




Clinicopathological Features of 12 Cases of Intraductal Papillary Neoplasm of the Bile Duct: A Case Series

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Abstract

Intraductal papillary neoplasm of the bile duct (IPNB) is rare, and its clinicopathological characteristics are still unclear. We retrospectively analyzed the clinicopathological data of IPNB patients who underwent surgical treatment in the Division of Hepatobiliary and Pancreatic Surgery of Zhejiang Provincial People's Hospital from September 2018 to June 2023 and reviewed the IPNB related literature on PubMed. A total of 12 patients with IPNB were enrolled, including 5 males and 7 females, with a median age of 64 years (range, 39–70 years). Abdominal pain (66.7%), jaundice (16.7%) and fever (16.7%) were the most common signs. 66.7% of the patients had a history of biliary stones. 75.0% of the patients had invasive carcinoma. Bile duct dilatation (83.3%), intraductal mass (58.3%) and bile duct wall thickening (25.0%) were the most common imaging findings. Surgical resection is the main treatment. The cumulative survival rates for 1, 3 and 5 years were 100%, 87.5% and 87.5%, respectively. The cumulative recurrence-free survival rates at 1, 3 and 5 years were 90.9%, 68.2% and 51.1%, respectively. More up-to-date research focusing on IPNB is warranted to help us better understand the diagnosis and treatment of this rare disease.

Keywords Intraductal papillary neoplasm of bile duct · Clinicopathological features · Surgery

Introduction

Intraductal papillary neoplasm of bile duct (IPNB) [1, 2] is relatively rare, accounting for approximately 4–15% of biliary tract neoplastic lesions, and is considered as one of the pre-cancerous lesions of cholangiocarcinoma [2–4]. Since 2010, IPNB has been officially defined by the World Health Organization (WHO) as an intraductal growing tumor covered by well-differentiated papillary neoplastic epithelium with fine fibrovascular cores in the intra- and extra-hepatic bile ducts [1]. In 2019, WHO included papillary cholangiocarcinoma in the IPNB category [5]. However, this definition is not perfect, and

there still is room for continued improvement. The majority of patients were middle-aged and elderly patients, with an average age of 64–67 years [2, 6], but there were also a few young patients. Most recent studies have shown a higher incidence in men [2–4, 6]. The incidence of IPNB is higher in areas of the Eastern world compared to the West [2]. Current studies have shown that bile duct stones and *Clonorchis sinensis* infestation are established risk factors for IPNB [2]. IPNB can occur in various parts of the biliary tree, including the intrahepatic and extrahepatic bile ducts, and even the cystic ducts. A meta-analysis [7] showed that IPNB in Asian patients was more likely to occur within the liver and was less invasive. Herein, we summarized the clinicopathological features, diagnosis and treatment experience of IPNB patients who underwent surgical treatment from September 2018 to June 2023, and reviewed recent IPNB related literature on PubMed.

Material and Method

Patient

Data of patients with hepatobiliary and pancreatic diseases who underwent surgery in the Division of

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Hepatobiliary and Pancreatic Surgery of Zhejiang Provincial People's Hospital between September 2018 to June 2023 were retrieved from the electronic medical record system. The inclusion criteria were as the following: 1. Patients were pathologically diagnosed as IPNB. 2. Patients underwent curative-intent surgery. Exclusion criteria: 1. Combined with other malignancies. 2. Incomplete clinical data. Surgical indications were decided after discussion by the department team. The patients all gave informed consents of collecting medical information. The current study was approved by the ethics committee of Zhejiang Provincial People's Hospital (Acceptance number, QT2023401).

Data Collection

For enrolled patients, relevant data were obtained by consulting the electronic medical record system. These include age, gender, admission signs, history of related disease, personal history, body mass index (BMI), imaging findings, laboratory tests, preoperative invasive treatment, operation related information, postoperative complications, postoperative hospital stay, pathological information and survival information. According to the electronic medical record system, the postoperative outpatient review of patients was inquired, and the patients who did not have a medical record in our hospital for more than 6 consecutive months were followed up by telephone to inquire about the recent situation.

Data Analysis

The SPSS 26.0 statistical software (SPSS Inc., Chicago, IL, USA.) was used to analyze the data. Categorical data were expressed in absolute numbers and percentages. Continuous data were reported as medians with ranges. The Kaplan-Meier method was used to calculate the cumulative survival rates.

Result

Clinical Characteristics

A total of 12 patients were included in this retrospective study, with a median age of 64 years (range 39–70 years). Of these, 58.3% (7/12) were females. 66.7% (8/12) of the patients presented with abdominal pain, 16.7% (2/12) had jaundice, 16.7% (2/12) had fever, 16.7% (2/12) were asymptomatic. 66.7% (8/12) had biliary stones. The details were shown in Table S1. A figure was presented showing imaging and surgical photographs of an IPNB patient with invasive carcinoma undergoing surgical treatment (Fig. 1).

Laboratory Tests

Tumor markers showed a slight increase in carcinoembryonic antigen in 8.3% (1/12) patients, and a slight increase in carbohydrate antigen 199 in 25.0% (3/12) patients.

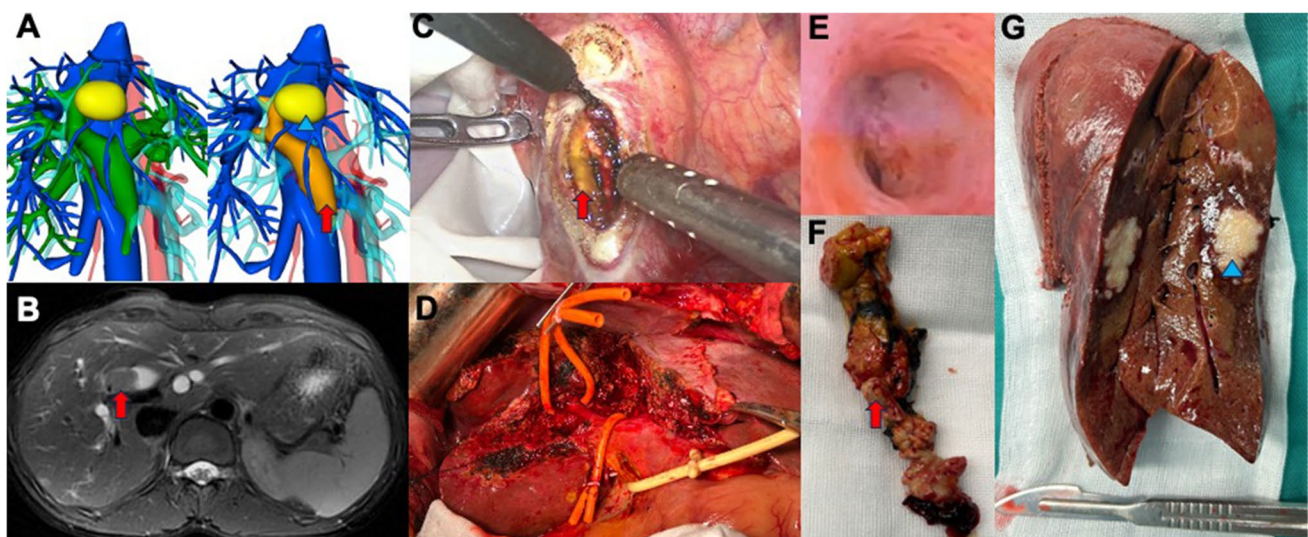


Fig. 1 Imaging and surgical photographs of an IPNB patient with invasive carcinoma undergoing surgical treatment. **A** Preoperative 3D reconstruction showing IPNB lesions (red arrow) and liver tumor lesion (blue triangle); **B** Magnetic resonance imaging showing IPNB lesion (red arrow); **C** Photos of laparoscopic exploration of IPNB

lesions (red arrow); **D** Photos of laparotomy; **E** The IPNB tumor was removed after choledochoscopy; **F** Photos of IPNB lesions after removal (red arrow); **G** Liver specimen and liver tumor lesion (blue triangle)

Alpha-fetoprotein was normal in all patients. The details were shown in Table S1.

Imagological Examination

Bile duct dilatation (10/12), intraductal mass (7/12) and bile duct wall thickening (3/12) were the most common imaging findings. However, in only one case was the possibility of IPNB explicitly mentioned in the imaging report. In the remaining 11 cases, 27.3% (3/11) considered benign lesions and 72.7% (8/11) considered malignant lesions. The details were listed in Table S1.

Pathological Results

25.0% (3/12) of the tumors were intrahepatic IPNB (I-IPNB), 58.3% (7/12) were extrahepatic IPNB (E-IPNB), and 16.7% (2/12) involved both. 75.0% (9/12) were pancreaticobiliary type. 75.0% (8/12) had invasive carcinoma. 58.3% (7/12) of the patients underwent lymph node dissection, and no lymph node metastasis was found. The details were shown in Table 1.

Treatment

75.0% (8/12) of the patients underwent laparoscopic surgery, 16.7% (2/12) underwent robot-assisted laparoscopic surgery, and 16.7% (2/12) underwent open surgery. The median operative time was 285 min (range 45–470 min). The median blood loss was 200 ml (range 10–2500 ml). One patient (8.3%) had a severe complication (Clavien-Dindo complication grade \geq III) of post-operative hematemesis, which was treated and covered by interventional treatment. The median length of post-operative hospital stay was 11 days (range 2–18 days). The details were shown in Table 2.

Prognosis

All 12 patients were followed up, for a median of 34.5 months (range 4–59 months). Among them, 8 patients survived without tumor. 3 patients survived with tumor, and the recurrence time was 6, 18 and 35 months after treatment, respectively. One patient died, the time of tumor recurrence was 13 months after treatment and the time of death was 34 months after treatment. The cumulative survival rates for 1, 3 and 5 years were 100%, 87.5% and 87.5%, respectively. The cumulative recurrence-free survival rates at 1, 3 and 5 years were 90.9%, 68.2% and 51.1%, respectively.

Discussion

Clinical Characteristics

Abdominal pain, jaundice, acute cholangitis and fever are the most common signs [2, 3, 8] in patients with IPNB, which may be related to biliary obstruction caused by bile duct neoplastic lesions and secreted mucus. IPNB may also be prone to forming fistula, such as hepatogastric fistulas [9]. Meanwhile, around 10–15% of patients may have no obvious symptoms [2], indicating the importance of regular physical examination.

Laboratory Tests

IPNB patients are often associated with biliary obstruction, biliary tract infection, and elevated leukocytes and neutrophils. Biliary obstruction in E-IPNB patients often leads to abnormal liver function and jaundice. Current studies have shown that carbohydrate antigen 199 [6], carcinoembryonic antigen [10] and carbohydrate antigen 242 [10] were associated with the malignancy of IPNB. However, our study did not show an association between the two. However, at present, the number of cases included in relevant studies is small, which still needs to be verified by multi-center studies with large sample size.

Imagological Examination

IPNB often presents as a solid mass with bile duct dilatation, bile duct dilatation with intraductal mass, and bile duct dilatation only [8]. Both enhanced ultrasound and enhanced computerized tomography (CT) showed enhancement in arterial phase, and weakened enhancement in venous phase [8]. Magnetic resonance imaging (MRI) showed isointensity or hypointensity on T1, slight hyperintensity on T2, and hyperintensity in arterial phase and portal vein phase after enhancement [11]. Gd-EOB-DTPA enhanced MRI can display mucin components of IPNB and tumor infiltration, and distinguish between inflammation and tumor [12]. Lee S et al. [13] have shown that MRI findings of intraductal mass, tumor diameter \geq 2.5 cm, multiple tumors, bile duct wall thickening, and adjacent organ invasion are helpful in identifying whether IPNB is invasive cancer. Jin KP et al. [14] have suggested that whole lesion apparent diffusion coefficient (ADC) histogram can distinguish invasive and noninvasive IPNBs.

Table 1 The pathological features of IPNB patients

Item	Patient (n = 12)	With invasive carcinoma (n = 8)	Without invasive carcinoma (n = 4)
Location of the tumor			
Intrahepatic bile duct	3	3	0
Extrahepatic bile duct	7	4	3
Both	2	1	1
Location of I-IPNB			
Left liver	3	2	1
Right liver	1	1	0
Both	1	1	0
Location of E-IPNB			
The hilar bile duct	5	2	3
The middle bile duct	2	1	1
The distal bile duct	2	2	0
Number of tumors			
Single	10	6	4
Multiple	2	2	0
Surgical margin			
Positive	1	0	1
Negative	11	8	3
Neural invasion			
Yes	2	2	0
No	10	6	4
Vascular invasion			
Yes	1	1	0
No	11	7	4
Lymphatic metastasis*			
Yes	0	0	0
No	7	7	0
Pathological type			
Pancreatobiliary type	9	7	2
Gastric type	1	0	1
Intestinal type	2	1	1
Oncocytic type	0	0	0

I-IPNB Intrahepatic intraductal papillary neoplasm of the bile duct, *E-IPNB* Extrahepatic intraductal papillary neoplasm of the bile duct

*: Lymph node dissection was performed in 7 cases

Positron emission tomography CT (PETCT) may predict the malignancy of IPNB. A higher maximum standardized uptake values (SUVmax) means that patients are more likely to develop invasive cancer. The cut-off value, however, is still controversial. A recent study [15] involving 101 patients identified 3.0 as the optimal cut-off value. However, because PETCT is expensive, it is not a routine examination in clinical practice.

In addition to traditional imaging, transoral choledochoscopy is becoming a very effective way for screening suspected neoplastic bile duct lesions [16, 17]. In 2021, a study [16] involving 207 patients showed that the success rate of transoral choledochoscopy was 96.1%, the success rate of

biopsy was 90.3%, and the neoplastic and non-neoplastic lesions could be directly distinguished in 91.6% of patients. Recent studies have shown that the success rate of examination and biopsy has further improved [17]. Meanwhile, transoral choledochoscopy combined with probe-based confocal laser endomicroscopy can be used for real-time diagnosis of IPNB [18].

Pathological Results

Pathological specimens were mainly obtained by surgical resection, choledochoscopic biopsy, and endoscopic ultrasound-guided or percutaneous fine needle aspiration biopsy.

Table 2 Operative data

Patient number	Surgical procedures	Pathology	Surgery time (min)	Intraoperative blood loss (ml)	Intraoperative transfusion	Postoperative hospital stays (day)	The Clavien-Dindo complications grade
1	Laparoscopic hepatectomy of segments IV, V and VIII + cholecystectomy + choledochoscopia + removal of tumor thrombus in bile duct + T-tube drainage + LND (turn to open procedures)	IPNB, pancreaticobiliary type, with invasive carcinoma	300	1000	No	14	II
2	Laparoscopic pancreaticoduodenectomy + nutritional jejunostomy + LND (turn to open procedures)	IPNB, pancreaticobiliary type, with invasive carcinoma	360	200	No	14	I
3	Robotic-assisted pancreaticoduodenectomy + LND	IPNB, intestinal type, with invasive carcinoma	270	100	No	10	III
4	Laparoscopic right hemihepatectomy + cholecystectomy + left liver tumor radiofrequency ablation + LND (turn to open procedures)	IPNB, pancreaticobiliary type, with invasive carcinoma	360	2500	Yes	18	II
5	Laparoscopic left hemihepatectomy + choledochoscopy + choledocholithotomy + T-tube drainage	IPNB, pancreaticobiliary type, with invasive carcinoma	180	300	No	7	I
6	Left hemihepatectomy + right posterior partial resection + cholecystectomy + choledochoscopia + choledocholithotomy + T-tube drainage + LND	IPNB, pancreaticobiliary type, with invasive carcinoma	215	200	No	14	I
7	Radical resection of common hepatic duct carcinoma + LND	IPNB, pancreaticobiliary type, with invasive carcinoma	300	30	No	7	I
8	Laparoscopic choledochoscopy + choledocholithotomy + T-tube drainage + biopsy of the mass in the lower common bile duct	IPNB, pancreaticobiliary type, without invasive carcinoma	240	30	No	10	I
9	Left intrahepatic lobectomy + extrahepatic bile duct resection + choledochoscopy + lithotomy of right intrahepatic bile duct + Roux-Y hepaticojejunostomy	IPNB, intestinal type, without invasive carcinoma	300	350	No	14	II
10	Laparoscopic choledochoscopy + resection of hilar bile duct lesion + cholecystectomy + T-tube drainage + cholecystoduodenal fistula repair	IPNB, pancreaticobiliary type, without invasive carcinoma	190	50	No	8	I
11	Robotic-assisted radical resection of hilar cholangiocarcinoma (IHIB) + LND	IPNB, pancreaticobiliary type, with invasive carcinoma	470	300	No	12	I
12	Laparoscopic cholecystectomy	IPNB, gastric type, without invasive carcinoma	45	10	No	2	0

IPNB Intraductal papillary neoplasm of bile duct, LND Lymph node dissection

However, there is a risk of needle tract seeding of needle aspiration biopsy [19]. In the past, the histological types were divided into pancreaticobiliary, gastric, intestinal, and oncocytic subtypes [20], and there were also mixtures of two or more subtypes. In 2018, pathologists proposed a new subclassification of IPNB [21]. Type I IPNB is histologically similar to intraductal papillary mucinous neoplasms of pancreas (IPMN), whereas type II IPNB is more complex histologically with irregular papillary branches or focal solid tubular components, often including extrahepatic bile ducts [21]. In 2020, pathologists [3] summarized a total of 694 cases of IPNB (520 cases of type I and 174 cases of type II), with type I IPNB being more common in I-IPNB and type II IPNB being more common in E-IPNB. Type I has a higher positive margin rate. Type I IPNB has a better prognosis than type II. This suggests the clinical value of the new classification. However, the boundary between type I and type II is not clear. In 2021, a Japanese study [22] included 181 cases of IPNB showed that a large number of cases were indistinguishable between type I and type II, which means that the pathological classification of IPNB still needs to be further explored. To note, a 2023 Japanese study [23] showed that T staging did not make a significant difference in the prognosis of type II IPNB patients with invasive cancer.

Treatment

Early surgical treatment is the main treatment after detection. Since IPNB may occur anywhere within the biliary tree, the primary purpose is to remove the tumor and ensure a negative margin. The surgery included hepatectomy, pancreaticoduodenectomy, and radical resection of hilar cholangiocarcinoma. For elderly patients who cannot tolerate surgery, transoral choledochoscopy provides options for endoscopic interventional therapy, such as endoscopic stent placement and argon plasma coagulation [24, 25]. Regular follow-up is also an appropriate option for patients with abnormal imaging findings but no tumor tissue found on biopsy. Hasebe T et al. [26] reported an IPNB patient who underwent liver resection after 13 years of long-term observation, and pathology confirmed IPNB with high-grade atypia. The recurrence rate of IPNB patients with invasive cancer is higher than that of IPNB patients without invasive cancer, and the prognosis is worse. Most IPNB patients without invasive cancer do not receive follow-up after surgery, which is what we need to improve in the future.

Prognosis

The overall prognosis of IPNB patients is better than that of biliary malignancies. Current published studies have shown that the 5-year OS of IPNB is around 65%–93.9% [6, 7, 27], which is consistent with the 5-year survival

rate of 87.5% observed in the current study. However, there is a large difference in prognosis between patients with type I IPNB and type II IPNB. A study [3] of 694 patients showed that the 5-year OS of type I IPNB and type II IPNB was 75.2% and 50.9%, respectively, and the 5-year disease-free survival was 64.1% and 35.3%, respectively. You Y et al. [28] found that cytokeratin 20, pancreaticobiliary type, tumor invasion outside the duct wall, tumor invasion to adjacent organs, and invasive carcinoma occurred more common in E-IPNB than in I-IPNB.

Another aspect that cannot be ignored may be related to the surgical procedure. In particular, pancreaticoduodenectomy is more likely to be planned for E-IPNB. A recent European multicenter retrospective study [29] showed that failure to achieve textbook outcomes (no prolonged hospital stay, no Clavien-Dindo complication grade \geq III, readmission, or death within 90 days) was an independent risk factor for OS. IPNB patients who underwent hepatectomy were more likely to have a textbook outcome (64.8% vs 32.0%) than those who underwent pancreatectomy, which correlated with more complications after pancreatic surgery. Khodr J et al. [30] reported a new surgical procedure to perform common bile duct resection and avoid pancreatic resection in patients with IPNB of the distal bile duct, which may help to improve the prognosis, but the preoperative diagnosis and intraoperative guarantee of negative surgical margins should be confirmed. Positive surgical margin has significant influence on the prognosis. One study [31] showed that the 5-year survival rates for positive and negative surgical margins were 38% and 87%, respectively. The expression of MUC5AC and MUC6 may be associated with good prognosis, while expression of MUC1 and cytokeratin 20 may be associated with poor prognosis [2, 5, 7].

Elevated carbohydrate antigen 199 [6], positive surgical margin [6, 31], lymph node metastasis [31] were associated with tumor recurrence. Local recurrence was the most common site of first recurrence. Distal metastasis may involve the liver, peritoneum and retroperitoneal lymph nodes [28]. You Y et al. [28] found that I-IPNB had a higher recurrence rate within 1 year (83.3% vs 33.3%) than that of E-IPNB, and E-IPNB had a higher recurrence rate within 1–3 years (50% vs 0%) than that of I-IPNB. This suggests that different types of IPNB require different follow-up plans.

Summary

More up-to-date research focusing on IPNB is warranted to help us better understand the diagnosis and treatment of this rare disease.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s12262-024-04029-6>.

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Data Availability The data gathered in this study are available from the authors on reasonable request.

Declarations

Conflict of Interest The authors have no financial disclosures or other conflicts of interest in relation to this work.

References

- Nakanuma Y, Curado MP, Franceschi S et al (2010) World Health Organization Classification of Tumours of the Digestive System[M], 4th edn. IARC, Lyon, pp 217–224
- Kim JR, Jang KT, Jang JY (2023) Intraductal papillary neoplasm of the bile duct: review of updated clinicopathological and imaging characteristics. *Br J Surg* 110(9):1229–1240
- Kubota K, Jang JY, Nakanuma Y et al (2020) Clinicopathological characteristics of intraductal papillary neoplasm of the bile duct: a Japan-Korea collaborative study. *J Hepatobiliary Pancreat Sci* 27(9):581–597
- Harada F, Matsuyama R, Mori R et al (2019) Outcomes of surgery for 2010 WHO classification-based intraductal papillary neoplasm of the bile duct: Case-control study of a single Japanese institution's experience with special attention to mucin expression patterns. *Eur J Surg Oncol* 45(5):761–768
- Nakanuma Y, Basturk O, Esposito I et al (2019) Intraductal papillary neoplasm of the bile ducts. In: Board E (ed) WHO Classification of Tumours of the Digestive System, 5th edn. IARC, Lyon, pp 279–282
- Youn JM, Hwang S, Ahn CS et al (2022) Clinicopathological features and long-term outcomes of intraductal papillary neoplasms of the bile duct of the liver: single-institution experience with 146 patients. *J Gastrointest Surg* 26(7):1394–1405
- Gordon-Weeks AN, Jones K, Harriss E et al (2016) Systematic review and meta-analysis of current experience in treating IPNB: clinical and pathological correlates. *Ann Surg* 263(4):656–663
- Zheng Q, Ruan SM, Shan QY et al (2019) Clinicopathological findings and imaging features of intraductal papillary neoplasm of the bile duct: comparison between contrast-enhanced ultrasound and contrast-enhanced computed tomography. *Abdom Radiol (NY)* 44(7):2409–2417
- Chan WH, Chen CM, Wang SY et al (2023) Intraductal papillary neoplasm of the bile duct presenting with hepatogastric fistula: a case report and literature review. *Front Oncol* 19(13):1193918
- Zhang H, Zhong Z, Kong G et al (2020) Clinicopathological findings and imaging features of intraductal papillary neoplasms in bile ducts. *PeerJ* 30(8):e10040
- Aslam A, Wasnik AP, Shi J et al (2020) Intraductal papillary neoplasm of the bile duct (IPNB): CT and MRI appearance with radiology-pathology correlation. *Clin Imaging* 66:10–17
- Ying SH, Teng XD, Wang ZM et al (2015) Gd-EOB-DTPA-enhanced magnetic resonance imaging for bile duct intraductal papillary mucinous neoplasms. *World J Gastroenterol* 21(25):7824–7833
- Lee S, Kim MJ, Kim S et al (2019) Intraductal papillary neoplasm of the bile duct: assessment of invasive carcinoma and long-term outcomes using MRI. *J Hepatol* 70(4):692–699
- Jin KP, Rao SX, Sheng RF et al (2019) Skewness of apparent diffusion coefficient (ADC) histogram helps predict the invasive potential of intraductal papillary neoplasms of the bile ducts (IPNBs). *Abdom Radiol (NY)* 44(1):95–103
- Choi JU, Hwang S, Ahn CS et al (2022) Diagnostic and prognostic impact of fluorodeoxyglucose-positron emission tomography in diagnosing intraductal papillary neoplasms of the bile duct of the liver. *Ann Surg Treat Res* 102(6):335–341
- Shin IS, Moon JH, Lee YN et al (2021) Use of peroral cholangioscopy to screen for neoplastic bile duct lesions in patients with bile duct stones (with videos). *Gastrointest Endosc* 94(4):776–785
- Shin IS, Moon JH, Lee YN et al (2023) Detection and endoscopic classification of intraductal neoplasms of the bile duct by peroral cholangioscopy with narrow-band imaging (with videos). *Gastrointest Endosc* 97(5):898–910
- Wen J, Ji JM, Gong B (2019) Cholangioscopy and probe-based confocal laser endomicroscopy for real-time diagnosis of intraductal papillary mucinous neoplasm of the bile duct. *Dig Endosc* 31(5):595
- Takahashi N, Taniguchi T, Adachi M (2014) A case of needle tract seeding of an intraductal papillary neoplasm of the bile duct (IPNB) after percutaneous biopsy. *Eur J Dermatol* 24(1):128–30
- Fukumura Y, Nakanuma Y, Kakuda Y et al (2017) Clinicopathological features of intraductal papillary neoplasms of the bile duct: a comparison with intraductal papillary mucinous neoplasm of the pancreas with reference to subtypes. *Virchows Arch* 471(1):65–76
- Nakanuma Y, Jang KT, Fukushima N et al (2018) A statement by the Japan-Korea expert pathologists for future clinicopathological and molecular analyses toward consensus building of intraductal papillary neoplasm of the bile duct through several opinions at the present stage. *J Hepatobiliary Pancreat Sci* 25(3):181–187
- Onoe S, Ebata T, Yokoyama Y et al (2021) A clinicopathological reappraisal of intraductal papillary neoplasm of the bile duct (IPNB): a continuous spectrum with papillary cholangiocarcinoma in 181 curatively resected cases. *HPB (Oxford)* 23(10):1525–1532
- Mitake Y, Onoe S, Igami T et al (2023) Is a specific T classification needed for extrahepatic intraductal papillary neoplasm of the bile duct (IPNB) type 2 associated with invasive carcinoma? *J Hepatobiliary Pancreat Sci* 30(6):745–754
- Cha B, Park JS, Jeong S et al (2019) Direct cholangioscopy with argon plasma coagulation of an intraductal papillary mucinous neoplasm of the bile duct. *Korean J Intern Med* 34(4):940–941
- Hinokuchi M, Iwaya H, Ido A (2020) Endoscopic ultrasound-guided hepaticogastrostomy for intraductal papillary neoplasm of bile duct with obstructive jaundice and cholangitis due to mucus overproduction. *Dig Endosc* 32(4):e80–e81

26. Hasebe T, Sawada K, Hayashi H et al (2019) Long-term growth of intrahepatic papillary neoplasms: a case report. *World J Gastroenterol* 25(36):5569–5577
27. Kim JR, Jang KT, Jang JY et al (2020) Clinicopathologic analysis of intraductal papillary neoplasm of bile duct: Korean multicenter cohort study. *HPB (Oxford)* 22(8):1139–1148
28. You Y, Choi SH, Choi DW et al (2020) Recurrence after resection for intraductal papillary neoplasm of bile duct (IPNB) according to tumor location. *J Gastrointest Surg* 24(4):804–812
29. Lluís N, Serradilla-Martín M, Achalandabaso M et al (2023) Intraductal papillary neoplasms of the bile duct: a European retrospective multicenter observational study (EUR-IPNB study). *Int J Surg* 109(4):760–771
30. Khodr J, Truant S, El Amrani M (2021) Surgical ampullectomy with resection of the common bile duct for biliary papillomatosis. *J Gastrointest Surg* 25(4):1087–1088
31. Uemura S, Higuchi R, Yazawa T et al (2021) Prognostic factors for surgically resected intraductal papillary neoplasm of the bile duct: a retrospective cohort study. *Ann Surg Oncol* 28(2):826–834

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