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Case Report: Pancreaticoduodenectomy for Pancreatic Ductal Adenocarcinoma with a Rare Anomaly of Celiac Trunk Originating from Superior Mesenteric Artery

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Abstract Identifying the vascular anatomical variations of the operating region is essential in carrying out successful surgery, and decreasing the rate of both intraoperative and postoperative complications. Surgeons must keep in mind that arterial variation may be present in the vascular structures intraoperatively, even though it was not revealed in preoperative imaging. The present study report a case of a 51 year old woman who was diagnosed with pancreatic ductal adenocarcinoma (PDAC) with a rare variation of celiaco-mesenteric trunk originating at the level of L1. The patient underwent pancreaticoduodenectomy. The postoperative course was favorable and the patient was discharged on postoperative day 15.

Keywords: *pancreaticoduodenectomy, celiaco-mesenteric trunk, pancreatic ductal adenocarcinoma*

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1. Introduction

Pancreaticoduodenectomy (PD) is a complex, high-risk surgical procedure performed for tumors of the pancreatic head and other periampullary structures. [1] Uncommon anatomical variations of the hepatic artery and celiac trunk put a patient at a high risk of perioperative and post-operative complication. Hence, knowing these arterial variations and identifying these accurately before operation is essential in carrying out successful surgery, and decreasing the rate of intraoperative and postoperative complications. Here, we describe a rare anomalous origin of celiac trunk, and superior mesenteric artery (SMA) originating together from the anterior wall of the abdominal aorta creating celiaco-mesenteric trunk. Celiaco-mesenteric trunk was originated from the abdominal aorta at the level of L1 indicating celiac trunk originated from SMA. Moreover gastroduodenal artery (GDA) was branched from right gastric artery (RGA) which originated directly from celiaco-mesenteric trunk.

2. Case Report

A 51-year-old woman was admitted to our department with a chief complaint of nausea, tension headache, loss of appetite, vomiting after eating, hematuria, epigastric pain radiating to the sides and fatigue starting from 1st of October 2018. The patient was diagnosed based on the result of abdominal CT & MRI and was sent to the National Cancer Center. She had no significant past medical history, but had a surgical history of caesarean section in 2002 and family history of pancreatic cancer (her father had pancreatic tumor). The patient was lifelong nonsmoker who did not consume alcohol. Physical examination revealed tenderness on light abdominal palpation. Biochemical parameter tests revealed elevated alkaline phosphatase 644u/l, total bilirubin 279.4mcmol/l, ALT 341.3u/l, AST 145.7 u/l and decreased creatinine 13.4mmol/l. Coagulation test revealed elevated PT-19.9sec and INR 1.77. The tumor marker carbohydrate antigen (CA) 19-9 was 522.1 and HBsAg was positive. Abdominal computed tomography showed dilated pancreatic duct (Figure 1) and intrahepatic biliary duct (IHBD), common bile duct (CBD), and pancreatic head mass (Figure 2). Also a rare anomaly of the celiac trunk originating from SMA was detected and is shown in maximum intensity projection (MIP) (Figure 3 and Figure 4). Vincent synapse was done in order to show the arterial anomaly in 3D without pancreas (Figure 5), and with pancreas (Figure 6). Magnetic resonance cholangiopancreatography (MRCP) showed abrupt flow cuttings in the distal CBD and in the proximal pancreatic duct and IHBD, CBD and pancreatic ductal dilatation (Figure 7).

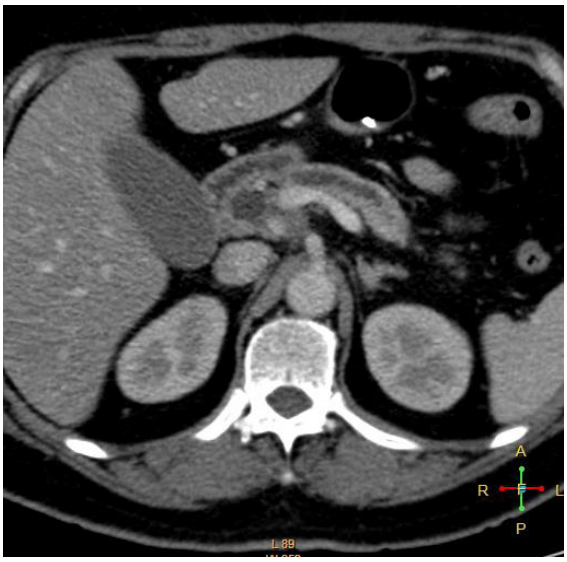

Figure 1. Abdominal CT showing dilated pancreatic duct

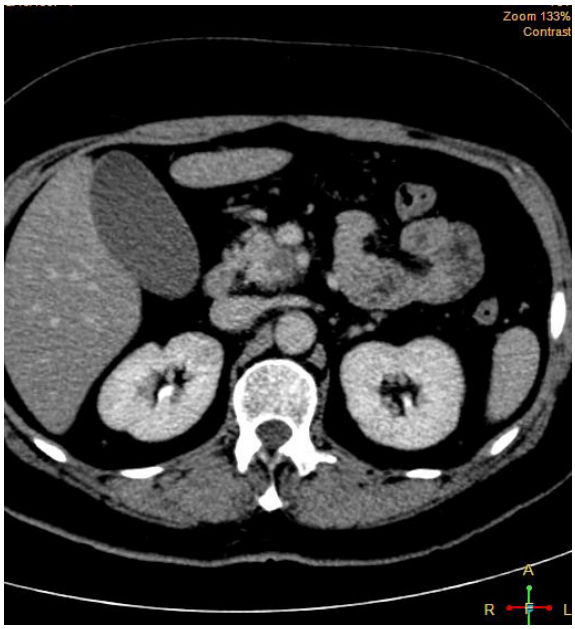

Figure 2. Abdominal CT showing pancreatic head mass

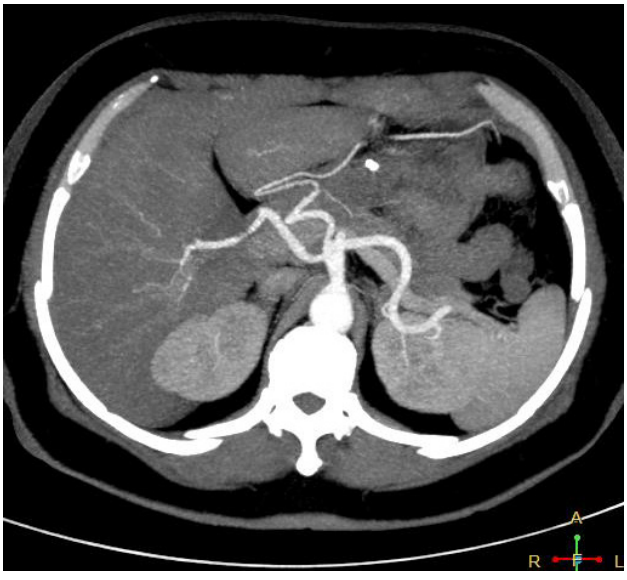

Figure 3. MIP showing branches of celiaco-mesenteric trunk

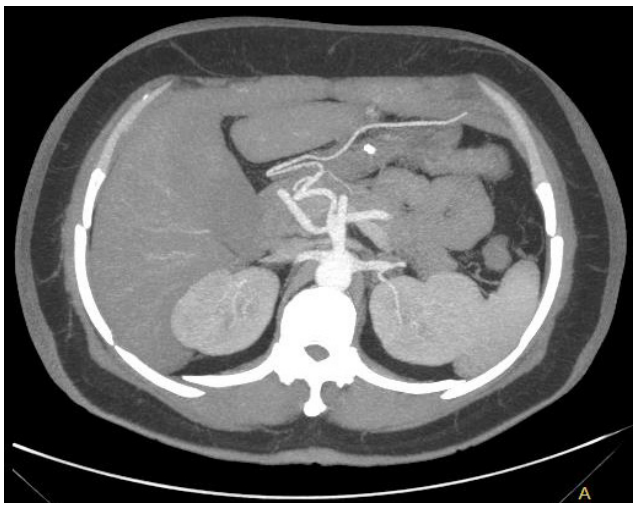

Figure 4. MIP showing celiac trunk originating from SMA at the level of L1

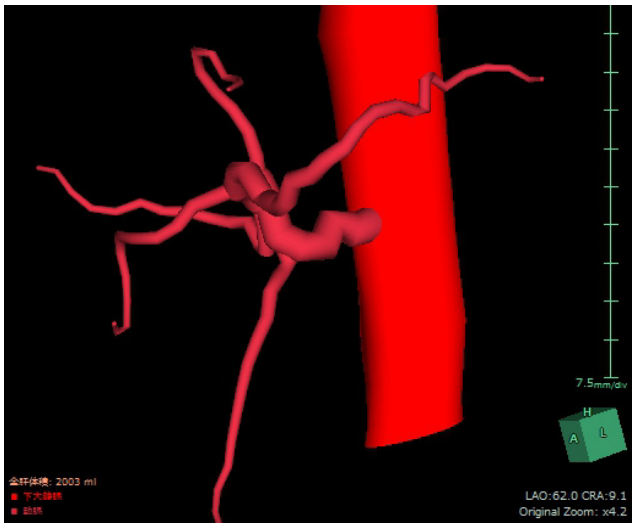

Figure 5. Vincent Synapse of celiaco-mesenteric trunk

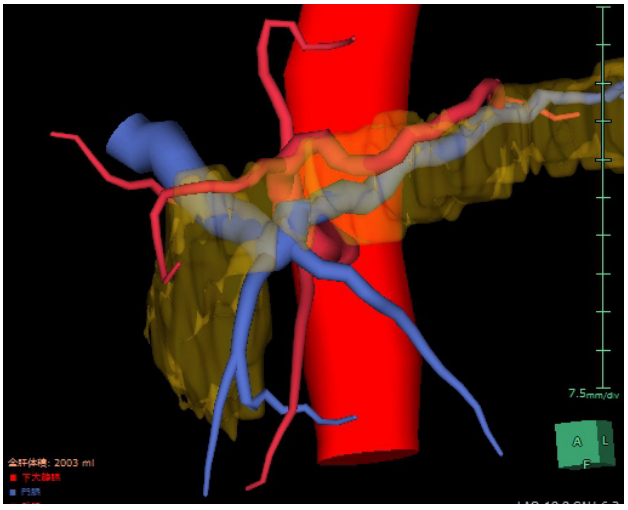

Figure 6. Vincent Synapse of celiaco-mesenteric trunk with pancreas

PD was performed to remove the 3x4cm tumor located on the head of pancreas. There was no intra-pancreatic metastasis (IPM) or multicentric carcinogenesis detected preoperatively. The common hepatic artery (CHA), splenic artery (SA), left gastric artery (LGA), RGA, SMA emerged together from the anterior wall of the abdominal

aorta creating celiaco-mesenteric trunk (Figure 8). The origin was at the level of L1 suggesting that celiac trunk originated from superior mesenteric artery. Simultaneously the GDA and RGA were abnormal, with the GDA branching from RGA which arised directly from celiaco-mesenteric trunk. Intraoperatively, the CHA was completely adhered to the posterior wall of the pancreas head and the uncinate process which complicated the surgery and prolonged the operation time. The pancreas was transected at the neck anterior to the portal vein (PV) and the CHA was preserved (Figure 9). Ultimately, PD was successfully performed and a definitive diagnosis of pancreatic ductal adenocarcinoma (PDAC) was made.

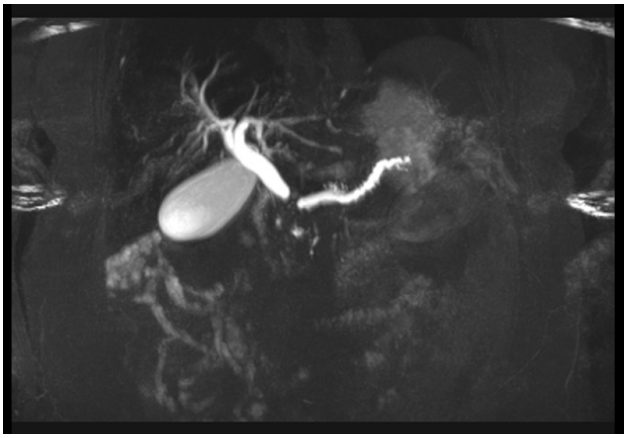

Figure 7. CBD and pancreatic ductal dilatation

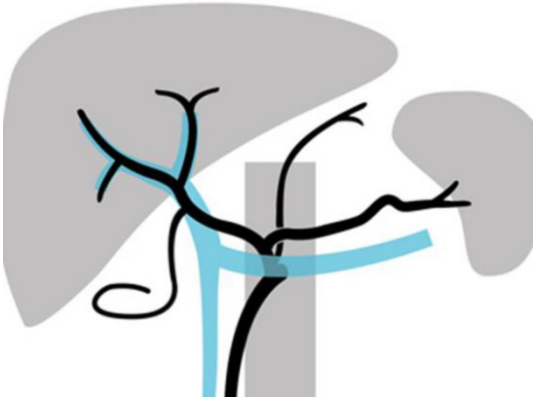

Figure 8. Illustration of celiaco-mesenteric trunk from Soon-Young et al's study [2]

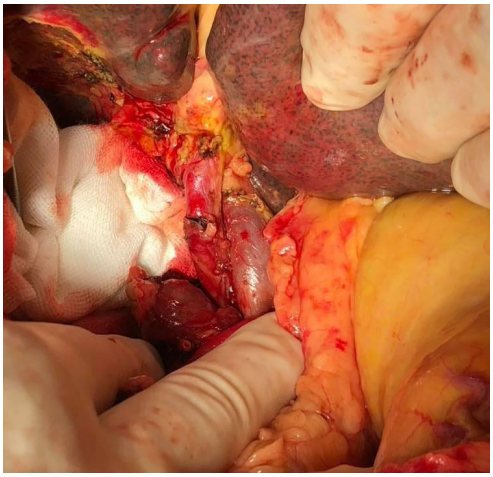

Figure 9. Intraoperative picture of CHA

Table 1. Changes of Biochemical Parameters in Postoperative Days

	Preoperative		POD1	POD2
ALT U/L	341.3		200.7	98.1
AST U/L	145.7		104.0	50.8
Alb g/L	41.4		27.0	27.5
TB μmol/L	279.4		232.9	188.9
AP U/L	644		470	277
	POD3	POD4	POD5	POD10
ALT U/L	71.4	56.9	49.8	33.4
AST U/L	41.6	37.8	32.5	31.1
Alb g/L	29.6	30.1	30.0	27.3
TB μmol/L	195.5	193.6	157.0	99.6
AP U/L	245	297	350	642

ALT= alanine aminotransferase, AST= aspartate aminotransferase, Alb= albumin, TB= total bilirubin, AP= alkaline phosphatase, POD= postoperative day.

Although there was a complete adhesion of CHA to the surrounding tissue, which complicated the surgery, the surgery lasted 6 hours and 55 minute and after the surgery the liver function and biochemical parameters gradually improved (Table 1). The postoperative course was favorable and the patient was discharged on postoperative day 15.

3. Discussion

The classical trifurcation of the celiac trunk into the common hepatic, left gastric, and splenic arteries was first reported by Haller [3] in 1756 at a frequency of 72% to 90% in the normal population [4,5,6]. Therefore the normal pattern is called Tripus Halleri. Knowing the variations of celiac trunk and identifying it accurately before hepatopancreatobiliary surgery is essential in carrying out successful surgery.

The anatomical variations in the celiac trunk and the superior mesenteric arteries were first studied and classified by Adachi in 1928. The celiac trunk presents several anatomical variations such as the absence of one of its branches (bifurcation or incomplete celiac trunk), additional branches, and common origin with the superior mesenteric artery (celiacomesenteric trunk), common origin with the superior and inferior mesenteric artery (celiac-bimesenteric trunk) and total absence. Based on the investigations performed on 252 people of Japanese origin Adachi formulated the Adachi's classification, which explains 6 types of division of Celiac and superior mesenteric trunks [7]. Celiaco-mesenteric trunk as reported in this case is the rarest in this classification (Table 2), and it is estimated to have an incidence of 0.75% [8].

Table 2. Adachi's classification

Trunk classification	Trunk classification number
Hepatogastrosplenic	1
Hepatosplenic	2
Hepatosplenomesenteric	3
Celiacomesenteric	4
Hepatomesenteric	5
Gastrosplenic	6

This variation of celiaco-mesenteric trunk was classified as Type VI according to Uflacker classification (Table 3). Uflacker types III and VI were the least with 0.6% incidence for each according to the study of Ahmed.M et al [9].

Table 3. Uflacker's classification

Trunk classification	Trunk classification number
Classic celiac trunk	I
Hepato-splenic trunk	II
Hepato-gastric trunk	III
Hepato-spleno-mesenteric trunk	IV
Gastrosplenic trunk	V
Celiac-mesenteric trunk	VI
Celiac-colic trunk	VII
No-celiac trunk	VIII

Superior mesenteric artery is developmentally considered as a part of the celiac complex and it follows that variations in the superior mesenteric artery are related to the celiac trunk. The anatomical variations of these vessels are due to developmental changes in the ventral splanchnic arteries [10].

Clear recognition of the anomalous branching pattern of celiac trunk and superior mesenteric artery both preoperatively and intraoperatively enhances the probability of a successful operation and limits harmful outcomes of complex hepatopancreatobiliary surgical procedures such as PD, or interventional procedures including lymphadenectomy around a hepatosplenomesenteric trunk, aortic replacement with reimplantation of the trunk, or chemoembolization of liver malignancies, all of which can potentially create significant morbidity because of the large visceral territory supplied by a single vessel.

4. Conclusion

The current study reports a case of PD with extremely rare celiac trunk and SMA variation with same origin at the level of L1 for PDAC. Overall, identifying the arterial variation accurately during preoperative imaging is necessary to avoid intraoperative vascular injury and complications after and throughout the surgery.

The patient tolerated the procedure well and was discharged without complication.

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