Case report

A case report of gallbladder cancer and pancreas cystic neoplasm associated with pancreaticobiliary maljunction

Kazuhito Sato a, Eisaku Ito b, Yukiyoshi Masaki a, Masako Ogawa a,c,*

a The Department of Surgery, Ome Municipal General Hospital, 4-16-5 Higashi Ome, Ome City, Tokyo, Japan
b The Department of Pathology, Ome Municipal General Hospital, 4-16-5 Higashi Ome, Ome City, Tokyo, Japan
c The Department of Surgery, the Fraternity (Doai) Memorial Hospital, 2-1-11 Yokoami, Sumida-ku, Tokyo, Japan

ARTICLE INFO

Keywords:
Case report
Pancreaticobiliary maljunction
Gallbladder cancer
Intraductal papillary mucinous neoplasm

ABSTRACT

Introduction and importance: Pancreaticobiliary maljunction (PBM) is a rare congenital anomaly that is frequently associated with carcinoma of the biliary tract. However, there is still no clear evidence that PBM is associated with pancreatic tumors. Here we describe a case of gallbladder cancer and intraductal papillary mucinous neoplasm (IPMN) that is associated with PBM.

Case presentation: A 72-year-old man underwent a cholecystectomy with hepatectomy (S4a + S5) and regional lymph node dissection for gallbladder adenocarcinoma invading the front lobe branch of the hepatic artery. A pylorus-preserving pancreaticoduodenectomy was also performed for pancreatic IPMN.

Clinical discussion: Presence of mucin type 6 (MUC6) -positive pyloric gland metaplasia in both the dilated pancreatic duct and the gallbladder background mucosa suggests that pancreatic IPMN and gallbladder cancer may have a common phenotypic origin. Additionally, analysis of 41 reported cases of pancreatic cancer associated with PBM revealed that in all metachronous multiple cancer cases, biliary tract cancer preceded the pancreatic cancer with congenital biliary dilatation accompanied by PBM. The analysis also revealed an increased proportion of pancreatic cancer cases with PBM in patients who had not undergone a flow diversion procedure located in pancreatic head.

Conclusion: We show an interesting relationship between pancreatic/gallbladder cancer and PBM. More comprehensive evaluations of the whole pancreaticobiliary system in follow-up of patients with PBM is required to understand the full extent of this relationship.

1. Introduction

Pancreaticobiliary maljunction (PBM) is a congenital anomaly with an overall incidence of 0.03% in patients who have undergone endoscopic retrograde cholangiopancreatography [1] and 3.3% in patients who have undergone hepatobiliary tract surgery [2]. This anomaly occurs when the junction of the pancreatic duct and the common bile duct is located outside the sphincter of Oddi [3,4], and is frequently associated with carcinoma of the biliary tract [3,5,6,8]. It has been proposed that biliary tract cancer develops when phospholipase A2 in refluxing pancreatic juice converts the phosphatidylcholine in bile into cytotoxic lysophosphatidylcholine. This can lead to damage of the epithelium with subsequent progression to carcinoma at the injured site [7]. Although PBM leads to the reciprocal regurgitation of pancreatic juice and bile, the association between pancreatic cancer and PBM is rare, possibly because the pancreatic duct pressure is higher than that of the bile duct [6,8,9].

Intraductal papillary mucinous neoplasms (IPMNs) were first described by Ohashi, et al. in 1982 [10], and Sessa, et al. introduced the term of IPMN in 1994 [11]. IPMN is characterized by the growth of epithelial tissue and mucin production in the main pancreatic duct or its branches [12]. It is agreed that IPMN is a precursor lesion of pancreatic...
carcinoma [11]; however, there is no evidence of a correlation between PBM and the development or malignant progression of IPMN. Here, we report a case of gallbladder cancer and IPMN associated with PBM. We used immunohistochemistry to show that PBM is involved in the development of the IPMN. We also performed a literature review of 41 cases of pancreatic neoplasm associated with PBM and show that in all metachronous cases, biliary tract cancer preceded the pancreatic cancer with congenital biliary dilatation accompanied by PBM. The case is reported according to SCARE criteria [13].

2. Presentation of case:

A 72-year-old Japanese male patient was referred from a local clinic to our hospital suspected of gallbladder and pancreatic tumor. He had past medical history of hypertension treated with a calcium blocker. He had no other medical histories including psychiatric disorders. His family medical histories and genetic background do not report any relevant conditions. No particular physical findings were detected on admission. His laboratory test results are shown in Table 1. A computed tomography (CT) scan revealed a thickened gallbladder wall with enhancement, suggestive of gallbladder cancer invading the liver bed. The common bile duct showed Todani type Ia cystic dilatation (Fig. 1a, b). A fluorine-18-fluorodeoxyglucose-positron emission tomography (FDG-PET) scan revealed abnormal uptake of FDG in the gallbladder wall, supporting the gallbladder cancer diagnosis. No other abnormal FDG accumulation was detected. A magnetic resonance cholangiopancreatography (MRCP) scan showed that the pancreatic duct joined the common bile duct above the papilla of Vater, diagnosed as pancreaticobiliary maljunction type B (Fig. 1c). An aggregation of small cystic lesions in the pancreatic head and a slight dilatation of the pancreatic duct was detected which was compatible with the branch duct type IPMN (Fig. 2). The patient was diagnosed with a gallbladder

### Table 1
Laboratory data.

| Test item                        | Result  | Normal range |
|----------------------------------|---------|--------------|
| Aspartate aminotransferase (AST) | 17 IU/L | 10–40        |
| Alanine aminotransferase (ALT)   | 12 IU/L | 5–45         |
| Total bilirubin (T. bil)         | 0.7 mg/dL | 0.3–1.2     |
| Direct bilirubin (D. bil)        | 0.1 mg/dL | <0.4        |
| Alkaline phosphatase (ALP)       | 224 IU/L | 104–338      |
| Gamma-glutamyl transferase (gamma-GTP) | 23 IU/L | <79        |
| Carcinoembryonic antigen (CEA)   | 3.4 ng/mL | <5.0        |
| Carbohydrate antigen 19-9 (CA19-9) | 75.4 U/mL | <37.0    |

Fig. 1. Preoperative CT and MRL.

a-b A horizontal image (a) and a coronal image (b) of an enhanced CT scan showing enhanced wall thickness in the gallbladder (yellow arrow). The common bile duct was dilated up to 43 mm (red arrow). c A MRCP scan showed an anomalous junction of pancreaticobiliary tracts. Both the common bile duct and the intrahepatic bile duct are dilated (yellow arrowhead). The pancreatic uncinate process is occupied by a “bunch of grapes” lesion apart from main pancreatic duct suggesting the branch duct type IPMN (red arrowhead). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Fig. 2. Macroscopic findings of the resected specimen.

a Mucosal side showed the wall thickness of gallbladder (solid arrow). b Serosal side showed the cystic dilatation of the common bile duct (arrowhead). Pancreatic duct joined the common bile duct approximately 30 mm above the papilla of Vater (white dashed arrow).
adenocarcinoma and pancreatic IPMN and the case was discussed in the multidisciplinary conference including the tolerability to the procedure.

2.1. Surgical findings

The patient consented to receiving the operation and underwent a cholecystectomy with hepatectomy (S4a + S5) and regional lymph node dissection for gallbladder cancer invading the front lobe branch of the hepatic artery. A pylorus-preserving pancreaticoduodenectomy was performed for pancreatic IPMN.

2.2. Pathological findings

Macroscopic findings of the resected gallbladder specimen revealed the tumor invading the liver bed. The histopathological diagnosis was a poorly differentiated tubular adenocarcinoma without lymph node metastasis, i.e., stage III according to the Union for International Cancer Control classification (Figs. 2a, 4a). The gallbladder cancer was evaluated as curative resection. With regard to the IPMN, precise pathological evaluation was impossible due to the autolysis of the surgical specimen. The main pancreatic duct at the pancreaticobiliary junction, adjacent to the IPMN, was dilated (Fig. 3a) and was associated with atypical changes (Fig. 3a, b).

Immunohistochemistry for mucin type 6 (MUC6) using the anti-MUC6 antibody was performed on the sections representing the pancreatic duct and the gallbladder cancer. The metaplastic lesion of the dilated main pancreatic duct was positive for MUC6, suggesting pyloric gland metaplasia (Fig. 3c). The gallbladder cancer lesion was negative for MUC6, whereas the non-cancerous background mucosa was positive, consistent with pyloric gland metaplasia (Fig. 4a, b).

3. Postoperative course and follow up

The patient was complicated with intraabdominal abscess which was treated with intravenous antibiotics administration. Furthermore, gastric bleeding caused by the compression of the drainage tube occurred 12 days after surgery, treated by parenteral hyperalimentation (Grade II according to Clavien-Dindo classification). The patient discharged the hospital postoperative day 69.

The patient was followed up with every 2 months after discharge. A CT scan taken 12 months after surgery revealed multiple metastasis in the hepatic hilum and perigastric lymph nodes, which was treated with gemcitabine+cisplatin chemotherapy. After 13 cycles, the regimen was changed to S1 due to nausea. He gave up receiving chemotherapy for the duration of nausea after 1 cycle of S1 and was followed up by a local clinic. He died 36 months after surgery.

4. Discussion

In this study we report a case of gallbladder cancer and IPMN that is associated with PBM. We show that MUC6-positive pyloric gland metaplasia is present in the dilated pancreatic duct as well as in the gallbladder background mucosa, suggesting that IPMN and gallbladder cancer may have a common origin.

Histopathological examinations have shown that PBM significantly increases incidences of hyperplastic changes in the non-cancerous epithelia of the gallbladder [14,15] and of metaplasia and dysplasia in the biliary mucosa [15,16]. Additionally, PBM is frequently associated with biliary tract cancer [3,5–7]. These results suggest that a sequence of hyperplastic changes through metaplasia and dysplasia plays an important role in the carcinogenesis of gallbladder with PBM. Although

Fig. 3. Histopathological examination of pancreas.

a Hematoxylin and eosin (H&E) staining for the dilated pancreatic duct at the site of the pancreaticobiliary junction. The magnification of the micrograph is 40×. b Higher magnification (200×) for the circled area of panel a. Atypical changes were detected in the epithelium of the dilated pancreatic duct. c Immunohistochemistry with the anti-MUC6 antibody on the dilated pancreatic duct. The presence of MUC6-immunoreactive cells suggested pyloric gland metaplasia in the atypical pancreatic epithelium. The magnification of the micrograph is 200×.

Fig. 4. Histopathological examination of gallbladder.

a Pathological diagnosis of gallbladder cancer was poorly differentiated tubular adenocarcinoma (arrow). The magnification of the micrograph is 40×. b Immunohistochemistry with anti-MUC6 antibody in the gallbladder. The gallbladder cancer lesion was negative for MUC6, whereas MUC6-positive pyloric gland metaplasia was detected in the non-cancerous mucosa of the gallbladder (arrowhead). The magnification of the micrograph is 40×.
Table 2
Summary of the 41 reported cases of pancreatic cancer with PBM.

| Author            | Ref        | Year | Age/sex | PBM type | Todani class. | Locus of panc. ca. | Pathol. of panc. ca. | Complication of biliary tract ca. | Treatment                                                                                           | Survival time (month) |
|-------------------|------------|------|---------|----------|---------------|-------------------|---------------------|------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------|
| Dexter            | [19]       |      | 22F     | B        | Ib           | Head              | Pap. ca.            | Hepatic duct ca. (syn.)             | Supportive care                                                     | 24mo. death            |
| Kelly, et al.     | [20]       |      | 30M     | Unk      | I            | Head              | Adenoca.            | Not described                     | Cholecodochoduodenostomy                                                      | 6mo.                  |
| Binks, et al.     | [21]       |      | 15M     | Unk      | I            | Head              | Unk                 | Not described                     | Cholecodochujejunostomy                                                      | 3mo. death            |
| Wood, et al.      | [22]       |      | 34F     | Unk      | I            | Head              | Mucin-producing adenoca. | Not described                     | Inoperable                                                             | 4mo. death            |
| Deeg, et al.      | [23]       |      | 70F     | Unk      | II           | Body              | Adenoca.            | Not described                     | Inoperative, irradiation devotion Cholecodochoduodenostomy and +hepaticojejunostomy→inoperable | 6mo. death            |
| Sanbonmatsu, et al.| [24]      |      | 15M     | Unk      | I            | Head              | IPMC or MCC         | None                               | Inoperable                                                             | 3mo. death            |
| Yoshitake, et al. | [25]       |      | 63M     | A        | ND           | Head              | Well-diff. tubular adenoca. | None                               | PD                                                                   | Unk                   |
| Suda, et al.      | [26]       |      | 66M     | B        | Unk           | Head              | Tubular adenoca.     | Not described                     | Inoperable                                                             | 3mo. death            |
| Kamisawa, et al.  | [27]       |      | 83F     | Unk      | ND           | Head              | Well-diff. tubular adenoca. | Not described                     | Unk                                                                   | Unk                   |
| Ueda, et al.      | [28]       |      | 58M     | B        | Ic           | Whole pancreatic duct | Intraductal pap. adenoca. | GB, intrapancreatic bile duct (syn.) | Extended cholecystectomy + TP                                           | 30mo. alive           |
| Aoki, et al.      | [29]       |      | 74M     | B        | Ia           | Body              | Intraductal pap. adenoca. | GB (met. 24mo.)                     | Extended cholecystectomy → DP R1                                              | 48mo. alive           |
| Kunimura, et al.  | [30]       |      | 40F     | C        | I            | Body              | Intraductal pap. adenoca. | GB (met. 32mo.)                     | Extended right hepatectomy combined with bile duct resection →DP + T. mesocolon resection and left adrenalectomy | 13mo. alive           |
| Morohoshi, et al. | [31]       |      | 67F     | Unk      | Ic           | Head              | Intraductal pap. adenoca. | GB, bile duct (syn.)               | PD + extended cholecystectomy                                                | 14mo. alive           |
| Okada, et al.     | [32]       |      | 63F     | B        | ND           | Tail              | cystadenocarcinoma   | GB (met. 32mo.)                     | Extended right hepatectomy combined with bile duct resection →DP + T. mesocolon resection and left adrenalectomy | 13mo. alive           |
| Nakamura, et al.  | [33]       |      | 70F     | Unk      | ND           | Head              | Por. diff. adenoca.  | GB (syn.)                          | Extended cholecystectomy + PD                                               | Unk                   |
| Nishihara, et al. | [34]       |      | 75F     | A        | II           | Head and uncinate | Adenoca.            | None                               | Endoscopic drainage                                                      | 4mo. death            |
| Miura et al.      | [35]       |      | 20F     | A        | Ia           | Body              | Mod.- diff. tubular adenoca. | Prime, laparotomy, intra-operative irradiation | Extended cholecystectomy + Exploratory laparotomy, intraoperative irradiation | 6mo. death            |
| Kinoshita, et al. | [36]       |      | 72F     | Unk      | Ic           | Head              | Intraductal pap. adenoca. | Not described                     | PD                                                                   | Unk                   |
| Tazawa, et al.    | [37]       |      | 48F     | B        | ND           | Head              | Well-diff. tubular adenoca. | Not described                     | PD                                                                   | 28mo. alive           |
| Kuga, et al.      | [38]       |      | 71F     | A        | Ic           | Head              | Well diff. adenoca.  | None                               | PD                                                                   | 6mo. died             |
| Kuga, et al.      | [39]       |      | 56F     | B        | ND           | Whole             | Unk                 | None                               | Inoperable                                                             | 4mo. died             |
| Ozawa, et al.     | [39]       |      | 45F     | A        | I            | Head              | Intramuscolap. pap. adenoca. | None                               | PpPD                                                                | > 120mo. alive        |
| Ozawa, et al.     | [39]       |      | 51M     | B        | Ia           | Head              | Mod.- diff. tubular adenoca. | None                               | PpPD                                                                | 11mo. death           |
| Huterbein et al.  | [40]       |      | 67F     | B        | Ic           | Head-body         | Adenoca.            | None                               | Inoperable                                                             | Unk                   |
| Ohana, et al.     | [41]       |      | 53M     | B        | ND           | Tail              | Por. diff. adenoca.  | None                               | Inoperable                                                             | 6mo. death            |
| Mayumi, et al.    | [42]       |      | 41F     | A        | Ic           | Head and uncinate (multiple) | Mod.- diff. tubular adenoca. | GB (met. 12mo.)                     | S4S + S5 resection combined with bile duct resection + D2 LN dissection →PD | 5mo. death            |
| Arakawa, et al.   | [43]       |      | 68M     | Unk      | ND           | Whole              | Pancreatic duct Head | IPMC                               | None                                   | 108mo. alive           |
| Eriyoshiki, et al.| [44]       |      | 42F     | Unk      | I            | Head              | Intraductal pap. adenoca. | None                               | Cholecdoch cyst excision with Roux-en-Y hepaticojejunostomy → PpPD           | 60mo. alive           |
| Kurokawa, et al.  | [45]       |      | 50F     | Unk      | Ia           | Head              | Well-diff. pap. adenoca. | None                               | Cholecdoch cyst resection and hepaticojejunostomy → TP (margin+)           | 5mo. death            |

(continued on next page)
| Author          | Ref        | Year | Age/sex | PBM type | Todani class. | Locus of panc. ca. | Pathol. of panc. ca. | Complication of biliary tract ca. | Treatment                              | Survival time (month) |
|-----------------|------------|------|---------|----------|---------------|-------------------|-------------------|-------------------------------|----------------------------------------|----------------------|
| Kobayashi, et al. | [46]      | 71F  | B       | ND       | Body-tail    | scc, scirrhouso  | GB (syn.)         | DP cholecystectomy partial duodenectomy and jejunal resection (palliative) | 6mo. death                                      |
| Mizutani, et al. | [47]      | 71F  | A       | III      | Head         | Mod.- diff. tubular adenocarcinoma | None             | PD                                      | Unk                                    |
| Arakura, et al. | [48]      | 74F  | C       | Ic       | Common channel | IPMC             | None             | PpPD                                      | ≥18mo. alive                          |
| Takeda, et al. | [49]      | 53F  | A       | Ia       | Head         | Well-diff. pap. adenocarcinoma | None             | Cholecystectomy, choledochectomy, and hepaticojejunostomy → TP | 5mo. death                              |
| Takeda, et al. | [49]      | 50F  | B       | Unk      | Body-tail    | Mod.- diff. tubular adenocarcinoma | None             | Cholecystectomy, choledochectomy, and Roux-en-Y choledochojejunostomy → distal pancreatectomy, splenectomy, left adrenalectomy, and partial gastrectomy | ≥44mo. alive                          |
| Lahmar, et al. | [50]      | 68F  | B       | I        | Head         | Adenosquamous ca. | GB, CBD (met. 45mo.) | Cholecystectomy → bisegmentectomy → PD | ≥12mo. alive                          |
| Honda, et al.  | [51]      | 67M  | A       | I        | Head-common channel | IPMC, oncocytic type | None             | PpPD                                      | ≥19mo. alive                          |
| Koizumi, et al. | [52]      | 76F  | B       | ND       | Head         | Adenocarcinoma. | GB (met. 7mo.)         | Cholecystectomy, choledochectomy, and Roux-en-Y choledochojejunostomy → chemo. | Unk                                    |
| Rungskulij, et al. | [53]    | 46F  | B       | I        | Head         | Well-diff ductal type adenocarcinoma | GB (syn.)         | HPD                                      | ≥10mo. alive                          |
| Kinowski, et al. | [54]     | 50M  | B       | I        | IPMC         | None             | PD                                      | Unk                                    |
| Mori, et al.   | [55]      | 72F  | B       | I        | IPMC         | Mod.- diff. ductal adenocarcinoma + IPMA | GB (syn.)         | SSPPD + extended cholecystectomy | 8mo. alive                              |
| Okubo, et al.  | [56]      | 54F  | B       | Unk      | Body-tail    | IPMC, pancreatobiliary type | GB (met. 36mo.)    | TP                                      | ≥6mo. alive                             |

Abbreviations used in the table above:

Adenocarcinoma; ca., cancer; CBD; common bile duct; chemo, chemotherapy; class., classification; diff., differentiated; DP, distal pancreatectomy; F, female; GB, gallbladder; HPD, hepatopancreaticoduodenectomy; M, male; MCC, mucinous cystic carcinoma; met., metachronous; mo., months; mod., moderately; ND, non-dilated; panc., pancreatic; pap., papillary; por., poorly; PD, pancreaticoduodenectomy; PpPD, pylorus-preserving pancreaticoduodenectomy; PTCD, percutaneous transhepatic cholangial drainage; syn., synchronous; Ref, reference; SSPPD, subtotal stomach-preserving pancreaticoduodenectomy; scc, squamous cell carcinoma; TP, total pancreatectomy; Unk, unknown
PBM induces the reciprocal regurgitation of bile and pancreatic juice, there are fewer reported cases of pancreatic cancer accompanied by PBM than biliary tract cancer [17], possibly because the pancreatic duct pressure is usually higher than that of the bile duct. However, after meals, bile duct pressure is raised by the contraction of the gallbladder, resulting in bile flowing into the pancreatic duct [8]. Pancreatic enzymes activated by the bile reflux possibly induce chronic inflammation and metaplastic epithelial change in the pancreatic duct, where pancreatic cancer may eventually develop [18].

We reviewed and summarized 41 reported cases of pancreatic cancer with PBM (Table 2). There were five cases with synchronous double cancers, two with synchronous triple cancers, six with metachronous double cancers, and one with metachronous triple cancers of the pancreas and the biliary tree. In all the metachronous cases, biliary tract cancer preceded the pancreatic cancer. Flow diversion procedure was performed for preceding gallbladder cancer in cases 14, 26, and 34. With the exception of these three cases and the cases with unknown history of diversion procedures, pancreatic cancer was located in the head or the entire pancreas in 25 of the 32 cases. This dataset indicated a trend of pancreatic cancer with PBM in patients who had not undergone a diversion procedure. In this subset of patients the pancreatic cancer was located in the pancreatic head, possibly due to the exposure to the regurgitated bile. However, data from the Japanese pancreatic cancer registry suggests that pancreatic head cancer had a higher instance than body/tail cancers by a ratio of 7:2 regardless of the etiology [57]. Therefore, whether bile regurgitation into the pancreatic duct affects the carcinogenesis of pancreatic cancer in PBM cases has yet to be confirmed. In terms of the pathology of the pancreatic tumors, at least five of the cases were reported to be intraductal papillary mucinous carcinoma (IPMC).

Although IPMN is a known precursor lesion of pancreatic carcinoma [11,12], the pathogenesis of IPMN has not been elucidated [10–12]. There is no evidence indicating a correlation between PBM and the development or malignant progression of IPMN. In terms of the etiology, the gallbladder cancer in this case was presumably caused by PBM. Immunohistochemistry of the IPMN lesion could not be evaluated due to the autolysis of the surgical specimen. Therefore, to explore whether PBM was involved in the development of IPMN in this patient, we performed immunohistochemistry of the dilated pancreatic duct. At the site of the pancreaticobiliary junction, the dilated pancreatic duct was associated with cellular atypia and MUC6-positive pyloric gland metaplasia, possibly due to exposure to the regurgitated bile. Pyloric gland metaplasia was also detected in the background mucosa of the gallbladder. Since pyloric gland metaplasia is a precancerous lesion for gallbladder cancer, these data suggest that IPMN and gallbladder cancer may have a common phenotypic origin. However, the association of pancreatic neoplasms, including IPMN, with PBM still remains unclear due to insufficient data. Future, more comprehensive evaluations of the whole pancreaticobiliary system in follow-up of patients with PBM will improve our understanding of the relationship between pancreatic neoplasms and PBM.

5. Conclusion

The presence of MUC6-positive pyloric gland metaplasia in the dilated pancreatic duct and gallbladder background mucosa in this patient suggests that IPMN and gallbladder cancer may have a common origin.

The analysis of 41 reported cases of pancreatic cancer with PBM showed that biliary tract cancer preceded the pancreatic cancer in all the metachronous multiple cancer cases. This observation suggests that patients with PBM should be monitored for synchronous and metachronous cancer of the whole pancreaticobiliary system, such that the appropriate surgical procedure and postoperative follow-up can be selected.

Ethical approval

The publication of this case was approved by the Ethics Committee of Ome Municipal General Hospital.

Sources of funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Author contribution

KS is the first author of this manuscript. MO is the corresponding author. KS, who had 6 years of experience as a surgeon at that time, did the procedure as an operator, supervised by YM and another chief surgeon. MO assisted the procedure. KS and MO collected the clinical data. EI and MO collected the pathological data. YM revised the manuscript. All authors read and approved the final manuscript.

Guarantor

Masako Ogawa, M.D., Ph.D.

Research registration number

Not applicable.

Consent for publication

The patient consented to the publication of these features of his case, and his identity has been protected.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Declaration of competing interest

The authors declare that they have no competing interests.

Acknowledgement

Editing assistance was provided by InPrint: A Scientific Editing Network at Washington University in St. Louis.

References

[1] K. Yamao, S. Mitustani, S. Nakazawa, K. Inui, N. Kanemaki, H. Miyoshi, K. Segawa, H. Zenada, T. Kato, Prospective study of the detection of anomalous connection of pancreaticobiliary ducts during routine medical examinations, Hepato-Gastroenterology 43 (1996) 1238–1245.
[2] A. Hasumi, H. Matsui, A. Sugita, I. Uyama, Y. Komori, J. Fujita, H. Aski, Precancerous conditions of biliary tract cancer in patients with pancreaticobiliary maljunction: reappraisal of nationwide survey in Japan, J. Hepato-Biliary-Pancreat. Surg. 7 (2000) 551–555.
[3] T. Kamisawa, H. Ando, Y. Hamada, H. Fujii, T. Koshinaga, N. Urushihara, T. Itoi, Diagnostic criteria for pancreaticobiliary maljunction, Tando 27 (5) (2013) 785–787 (in Japanese with English abstract).
[4] T. Kamisawa, H. Anjiki, N. Egawa, M. Kurata, G. Honda, K. Tsuruta, Diagnosis and clinical implications of pancreatobiliary reflux, World J. Gastroenterol. 14 (43) (2008) 6622–6626.
[5] T. Funabiki, K. Sugiu, T. Matsubara, H. Amano, M. Ochiai, Bile acids and biliary carcinoma in pancreaticobiliary maljunction, Keio J. Med. 40 (3) (1991) 118–122.
[6] T. Funabiki, T. Matsubara, S. Miyakawa, S. Ishihara, Pancreaticobiliary maljunction and carcinogenesis to biliary and pancreatic malignancy, Langenbeck&aapost;s Arch. Surg. 394 (2009) 159–169.
[7] T. Kamisawa, S. Kuruma, K. Chiba, T. Tabata, S. Kozumi, M. Kikuyama, Bilary carcinogenesis in pancreaticobiliary maljunction, J. Gastroenterol. 52 (2017) 158–163.
[8] K. Shimada, J. Yanagisawa, F. Nakayama, Increased lysophosphatidylcholine and pancreatic enzyme content in bile of patients with anomalous pancreaticobiliary ductal junction, Hepatology 13 (1991) 438–444.
S. Okada, S. Tanaka, A case of an anomalous arrangement of pancreatobiliary
T. Kunimura, T. Morohoshi, M. Kanda, T. Kuroki, T. Umezawa, K. Asanuma,
K. Aoki, E. Miyazaki, T. Kido, N. Hata, S. Hazama, S. Fujita, A. Kurata, An autopsy
N. Ueda, T. Nagakawa, T. Ohta, K. Tugawa, T. Takeda, N. Kadoya, H. Kimura,
K. Suda, T. Koyama, Y. Matsumoto, H. Fujii, K. Sugawara, J. Mutou, An operative
E. Yoshitake, K. Hirata, K. Yoshida, M. Mukaida, T. Shirakawa, T. Takamuro,
H. J. Deeg, J. M. Rominger, A. N. Shah, Choledochal cyst and pancreatic carcinoma
G. B. Wood, M. Baum, Carcinoma of the head of the pancreas developing in a young
D. Dexter, Choledochal cyst with carcinoma of the intrahepatic bile ducts and
F. Sessa, E. Socia, C. Capella, M. Bonato, A. Scarpa, G. Zamboni, N. S. Pellegrato,
D. L. Carr-Locke, J. A. Gregg, Endoscopic manometry of pancreatic and biliary
gallbladder and pancreatic cancer, Tando 4 (1) (1990) 68–74.
T. Morohoshi, T. Kunimura, M. Kanda, H. Takahashi, H. Yagi, K. Shimizu,
A. Nakayashiki, K. Asanuma, Multiple carcinomata associated with anomalous
arrangement of the biliary and pancreatic duct system, a report of two cases with a
literature survey, Acta Pathol. Jpn. 40 (10) (1990) 755–763.
S. Okada, S. Tanaka, A case of an anomalous arrangement of pancreatobiliary
ductal system associated with metachronous gallbladder and pancreatic cancer,
Shujutu (Operation) 55 (4) (2001) 579–582.
T. Kobayashi, F. Koyama, A case with long-term survival after undergoing
total pancreatectomy for intraductal papillomucinous carcinoma, Jpn. J. Gastroenterol.
S. Okubo, Y. Kato, M. Kudo, H. Aizawa, D. Takahashi, Y. Nishida, Y. Nakayama,
N. Rungsakulkij, P. Boonsakan, Synchronous gallbladder and pancreatic cancer
J. Hepato-Biliary-Pancreat. Surg. 7 (2000) 198–205.
Y. Noda, N. Fujita, G. Kobayashi, K. Kimura, K. Ito, J. Horaguchi, M. Takazawa,
Mucosal hyperplasia and cancer of the gallbladder in patients with abnormal
arrangement of the biliary-pancreatic ductal system, J. Biliary Tract Pancreas 25 (1)
(2004) 21–25.
S. S. Fischer, P. C. Nance, Choledochal cyst and neoplasm: a comprehensive review
of 106 cases and presentation of two original cases, Am. Surg. 63 (1) (1997) 98–987.
A. Lahmar, S. B. Abid, M. N. Arfa, R. Bayar, M. Tahar, S. Mzabi-Regaya,
Metachronous cancer of gallbladder and pancreas with pancreaticobiliary
maljunction, Shujutu (Operation) 58 (7) (2004) 1207–1209.
D. Dexter, Choledochal cyst with carcinoma of the intrahepatic bile ducts and
pancreatic ducts, Br. J. Cancer 11 (1) (1957) 15–28.
T. R. Kelly, T. M. Schultkraut, Choledochal cyst with coexistent carcinoma of the
pancreas, Am. J. Surg. 90 (1964) 209–212.
J. B. Links, G. J. Dauline, Choledochal cyst and carcinoma of the pancreas in a body
of fifteen years, Aust. N. Z. J. Surg. 40 (1970) 42–44.
G. B. Wood, M. Baum, Carcinoma of the head of the pancreas developing in a young
woman with a choledochal cyst, Br. J. Clin. Pract. 29 (1975) 160–162.
H. J. Deeg, J. M. Rominger, A. N. Shah, Choledochal cyst and pancreatic carcinoma
demonstrated simultaneously by endoscopic retrograde cholangiopancreatography,
Southern Med. J. 73 (1980) 1679–1679.
T. Sanbonmatsu, Y. Yokoyama, M. Endo, H. Ikawa, K. Katsumura, A case of a
genital biliary dilatation performed choledochoduodenostomy with pancreatic
cancer, J. Jpn. Soc. Pediatr. Surg. 21 (5) (1985) 884–885.
E. Yoshinaka, K. Hirata, K. Yoshiida, M. Mukada, T. Shirakawa, T. Takamuro,
K. Kobayashi, K. Shiramatsu, H. Hayasaka, A case of an anomalous junction of the
pancreatobiliary ductal system with carcinoma of the head, J. Jpn. Gastroenterol.
Soc. 19 (1) (1986) 59–62.
S. Kato, T. Koyama, T. Kudo, H. Fujii, K. Sugawara, J. Mutou, An operative case of pancreatic carcinoma, associated with a long common channel suspected
preoperatively as an anomalous union of the bile duct and the main pancreatic
duct, J. Biliary Tract Pancreas 7 (1986) 923–926.
Kamisawa, et al., Pancreaticobiliary maljunction and pancreatic disorders, in:
Japanese Study Group on Pancreatic Biliary Maljunction Proceedings 11, 1988,
p. 44–45.
N. Ueda, T. Nagakawa, T. Otta, K. Tugawa, T. Takeda, N. Kadoya, H. Kikuma,
K. Maeda, M. Kayahara, K. Ueno, R. Izumi, I. Miyazaki, A. Nonomura, A case of carcinomas of the gallbladder, common bile duct and pancreas associated with
anomalous arrangement of the pancreaticobiliary ductal system, J. Jpn. Surg. Assoc.
49 (11) (1988) 2198–2205.
K. Aoki, E. Miyazaki, T. Kid,, N. Hata, S. Hazama, S. Fujita, A. Kurata, An autopsy
of cancer of the pancreas with anomalous connection of the pancreatic and
biliary ducts, Iryo 44 (2) (1989) 173–177.
T. Kunimura, T. Morohoshi, M. Kanda, T. Tukru, T. Umezawa, K. Asanuma,
Anomalous arrangement of pancreatobiliary ductal system associated with
gallbladder and pancreatic cancer, Tando 4 (1) (1990) 68–74.
T. Morohoshi, T. Kunimura, M. Kanda, H. Takahashi, H. Yagi, K. Shimizu,
A. Nakayashiki, K. Asanuma, Multiple carcinomata associated with anomalous
arrangement of the biliary and pancreatic duct system, a report of two cases with
a literature survey, Acta Pathol. Jpn. 40 (10) (1990) 755–763.
S. Okada, S. Tanaka, A case of an anomalous arrangement of pancreatobiliary
ductal system associated with non-dilated type pancreaticobiliary carcinoma,
Japanese Study Group on Pancreatico Biliary Maljunction Proceedings 16, 1993, pp. 22–33.