Difficult Biliary Cannulation for Intradiverticular Papilla: Forceps Technique Revisited

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Abstract
Periampullary diverticula (PAD) have been encountered in 5.9 to 18.5% of patients during all the endoscopic retrograde cholangiopancreatography (ERCP). Cannulation in the presence of PAD can sometimes be difficult, time consuming, and often requires a higher level of endoscopic skills. Several techniques have been reported to facilitate and increase the chances of successful bile duct cannulation in the presence of PAD. The two-devices in one-channel method has been sparingly used. It involves the simultaneous use of a biopsy forceps and another instrument, either a cannula or sphincterotome through the same working channel. We successfully performed ERCP in three cases, where bile duct cannulation was performed in the setting of intradiverticular papilla using two-devices in one-channel method. We feel that the two-devices in one-channel method can be very useful and positioned higher up in the algorithm for successful cannulation in patients with PAD.

Keywords
► periampullary diverticula
► ERCP
► two-devices in one-channel method
► difficult biliary cannulation

Case Series

Case 1
A 78-year-old male presented with complaints of fever, jaundice, and pain abdomen and was diagnosed to have cholangitis with choledocholithiasis. He was referred to our center after a failed attempt at ERCP cannulation. He was a known case of type 2 diabetes mellitus, systemic hypertension, obstructive airway disease, chronic kidney disease, dilated cardiomyopathy, and status post cholecystectomy. At the time of admission, the patient was afebrile and hemodynamically stable. Laboratory parameters revealed a hemoglobin (Hb) of 9.9 g/dL, white blood cell...
counts were 4,500 /mm³, and platelets were 1,30,000/mm³. Liver function tests showed total bilirubin of 2.8 mg/dL, aspartate transaminase (AST) of 273 U/L, alanine transaminase (ALT) of 294 U/L, and alkaline phosphatase (ALP) of 343 U/L. Multiple intraluminal calculi at the distal end of the common bile duct (CBD) with proximal dilatation were seen at magnetic resonance cholangiopancreatography (MRCP) (► Fig. 1A and 1B).

The patient was managed conservatively with intravenous antibiotics and other supportive measures after admission. At ERCP, a therapeutic duodenoscope (channel diameter 4.2 mm) was used, and a large PAD (around 1.5 cm in diameter) was seen in side view endoscopy (► Fig. 1A). The papillary orifice could not be visualized for biliary cannulation. A pediatric biopsy forceps (diameter—2 mm) was used to grasp the inferior lip of the diverticulum, and the diverticular mucosa was pulled out, exposing the papilla, which was located inside the diverticulum at 7 o’clock position. The sphincterotome (diameter—1.8 mm) was used simultaneously, and successful biliary cannulation was achieved (► Fig. 1B). Cholangiogram of the biliary system revealed a filling defect in the CBD (► Fig. 1C) after which endoscopic sphincterotomy and stone extraction were performed. Postprocedure was uneventful and the patient was asymptomatic for 3 months on follow-up.

Case 2
A 54-year-old female, known case of type 2 diabetes mellitus, hypothyroidism, chronic kidney disease, and coronary artery disease, presented with pain abdomen, jaundice, and vomiting for 2 weeks. At the time of admission, the patient was hemodynamically stable, afebrile, and icterus was present. Laboratory parameters revealed a Hb of 6.5 g/dL, white blood cell counts were 10,100/mm³, and platelets were 90,000/mm³. Liver function tests showed total bilirubin of 9.4 mg/dL (direct bilirubin of 5.9 mg/dL), AST of 46 U/L, ALT of 9 U/L, ALP of 328 U/L, and gamma-glutamyl transpeptidase (GGT) of 164 U/L. MRCP showed chronic calculous cholecystitis and choledocholithiasis with dilated intrahepatic biliary radicles.

During ERCP, a large PAD (around 2 cm in diameter) was seen with the papillary orifice at 5 o’clock position in relation to the diverticulum. Two-devices in one-channel method, as described above, was used and biliary cannulation was attempted by simultaneous use of pediatric biopsy forceps and sphincterotome (► Fig. 2A). Guidewire inadvertently entered in the main pancreatic duct (MPD), after which pancreatic duct assisted CBD cannulation was done. Cholangiogram of the biliary system revealed dilated CBD with a filling defect (► Fig. 2B), after which endoscopic sphincterotomy and removal of stone were performed. A plastic stent was deployed in PD (5 Fr × 5 cm) and another plastic stent was positioned in the CBD (10 Fr × 10 cm). Postprocedure was uneventful and the patient was asymptomatic for 3 weeks on follow-up.

Case 3
A 52-year-old male, known case of type 2 diabetes mellitus, presented with jaundice and fever for the last 2 weeks. On Table 1 Summary of patient characteristics

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Age</th>
<th>Sex</th>
<th>Diagnosis</th>
<th>Position of papilla in relation to PAD</th>
<th>Method used</th>
<th>Successful CBD cannulation</th>
<th>Adverse events</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>78</td>
<td>Male</td>
<td>Choledocholithiasis with recurrent cholangitis in postcholecystectomy status</td>
<td>7 o’clock</td>
<td>Two-devices in one-channel method</td>
<td>Yes</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>54</td>
<td>Female</td>
<td>Choledocholithiasis with obstructive jaundice</td>
<td>5 o’clock</td>
<td>Two-devices in one-channel method</td>
<td>Yes</td>
<td>None</td>
</tr>
<tr>
<td>3</td>
<td>52</td>
<td>Male</td>
<td>EHBO with mass in uncinate process and head of pancreas</td>
<td>7 o’clock</td>
<td>Two-devices in one-channel method</td>
<td>Yes</td>
<td>None</td>
</tr>
</tbody>
</table>

Abbreviations: CBD, common bile duct; EHBO, extrahepatic biliary obstruction; PAD, periampullary diverticulum.

counts were 4,500 /mm³, and platelets were 1,30,000/mm³. Liver function tests showed total bilirubin of 2.8 mg/dL, aspartate transaminase (AST) of 273 U/L, alanine transaminase (ALT) of 294 U/L, and alkaline phosphatase (ALP) of 343 U/L. Multiple intraluminal calculi at the distal end of the common bile duct (CBD) with proximal dilatation were seen at magnetic resonance cholangiopancreatography (MRCP) (► Fig. 1A and 1B).

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Case 3
A 52-year-old male, known case of type 2 diabetes mellitus, presented with jaundice and fever for the last 2 weeks. On
admission, the patient was hemodynamically stable, febrile and icterus was present. Laboratory parameters showed a Hb of 12.4 g/dL, white blood cell counts were 9,200/mm³ and platelets were 5,94,000/mm³. Liver function tests showed total bilirubin of 12.5 mg/dL (direct bilirubin of 7.5 mg/dL), AST of 105 U/L, ALT of 120 U/L, ALP of 1,297 U/L, and GGT of 807 U/L. Carbohydrate antigen 19-9 levels were 220 U/mL. Computed tomography abdomen revealed an ill-defined hypodense mass in the head and uncinate process of pancreas; with dilated CBD and MPD, likely carcinoma head of the pancreas.

At ERCP, a PAD was visualized with the papillary orifice at 7 o'clock position in relation to the diverticulum. Two-devices in one-channel method as described in the first case was used, and biliary cannulation was attempted with the simultaneous use of pediatric biopsy forceps and sphincterotome. Cholangiogram of the biliary system revealed stricture in lower CBD with upstream dilatation. Brush cytology was taken from the stricture area. Biliary sphincterotome was done, and a 6 cm fully covered self-expanding metal stent was deployed across the stricture. Subsequent liver function tests showed a downward trend. Brush cytology from CBD did not show any malignant cells and subsequent endoscopic ultrasound-guided fine needle aspiration from the pancreatic head mass was suggestive of adenocarcinoma. Postprocedure was uneventful, and the patient was asymptomatic for 3 weeks on follow-up.

### Discussion

ERCP in patients with PAD requires the use of specialized techniques and an experienced endoscopist. Out of the 410 cases who underwent ERCP during the study duration, PAD was seen in 34 cases. Cannulation was achieved successfully.

### Table 2 ERCP techniques to facilitate biliary cannulation in presence of PAD

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Technique</th>
<th>Devices used</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PD stent placement followed by precut sphincterotomy</td>
<td>PD stent precut needle knife</td>
<td>Stent placement keeps papilla out of the diverticulum</td>
</tr>
<tr>
<td>2</td>
<td>Submucosal saline injection</td>
<td>Saline injector</td>
<td>2–4 mL of normal saline is injected in the submucosa that enables intradiverticular papillary eversion</td>
</tr>
<tr>
<td>3</td>
<td>Endoclip-assisted cannulation</td>
<td>Endoclips</td>
<td>Endoscopic clips evert and stabilize the papillary opening</td>
</tr>
<tr>
<td>4</td>
<td>Reversed guidewire method</td>
<td>Reversed guidewire (stiff end forward)</td>
<td>Reverse end of the guidewire used to push papillary mucosa toward the lumen and thus everting the papilla</td>
</tr>
<tr>
<td>5</td>
<td>Double endoscope method</td>
<td>Duodenoscope, gastroscope, FB forceps</td>
<td>Grasping tissue adjoining the papilla with forceps through the gastroscopy followed by insertion of the duodenoscope</td>
</tr>
<tr>
<td>6</td>
<td>Cap-assisted cannulation</td>
<td>Transparent cap, papillotome</td>
<td>Papillary orifice is directly seen using cap-assisted forward viewing endoscopy</td>
</tr>
<tr>
<td>7</td>
<td>Entering the diverticulum</td>
<td>Duodenoscope</td>
<td>Enter the duodenal diverticulum with distal end of the duodenoscope</td>
</tr>
<tr>
<td>8</td>
<td>Dilatation of the diverticular neck by balloon</td>
<td>Stone retrieval balloon</td>
<td>Intradiverticular balloon dilatation allows eversion of the papilla</td>
</tr>
<tr>
<td>9</td>
<td>Two-devices in one-channel method</td>
<td>Biopsy forceps, catheter (cannula, sphincterotome)</td>
<td>Simultaneous use of biopsy forceps and sphincterotome</td>
</tr>
</tbody>
</table>

Abbreviations: ERCP, endoscopic retrograde cholangiopancreatography; FB, foreign body; PAD, periampullary diverticulum; PD, pancreatic duct.
by the standard technique in 31 cases with PAD; however, despite 10 minutes of efforts, cannulation was not achieved in three patients for whom the two-devices in one-channel method was used.

Ease of cannulating the papilla also depends on the position according to the diverticulum. Fig. 3 shows the different locations of the papilla in relation to the diverticulum. Cannulation procedures are more difficult in the 1 o'clock position as compared with the other locations of the papilla. The rates of successful cannulation reported in PAD patients vary from 61 to 95.4%, which are markedly lower than that seen in patients without PAD. Patients with PAD are more likely (1.8–6 times) to have retained CBD stones as compared with those without PAD. The possible factors leading to increased formation of biliary stones in the presence of PAD are dysfunction in the sphincter of Oddi, diverticula causing spasm of the sphincter, and increased biliary tract pressure or diverticula, leading to biliary stasis by compression of the distal part of the CBD.

Several methods have been described in the literature to facilitate difficult biliary cannulation in the presence of PAD that has been summarized in Table 2. The method to be used counts on the endoscopist’s choice and patient conditions. The central goal of the different techniques is to bring the papilla in a better position and angle, suitable for cannulation. We have successfully used the two-devices in one-channel method in three cases with PAD. We feel that this can be a very useful technique that can be positioned higher up in the algorithm for successful cannulation in patients with PAD.

Financial Support and Sponsorship
Nil.

Author Contributions
Mahesh Goenka was involved in conceptualization, methodology, supervision, writing, reviewing, and editing. Gajanan Rodge was involved in visualization, data curation, writing, original draft preparation, and investigation. Bhavik Shah and Shivraj Afzalpurkar were involved in writing, reviewing, and editing of the manuscript.

Conflict of Interests
None.

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