



Submucosal injection to facilitate needle-knife sphincterotomy: a novel technique

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Background and Aims: Needle-knife sphincterotomy (NKS) is a valuable rescue technique for biliary access but carries an increased risk of bleeding and perforation, particularly in flat (type 1) ampullae. Such adverse events typically result from poor visualization or differentiation of the various tissue planes during NKS. We describe a novel technique using submucosal dye injection to better visualize anatomical planes during dissection.

Methods: A 59-year-old woman with a pancreatic head mass and obstructive jaundice was referred for ERCP. EUS-guided biopsy confirmed pancreatic adenocarcinoma. She was found to have a flat ampulla during ERCP. Despite multiple attempts using a standard sphincterotome, deep cannulation of the common bile duct was not achieved. We subsequently decided to proceed with advanced cannulation using a NKS with submucosal lift. Three mL of hetastarch with methylene blue was injected 2 mm above the ampullary os, resulting in an adequate submucosal lift. A mucosal incision was made, starting at the ampullary os and extending cranially to the 12-o'clock position.

Results: Layer-by-layer dissection was performed, and deep cannulation of the bile duct was obtained without adverse events.

Conclusions: In our patient, submucosal injection enhanced tissue-plane visualization during NKS, allowing for controlled and anatomically guided dissection. (VideoGIE 2026;11:12-5.)

BACKGROUND

Precut sphincterotomy is a valuable rescue technique to achieve deep cannulation of the bile duct when conventional methods fail. However, it carries a high risk of adverse events such as bleeding and perforation, largely because of limited visualization and technical complexity.

A key limitation of needle-knife sphincterotomy (NKS) is the inability to clearly differentiate between ampullary tissue, bile duct, duodenal muscularis propria, and submucosa, often leading to inadvertent injury of the duodenal wall. The authors of previous studies suggest limiting NKS to papillas with long intramural segments as the result of lower adverse events rates in this ampullary morphology.¹⁻³ In recent years, submucosal dye injection has improved safety in third-space procedures by clearly delineating tissue planes. We describe the use of submucosal injection to facilitate precise and controlled layer-by-layer dissection during NKS.

Abbreviations: CBD, common bile duct; NKS, needle-knife sphincterotomy.

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CASE PRESENTATION

A 59-year-old woman was referred to our practice to further evaluate a computed tomography-avid lesion in the pancreatic head with associated jaundice. The patient underwent a EUS fine-needle biopsy and was diagnosed with a head of pancreas adenocarcinoma, distal common bile duct (CBD) involvement, and cholestatic liver chemistry abnormalities.

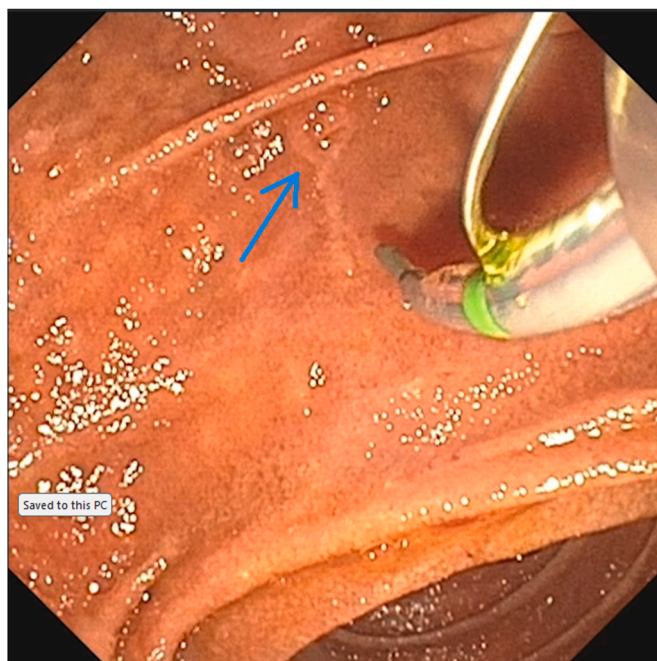


Figure 1. Endoscopic image demonstrating a flat (type 1) ampulla (*blue arrow*).

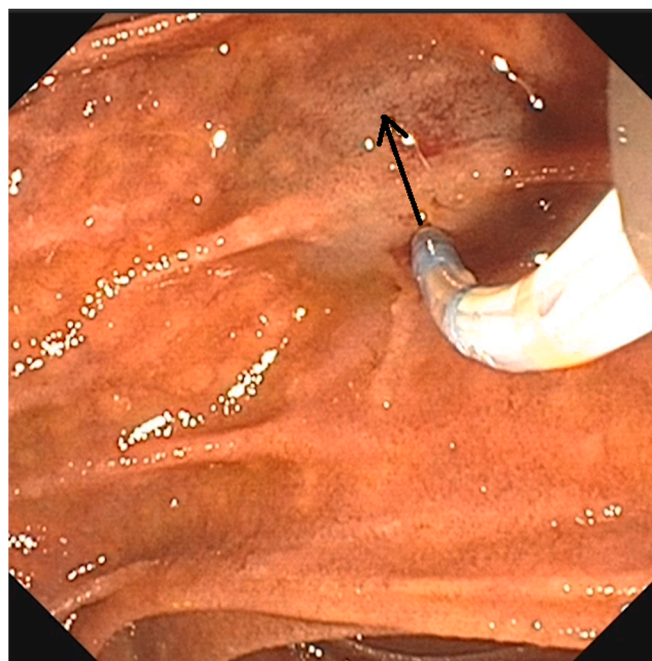


Figure 3. Endoscopic image demonstrating the direction (*black arrow*) of serial dissection that was used to gain biliary access.

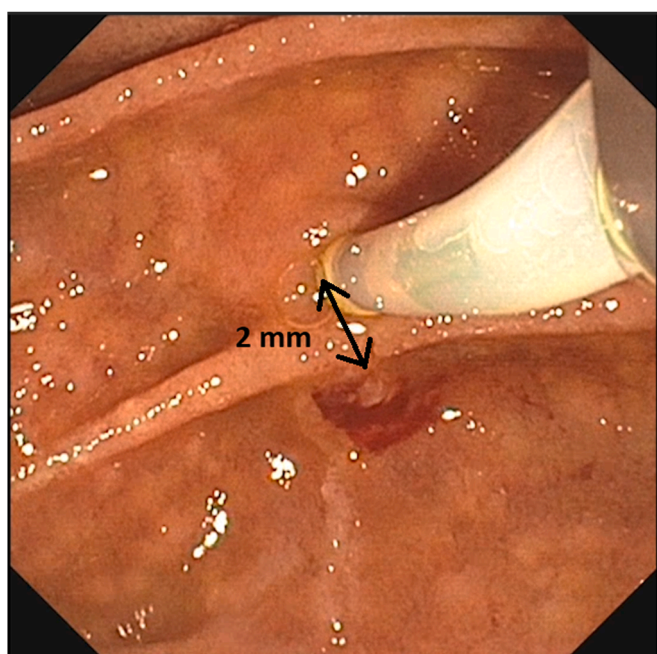


Figure 2. Endoscopic image demonstrating the site of injection, located 2 mm above the ampullary os.

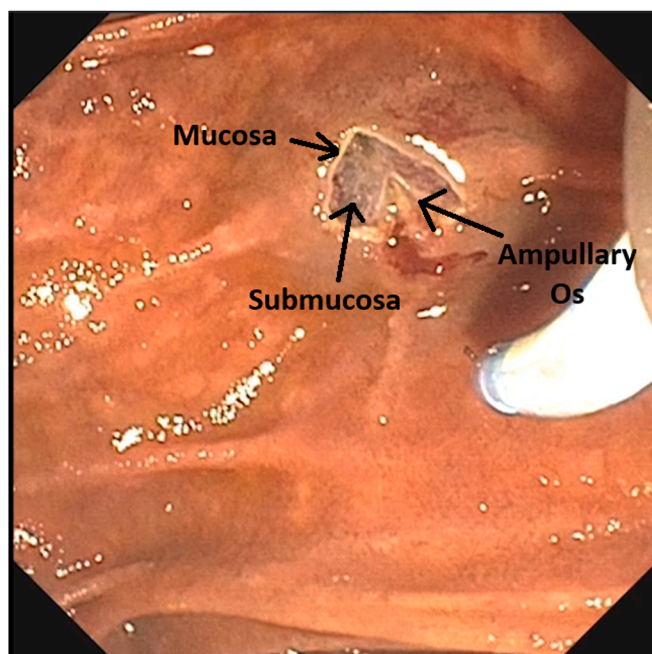


Figure 4. Endoscopic image demonstrating the clear separation of anatomical tissue planes during dissection.

Endoscopic methods

The patient was found to have a flat (type 1) ampulla that is generally considered unfavorable for precut sphincterotomy (Fig. 1).⁴ Using a standard sphincterotome, we attempted deep cannulation of the CBD for more than

15 minutes. The main pancreatic duct was inadvertently injected, but deep cannulation of the CBD was not obtained. We subsequently decided to proceed with advanced cannulation using an NKS with submucosal lift. A 3-mL submucosal injection of 6% hetastarch and 0.1%

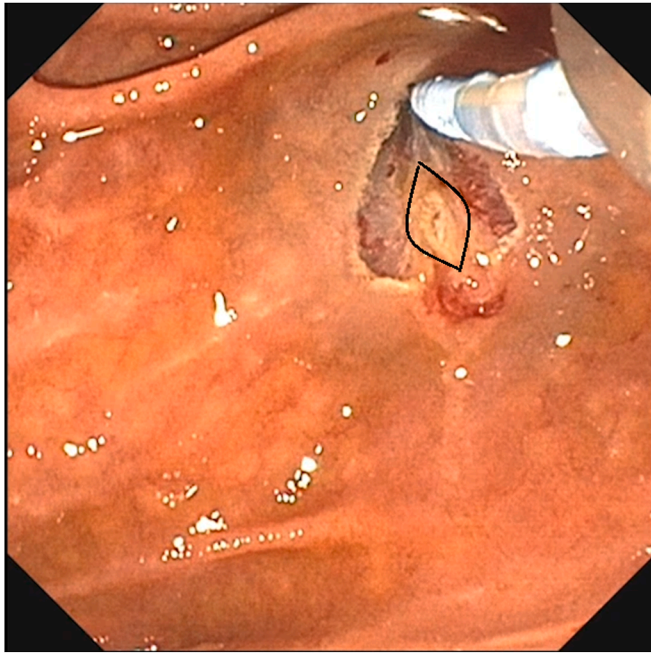


Figure 5. Endoscopic image outlining the ampullary os (*black lines*). Note its distinct appearance (does not stain with methylene blue) when compared with adjacent submucosal tissue (stains with methylene blue).



Figure 6. Endoscopic image after extension of the septotomy. Note the bile tinged biliary orifice (*black arrow*).

methylene blue was administered approximately 2 mm above the ampullary os (Fig. 2). After this, a standard needle-knife was used, and a mucosal incision was made, starting at the ampullary os and extending cranially toward the 12-o'clock position (Fig. 3). The submucosal injection

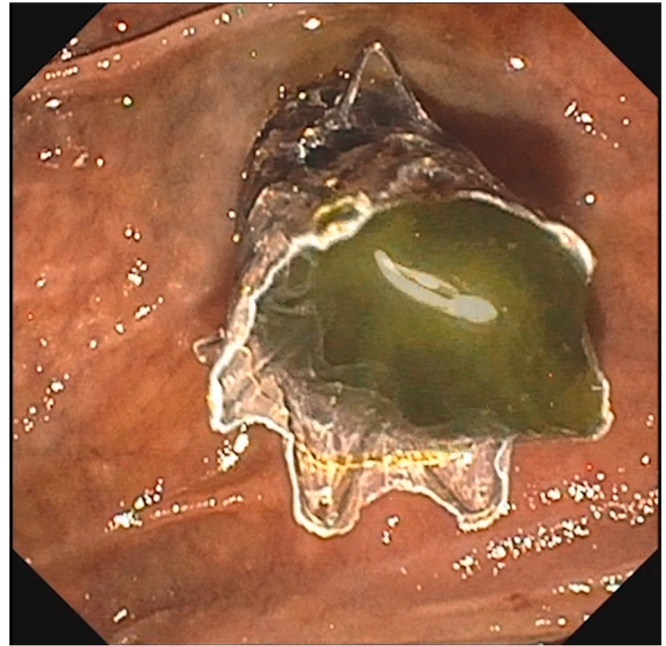


Figure 7. Endoscopic image demonstrating a fully covered metal stent that was placed into the bile duct.

created a distinct separation between the ampullary mucosa and the surrounding submucosa, permitting safe dissection and targeted septotomy (Figs. 4-6). The bile duct was successfully identified and cannulated without adverse events. The sphincterotomy was extended using a sphincterotome, and a stent was placed (Fig. 7) (Video 1, available online at www.videogie.org).

CONCLUSION

In the described case, submucosal injection before NKS resulted in improved visualization of tissue planes, facilitating precise and anatomically guided dissection and deep cannulation of the CBD. By potentially reducing the risk of injuring the duodenal muscularis propria, this approach may improve safety, particularly in patients with high-risk or flat ampullae. Further studies are needed to validate this technique as a standard adjunct to advanced cannulation.

PATIENT CONSENT

Written informed consent was obtained from the patient for the procedure.

DISCLOSURE

The following authors disclosed financial relationships: M. K. Hasan: Consultant for Boston Scientific, Olympus,

and Medtronic. S. Irani: Consultant for Boston Scientific, Conmed, and Gore. All other authors disclosed no financial relationships.

REFERENCES

1. Horiuchi A, Nakayama Y, Kajiyama M, et al. Effect of precut sphincterotomy on biliary cannulation based on the characteristics of the major duodenal papilla. *Clin Gastroenterol Hepatol* 2007;5:1113-8.
2. Testoni PA, Mariani A, Aabakken L, et al. Papillary cannulation and sphincterotomy techniques at ERCP: European Society of Gastrointestinal Endoscopy (ESGE) clinical guideline. *Endoscopy* 2016;48:657-83.
3. Katsinelos P, Lazaraki G, Chatzimavroudis G, et al. The endoscopic morphology of major papillae influences the selected precut technique for biliary access. *Gastrointest Endosc* 2015;81:1056.
4. Canena J, Lopes L, Fernandes J, et al. Influence of a novel classification of the papilla of Vater on the outcome of needle-knife fistulotomy for biliary cannulation. *BMC Gastroenterol* 2021;21:147.