered from a severe needle phobia and body dysmorphia and had previously undergone spinal surgery following trauma.

Her colonoscopy was incomplete but revealed both macroscopic and microscopic evidence of Crohn's Disease (Images 1 and 2).



Image 1: Endoscopic images demonstrating ulceration.

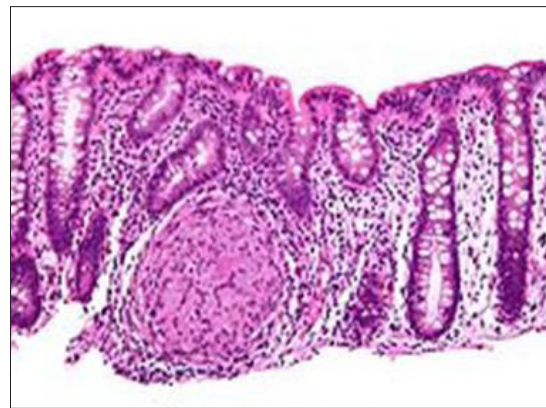


Image 2: Pathology slide. H&E stain of crohn's demonstrating granuloma formation.

Despite medical therapy, she was again admitted as an emergency requiring an intensive course of steroids for symptom control. Following psychology input to assist in treatment monitoring, Azathioprine was commenced. Despite counselling she still required topical anaesthetic and anxiolytic medication for simple venepuncture. Her symptoms of weight loss and abdominal pain persisted which prompted further investigations.

Barium follow-through revealed strictures within the ileum. CT Enterography identified active disease in the terminal ileum, a right sided inflammatory mass involving sigmoid colon and fistulae between sigmoid and rectum (Image 3).



Image 3: CT Enterography demonstrates fistulae involving small bowel (a), sigmoid colon (b) and rectum (c).

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She was commenced on an elemental diet with significant improvement in her obstructive symptoms and weight maintenance, however, the diarrhoea persisted. Obstructive fistulating disease not responding to medical therapy requires surgical consideration. After numerous consultations she agreed to laparotomy, right hemicolectomy and was aware of the possible need for an anterior resection. This team normally favours a covering ileostomy in the event of a low anastomosis or two anastomoses in the presence of Crohn's Disease (CD). The patient was adamant, despite counselling, that consent would not be given for the stoma.

Flexible sigmoidoscopy under anaesthetic identified mild rectosigmoid inflammation. She underwent a right hemicolectomy and anterior resection for multiple terminal ileal strictures and enterocolonic fistulae between ileum and sigmoid and a colorectal fistula between sigmoid and rectum. Seven days post-operatively she represented with a small bowel obstruction secondary to small bowel adhering to a defect in the colorectal anastomosis (Image 4). Contamination was minimal and the patient was systemically well. She returned to theatre for a defunctioning stoma, relieving the obstruction and allowing pelvic wash-out and drainage. The patient has subsequently undergone stoma reversal and is currently maintained on Azathioprine only.

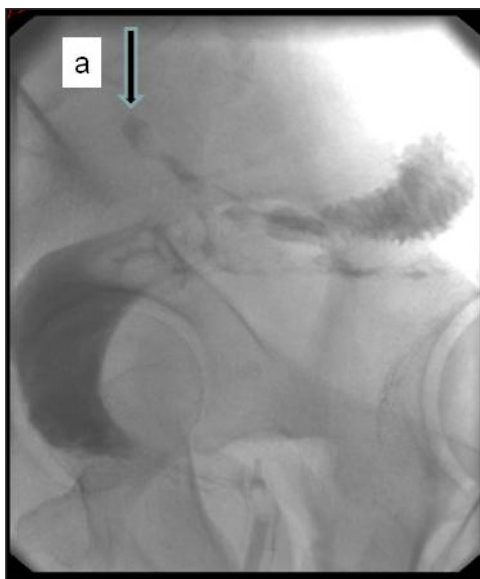


Image 4: Gastrograffin enema demonstrates a post-operative anastomotic leak (a).



Image 5: Macroscopic specimen of ileocolic resection with enteroenteric fistula (a) and enteric defect from enterocolonic fistula (b.)



Image 6: Macroscopic appearance of terminal ileal CD.

Discussion

Crohn's Disease is an autoimmune chronic inflammatory bowel condition that can affect the gastrointestinal tract anywhere from the mouth to the anus. The lining of the tract becomes inflamed, ulcerated and the affected segment can become thickened. It most commonly presents in adolescence between 15 and 35 years of age. Approximately 60,000 people in the UK are affected (1). Common complications include obstruction secondary to strictures, fistulae development and perianal disease that includes fistulae, abscess and fissures.

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A fistula is an abnormal communication between two epithelialized surfaces. GI fistulas are named according to their participating anatomic components. It is useful to separate congenital and acquired. Acquired can be categorised into internal or external. The major causes of internal GI fistulae are given in Figure 1 (2). In CD ileocolic and enterovesical fistulae are the most common (3). Fistulae develop in 17-43% of people with Crohn's Disease.

Causes of Internal Fistula	
Inflammation	
	Crohn's Disease
	Diverticulitis
	Infection
	Cholecystitis
	Appendicitis
	Pancreatitis
Surgery/Iatrogenic	
Malignancy	
Radiation	
Aortic aneurysm/graft	
Peptic ulcer disease	
Trauma	
Ischaemia	
Foreign body	
Idiopathic	

Figure 1: Causes of internal gastrointestinal fistula.

The pathogenesis of fistula formation is not fully understood. Bataille et al (4) discovered that the cells involved in the inflammatory infiltrate differed between patients suffering from CD and those not, suggesting potentially differing responses or differing stimuli to cause inflammation in the first place. They did however hypothesise that an initial insult occurred in all fistulae in association with an inflammatory response that culminated in tissue loss. Myofibroblasts then migrate into this area forming a protective basement membrane along which epithelial cells migrate forming a tract.

Asymptomatic internal fistulae found incidentally require no specific therapy. The presence of distal obstruction and fistulae arising from a grossly diseased segment of bowel increases the risk of surgical intervention (5).

Pharmacological Therapy

Currently, there is no formal controlled evidence on which to base recommendations about therapy of internal fistulae in CD.

The use of antibiotics in CD has two potential benefits, firstly in the direct healing of the fistula and secondly to treat infection and abscess formation. The two most commonly used antibiotics are Metronidazole and Ciprofloxacin and are more commonly used in perianal fistula with limited ultimate success in permanent closure of fistula (6).

Corticosteroids are effective at inducing disease remission but should be avoided in fistulising CD as they may worsen the outcome (7).

Methotrexate is a cytotoxic antimetabolite drug that can be used to maintain remission in CD. Information with regards to its use in fistulising CD is limited. One study showed that after 6 months therapy with Methotrexate, 22% had complete fistula closure and 44% had either complete or partial closure (8).

Immunosuppressant drugs such as Azathioprine and Mercaptopurine are often used in the treatment of CD. A meta-analysis found that 54% of patients underwent either complete healing or decreased output from their fistula when they received either Azathioprine or Mercaptopurine in comparison to a 21% response from those receiving placebo (9). Calcineurin inhibitors (Ciclosporin and Tacrolimus) are inhibitors of T-helper cell activation. Studies have suggested that these agents may decrease morbidity associated with fistulising CD whilst awaiting induction of other agents (10).

Infliximab is an anti-TNF therapy shown in the ACCENT II trial to have a significant impact on fistulising CD. Of the 39 patients with internal fistulae, 58% responded to the initial infusions of infliximab (11). However other studies have shown little effect in internal fistulae. As many patients with internal fistulae have accompanying intra-abdominal sepsis, the use of infliximab cannot be recommended except in rare cases where sepsis has been excluded. There is also considerable debate as to whether infliximab increases perioperative morbidity (12).

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Surgical Management

The key factors in the surgical management of Crohn's internal GI fistulae are given in Figure 2 (13).

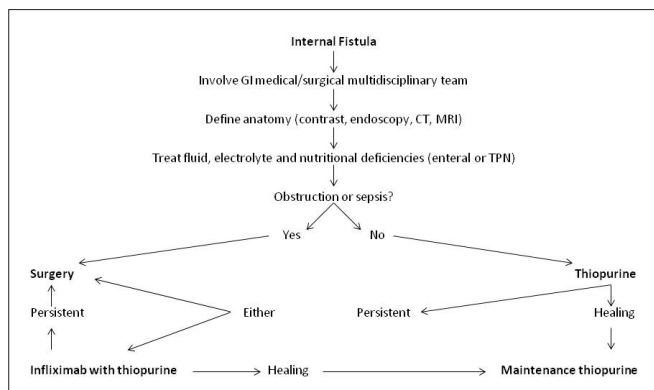


Figure 2: Algorithm for management of internal fistula in Crohn's Disease.

Define Anatomy

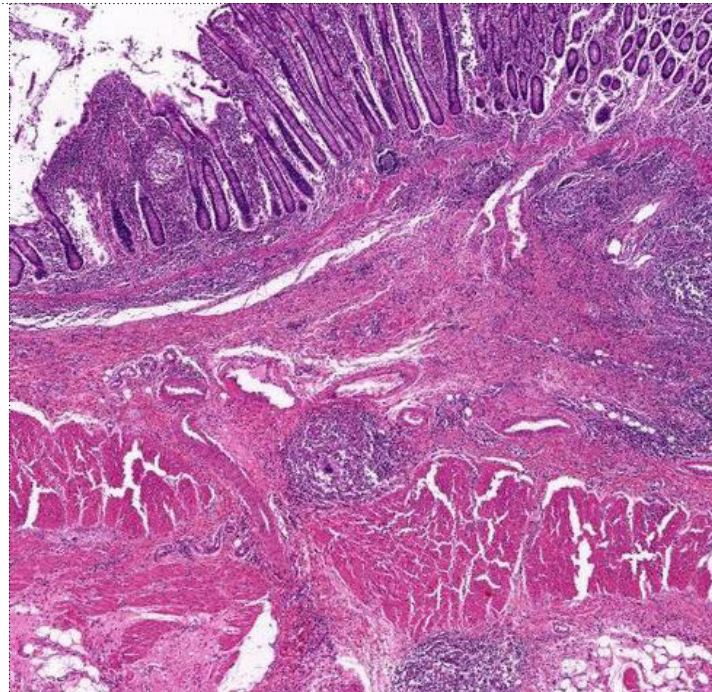
The information required includes the organs involved, the length and complexity of the fistula, the presence of any associated abscess, any distal obstruction and the length of uninvolved intestine. This information is delineated using contrast radiology (e.g. barium), endoscopy, abdominal computed tomography (CT) and /or magnetic resonance imaging (MRI).

While endoscopy may not demonstrate fistula formation, it is important to delineate the extent of colonic disease.

Contrast-enhanced fluoroscopic examinations are generally superior to endoscopy in demonstrating the presence of fistula. Barium is more sensitive than aqueous contrast agents for demonstrating fistulae but is contraindicated where perforation is suspected. CT may be less sensitive for the direct detection of some GI fistulae but CT is more sensitive for non-GI communication such as an enterovesical fistula. CT also provides other valuable information such as extraluminal disease, abscess formation and unrelated but relevant pathology and anatomy (14).

The role of MRI in non-perineal disease continues to be investigated. Recent studies have reported CT and MRI to have comparable diagnostic yields in patients with suspected or known CD. MR may be superior in detecting intestinal strictures and ileal wall enhancement. However CT provides better image quality and inter-observer agreement (15).

The investigation of choice is best decided following discussions with a radiologist with an IBD interest.



Investigations in our patient were limited. MRI enterocholysis was abandoned after a scout film because of artefact from the spinal fixation. Contrast CT required topical anaesthetic and oral sedation.

Fluid and Electrolyte Correction

Fluid and electrolyte imbalance in CD is usually a result of unremitting diarrhoea. The pathophysiology of the diarrhoea is multi-factorial and treatment needs to be tailored to the abnormalities (16).

1. Inflamed enterocytes are reported to have the ability to change intestinal electrolyte movement by increasing second messenger systems such as Camp. Pro-inflammatory cytokines such as TNF and secretory prostaglandins are also increased. Immunomodulators are effective here.
2. Steatorrhea is also a significant cause of diarrhoea in CD due to the stimulation of fluid and electrolyte secretion by non-absorbed fatty acids in the intestine. The steatorrhea in CD may be caused by:

a) reduced intraduodenal concentration of conjugated bile acids secondary to ileal dysfunction,

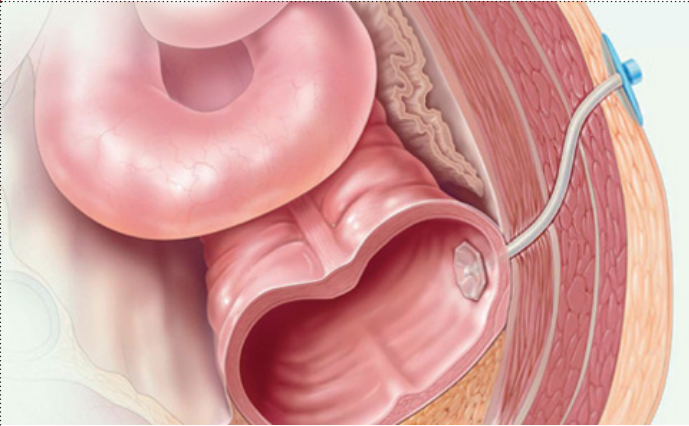
b) inadequate small bowel surface area, or

c) stasis or bacterial overgrowth.

This may result in hypocalcaemia, hypomagnesaemia and vitamin K deficiency with secondary clotting abnormalities.

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3. Changes in bile acid physiology occur with ileal inflammation or resection. Increased concentrations of bile acids entering the colon result in active chloride-induced fluid secretion. The liver increases bile salt production in the initial phases but eventually bile salt depletion occurs resulting in both bile induced diarrhoea and steatorrhoea. A low fat diet may be the only treatment.

4. Stasis and bacterial overgrowth are common in CD where there is fistulisation and strictures. Antibiotics have a limited intermittent role. B12 deficiency needs to be remembered. Surgery has an important role.

5. Short gut syndrome may occur where significant lengths of bowel are bypassed by fistulating disease.

While total body water depletion can occur, electrolyte depletion is more common. Total body sodium is most commonly affected, with urinary sodium being the most sensitive predictor of dehydration and electrolyte disturbance.

Nutritional Optimisation

CD in adolescent patients provides some additional challenges to treatment compliance, particularly nutrition. Growth abnormalities are reported in 15-40% of patients and weight loss of an average of 5.8kg reported is observed in 87% of Crohn's children and adolescents (17). The cause of growth failure and malnutrition is multi-factorial. Decreased nutrient intake, malabsorption, increased nutritional requirements and drug therapy have all been suggested.

Hypoalbuminaemia is found in 50% of patients. Steatorrhoea associated with bile acid malabsorption or bacterial overgrowth is found in one third of patients. Low iron and folate levels are common and vitamin B12 deficiency is common with ileal disease or following resection. Each deficiency can significantly impact on operative morbidity and require correction prior to surgery.

Bowel Fistula Patient Management

Intervention

Nutritional supplementation to provide 100% of the daily vitamin, mineral and trace element requirements is advised. With active disease, deficiencies may require intravenous replacement. Caloric requirements advised for weight gain are 60 to 80kcal/kg/day with 2.0 to 3.0g/kg/day. The preferred route of calorie provision is enteral. However, because of the reasons for malnutrition, parenteral nutrition is sometimes required.

Dietary restrictions are difficult in this age cohort. In paediatric groups enteral nutrition has been shown to be as effective as steroid management with 70-80% remission rates (18). In an adult population, enteral nutrition is better than placebo at inducing disease remission but not as efficacious as steroids. Several studies have documented improvement in clinical and biochemical parameters of disease activity in patients receiving enteral nutritional supplements. A Cochrane review advised enteral supplementation in adults who are hospitalised with active disease refractory to medical therapy or with significant treatment side effects. Relapse rates on treatment withdrawal however are high (19).

Parental nutrition has induced clinical remission in Crohn's patients and is useful for pre-operative optimisation if required. In a malnourished group, additional care needs to be taken to avoid line sepsis and re-feeding syndrome.

Thankfully our patient was compliant with an elemental diet. This allowed time for steroid withdrawal, full investigation of anatomy and maintenance of nutritional status without the need for nasogastric or intravenous feeding. Both of these would have been extremely difficult given her body dysmorphia and needle phobia.

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Surgical Aims

There is a paucity of controlled data on the management of Crohn's internal fistula management. Optimising patients pre-operatively to be biochemically well and relatively sepsis free, the operator should be aware of intestinal disease extent, excluded any obstructing lesions and clear knowledge of fistula anatomy.

In broad terms the surgery for internal fistulae involves enbloc resection of the primary diseased bowel and fistula and often simple closure of the secondary defect. Resection of the secondarily involved bowel is rarely required. Where inflammation is present a defunctioning stoma is advisable. The short-term outcome does not appear to differ whether colonic resection or oversewing of colonic defect is performed. Longer-term outcome is poorer in those with active colonic disease (20,21).

Our patient had inflammation of the rectosigmoid region at the time of surgery and so resection of the colorectal fistula was performed. Surgery also required complete enterolysis.

In an attempt to maximise enteric length where there are multiple strictures, stricturoplasty may be used with 98-99% symptomatic relief (22). Balloon dilatation may also have a roll, particularly in anastomotic strictures (23).

In this case, disease was limited to the distal 30cm of ileum and therefore resection was undertaken (Images 5 and 6).

CD patients on immunomodulators, even with nutritional optimisation have documented higher complication rates. Colorectal anastomotic leaks in CD are reported to be 5-8%. However, in most series, those patients with rectosigmoid inflammation had a diverting stoma. Steroids increase the risk of sepsis nearly three-fold and death two-fold when surgery is required. All peri-operative complications, including infective are higher in patients on immunosuppression. A 2011 review provides a detailed analysis of the perioperative complications in inflammatory bowel disease (24).

Nearly half of all affected patients with CD will require surgery within a year of diagnosis. 20-25% will require further surgery in 5 years and 35-40% at 10 years. There is colonoscopic evidence of recurrence at 72% at 1 year and 88% with longer-term follow-up (25).

Internal GI fistulae in patients with Crohn's disease are challenging to manage. While treatment algorithms are relatively clear, complication rates of treatment remain high and disease relapse is to be expected.

**Questions**

1. What factor in this history made surgery the treatment of choice?

- a) Terminal ileal strictures
- b) Multiple fistulae
- c) Patient's needle phobia
- d) Failure of medical therapy to relieve symptoms
- e) Patient's reproductive potential

2. Which of the following is useful for determining nutritional status?

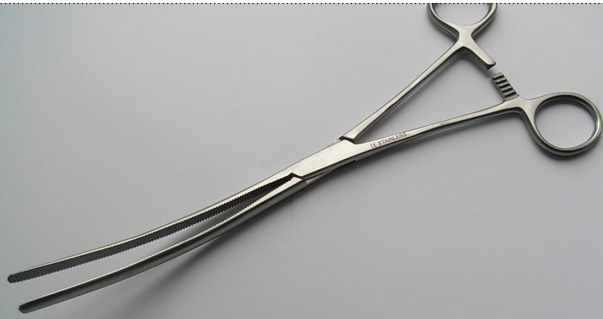
- a) mid-arm circumference
- b) serum albumin
- c) urinary creatinine excretion
- d) Haemoglobin
- e) BMI

3. Immunomodulators are effective treatment for which of the following causes of diarrhoea in CD?

- a) Bile-salt induced colonic water excretion
- b) Short gut syndrome
- c) Steatorrhoea
- d) Bacterial overgrowth
- e) Cytokine driven cell secretion

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**Bowel Fistula
Patient Management**

4. A CD patient presents with several days of jerky movements and a tremor followed by a convulsion. What electrolyte abnormality may be present?

- a) Potassium
- b) Zinc
- c) Magnesium
- d) Copper

5. What is the most sensitive measurement of dehydration and electrolyte disturbance?

- a) Potassium
- b) Urinary sodium
- c) Urea
- d) Creatinine
- e) Plasma sodium

Answer**1. Answer: d**

While each of the answers provided are relevant, ultimately (d) was the driving factor. Internal GI fistulae respond the least well to medical therapy. However, despite the fistulae and strictures nutrition was preserved with an elemental diet. Strictures without inflammation generally require surgical intervention. The patient's pain was likely to be secondary to the mechanical strictures and the diarrhoea a combination of bacterial overgrowth, relative short-gut due to enteric bypass as well as active disease. Only the later is responsive to medical therapy and that had been exhausted.

2. Answer: All of the above.

However serum albumin, as an acute phase respondent may be reduced with active disease without malnutrition. Haemoglobin may be low in conditions such as CD where GI blood loss is common without malnutrition. Urinary creatinine excretion is a good marker of skeletal muscle mass rather than total nutrition. Together however with other biochemical parameters such as folate, B12, iron binding capacity, pre-albumin, calcium, phosphorus and vitamin D, they each contribute to the nutritional assessment.

3. Answer: a, c, e.

Reduction in mucosal inflammation reduces cellular driven diarrhoea and diarrhoea secondary to dysfunction of ileal bile salt metabolism. Minimizing bile salt dysfunction also minimises steatorrhoea in the longer-term.

4. Answer: c

Patients with extreme sodium deficiency may present with convulsions but the presentation here is typical of hypomagnesaemia. Levels less than 0.6mmol/L may result in abnormal movement and <0.2mmol/L convulsions. Hypomagnesaemia is common in patients with severe diarrhoea or high output stomas.

5. Answer: b.

Urinary sodium is the most sensitive predictor of dehydration and electrolyte disturbance. A random urinary sodium sample should be >10mmol/L. The other electrolytes that require attention include potassium, chloride, magnesium and longer-term zinc.

References

1. National Institute of Health and Clinical Excellence (NICE). Crohn's Disease – Infliximab (review) and Adalimumab: appraisal consultation document. March 2010
2. Pickhardt PJ, Bhalla S, Balfé DM. Acquired gastrointestinal fistulas: classification, aetiology and imaging evaluation. *Radiology* 2002; 224: 9-23
3. Glass RE, Ritchie JK, Lennard-Jones JE, Hawley PR, Todd IP. Internal Fistulas in Crohn's Disease. *Diseases of Colon & Rectum* 1985;28:557-61
4. Bataille F, Klebl F, Rummele P, Schroeder J, Farkas S, Wild P-J, Furst a, Hofstetter f, Scholmerich J, Herfarth H, Rogler G. Morphological characterisation of Crohn's disease fistulae. *Gut*. 2004; 53: 1314-1321
5. Pettit SH, Irving MH. The operative management of fistulous Crohn's disease. *Surgery Gynaecology and Obstetric Journal* 1988; 167: 223-8
6. Bressler B, Sands BE. Review article: medical therapy for fistulizing Crohn's Disease. *Alimentary Pharmacology & Therapeutics* 2006; 24: 1283-1293
7. Sparberg M, Kirnser JB. Long-term corticosteroid therapy for regional enteritis: an analysis of 58 courses in 54 patients. *American Journal of Digestive Disease* 1966; 11: 865-80
8. Soon SY, Ansari A, Yaneza M, Raoof S, Hirst J, Sanderson JD. Experience with the use of low-dose Methotrexate for inflammatory bowel disease. *European Journal of Gastroenterology Hepatology* 2004; 16: 921-926

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9. Schechter WP, Hirshberg A, Chang DS, Harris HW, Napolitano LM, Wexner SD, Dudrick SJ. Enteric Fistulas: Principles of management. *Journal of American College of Surgeons*. 2009; 209: 484-491
10. Bataille F, Klebl F, Rummele P, Schroeder J, Farkas S, Wild P-J, Furst a, Hofstdter f, Scholmerich J, Herfarth H, Rogler G. Morphological characterisation of Crohn's disease fistulae. *Gut*. 2004;53: 1314-1321
11. Sands BE, Anderson FH, Bernstein CN. Infliximab maintenance therapy for fistulising Crohn's Disease. *New England Journal of Medicine* 2004; 350: 876-85
12. Poritz LS, Rowe WA, Koltun WA. Remicide does not abolish the need for surgery in fistulising Crohn's Disease. *Diseases of Colon and Rectum* 202; 45: 771-5
13. Irving PM, Rampton DS, Shanahan F. *Clinical Dilemmas in Inflammatory Bowel Disease*. Oxford, Blackwell Publishing, 2006, p 176
14. Rubesin SE, Scotiniotis I, Birnbaum BA, Ginsberg GG. Radiologic and endoscopic diagnosis of Crohn's disease. *Surgical Clinics of North America Journal* 2001; 81: 39-70
15. Fiorino G, Bonifacio C, Peyrin-Biroulet L, Minuti F, Repici A, Spinelli A, Fries W, Balzarini L, Montorsi M, Danese S, Malesci A. Prospective comparison of computed tomography enterography and magnetic resonance enterography for assessment of disease activity and complications in ileocolonic Crohn's disease. *Inflammatory Bowel Disease* 2001; 17(5): 1073-80
16. Irving PM, Rampton DS, Shanahan F. *Clinical Dilemmas in Inflammatory Bowel Disease*. Oxford, Blackwell Publishing, 2006, p 168-70
17. Michener WM, Wyllie R. Management of Children and Adolescents with Inflammatory Bowel Disease. *Medical Clinics of North America* 1990; 74: 103-117.
18. Heuschkel RB, Walker-Smith JA. Enteral nutrition in inflammatory bowel disease of childhood. [Review]. *Journal of Parenteral and Enteral Nutrition* 1999; 23(Suppl 5): 529-32
19. Zachos M, Tondeur M, Griffiths AM. Enteral nutritional therapy for inducing remission of Crohn's disease. *Cochrane Database Systematic Review* 2001;3:CD000542
20. Saint-Marc O, Vaillant JC, Frileux P, Balladur P, Tivet E, Parc R. Surgical management of ileosigmoid fistulas in Crohn's disease: role of colonoscopy. *Diseases of Colon & Rectum* 1995; 38: 1084-7
21. Young-Fadok TM, Wolff BG, Meagher A, Benn PL, Dozois RR. Surgical management of ileosigmoid fistulas in Crohn's disease. *Diseases of Colon & Rectum* 1997; 40: 558-61
22. Tjandra JJ, Fazio VW, Lavery IC. Results of multiple stricturoplasties in diffuse Crohn's disease of the small bowel. *Australian & NZ Journal of Surgery*. 1993; 63: 95-9
23. Williams AJ, Palmer KR. Endoscopic balloon dilatation as a therapeutic option in the management of intestinal strictures resulting from Crohn's disease. *British Journal of Surgery* 1991; 78: 453-4.
24. Beddy D, Dozois EJ, Pemberton JH. Perioperative complications in inflammatory bowel disease. *Inflammatory Bowel Disease* 2011; 17(7): 1610-9
25. Williams JG, Wong WD, Rothenberger DA, Goldberg SM. Recurrence of Crohn's disease after resection. *British Journal of Surgery* 1991; 78: 10-19.

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ENHANCED RECOVERY PROGRAMME IN SURGERY

RM Anwar



Enhanced Recovery Programme in surgery Good Clinical Care

Abstract

The Enhanced Recovery Programme (ERP) is an innovative method of care for patients undergoing 'major abdominal and certain thoraco-abdominal surgery'. ERP is a structured combination of interventions resulting in speedy and safe early recovery.

The main purpose of ERP is to maintain the physiological function of the patient during their stress response to major surgical procedures so aiding their quicker recovery. Interventions of ERP include counseling in the pre-operative period, feeding, mechanical bowel preparation, peri-operative fluid administration, prevention of hypothermia, use of epidural analgesia and avoidance of opiates analgesia, laparoscopic versus open surgery, use of NG tube, urethral catheter and drains, early mobilization and feeding, and antimicrobial and prophylaxis against thrombo-embolism. The elements of the ERP protocol have been evidenced to reduce post-operative morbidity, but there is a significant inconsistency in uptake of these strategies in clinical practice. To reap the maximum result, it is important to incorporate in an ERP all the strategies of the ERP protocol. ERP is now known to improve patient experience after major surgery, reduce post-operative complications, allow early discharge from hospital and eventually reduce health care costs.

Introduction

ERP is a novel approach to patient care following major thoraco-abdominal surgery. ERP strives to reduce the stress response to the physical trauma of surgery, achieve a complication-free recovery and a shortening of hospital stays for patients (1). ERP is effectively applicable to major abdominal and thoracic interventions including colorectal resections, oesophagectomy, liver resection and the repair of aortic aneurysm (2).

ERP is a collection of strategies combined in a structured pathway that allows the surgical and anaesthetic teams to aid quicker recovery of major surgical patients enabling earlier discharge (3).

In the UK National Health Service, the purpose of the programme is 'To improve the quality of the patient experience and outcomes and reduce the length of elective care pathways across the NHS by sharing the good practice principles of enhanced recovery models of care' (4).

Objectives

The principle purpose of ERP is to maintain physiological function through a number of interventions in the face of the physiological response to surgical trauma.

The stress response to surgery

The stress response to surgery is characterized by a cascade of physiologic and metabolic events through increased secretion of pituitary hormones and the activation of the sympathetic and somatic nervous system. The release of corticotrophin from the anterior pituitary stimulates cortisol secretion from the adrenal cortex, and vasopressin from the posterior pituitary affects the kidney. In the pancreas, glucagon is released and insulin secretion may be diminished.

The overall metabolic effect of the hormonal changes is increased catabolism which mobilizes substrates to provide energy sources, and a mechanism to retain salt and water and maintain fluid volume and cardiovascular homeostasis. The resultant release of neuroendocrine mediators and cytokines produces the clinical sequelae of tachycardia, hypertension, fever, immunosuppression, and protein catabolism that results in increased post-surgical morbidity. Surgical stress-activated reflex sympathetic activity and abdominal pain mediated through afferent pain fibers contributes to post-operative ileus that delays post-operative recovery. The magnitude of the stress response likely correlates with postoperative cardiac, vascular, and infectious morbidity (5,6).

Interventions maintaining physiological functions

Interventions proven to maintain physiological functions and influence post-operative outcome include counseling in the pre-operative period, feeding, mechanical bowel preparation, peri-operative fluid administration, prevention of hypothermia, use of epidural analgesia, avoidance of opiates analgesia, laparoscopic versus open surgery, use of NG tube, urethral catheter and drains, early mobilization and feeding, and antimicrobial and prophylaxis against thrombo-embolism. Appropriate antimicrobial and prophylaxis against thrombo-embolism are universally accepted as reducing post-operative morbidity and mortality and promoting post-surgery recovery (7).

ENHANCED RECOVERY PROGRAMME IN SURGERY

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Counseling

A clear and a frank explanation of expectations and comprehensive pre-operative information facilitates adherence to care pathway and enhances recovery and discharge (7).

Pre-operative feeding

To avoid aspiration pneumonia during general anaesthesia, surgical patients have been prevented from eating for six hours before anaesthesia, usually keeping nil by mouth from midnight before the day of surgery. ERP allows clear fluid 2 hours and solid food 6 hours prior to major surgery as robust evidence exists that clearly supports that the practice does not in any way increase complications (8). Nutritional supplements containing carbohydrate rich fluid 2 to 3 hours before surgery reduce thirst, hunger and anxiety. Fasting reduces insulin stimulated glucose transport into skeletal muscle and fatty tissue and hyperglycaemia that leads to increased post-surgical morbidity. Evidence suggests that pre-operative carbohydrate rich drinks lead to quicker return to bowel function, reduced post-operative nausea and vomiting and early discharge from hospital (9).

Role of bowel preparation in colo-rectal surgery

Mechanical bowel preparation was used routinely in elective colonic resection in the past. All bowel preparations can cause simple to debilitating side-effects, particularly in the elderly. Bowel preparations can usually be classified into one of three categories: High-volume gut lavage solutions such as Polyethylene glycol, osmotic agents, such as sodium phosphate, magnesium citrate, lactulose, and mannitol draw extracellular fluid across the bowel wall and into the lumen and bowel stimulants such as castor oil, senna, sodium picosulfate, and bisacodyl that increase smooth muscle activity within the wall of the colon (10).

Evidence suggests that mechanical bowel preparation is not beneficial for elective bowel resection and may increase the risk of anastomotic leaks and other post-operative morbidity. However mechanical bowel preparation may be required when intra-operative colonoscopy is required. Evidence is emerging that it may protect against anastomotic leak in ultra low anterior resection of the rectum and if a diverting stoma is constructed then the bowel should be cleansed distal to the stoma (7).

Perioperative fluid administration and prevention of hypothermia

It has been common practice to infuse far more fluid intravenously perioperatively than is lost or required and this may lead to delayed return of gastro-intestinal function, impaired tissue oxygenation and healing and a prolonged hospital stay (7). Transesophageal Doppler monitoring during operations has been shown by randomized controlled trials to reduce post-operative complications and oral feed and fluids should be started early to limit intravenous fluid administration after surgery (11).



Sustaining normothermia and the prevention of hypothermia by the use of devices such as upper body forced air heating cover during major surgery have been shown to reduce cardiac and wound complications as well as bleeding and transfusion requirements (7).

Laparoscopic or open surgery

Laparoscopy, amongst others in colonic resection surgery, is known to reduce morbidity and hospital stay after surgery. However the effect of laparoscopic surgery within a long established ERP on short term benefit has been reported as inconclusive in the past (12). More recent studies however favour the laparoscopic approach in surgical outcome within an established ERP. A laparoscopic approach within an ERP resulted in significant reduction in the length of hospital stay and in fewer non surgical post operative complications (13,14). ERP after laparoscopic colorectal surgery has been shown to reduce hospital stay significantly compared to conventional care (15). Larger trials such the LAFA and EnROL are expected to conclusively determine the role of laparoscopic surgery within the framework of an ERP (12).

Epidural anaesthesia/analgesia

Multiple studies and systemic reviews have demonstrated that epidural anaesthesia and analgesia improve postoperative outcome and attenuate the physiological response to surgery and have been considered fundamental to ERP. They offer excellent post-operative pain control, a marked beneficial effect on pulmonary function and a decrease in morbidity after major abdominal surgery (5). However studies demonstrate that though epidural analgesia significantly improves pain and gastro-intestinal function it can have some adverse effects and does not by itself reduce hospital stays. More recent studies have demonstrated other modes of analgesia such as intrathecal, spinal or patient controlled analgesia with parental opioids, regional or local nerve blocks may lead to a better outcome than epidural analgesia in laparoscopic colorectal surgery (16,17).

ENHANCED RECOVERY PROGRAMME IN SURGERY

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**Early mobilization, feeding and tube drains**

Early mobilisation after surgery prevents muscle loss and decreases in muscle strength, improves pulmonary function and increases tissue oxygenation, prevents thrombo-embolism and aids early recovery (7). Early feeding after major surgery on the other hand though may increase the incidence of post-operative vomiting, reduce the risk of infection and the length of hospital stays (18).

The routine use of naso-gastric tubes, intracavity drains and urinary catheters is not encouraged within the framework of ERP. The routine use of NG tubes prevents the earlier return of bowel function and increases pulmonary complications (19).

Naso-gastric tubes used for decompression of air entering the stomach during ventilation should be removed at the time of extubation.

Abdominal drains are used to detect bleeding, abscess formation and anastomotic leak but the routine use of abdominal drains after major surgery may cause more harm than good. The use of intra-abdominal drains after colorectal surgery has been shown to produce no beneficial effect and may fail to allow the egress of pus or faeces when anastomotic dehiscence occurs, imparting a false sense of security (20, 21).

The judicious use of urinary catheters and their timely removal has been demonstrated to independently affect the length of hospital stays (14).

**Enhanced Recovery Programme in surgery
Good Clinical Care****Discussion**

ERP, also known as Fast Track FT perioperative care and 'Enhanced Recovery after Surgery' (ERAS) is a novel way to care for a surgical patient before, during and after a major surgical procedure. ERP is credited with a reduction in the physiological stress response to surgical trauma, aiding recovery after major surgery, early discharges and a subsequent reduction in health care costs (7, 12, 13, 14, 22, 23).

Incorporation of any one element of ERP protocol in surgical patient care leads to reduced morbidity and post-operative hospital stay. Though a substantial number of strategies have been incorporated in the ERP protocol and guidelines, there is a significant inconsistency in the uptake of such strategies in clinical practice to date. It is thus essential to incorporate in an ERP all strategies shown to have beneficial effect on the outcomes for surgical patients to reap maximum benefit (1, 14, 24).

A successful ERP requires the services of a motivated and committed team of a co-ordinator, surgeon, anaesthetist, physiotherapist, dietician, social worker and the nursing team. Evidence suggests that the failure of contribution from any of the team members can adversely affect the benefit of ERP (1, 7, 14).

One of the major concerns of ERP has been the possibility of higher readmission consequent on early discharge from hospital though evidence demonstrates no significant difference in readmission rate between ERP and conventional care (1, 12, 25). However, too early discharge from hospital may be counterproductive and detrimental to the patient's wellbeing. It must be the principle objectives of ERP to improve the quality of the patient's experience, to aid patient recovery and to reduce morbidity following surgery. Patients' earlier discharge is not the main objective but is a consequence of improved recovery and reduced complications.

Conclusion

ERP has been evidenced to reduce the the physiological response to surgical trauma, improve patient experience, accelerate recovery and reduce post-operative complications after major surgical intervention. The affects of ERP on surgical outcomes can be realised as earlier discharge from hospital and a reduction in health care costs.

ENHANCED RECOVERY PROGRAMME IN SURGERY

RM Anwar

Questions

1. ERP:

- a) is an old method that has been practiced for many years
- b) is an innovative procedure that has been popularized in recent years
- c) is an old method that is being polarized in recent years
- d) is an innovative method but has been practiced for many years
- e) None of the above is true

2. Major surgery produces:

- a) no effect on the immune system
- b) dissimilar stress response to trauma
- c) no effect on the heart
- d) physiological neuro-endocrine responses
- e) no cardiovascular responses

3. ERP involves the following interventions:

- a) counseling in the pre-operative period
- b) pre-operative feeding
- c) perioperative fluid administration
- d) mechanical bowel preparation
- e) all of the above

4. The effect of laparoscopic surgery within a long established ERP on short term benefit:

- a) is well established
- b) is inconclusive
- c) recent studies favour laparoscopy over open surgery
- d) open surgery produces better outcome
- e) b and c

5. The principle objective of ERP is:

- a) is to discharge patient early from hospital
- b) is to reduce health care cost
- c) a complication free recovery
- d) is to try to maintain physiological function
- e) None of the above

Answers

1. Answer (d)

The principle purpose of ERP is to maintain physiological function through a number of interventions in the face of the physiological response to surgical trauma.

2. Answer (b)

ERP is an innovative method that has been popularized in recent years. Some of the components have been practiced in the past but never in a structured way. The ERP protocol is advocated.

3. Answer (d)

Major surgery produces response that is characterized by a cascade of physiologic and metabolic events through increased secretion of pituitary hormones and the activation of the sympathetic and somatic nervous system having effects on both the heart and cardiovascular system.

4. Answer (e)

ERP includes counseling in the pre-operative period and feeding, mechanical bowel preparation, perioperative fluid administration, prevention of hypothermia, use of epidural analgesia and avoidance of opiates analgesia, laparoscopic versus open surgery, use of NG tube, urethral catheter and drains, early mobilization and feeding, and antimicrobial and prophylaxis against thrombo-embolism.

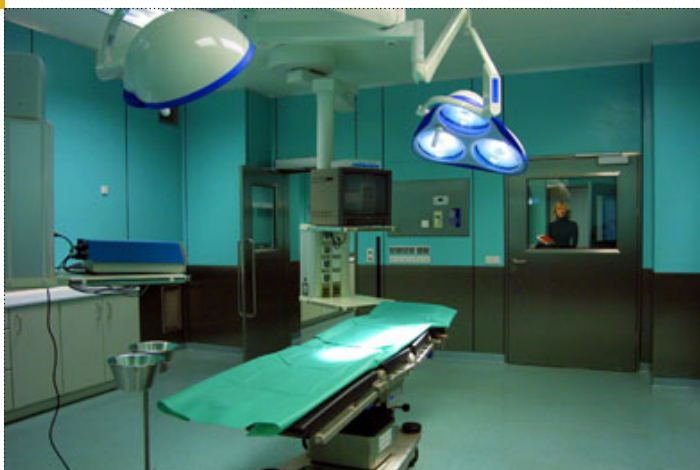
5. Answer (e)

The effects of laparoscopic surgery within a long established ERP on short term benefit have been reported as inconclusive in the past 12. More recent studies however favour a laparoscopic approach in surgical outcome within established ERP. Laparoscopic approach within ERP results in a significant reduction in the length of hospital stay and in fewer non surgical post operative complications.



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**References**

1. Wind J, Polle SW, Fung Kon Jin PH et al, systematic review of enhanced recovery programmes in colonic surgery, *Br J Surg*. 2006 Jul; 93(7):800-9
2. Hendry PO, Van Dam RM, Bukkems SF et al, Randomized clinical trial of laxatives and oral nutritional supplements within an enhanced recovery after surgery protocol following liver resection, *Br J Surg*. 2010 Aug;97(8):1198-206
3. Holte K, Kehlet H Postoperative ileus: progress towards effective management *Drugs*. 2002; 62(18):2603-15
4. About Enhanced Recovery, DOH, September 2010
5. Moraca RJ, Sheldon DG, Thirlby RC, The Role of Epidural Anesthesia and Analgesia in Surgical Practice, *Ann Surg* 2003; 238(5): 663-673
6. Desborough JP, The stress response to trauma and surgery, *Br J Anaesth* 2000; 85: 109-117
7. Lassen K, Soop M, Nygren J et al, Consensus review of optimal perioperative care in colorectal surgery: Enhanced Recovery After Surgery (ERAS) Group recommendations, *Arch Surg*. 2009 Oct;144(10):961-9
8. Brady M, Kinn S, Stuart P. Pre-operative fasting for adults to prevent perioperative complications. *Cochrane Database Syst Rev* 2003; (4): CD004423
9. Jones C, Badger SA, Hannon R. The role of carbohydrate drinks in pre-operative nutrition for elective colorectal surgery. *Ann R Coll Surg Eng* 2011; (93): 504-507
10. Atreja A, Making the most of currently available bowel preparations for colonoscopy. *Cleveland Clinic Journal of Medicine* 2010; 77 5: 317-326
11. Walsh SR, Tang T, Bass S, Gaunt ME, Doppler-guided intra-operative fluid management during major abdominal surgery: systematic review and meta-analysis, *Int J Clin Pract*. 2008 Mar;62(3):466-70. Epub 2007 Nov 21
12. Rawlinson A, Kang P, Evans J, Khanna A, A systematic review of enhanced recovery protocols in colorectal surgery, *Ann R Coll Surg Engl*. 2011 Nov;93(8):583-8
13. Feroci F, Kroning KC, Lenzi E, Moraldi L, Cantafio S, Scatizzi M Laparoscopy within fast track program enhances the short term results after elective surgery for resectable colorectal cancer, *Surg Endosc* 2011 25:2919-2925
14. Aarts MA, Okrainec A, Glicksman A, Pearsall E, Charles Victor J, McLeod RS, Adoption of enhanced recovery after surgery (ERAS) strategies for colorectal surgery at academic teaching hospitals and impact on total length of hospital stay. *Surg Endosc*. 2011 Oct 20. [Epub ahead of print]
15. Haverkamp MP, de Roos MA, Ong KH, The ERAS protocol reduces the length of stay after laparoscopic colectomies, *Surg Endosc*. 2011 Oct 13. [Epub ahead of print]
16. Levy BF, Scott MJ, Fawcett W, Fry C, Rockall TA, Randomized clinical trial of epidural, spinal or patient-controlled analgesia for patients undergoing laparoscopic colorectal surgery, *Br J Surg*. 2011; 98(8):1068-1078
17. Virlos I, Clements D, Beynon J, Ratnalikar V, Khot U, Short-term outcomes with intrathecal versus epidural analgesia in laparoscopic colorectal surgery, *Br J Surg*. 2010 Sep;97(9):1401-1406.
18. Ren L, Zhu D, Wei Y, Pan X et al, Enhanced Recovery After Surgery (ERAS) Program Attenuates Stress and Accelerates Recovery in Patients After Radical Resection for Colorectal Cancer: A Prospective Randomized Controlled Trial, *World J Surg*. 2011 Nov 19. [Epub ahead of print]
19. Nelson R, Edwards S, Tse B, Prophylactic nasogastric decompression after abdominal surgery, *Cochrane Database Syst Rev*. 2007;(3):CD004929
20. Wasey N, Baughan J, and de Gara CJ, Prophylaxis in elective colorectal surgery: the cost of ignoring the evidence, *Can J Surg*. 2003; 46(4): 279-284
21. Karliczek A, Jesus EC, Matos D, Castro AA, Atallah AN, Wiggers T. Drainage or nondrainage in elective colorectal anastomosis: a systematic review and meta-analysis, *Colorectal Dis*. 2006;8(4):259-65
22. Delaney CP, Fazio VW, Senagore AJ et al, 'Fast track' postoperative management protocol for patients with high co-morbidity undergoing complex abdominal and pelvic colorectal surgery, *Br J Surg*. 2001 Nov;88(11):1533-8
23. Zhou JJ, Li J, Ying XJ et al, Fast Track Multi-Discipline Treatment (FTMDT trial) Versus Conventional Treatment In Colorectal Cancer - The Design of A Prospective Randomized Controlled Study, *BMC Cancer*. 2011 Nov 24;11(1):494. [Epub ahead of print]
24. Maessen J, Dejong CH, Hausel J, Nygren J et al, A protocol is not enough to implement an enhanced recovery programme for colorectal resection, *Br J Surg*. 2007 Feb;94(2):224-31
25. Gouvas N, Tan E, Windsor A, Xynos E, Tekkis PP, Fast-track vs standard care in colorectal surgery: a meta-analysis update, *Int J Colorectal Dis*. 2009 Oct;24(10):1119-31

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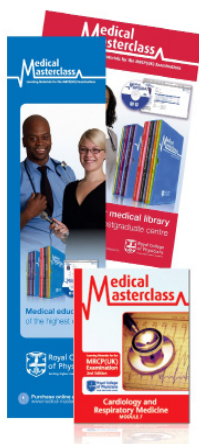
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CASE BASED DISCUSSION: INITIAL MANAGEMENT OF LARGE BOWEL OBSTRUCTION

W Carr, S Wakefield



Case Based Discussion: Initial Management of Large Bowel Obstruction Patient Management

Abstract

Large bowel obstruction is a common surgical emergency. The history and examination findings can often confirm the underlying diagnosis and guide the next steps in surgical management. These steps are important to improve clinical outcomes for patients who are at a high risk of mortality and morbidity. This paper discusses the management decisions that need consideration by the junior surgical team and covers the basic steps of history taking, fluid management, NG tube insertion and abdominal X-ray interpretation. The discussion aims to highlight the relevance of clinical findings and provide an understanding of the thought processes needed to manage the condition.

Case

Patient GH, a 65 year old gentleman, is referred to the Surgical Admissions Unit with vomiting and constipation.

On receiving the call, what should the junior surgeon be thinking about?

After receiving the referral it is worth taking a minute to consider a plan of action. From the referral bowel obstruction is the most likely diagnosis. It is therefore worth considering the relevant questions that need to be asked to confirm the diagnosis, what clinical signs to look out for and to consider the need for immediate fluid resuscitation.

On arrival at the patient's bedside, you find Mr GH to be sat up in bed, alert and chatting, clutching a vomit bowl close to his chest.

What are the key points on the history?

The history needs to confirm the presence of bowel obstruction with regard to four main features:

- Abdominal distension
- Vomiting
- Absolute constipation (failure to pass flatus or motions)
- Crampy abdominal pain

The duration of symptoms can give a clue as to the site of the obstruction. Small bowel obstruction (SBO) presents with vomiting as an early sign and constipation as a relatively late feature. Vomiting is a late feature of large bowel obstruction (LBO). The colour of the vomit gives a clue to the duration of obstruction. If the vomit is foul smelling and feculent the small bowel has been obstructed for some time. Abdominal pain in the mid abdomen is suggestive of SBO (due to the embryological origins of the midgut) whereas LBO tends to present with lower abdominal pain (hind gut pain).

GH has been unwell for 5 days. He initially developed vague lower abdominal cramps associated with abdominal distension, constipation and a failure to pass flatus. He had been distended for several days but vomiting has only begun 24 hours ago. Initially the vomit was bile stained but has become thicker and brown in colour.

Can the history help differentiate large and small bowel obstruction?

The key thought process at this point is to understand the most common causes of large and small bowel obstruction. A good way to classify this is:

Mechanical vs. Functional

Large vs. Small Bowel

Large bowel Obstruction	Approx Incidence (%)	Small Bowel Obstruction	Approx Incidence (%)
Bowel Cancer	70	Adhesions	70
Pseudo obstruction	15	Hernia	20
Volvulus	10	Inflammatory / ischemic stricture	5
Inflammatory Stricture	5	Caecal Cancer	5
		Gallstone ileus	<1

Table 1: Relative frequency of the underlying cause of bowel obstruction.

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It is important to consider the possibility that the obstructive symptoms are the result of a functional problem. Pseudo obstruction usually occurs because of electrolyte abnormalities or sepsis and can mimic mechanical obstruction. The initial management remains the same with a focus on fluid and electrolyte replacement until definitive imaging has been arranged. Surgical intervention is not indicated in the absence of perforation.

Small Bowel obstruction: Adhesions (internal scarring) are the commonest cause in a patient with previous abdominal surgery but in the absence of previous surgery hernias are the likely cause. Most commonly these will be inguinal or femoral and this will usually be apparent on clinical examination. However a small femoral hernia in large patient can be difficult to identify. Likewise a hernia can be present without being the cause for obstruction.

Large Bowel Obstruction: Colorectal malignancy is by far the commonest cause of LBO. Clues can often be gained in the history relating to change in bowel habit, weight loss, rectal bleeding or symptoms of anaemia. Diverticular disease rarely presents with complete obstruction and malignancy needs to be excluded, even in a patient with known diverticular disease.



Image 1 & 2: These X-rays from the same patient show large bowel obstruction. It is important to obtain full views of the abdomen and on digital X-ray images this often means several different images are necessary. The colon lies in the periphery of the film although the transverse colon does loop down into the centre. Haustral marking are visible in the transverse colon (white arrows). There is an absence of gas in the rectum suggesting complete obstruction (green oval). The caecum is grossly distended upto 9cm (red line) and the site of obstruction is likely to lie in the sigmoid colon (red box).

Some 20% of colorectal cancers present as emergencies with obstructive symptoms. This equates to about 10,000 cases per year in the UK (1-4). The mortality rate is up to 20% for these cases compared with <5% for elective cases (5,6). This emphasizes the importance of initial management and diagnosis in the treatment of extremely high-risk patients.

Left sided lesions most commonly present with obstructive symptoms whereas right colonic lesions are more likely present with an abdominal mass and anaemia. It is rare for rectal cancer to present with obstruction due to the compliance of the rectum, which can accommodate a large tumour before becoming obstructed.

Obstructing bowel cancers tend to arise from three main sites along the colon although a tumour anywhere has the potential to cause obstruction. Sigmoid and splenic flexure tumours are common sites for obstruction as the lumen narrows and the bowel content thickens further down the colon. Obstructing caecal cancers present as small bowel obstruction due to obstruction at the ileocaecal valve.

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The other common cause of LBO is volvulus, which is defined as twisting of the bowel around its mesentery. This occurs most commonly in the sigmoid and is common in patients with underlying neurological disease or elderly frail patients. There is often a history of recurrent distension or a previous history of volvulus. It is rarely an unprecedented acute presentation. Rectal tube decompression (flatus tube) of a sigmoid volvulus is successful in 70-90% of patients (7,8).

GH has seen his GP 3 weeks ago for a change in his bowel habit to looser more frequent bowel motions with occasional blood in the toilet bowl. He has been referred through the 2-week rule pathway and was waiting for an outpatient colonoscopy. He has history of a perforated duodenal ulcer requiring emergency surgery.

What else must I find out?

After confirming the patient's medications and doses it is important to understand the indications for each. For a patient who is Nil by Mouth important medications are often omitted because no one has thought to consider an alternative route of administration. E.g. Anti epileptic medications, cardiac medications, steroids.

A full medical history should be completed. It is important to assess the patient's overall function. This can inform suitability for major surgery and future decisions. Can he run for a bus or only manage a few steps before stopping due to breathlessness?

GH was sat up in bed vomiting foul smelling brown vomit into a bowl. Observations revealed sinus tachycardia of 115, BP 100/60, RR 28. He was apyrexial. Clinical examination revealed dry mucus membranes, reduced skin turgor and cool peripheries. JVP was not visible. Capillary refill was prolonged at 4 seconds.

What do I need to establish from clinical assessment and examination?

The next steps in patient management can be divided into two parts. The first is to identify the unwell patient who needs immediate resuscitation and senior review. The second is to confirm the underlying diagnosis and guide ongoing investigation.

What can I learn from the edge of the bed?

Recognition of the unwell surgical patient is an important skill and is achieved by combining clinical examination findings and assessment of the patient's observations.

The overall condition of this patient is worrying. Tachycardia, tachypnoea and hypotension are clear signs that the patient is unwell and in need of aggressive fluid resuscitation to prevent further deterioration. These findings should trigger a call for help from a senior doctor and assessment from Critical Care. Reference to an Early Warning System is a readily applicable tool to help recognise an unwell patient (10,11).

Score	3	2	1	0	1	2	3
Heart Rate (beats/min)	<40	41-50	51-100	101-110	111-130	>129	
Respiratory Rate (breaths/min)	<8		9-14	15-20	20-29	>29	
Blood Pressure (Systolic mmHg)	<70	71-80	81-100	101-199		>200	
Temperature (Celsius)	<35	35.1-36	36.1-38	38.1-38.5		>38.6	
Conscious level			A	V	P	U	
			Alert	Voice	Pain	Un-responsive	
Urine output (ml/kg/hr)	Nil	<0.5					

Table 2: An example of an early warning score system.

Inspection from the edge of the bed revealed a distended abdomen with a midline scar extending from the xiphisternum to below the umbilicus. There were no groin or midline swellings. Palpation revealed mild tenderness over the lower abdomen with no guarding. Percussion was tympanic and audible borborygmi was present. Rectal examination was normal.

The findings of abdominal distension and high-pitched bowel sounds confirm the diagnosis of bowel obstruction. The presence of previous scars raises the possibility of adhesional obstruction whilst absence of any hernia rules out this cause of obstruction. Although rectal examination is essential at this point, it is unlikely to be abnormal.

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In large bowel obstruction dilation above the obstruction leads to mucosal oedema, impaired venous and arterial blood flow which in turn leads to increased bowel wall permeability, bacterial translocation and electrolyte and fluid loss. The caecum has the thinnest wall and is the widest segment of the colon. The Law of Laplace dictates that the caecum will distend the most and is therefore the commonest site of perforation. Findings of guarding, rebound tenderness and percussion tenderness are warning signs of perforation and require further investigation and urgent senior review.

What is the initial management?

- Supplemental oxygen.
- Large venflon access and Urgent bloods for FBC, U&E, LFTs, Bone Profile, Coagulation Screen and Group and Save
- Arterial blood gas
- 500ml fluid bolus (Normal Saline)
- IV Antibiotics
- IV Analgesia: paracetamol, tramadol or morphine.
- IV Antiemetic: Metoclopramide is contraindicated in the presence of mechanical bowel obstruction but cyclizine and ondansetron are useful alternatives.
- ECG
- Urgent Abdominal (AXR) and Erect Chest X-rays (CXR)
- Urinary catheter (attached to a urometer bag)
- Wide bore NG tube



Steps for NG tube insertion

- 1 Preparation: Apron and Gloves, Nursing assistant, Vomit bowl, Size 12Fr of greater NG tube (wide bore), lubricant jelly, glass of water with straw, 50ml bladder syringe, adhesive tape, drainage bag
- 2 Consent and Discussion: explain the indications for insertion, the steps involved in the procedure and that it will not be pleasant but will help resolve the sickness and vomiting symptoms
- 3 Measure the length of insertion. The OGJ lies at around 40cm from the teeth but this is variable. Measure the distance from the tip of the nose to the earlobe, then from the ear to the mid point between the xiphisternum and umbilicus. This is the distance the NG tube needs to be inserted.
- 4 Sit the patient as upright as possible, preferably with the bed in an upright position to prevent the patient's hand from pulling back as the tube is inserted.
- 5 Inspect the nostrils and inquire about previous nasal injury. Once decided on a side generously lubricate then insert the NG tube. Remember the nasal cavity runs directly backwards not upwards.
- 6 Resistance will be felt as the tube enters the pharynx. The patient may begin to cough. Pull back slightly at this point if necessary then prepare the patient for the next step.
- 7 Ask the patient to take a mouthful of water and hold the water in his mouth. On the command swallow, gently push the tube down further as the patient swallows.
- 8 After insertion to the correct distance aspirate the stomach contents to dryness. Several litres are often present.
- 9 Secure the tube to nostril and attach drainage bag.
- 10 Inform nursing staff to aspirate 4 hourly and to monitor fluid balance.

Table 3: Steps for Nasogastric tube placement.

How Much Fluid is needed?

The assessment of fluid requirements is an essential skill and requires an understanding of:

- maintenance requirements;
- fluid deficit at presentation;
- ongoing losses.

The choice of fluid is debatable but for volume replacement when correcting hypotension colloid is effective, e.g. Volplex. When replacing electrolyte and fluid loss without hypotension crystalloid is used, e.g. Normal Saline. 5% Dextrose is only useful for maintenance fluid replacement.

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Maintenance requirements

In health, all patients have fluid requirements to maintain fluid and electrolyte balance and replace urine output and insensible losses from sweating and respiration.

IV replacement	Amount
Fluid	4ml/kg/hour for first 10kg 2ml/kg/hour for the second 10kg 1ml/kg/hour after that
Sodium	1-2 mmol/kg/24hours
Potassium	0.5 -1 mmol/kg/24hours

Table 4: Maintenance fluid requirements per kg body weight.

So for the average 70kg man maintenance fluids involve:

(2x70) = 140mmol Sodium/24hours
 (1x70) = 70mmol Potassium/24hours
 (4x10) + (2x10) + (1x50) = 110ml/hr which is 110x24=2640ml per 24 hours

Fluid deficit

Prior to admission, the patient will be behind on his daily fluid requirement and have increased losses from vomiting. Additional fluid will be lost into the third space (fluid sequestered into the bowel or the tissues due to capillary leak as a result of sepsis). Patients can develop atrial fibrillation as a result of dehydration and hypokalaemia and the first line of treatment is correction of the underlying cause rather than medication. Replacement of pre-existing fluid deficits needs to be achieved before maintenance fluids can be prescribed.

Ongoing losses

Once deficits have been replaced, increased fluid will be needed to cover:

- Pyrexia (500ml/day per degree Celsius)
- NG loss
- Ongoing third space fluid loss

Effective fluid resuscitation requires regular reassessment and consideration of effectiveness. It is therefore essential that accurate fluid balance charts are recorded. Is the patient responding as evidenced by a reduction in early warning score and increased urine output? Persistent oliguria (<0.5ml/kg/hr) or failure to respond should trigger the call for senior support.

A similar approach is needed to correct electrolyte abnormalities but this can be guided by blood tests. Vomit and gastrointestinal losses high in Potassium and deficits need correction. It is worth noting that IV Potassium can only be replaced at 10mmol/hour.

3 litres of fluid were immediately aspirated from the NG tube on insertion. The patient confirmed minimal oral intake for three days and vomiting for the last 24 hours. 100mls of concentrated urine were drained on insertion of the catheter and over the first hour 10mls drained.

The early warning score was 7.

Fluid Requirements were calculated as follows:

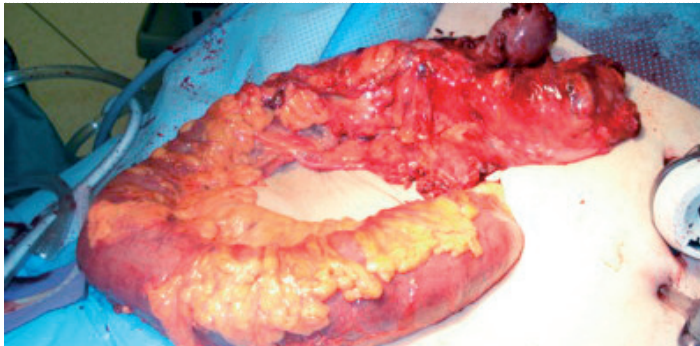
Failure to meet maintenance requirements for 3 days: 3 x 2.5 litres
 Vomiting for 24 hours: 3 litres
 NG output: 3 litres
 Third space losses: approx 3-4 litres
 Maintenance for next 24hrs: 2.5 litres

Whilst only estimations, the above calculations suggest this patient is at least 10 litres behind on his fluid requirements on admission. This estimates to about 14% of his total weight. The patient received 3 x 500ml colloid over the first hour to correct his hypotension. Following this, 4 litres of crystalloid were administered over 4 hours.



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What are the important points for X-ray interpretation?

Chest X-ray (CXR): the most important finding is the presence of free gas under the diaphragm. This would indicate a perforation and the need for urgent surgery.

Abdominal X-ray (AXR): The features described in table below help differentiate LBO and SBO. The absence of gas in the rectum or left side colon can often differentiate between complete and impending obstruction. Rigler's sign can be seen on an AXR and demonstrates free gas suggesting perforation. It represents gas on both sides of the bowel wall.



Image 3: This shows a good example of Rigler's sign suggesting free intra-abdominal gas. (White arrows) This is not present in the discussed case.

Large Bowel Obstruction	Small Bowel Obstruction
Peripherally placed bowel gas pattern	Central bowel loops
Haustral pattern	Valvulae Coniventes
>6cm for colon/ 9cm for caecum	>5cm
	Air fluid levels

Table 5: Radiological findings on Abdominal X-Rays suggesting bowel obstruction.

Valvulae coniventes are present in small bowel. They are circular folds in the mucous membrane and extend across the full width of the lumen. Haustrations are present in the large bowel and only project across part of the lumen.

In LBO, the small bowel may also become distended implying the ileocaecal valve is incompetent and the large bowel is decompressing. If the ileocaecal valve is competent then a closed loop colonic obstruction is present and caecal perforation is more likely.

Erect CXR confirmed the absence of free gas under the diaphragm and AXR showed a grossly distended large bowel with a distended caecum. There is no evidence of small bowel distension implying a competent ileocaecal valve.

Does the patient need surgery, resuscitation, or further investigation?

In most cases of SBO secondary to adhesions, conservative treatment will resolve the obstruction. Surgery is a last resort. The term "drip suck" is often used to describe the conservative management approach. The opposite is true for large bowel obstruction.

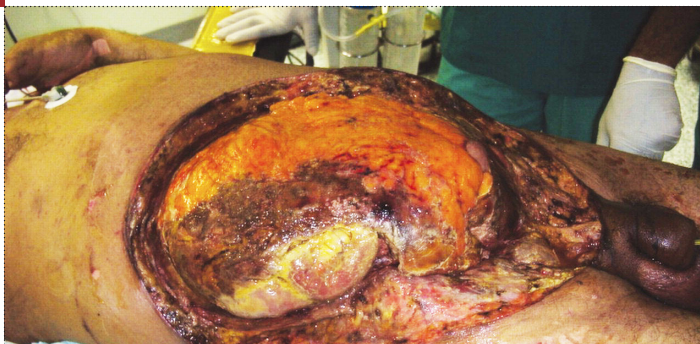
The history, examination and X-ray findings have identified that this patient is unwell with significant dehydration secondary to large bowel obstruction and the need for continued fluid resuscitation. The examination findings do not suggest acute perforation and so an urgent laparotomy is not indicated.

There is a window of opportunity to improve the patient's fluid status and confirm the diagnosis by performing a CT scan of the abdomen prior to definitive treatment. The continued care of the patient requires close monitoring and regular reassessment. Transfer to the High Dependency Unit (HDU) should be considered for arterial and central venous lines.

Overnight: After admission to the HDU, the surgical registrar on call reviewed the patient and a CT scan of the abdomen was requested for the following morning. Fluid resuscitation continued overnight and 12 litres of fluid were required with normalization of observations and good urine output.

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Why does the patient need a CT scan?

CT imaging will confirm a mechanical obstruction and rule out a functional pseudo obstruction which requires conservative management.

In large bowel obstruction a CT scan provides the following additional information that will alter the choice of intervention.

- The site and size of obstructing tumour
- Presence of metastatic disease/ local invasion
- Presence of gas in the caecal wall (pneumatosis) suggesting impending caecal perforation
- The presence of perforation as evidenced by free gas and fluid

There are many treatment options available for consideration:

1. Emergency Surgery: This usually requires a laparotomy with resection of the obstructing cause. For a left side lesion this would probably result in the formation of an end colostomy. In the setting of an acute obstruction in an unwell patient performing an anastomosis has an increased risk of leaking but may be considered for right-sided tumours.

2. "Bridge to Surgery": A colonic stent can be inserted as a temporary measure to resolve the obstruction enabling the patient to be optimized prior to definitive elective surgery associated with reduced operating risk and the avoidance of a stoma. This option is gaining favour in the UK (11,12).

3. Palliative Colonic Stent: For a patient who is unlikely to survive major surgery a colonic stent can be attempted to relieve the obstruction with the understanding that this is a palliative measure and that the cancer will progress over the following months.

4. Palliative Defunctioning: In presence of incurable disease in a patient suitable for a general anaesthetic a defunctioning stoma can be fashioned to relieve the obstruction when a stent is not technically possible. Rectal cancers cannot be stented.

5. Conservative treatment: For a patient with multiple co-morbidities who is too unwell to survive surgery. A full discussion with patient and next of kin is necessary before placing the patient on an End of Life Care Pathway

The CT scan showed an obstructing sigmoid cancer with no evidence of metastatic disease or perforation. A laparotomy was performed which showed patches of necrosis on the caecum suggesting impending perforation. A subtotal colectomy and end ileostomy was performed. The patient was admitted to HDU post operatively and subsequently made an uncomplicated recovery.

Learning Points

- Bowel cancer presenting with obstruction is a serious condition requiring appropriate first line treatment.
- Fluid resuscitation is essential and needs to be implemented early.
- History and examination findings can often determine the diagnosis alone.
- Plain abdominal X-rays are useful to guide first line management but CT scanning provides far more information to plan further intervention.

Questions

1. Which of the following is the commonest cause of large bowel obstruction?

- Bowel cancer
- Obstructing femoral hernia
- Obstructing inguinal hernia
- Adhesions
- Diverticulitis

2. In acute large bowel obstruction which of the following is true?

- Large Bowel obstruction is not a surgical emergency because the patients do not need immediate surgery.
- Conservative treatment will be successful most of the time.
- Patients only require maintenance fluid therapy.
- HDU is only required after surgery.
- Large volumes fluid therapy can be needed to resuscitate a patient.

3. Abdominal X-ray findings. Which of the following is true?

- Gas in the Caecal wall is a sign of impending perforation.
- Obstructing caecal cancers present with findings of large bowel obstruction.
- A normal caecal width excludes large bowel obstruction.
- Valvulae conniventes are features of the large bowel wall.
- Free gas on CXR excludes perforation.

CASE BASED DISCUSSION: INITIAL MANAGEMENT OF LARGE BOWEL OBSTRUCTION

W Carr, S Wakefield

4. Which of the following statements regarding bowel cancer is true?

- a) Rectal cancers commonly present with obstruction.
- b) The mortality from emergency bowel surgery is the same as elective surgery.
- c) Stenting obstructing tumours always improves survival.
- d) 20% of bowel cancers present as an emergency.
- e) Diverticular disease can be differentiated from bowel cancer by taking a detailed history.

5. Which of the following statements regarding the differentiation of large bowel and small bowel obstruction is true?

- a) Vomiting is an early sign of large bowel obstruction.
- b) The absence of hernias rules out small bowel obstruction.
- c) Large bowel obstruction is usually associated with lower abdominal discomfort.
- d) Feculent vomiting implies it is large bowel obstruction.
- e) The history is not helpful in making the diagnosis.

6. Which of the following are referral criteria for colorectal cancer under the 2 Week Rule?

- a) A definite palpable right-sided abdominal mass consistent with involvement of the large bowel.
- b) A definite palpable rectal (not pelvic) mass.
- c) Iron deficiency anaemia WITHOUT an obvious cause (Hb <11 g/dl in men or <10 g/dl in postmenopausal women)
- d) Age over 40 and rectal bleeding with a change of bowel habit towards looser stool and/or increased stool frequency persisting for 6 weeks or more.
- e) Age over 60 and rectal bleeding persisting for 6 weeks or more WITHOUT anal symptoms or change in bowel habit.
- f) Age over 60 and change of bowel habit to looser stools, and/or increased frequency of defecation, WITHOUT rectal bleeding and persistent for 6 weeks or more.

Answers

1. Answer: a

b) c) and d) are causes of small bowel obstruction whilst diverticular diseases rarely presents with acute large bowel obstruction.

2. Answer: e

Aggressive fluid resuscitation is needed in LBO when the patient may present profoundly dehydrated with up to 15 litres of fluid deficit. Monitoring and appropriate fluid replacement often requires HDU care.

3. Answer: a

Caecal wall distension above 9 cm increases the risk of perforation and gas in the wall suggests this is imminent. Free abdominal gas is best seen on an erect CXR but can sometimes be seen on AXR. Absence of gas does not exclude a perforation.



4. Answer: d

Bowel cancer presents with obstruction in 20% of cases and is associated with a high mortality. Stenting is successful in up to 90% of patients but the results of a randomized trial comparing stenting to surgery are awaited.

5. Answer: c

Abdominal pain is a cardinal feature of bowel obstruction. In LBO it arises in the lower abdomen due to the embryological origin of the colon (hind gut).

6. Answer: All are true!

References

1. Phillips RK, Hittinger R, Fry JS, Fielding LP: Malignant large bowel obstruction. *Br J Surg* 1985, 72:296-302.
2. Mella J, Biffin A, Radcliffe AG, Stamatakis JD, Steele RJC: Population-based audit of colorectal cancer management in two UK health regions. *Br J Surg* 1997, 84:1731-1736.
3. Serpell JW, McDermott FT, Katrivesis H, Hughes ESR: Obstructing carcinomas of the colon. *Br J Surg* 1989, 76:965-969.
4. Umpleby HC, Williamson RCN: Survival in acute obstructing colorectal carcinoma. *Dis Colon Rectum* 1984, 27:299-304.
5. VS. Ellensen, J Elshove-Bolk, G Baatrup Morbidity and Mortality after Emergency and Urgent Colorectal Surgery for Malignant and Benign Disease. *The Open Colorectal Cancer Journal*, 2009, 2, 1-6
6. J. H. Anderson, D. Hole, C. S. McArdle Elective versus emergency surgery for patients with colorectal cancer. *British Journal of Surgery* Volume 79, Issue 7, pages 706-709, July 1992
7. Ballantyne GH. Review of sigmoid volvulus: History and results of treatment. *Dis Colon Rectum* 1982; 25: 494-501
8. Avots-Avotins KV, Waugh DE. Colon volvulus in the geriatric patient. *Surg Clin North Am* 1982; 62: 249-60
9. Stenhouse C, Coates S, Tivey M, Allsop P, Parker T. Prospective evaluation of a modified Early Warning Score to aid earlier detection of patients developing critical illness on a general surgical ward [Abstract] *Br J Anaesth*. 1999;84:663P.
10. Morgan RJM, Williams F, Wright MM. An early warning scoring system for detecting developing critical illness. *Clin Intensive Care*. 1997;8:100.
11. Y Saida, Y Sumiyama, J Nagao, M Uramatsu. Long-term prognosis of preoperative "bridge to surgery" expandable metallic stent insertion for obstructive colorectal cancer: comparison with emergency operation. *Diseases of the Colon and Rectum* 2003, 46(10 Suppl):S44-9]
12. Van Hooft JE, Bemelman WA et al, collaborative Dutch Stent-In study group. Colonic stenting versus emergency surgery for acute left-sided malignant colonic obstruction: a multicentre randomised trial. *Lancet Oncol*. 2011 Apr;12(4):344-52.

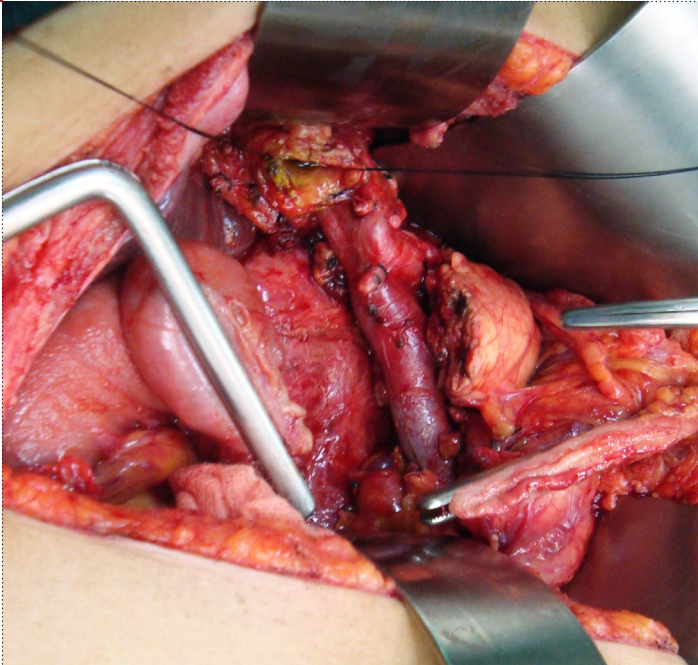
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PANCREATICO-DUODENECTOMY: A GUIDE FOR FOUNDATION YEAR DOCTORS

M Farhad, B Alkari



**Pancreatico-duodenectomy:
A guide for Foundation Year Doctors
Patient Management**

Abstract

Pancreatico-duodenectomy is a common surgical procedure performed in specialist hepato-biliary units. The aim of the article is to highlight the pre-, peri- and post-operative work up and care of surgical patients presenting with lesions in the head of the pancreas and peri-ampullary region requiring surgical resection. The focus is to assist foundation doctors to appreciate specific aspects of patient-care pertinent to this type of specialist surgery.

Introduction

The article consists of a brief “question & answer” guide describing different aspects of patient care of a patient presenting to the hepato-biliary unit. The article focusses on initial referral with a suggestion of a tumour in the head of pancreas, the initial staging procedure, a discussion at the hepato-pancreato-biliary multi-disciplinary meeting, further staging and assessment of the patient, and the consent procedure to include a highlight of the prognosis and possible complications. The indications and contra-indications for pancreatico-duodenectomy are summarised. Different variations of the operative procedure are described. The perioperative work-up and care is then summarised, to include details of the operative procedure. Post operative care and management is detailed, leading to the final outcomes based on histopathology.

This advanced type of surgery requires an understanding of specific aspects of patient management at a team level to facilitate a safe patient journey. Foundation year doctors should gain adequate skills in the management of this sub-group of surgical patients.

Medical history

A 64 year old male patient presented to the general practitioner with a three weeks history of painless jaundice (Figure 1). He was referred urgently to the jaundice clinic.



Figure 1 – A photo demonstrating jaundice which is noted both in the skin and sclera.

During his visit to the clinic further detailed history was obtained and he was found to have worsening painless jaundice over three weeks associated with dark urine, pale stool, and itching. This was associated with loss of appetite and loss of 5 kg of weight over 6 weeks.

He had no past history of gall stones, no previous blood transfusion and no previous liver disease.

Past medical history included a ten year history of controlled hypertension. Additionally he was a non-smoker and consumed alcohol on occasions. He had no relevant family history.

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Clinical examination

On examination the patient was found to be jaundiced in the sclera and skin. No palpable cervical lymph nodes were identified.

Abdominal examination revealed a soft abdomen with a positive Courvoisier's sign (a distended non-tender palpable gallbladder associated with jaundice. This is unlikely to be due to gallstones and more likely representing a tumour in the head of pancreas).

The rest of the examination was normal with no palpable masses or organomegaly.

Investigations

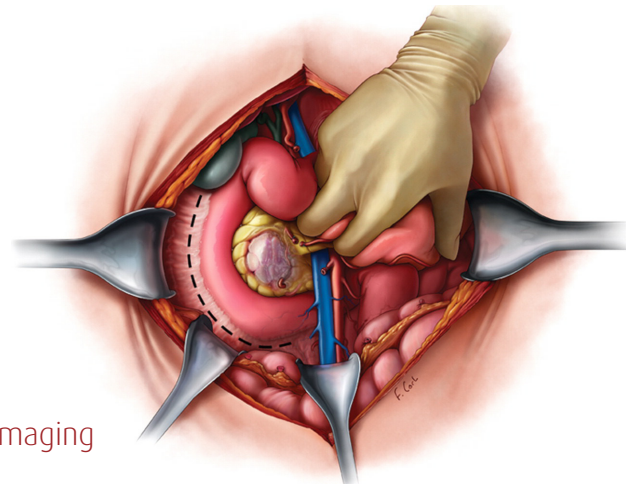
Laboratory Tests

The laboratory findings are summarised in table 1 Hepatitis serology was negative.

	Test	Result	Normal Range
Haematology	HB †	140	130-170 g/L
	WCC ‡	5.210 ⁹ /L	4.0-10.0 x 10 ⁹ /L
	Platelets	27310 ⁹ /L	150-400 x 10 ⁹ /L
	INR§	1.4	0.8 – 1.2
Biochemistry	Total Protein	70 g/L	60 – 80 g/L
	Albumin	37 g/L	37 – 49 g/L
	Total Bilirubin	70 □mol/L	1 – 22 □mol/L
	Alanine Transaminase	73 U/L	1 – 40 U/L
	Aspartate Transaminase	64 U/L	1 – 40 U/L
	Alkaline Phosphatase	542 U/L	45 – 105 U/L
	Gamma Glutamyl Transferase	1012 U/L	4 – 35 U/L
	Urea	4.3 mmol/L	3.4 – 7.0 mmol/L
	Creatinine	92 μmol/L	84 – 116 μmol/L
	Sodium	138mmol/L	137 – 144 mmol/L
	Potassium	3.8mmol/L	3.5 – 4.4 mmol/L
	Chloride	102mmol/L	95-107mmol/L

† HB= Haemoglobin; ‡ WCC = White blood Cell Count; § INR = international normalised ratio for prothrombin time

Table 1: Laboratory Results of patient presenting with obstructive jaundice.



Imaging

1. Abdominal ultrasound

"The gall bladder is distended with no gall stones. Intra- and extra-hepatic biliary dilatation with the common bile duct dilated to 22 mm. The pancreas cannot be visualized due to overlying bowel gas. Kidneys, spleen, liver and urinary bladder are normal. No free fluid or masses."

2. Triple-phase thin-slice Computed Tomography (CT) Scan of chest, abdomen and pelvis:

This is considered the gold standard for diagnosis and staging of pancreatic tumours.

"The gall bladder is distended with intra- and extra-hepatic duct dilatation. The common bile duct measures 22 mm. The pancreatic duct is also dilated to 8 mm (double duct sign) (Figure 2a). A 1.5 cm low-attenuation lesion within the head of the pancreas is identified raising the possibility of cancer of the head of pancreas. The lesion is not involving the superior mesenteric vein (SMV) or the portal vein (PV) (Figure 2b).

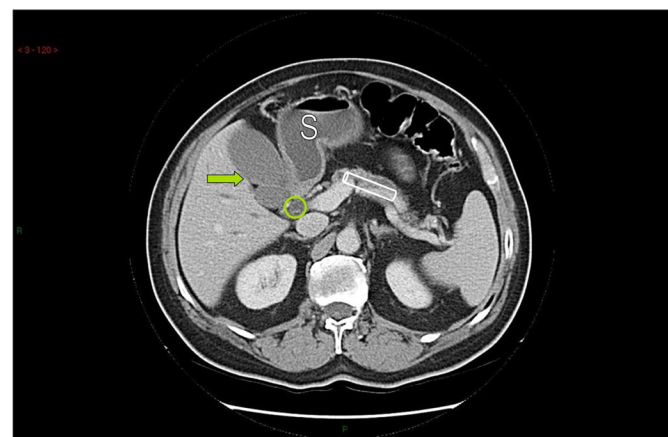


Figure 2a - Computed Tomography scan image of tumour in the head of the pancreas showing a "double duct" sign, causing biliary (green circle) and pancreatic duct (white cylinder) obstruction. The Gallbladder is distended (green arrow), S is stomach.

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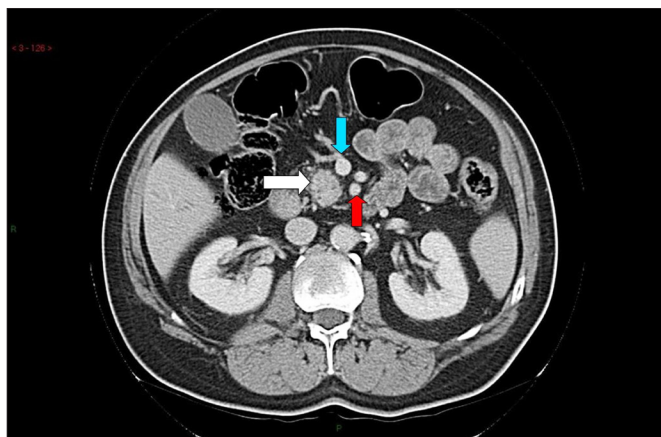
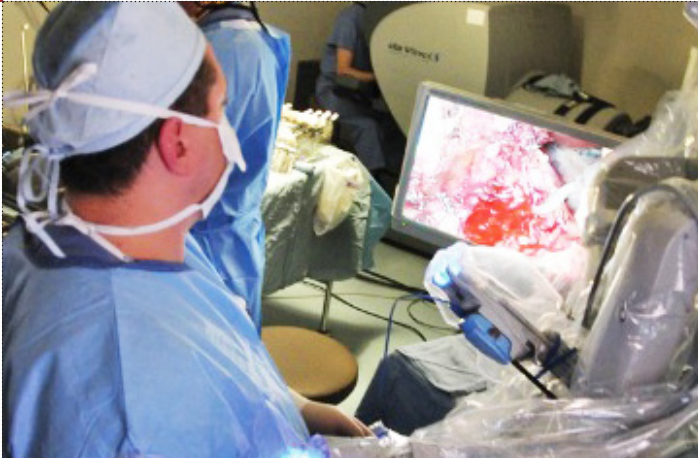


Figure 2b – The tumour in the head of the pancreas (white arrow) is not involving the superior mesenteric vein (blue arrow) or the superior mesenteric artery (red arrow).

No evidence of liver, lung or distant metastasis. No evidence of peritoneal deposits or ascites. The spleen, kidneys, abdominal hollow organs are within normal. No cervical or mediastinal lymphadenopathy. Both lung fields are clear". Referral to the hepato-pancreatico-biliary (HPB) multidisciplinary team (MDT) meeting was recommended.

Multidisciplinary Team (MDT) meeting

The team members include the HPB surgeon, HPB radiologist, HPB oncologist, HPB pathologist, HPB cancer nurse specialist, HPB MDT co-ordinator, palliative care specialist and a specialist dietician. The case and images were reviewed and considered to be in keeping with a resectable tumour of the head of the pancreas. Pancreatico-duodenectomy (PD) in a curative intent was considered to be the treatment of choice if deemed appropriate.

HPB clinic

The patient was referred to the HPB clinic. His history and examination were reviewed and confirmed the case. The patient was counselled for a pylorus-preserving pancreaticoduodenectomy (PPPD). On reaching informed consent to proceed in the absence of contraindication, he was sent for pre-assessment. Pre-assessment confirmed his fitness for anaesthesia and surgery.

Pancreatico-duodenectomy: A guide for Foundation Year Doctors Patient Management

What are the indications for PD?

- Carcinoma of the head of pancreas.
- Distal cholangiocarcinoma involving the lower common bile duct.
- Ampullary tumours.
- Duodenal tumours.
- Intra-ductal papillary mucinous neoplasia (IPMN) involving the head of pancreas
- Other rare tumours of the head of pancreas (neuroendocrine, adenoma).
- Chronic pancreatitis involving the head of the pancreas.

What are the contraindications for PD?

- Locally advanced tumour with vessel involvement (superior mesenteric vein/ portal vein confluence, superior mesenteric artery, hepatic artery, unless portal vein resection is possible).
- Distant metastases (including direct intra-peritoneal spread).
- Patient is not fit for surgery.
- Patient refusing surgery.

What information needs to be discussed during pre-operative counselling?

The information given to the patient includes:

- The type and the extent of the treatment recommended.
- The advantages and disadvantages of the treatment.
- Any possible alternative treatments (palliative endoscopic stenting, palliative gastric and biliary by-pass, palliative chemo-radiotherapy) that may be available.
- Any significant risks or side effects of the treatment.

Risks of the operation and efforts to minimise them include:

- General anaesthetic: the risk is minimised by careful patient selection and pre-operative assessment. Modern anaesthetic technique and perioperative monitoring, including invasive monitoring of arterial and central venous blood pressure, facilitate safe anaesthesia and recovery
- Intra-operative bleeding: pre-operative correction of clotting abnormalities (especially in jaundiced patients due to vitamin K insufficiency) and cross-match of blood is necessary. Careful surgical technique and experience is vital.

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- Deep vein thrombosis (DVT) and pulmonary embolism: this is prevented by the perioperative administration of low molecular weight heparin (LMWH), anti-embolism compression stockings, and intra-operative intermittent pneumatic compression pumps.
- Urine infection: perioperative catheterisation is necessary. Careful aseptic technique and post-operative care is applied.
- Atelectasis and chest infection: especially in upper abdominal incisions due to post operative pain. This is minimised by the use of early chest physiotherapy and epidural analgesia. Pain teams are involved on a daily basis to facilitate suitable adequate analgesia (epidural, patient-controlled, etc)
- Anastomotic leak (pancreatic and/or biliary): the majority is self limiting. Drains are used to monitor for a leak. An early significant leak may require re-intervention. Delayed leak presenting as a collection would be suitable for percutaneous drainage.
- Delayed postoperative bleeding: this happens between day 7 and 10 postoperatively as a result of pseudoaneurysm formation particularly at the site of resection (gastrododenal artery stump). Bleeding can be serious and early recognition and management by means of mesenteric angiography and embolisation is necessary.
- Delayed gastric emptying: happens in 25% of patients and is usually self limiting. It can become prolonged and require nutritional support by means of naso-jejunal feeding. Rarely, total parenteral nutrition is required. Prokinetics (Metoclopramide, Erythromycin) are indicated.
- Mal-absorption: When oral feed is restarted, pancreatic enzyme supplementation is required to facilitate absorption.
- Chyle leak: as a result of lymphadenectomy, a persistent high drain output producing large volumes of milky amylase-poor fluid is a sign of chyle leak. This is due to interruption of the lymphatic channels, is usually self-limiting, lasting for 1-2 weeks, and can result in delayed patient discharge.

Intra-operative findings

Although pre-operative staging is highly sensitive, intra-operative findings may demonstrate an unresectable tumour due to local invasion, or evidence of metastatic spread (hepatic, peritoneal, mesenteric, etc.). These findings preclude resection and the alternative would be a palliative bypass (bypassing the stomach to prevent gastric outlet obstruction and a biliary bypass to treat jaundice).

Prognosis

Prognosis of the disease will only be determined following resection and histopathological assessment. Determinants of prognosis include:

- Tumour stage: R0 resection with clear resection margin and level of lymph node involvement.
- Tumour grade: invasiveness, differentiation and evidence of lymphovascular and perineural invasion².

What are the different types of pancreatico-duodenectomy:

- Kausch-Whipple Procedure: resection of the head of pancreas including the duodenum, the distal common bile duct and distal part of the stomach.
- Pylorus-Preserving PD (PPPD): a modification of Kausch-Whipple with preservation of the distal stomach and pylorus, which was found to have better functional results¹

Pylorus Preserving Pancreatico-Duodenectomy (PPPD)

The operation lasts between 4-7 hours. A roof-top incision is the most suitable and provides adequate access. After careful assessment and evaluation to confirm resectability, the head of the pancreas, a portion of the bile duct, the gallbladder and the duodenum (preserving the post-pyloric duodenum) are removed. The remaining pancreas, bile duct and post-pyloric duodenum are joined up to the intestine (Figure 3).

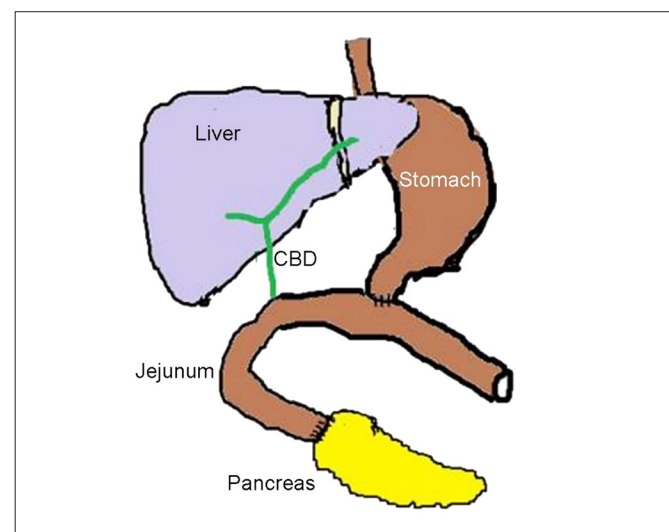


Figure 3 – Schematic representation of one type of anastomotic restoration of gastrointestinal continuity following pylorus-preserving pancreatico-duodenectomy (PPPD). CBD = common bile duct.

Regional lymphadenectomy is performed to facilitate adequate staging and assessing the prognosis. It also helps determining the need for adjuvant therapy.



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The day of surgery

Premedication is prescribed as advised by the anaesthetist. A sample of operative notes is demonstrated in figure 4.

OPERATION NOTE	
FAMILY, PERSON	
Male	01/01/1947 0000000000
Diagnosis	Cancer Head of the Pancreas
Operation	Pylorus Preserving Pancreatico-Duodenectomy (PPPD)
Date	01/12/2011
Start	10:00
Finish	15:00
Urgency	Elective
ASA	2
Anaesthetic	General
Cons Surg	Mr Surgeon
Cons Anaes	Dr Anaesthetist
Surgeon	Mr Surgeon
Assistant	Mr Assistant
Anaesthetist	Dr Anaesthetist
DVT Proph	LMWH, Stockings, Pneumatic
Antibiotics	Tazocin 4.5 gr at induction
Indication	Cancer, HoP
Position	Supine
Incision	Roof-top
Findings	Distended Gallbladder and dilated Bile Duct. Palpable tumour in Head of Pncreas area. No peritoneal or hepatic metastases. No tumour mass in root of mesentery. No portal Lymph node mass. No involvement of Superior Mesenteric Vein(SMV)/Portal Vein(PV) confluence
Procedure	Gastrocolic omentum divided. Wide Kocher manoeuvre. neck of pancreas lifted off the SMV/PV confluence confirming resectability. Antegrade cholecystectomy, ligating Cystic Artery and transfixing Cystic Duct. Dilated Common Bile Duct (CBD) slung and divided proximal to Cystic Duct insertion. CBD stump oversewn. PV exposed. Common Hepatic Artery (CHA) exposed and traced to isolate Gastro-Duodenal Artery(GDA) with wide Lmphadenectomy. GDA was divided and transfixed after a trial of clamping to safeguard CHA. Neck of Pancreas slung. first-second part of Dudenum divided with linear stapler transfixing Right Gastro-epiploic artery. Pancreas neck divided with diathermy. First arcade Jejunal loop divided with linear stapler, controlling mesentery and mobilizing Dudenno-Jejunal flexure with Harmonic scalpel. loop rotated behind SMA and SMV. Resection completed dissecting Head of Pancreas and uncinate process off SMV/ PV and SMA with ligating individual branches. Meticulous haemostasis. Proximal jejunal loop delivered through a window in transverse mesocolon. Anastomoses: Single layer end-to-side duct to mucosa pancreatico-jejunostomy including full thickness of pancreas, using interrupted 3/0 PDS. Single layer end-to-side Choledocho-jejunostomy with continuous 3/0 PDS End-to-side ante-colic duodeno-jejunostomy in single layer continuous 3/0 PDS at 60 cm distal to previous anastomoses. Haemostasis and no bile leak confirmed. Washout with Saline. 2 size 20F tube drains Closure: Mass loop 1/0 PDS Staples to skin. This was a potentially curative operation for malignant disease.
Blood loss	200 mls
Transfusion	no
Post-op	High Dependency Unit care as per Hepato-pancreato-Biliary Protocols.

Figure 4 - Sample operation notes of pylorus-preserving pancreatico-duodenectomy (PPPD).

Post-operative care

- Average hospital stay is 7-10 days.
- The patient spends about 2-4 hours in the recovery ward until fully recovered, then he will be transferred to the high dependency unit (HDU).
- HDU allows for invasive monitoring of vital signs and administration of organ support (vasopressors and non-invasive ventilatory support). Average HDU stay is 3-5 days and discharge is usually decided by patient progress and removal of epidural analgesia (if present).
- Physiotherapy is provided as part of an enhanced recovery programme.

Histopathology

The histopathology report should contain the following information:

- Tumour: Type, size, location, invasiveness and differentiation, extent and resection margin. Evidence of lymphovascular or perineural invasion.
- Lymph node: Direct involvement and number of nodes involved by metastatic spread out of the overall number of nodes excised.

Results

The patient underwent PPPD and recovered in 9 days. He was mobilising and tolerating diet. He was discharged with arrangement for follow-up with the results of histopathology.

Histology has shown a 1.5 cm invasive moderately-differentiated adenocarcinoma of the head of the pancreas, with a clear resection margin. There was evidence of peri-neural and lympho-vascular space invasion. Two out of 17 lymph-nodes were involved with the tumour. He was referred to the medical oncologist for consideration of adjuvant chemotherapy

Summary

- PD is a complex operation performed in specialist centres familiar with the management of HPB disease.
- Not all patients presenting with a tumour of the head of pancreas are suitable for surgical resection by PD.
- Good MDT approach to patient selection, pre-operative counselling, careful staging, preoperative workup and peri-operative care is essential to achieve best results.
- Foundation doctors should be familiar with possible complications to be able to recognise them early and manage them appropriately.

Questions. Give the single best answer.

1. What is the sign describing a palpable non-tender gallbladder with painless jaundice?

- Whipple's sign.
- Courvoisier's sign.
- Child's sign.
- Kocher's sign.

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2. Considering the following being the normal values for liver function tests, what set of test results below point to obstructive jaundice?

Total bilirubin (Bil) = 1-22 $\mu\text{mol/L}$
Alkaline phosphatase (ALP) = 45-105 U/L
Alanine Transaminase (ALT) = 1 - 40 U/L

- a) Bil = 150 $\mu\text{mol/L}$, ALP = 60 U/L, ALT = 600 U/L.
- b) Bil = 250 $\mu\text{mol/L}$, ALP = 600 U/L, ALT = 120 U/L.
- c) Bil = 23 $\mu\text{mol/L}$, ALP = 120 U/L, ALT = 600 U/L.
- d) Bil = 150 $\mu\text{mol/L}$, ALP = 110 U/L, ALT = 35 U/L.

3. What is the gold standard test for the diagnosis and staging of carcinoma of the head of pancreas?

- a) Magnetic Resonance Imaging (MRI).
- b) Ultrasound.
- c) Endoscopic Retrograde Cholangio Pancreatography (ERCP).
- d) Triple phase, thin slice CT scan.

4. All of the following are absolute contraindication to PPPD except?

- a) Lung metastases.
- b) A single liver metastasis in the right lobe.
- c) Involvement of the hepatic artery.
- d) Involvement of the second part of the duodenum.

5. Which of the following statements is true?

- a) A PD is only indicated in carcinoma of the pancreas.
- b) Involvement of the portal vein is a relative contraindication to PD.
- c) It is always possible to decide by the triple phase CT scan whether the patient will have a curative surgery or not.
- d) The presence of a 1.5 cm tumour in the head of pancreas is always an indication to proceed to PD.

Answers

1. Answer: b.

Gallstone disease results in chronic inflammation and fibrosis restricting distension. A tender distended gallbladder suggests acute cholecystitis.

2. Answer: b.

The response of the liver to any form of biliary tree obstruction is to synthesize more alkaline phosphatase. The main site of new enzyme synthesis is the hepatocytes adjacent to the biliary canaliculi. The picture in A suggests hepatocyte injury (such as hepatitis). In C there is no evidence of jaundice as bilirubin is close to normal. In D the liver profile raises the possibility of haemolysis (pre-hepatic).



3. Answer: d.

Thin slice triple-phase computed tomography (CT) of the chest, abdomen and pelvis, provides excellent visualization of the liver, gallbladder, pancreas, kidneys, and retro-peritoneum. It can assess the local extent of the disease and involvement of the neighboring structures (hence assessing resectability), lymph-node involvement, and rule out metastatic disease.

4. Answer: b.

While metastatic disease precludes the opportunity for a curative resection, involvement of the hepatic artery makes resection technically not possible. However, the duodenum is usually removed during resection and the presence of duodenal involvement does not preclude resection.

5. Answer: b.

In selected cases of adenocarcinoma of the pancreatic head, PD with partial portal vein resection may be possible if detected intra-operatively. This is why this type of surgery is only performed in specialist units with expertise in the management of these complex cases.

References

- Zerbi A, Balzano G, Patuzzo R et al. Comparison between pylorus-preserving and Whipple pancreatoduodenectomy. *Br J Surg* 1995; 82:975-979
- Cleary SP, Gryfe R, Guindi M et al. Prognostic factors in resected pancreatic adenocarcinoma: Analysis of actual 5-year survivors. *J Am Coll Surg* 2004; 198(5): 722-731.

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PATIENT SUFFERED A TRAUMATIC C - SPINE INJURY WITH EXTENSIVE HEAD WOUND

L Olson, S Chatterjee



Patient suffered a traumatic c - spine injury with extensive head wound
Practical Procedures

Abstract

Patients with traumatic head injuries can be daunting to manage, especially in the middle of the night. It is imperative to approach the patient as per Advanced Trauma Life Support (ATLS) guidance and get senior assistance early. Closure of scalp wounds requires adequate time, appropriate analgesia, consent and knowledge of the difference techniques for wound closure and complications that can develop.

I present a case of a 75 year old female who attended A&E in the middle of the night after a mechanical fall with an unstable, c-spine injury and a deep laceration to her scalp of unknown size or depth. I present the step - by - step process of this lady's scalp wound closure with the issues raised, followed by MCQs.

History

A 75 year old female suffered a traumatic, unstable, c-spine injury post-mechanical fall. She had fallen down 13 stairs. She presented at midnight to the A&E department with pain in her neck and a deep laceration to her scalp. The paramedics suitably achieved adequate c-spine control at the patient's home before transferring her to the hospital and applied continuous, direct pressure to the wound to achieve haemostasis. She was maintaining her own airway and vital signs were normal on arrival to A&E throughout the assessment. The patient had Medical Research Council (MRC) grade 5 power in all limbs and her sensory pathways were intact.



Figure 1. Inline immobilisation of c-spine (1).

CT imaging of the patient's cervical spine illustrated left lamina fractures through C6 and C7 with significant pre-vertebral soft tissue swelling, especially anterior to C5 and C6 raising the possibility of a ligamentous injury which, in the context of the fractures, suggested an unstable injury. Her CT head was normal.



Figure 2. Normal lateral cervical spine X-ray illustrating vertebrae (2).

Immediate management of this patient included an ABCDE (airway, breathing, circulation, disability, exposure) approach as per Advanced Trauma Life Support guidelines which included adequate c-spine control and haemostasis of the head wound. Intravenous (IV) access was gained, the patient was given analgesia and a discussion with the spinal surgeons occurred.

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In the trauma setting, a lateral cervical spine X-ray is mandatory. (3) The whole cervical spine must be visualised, from the skull base to the cervico-thoracic junction. If not, then a repeat film or a swimmers view, which involves caudal traction on the arms during the film, must be obtained. When interpreting this X-ray in the trauma setting, the following aspects need to be assessed:

- alignment of the columns - anterior vertebral line, posterior vertebral line and spinolaminar line to ensure they have a smooth curve with no interruptions (4)
- vertebral bodies - the bodies should be regular cuboids similar in size and shape to the vertebrae immediately above and below, excluding C1 and C2 (4)
- intervertebral disc space - if reduced many indicate disc herniation (4)
- pre-vertebral soft tissues - above C4 the width of the shadow should be less than 50% of the width of a vertebral body, while below C4 the limit is one full vertebral body width (4)
- atlanto-occipital relationship - distance from the occiput to the atlas should not exceed 5 mm anywhere on the film (4)
- odontoid peg – atlanto-dens interval (ADI) in adults should be < 3 mm (in flexion). Shift of more than 3.5 mm implies injury to the transverse ligament and more than 5mm indicates complete rupture and instability (4)

The scalp wound commenced at the right frontal hair line and coursed to the right parietal area to an unknown distance. The patient had a neck collar on and the wound could be palpated down past the collar on initial assessment. The wound was continually bleeding, the patient's hair was tangled with blood clots and she was very agitated. How could this wound be closed adequately and maintain asepsis?

Pre-procedure

The wound needed to be closed to stop the bleeding and to prevent infection developing. This was going to be a difficult procedure - the wound edges may not come together, the patient may become too agitated, the patient may need to go to theatre and the patient's neck may not be protected.

The procedure was explained to the patient. It was explained that there was a cut in her scalp that needed to be closed as it was bleeding. Painkillers, given as an injection in to the wound, would be given so the procedure would not hurt. It may take a long time.



The patient was happy for the procedure to continue and gave her consent verbally.



Figure 3. Lidocaine ampoules (5).

Procedure

Preparation included:

- Gaining IV access and administering suitable analgesics.
- A senior to assess the wound to ensure no neurosurgical intervention was required.
- Nursing staff to assist.
- Ensure that other patients in the department were stable and no standby or courtesy calls were due to arrive.
- Equipment required - sterile table with sutures, suture pack, gauze, saline, scissors, surgical clips, sterile gloves, razor, 1% lidocaine, 1L bag of normal saline to irrigate wound and sharps bin.



Figure 4. Photograph of a sutured head wound (6).

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The patient's wound was irrigated with 1L normal saline, extracting blood clots and an assessment of the wound depth and width was carried out. The patient's neck collar was maintained in situ during the preparation. At this point, it was not possible to illicit the full extent of the length of the wound. The width of the wound was about 7 cm at its greatest and its depth was down to the scalp.

The patient's hair on either side of the wound, superior to the neck collar, was cut using a razor to ensure no hair was sutured in to the wound. A sterile field needed to be created prior to infiltration with lidocaine. This was going to be hard to achieve. The patient's head was draped ensuring her face was visible as she was very agitated and either side of her head was covered. 15mls of 1% lidocaine was infiltrated in the wound which was visible above the collar. The trolley was manoeuvred to the correct height for suturing.

There were difficulties encountered.

- Was this wound ever going to come together?
- Another blood clot
- Should we have used surgical clips?
- Patient asks, "Why is this taking so long doctor?"

90 minutes later;

- 25 interrupted monofilament non-absorbable 5.0 sutures were in place. The wound superior to the neck collar was closed.

It became clear that the patient needed to be log-rolled with the collar removed to adequately close the wound and stop the bleeding. A log roll was performed by 4 nursing staff ensuring c-spine control was maintained. The patient was soaked in normal saline from the irrigation, the scalp wound extended another 4 cm posteriorly.

Within 10 minutes of continued log-roll:

- The patient had her wet clothes removed and a new dry set applied.
- A new sterile field was created with the patient suspended on her left side.
- 5mls 1% lidocaine was administered and 5 new sutures inserted.
- A closed 30 cm wound was achieved.
- The patient was placed back on her bed and a new dry neck collar was applied.

Post-procedure

This procedure was one of the most difficult tasks I have undertaken on A&E. It displayed teamwork as its best. The patient was settled very quickly post-procedure and was grateful for a clean, dry set of clothes.

The procedure was documented in the medical and nursing notes, outlining the maintenance of asepsis and c-spine control, the number and type of suture material used and post care instructions. The patient was admitted to a ward post procedure and followed up by the spinal surgeons. The wound needed to be kept dry. Sutures needed to be removed in 7 days and assessed by a district or practice nurse.

The patient has not developed any complications of this wound closure post procedure.

Management

Many patients attend A&E requiring sutures, some straightforward, others require a more technical wound closure. This patient's case illustrates a relatively simple wound, requiring one layer skin closure of interrupted sutures, however the issues that complicated the procedure included:

- Difficult sterile field to maintain.
- Unstable c-spine injury requiring log-rolling to close the wound.
- Unknown wound extension on initial assessment.
- Hair, continued bleeding and large blood clots present in the wound.
- Agitated patient.
- Middle of the night with small number of medical staff available.

This case demonstrates that basic surgical skills can be applied to most circumstances whatever obstacles come your way and continued communication with the patient and teamwork with colleagues ensures a favourable outcome for all.

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Questions

1. What is the maximum safe dose of lidocaine?

- a. 5 mg/kg
- b. 7 mg/kg
- c. 4.5 mg/kg

2. What do you need for adequate c-spine control?

- a) C-spine collar
- b) Qualified personnel maintaining inline immobilisation
- c) C-spine blocks

3. What is MRC muscle grade 5?

- a) Normal movement of muscle group
- b) Can move muscle against gravity
- c) Can move muscle with gravity eliminated

4. How long are sutures left in for?

- a) 5 days
- b) 7 days
- c) 10 days

5. What do you need to clear a cervical spine in a conscious patient?

- a) Lateral c-spine X-ray
- b) AP c-spine X-ray
- c) Absence of c-spine spinous process tenderness in young patient in low risk trauma

Answers

1. Answer: It depends!

It depends if the lidocaine is used alone or with adrenaline. If used alone, in adults the maximum dose should not exceed 4.5 mg/kg and in general it is recommended that the maximum total dose not exceed 500 mg. When used with adrenaline, the maximum dose should not exceed 7 mg/kg. Adrenaline causes local vasoconstriction which limits local spread of lidocaine and therefore allowing a larger dose of drug to be infiltrated without causing systemic toxicity. In children, it is best to confer with the BNF as it differs for age and weight. (7)

What does 2% or 1% lidocaine actually mean? The percentage relates to the strength of the drug.

For example, 1% lidocaine.

1% means 1 in 100.

1ml = 1g, therefore 1% lidocaine means 1g in 100ml.

This means 1000mg = 100ml

1ml of 1% lidocaine will therefore contain... (1000/10 mg)

1% lidocaine is equivalent to 10mg per ml (8)

2. Answer: b.

The trauma patient's neck must be immobilized as soon as help arrives at the scene until complete evaluation, which includes imaging, shows that there is no injury. Soft collars are unsatisfactory for immobilization because they permit 75% of normal neck movement. Rigid collars, such as the Philadelphia and the extrication collars, reduce flexion and extension to about 30% normal and rotation and lateral movement to about 50%. The most appropriate immobilization method is to secure the patient to a hard board from the head to feet, place sandbags at either side of the head and put a rigid collar around the neck. This decreases movement to about 5% of normal.

Another method of immobilising the c-spine includes a fully trained individual to hold the head stable, not allowing any movement.

The log-roll is the standard manoeuvre to allow examination of the back and transfer on and off back boards. Four people are required, one holding the head and coordinating the roll, and three to roll the chest, pelvis and limbs. The number and degree of rolls should be kept to an absolute minimum. Rigid transfer slides (eg. Patslide) are useful for transferring the patient from one surface to another (eg CT scanner, operating table). (9)

3. Answer: a.

These are the Medical Research Council's (MRC) guidelines for muscle power.

The patient's effort is graded on a scale of 0-5:

- Grade 5: Muscle contracts normally against full resistance.
- Grade 4: Muscle strength is reduced but muscle contraction can still move joint against resistance.
- Grade 3: Muscle strength is further reduced such that the joint can be moved only against gravity with the examiner's resistance completely removed. As an example, the elbow can be moved from full extension to full flexion starting with the arm hanging down at the side.
- Grade 2: Muscle can move only if the resistance of gravity is removed. As an example, the elbow can be fully flexed only if the arm is maintained in a horizontal plane.
- Grade 1: Only a trace or flicker of movement is seen or felt in the muscle or fasciculations are observed in the muscle.
- Grade 0: No movement is observed. (10)

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4. Answer: This is a trick question!

The duration of time depends on the site of suture, the type of suture material used and extent of injury. (11)

Sutures can be absorbable or non-absorbable. Absorbable sutures rapidly break down in the tissues and lose their strength within 60 days. This type of suture does not have to be removed. Non-absorbable sutures, on the other hand, maintain their strength for longer than 60 days. These sutures are used to close skin or external wounds and require removal once the wound has healed. (11)

The length of time sutures are left in for are outlined below:

Face: 3-5 days

Scalp: 7-10 days

Trunk: 7-10 days

Arms and legs: 10-14 days

Joints: 14 days

At the time of suture removal, the wound has only regained about 5%-10% of its strength. Therefore, protect the wound from injury during the next month. (11)

5. Answer: c.

It is important to remember spinal immobilisation is a priority in poly-trauma, spinal clearance is not. Imaging the spine does not take precedence over life-saving diagnostic and therapeutic procedures.

Below is a flow diagram of the Modified Canadian C-spine imaging rules for conscious patients. If no radiography is required the patient's neck is safe. The Canadian c-spine rules are recommended by The College of Emergency Medicine. (12)

Radiology includes lateral c-spine, anterior-posterior and odontoid peg X-rays. If required CT neck can be undertaken. If radiographs of the c-spine from the skull to T1 are negative and the patient has moderate to severe cervical spine tenderness, then the collar is left in place until voluntary flexion and extension radiographs or MRI is taken. (13)



Modified Canadian cervical spine rule (12)

Cervical spine imaging should be requested for the following patients that have been subjected to blunt trauma with a mechanism that may have injured the neck:

- GCS < 15 on assessment in the ED
- Paralysis, focal neurological deficit, or paraesthesia in the extremities
- Patients with abnormal vital signs (systolic BP < 90mmHg or respiratory rate outside of the range 10-24 breaths per minute)
- Urgent requirement to identify a cervical spine fracture (eg prior to surgery)
- Severe neck pain ($\geq 7/10$ severity)
- Patients with neck pain and any of the following high risk factors (level one evidence unless otherwise stated):

- a fall from greater than one metre or five stairs
- an axial load to the head eg diving
- a high-speed motor vehicle collision (combined speed >60mph)
- a rollover motor vehicle accident
- ejection from a motor vehicle
- an accident involving motorised recreational vehicles
- a bicycle collision
- age 65 years or more
- injured more than 48 hours earlier
- re-attending with the same injury
- known vertebral disease (eg ankylosing spondylitis, rheumatoid arthritis, spinal stenosis, or previous cervical surgery)

- Patients with a dangerous mechanism of injury (see above) and either a visible injury above the clavicles or a severely painful ($\geq 7/10$ severity) thoracic injury even if there is no neck pain or tenderness

If none of the high risk factors above are present and any of the following low risk factors are identified then the patient can have their collar removed and their range of movement assessed):

- simple rear-end motor vehicle collision (but not if pushed into another vehicle, or if hit at high speed or by a large vehicle)
- sitting position in ED
- ambulatory at any time since injury
- delayed onset of neck pain (ie not immediate)
- absence of midline cervical spine tenderness

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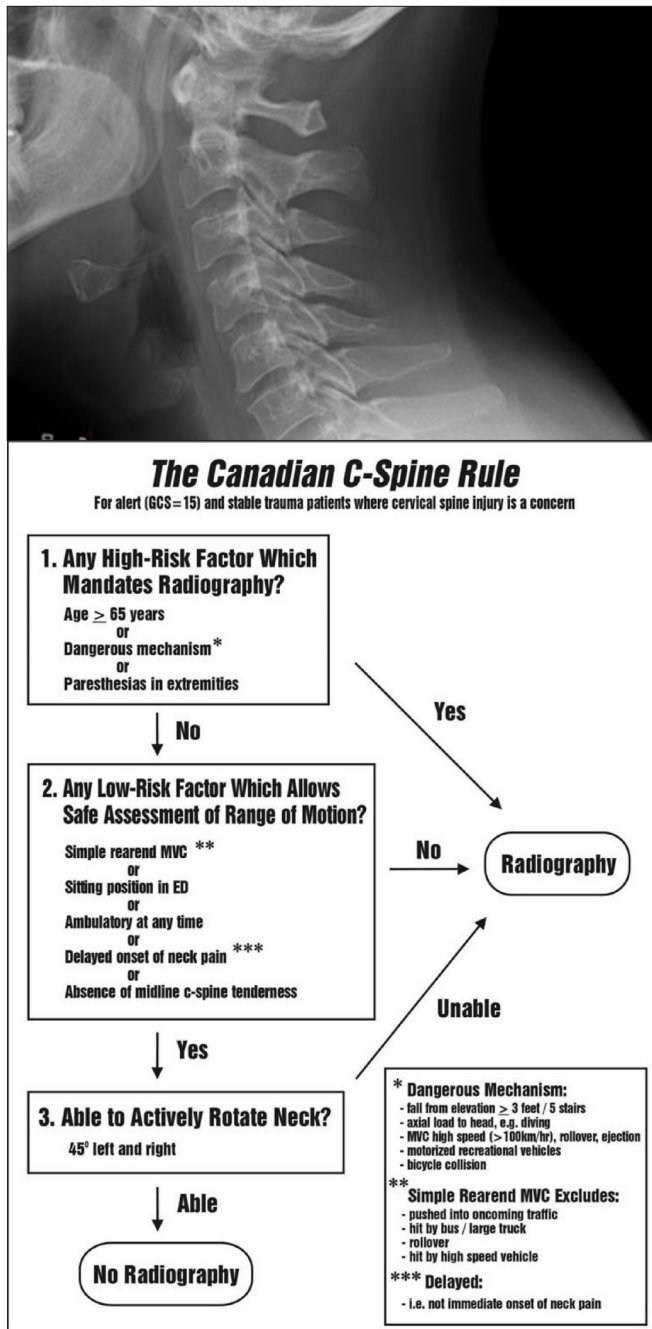


Figure 5. Canadian C-spine rules for imaging (9)

Indications for CT of the cervical spine (12)

CT should be used as the primary imaging modality for excluding cervical spine injury in adults following blunt trauma if any of the following criteria are met:

- GCS below 13 on initial assessment
- Intubated patients
- Inadequate plain film series
- Suspicion or certainty of abnormality on plain film series*
- Patient's being scanned for head injury or multi-region trauma
- Patient has dementia (or a chronic disability precluding accurate clinical assessment)
- Patient has new neurological signs or symptoms
- Patient has severe neck pain (\geq 7/10 severity)
- Patient has a significantly reduced range of neck movement
- Patients with known vertebral disease (eg ankylosing spondylitis, rheumatoid arthritis, spinal stenosis, or previous cervical surgery)

*As a minimum the CT should cover the area from the cranio-cervical junction to the thoraco-cervical junction since selective scanning may miss injuries.

Guidelines should be agreed with local radiologists as to the most appropriate primary imaging modality for patients aged \geq 65 years.

Indications for MRI of the cervical spine

Recommendation:

MRI should be used to exclude cervical spine injury* in adults following blunt trauma if any of the following criteria are met:

- Neurological signs and symptoms referable to the cervical spine
- Suspicion of vertebral artery injury (eg spinal column displacement, foramen transversarium or lateral process fracture, posterior circulation syndromes).

MRI should also be used to exclude cervical spine injury* in adults with severely restricted neck movement or severe pain (\geq 7/10) despite a normal CT.

*MRI should always be used in conjunction with another modality, preferably CT, in order not to miss bony injuries.

The guidelines for CT imaging of the head are as follows. These are the National Institute of Clinical Excellence (NICE) guidelines and are recommended by The College of Emergency Medicine. (14).

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Criteria for immediate request for CT scan of the head (adults) (14)

- GCS less than 13 on initial assessment in the emergency department
- GCS less than 15 at 2 hours after the injury on assessment in the emergency department
- Suspected open or depressed skull fracture
- Any sign of basal skull fracture (haemotympanum, 'panda' eyes, cerebrospinal fluid leakage from the ear or nose, Battle's sign)
- Post-traumatic seizure
- Focal neurological deficit
- More than one episode of vomiting
- Amnesia for events more than 30 minutes before impact

CT should also be requested immediately in patients with any of the risk factors below provided they have experienced some loss of consciousness or amnesia since the injury. (14).

Criteria for immediate request for CT scan of the head provided patient has experienced some loss of consciousness or amnesia since the injury (adults) (14)

- Age 65 years or older
- Coagulopathy (history of bleeding, clotting disorder, current treatment with warfarin)
- Dangerous mechanism of injury (a pedestrian or cyclist struck by a motor vehicle, an occupant ejected from a motor vehicle or a fall from a height of greater than 1 m or five stairs)

References

1. Inline immobilisation of c-spine. <http://www.laerdal.com/images/w200h200/AEJBHVQJ.jpg> (accessed 3 January 2012)
2. Normal lateral cervical spine x-ray illustrating vertebrae. <http://www.jbjs.org/data/Journals/JBJS/4361/e132fig1.jpg> (accessed 1 May 2012)
3. Kool D R, Blickman J G. Advanced Trauma Life Support. ABCDE from a radiological point of view. *Emerg Radiol* 2007 July; 14(3): 135-141. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1914302/> (accessed 1 May 2012)

4. Trauma.org. The Lateral Cervical Spine X-Ray. <http://www.trauma.org/archive/spine/lateral-cspine.html> (accessed 1 May 2012)
5. Lidocaine ampoules. http://www.google.co.uk/imgres?imgurl=http://www.fireflymedical.co.uk/scripts/thumbnaill.aspx%3Fimg%3D..%2FProdImages/P0029.jpg%26w%3D200%26h%3D200&imgrefurl=http://www.fireflymedical.co.uk/scripts/prodview.asp%3Fidproduct%3D853&usg=__6JbREQUUl6kulxpaTzWoYcBNzwc=&h=200&w=200&sz=31&hl=en&start=25&zoom=1&tbid=yXaBzXn7cyFDYM:&tbnh=104&tbnw=104&ei=mwTlTvyLIZL74QSMwMi5BQ&prev=/images%3Fq%3Dlidocaine%2Bampoule%26start%3D21%26hl%3Den%26safe%3Dactive%26sa%3DN%26gbv%3D2%26tbn%3Disch&itbs=1 (accessed 3 January 2012)
6. Photograph of a sutured head wound. http://www.sciencephoto.com/image/279158/350wm/M5900095-Scalp_suturing_during_baldness_reduction_surgery-SPL.jpg (accessed 3 January 2012)
7. The Multi media Procedure Manual. Local anaesthesia techniques. <http://emprocedures.com/anaesthesia/pharmacology.htm> (accessed 3 January 2012)
8. Paediatric Nursing. Calculation Skills. Accessed from: <http://www.cardiff.ac.uk/mathssupport/learningresources/mathsforschool/pncalculationskills.pdf> (accessed 1 May 2012)
9. Trauma.org. Anaesthesia and Critical Care. Injuries to the cervical spine. <http://trauma.org/archive/anaesthesia/cspineanaes.html> (accessed 1 May 2012)
10. Medical Criteria.com. Medical Research Council (MRC) Scale for Muscle Strength. http://medicalcriteria.com/site/index.php?option=com_content&view=article&id=238%3Aneuromrc&catid=64%3Aneurology&Itemid=80&lang=en (accessed 3 January 2012)
11. eMedicine Health. Removing Stitches. http://www.emedicinehealth.com/removing_stitches/article_em.htm (accessed 3 January 2012)
12. The College of Emergency Medicine. Exclusion of significant cervical spine injury in alert, adult patients with potential blunt neck trauma in the Emergency Department. 2010
13. Wheelless' Textbook of Orthopaedics. Cervical Spine Clearance in the Trauma Patient. <http://www.wheelsonline.com/ortho/12588> (accessed 3 January 2012)
14. National Institute for Health and Clinical Excellence. CG56. Head injury: Triage, assessment, investigation and early management of head injury in infants, children and adults. London: 2003.

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THE DIFFERENTIALS OF RIGHT UPPER QUADRANT PAIN AND THE PERIL OF DIAGNOSTIC ANCHORING

L Arwynck, J Read, H Allan, S Vig



The differentials of right upper quadrant pain and the peril of diagnostic anchoring

Good Clinical Care

Abstract

Emergency surgical admissions are some of the sickest patients in the hospital and it is important that at their initial assessment appropriate management is instigated. Senior clinicians reviewing such cases will recognize the pattern of presenting history and clinical signs which allows them to make a diagnosis based on their experience.

Unfortunately mistakes are made and we highlight a case from our experience that recurrently presents in surgical practice. The following discussion highlights an atypical presentation that junior doctors should be reminded of each time a patient is referred to them with right upper quadrant pain. We discuss the learning points from this case and suggest further reading for interested trainees.

A case of right upper quadrant pain

A 45 year old woman, Mrs G, with known gallstones was referred to the general surgical on call by her GP for treatment of suspected cholecystitis. She was assessed in A&E by the on call general surgical Foundation Year 2 Doctor (FY2). She was complaining of a gradually worsening 24 hour history of constant right upper quadrant pain. She remarked that the pain was quite different from her 2 previous attacks of biliary colic. She complained of fever and nausea for 2 days. She also had had a non productive cough for three days.

On examination the doctor noted that Mrs G was obese and not jaundiced. On abdominal examination they recorded that she was tender in the right upper quadrant on deep palpation. Murphy's sign was negative. She was febrile, tachycardic and tachypnoeic. A chest examination was not documented and although it had been requested a chest X-ray was not obtained.

Initial investigations included a normal urine dipstick. Her liver function tests were deranged with a mildly raised bilirubin and alanine transaminase but a normal alkaline phosphatase. She had a raised white cell count and C reactive protein. Her haemoglobin and serum amylase were normal.

The assessing doctor recorded a differential diagnosis of biliary colic or cholecystitis and organised an abdominal ultrasound. The scan confirmed the presence of gallstones with some mild thickening of the gallbladder and no intra or extra hepatic duct dilatation. Whilst the report noted there was no obvious acute changes or pericholic fluid it commented that a diagnosis of cholecystitis could not be excluded as the patient was obese and it was a technically difficult study. The assessing doctor recorded a diagnosis of cholecystitis and prescribed paracetamol analgesia, intravenous fluids and antibiotics.

Mrs G is next reviewed 11 hours later as the last case on the post take ward round. She was found on an outlying ward to be agitated, febrile, more tachycardic with decreased oxygen saturations and a raised respiratory rate. The drug chart that had been issued in A&E recorded that whilst she was prescribed doses of regular antibiotics the previous evening she had unfortunately missed the 10pm dose in the transfer and accordingly had only just had her first dose of antibiotics that morning.

Mrs G was assessed as being acutely unwell by the senior team and extensive right basal crepitations were found on further clinical examination. Mrs G was commenced on appropriate antibiotics for community acquired pneumonia, her intravenous fluids were increased and she was administered oxygen which improved her saturations. The diagnosis of right lower lobe pneumonia was confirmed with a portable chest X-ray which showed a large right basal consolidation. Mrs G then improved over the next five days without ventilation or inotropic support. She completed her course of antibiotics before being discharged home with a follow up repeat chest X-ray in six weeks time.

Differentials & what can we learn from the case

Trainees should expect to frequently encounter atypical presentations of common conditions. Severe right upper quadrant pain with a right lobar pneumonia is not rare. The variety of atypical presentations to which right upper quadrant pain may be attributed illustrates the need for thorough history and examination of each patient.

THE DIFFERENTIALS OF RIGHT UPPER QUADRANT PAIN AND THE PERIL OF DIAGNOSTIC ANCHORING

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Common Causes of RUQ pain	Uncommon Causes of RUQ pain
Biliary colic	Pneumonia/Pleuritis
Cholecystitis	Peptic ulcer disease
Cholangitis	Renal abscess/tumor
Pancreatitis	Hepatic abscess
Hepatitis	Budd-Chiari syndrome
Acute pyelonephritis	Hepatic metastasis

RUQ Table

The national confidential enquiry into patient outcome and death in 2007 reported that initial assessment of the acute admission is poor or unacceptable in 7.1% of cases. (1)

Any doctor managing such a case must document a thorough examination, maintain an appropriate differential diagnosis, follow up on all pertinent investigations and ensure prescribed medications are given.

The clinician concerned appears to have selected the most likely available diagnosis then anchored himself to it. Trainees have a narrower scope of experience and therefore the correct diagnosis is less likely to present itself. The “premature closure” of this consultation resulted in the doctor missing the antecedent viral infection that can be associated with severe pneumonia and also the chest signs that were likely apparent on auscultation. The trainee also illustrates the classic “diagnostic anchoring” of favouring the history, examination findings and investigation results that support the prematurely chosen diagnosis and continuing to blindly disregard those that refute it. Whilst clinicians must necessarily make decisions we must still maintain an open mind and revisit the diagnosis regularly. The lack of conclusive acute changes on the ultrasound report conducted should have precipitated the F2 to re-attend the patient, to fully reassess, chase the chest X-ray and perform a full “septic screen” to look for other causes of infection. The “availability heuristic”, “premature closure” and “diagnostic anchoring” are aberrant reasoning and a common theme in missed diagnoses. The article written on this matter by the cognitive psychologists Donald and Redelmeier makes for an interesting read. (2)

The assessing clinician also failed to act on the observations that indicate the patient was septic at the initial consultation. Such patients should be adequately resuscitated and the management responsibility shared with a senior. The patient should also have been comprehensively handed over in appropriate detail at the hospital at the night meeting where the case should have received senior input.



There is good evidence that mortality increases sharply with delays in antibiotic administration and “surviving sepsis” guidelines are that antibiotics should be commenced within one hour of recognition of suspected sepsis. (3) Doctors should prescribe these antibiotics on the dedicated portion of the chart for immediate administration and ensure that they are given. The missed evening dose of antibiotics was a handover error amongst clinical staff and the failure should be investigated. Handovers are recognized as areas of clinical risk and it is recommended patient ward transfers are minimized. (1)

The national enquiry into patient outcome and perioperative death recognizes that trainees must be exposed to acute clinical problems with appropriate mid and senior level support. Seeking senior advice on all admissions is essential for the junior trainees to facilitate learning and mitigate the risk that would otherwise occur from such errors. Reflecting on our mistakes with senior support helps trainees learn the right lesson and sharing them with peers disseminates the immensely valuable lessons without our patients suffering the cost. Case based discussions and reflective practice facilitate and formalise this learning.

THE DIFFERENTIALS OF RIGHT UPPER QUADRANT PAIN AND THE PERIL OF DIAGNOSTIC ANCHORING

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CORESS is a body dedicated to collecting and analyzing safety related reports from surgeons and publishing lessons learnt and is available at: www.coress.org.uk. Medico-legal organizations such as the MDU and MPS also support clinicians by publishing similar case vignettes in their newsletters and also online.

Questions

1. Which one of the following has been identified by cognitive psychologists as an aberration of reasoning that is commonly identified in missed diagnoses?

- a) Academic focus of doctors
- b) Disenfranchisement of doctors with their institution
- c) Diagnostic anchoring of doctors
- d) Doctors fixation on demographics
- e) Doctors lack empathic ability

2. Which of the following is not a recognized surgical diagnostic pitfall?

- a) Rupturing AAA diagnosed as Epididymitis
- b) Right lobar pneumonia diagnosed as cholecystitis
- c) Testicular torsion diagnosed as appendicitis
- d) Perforated duodenal ulcer diagnosed as appendicitis
- e) Left lobar pneumonia diagnosed as a splenic volvulus

The differentials of right upper quadrant pain and the peril of diagnostic anchoring

Good Clinical Care

Answers

1. Answer: c

Diagnostic anchoring is described by Donald and Redelmeir as the heuristic in which people anchor to their initial impressions despite evidence to the contrary.

2. Answer: e

The authors have witnessed each of the misdiagnosis from (a) to (d) made on more than one occasion and often with catastrophic consequence. (e) is unlikely to occur as it is normally atypical presentations of common illnesses which are misdiagnosed as other common illnesses (splenic volvulus is very rare and would be therefore unlikely to fulfill the availability heuristic).

References

1. I C Martin, D.G.M., J Stewart, M Mason, N C E Smith, K Gill, Emergency Admissions: A journey in the right direction? 2007, National Confidential Enquiry into Patient Outcome and Death.
2. Redelmeier, D.A., The Cognitive Psychology of Missed Diagnoses. *Annals of Internal Medicine*, 2005. 142(2): p. 115-120.
3. Dellinger RP, L.M., Carlet JM, Bion J, Parker MM, Jaeschke R, Reinhart K, Angus DC, Brun-Buisson C, Beale R, Calandra T, Dhainaut JF, Gerlach H, Harvey M, Marini JJ, Marshall J, Ranieri M, Ramsay G, Sevransky J, Thompson BT, Townsend S, Vender JS, Zimmerman JL, Vincent JL, Surviving Sepsis Campaign: international guidelines for management of severe sepsis and septic shock: 2008. *Crit Care Med.*, 2008. 36(1): p. 296-327.

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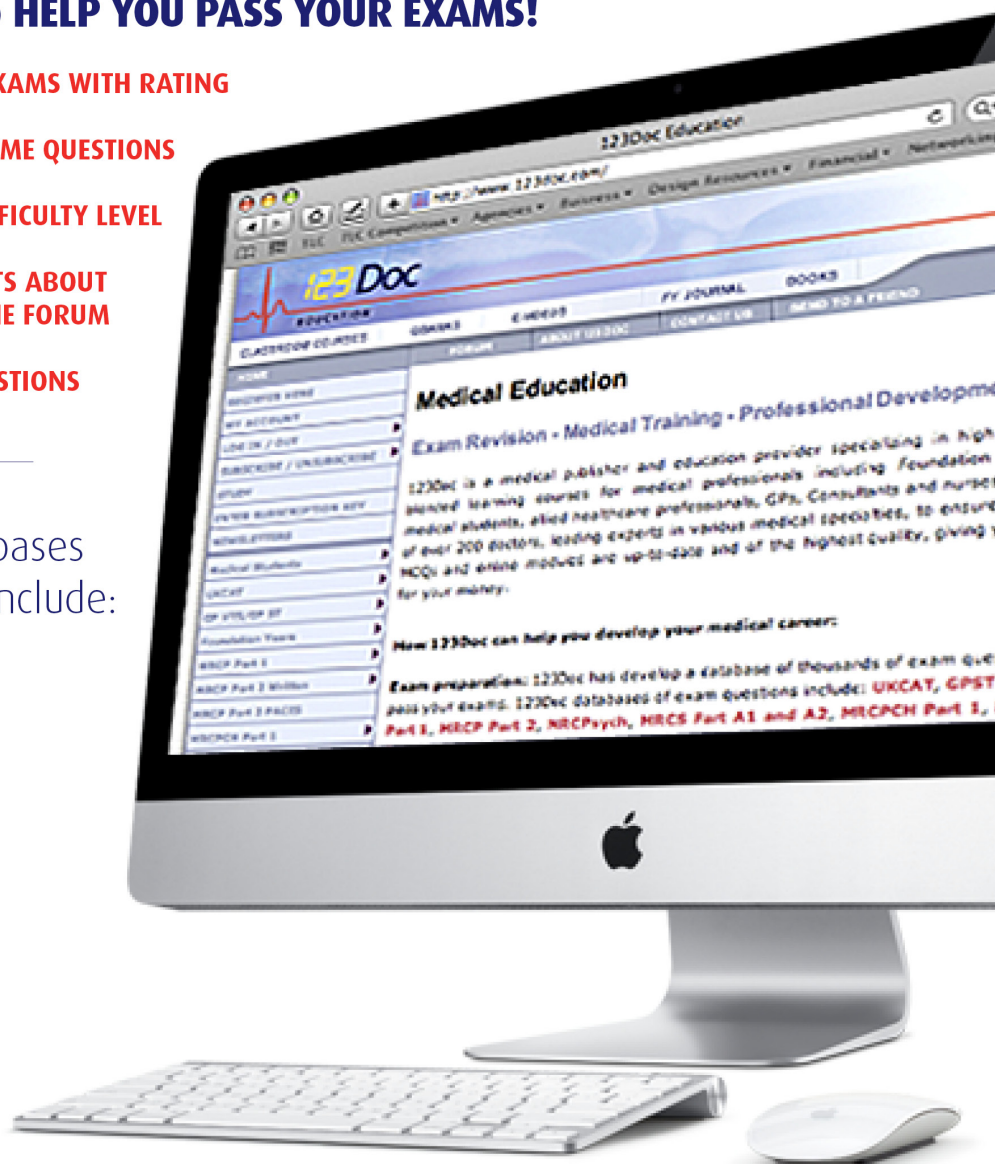
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THE SURGICAL MANAGEMENT OF BOWEL CANCER

D Mitchell, AK Venkatsubramaniam



nhs.uk/bowelcancer

The surgical management of bowel cancer Patient Management

Abstract

Management of bowel obstruction secondary to cancer can be challenging. A patient with an obstructing bowel cancer is presented in detail. This patient's management is used to illustrate management of a complex obstructing bowel cancer. Aspects discussed include aims of treatment, assessment of disease and choice of appropriate surgical management.

Case History

A 78 year old female presents with abdominal distension and pain. Her abdomen was distended but minimally tender. Large bowel obstruction is suggested by abdominal X-ray (figure 1). Because the patient's condition is stable a CT scan of abdomen and pelvis is organised. This shows a malignant stricture of the sigmoid colon causing large bowel obstruction with evidence of caecal dilatation (figure 2) and multiple liver metastases (figure 3).



Figure 1 – large bowel obstruction with caecal dilatation.

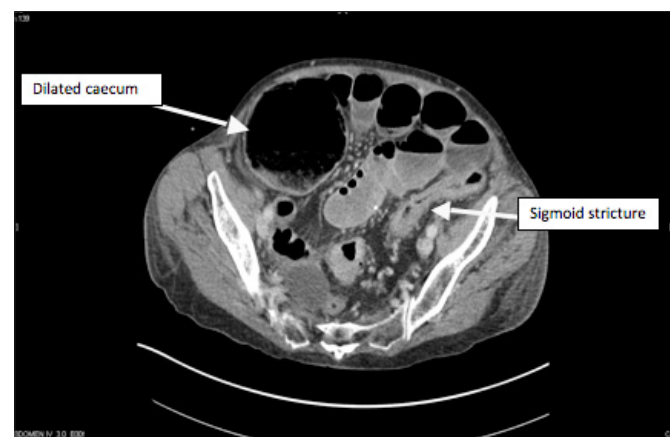


Figure 2 – sigmoid stricture with dilated caecum.



Figure 3 - liver metastases.

The patient had a self expanding colonic stent inserted as a palliative procedure to decompress the bowel. The patient recovered very quickly with bowels opening almost immediately after the stent insertion and went home on day 4 post-procedure.

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The patient re-presented 4 days after discharge in extremis with signs of peritonitis and septic shock. A chest X-ray showed free peritoneal air consistent with visceral perforation, presumed from the primary sigmoid tumour (figure 4).

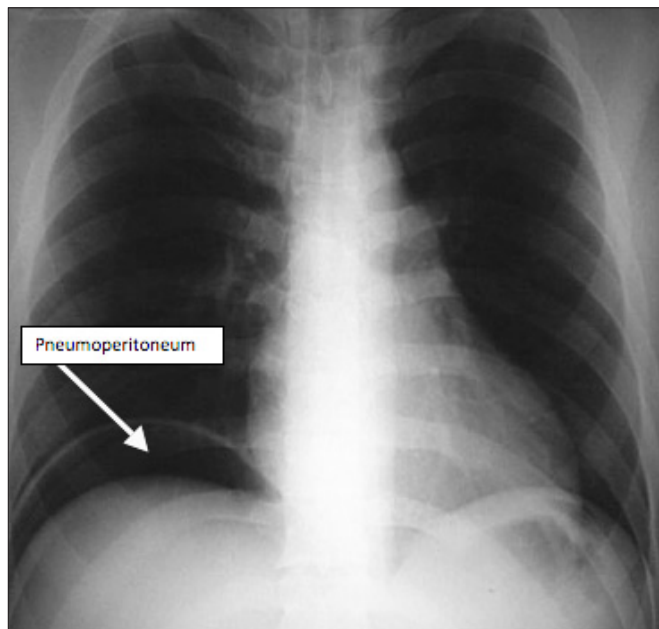


Figure 4 - shows pneumoperitoneum.

Although the patient's original treatment had been with palliative intent it was felt appropriate given a good previous quality of life and minimal comorbidity that emergency laparotomy be performed. The colonic stent had eroded through the bowel causing a perforation. An emergency Hartmann's procedure was performed as described below. Figures 5 and 6 show the perforated resected bowel with the metallic stent clearly visible.



Figure 5 - stent erosion.

Discussion

Colorectal cancer is now the third most common cancer in women after breast and lung cancer whereas in men it also ranks third after prostate and lung cancer. There is a male preponderance with a higher incidence in over 60s. The incidence is thought to be rising in the western population. (1,2) Increasing awareness, bowel cancer screening and better diagnostic tools have also contributed to more cancers being detected. It is one of the cancers which can be cured if detected and treated at an early stage. Surgery still remains the main stay of treatment. Structured training for surgeons and better anaesthetic advances have resulted in reduced mortality and morbidity. More patients who would have been considered unfit less than a decade ago are currently offered surgery with increasing success rates.

This article is aimed to educate the junior doctors by providing an overview of surgical management of bowel cancers.

The case presented is not unusual in that the patient presented as an emergency as do up to 30% of bowel cancer cases. Had she been referred earlier then time would have been spent appropriately diagnosing her bowel cancer, staging the disease and planning management. This is discussed below.



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Pre-operative investigations and preparation

Investigations

A colonoscopy to visualise the remainder of the large bowel mucosa is needed together with biopsies of the primary sigmoid tumour as well as endoscopic tattooing to allow visualisation if having a laparoscopic resection. This can be necessary especially with small cancers which are difficult to palpate with laparoscopic instruments. A rigid sigmoidoscopy is performed in the clinic room to assess tumour distance most accurately for rectal cancers (measured as 'height' from anal margin). In this case the tumour would have been too proximal in the bowel to be seen with a rigid sigmoidoscope.

A CT of chest, abdomen and pelvis will accurately describe the disease burden and the presence or absence of metastatic disease, indicating whether treatment is with curative or palliative intent. Sites of most common metastasis from colorectal cancer are mesenteric lymph nodes, liver, lung and peritoneum. Local invasion can occur to adjacent organs (in this case e.g. uterus, left ovary, bladder, small bowel).

In rectal cancers (fewer than 15 cm from the anal margin) an MRI is mandatory. It helps define the tumour extent and if there is evidence of involvement of the circumferential resection margin (CRM). Involvement of CRM is an indication for long course chemoradiotherapy pre-operatively (called neoadjuvant therapy as it occurs before surgery). Most centres both in the UK and internationally would also use short course radiotherapy in other situations to reduce the risk of local recurrence although this is not a standardised practice everywhere.

In this case the patient presented with advanced disease and treatment was palliative.

Surgery

Surgery for bowel cancer is primarily aimed at resecting 'all known disease'. This translates as removing the cancer containing bowel with clear margins and simultaneously removing the lymph nodes that drain the cancer. The lymph nodes in the GI track follow the arteries, with the highest nodes in proximity to the origin of the most proximal artery (which can be sacrificed) supplying the segment with cancer. The presence or absence of lymph node metastasis is an essential part of staging bowel cancer with either the Dukes classification or TNM system (see question section below). Lymph node involvement stratifies the patient into a higher risk group, with increased risk of recurrence and/ or distant metastasis into the liver or lungs.

Surgery for bowel cancer can be broadly discussed under the following categories of elective and emergency.

The surgical management of bowel cancer

Patient Management

Elective surgery

This is performed in patients with a confirmed cancer (both histologically and endoscopically) and who have been staged as having no distant disease. The exception to this is patients who present with potentially resectable liver (or even lung) lesions in whom resection of the metastasis is deemed feasible. These patients will go on to have both primary and metastasis removed usually with two operations.

Due to the site at which colorectal cancer presents the five most commonly performed operations are:

- Right hemicolectomy
- Anterior resection of rectum/Total mesorectal excision
- Sigmoid colectomy
- Left hemicolectomy
- Abdominoperineal excision (removal of rectum and anus)

For a patient presenting with a sigmoid or left colon cancer as in this instance then operations to remove these are described below.

Left hemicolectomy involves resecting the bowel from distal transverse, splenic flexure and descending colon. The arteries ligated include left branch of the middle colic, left colic at its origin.

In left sided resections, the colo-colic anastomosis is predominantly joined by hand sewn, single or double layer, end-to-end, sero muscular sutures. Sigmoid colectomy is reserved for cancers involving sigmoid and resection as the name indicates involves from proximal sigmoid to upper rectum. Anastomosis is performed between the descending colon and upper rectum, often carried out by a circular stapling device inserted via the anus to create an end to end or side to end anastomosis.

Emergency surgery

The indications for emergency surgery in bowel cancer are obstruction, perforation and occasionally bleeding.

The oncological aim of surgery is same as for elective which is to remove all known disease. What differs in the emergency setting is that patients are often acutely unwell and time does not allow for staging or neoadjuvant treatment to take place. In these cases the aim is to save lives whilst adhering as best as possible to sound oncological principles.

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Operations can differ in the emergency setting. An elderly patient, with iron deficiency anaemia with no previous history of abdominal surgery presenting with small bowel obstruction should raise strong suspicion of right sided colonic tumour. Although a right hemicolectomy with primary anastomosis is still the procedure of choice it may be deemed unsafe in the very ill patient (for example if perforation and contamination present and/or patient on high doses of inotropes due to sepsis) to perform a primary anastomosis and therefore the two divided ends of bowel are brought out as a double barrelled stoma (via the same opening) or as an end ileostomy and separate mucus fistula (the colonic end).

Patients with a perforated left sided tumour (this case) will usually undergo a Hartmanns procedure. Here the bowel is resected in the same way as described for elective surgery but due to concerns about a contaminated abdomen and the fact that these patient are often critically unwell a primary anastomosis is rarely risked. Instead an end colostomy is brought out in the left iliac fossa and the distal bowel (distal sigmoid or upper rectum) is stapled off and left insitu within the abdomen. A second stage reversal operation can be performed months later if the patient desires to be rid of their stoma although this is a further major colorectal operation with associated morbidity and mortality. The patient therefore needs to be counselled carefully in the pre-operative period to ensure that the risk of surgery is understood in order to gain the benefit of life without a stoma. This is therefore a patient led decision.

Obstructing large bowel tumours present a number of options to the surgeon depending on each individual case. On the right they cause small bowel obstruction and can be managed by right hemicolectomy +/- primary anastomosis. Options for left sided, sigmoid or rectal cancers which obstruct are:

- Resection of primary tumour, no anastomosis, end colostomy and stapled off distal end/mucus fistula;
- Resection of primary tumour, washout on table of the colon, primary anastomosis with covering loop ileostomy.

If caecum is so distended that it is deemed no longer viable then subtotal colectomy is usually performed with end ileostomy or ileorectal anastomosis.

Endoscopically placed colonic stent can act as a 'bridge to surgery'. It can decompress the bowel (i.e. converting the situation from emergency to elective). It can also be used in palliative setting where major surgery and stoma is preferably avoided. (3,4) (the original aim in this case).

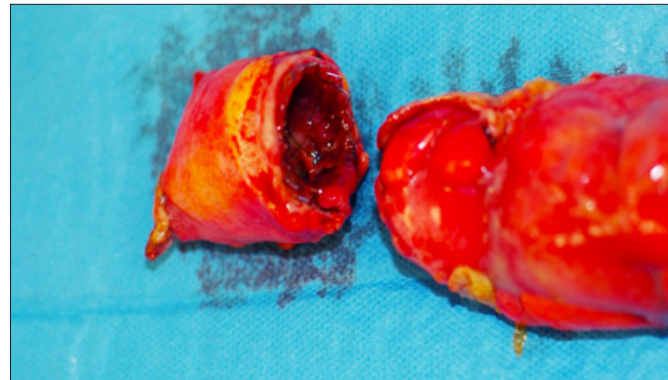
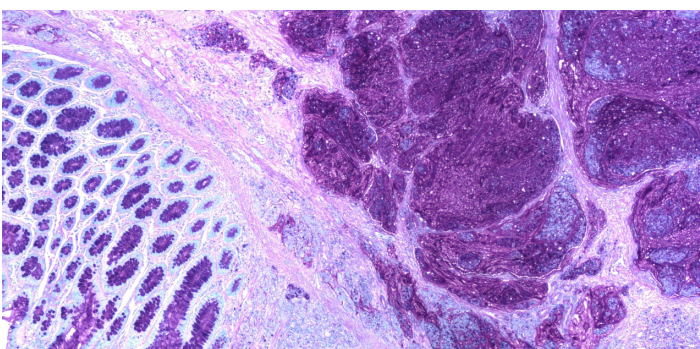


Figure 6 – tumour fracture due to stent.

Large bowel obstruction, especially when absolute constipation is present and the patient displays tenderness over the caecum, is a true surgical emergency and prompt review by senior surgeons with a view to performing emergency surgery is vital.

Laparoscopic colorectal surgery

This is becoming increasingly available as more surgeons are being trained to be competent. (5) Again oncological principles are the same as are the sections of bowel removed. What differs is the site and size of incisions and the way in which the colon is dissected. Operations can be performed with as few as three 5 mm ports. An incision (usually around 5 cm) is then needed to extract the dissected bowel and perform the anastomosis. This is commonly the umbilical port wound which gets extended but can also be a separate Pfannenstiel suprapubic incision for rectal cases.

Recent studies have concluded that in trained hands this type of surgery is safe and without compromise to oncological principles. The advantages of laparoscopic surgery over traditional open surgery are reduced post-operative pain and length of hospital stay as well as probably fewer longer term complications such as adhesions and bowel obstruction (although this latter point is yet to be proven beyond doubt). In 2010 just over 1/3 of cancer resections were performed laparoscopically according to National Bowel Cancer Audit figures (submitted by all departments to a national database) and this figure continues to rise. It is still unusual for emergency cases of colorectal cancer to be operated on laparoscopically as demonstrated by this case which was an open procedure.

Summary

Bowel cancer challenges the clinician to match treatment with disease for each individual patient and as this case demonstrates this treatment has to evolve to meet the differing ways in which bowel cancer can present.

THE SURGICAL MANAGEMENT OF BOWEL CANCER

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Questions

1. The main vascular pedicle divided during right hemicolectomy is:

- a) Ileocolic artery
- b) Inferior mesenteric artery
- c) Superior mesenteric artery
- d) Right colic artery
- e) Middle colic artery

2. Regarding laparoscopic right hemicolectomy which statement is false:

- a) Standard laparoscopic surgery involves usually 3 or 4 ports
- b) Cannot be performed via single incision laparoscopy
- c) Pneumoperitoneum is maintained with carbon dioxide
- d) Is possible as an emergency surgery
- e) Is the treatment of choice for right sided bowel cancers in otherwise healthy patient

3. A perforated sigmoid colon cancer is removed as an emergency. Histology shows no involved nodes and CT scan shows no distant metastases. This is a:

- a) T3N0M0 Dukes B
- b) T3N1M0 Dukes C
- c) T4N0M1 Dukes D
- d) T4N0M0 Dukes B
- e) cannot tell with the information given

4. Removal of a rectal cancer at 12 cm from the anal verge with primary anastomosis from colon to rectum is most commonly called:

- a) anterior resection
- b) posterior resection
- c) abdominoperineal resection
- d) proctectomy
- e) panproctocolectomy

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5. When performing a bowel anastomosis the least important feature is:

- a) meticulous technique and apposition of bowel edges
- b) adequate blood supply
- c) absence of tension
- d) avoidance of luminal discrepancy
- e) completely empty bowel

Answers

1. Answer: a.

Right hemicolectomy involves removing the caecum, ascending colon and proximal transverse colon. If the tumour is in the mid transverse colon, resection will be extended to distal transverse colon. Vessels ligated during a right hemi include, ileo colic, right colic and right branch of the middle colic vessels but the main pedicle is the ileocolic. Division of SMA would lead to infarction of the entire small bowel and would be a disaster. Ligation of IMA is performed during left sided operations. Extended right hemi colectomy is reserved for distal transverse or splenic flexure tumour. The anastomosis in right hemi is between terminal ileum and colon and hence is called an ileo-colic anastomosis. This is often performed by hand sewn technique with slow absorbable sutures usually 3-0 PDS. The suturing technique is referred to as sero-muscular which refers to the stitch through serosa, muscular layer of the colon excluding the mucosa in a single layer of stitches. If the two ends are brought together end-on, it is referred to as end- to-end anastomosis and is usually performed. If the ends are approximated sideways it is referred to as side-to side anastomosis and is usually performed in two layers. The alternative to hand sewn anastomosis is stapled anastomosis. The GIA™ (Covidien) reloadable Staplers place two double staggered rows of titanium staples and simultaneously cut and divide tissue between the two double rows. The GIA™ Reloadable Staplers and Single Use Loading Units (SULU) are available in the 60, 80 and 100mm lengths. Other stapling devices are available such as the Ethicon TLC75.

2. Answer: b.

Single port laparoscopic surgery (SILS) is a potential way of performing right hemicolectomy. Single port laparoscopic surgery already exists and as the name suggests all operating is performed with instruments which pass down one specially devised port. The benefit over standard multi-port laparoscopy is not proven but less post-operative pain and improved cosmesis are proposed benefits. Other advances worthy of note are robotic surgery and natural orifice surgery for colorectal cancer.

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Robotic colorectal surgery

Again this is currently practiced in some centres where equipment and expertise are available. The precision of dissection and the versatility of the robotic instruments is the proposed benefit but costs are currently considered prohibitive.

N.O.T.E.S.

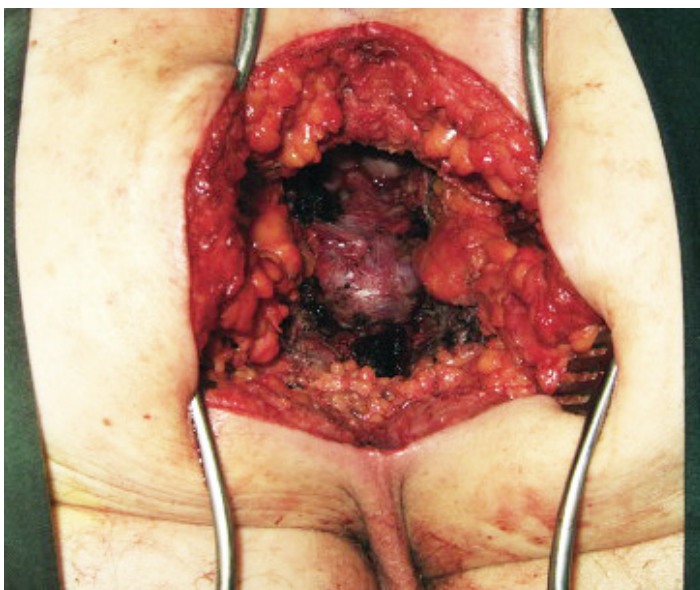
Natural orifice transluminal endoscopic surgery (N.O.T.E.S.) refers to so-called scarless surgery where instruments are introduced to the abdominal cavity via stomach, rectum, colon, bladder or vagina. N.O.T.E.S. remains at its infancy although natural orifice specimen extraction (N.O.S.E.) has been used following laparoscopic colorectal surgery.

3. Answer: d.

The fact that the tumour has perforated makes it a T4 (through bowel wall) but nodes are negative (N0) and there are no metastases (M0). Although perforation will seed tumour cells this is not the same as metastasis, hence T4N0M0 Dukes B.

4. Answer: a.

Removal of rectal cancer is referred to as anterior resection and/or total mesorectal excision (TME). This refers to removing mid or lower rectal cancers along with the mesorectum which envelopes the rectum. There is an avascular surgical plane around the meso rectum often referred to as "The Holy plane". This surgical technique popularised by Professor Heald, can be hailed as a significant step which has changed the outcome of rectal cancer all over the world. The anastomosis following TME is quite low and has a higher incidence of anastomotic leak. Hence these patients are routinely defunctioned with a loop ileostomy. This helps to divert the bowel content and reduces the consequences of a leak from a low anastomosis. If the patient develops a leak, this can often be managed successfully preserving the anastomosis provided it has been defunctioned. The ileostomy is reversed at a later date (usually after 3 months) with a second operation once it has been confirmed with gastrograffin enema that the anastomosis has healed well.



Abdominoperineal excision (APER) is performed for low rectal cancers where it is not deemed safe or possible to excise the rectum and leave sufficient clear normal tissue to perform an anastomosis. Therefore the entire rectum and anus are excised and the patient has a permanent end colostomy fashioned in the left iliac fossa. The surgeons work from both an abdominal approach which proceeds in the manner of a TME and also through a perineal incision 'up' to join with the abdominal dissection. The perineal wound is often closed with the use of plastic surgical techniques such as a musculocutaneous flap and can be prone to difficulties with healing due to anatomical location and it is often following pre-operative radiotherapy.

Proctectomy is removal of rectum in patients who have previously undergone sub-total colectomy.

Panproctocolectomy is removal of the entire large bowel and rectum usually for colitis (either ulcerative, infective or Crohn's), polyposis syndromes or synchronous colon and rectal cancers.

5. Answer: e.

Bowel preparation

This issue remains contentious. Whilst most surgeons now agree that formal bowel preparation is not necessary for right sided bowel cancers (requiring right hemicolectomy) for tumours distal to the splenic flexure there is debate as to whether mechanical bowel preparation (e.g. with picolax) is necessary. This remains a matter of individual preference.

References

1. Office for National Statistics, Cancer Statistics registrations: registrations of cancer diagnosed in 2008, England. (PDF 544KB) 2011
2. ISD Online. Cancer Incidence, Mortality and Survival data. Accessed 2011
3. Sagar J. Colorectal stents for the management of malignant colonic obstructions. Cochrane Database Syst Rev 2011 Nov 9; 11: CD007378 ePub
4. Angenete E, Asplund D, Bergström M, Park PO. Stenting for colorectal cancer obstruction compared to surgery—a study of consecutive patients in a single institution. Int J Colorectal Dis. 2011 Nov 29
5. Kuhry E, Schwenk WF, Gaupset R, Romild U, Bonjer HJ. Long-term results of laparoscopic colorectal cancer resection. Cochrane Database Syst Rev. 2008 Apr 16;(2)

Authors

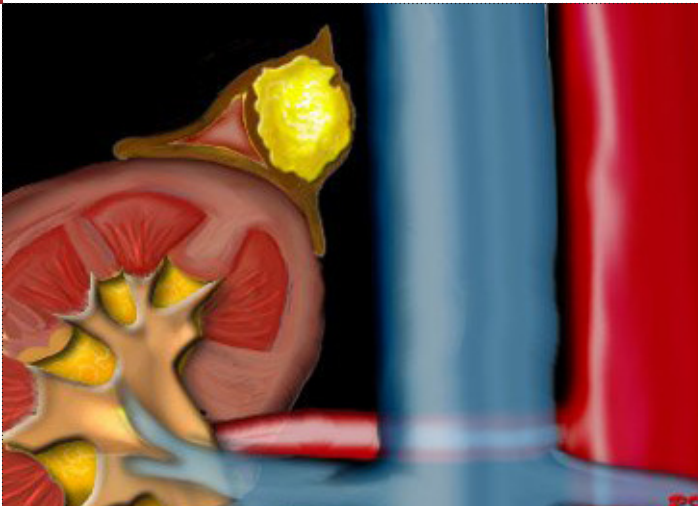
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ADRENAL MASSES: THE MANAGEMENT OF ADRENAL ADENOMA

K Kanesalingam, D van Dellen, JRE Davis, T Augustine



Abstract

Most adrenal masses are found incidentally during cross-sectional imaging. The investigations and management of an adrenal mass requires a thorough understanding of adrenal pathophysiology. We highlight the diagnosis and management of adrenal adenomas.

Introduction

Adrenal lesions are commonly detected as incidental masses during imaging for other pathology. They are otherwise known as incidentalomas. They also present as various endocrine syndromes, including Cushing's, Conn's syndrome and Pheochromocytomas and as components of the MEN (Multiple Endocrine Neoplasia) Syndromes. The evaluation and management may be complex but follow some basic principles. The first principle is determination whether it is a malignancy and if so whether it is a primary or metastatic. The next important factor is determination if the adrenal mass secretes hormones and if so whether the symptom complex is related to a specific hormone secreted. Depending on these findings, a decision is made for surgical intervention or surveillance. Five cases are presented which encompass broadly the spectrum of adrenal masses commonly encountered in clinical practice.

Clinical presentation

A 69 year old woman was initially referred to the urology team with asymptomatic microscopic haematuria on dipstick urinalysis. She described no previous urological history. She had an extensive medical history, predominantly cardiovascular in nature including a recurrent DVTs and PEs. She was on life-long warfarin treatment.

A bedside clinical examination and flexible cystoscopy was unremarkable. An ultrasound revealed a left renal mass suggestive of renal cell carcinoma. However, a contrast CT scan evaluated this lesion in more detail, identifying it as a 7.5 cm solid left adrenal gland lesion (Figure 1). This was confirmed on MR imaging (Figure 2). She then went on to have specific adrenal endocrine functional testing which were essentially normal. She then underwent a laparoscopic hand assisted left adrenalectomy (Figure 3) and the histology revealed a benign adenoma.

Adrenal masses: The management of adrenal adenoma Patient Management

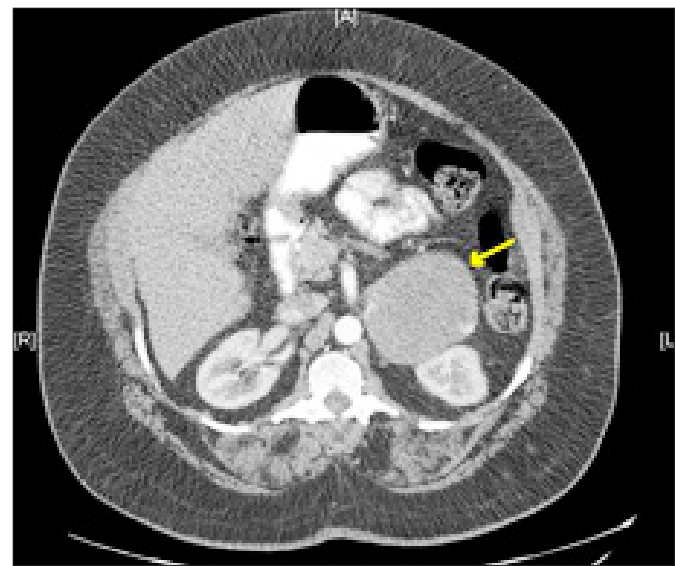


Figure 1. Cross sectional abdominal CT with contrast showing a 7.5 cm left adrenal solid adrenal mass (yellow arrow).

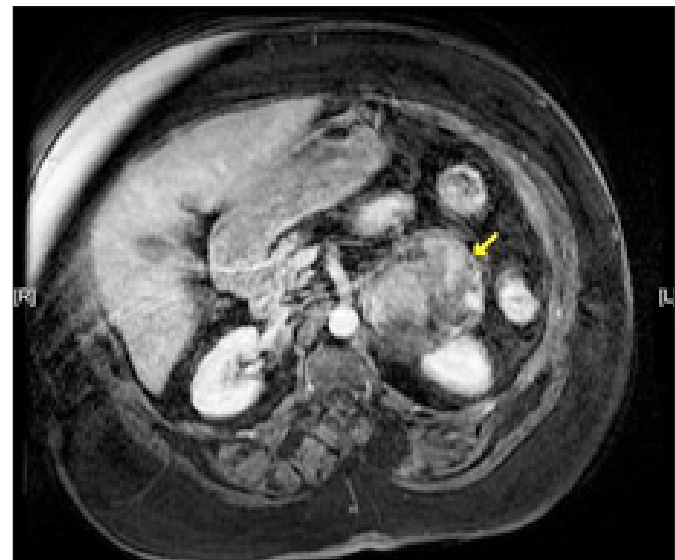


Figure 2. Cross sectional abdominal MRI with contrast showing delayed enhancement of left adrenal mass at three minutes.

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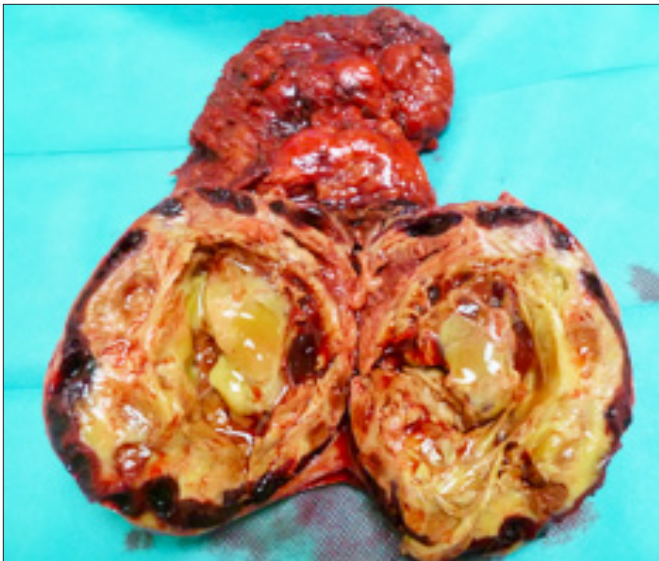


Figure 3. Adrenal tumour after laparoscopic adrenalectomy.

How common are adrenal adenomas?

Adrenal adenomas are benign tumours of the adrenal cortex. It is usually an incidental finding during imaging for other suspected pathology. A large study looking at 61,054 patients performed at the Mayo Clinic found a prevalence of incidental adrenal masses of 3.4%, rising to 4.2% of 520 patients studied later with higher resolution imaging. (2) The incidence of adrenal masses at autopsy in patients who had no evidence of adrenal disease is between 1.4% and 9%. (3) About one third of these are benign adenomas (either functioning or non-functioning) and 5% are adrenocortical carcinomas (ACC). (4) The incidence of adrenal tumours presenting with symptoms is small, approximately 10 per million. Therefore, a careful strategy is required to determine adenomas that need further definitive treatment.

How do you investigate an adrenal mass?

A full history and focused examination is essential to identify any signs or symptoms of Cushing's syndrome, hypertension, diabetes or any evidence of pituitary-adrenal axis imbalance. A past medical history of malignant disease or a family history of endocrine disease should also be sought.

The initial investigations include routine blood tests (full blood count and urea and electrolytes) and a chest X-ray leading on to specific endocrine biochemical tests. These tests will usually confirm or exclude pheochromocytoma, Cushing's syndrome, an androgen secreting tumour and Conn's syndrome or a MEN syndrome. If initial biochemical investigations prove positive then further investigations and treatment should be initiated accordingly.

If the tumour is devoid of any endocrine function further imaging is performed to elucidate the cause of the enlarged adrenal gland as there is a risk the tumour being an adrenocortical malignancy, either a primary or metastatic disease. Radiological guided fine-needle aspiration biopsy should be considered in patients with a recent history of malignancy. Cells retrieved that resemble the original primary tumour can be diagnostic. In the absence of previous or distant malignant disease, fine-needle aspiration biopsy or core biopsy is generally unhelpful as the interpretation of primary adrenal pathology is difficult in small samples.

A combination of a CT scans, MRI and, where appropriate, fine-needle aspiration biopsy and PET scans will identify the cause of the adrenal mass in the majority of cases. The risk of an adrenal tumour being an ACC is related to the mass size, even if the correlation is far from perfect. Assessment of the lipid content of an adrenal mass and rapidity of the washout of contrast medium are possibly the best criteria for diagnosing ACC. Benign adrenocortical adenomas are usually lipid-rich tumours. Using a threshold value of 10 Hounsfield units (HU) on a CT scan results in a sensitivity of 70% and a specificity of 98% for the diagnosis of an adenoma. A density equal to or below 10 HU is considered diagnostic of adenoma. However, 30% of adrenal adenomas do not contain enough intracellular lipid to have a density of less than 10 HU and cannot be differentiated from malignant masses on an unenhanced CT. These adenomas are called lipid-poor. (5) Adenomas have rapid wash-out of contrast medium whereas non-adenomatous tumours have delayed wash-out of contrast. (6)

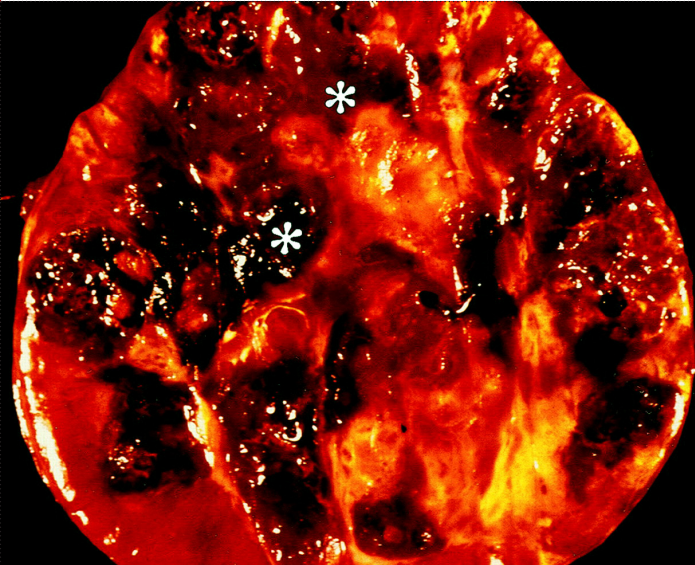
Despite the important anatomic and structural detail provided by CT and MRI, scintigraphy using a variety of radiopharmaceuticals that exploit the unique characteristics of adrenal function and metabolism offers high sensitivity and specificity for characterization of incidentally discovered adrenal masses.

How to manage an adrenal adenoma?

In small (< 3 cm), benign non-functioning adrenal tumours, a wait and watch policy with serial MRI on a yearly basis seems safe. In tumours over 3.5 cm, the threshold for surgical removal is less because there appears to be a significant risk of malignancy in larger tumours. (7) Adrenal adenomas that are growing on serial scans or in which there is any suspicion of malignancy should also be removed surgically. The laparoscopic approach is now the preferred option.

ADRENAL MASSES: THE MANAGEMENT OF ADRENAL ADENOMA

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References

1. Endocrine surgery: a companion to specialist surgical practice. 2nd ed. J. R. Farndon (ed.) 250 × 190 mm. Pp 319. Illustrated. 2001. London: WB Saunders.
2. Aron DC. The adrenal incidentaloma: disease of modern technology and public health problem. *Reviews in Endocrine & Metabolic Disorders* 2001; 2: 335-342.
3. Prevalence of adrenal incidentaloma in a contemporary computerized tomography series. Bovio S, Cataldi A, Reimondo G, Sperone P, Novello S, Berruti A, Borasio P, Fava C, Dogliotti L, Scagliotti GV, Angeli A, Terzolo M. *J Endocrinol Invest.* 2006; 29:298-302
4. Nieman LK. Approach to the patient with an adrenal incidentaloma. *J Clin Endocrinol Metab.* 2010; Sep;95(9):4106-13.
5. Elaine M. Caoili et al. Adrenal Masses: Characterization with Combined Unenhanced and Delayed Enhanced CT *Radiology* 2002;222:629-633.
6. Mantero F, Terzolo M, Arnaldi G et al. A survey on adrenal incidentaloma in Italy. *The Journal of Clinical Endocrinology and Metabolism* 2000; 85: 637-644.
7. Kasperlik-Zaluska AA, Otto M, Cichocki A et al. Incidentally discovered adrenal tumors: a lesson from observation of 1444 patients. *Hormone and Metabolic Research* 2008; 40: 338-341.

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Questions

Which of these statements are false about adrenal adenomas?

- a) Are usually incidental findings on cross sectional imaging
- b) Lipid rich tumours that appear hypodense on non-contrast CT
- c) Small tumours (< 3 cm) can be observed with annual scanning
- d) Rarely symptomatic
- e) Fine needle biopsy is the gold standard tool to confirm the diagnosis

What characteristics of an adrenal mass are suspicious of an adrenocortical carcinoma (ACC)?

- a) Adrenal adenoma that are not growing on serial scans
- b) Small (< 3 cm) adrenal tumours
- c) Lipid-rich tumours on unenhanced CT
- d) Delayed washout of contrast medium
- e) Cortisol secreting lesions

Answers

1. e.
Cells retrieved that resemble the original primary tumour can be diagnostic.

2. d.
Adenomas have rapid washout of contrast medium whereas non-adenomatous tumours have delayed wash-out of contrast.

ADRENAL MASSES: THE MANAGEMENT OF ADRENAL METASTATIC TUMOUR

K Kanesalingam, D van Dellen, JRE Davis, T Augustine

Abstract

The adrenal gland is a common site for metastasis from a variety of malignancies. We present a patient with a solitary adrenal metastatic tumour originating from a primary tracheal squamous carcinoma. This case based discussion focuses on the assessment and management of metastatic adrenal disease.

Clinical case

A 55-year old man was referred to the respiratory physicians with a ten week history of exertional dyspnoea with associated wheezing. There was no history of any chest pain, haemoptysis or palpitations. He was an ex-smoker (35 pack year history) and was treated with inhalers and oral steroids without improvement.

High resolution computed tomography (CT) showed a soft tissue mass in the lower trachea just above the carina (Figure 1A). He underwent bronchoscopy which revealed a right lower tracheal smooth tumour extending down towards the right bronchus with 20% occlusion of the distal right bronchus, which was confirmed histologically as squamous cell carcinoma (Figure 2A). He underwent a Positron Emission Tomography and Computed Tomography (PET-CT) scan for staging which revealed a high intensity 18-fluorodeoxyglucose (18-FDG) uptake of both the abnormal soft tissue in the lower trachea and the left adrenal gland (Figure 1 B,C). Functional biochemical testing revealed no abnormalities to the adrenal function.

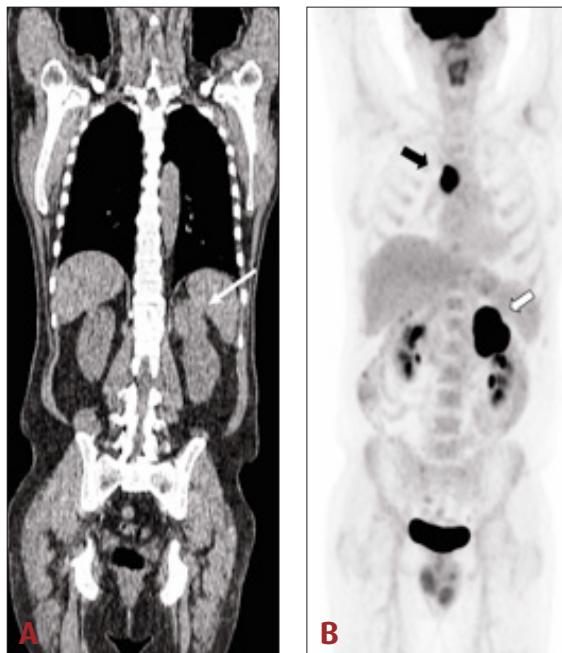
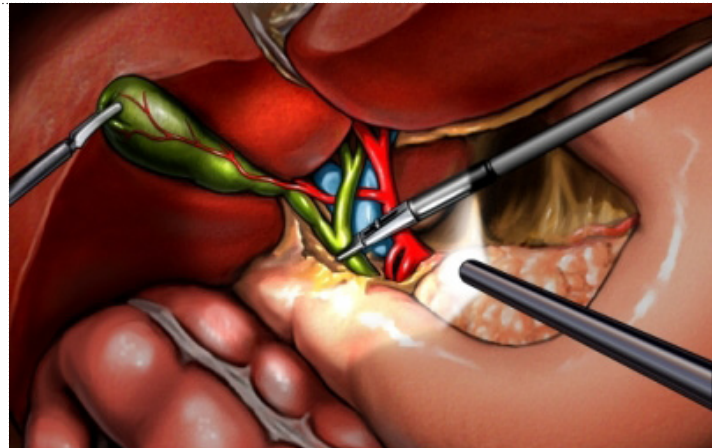


Figure 1. (A) Abdominal non-contrast CT (coronal view) showing a large lesion inseparable from the superior aspect of the left kidney (denoted by arrow). (B). PET-CT confirmed abnormal intense uptake of 18-fluorodeoxyglucose (18-FDG) in the lower trachea and in the left side of the abdomen (denoted by arrows).The intensity of FDG uptake within this region was comparable to that of urine within the bladder.



This patient initially underwent a laparoscopic-assisted adrenalectomy, with histology confirming a metastatic squamous cell tumour (Figure 2B). The thoracic lesions were deemed unsuitable for resection and treated with chemoradiotherapy.

How common is adrenal metastatic disease?

The adrenal gland is a common site of metastasis from a variety of primary tumours and is most common in patients with primary lung and renal cell carcinomas (51% and 28% respectively.) (1) Other tumours which commonly metastasise to the adrenal include breast, ovaries, gastrointestinal, skin (particularly melanomas) and lymphomas. There are no previous reported cases of an adrenal metastasis from a primary tracheal lesion.

Patients with adrenal metastases are usually asymptomatic but may present with back pain, retroperitoneal haemorrhage or signs and symptoms of adrenal insufficiency. The majority of these lesions are incidentally discovered during initial disease staging or during subsequent surveillance imaging.

What is the best imaging modality for the adrenal gland?

It is crucial that benign and malignant adrenal tumours are differentiated as this is important for both staging and further management.

Ultrasound imaging can detect adrenal lesions larger than 2 cm but is unable to adequately characterise potential malignant features. CT detected metastatic lesions may have a wide range of radiological features. They may vary in size, consistency and present either bilaterally or unilaterally. Magnetic resonance imaging (MRI) also has a role in tumour characterisation, particularly in patients with contraindications to intravenous contrast. (2) 18-FDG PET scans also have a high diagnostic value for adrenal metastatic disease with a 93%, 90%, and 92% sensitivity, specificity, and accuracy respectively. (3)

Percutaneous biopsy remains the most effective diagnostic tool with accuracies reported between 80 to 100%. (4) Fine needle aspiration (FNA) under CT guidance is highly specific and sensitive and is reported to be as high as 85 to 100%. (4) FNA is recommended in patients with non-metabolically active adrenal masses with a recent past history of malignancy or inconclusive imaging.

ADRENAL MASSES: THE MANAGEMENT OF ADRENAL METASTATIC TUMOUR

K Kanesalingam, D van Dellen, JRE Davis, T Augustine

How to treat adrenal metastatic disease and what is the long term survival of these patients?

Treatment of patients with adrenal metastasis is dependent on the primary disease, the presence of synchronous distant metastasis and patients' comorbidities. In several series, patients with isolated adrenal metastasis have shown to have improved survival rates after potentially curative adrenal metastectomies.⁽⁵⁾

These are most beneficial when the primary cancer is controllable with no evidence of extra-adrenal metastases.⁽⁵⁾ Risk factors such as the primary cancer site and size, histological type, (adenocarcinoma potentially more favourable), presence of other metastases, local invasion, and a lengthy disease-free interval after initial diagnosis may impact on cancer survival. ⁽⁵⁾

Open vs. laparoscopic resection of metastatic adrenal lesions?

The benefit of laparoscopic procedures over traditional open adrenalectomy in patients with metastases remains the subject of some question. The choice of technique usually depends on the surgeon preference, size (improved results if tumour < 8 cm), location and invasive properties of the tumour, as well as traditional relative contraindications to laparoscopic surgery.

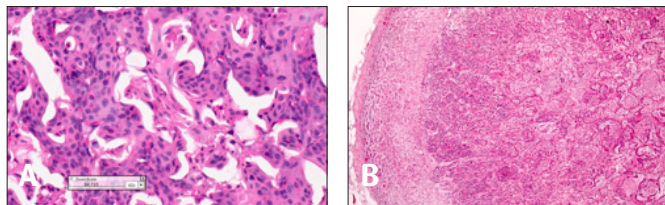


Figure 2. (A) Histology of tracheal biopsy demonstrated evidence of squamous cell carcinoma. (B) Histology of adrenal lesion confirmed squamous cell carcinoma likely of metastatic origin.

Questions

1. What is the gold standard diagnostic tool for adrenal lesions?

- CT
- PET
- MRI
- CT guided Fine Needle Aspiration
- Ultrasound scan

2. Which of the statements below regarding laparoscopic surgery is incorrect?

- There is no difference in the patient long term survival.
- Patients require less analgesia.
- Patients have less intraoperative blood loss.
- It is the treatment of choice in a large 10cm adrenal tumour
- Patients have shorter hospital stay.



Answers

1. a.

CT guided FNA is the gold standard diagnostic tool but it is recommended in patients with non-metabolically active adrenal masses with a recent past history of malignancy and inconclusive imaging.

2. d.

With large tumours > 8 cm, open adrenalectomies are the preferred choice of surgery.

References

- Hess, K. R., Varadhachary, G. R., Taylor, S. H., Wei, W., Raber, M. N., Lenzi, R. and Abbruzzese, J. L. (2006), Metastatic patterns in adenocarcinoma. *Cancer*, 106: 1624-1633. doi: 10.1002/cncr.2177
- Abrams HL, Siegelman SS, Adams DF, Sanders R, Finberg HJ, Hessel SJ, et al. Computed tomography versus ultrasound of the adrenal gland: a prospective study. *Radiology*. 1982;143:121-8.
- Kumar R, Xiu Y, Yu JQ, Takalkar A, El-Haddad G, Potenta S, Kung J, Zhuang H, Alavi A. 18F-FDG PET in evaluation of adrenal lesions in patients with lung cancer. *J Nucl Med*. 2004 Dec;45(12):2058-62.
- Kindelberger DW, Cibas ES. Evaluating metastatic carcinoma to the adrenal: utility of fine needle aspiration cytology. *Pathol Case Rev*. 2005;10:257-62.
- Fumagalli, U. et al., 2010. Adrenal metastases from adenocarcinoma of the esophagogastric junction: adrenalectomy and long-term survival. *Updates in surgery*, 62(1), p.63-67.
- Mathew G, Watson DI, Ellis T, De Young N, Rofe AM, Jamieson GG. The effect of laparoscopy on the movement of tumour cells and metastasis to surgical wounds. *Surg Endosc*. 1997;11:1163-6.

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ADRENAL MASSES: THE DIAGNOSIS AND MANAGEMENT OF CUSHING'S DISEASE

K Kanesalingam, D van Dellen, JRE Davis, T Augustine

Adrenal masses: The diagnosis and management of Cushing's disease Patient Management

Abstract

The diagnosis of Cushing's syndrome is often missed due to its subtle clinical signs and symptoms. This case highlights the diagnosis of Cushing's syndrome focusing on the management and treatment of pituitary-dependent Cushing's disease.

Clinical case

A 15 year old girl presented with a 12 month history of short lasting irregular periods prior to becoming amenorrhoeic. She complained of weight gain particularly around the face and noticed worsening abdominal and thigh striae over the last six months. She also felt dizzy and collapsed on a couple of occasions.

On examination she appeared to have a moon-like face (Figure 1A), abdominal and thigh striae (Figure 1B) and mild weakness of her hip flexors. She had a normal blood glucose but had glycosuria.

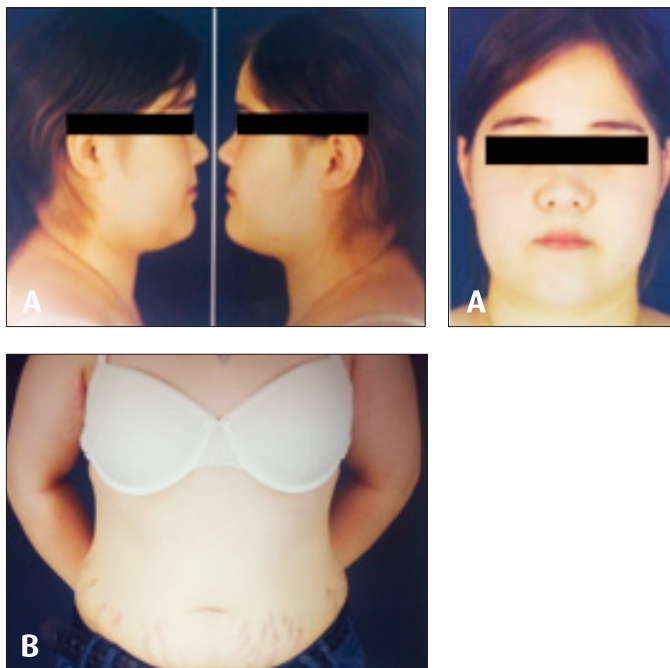


Figure 1: A. The appearance of 'moon face'. B. Abdominal striae typically seen in patients with Cushing's syndrome.



Random cortisol and (adrenocorticotropic hormone) ACTH levels were high and a dexamethasone suppression test showed lack of suppression indicating ACTH dependant Cushing's syndrome. An abdominal ultrasound scan revealed normal adrenal glands, however a MRI (magnetic resonance imaging) scan of the brain revealed a pituitary adenoma (Figure 2).

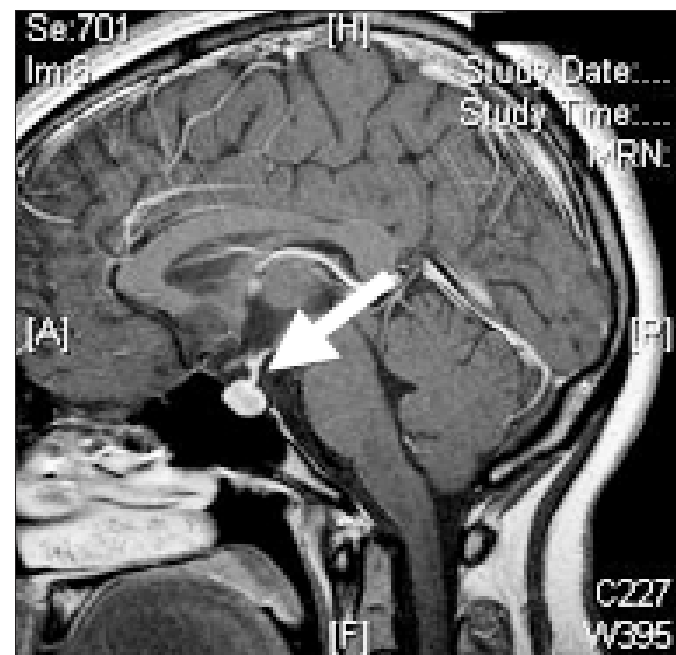


Figure 2: Contrast MRI scan showing pituitary adenoma (white arrow).

A transphenoidal hypophysectomy was performed for the pituitary adenoma. However, the patient continued to have persistent Cushing's disease. Further evaluation showed incomplete excision of the adenoma. She had a second attempt at a hypophysectomy which was complicated by meningitis and a CSF leak. Unfortunately she continued to demonstrate hypercortisolism and further developed diabetes insipidus, hypothyroidism and gonadotrophin deficiencies. Hence a decision was made to manage her with bilateral adrenalectomy. This was undertaken laparoscopically. She recovered well after her operation and was rendered cortisol insufficient.

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What is Cushing's syndrome?

Cushing's syndrome is an uncommon disorder that is characterised by raised circulating glucocorticoids with systemic manifestations.

What are the causes Cushing's syndrome?

There are two types:

1. ACTH dependent Cushing's syndrome; ACTH is produced by a pituitary adenoma or from an ectopic source.
2. ACTH independent due to adrenal pathology.

ACTH - secreting pituitary adenoma

It is the most common cause of Cushing's syndrome accounting for 60–80% of patients with an annual incidence of 0.1–10 per 100,000. (2)

Ectopic secretion of ACTH

ACTH which is secreted ectopically is usually from a small cell lung cancer which accounts for 10–15% of ACTH-dependent Cushing's syndrome. (2)

ACTH independent Cushing's syndrome

The causes of ACTH independent Cushing's syndrome are functioning adrenal adenomas and carcinomas, bilateral adrenal hyperplasia and iatrogenic steroid intake.

How is Cushing's syndrome diagnosed?

Establishing a diagnosis of Cushing's syndrome, either primarily or at the time of recurrence, can be difficult as many of the presenting clinical signs and symptoms are subtle and non-specific.

Clinical symptoms and signs

It is crucial that a good history is obtained focusing on symptoms of weight gain (central), menstrual irregularities in female patients, visual defects or loss, headache, dizziness, depression, psychosis, insomnia, poor libido, muscular weakness, polyuria and polydipsia and hirsutism. When examining a patient with Cushing's syndrome, clinicians need to look for the typical cushingoid appearance; "a moon face", truncal obesity, abdominal striae, atrophied skin, and hyperpigmentation of skin folds. Patients may have acne, hirsutism, muscular weakness, osteoporosis and glycosuria.

Investigations

The confirmatory diagnosis of Cushing's syndrome is often based on biochemical evidence. The tests commonly performed for screening include 24 hour urinary free cortisol, plasma cortisol diurnal rhythm and low-dose dexamethasone suppression test.

Determination of the aetiology of Cushing's syndrome

After tests confirm Cushing's syndrome, further investigations are required to determine its aetiology. The first stage is to perform tests to determine if Cushing's syndrome is ACTH dependent or independent. Serum ACTH measurements distinguish between ACTH dependent and ACTH independent causes of hypercortisolism. Corticotrophin-releasing hormone will fail to trigger a response in patients with adrenal hypercortisolism or extrapituitary ACTH secreting neuroendocrine tumours while those with pituitary Cushing's disease have exaggerated ACTH and cortisol responses. (6) High-dose dexamethasone suppression test will cause a reduction in serum cortisol in patients with pituitary ACTH-secreting microadenomas. (3) If the Cushing's is determined to be ACTH-independent, then it is almost certainly due to adrenal disease. Adrenal imaging is then carried out using ultrasound, or preferably CT or MRI. If the Cushing's is ACTH dependent, then further tests are required to determine the source of ACTH secretion.

Determining the source of ACTH secretion in ACTH-dependent Cushing's syndrome.

1. Overnight high dose dexamethasone test

High dose dexamethasone suppression testing involves administration of dexamethasone overnight followed by measurement of serum cortisol or urinary free cortisol at 24 and 48 hours to determine suppression of cortisol. This test is not often done these days, due to high rates of false positive and negative results.

2. Inferior petrosal sinus (IPS) sampling

Bilateral IPS sampling after catheterisation can differentiate between pituitary and ectopic ACTH overproduction if other methods have failed and can also localize the side of an ACTH-producing adenoma. This test directly measures the ACTH produced from the pituitary gland as the pituitary secretions drain into the petrosal sinus via the cavernous sinus. (6) Peripheral blood levels of ACTH must also be measured to detect any concentration gradient. (3)

ADRENAL MASSES: THE DIAGNOSIS AND MANAGEMENT OF CUSHING'S DISEASE

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3. Imaging

Patients diagnosed with Cushing's disease should have their pituitary gland imaged using MRI or CT scans. Pituitary lesions are often microadenomas and the pituitary may appear normal radiologically. The MRI detection rate is 40-70% with a specificity of 87%.⁴ In patients with ectopic ACTH secretion, CT or MRI of the chest should be performed to identify ectopic tumours.

How is Cushing's disease treated?

Transsphenoidal surgery

This is the initial treatment of choice for most patients with Cushing's disease. The principal goals of surgery include complete resection of the ACTH secreting pituitary tumour with maximal preservation when possible of normal pituitary gland tissue to avoid long term hormone replacement therapy.

How do you treat patients who have not remitted after surgery?

Radiotherapy

Radiotherapy has been used in the management of patients with Cushing's disease who have not been cured by pituitary surgery. Patients with persistent Cushing's disease can be treated with stereotactic radiosurgery whenever possible, especially younger patients.

Bilateral adrenalectomy

Bilateral adrenalectomy is performed when all other treatments have failed to treat Cushing's disease. Laparoscopic bilateral adrenalectomy is usually the treatment modality of choice as it is a relatively safe procedure.

Questions

1. Which of the following statements about Cushing's syndrome are incorrect?

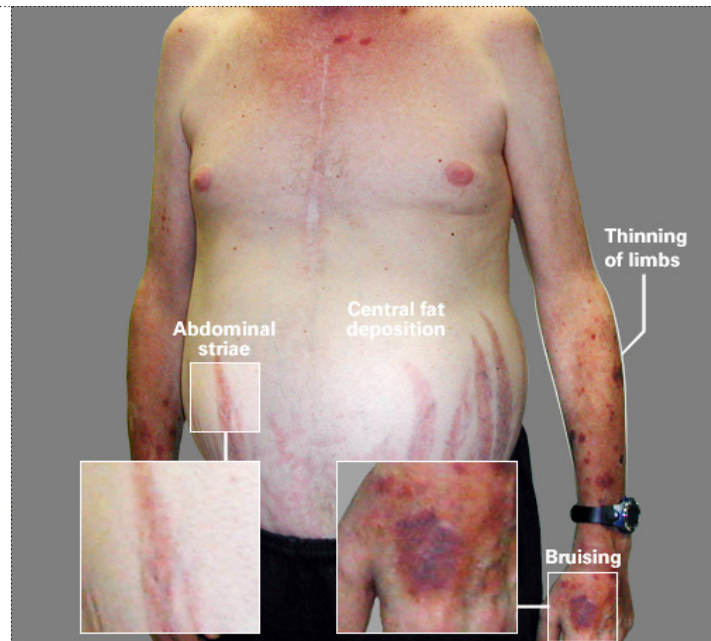
- The diagnosis can be difficult due to the subtle clinical signs
- Patients may develop osteoporosis
- All patients will have elevated ACTH levels
- It could be caused by excessive or prolonged steroid intake
- Patients could have underlying small cell lung cancer

2. What is the initial treatment choice for patients with Cushing's disease?

- Transsphenoidal surgery
- Bilateral adrenalectomy
- Radiotherapy
- Chemotherapy
- Optimize medical therapy

Answers

- c.** Cushing's syndrome can be ACTH independent and dependent.
- a.** This is the initial treatment of choice for most patients with Cushing's disease.



References

- Cushing H. The basophil adenomas of the pituitary body and their clinical manifestation. *Bull Johns Hopkins Hosp.* 1932;50:137-195
- Boscaro M, Barzon L, Fallo F, et al. Cushing's syndrome. *Lancet* 2001;357:783-91.
- Nieman LK, Biller BM, Findling JW, Newell-Price J, Savage MO, Stewart PM, Montori VM. J Clin Endocrinol Metab. The diagnosis of Cushing's syndrome: an Endocrine Society Clinical Practice Guideline. 2008; May;93(5):1526-40. Epub 2008 Mar 11.
- Klibanski A, Zervas N. Diagnosis and management of hormone-secreting pituitary adenomas. *N Engl J Med* 1991;324:822-31
- Hammer GD, Tyrrell JB, Lamborn KR, et al. Transsphenoidal microsurgery for Cushing's disease: initial outcome and long-term results. *J Clin Endocrinol Metab* 2004;89:6348-57
- Jenkins PJ, Trainer PJ, Plowman PN, Shand WS, Grossman AB, Wass JAH, Besser GM. The role of prophylactic pituitary radiotherapy in the long-term outcome after adrenalectomy for Cushing's disease. *J. Clin. Endocrinol. Metab.* 1994;79; 165-171.

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ADRENAL MASSES: THE DIAGNOSIS AND MANAGEMENT OF CONN'S SYNDROME

K Kanesalingam, D van Dellen, JRE Davis, T Augustine



Adrenal masses: The diagnosis and management of Conn's Syndrome Patient Management

What is the function of aldosterone and how is it related to the renin-angiotensin system?

Aldosterone controls the resorption of sodium by the distal renal tubules via Na⁺/K⁺ and H⁺ pumps. Aldosterone enhances the exchange of sodium for potassium in the kidney. Water is resorbed with sodium, causing retention of water. The subsequent increase in the circulating volume results in hypertension.

The secretion of aldosterone secretion is primarily under the control of angiotensin II, which in turn is generated through the renin-angiotensin system as shown in Diagram 1.

Abstract

This case highlights the clinical history and presentation of a young man with hyperaldosteronism. We discuss in detail the aetiology, investigations and treatment options of patients with Conn's syndrome.

Clinical Case

A 29 year old previously fit and well man presented acutely with a two week history of ascending paralysis. This started during a visit abroad to Pakistan where he also suffered from diarrhoea. His symptoms progressively worsened until he was unable to walk. He also complained of polydipsia and polyuria, producing volumes of up to six litres of urine a day. He had an impaired urine concentrating ability which was demonstrated with the water deprivation test on the ward.

He was persistently hypertensive and blood biochemistry revealed low serum potassium (1.5mmol/l). His serum aldosterone levels were significantly raised with low levels of renin. Saline infusion test confirmed raised urinary potassium in the presence of very low serum sodium indicating the inability of the kidneys to control potassium. A computed tomography (CT) scan of the adrenal glands revealed a 4.8 cm left adrenal lesion (Figure 1).The patient was diagnosed with Conn's syndrome.

He was admitted to intensive care for potassium replacement through a central line and his neurological symptoms completely resolved after electrolyte correction.He underwent a left laparoscopic adrenalectomy and the histology was consistent with Conn's. His post-operative recovery was uneventful after which his blood pressure normalised.

What is Conns' syndrome?

Primary hyperaldosteronism (PA) or Conn's syndrome was first described by Jerome W Conn in 1955 and can be present in up to 11% of hypertensive patients.It is caused by the excessive release of aldosterone. (1)

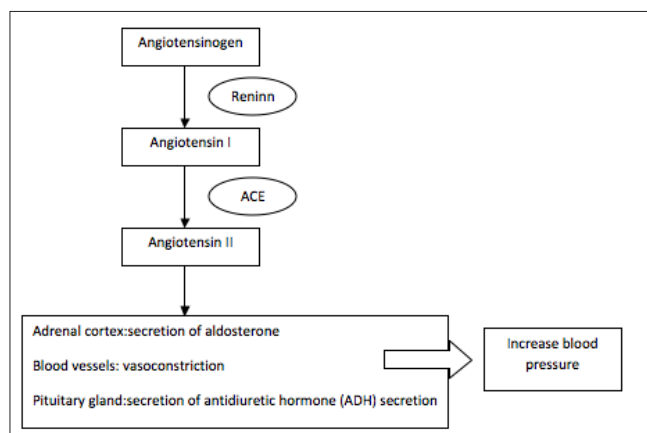


Diagram 1: Schematic diagram illustrating the renin-angiotensin system.



ADRENAL MASSES: THE DIAGNOSIS AND MANAGEMENT OF CONN'S SYNDROME

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What are the causes of Conn's syndrome?

Conn's syndrome is most commonly caused by an adrenal aldosterone producing benign adenoma (APA) or rarely due to bilateral micronodular or macronodular hyperplasia zona glomerulosa of the adrenal gland (BAH), which is rarely suitable for surgical intervention.

What tests confirm the diagnosis of Conn's?

Patients present with symptoms related to hypertension and hypokalaemia including headache, dizziness, weakness, periodic paralysis, and polyuria. Confirmatory tests are based on demonstration of excessive autonomous aldosterone production without modulation by salt or blocking of the renin-angiotensin system.

The four common confirmatory tests used are:

1. Oral sodium loading:

The patient receives a high sodium diet for three days following which a 24 hour urine sample is collected. Lack of suppression of plasma aldosterone is suggestive of Conn's syndrome.

2. Intravenous isotonic saline infusion:

The patient is given an infusion of sodium chloride solution over 4 hours and plasma aldosterone is measured: lack of suppression is seen with autonomous aldosterone secretion from adrenal adenomas.

3. Captopril challenge:

Aldosterone-renin ratio (ARR) is measured 2 hours after drug administration, with an ARR of 30 or less proposed as the pathognomonic cut-off value for Conn's syndrome.

4. Fludrocortisone administration plus sodium loading:

Upright plasma aldosterone levels are measured after four days of synthetic mineralocorticoid 9-alpha-fludrocortisone acetate and sodium chloride administration. Aldosterone levels are maintained greater than 6ng/dl in patients with Conn's syndrome.

Fludrocortisone suppression test

Adrenal imaging

After a positive confirmatory test, a high resolution CT scan or magnetic resonance imaging (MRI) remains important to obtain accurate imaging of the adrenal glands. CT imaging currently displays the best sensitivity in identifying adrenal nodules with reported abilities at distinguishing APA from IHA of 80% to 85%. Iodocholesterol scanning may also be a further imaging modality if diagnostic doubt remains, with an estimated 83% positive predictive value for adenoma diagnosis. (4)

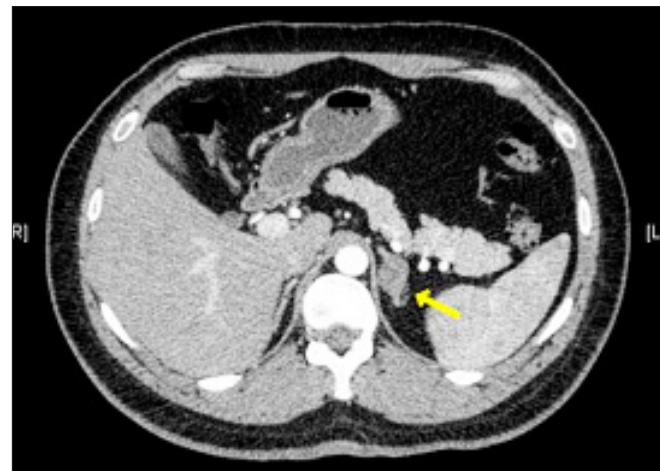


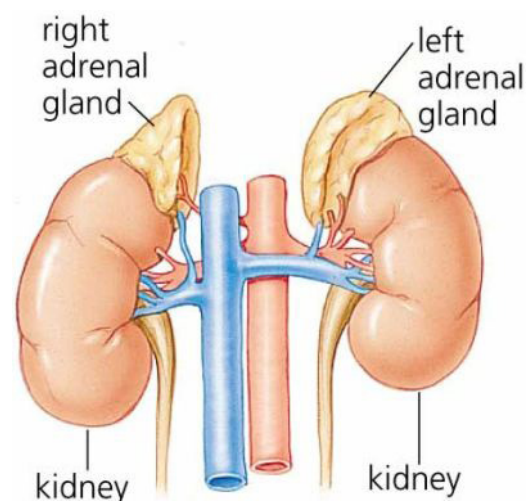
Figure 1: Computed Tomography scan demonstrating a 4.8 x 1.9 cm low attenuation nodule in the left adrenal gland suggestive of an adrenal lesion. (indicated by arrow)

Adrenal venous sampling (AVS)

The utility of AVS is to differentiate BAH, which is not treatable with surgery, from APA and primary adrenal hyperplasia, which are potentially curable by adrenalectomy. Therefore, in light of the procedure's complexity, advocates suggest performing AVS only in patients that are potential surgical candidates. (5)

How to treat patients with Conn's syndrome?

Patients with unilateral overproduction of aldosterone, due to APA or unilateral adrenal hyperplasia, are amenable to a curative surgical resection. However, in BAH, a medical approach remains the treatment of choice.



ADRENAL MASSES: THE DIAGNOSIS AND MANAGEMENT OF CONN'S SYNDROME

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References

1. Conn JW: Primary aldosteronism: a new clinical syndrome. *J LabClin Med* 1955, 45:3-17.
2. Rossi GP, Bernini G, Caliumi C, et al.: A prospective study of the prevalence of primary aldosteronism in 1,125 hypertensive patients. *J Am Coll Cardiol* 2006, 48:2293-2300. This is a large prospective study that was performed to identify the incidence of PA in hypertensive patients.
3. Hiramatsu K, Yamada T, Yukimura Y, et al. A screening test to identify aldosterone producing adenoma by measuring plasma renin activity. *Arch. Intern. Med.* 1981;141:1589-1593
4. M. Bloomston, O. Al-Saif, D. Klemanski, et al.: Hepatic artery chemo embolization in 122 patients with metastatic carcinoid tumor: lessons learned. *J Gastrointest Surg.* 11,2007, 264, 71.
5. Young WF, Stanson AW: What are the keys to successful adrenal venous sampling (AVS) in patients with primary aldosteronism? *Clin Endocrinol* 2009, 70:14-17.
6. Rossi HP, Seccia TM, Pessina AC: Primary aldosteronism—part II: subtype differentiation and treatment. *J Nephrol* 2008, 21:455-462

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Questions

1. What electrolyte imbalance do patients with hyperaldosteronism demonstrate?

- a) hyperkalaemia
- b) hypokalaemia
- c) hypercalcaemia
- d) hypocalcaemia
- e) hyponatraemia

2. Which of the statements below about the renin-angiotensin system is false?

- a) Angiotensin II stimulates the secretion of aldosterone from the adrenal cortex
- b) Increased aldosterone causes hyperkalaemia.
- c) Angiotensin converting enzymes is found in the lungs
- d) Angiotensin II causes blood vessels to vasodilate.
- e) Juxtaglomerular cells in the kidneys secrete renin directly into circulation.

Answers

1. b.

Aldosterone enhances exchange of sodium for potassium in the kidney so increased aldosteronism will lead to hypernatraemia and hypokalaemia.

2. d.

Angiotensin II is a potent vaso-active peptide that causes blood vessels to constrict

ADRENAL MASSES: THE DIAGNOSIS AND MANAGEMENT OF PHAEOCHROMOCYTOMA

K Kanesalingam, D van Dellen, JRE Davis, T Augustinea

Abstract

We discuss a case of a patient with bilateral phaeochromocytomas. This case highlights general aspects of the diagnosis, management and treatment of a phaeochromocytoma, a relatively rare adrenal lesion.

Clinical presentation

Mr JC is a 28 year old gentleman who is known to have Von Hippel-Lindau disease (VHL) since the age of 15. He was diagnosed to have cerebellum and retinal haemangiomas which were being observed regularly by the neurosurgeons. He was screened on an annual basis by the geneticist with a 24 hour urine test and earlier this year was found to have raised urinary metanephrines suggestive of phaeochromocytoma. This was later confirmed with elevated plasma metanephrines. He was found to be normotensive and denied any symptoms of episodic headache, sweating, hypertension or postural hypotension.

He underwent an MRI scan that showed bilateral adrenal lesions (Figure1). An [123-I]-Metaiodobenzylguanidine (MIBG) scan showed an increased tracer uptake in both adrenal glands on day one which persisted on subsequent images acquired at 24 hours and 48 hours (Figure 2). The abnormal uptake was confined to the enlarged adrenal glands on the single-photon emission computed tomography (SPECT). There was no tracer uptake of seen elsewhere. This was consistent with a diagnosis of bilateral phaeochromocytoma with no evidence of extra-adrenal disease.

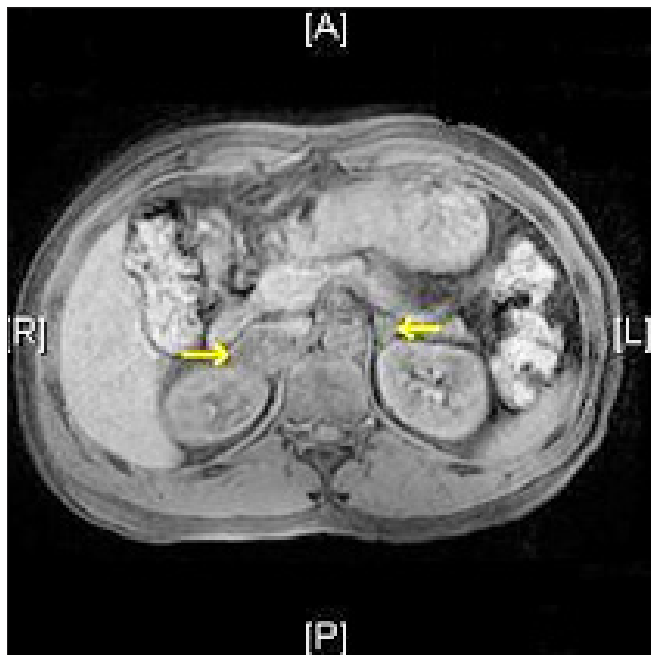


Figure 1. Cross-sectional abdominal MRI revealing bilateral adrenal lesions (yellow arrows).

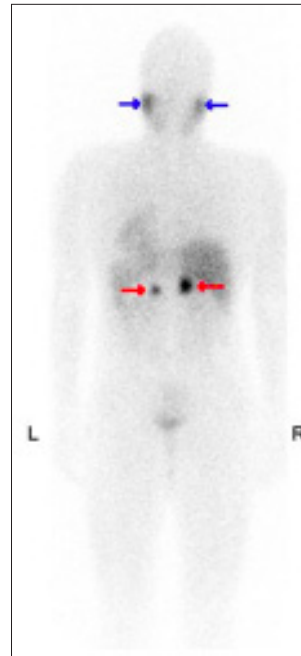


Figure 2: MIBG scan shows the increased uptake in both adrenal glands consistent with phaeochromocytomas (red arrows) and the physiological tracer uptake in the salivary glands (blue arrows).

He was started on alpha-blockers and was referred to the endocrine surgical team for a laparoscopic bilateral adrenalectomy and the histology was consistent with phaeochromocytoma (Figure3).

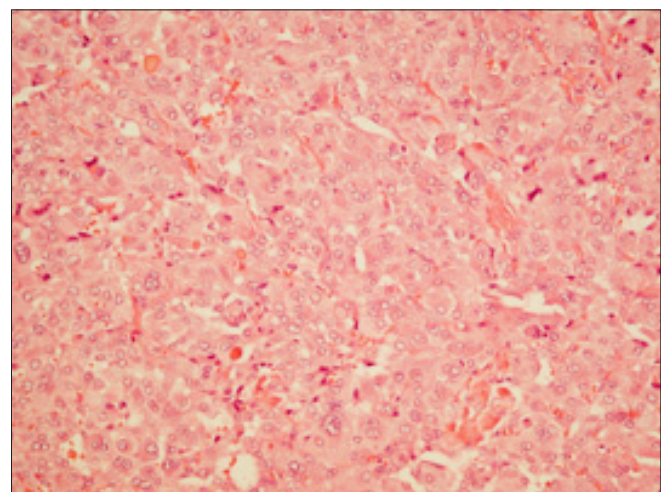
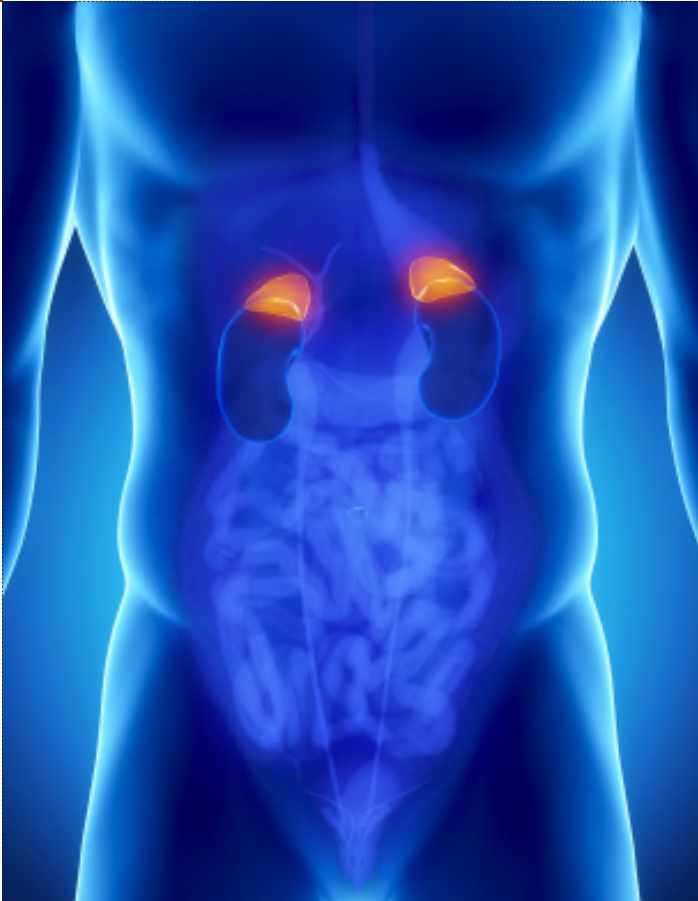


Figure 3: Histology of a phaeochromocytoma lesion consisting of large polygonal cells arranged in a nest-like pattern with interspersed vascular structures.

ADRENAL MASSES: THE DIAGNOSIS AND MANAGEMENT OF PHAEOCHROMOCYTOMA

K Kanesalingam, D van Dellen, JRE Davis, T Augustine



What are pheochromocytomas?

Pheochromocytomas are present in about 0.01-0.1% of hypertensive individuals. (1) They are rare tumours arising from chromaffin cells in the adrenal medulla or other paraganglial tissue (extra-adrenal pheochromocytomas). It causes increased catecholamine production which if not recognized, could lead to death as a result of a hypertensive crisis, arrhythmia, myocardial infarction, or multisystem crisis. (1)

What are the clinical symptoms and signs?

Pheochromocytoma classically presents with triad of episodic headache, sweating, and hypertension. However, 13% of patients are normotensive; 50% are persistently hypertensive; and 50% intermittently hypertensive. (1) Patients may also complain of hypotension, particularly with postural hypotension, or alternating episodes of high and low blood pressure if they are on high doses of antihypertensive agents or they are pure adrenaline-secreting tumours. Patients may demonstrate attacks of anxiety or fear, stroke in young, or congestive heart failure. Less commonly, severe hypertensive reactions may occur during incidental surgery, following trauma, exercise, drug intake, or micturition (micturition syncope in a bladder pheochromocytoma) when the diagnosis is unsuspected.

Adrenal masses: The diagnosis and management of pheochromocytoma Patient Management

How does one confirm a diagnosis of pheochromocytoma?

Patients are tested for serum metanephrines and normetanephrines. However a negative test can miss exclusively dopamine secreting tumours, or small pheochromocytomas (< 1 cm). (3) Twenty-four hour urine catecholamines can be used with sensitivity 97% and a specificity of 98%. The administration of Clonidine, a centrally-acting alpha-2 agonist will reduce the catecholamine production in a healthy adrenal medulla ruling out pheochromocytoma.

How to localize pheochromocytoma?

Patients undergo CT abdomen first. If the CT scan is negative, the patient should have an MRI scan. Irrespective of the anatomical imaging results, functional imaging with Metaiodobenzylguanidine imaging (MIBG) should be performed. MIBG is an aralkylguanidine, resembling noradrenaline, and is labelled with iodine isotopes [131-I] or [123-I]. MIBG is administered intravenously and accumulates within the adrenergic tissues utilising a noradrenergic transporter system. PET imaging has low radiation exposure and superior spatial resolution are among the advantages of PET but is costly. Up to 73% of pheochromocytoma cells in vitro express somatostatin receptors. Somatostatin Receptor Scintigraphy (SRS) imaging uses either [123-I]- Tyr3-octreotide or [111-In]-DTPA-octreotide. Octreotide is given intravenously and scintigraphic views are obtained. SPECT studies can also be undertaken.

How is a pheochromocytoma treated?

Immediate blockade with D-adrenergic drugs should be commenced. Phenoxybenzamine is used most frequently while an alternative is doxazosin. (5) The sole use of beta-blockers should be avoided as a hypertensive crisis can be precipitated. After alpha-blockade is established, beta-blocking such as propranolol may be added over the last few days pre-operatively.

ADRENAL MASSES: THE DIAGNOSIS AND MANAGEMENT OF PHAEOCHROMOCYTOMA

K Kanesalingam, D van Dellen, JRE Davis, T Augustinea

Most tumours are amenable to laparoscopic adrenalectomy, but extremely large tumours and malignant tumours may be more easily managed with a laparotomy. Extra-adrenal phaeochromocytomas should also be surgically resected. During surgery any undue handling of the tumour can result in a surge in the secretion of catecholamines and wide excursions in blood pressure which could precipitate major end-organ morbidity, such as stroke and myocardial infarction. Once the tumour is devascularised a significant fall in catecholamines will occur and the patient may become hypotensive requiring significant volume replacement or even inotropic support.

During the postoperative period the patient is managed in the high-dependency or intensive care unit for regular monitoring of blood pressure and cardiovascular status. Regular monitoring of blood sugar is advised as a sudden reduction in circulating catecholamines can include severe hypoglycaemia.

Questions

1. Which of the following test will be able to confirm a diagnosis of phaeochromocytoma?

- a) ECG
- b) Chest X-ray
- c) 24 hour Urine catecholamines
- d) CT abdomen
- e) Ultrasound of the abdomen

2. Which of these statements about phaeochromocytoma is false?

- a) Phaeochromocytoma classically presents with triad of episodic headache, sweating, and hypertension.
- b) Phaeochromocytomas can be associated with neurofibromatosis.
- c) The sole use of beta-blockers should be avoided as a hypertensive crisis can be precipitated.
- d) After surgical resection of a lesion, regular monitoring of blood sugar is advised.
- e) The best imaging modality for localization of lesion is an ultrasound scan of the abdomen.

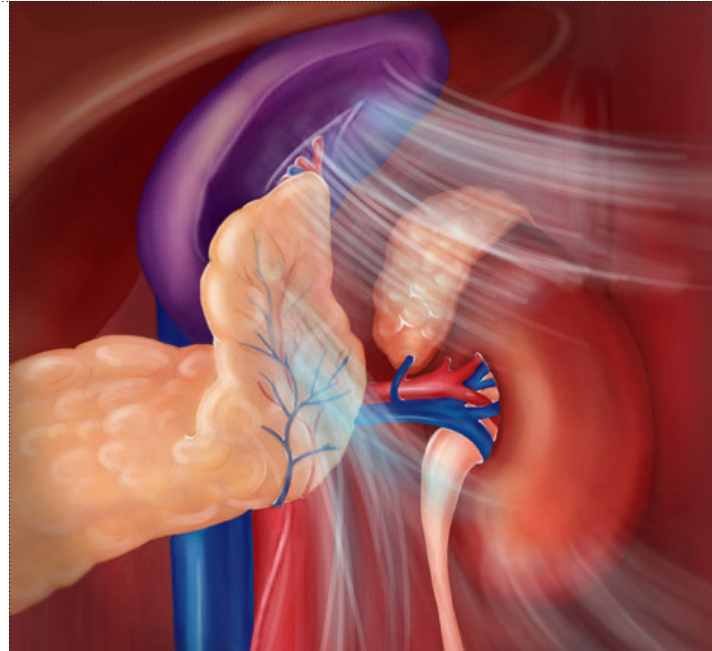
Answers

1. c.

Twenty-four hour urine catecholamines or plasma metanephrines can be used with sensitivity 97% and a specificity of 98%.

2. e.

CT mostly used to localize the lesions. MRI scans are performed if CT is contraindicated. After this, functional imaging (MIBG) is performed.



References

1. Young WF, Jr Endocrine hypertension: Then and now. *Endocr Pract.* 2010;16:888-90
2. DeLellis RA, Lloyd RV, Heitz PU, et al, eds. World Health Organization Classification of Tumours: Pathology and Genetics of Tumours of Endocrine Organs. 3rd ed, vol 8. Lyon, France: IARC Press; 2004
3. Pacak K, Eisenhofer G, Ahlman H, et al. Pheochromocytoma: recommendations for clinical practice from the First International Symposium. October 2005. *Nat Clin Pract Endocrinol Metab.* 2007;3(2):92-102.
4. Francis IR, Korobkin M. Pheochromocytoma. *Radiol Clin North Am.* 1996;34:1101-1112.
5. Welbroun B. Phaeochromocytomas in 72 patients: clinical and diagnostic features, treatment and long term results. *Br. J. Surg.* 1979; 66,456-65.

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