Fish bone migration after pancreaticoduodenectomy: Incidence and treatment options

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Abstract

Objective

The migration of a fish bones to the bile duct or pancreatic duct is a possible complication of undergoing a pancreaticoduodenectomy (PD). The aim of this study was to clarify the incidence and indications for intervention in such cases.

Methods

We reviewed the cases of fish bone migration after a PD detected on computed tomography (CT) performed between October 2000 and October 2020 and investigated the incidence, presence or absence of symptoms, treatment options and outcomes.

Results

Among the 1475 pancreaticoduodenectomies performed at our institution during the study period, 14 cases of fish bone migration were noted on CT, at a frequency of

0.95% (14/1475). The time from surgery to the detection of fish bones ranged from 88 to 5902 days (median 917 d). Ten patients remained asymptomatic without therapeutic intervention for up to 2919 days (median 509 d). Four patients were treated by endoscopy, either at the patient's request (n = 1) or because of symptoms (n = 3), and removal was successful in three cases but failed in one case in which the fish bone migrated to the right intrahepatic bile duct. No surgical treatment was required in any case.

Conclusion

The incidence of fish bone migration on CT after PD was about 1%. Some cases resolved spontaneously, and most of the asymptomatic cases required no intervention. For symptomatic cases, endoscopic treatment should be considered first, but it is important to confirm the location of the fish bone by CT and determine whether or not it can be removed.

Graphical Abstract

Fish bone migration into the bile duct, pancreatic duct or elevated jejunum after a pancreaticoduodenectomy (PD) occurs in about 1% of postoperative cases and is not uncommon. But it is unclear whether therapeutic intervention is necessary for asymptomatic cases, and if so, what kind of treatment is most appropriate. We reviewed the 14 cases of fish bone migration after PD in our hospital. Many cases were asymptomatic and could be followed up without therapeutic intervention.

KEYWORDS

bile ducts

computed tomography

double-balloon endoscopy

foreign bodies

pancreaticoduodenectomy

1. INTRODUCTION

Fish bones are the most frequently ingested foreign body, especially in Asian countries in which fish is frequently eaten.[1] Most of the ingested bones can be excreted spontaneously, but in about 1% of the cases they lead to complications such as perforation which require surgery.[2] Occasionally, bones migrate into the bile duct and form common bile duct stones.[3,4] There have been several reports on successful interventions for symptomatic fish bone migration into the bile duct in patients with surgically altered anatomy, especially after pancreaticoduodenectomy (PD);[5-12] however, one case has been reported to be asymptomatic at diagnosis and the patient experienced a spontaneous resolution at follow-up.[11] We occasionally detect a linear, hyperattenuating structure suggestive of a fish bone in the bile duct, pancreatic duct or elevated jejunum on postoperative computed tomography (CT) scan. However, the actual frequency of such cases remains unknown. It is unclear whether therapeutic intervention is necessary for asymptomatic cases, and if so, what kind of treatment is most appropriate needs to be further clarified. In this study we aimed to clarify the incidence and indications for intervention in cases of fish bone migration after PD by summarizing the cases in our hospital.

2. PATIENTS AND METHODS

This was a single-center, retrospective study performed at the Nagoya University Hospital (Showa-ku, Nagoya, Japan) with the approval of the Ethics Committee of Nagoya University Hospital and in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. The content of the research is described and contact information for non-participation is provided in an opt-out format on the website of our hospital (approval number: 2020-0487).

Abdominal CT findings obtained at our institution between 30 October 2000 and 30 October 2020 that included the key word “fish bone” in the reports were retrospectively reviewed. A fish bone detected on CT scan was defined as a linear, hyperattenuating structure. The CT images were interpreted by two radiologists (at least one of whom is an expert in pancreaticobiliary diseases) and the final reports were made by mutual agreement. Altogether 31 cases of fish bone detected on abdominal CT were included. Of these, 15 cases had migrated into the bile duct, pancreatic duct or elevated jejunum, including 14 after PD and one after a right lobe caudal lobectomy and extrahepatic bile duct resection. The other 16 cases experienced migration into the gastrointestinal tract other than the elevated jejunum, but none of these occurred after PD. We then reviewed the 14 cases of fish bone migration after PD. The flowchart of case enrollment is shown in Figure 1. The incidence, underlying diseases, operative technique, time from surgery to the detection of the fish bone, location of the fish bone, presence or absence of symptoms, treatment plan, and outcomes were summarized and analyzed.

3. RESULTS

A total of 1475 PD procedures were performed at our institution between 30 October 2000 and 30 October 2020, and the incidence of fish bone migration after PD was 0.95% (14/1475). Of these 14 patients nine were male and five were female. All patients underwent CT for follow-up every 3 to 6 months. The underlying disease was pancreatic cancer in seven cases, intraductal papillary mucinous adenocarcinoma in four cases, cholangiocarcinoma in one case, solid pseudopapillary neoplasm in one case and chronic pancreatitis in one case, respectively. The stomach-preserving pancreaticoduodenectomy (SSPPD) was performed in 11 cases, PD in 2 cases, and pylorus-preserving pancreatoduodenectomy (PpPD) in one case, respectively. All were PD-IIA reconstruction and the gastrointestinal tract was reconstructed using the Roux-en-Y method in two cases. The time duration from surgery to the detection of fish bone ranged from 88 to 5902 days (median 917 d), and the fish bone was located in the intrahepatic bile duct in four cases, in the left or right hepatic ducts in three cases (Figure 2), in the bile duct jejunal anastomosis in two cases, in the main pancreatic duct in three cases (Figure 3) and in the elevated jejunum in two cases, respectively. Twelve patients were asymptomatic at the time the fish bones were detected, and four received therapeutic intervention during the study course. None of the patients had experienced esophageal symptoms before the fish bones were detected. The median length of the fish bone was 18.5 mm (interquartile range [IQR] 16-30 mm) (Table 1). Ten patients were followed up without therapeutic intervention. The fish bone spontaneously disappeared in six cases; although they remained visible on CT images in four cases, they remained asymptomatic. The length of time needed for the fish bone to disappear on CT images ranged from 18 to 2919 days (median 509 d). Among the four patients

who received therapeutic intervention, the indication was cholangitis in two cases, abdominal pain due to elevated jejunum penetration in one case, respectively; in the other case, the intervention was performed at patient's request. And the fish bone was located in the right hepatic duct, the right intrahepatic bile duct, the bile duct jejunal anastomosis and the elevated jejunum in one case each. All cases underwent double-balloon endoscopy (DBE) and the fish bones were successfully removed in three (75.0%) cases (Figure 4); while the procedure failed in the other in which the fish bone had migrated to the right intrahepatic bile duct. No surgical treatment was required in any case.

Regarding the case from whom the fish bone could not be successfully removed, the description is summarized below. A man in his 60s underwent SSPPD and PD-IIA reconstruction for pancreatic head cancer. During chemotherapy for peritoneal dissemination, CT showed a linear, hyperattenuating structure in the right intrahepatic bile duct that was suspected to be a fish bone. The patient was followed up without intervention as he was asymptomatic at that time. He was then hospitalized for cholangitis during the course of treatment, and the fish bone was thought to be the cause of cholangitis. CT showed a fish bone in the right intrahepatic bile duct (Figure 5A), but DBE (Figure 5B) and X-ray scan (Figure 5C) failed to show the fish bone and removal attempts were abandoned. There was no evidence of biliary obstruction and the patient recovered well after conservative treatment with antibiotics. One month after his discharge, CT showed residual fish bones (Figure 5D), but the patient remained free from recurrence of cholangitis.

4. DISCUSSION

Cases of accidental ingestion of fish bones and other foreign bodies are not uncommon in daily clinical practice. Due to their long and thin shape, fish bone tends to stay in the pharynx and esophagus and is often found as a symptom of neck discomfort or pain,[13] but they can also migrate into the gastrointestinal tract, bile duct and pancreatic duct without being noticed. Fish bone can cause cholangitis and stone formation if they migrate into the bile duct; such condition is rare, as the reflux is usually prevented by the sphincter of Oddi. However, in postoperative cases, such as patients who have undergone choledochojejunostomy, the absence of the ampulla allows the fish bone to migrate into the bile duct when it reaches the site of anastomosis. When we searched for the terms “pancreaticoduodenectomy” and “fish bone” in the Japan Medical Abstracts Society and PubMed, we found 13 cases (Table 2)[5-12] in which fish bone had migrated after PD, all of which were reported to have migrated into the bile duct. Twelve of the 13 cases were reported from Japan, three of which were reported in Japanese. Seven patients were symptomatic, including one treated with surgery and endoscopy, five treated with endoscopy alone and one treated with surgery alone. Six patients were asymptomatic, including one who requested treatment and underwent removal of the fish bone by endoscopy and five in whom the bone disappeared spontaneously during a median follow-up period of 176 days. Of the 1475 patients who underwent PD in our institution, a total of 14 (approximately 1%) over the 20-year observation period had a linear, hyperattenuating structure on abdominal CT that was suggested to be fish bones. Twelve were asymptomatic at the time of detection, and 10 (83.3%) of them were followed up without intervention, while the spontaneous disappearance of the fish bone was observed in six (50.0%). These results suggest that asymptomatic patients can usually be followed up without any intervention. Although therapeutic intervention

should be considered for symptomatic cases, approaching the bile and pancreatic ducts in the postoperative intestinal tract had been considered difficult and required surgical or percutaneous treatment. In recent years, however, the advent of small bowel endoscopy (eg, DBE or single-balloon endoscopy) has made minimally invasive and safe endoscopic approaches possible.[14,15] Of the four patients who underwent endoscopic treatment at our institution, the fish bones were removed successfully in three (75.0%) by endoscopy, while in one case it could not be removed because it had migrated deep into the intrahepatic bile duct and could not be detected. Endoscopic treatment is minimally invasive and useful in cases of fish bone migration, but the location of the fish bone needs to be confirmed by CT to determine whether or not it can be removed.

Fish bone migration into the afferent loop was mostly related to PD in the present study. For fish bones to migrate into the bile and pancreatic ducts after PD, they have to advance inside the afferent loop while moving against the normal peristalsis of the gastrointestinal tract. Although the mechanism underlying this phenomenon remains unclear, it has been suggested that resection of the duodenum reduces the plasma concentration of motilin, a type of peptide hormone and causes the delayed excretion of gastric contents due to reduced coordinated movements of the stomach, duodenum and proximal jejunum.[16] This may lead to a reflux of fish bones into the elevated jejunum, which seems to the reason for a high incidence of fish bone migration after PD. The fact that most of the reports originated in Japan may be due to the fact that Japanese individuals consume large quantities of fish and that the number of CT scanners per million population in Japan is extremely high. However, this study was limited by its single-center study setting and small number of cases and because the diagnosis was

made based on CT findings, we had not been able to evaluate other types of bone and debris that were not depicted on CT scan. In addition, it is not possible to determine whether or not the noted linear hyper-attenuated structure was actually a fish bone, except in cases when they were removed endoscopically. However, two radiologists (at least one of whom is an expert in pancreaticobiliary regions) of our hospital read the radiological findings, and given the fish bone's unique linear hyper-attenuated structure on CT, we believe that the accuracy of the diagnosis is therefore high.

5. CONCLUSION

Fish bone migration after PD occurs in about 1% of postoperative cases and is not uncommon, but many cases were asymptomatic and able to be followed up without therapeutic intervention. For symptomatic cases, endoscopic treatment should be considered first, but it is important to confirm the location of the fish bone on CT images and thereby determine whether or not its removal is possible.

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FIGURE 1 Flowchart of the study design

FIGURE 2 Fish bone migration into the right hepatic bile duct

FIGURE 3 Fish bone migration into the main pancreatic duct

FIGURE 4 Successful removal of a fish bone that had migrated into the bile duct by endoscopic treatment. A, The bone located in the right hepatic duct (shown in Figure 2) was successfully removed using double-balloon endoscopy (DBE) and B, the disappearance of the fish bone was confirmed by computed tomography

FIGURE 5 Unsuccessful removal of a fish bone migrated into the bile duct by endoscopic treatment. A, A fish bone migrated into the right intrahepatic bile duct and double-balloon endoscopy (DBE) was performed. B, Endoscopy and (C) X-ray scan failed to show a fish bone. D, One month after the DBE, computed tomography showed residual fish bones

TABLE 1 Patients' characteristics

Patients' no.	Age (y), sex	Underlying diseases	Surgery	Location and length (mm) of the fish bone	Symptoms	Treatment	Outcome
1	81, M	Cholangiocarcinoma	PD and extrahepati	Left hepatic bile duct,	None	None	Disappeared

			c bile duct resection	17			
2	64, F	Pancreatic cancer	SSPPD	Intrahepatic bile duct, 17	None	None	Disappeared
3	77, M	Pancreatic cancer	SSPPD	Main pancreatic duct, 16	None	None	Disappeared
4	58, F	Pancreatic cancer	SSPPD	Intrahepatic bile duct, 31	None	None	Disappeared
5	74, M	IPMC	SSPPD	Main pancreatic duct. 11	None	None	Disappeared
6	75, M	IPMC	SSPPD	Elevated jejunum, 20	None	None	Disappeared
7	73, M	IPMC	PD	Right hepatic bile duct, 21	None	None	Remained
8	41, F	SPN	PpPD	Bile duct jejunostomy anastomosis, 16	None	None	Remained

9	71, F	Pancreatic cancer	SSPPD	Main pancreatic duct, 13	None	None	Remained
10	57, M	Chronic pancreatitis	SSPPD	Intrahepatic bile duct, 16	None	None	Remained
11	67, M	Pancreatic cancer	SSPPD	Right hepatic bile duct, 30	None	DBE	Extracted
12	65, M	Pancreatic cancer	SSPPD	Bile duct jejunostomy anastomosis, 22	Fever	DBE	Extracted
13	75, F	IPMC	SSPPD	Elevated jejunum, 40	Fever, abdominal pain	DBE	Extracted
14	66, M	Pancreatic cancer	SSPPD	Intrahepatic bile duct, 41	None	DBE	Remained

Abbreviations: DBE, double-balloon endoscopy; F, female; IPMC, intraductal papillary mucinous adenocarcinoma; M, male; PD, pancreaticoduodenectomy; PpPD, pylorus-preserving pancreatoduodenectomy; SSPPD, subtotal stomach-preserving pancreaticoduodenectomy; SPN, solid pseudopapillary neoplasm.

TABLE 2 Previous reports of fish bones that had migrated after pancreaticoduodenectomy

First author	Age, (y), sex	Symptoms	Fish bone Location	Spontaneous disappearance of the bone	Treatment
Kuga[5]	63, M	Fever, abdominal pain	Right hepatic bile duct	No	Surgery and endoscopy
Sakakida[6]	78, F	Fever abdominal pain	Bile duct jejunostomy anastomosis	No	SBE
Bamba[7]	71, M	Fever, liver damage	Bile duct jejunostomy anastomosis	No	SBE
Ishiguro[8]	70, F	Fever	Right hepatic bile duct	No	DBE
Koga[9]	71, M	Fever	Right hepatic bile duct	No	DBE
Wu[10]	62, M	Fever, liver damage	Right hepatic bile duct	No	surgery
Akahane[11]	60s, M	Fever, liver damage	Right hepatic bile duct	No	endoscopy
	50s. M	None	Left hepatic bile	Yes	None

			duct		
	60s, F	None	Right hepatic bile duct	Yes	None
	70s, M	None	Right hepatic bile duct	Yes	None
	70s, M	None	Right hepatic bile duct	Yes	None
	60s, F	None	Right hepatic bile duct	Yes	None
Ishikawa[12] (in the present study)	67, M	None	Right hepatic bile duct	No	DBE

Abbreviations: DBE, double-balloon endoscopy; SBE, single-balloon endoscopy.