PATIENT CHALLENGES

The first patient you see is a 63-year-old man who was admitted to your ICU after an emergency procedure for a ruptured abdominal aortic aneurysm (AAA). He was on an angiotensin II receptor antagonist because of hypertension, and suffered a transient ischaemic attack one week before admission.

The surgical procedure was uncomplicated, and two units of red blood cells were administered intraoperatively. On admission to the ICU, the patient was haemodynamically stable but still intubated because of hypothermia.

The patient was extubated a few hours later. At that time a right-sided hemiparesis became apparent. A CT scan of the brain showed no abnormalities, and the clinical situation gradually improved.

Learning issues

Epidemiology of abdominal problems

One day after surgery, the patient became progressively dyspnoeic, and he expectorated purulent sputa. His temperature rose to 38.9 °C. The chest X-ray is below.

Learning issues

Radiological assessment and imaging techniques

PACT module on Clinical imaging

Q  What is your diagnosis?

Learning issues

Organ supportive therapy – respiratory

PACT module on Respiratory failure
Given the purulent secretions, the patient was diagnosed as having pneumonia, and cefuroxime i.v. was started.

Three days post surgery, C-reactive protein (CRP) levels increased to 40 mg/dl, and the patient started complaining of severe abdominal pain.

Q  What abdominal complications may occur after aortic surgery?

Learning issues

Complications

Q  What diagnostic tool(s) would you use in this setting?

Learning issues

Colonoscopy (1)

Colonoscopy (2)

Colonoscopy revealed ischaemic changes in the distal colon (see figure).

The patient was taken to the operating room (OR). At laparotomy, the sigmoid colon was ischaemic and perforation had occurred, with resulting diffuse peritonitis. A sigmoidectomy was performed with a terminal colostomy on the descending colon.

Learning issues

Laparotomy (1)

Laparotomy (2)

Peritonitis (1)

Peritonitis (2)

Note  Gastrointestinal ischaemia is an emergency. Prompt surgical exploration is mandatory.
Postoperatively, the patient remained ventilated because of the associated pneumonia, but the other organ systems functioned normally. Inflammatory parameters gradually improved. Antibiotics were switched to piperacillin-tazobactam.

Two days later, 600 ml of fresh blood was evacuated from the colostomy, which looked ischaemic. Clinical examination revealed diffuse abdominal tenderness, with guarding and rebound tenderness. Laboratory results showed a WBC count of 23 400, and a C-reactive protein of 35.6 mg/dl.

Learning issues

- Antibiotic treatment
- Clinical examination
- Laboratory assessment

What approach would you suggest at this stage: operation, endoscopy or other imaging techniques?

Learning issues

- Laparotomy (1)
- Laparotomy (2)

The patient was reoperated, and intra-operatively, a new large bowel perforation was found. The colon was further resected up to the midtransverse colon, and a new colostomy constructed. The abdomen was closed, and an on-demand laparotomy approach preferred.

Postoperatively the patient needed vasopressor support, and progressively he became oliguric, and platelets decreased to 80 000/mm$^3$. Because of the recurrent haemorrhage, administration of rhAPC was not considered. Enteral nutrition was started via the nasogastric route at 20 ml per hour.

After three days, vasopressor support could be stopped, the bilateral infiltrates had subsided, and renal function had recovered. The patient was extubated one day later.

The abdomen, however, remained grossly distended, and bowel sounds were absent. The patient did not tolerate enteral feeding, and complained of nausea. IAP remained stable around 9 mmHg.

Note: Close interaction with the surgeon is essential in the management of abdominal complications.

Learning issues

- Organ supportive therapy – renal
- Nutrition (1)
- Nutrition (2)
How would you assess the bowel function in this patient?

A few days later, fluid stool began to evacuate from the colostomy, and the patient complained of cramping pain.

What technical examination would you request?

Microbiological testing for Clostridium difficile toxin – ordered by the attending physician – was negative. The patient received antibiotics for seven days after the last surgical intervention.

Oral feeding was started in the next few days, and was well tolerated. Three days after antibiotics were stopped, spiking fever developed, and inflammatory parameters rose sharply.

What complication would you expect in this patient?

Clinical examination showed a normal wound, and the abdomen was not painful. Chest auscultation revealed diminished breath sounds on the left side. CT scan showed a left subdiaphragmatic abscess, and reactive pleural effusion. The abscess was drained percutaneously under CT guidance. Intravenous levofloxacin and metronidazole were started, the drain was rinsed three times daily with 20 ml saline. The patient's condition continued to improve and the drain was removed five days later. He was discharged from the ICU the same day.
The second patient on your rounds is a 67-year-old woman with a history of colon carcinoma. She was admitted to the accident and emergency department with a one-week history of intermittent abdominal pain, nausea and vomiting. She complained of worsening pain after meals. One year before admission she was treated with a right hemicolectomy followed by chemotherapy (last session five months earlier). She has a Body Mass Index (BMI) of over 30 and has a known history of severe COPD, insulin-dependent diabetes, Child–Pugh class A alcoholic cirrhosis and ischaemic heart disease.

Clinical examination shows an obese woman with stable haemodynamic parameters, a blood pressure of 120/80 mmHg and a regular pulse at 90 bpm. There is a fever of 39 °C with chills. Breath sounds and respiration are normal. The abdomen is distended and painful without signs of peritonitis. Rectal examination is normal. Examination shows shifting dullness with positive fluid wave test, suggesting the presence of ascites. Full blood analysis shows a slightly elevated leukocytosis with left shift and raised CRP. Serum creatinine is 106 µmol/l (1.2 mg/dl).

Blood and ascites cultures taken on admission grew E. coli, hence confirming the diagnosis of SBP. Despite this and adequate intravascular fluid resuscitation, the patient remains febrile with nausea, vomiting and worsening abdominal pain.
Given the patient's history with previous abdominal surgery and chemotherapy what should you exclude?

What would be your next step to confirm this diagnosis?

Abdominal X-ray shows no free air but signs of small intestine occlusion with multiple centrally located air-fluid levels. The CT scan confirms the diagnosis of intestinal occlusion and she goes straight to the OR. Explorative laparotomy confirmed the small bowel obstruction due to adhesions from previous interventions. She is postoperatively re-admitted to the ICU for overnight observation.

In view of her history, obesity and current problems, what complication in the abdomen might you expect to develop?

The intra-abdominal pressure (IAP) is measured via a urinary bladder catheter and the first IAP value is around 6 mmHg. Although initially stable, she develops hypotension which is treated with fluid resuscitation and noradrenaline infusion. She complains of worsening abdominal pain and shortness of breath. She gets agitated and pulls out her nasogastric tube. Respiratory rate is 30/min. Clinical examination reveals inspiratory and expiratory wheezing with use of accessory muscles.

Non-invasive ventilation is applied because of progressive deterioration, and 12 hours later, she develops asystole. Resuscitation is promptly initiated, the patient is intubated, and is stabilised shortly after.
Colonoscopy revealed ischaemic changes in the distal colon (see figure).

Urgent chest X-ray and abdominal X-ray (figure) showed correct endotracheal tube positioning, no pneumothorax, but also massive gastric distension. The IAP at that time was 23 mmHg.

Thinking of simple measures first in the treatment of IAH!

The high IAP value, together with the underlying organ dysfunction was compatible with the diagnosis of ACS. A nasogastric tube was immediately inserted. This resulted in an almost instantaneous resolution of the intra-abdominal hypertension with a normalisation of IAP from 23 to 7 mmHg, and resolution of the respiratory problems. One hour later, the patient was stable on FiO$_2$ of 0.4.

The patient's condition gradually improved, and she could be extubated one day later. In the next few days, inflammatory parameters improved, however she does not tolerate enteral feeds (gastric residuals above 400 ml). Despite the use of prokinetics, the patient could not be enterally fed. A nasojejeunal tube
is placed endoscopically and jejunual feeds are started. However progressive abdominal distension is observed.

What could be the cause of the abdominal distension and intolerance for enteral feeds?

Learning issues

Managing complications – ileus

This abdominal X-ray shows normal volume of small intestines but dilated colon consistent with colonic pseudo-obstruction or Ogilvie syndrome. Treatment with neostigmine intravenously is started after ensuring no obstruction was present, which resulted in an almost instant regression of the colon diameter.

What are other options for treating the Ogilvie syndrome in this patient?

Learning issues

Managing complications – colonic pseudo-obstruction

When the situation seemed to be improving, the patient's condition deteriorated again with all the signs and symptoms of septic shock. An abdominal CT scan to look for peritonitis or abscesses shows unexpectedly diffuse mesenteric ischaemia as evidenced by pneumatoses coli, and ischaemia of the liver (figures below).
At laparotomy, the ischaemic large bowel was resected, and liver ischaemia was noted. Postoperatively, liver function further deteriorated, with ASAT and ALAT at 3000 and 6000 IU/ml respectively, and prolonged prothrombin time. The patient had become anuric in the meantime and rapidly died of multiple organ failure.

The third patient is a 65-year-old man who developed acute abdominal pain, distension and weakness in the lower limbs. He was transported haemodynamically unstable from the emergency department (ED)
to your ICU by a young colleague on duty. On clinical examination the patient was in shock with a
distended abdomen.

Learning
issues

*Clinical assessment – abdominal pain*
*Haemodynamic alterations*
*Clinical examination*
*PACT module on Basic clinical examination*

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**Q** How can you further assess the abdominal distension?

>>> Is clinical examination enough to evaluate abdominal distension?

**Q** Given the history of this patient with the acute onset of his symptoms together with the
weakness in his legs, what is the most likely diagnosis and what diagnostic tests would you
perform?

Learning
issues

*Assessment of intra-abdominal pressure*
*Epidemiology of abdominal problems*

Normally, ruptured abdominal aneurysms are accompanied by retroperitoneal haemorrhage but in this
case there is also blood observed in the peritoneal cavity.

Bedside abdominal ultrasound showed free fluid around the liver and spleen and an abdominal aneurysm
of 7 cm. The patient was immediately taken to the operating room (OR). The aneurysm was repaired, but
coaegulopathy, acidosis and hypothermia complicated the procedure.

Learning
issues

*Radiological assessment and imaging techniques*
*PACT module on Clinical imaging*
What is the most feared complication in this patient?

Intra-abdominal hypertension

To avoid development of abdominal compartment syndrome (ACS), the patient's abdomen is left open and a plastic intravenous bag (a so-called 'Bogota bag') is sewn to the patient's skin as a temporary abdominal closure.

The patient is then transferred to the ICU for rewarming and ongoing resuscitation.

How should you monitor this patient in the ICU?

Monitoring of intra-abdominal pressure

Measuring abdominal perfusion pressure

How would you measure the IAP?
In the ICU, the patient remains hypotensive with elevated arterial lactate levels and low urinary output. His heart rate (HR) is regular at 150 beats per minute (bpm) and the postoperative IAP was 14 mmHg.

A volumetric pulmonary artery catheter is placed to guide the patient's management. The initial haemodynamic profile was consistent with profound intravascular volume depletion as a result of his haemorrhagic shock. Urine output (UOP) was 10 ml/hr.

Aggressive resuscitation using crystalloids and blood products was started to both increase the patient's intravascular volume as well as correct the patient's coagulopathy. He initially responded appropriately to volume administration with increased CI, decreased HR, increased right ventricular end-diastolic volume index (RVEDVI), and a trend towards improved UOP. However respiratory function deteriorated with hypercapnia, hypoxia and difficult ventilation with increased alveolar pressures (peak and plateau), while IAP was 26 mmHg.

What do the patient's increasing IAP and peak inspiratory pressures suggest?

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**NOTE**  
IAH can recur in patients with open abdomen treatment. Continued IAP
Monitoring is essential in these patients.

Learning issues

- Abdominal compartment syndrome (1)
- Abdominal compartment syndrome (2)

What is the appropriate treatment now?

Note: Mortality from ACS is directly correlated with the rapidity with which decompressive laparotomy is performed. Delays of even 30-60 minutes can make the difference between life and death for these patients. Diuretics are contraindicated as this will only worsen systemic perfusion.

Given the severity of the patient's physiological derangements, a decision was made to re-explore the abdomen in the ICU. The surgeon drained about 1500 ml of blood, and ligated several bleeding vessels. A vacuum-assisted closure technique was installed, and bleeding stopped.

Learning issues

- Laparotomy (1)
- Laparotomy (2)

Vacuum-assisted fascial closure

Organ dysfunction gradually improved, and the abdomen could be closed five days later. The patient was discharged from the ICU shortly thereafter.

Learning issues

- Management and support of the patient with an open abdomen
- Recognising the patient at risk
Your fourth patient, a 72-year-old lady has undergone a Hartmann's procedure (sigmoidectomy and terminal colostomy) for an obstructing sigmoid carcinoma. She is admitted to your intensive care unit as shown in the figure below.

What information do you want with her admission?

Learning issues

How to assess the patient

The anaesthesiologist confirms that the operation was difficult, with extensive inflammation in the abdomen. The patient was on oral medication for diabetes, and admitted to the hospital only hours before the operation.

Now that the patient is in the ICU, you note the vital signs (figure below): the heart rate is 70, mean arterial pressure 84, CVP 19, intra-abdominal pressure 23 and oxygen saturation is 98%.

Learning issues

Calculation of filling pressure when IAP present

Transmural CVP
Are you satisfied with her present status?

If we look closely at the patient, we can see there is a potential problem (see figures below)

First of all, what do you notice that would make you concerned?

How are you going to assess this patient for potential intraabdominal problems?

Learning issues

Organ supportive therapy

Abdominal compartment syndrome (1)

Abdominal compartment syndrome (2)

How to assess the patient

NOTE Always perform a thorough clinical examination of the abdomen as a first step in patients after abdominal surgery.

What additional examinations do you want in this patient?

Learning issues
The status of this patient now at 14 hours following surgery, is that her airway pressures have increased to 35 cmH\textsubscript{2}O, her arterial pCO\textsubscript{2} is 52 mmHg, PO\textsubscript{2} is 74 mmHg on FiO\textsubscript{2} of 80% with a PEEP of 10 cmH\textsubscript{2}O. Her mean arterial pressure has fallen to 68, and her urinary output has decreased. The intra-abdominal pressure is now 22 mmHg.

**Q** How are you going to manage this patient?

*Learning issues*

*Managing complications*

**Abdominal compartment syndrome (1)**

**Abdominal compartment syndrome (2)**

**NOTE** Organ dysfunction in these patients is often further compromised by administering fluids, leading to tissue oedema, and secondary ACS.

In discussion with the surgical team, it transpires that during the operation, there was an extreme thickening of the bowel, with ischaemic points, which were felt to be of a minor nature, in her colon. It was decided that the colon was viable and a Hartmann's colostomy had been performed.

Digital exploration and passage of a flatus tube by the surgeon does not produce any gas release. The patient's IAP has now increased to 32 mmHg despite non-surgical therapies.

**Q** Do you think this patient needs another operation? On what arguments would you base your decision for surgical reintervention?

*Learning issues*

*Management of intra-abdominal hypertension*

**NOTE** Unnecessary additional laboratory and imaging examinations often delay adequate therapy in patients with intra-abdominal problems. Close communication with the surgeon is essential.
Q What specific instructions would you advise the anaesthesiologist of during handover?

Learning issues

 관한 module on Communication skills

At surgery her entire large bowel was resected where there was frank necrosis of the transverse colon, an ileostomy was formed. After resection the pressure within the abdomen was relieved allowing the abdominal wall to be closed. The IAP was measured after closure, and was 14 mmHg.

Learning issues

 관한 module on Communication skills

Q Was it advisable to close the abdomen in this patient? Give your reason.

Further surgery was not anticipated in this lady as there was no intra-abdominal sepsis and hence the probability of a third laparotomy would be unlikely.

The patient returned to intensive care and during a stormy 24-hour period required significant fluid resuscitation with a positive balance of 3.8 litres of crystalloid. Her renal function was maintained clinically, although biochemically her urea increased to 12.8, and creatinine to 216. Her liver function became slightly abnormal, and she was commenced on enteral feeding, 20 ml per hour via nasogastric tube.

She eventually was discharged from the ICU on day eight and home on day 19.

NOTE Despite significant intra-abdominal problems, the enteral route can be used if anatomically intact.

On reflection, you were presented with challenging cases demonstrating the diversity of abdominal problems in the ICU, and the need for an individualised approach.

Close cooperation with the surgeon, and other specialties is important for successful management of these often-complicated cases

Q Thinking about the management of these patients, what are the key issues in the management of intra-abdominal problems?