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How to perform transcystic stenting in the COVID-19 pandemic: an approach to biliary stenting without specialized endobiliary stenting equipment

Management of common bile duct (CBD) stones found at laparoscopic cholecystectomy often includes concurrent trans-cystic biliary stenting, effectively providing a conduit for CBD drainage and improving the success of subsequent endoscopic retrograde cholangiopancreatography (ERCP).[1]

In the unprecedented COVID-19 pandemic, however, disruptions to the medical supply chain have been far reaching,[2] including on the distribution of specialized biliary stent sets. To overcome this at our centre, we substituted traditional stent sets with standard, universally accessible open-ended ureteral catheters, jagwires and pancreatic or biliary stents with similar procedural success.

The patient is placed under general anaesthetic and positioned supine. The theatre table is oriented to allow placement of the fluoroscopic C-arm and laparoscopic screen on the patient's right side.

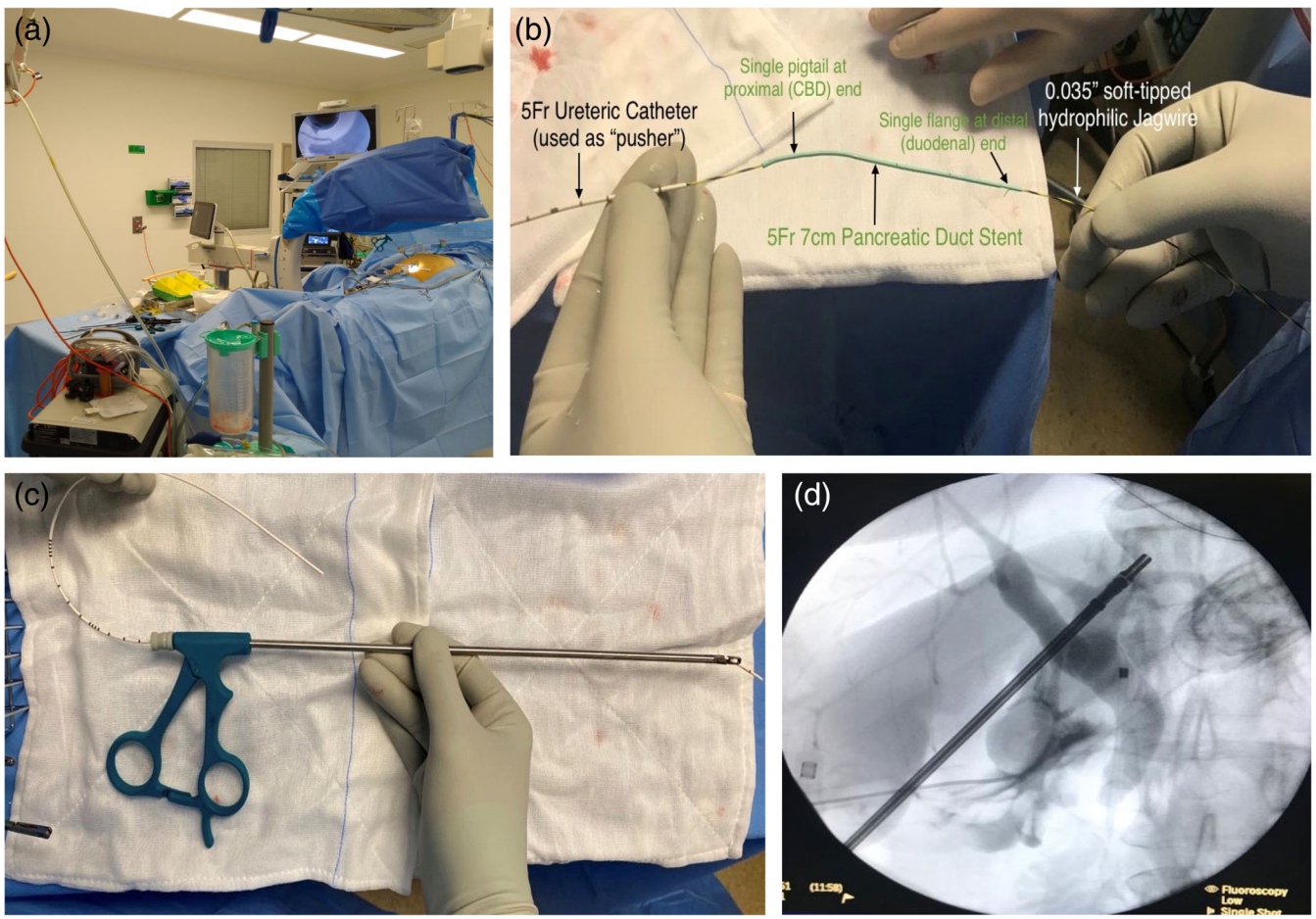

Fig 1. (a) Operative layout: This layout optimizes view and minimizes unnecessary movement. The X-ray screen and laparoscopic instruments are concurrently in full view of the primary operator. The radiographer also has sufficient space beside the C-arm for its manipulation as required. (b) In the absence of formal endobiliary stent sets, we employed a combination of a 5 French ureteral catheter, used as a pusher, 5-French 5 cm or 7 cm pancreatic stent and soft tipped hydrophilic jagwire. (c) Disposable Reddick-Olsen forcep. (d) Intraoperative cholangiogram; following deployment of the stent, the intraoperative cholangiogram confirms correct CBD stent positioning by a contrast visualization within duodenum and by thick radio-opaque pancreatic stent marker 2–3 cm distal to ampulla.

The screen is in full view of the primary operator, who is positioned on the patient's left (Fig. 1a). Lead is worn to ensure radiation protection.

Using the standard laparoscopic technique, the cystic duct is identified with the critical view of safety, incised transversely and milked to remove *in situ* stones. The cystic duct is cannulated with a 5 French ureteric catheter introduced using either Reddick-Olsen forceps (Fig. 1c) or Concord needle. The catheter is flushed with saline, followed by urograffin to delineate the biliary anatomy, including the length and tortuosity of the CBD, location of the ampulla and presence of stones.[3]

The catheter is carefully advanced through the cystic duct into the CBD and eventually, via the ampulla into the duodenal lumen. If resistance is met, an over-the-wire method is employed, using a 260 cm straight soft-tip ERCP hydrophilic jag wire. The wire is guided through the catheter and advanced at least 40 cm from the cystic duct into the duodenal lumen under fluoroscopic guidance. Adequate wire length within the duodenal lumen is critical to reduce the risk of duodenal perforation by ensuring the stent passively feeds downwards along the duodenal lumen rather than transversely into the duodenal wall. The ureteric catheter is then removed.

In place of specialized endobiliary stents, we utilize standard pancreatic stents. A 5-French 5 or 7 cm single pigtail pancreatic stent is loaded onto the wire, with the flanged end orientated distally (Fig. 1b). We found greater procedural success with the deployment of the 5 cm rather than 7 cm pancreatic stent as there is more structural integrity and manoeuvrability. The stent is advanced using the ureteral catheter as a 'pusher' (Fig. 1c). At this time, the surgeon uses one hand to retract the wire and the other hand to advance the stent into the cystic duct and through the ampulla under laparoscopic vision. Fluoroscopy is used to confirm that the single radio-opaque marker is positioned within the CBD, approximately 2 cm proximal to the ampulla. When the surgeon is satisfied with the stent's positioning, the wire can be removed. Contrast is injected via the pusher to confirm adequate contrast entry into the duodenum and visualization of the stent 2–3 cm within the duodenal lumen (Fig. 1d).[2] The ureteral catheter is then removed. Transcystic stenting is now complete, allowing for cystic duct ligation and completion of the cholecystectomy. ERCP and stone removal can subsequently be planned as a separate procedure.

In this article, we have described the operative layout, procedural equipment and technical steps required to perform transcystic stenting with universally accessible equipment. This may be adapted in future disaster situations or circumstances where supply is compromised.

This study has employed TGA approved surgical equipment utilized for human patients and was formulated in accordance with ethical standards outlined in the Declaration of Helsinki (revised Brazil 2013).

AUTHOR CONTRIBUTIONS

Maria Joseph: Conceptualization; writing-review & editing. **Rafael Gaszynski:** Conceptualization; project administration; writing-review & editing. **Daniel Daly:** Conceptualization; writing-review & editing. **Kyle Bender:** Conceptualization. **Neil Merrett:** Supervision. **Christos Apostolou:** Supervision.

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