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Post-intervention complications and management: Following percutaneous catheter drainage

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ABSTRACT

The role of an interventional radiologist in the care of the patent with pancreatitis is twofold – as a diagnostician and as an interventionalist. The diagnostic part includes the role in the diagnosis of pancreatitis, the possible etiology, and associated complications if any. From the therapeutic point of view it includes the management of the various vascular and non-vascular complications of pancreatitis. With increase in the percutaneous management of pancreatitis associated collections, it is prudent to be well versed with the complications that may be encountered. This article focusses on the various complications secondary to percutaneous management of collections in pancreatitis and the management options that are available at the interventional radiologist's disposal. The complications are discussed under different sections including access-related, catheter-related and other non-vascular complications.

Introduction

Pancreatic fluid collections secondary to acute pancreatitis are one of the most common referrals to the interventional radiologist for percutaneous drainage. Percutaneous catheter drainage (PCD) has been in practice for a few decades now and is one of the most commonly performed procedures in the IR service on a daily basis. As more and more cases of acute pancreatitis continue to be managed with minimally invasive techniques, complications related to these interventions will be encountered more frequently. Necrotic fluid collections are usually drained when there is an obvious encapsulation around them. However, drainage of these collections early during the course of disease has gained momentum in recent years [1]. The PANTER study established the safety of minimally invasive step-up approach over open necrosectomy [2]. Percutaneous drainage or endoscopic drainage of necrotic collections is the first step in this approach. Percutaneous drainage is carried out by placing the catheters in the dependent part of the collection and may utilize multiple number of catheters. The complications secondary to percutaneous interventions may be a result of a number of factors like deep-seated collections, unsafe access window due to overlying bowel or vessels, fragile surrounding tissues as a result of profound inflammation. All these factors combine in creating a hostile environment for any planned intervention.

A thorough search of PubMed, Medline and other resources was done using keywords like 'pancreatitis', 'percutaneous drainage complication', 'catheter drainage complication', 'percutaneous interventions', 'collection drainage', 'image guided catheter drainage'. A total of 373 articles related to percutaneous drainage in pancreatitis were identified from 2000 to 2023. Although there is enough evidence supporting the role of percutaneous image-guided and other minimally invasive interventions in acute pancreatitis, there is scarcity of literature discussing the complications of percutaneous catheter drainage in this scenario. This is a narrative article discussing the various complications and their management secondary to percutaneous catheter drainage in acute pancreatitis.

The complications associated with PCD can be grouped intocatheter-related, access-related, non-vascular and vascular complications.

Catheter-related complications

These include catheter dislodgement/migration, pericatheter leakage, catheter breakage or catheter blockage. Catheter dislodgement occurs mostly due to poor handling of the catheters during patient shifting or due to inadvertent movements by the patient. Accidental catheter dislodgement has been reported to be up to 9 % for non-vascular catheters [3]. The management of dislodged catheters includes re-insertion of catheter through a fresh access point or attempt access through the original track in case the track has matured. Reinsertion of catheters through the original track is usually more successful in catheters with a longer indwelling time and in those where the reinsertion is taken

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up early before the track heals [4]. Rarely the catheter may fracture, and a fragment may be retained (Fig. 1). In such scenarios, every attempt to retrieve the fragment, either surgically or otherwise, must be undertaken. Catheters draining viscous or bloodstained materials are more prone for blockage. The blockage can usually be cleared by injecting warm saline with force [5]. Daily saline flush and active aspiration usually prevents blockage from occurring. In case saline flush alone does not relieve the blockage, probing with a guidewire may help. It is to be noted that the probing and manipulation of catheters should always be done under fluoroscopic guidance. Pericatheter leakage occurs due to malpositioned or blocked catheters. Upsizing the catheter usually solves this problem.

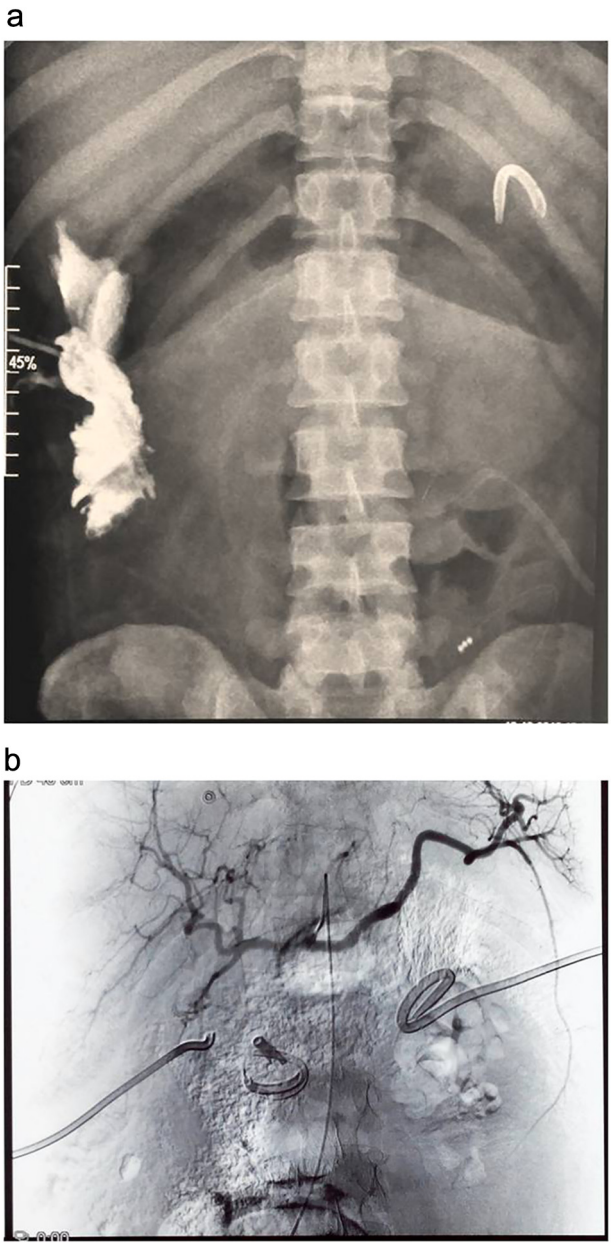

Fig. 1. 36 year male with acute pancreatitis, post PCD. X-ray abdomen AP view obtained during a tubogram shows the broken-off tip of a pigtail catheter in the left hypochondrium. This had to be removed surgically. 1b). 41 year male with acute necrotizing pancreatitis post PCD in bilateral anterior pararenal spaces developed bloody discharge after 2 weeks from the catheter on the right side. DSA run of the coeliac artery shows broken-off tip of the right-sided catheter (in two fragments). However, no pseudoaneurysm or active extravasation of contrast is seen. The catheter was removed with close monitoring of the patient. Subsequently, the fragments of the tips were removed during surgical necrosectomy.

Access-related complications

Access-related complications include pain at the access site, inadvertent bowel transgression, catheter buckling, skin excoriation at access site. Pain at the access site is usually self-limiting and rarely needs any intervention. In case of access inferior to rib margin, the pain can be due to irritation of the intercostal nerves and this is managed with analgesics. Skin excoriation at the access site is due to irritation of the skin by the gastric or pancreatic secretions. This can be prevented by keeping the site clean and dry with regular dressing. Inadvertent bowel transgression can occur with any abdominopelvic drainage. The location of the pancreatic fluid collections in the lesser sac and other retroperitoneal locations imply more risk of bowel perforation or subsequent fistula formation. While puncture with a small 21 G needle usually does not itself result in any symptoms, the subsequent track dilatation or catheter placement may result in significant morbidity.

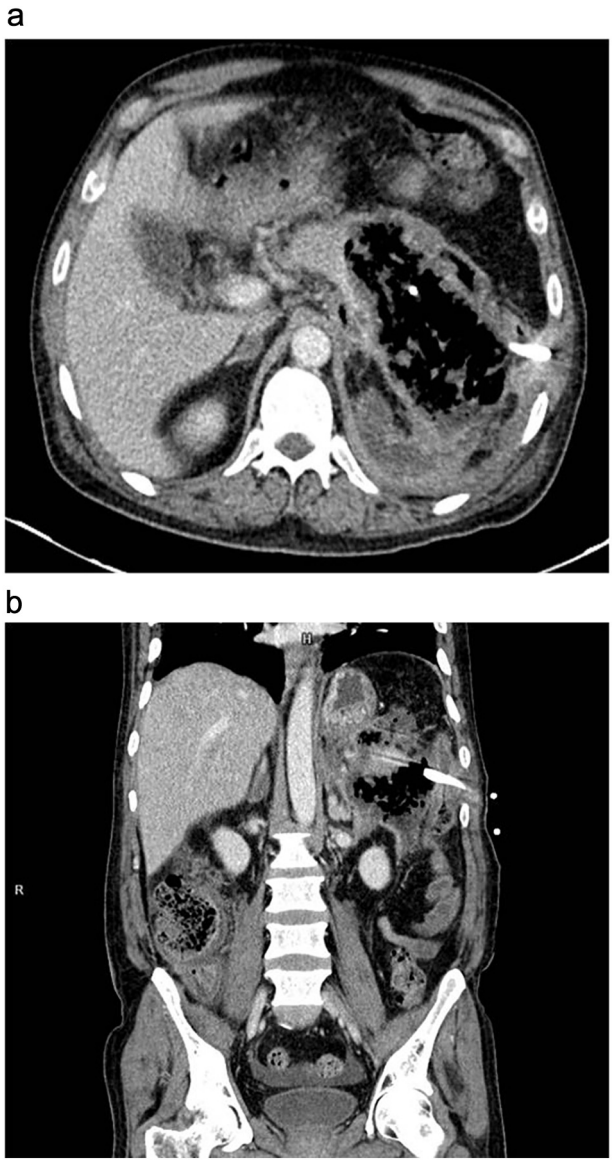

Fig. 2. 36 year male with acute necrotizing pancreatitis, post PCD placement. Follow-up CECT a). Axial and b). Coronal reformatted images demonstrate transgression of the Splenic flexure by the PCD. A fresh PCD was placed using a more posterior approach under CT guidance and this catheter removed in a graded manner.

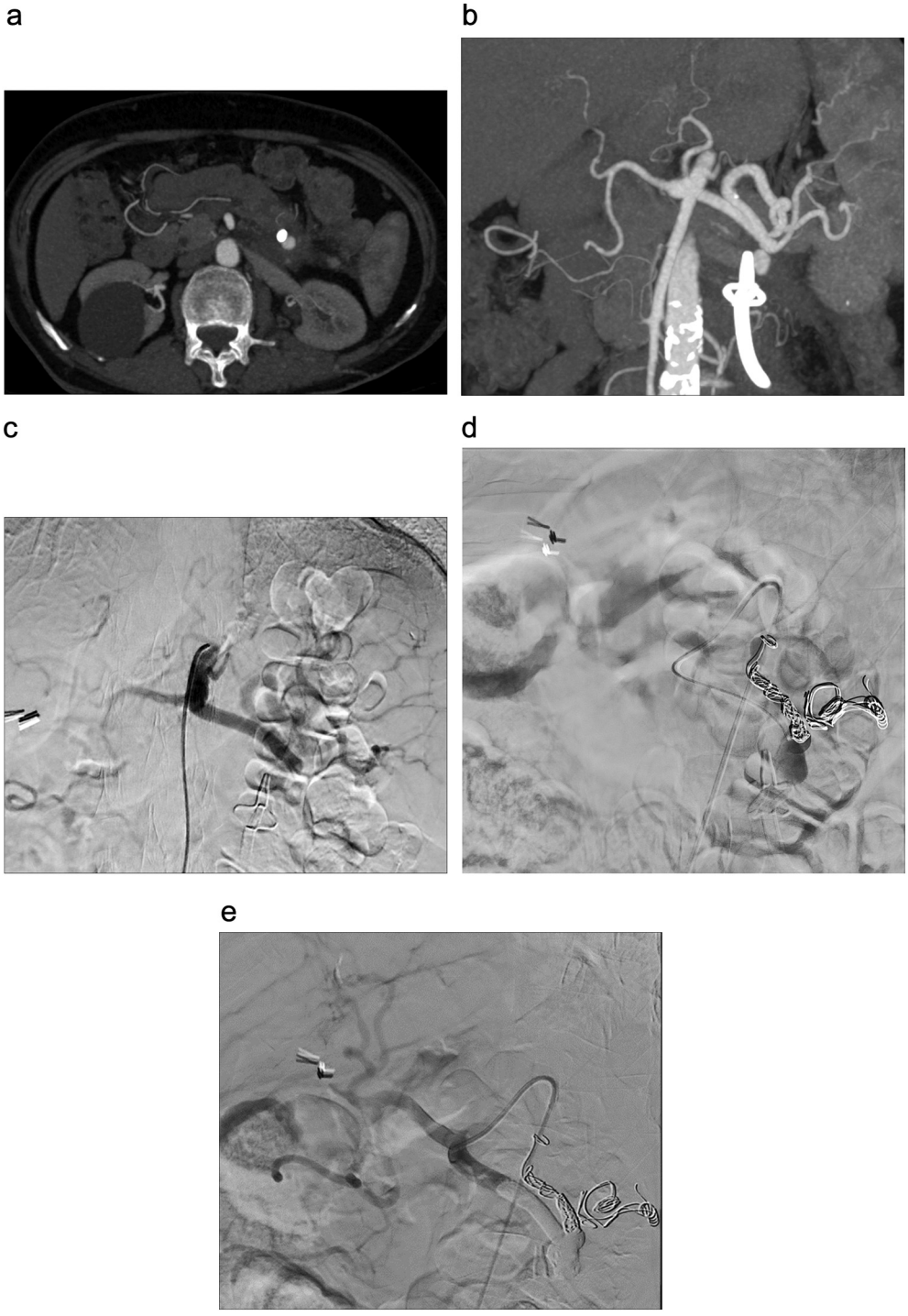

Fig. 3. 29 year female post cholecystectomy with acute pancreatitis, status post PCD. PCD was upsized to 14F malecot catheter, following which, the patient developed melena with hypotension and falling hematocrit. CT Angiography a) axial and b) multiplanar MIP images demonstrate a tortuous splenic artery with a large pseudoaneurysm arising from its inferior aspect with no active contrast extravasation. The tip of the malecot catheter is seen in close apposition to the pseudoaneurysm. The patient was taken up for angioembolization. c). DSA run of the celiac artery confirms the pseudoaneurysm. d). Splenic artery run after packing of the artery distal to the pseudoaneurysm with coils. e). Splenic artery run after glue embolisation shows the glue cast with no filling of the pseudoaneurysm.

Non-vascular complications

Bowel fistulas are a known complication of percutaneous catheter drainage which can occur either due to direct puncture or due to constant pressure of indwelling drains [6]. The reported incidence of gastrointestinal fistulas in patients undergoing the step-up approach is around 9–14% [2,7,8]. Local complications like acute necrotic collections and walled-off necrosis occur due to inflammatory process. Infected fluid under high pressure may lead to compression and erosion of the adherent, inflamed surrounding bowel resulting in perforation and fistula formation. The inflammatory process can also result in thrombosis of the middle colic artery and lead to ischemia and necrosis of the affected bowel wall with resultant fistula formation [9]. Longer indwelling time of catheter correlates with fistula formation [7,10]. Most of these are colonic fistula ranging from 45 % to 70 % of the cases [7,8,11]. This may be due to the fact that the colon lies in close proximity to the

collections in the lesser sac and paracolic gutters (Fig. 2). Conservative approach is successful in most of the cases of colonic fistulae [12]. A conservative approach involving graded withdrawal of catheters with maintenance of nutrition is practised in cases with no overt signs of peritonitis [7].

Vascular complications

The incidence of PCD-related bleeding has been variably reported from 4 to 14 %. It can be due to direct injury of vessel during puncture or erosion by an indwelling catheter. The spectrum of vascular injuries includes pseudoaneurysm, vessel laceration, arteriovenous fistula. It is important to remember to obtain follow-up imaging before moving or removing the catheter in case of bleeding. A CT angiography of the abdomen is the investigation of choice in cases presenting with bloody output from the catheter. Premature removal from a large vessel can result in catastrophic escalation in bleeding. In general, bleeding from small vessels is usually self-limiting and can be managed conservatively with fluid resuscitation, blood transfusion and active monitoring. Temporary capping, upsizing, or repositioning of the catheter may tamponade acute bleeding, but persistent bleeding from small vessels, pseudoaneurysms, or fistulae may require treatment with transcatheter embolization. Temporary capping of the catheters will elicit a tamponade effect on the active bleed till further measures are undertaken. In haemodynamically stable patients with pseudoaneurysm or active leak, endovascular embolization can be taken up after initial resuscitation. Endovascular embolization (Fig. 3) is generally considered the preferred approach to managing hemorrhage in acute pancreatitis patients [13]. In the event of a large-vessel laceration or haemodynamic instability, a surgical consult should be obtained and planned for laparotomy accordingly. This can be prevented by using USG Doppler guidance during catheter placement to avoid any major vessels in the path of catheter placement. The use of Seldinger technique and smaller size catheters initially with subsequent upsizing of the catheters has been suggested to reduce the incidence of vascular complications.

The Society of Interventional Radiology (SIR) quality improvement guidelines for percutaneous drainage/aspiration of abscess and fluid collections have come up with a set of suggested thresholds for various major complications [14].

Specific major complication	Reported rate (%)	Suggested threshold (%)
Septic shock	1–2	4
Bacteraemia requiring significant new intervention	2–5	10
Hemorrhage requiring transfusion	1	2
Superinfection (includes infection of sterile fluid collection)	1	2
Bowel transgression requiring intervention	1	2
Pleural transgression requiring intervention (abdominal interventions)	1	2

CRediT authorship contribution statement

All authors: Concept and design of study, data acquisition, analysis and interpretation of data, drafting the article, revision, final approval.

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Ethical approval

Since this is a review of literature with no patients comprising a study group, IRB approval was not required.

Declaration of competing interest

None of the authors have any conflicts of interest to disclose.

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