

Intraoperative pancreatoscopy with narrow band imaging: a novel method for assessment of resection margins in case of intraductal papillary mucinous neoplasm

Arun Yelamali · Magnus Jayaraj Mansard ·
Rohit Dama · Pradeep Rebela · Guduru Venkat Rao ·
Duvvuru Nageshwar Reddy

Received: 5 December 2011 / Accepted: 2 May 2012
© Springer Science+Business Media, LLC 2012

Abstract

Background Intraductal papillary mucinous neoplasm (IPMN) is characterized by intraductal proliferation of neoplastic mucinous cells with a variable extent along the main duct or its branches. The lesion may be continuous or discontinuous. Skip lesions have been described in about 6–19 % of cases. Complete resection without leaving behind any skip lesions is important, to such an extent that many groups suggest even total pancreatectomy, a major and morbid surgery.

Methods A 40 year-male patient with chronic pancreatitis presented with recent-onset diabetes mellitus and weight loss. Ultrasound and computed tomography (CT) scan showed a cystic lesion in the head and uncinate process of pancreas. Peroral pancreatoscopy showed villous projections with dilated tortuous vessel in the head, suspicious of IPMN. The duct beyond pancreatic head could not be visualized and remained unassessed. At pancreatoduodenectomy, pancreatoscopy with narrow band imaging (NBI) was done using flexible pancreatoscope through the cut end of the duct at the neck to assess the duct in the body and tail.

Results Pancreatoscopy with NBI showed a normal-looking resection margin and a skip lesion 1 cm beyond it. The revised resection margin confirmed the skip lesion on frozen section and also that the fresh cut margin was negative. The remaining duct in the body and tail was normal on pancreatoscopy. Total clearance of the disease could be achieved without a major procedure such as total pancreatectomy.

Conclusions Intraoperative pancreatoscopy, especially with NBI, is a good diagnostic tool for IPMN and also helps in intraoperative decision-making of the resection margins.

Intraductal papillary mucinous neoplasm (IPMN) account for up to 7 % of clinically diagnosed pancreatic neoplasms and up to 50 % of incidentally detected pancreatic cysts [1]. IPMN is characterized by intraductal proliferation of neoplastic mucinous cells, which usually form papillae and lead to cystic dilation of the main pancreatic duct and/or secondary branches. Discontinuous lesions have been reported in between 6–19 % in different series [2]. The importance of a skip lesion is the potential for recurrence despite a negative resection margin. To detect “skip” lesions, reported techniques are cytology of pancreatic juice harvested in the remnant [3] in addition to frozen section of resected margins and creeping resections as required.

Aim of operative resection is to remove all adenomatous or malignant ductal epithelium and to ensure that recurrence in the pancreatic remnant is minimized. Surgery involves radical resection with intraoperative assessment of the resected margin with frozen section. If margin is positive, then further creeping resections are necessary and in selected cases total pancreatectomy may be necessary.

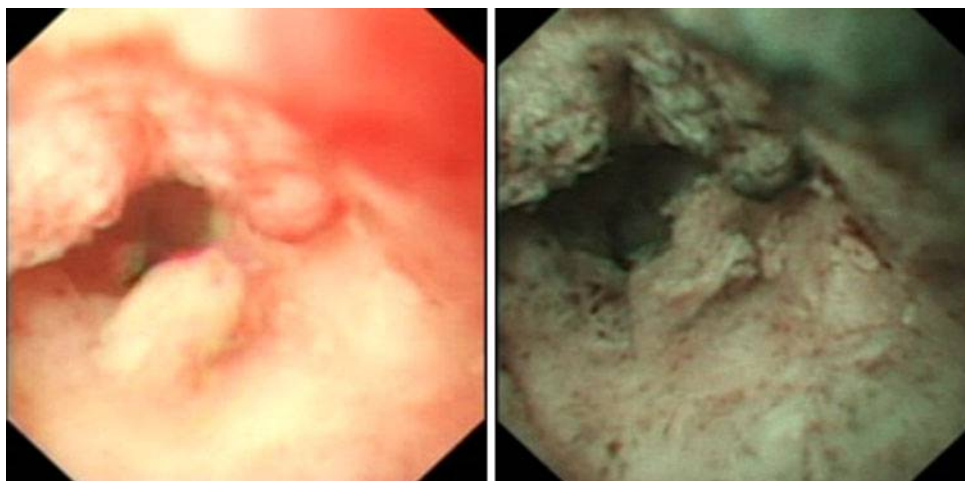
Electronic supplementary material The online version of this article (doi:10.1007/s00464-012-2365-6) contains supplementary material, which is available to authorized users.

A. Yelamali (✉) · M. J. Mansard · R. Dama · P. Rebela ·
G. V. Rao

Department of Surgical Gastroenterology, Asian Institute of
Gastroenterology, 6-3-661, Somajiguda, Hyderabad 500082,
India
e-mail: drarunyelamali@gmail.com

D. N. Reddy
Department of Medical Gastroenterology, Asian Institute of
Gastroenterology, Hyderabad, India

Fig. 1 Intraoperative pancreatoscopy images with white light (left) and NBI (right). A lesion is seen in the main pancreatic duct in the body distal to the transected end. NBI enhances the mucosal vascular pattern



Total pancreatectomy leads to brittle diabetes and exocrine insufficiency, leading to significant increase in morbidity.

Here, we investigate a technique of intraoperative pancreatoscopy with addition of narrow band imaging (NBI) to rule out skip lesions and limit to a less morbid procedure.

Patient and methods

Patient

A 40 year-old male known to have chronic pancreatitis since 5 years presented to us with recent-onset diabetes mellitus and significant weight loss. Imaging showed changes of chronic pancreatitis with parenchymal atrophy, parenchymal calcifications, and dilated pancreatic duct of 11 mm with a cystic lesion in the head of the pancreas. Endoscopic retrograde cholangiopancreatography (ERCP) showed fish mouth papilla with dilated irregular pancreatic duct (PD). Peroral pancreatoscopy was done which showed villous projections with dilated tortuous vessel in the main pancreatic duct in the head region suspicious of IPMN. The duct beyond the head region could not be visualized by peroral pancreatoscopy and remained unassessed. Patient was posted for surgical resection with intraoperative pancreatoscopy to assess the body/tail pancreatic duct to help plan the extent of resection.

Operation

A Whipple pancreatoduodenectomy was planned. The neck of pancreas was resected beyond the grossly palpable tumor. Intraoperative pancreatoscopy was done using a flexible 10-F (3.33 mm) pancreatoscope with Olympus Evis CV-260SL camera with facilities for narrow band imaging (NBI). Continuous irrigation with normal saline

was used to improve vision. Image was viewed on a high-definition (HD) monitor.

Results

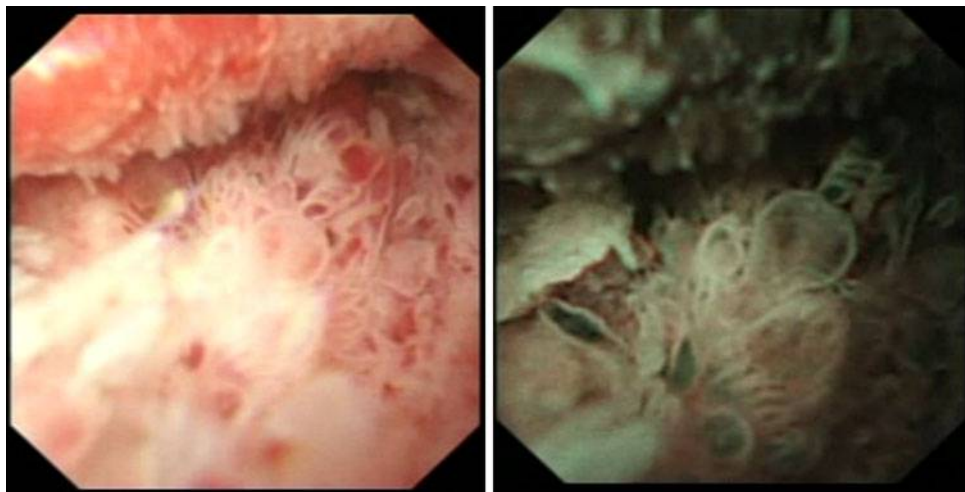
An erythematous lesion was detected 1 cm distal to the resection margin. On NBI there was enhancement of mucosal vascular pattern and increased vascularity (Fig. 1; Video 1). The remaining duct visualized till the tail of pancreas showed normal duct with no mucosal vascular abnormality on NBI. The resection margin was revised based on pancreatoscopy findings, and histopathological examination from the suspicious area confirmed this lesion as IPMN with high-grade dysplastic cells with invasion. The fresh resection margin was confirmed as negative on frozen section. Total clearance of disease was achieved. There was no procedure-related complication.

Specimen pancreatoscopy was done ex vivo, which showed lesion in main pancreatic duct with papillary projections. The cut margin of the specimen did not show any growth (Fig. 2; Video 2). Histopathology from the specimen showed features of IPMN with invasive adenocarcinoma.

Discussion

Various case series have shown that 7–58 % of patients at the time of diagnosis of IPMN already have an established invasive malignancy [4]. IPMN is believed to have a multicentric origin, and intrapancreatic recurrences were observed after surgical resection of IPMN in patients with negative surgical margins. Preoperative investigations may be inadequate in identifying skip lesions [3]. In this particular case, the preoperative peroral pancreatoscope could

Fig. 2 Specimen pancreatoscopy images with *white light* (left) and NBI (right), showing multiple papillary projections in the main pancreatic duct in the head. NBI shows vascular enhancement. There was 1 cm of normal-looking duct at the transected margin



not be negotiated beyond the main lesion, hence the remaining duct remained unassessed.

For branch-duct IPMN, several studies strongly suggest that local anatomic resection is essentially curative. In contrast, in main-duct IPMN, occurrence in the remnant gland has been found with variable rates (0–10 %) provided that the frozen-section margin is negative and the resected specimen lacks invasive IPMN. When the resection specimen shows invasive disease, even if the margin is negative, recurrent IPMN occurs in 50–90 % of patients, thereby decreasing 5 year survival to less than 50 % [5]. The cause of recurrence in the remnant gland may be left behind skip lesions. Hidetoshi Eguch et al. [3] in their series reported skip lesion in 8 out of 43, i.e., 19 % of resected specimens.

Peroral pancreatoscopy has been used to examine the pancreatic duct preoperatively. Thorough observation throughout the main pancreatic duct has proved difficult, however, because of the angle formed by the junction of the ducts of Wirsung and Santorini and the main pancreatic duct kinking. Intraoperative pancreatoscopy overcomes this difficulty [6].

Tetsuya Kaneko et al. [6] evaluated the diagnostic accuracy of intraoperative pancreatoscopy in their series of 24 cases. Intraoperative pancreatoscopy detected 10 cases of intraductal mucinous papillary tumor (MPT) lesions that could not be detected by endoscopic ultrasound (EUS) or endoscopic retrograde pancreatography (ERP). Five of 10 cases were intraductal multicentric lesions. Three of these required re-resection. For diagnosis of mucinous papillary lesions, the sensitivity, specificity, and overall accuracy of intraoperative pancreatoscopy were all 100 %; respective values were 43.8, 100, and 60.9 % for ERP and 47, 100, and 62.5 % for EUS. They reported the incidence of multicentric lesions as 20.8 %.

Conventional endoscopy uses white light with a spectrum ranging from 400 nm to 700 nm. NBI uses optical filters to

isolate two specific wavelengths of light: 415 nm blue light and 540 nm green light. The deeper-penetrating 540 nm light corresponds to a secondary hemoglobin absorption peak. Capillaries in the superficial mucosal layer are emphasized by the 415 nm light and are displayed in brown, whereas deeper mucosal and submucosal vessels are made visible by the 540 nm light and are displayed in cyan [7].

There are few case reports and series [8–11] of use of peroral pancreatoscopy (POPS) with NBI for IPMN. NBI has facilitated visualization of surface structure and the capillary vessels and assisted in identifying lesions along the pancreatic duct, which were difficult to see on conventional pancreatoscopy. Difficulties reported are maneuverability, fragility of scope, and image resolution. With newer scopes, image quality has improved.

Here, we report the first case of intraoperative pancreatoscopy with the use of NBI. During the peroral pancreatoscopy, the head duct lesion could be visualized. The skip lesion was missed as the scope could not be negotiated beyond the lesion into the main pancreatic duct. Intraoperative pancreatoscopy assisted in accurate examination of the entire duct. NBI facilitated in better identification of the vascular pattern of the lesion. With the use of newer scopes and high-definition cameras, image quality is very good. As the diameter of the scope is only 3.33 mm, any duct larger than this can be examined. This is particularly the case in main duct IPMN, which has a dilated main duct and higher chances of skip lesions. Risk of damage to scope is less as we have good control of the instrument. No maneuverability problems are encountered as the body of pancreas can be manipulated and the pancreatoscope can be positioned in the center of the main pancreatic duct. Pancreatoscopy led to revision of the resection margin, which would not have been done if only intraoperative frozen section had been considered.

We conclude that intraoperative pancreatoscopy with NBI is a good diagnostic tool for IPMN and access to main

duct is better compared with POPS. It may help in deciding extent of resection in cases with IPMN.

Acknowledgement Disclosures Dr. Arun Yelamali, Dr. Magnus Jayaraj Mansard, Dr. Rohit Dama, Dr. Pradeep Rebela, Dr. Guduru Venkat Rao, and Dr. Duvvuru Nageshwar Reddy have no conflicts of interest or financial ties to disclose.

References

1. Andrejevic-Blant S, Kosmahl M, Sipos B, Klöppel G (2007) Pancreatic intraductal papillary-mucinous neoplasms: a new and evolving entity. *Virchows Arch* 451:863–869
2. Alain S, Anne C, Jacques B (2010) Role of frozen section assessment for intraductal papillary and mucinous tumor of the pancreas. *World J Gastrointest Surg* 2(10):352–358
3. Hidetoshi E, Osamu I, Hiroaki O, Sasaki Yo, Terumasa Y, Akihiko N, Hiroyuki U, Akemi T, Tsutomu K, Shingi I (2006) Role of intraoperative cytology combined with histology in detecting continuous and skip type intraductal cancer existence for intraductal papillary mucinous carcinoma of the pancreas. *Cancer* 107:2567–2575
4. Lai ECH, Lau WY (2005) Intraductal papillary mucinous neoplasms of the pancreas. *Surgeon* 3(5):317–324
5. Sakorafas GH, Sarr MG (2007) Primary cystic neoplasms of the pancreas. In: Yeo CJ, Dempsey DT, Klein AS, Pemberton JH, Peters JH (eds) *Shackelford's surgery of the alimentary tract*, 6th edn. Saunders Elsevier, Philadelphia, pp 1387–1399
6. Kaneko Tetsuya, Nakao Akimasa, Nomoto Shuji, Furukawa Tsuyoshi, Hirooka Yoshiki, Nakashima Nobuo, Nagasaka Tetsuro (1998) Intraoperative pancreatoscopy with the ultrathin pancreatoscope for mucin-producing tumors of the pancreas. *Arch Surg* 133:263–267
7. Song LM, Adler DG, Conway JD (2008) Narrow band imaging and multiband imaging, ASGE Technology Committee. *Gastrointest Endosc* 67:581–589
8. Yoshifumi A, Daisuke M, Ken K, Katsuhiko M, Ken-Ichi K (2007) Peroral pancreatoscopy: current status and future expectations using narrow band imaging. *Dig Endosc* 19:79–86
9. Yoshinori I, Tomihiro M, Naoki O, Ken I, Kazumasa M (2007) Endoscopic diagnosis of intraductal papillary mucinous neoplasm using peroral pancreatoscopy with narrow band imaging. *Dig Endosc* 19:105–108
10. Akihiro I, Yoshiki H, Hiroki K, Yasumasa N, Hidemi G (2007) Endoscopic approach to the pancreatobiliary tract using narrow band imaging. *Dig Endosc* 19:115–120
11. Tomihiro M, Yoshinori I, Naoki O, Kazumasa M, Yoichiro O (2010) Endoscopic diagnosis of intraductal papillary/mucinous neoplasm of the pancreas by means of peroral pancreatoscopy using a small/diameter videoscope and narrow/band imaging. *Dig Endosc* 22:119–123