Pneumoperitoneum after PTC stent dislodgement

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Learning objectives

The presence of severe abdominal pain and free intra-abdominal gas usually indicates sinister pathology. After percutaneous transhepatic cholangiography (PTC) and biliary intervention, such signs would raise the question of bowel perforation or even transgression of lung though both are uncommon. Here we present a case with a more rare cause for pneumoperitoneum.
Background

Percutaneous transhepatic cholangiography (PTC) involves injection of contrast to opacify bile ducts. It is usually performed for patients who fail or are inappropriate for endoscopic retrograde cholangiopancreatography (ERCP). It provides many management options for a broad spectrum of biliary tract disorders (1).

Percutaneous cholangiography was first reported by Burckhardt and Muller in 1921(2). Biliary drainage was introduced by Molnar and Stockum in 1974(3) and over time, non-surgical management of pathology relating to biliary ducts has eclipsed surgical management which, at the time had complication rates ranging from 15 to 60%. The reported complication rates of percutaneous biliary interventions vary in the literature, and depend on the procedure(s) performed and the patient's health and biliary pathology.

It is generally accepted with cholangiography that there is a combined 2% risk of complication (sepsis, cholangitis, bile leak, haemorrhage, or pneumothorax). This rate rises to 2.5% with percutaneous transhepatic biliary drainage (sepsis 2.5%, haemorrhage 2.5%, inflammation/infection 1.2%, pleural 0.5% and death 1.7%). This risk is slightly higher yet again with percutaneous cholecystostomy, 2.9% risk of inflammation/sepsis and 1.6% chance of transgressing adjacent structures (4,5,6). Patients with stones, coagulopathies, cholangitis or proximal obstruction will have a worse outcome. Unfortunately it is not unheard of to have seeding of metastases along the percutaneous tract as well (7). This risk is minimised when procedures are performed by experienced staff and their impact lessened by predicting their occurrence. In order to reduce the risk of cholangitis, decompression of the bile duct prior to instrumentation is recommended, as is the use of antibiotics (8).

Pneumoperitoneum is mostly commonly seen post operatively, after laparoscopy and laparotomy. In non-operative patients, 90% of pneumoperitoneum is due to intra-abdominal viscus perforation (9). The remaining 10% of pneumoperitoneum is due to thoracic, genitourinary tract and miscellaneous other causes. A thorough history and physical examination may prevent an unnecessary laparotomy in certain patients.

A rare complication of pneumoperitoneum is tension pneumoperitoneum. Like tension pneumothorax, this is a clinical emergency and must not be missed. It responds to emergency needle/catheter decompression but the definitive treatment is usually surgical. Pneumoperitoneum should always be considered in patients with severe abdominal pain, bloating and haemodynamic instability post percutaneous intervention (10).
Imaging findings OR Procedure details

A 58 year old male with known non-operable adenocarcinoma of the pancreatic head and bi-lobar liver metastases presented with new onset jaundice, obstructive liver function tests and coagulopathy. He was undergoing chemotherapy at the time. After failed ERCP, percutaneous biliary drainage was requested.

A right lateral puncture was performed and right ducts accessed. Obstructed mid segment of common bile duct was visualised. This was negotiated and duodenum catheterised. After pre dilation with a 5 mm balloon catheter, a 10 mm diameter 90 mm long Wallstent was placed in satisfactory position with its downstream end just within the duodenum. The stent was post dilated with an 8 mm diameter 40 mm long balloon (Fig. 1 on page 7) and A 10.2 French internal/external biliary drain was placed with its loop in duodenum (Fig. 2 on page 7) and catheter capped. The purpose of this drain was to afford ready access to the biliary tree in the event of a post stenting complication such as obstruction by blood clot.

The post procedure plan was for cholangiography in 1 week with a view to removing the internal/external drain and embolising the access tract with gelfoam. However, the next day while straining at defaecation the patient developed sudden onset 10 out of 10 right upper quadrant abdominal pain. A CT abdomen was ordered and reported by the on-call Radiology Registrar. No obvious cause for sudden deterioration in patient status was identified by this Registrar or the Radiology Fellow.

The patient was then taken for diagnostic laparoscopy and washout. Bile was found in the right upper quadrant, as were adhesions between the liver and anterior abdominal wall, duodenum and stomach. A bowel run revealed no perforation. Due to the metastatic nature of the disease, the patient was washed out and 2 Jackson Pratt drains were inserted. Upon morning Radiology consultant review of the pre-surgery CT scans (Fig. 3 on page 8), withdrawal of the internal/external biliary drain with formation of a loop between liver capsule and abdominal wall was appreciated.

The patient then attended the angiography suite where it was clear that despite the loop of the pigtail catheter being formed, the catheter had migrated proximally so that the loop lay within the cranial segment of stent and proximal holes lay outside the liver (Fig. 4 on page 9). Fortunately the formed pigtail loop of the catheter afforded some purchase so that the catheter loop between liver and abdominal wall could be straightened. Using a stiff Glide wire for support the drainage catheter was pushed through the stent to the duodenum (Fig. 5 on page 10). The catheter was then removed over an Amplatz wire and a 7 French haemostasis sheath introduced. Cholangiogram demonstrated good
antegrade flow through the in situ biliary stent into the duodenum (Fig. 6 on page 11). The catheter track was then embolised with multiple gelfoam pledglets.

Pneumoperitoneum is relatively rare in PTC, and though bowel perforation must be avoided, it is usually attributed to transhepatic duodenal gas or percutaneous tract leakage (11, 12). This case involved a retracted tube which is yet to be reported in the literature as a cause of pneumoperitoneum. Although there was no apparent peritonitis, A CT was warranted due to severe abdominal pain and status post PTC. The abdominal pain would be due to air, bile or small bowel contents (13) forced into the peritoneal cavity by raised intra-abdominal pressure during defaecation.

Pain following a percutaneous interventional procedure needs to raise red flags in the mind of any Radiologist or Registrar. Here, the initial reporting of the CT scan missed the opportunity to diagnose the catheter malposition and free gas. There was a failure to escalate. The on-call Interventional Radiologist should have been contacted. The first query by both the Registrar and Fellow should have been about the position of the tube and if there was any leakage around it. A plain film would have revealed the tube position. Instead the surgical team was left in control of the patient. An urgent return to the angiography suite could well have saved unnecessary surgery and associated surgical and anaesthetic risks.

A Radiology curriculum dictating greater exposure to interventional procedures and complications is suggested. Furthermore, to assist during review, images obtained during a procedure should be formatted so that the last image demonstrates the final position of a stent and any remaining drainage catheter. With the current trend towards fluoroscopic image capture, a crucial image showing completion status may be lost within a host of other images.

Displacement of a biliary drain with formation of loop between the liver capsule and abdominal/chest wall is assumed to be related to hepatic respiratory excursion (14). This case suggests the forces involved can be substantial. This kind of loop presents a particularly difficult situation for the interventional radiologist. Pulling on the tube or attempting to pass a wire through it will often completely displace it from the biliary tree before straightening the loop. Thus ready access, the whole point to leaving the tube in place is lost. The authors suggest the technique of skewering the tube to pull the loop out as suggested by Budak and Zealey in 2012(15). This avoids the need for a second puncture and the associated complications of further instrumentation.

This case also raises the question of whether the internal/external drain needed to be left in place. There is controversy as to whether it is appropriate at all (14). Here the drain that was left in place to deal with complications itself caused complications.
Fig. 1: Dilation of 90 mm long Wallstent with 8mm diameter 40mm long balloon

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**Fig. 2:** 10.2 French internal/external biliary drain in duodenum with catheter capped

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Fig. 3: CT Abdomen showing cranial segment of tube loop with fluid and pneumoperitoneum around liver capsule

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Fig. 4: Migrated biliary drain with curled tail in proximal stent and holes present outside hepatic tract inside abdomen. Note the extra length of drain inside the abdomen next to the liver capsule and leak of contrast into abdominal cavity through migrated biliary drain.
Fig. 5: Biliary drain repositioned in duodenum

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Fig. 6: Contrast injection showing patent biliary stent post removal of biliary drain

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Conclusion

This case highlights the need to escalate when patients are unwell and the need to educate and expose Radiology Registrars to interventional procedures.
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