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ORIGINAL RESEARCH OPEN ACCESS

Clinico-radiological study of the pancreatic tail in relation to the splenic hilum

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Abstract

Introduction: Splenectomy is one of the most commonly performed surgical procedures worldwide. The splenic hilum is closely related to adjacent organs like the tail of the pancreas, stomach, splenic flexure of colon, and left kidney. One of the morbid complications of splenectomy is injury to the tail of pancreas. The objective of this study was to assess the anatomical details of the pancreatic tail with respect to the splenic hilum by assessing patient's abdominal computed tomography (CT) imaging.

Methods: A total of 150 patients' abdominal CT imaging was taken for evaluation in this study. The distance between the pancreatic tail and the splenic hilum was measured. The level of location of the pancreatic tail in relation to the splenic hilum was also noted for each patient.

Results: The pancreatic tail was inferior to the level of the splenic hilum in 59.3 percent (n =89) of the patients, superior to the level of the splenic hilum in 2.0 percent (n =3) of the patients, and at the level of the hilum in 38.7 percent (n = 58) of the patients. The mean distance from the pancreatic tail to the splenic hilum was 13.1 ± 5.2 mm.

Conclusion: Abdominal CT imaging will provide a road map regarding the location of the pancreatic tail and the distance between the pancreatic tail and the splenic hilum. With the preoperative CT imaging details and efficient surgical dissection as close as possible to the splenic hilum, the potential injury to the pancreatic tail can be prevented.

Keywords: splenectomy; pancreatic tail injury; splenic hilum; pancreatic fistula

Introduction

Splenectomy is one of the most commonly performed surgical procedures. Splenectomy is the surgical treatment for the management of hematologic disorders involving the spleen and also for the management of splenic trauma. Splenectomy can be done either by open surgical approach or by laparoscopic approach. The splenic hilum is closely related to adjacent organs like the tail of the pancreas, stomach, splenic flexure of the colon, and left kidney. One of the morbid complications of splenectomy is an injury to the tail of the pancreas which has various clinical presentations- asymptomatic hyperamylasemia, pancreatitis, subphrenic collection, peritonitis, pancreatic ascites, and pancreatic fistula [1-3]. There are only a few studies that have described the anatomical detail of the lienorenal ligament and the relation of the pancreatic tail to the splenic hilum [4-7]. Since such anatomical information may have significant surgical importance, the objective of this study was to assess the anatomical details of the pancreatic tail with

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respect to the splenic hilum by assessing the patient's abdominal computed tomography (CT) imaging.

Materials and methods

The study was approved by ethical committee and it was conducted from Jun 2022 to May 2023. All patients with abdominal complaints who required abdominal computed tomography (CT) with intravenous contrast for evaluation of their complaints were included in this study. Patients with clinical or radiologic evidence of pancreatic disease or splenomegaly and patients who had previous upper abdominal surgery were excluded from this study. All patients were evaluated as per the department protocol. A total of 150 patients' abdominal CT imaging was taken for evaluation in this study. Plain and contrast-enhanced CT imaging was taken using GE optima 128 slice CT (70-100 ml of iodinated contrast-omnipaque). Post-processing and viewing of the images were done in the dedicated CT workstation. The distance between the pancreatic tail and the splenic hilum was measured using oblique reformations and recorded in millimeters. The level of location of the pancreatic tail in relation to the splenic hilum was also noted for each patient (Figure 1). The patient's demographic details like age, gender, weight, height, and body mass index were noted. Statistical analysis was performed using independent t test, Pearson's correlation coefficient, and multivariate analysis.

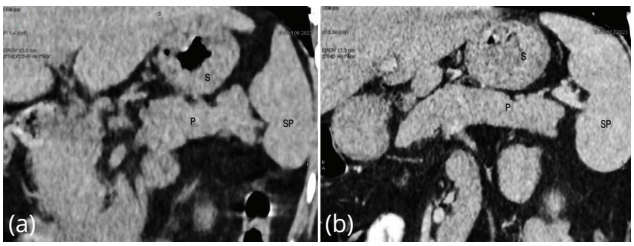

Figure 1: Abdominal computed tomography imaging showing the level of location of the pancreatic tail is at the level of the splenic hilum (a) and inferior to the level of the splenic hilum (b). S- stomach, P- pancreas, SP- spleen.

Results

The demographic characteristics of the 150 patients involved in this study are presented in Table 1. The patient's ages ranged from 18 to 80 years; the mean age of these patients was 44.8 ± 15.9 years. Eighty-three (55%) patients studied were male and 67 (45%) were female. The average body mass index (BMI) of the patients was 23.5 ± 5.0.

The distribution of patients based on their BMI was as described: 14.7 percent (n = 22) of the patients were underweight with a BMI range of less than 18.5 kg/m^2; 48.7 percent (n = 73) were normal in weight with a BMI range of 18.5 to 24.9 kg/m^2; 26.7 percent (n = 40) were overweight with a BMI range of 25 to 29.9 kg/m^2; 10 percent (n =15) were obese with a BMI range of 30.0 kg/m^2 or greater.

Table 1: Demographic characteristics of the study population.

Variable	*Mean*	*Standard Deviation*
Age (years)	44.8	15.9
Weight (Kg)	45.6	3.7
Height (cm)	160.4	10.6
Body mass index (Kg/m^2)	23.5	5.0

The level of location of the tail of the pancreas with respect to the splenic hilum was identified for each patient. The pancreatic tail was inferior to the level of the splenic hilum in 59.3 percent (n =89) of the patients, superior to the level of the splenic hilum in 2.0 percent (n =3) of the patients, and at the level of the hilum in 38.7 percent (n = 58) of the patients.

The shortest distance from the tail of the pancreas to the splenic hilum was measured for each patient. The shortest distance between the tail of the pancreas to the splenic hilum ranged from 5.0 to 35 mm. The mean distance from the pancreatic tail to the splenic hilum was 13.1 ± 5.2 mm. The mean pancreatic tail–splenic hilum distances for each of the variables of gender, location of the tail of the pancreas with respect to the splenic hilum, and BMI are described in Table 2.

Table 2: The mean distance between the pancreatic tail and the splenic hilum with respect to the study variables.

Variables	*Mean distance ± SD (mm)*	*p value*
Gender		*0.234*
Male (n= 83)	13.54 ± 5.43	
Female (n= 67)	12.52 ± 4.91	
Body mass index		0.243
Underweight (n= 22)	12.4 ± 3.7	
Normal (n= 73)	13.2 ± 4.9	
Overweight (n= 40)	12.3 ± 5.3	
Obese (n= 15)	15.4 ± 7.8	
Level of the pancreatic tail location		0.018
Superior to the hilum (n= 3)	20.6 ± 9.9	
At the level of the hilum (n= 58)	12.3 ± 4.7	
Inferior to the hilum (n= 89)	13.4 ± 5.2	

Of the study variables (age, gender, weight, height, BMI, and the location of pancreatic tail) measured, there is a significant association between the pancreatic tail to splenic hilum distance and the level of location of the pancreatic tail in relation to splenic hilum (P=0.018). The mean distance between the pancreatic tail and the splenic hilum based on the different levels of the pancreatic tail location is depicted in Figure 2.

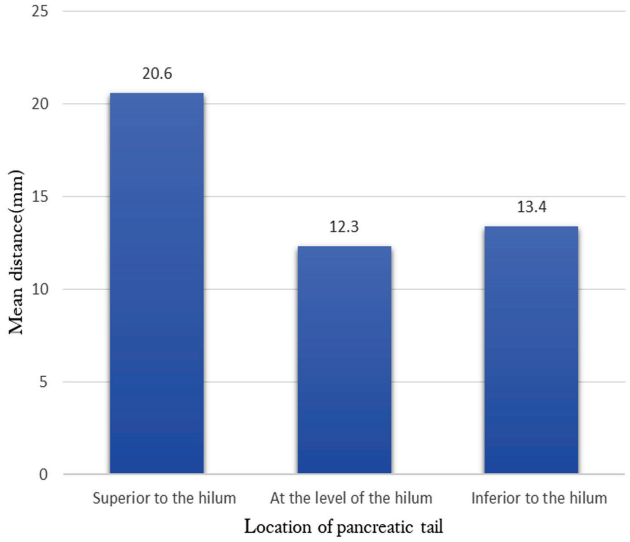

Figure 2: The mean distance between the pancreatic tail and the splenic hilum with respect to the level of location of the pancreatic tail.

Discussion

Splenectomy is one of the common operations, with approximately 70 cases per million population performed worldwide every year [8]. Splenectomy is increasingly performed with a laparoscopic approach than with an open surgical approach because of the benefits of minimally invasive nature and the majority of indications of splenectomy are of benign etiology. Indications of splenectomy are either pathological conditions primarily involving the spleen (primary splenectomy), adjacent organ pathology involving the spleen which mandates its removal (secondary splenectomy), or splenic trauma (traumatic splenectomy) [9-11].

The major complications of splenectomy are bleeding from splenic hilar vessels or capsular tear and inadvertent injury to the tail of the pancreas leading to postoperative pancreatic fistula (POPF). POPF is defined as an elevation of amylase levels of at least three times the hospital laboratory's norm in fluid drained from the abdominal cavity on or after postoperative day 3, associated with a relevant impact on the clinical outcome [12]. The reported incidence of clinically relevant POPF (POPF of grade B/C) was 4.5% after splenectomy [13, 14].

Inadvertent Injury to the pancreatic tail during splenectomy mandates either drainage or repair of the pancreatic injury. In case of unrecognized injury to the pancreatic tail during splenectomy, the patient will have various clinical presentations of either asymptomatic hyperamylasemia, pancreatitis, peritonitis, subphrenic collection, pancreatic ascites, or pancreatic fistula. Such complications will delay the patient's recovery and extend the hospital stay. The management of these patients may require admission in an ICU setting, administration of total parenteral nutrition, intravenous antibiotics, and image-guided drainage of collection, and there may be a requirement for further surgical interventions in some cases.

Several techniques have been described in the existing literature to prevent the risk of injury to the tail of the pancreas and the splenic hilar vessels during splenectomy [15-17]. It is important to recognize the location of the pancreatic tail prior to addressing the splenic hilum to avoid pancreatic injury in both laparoscopic and open surgical approaches for splenectomy. The operating surgeon should know the anatomic details of the lienorenal ligament and its content.

Studies describing the anatomic relation of the pancreatic tail and the splenic hilum are cadaveric studies and reported varying results regarding the distance between these two organs and the level of the pancreatic tail [5, 18, 19]. There are few studies wherein the abdominal computed tomographic imaging of patients was taken to study the lienorenal ligament and the relation of the pancreatic tail to the splenic hilum [4, 7, 6].

Based on the abdominal CT imaging, Saber et al [7] observed that in 85.3 percent of patients, the pancreatic tail was located inferior to the level of the splenic hilum and the mean distance between the pancreatic tail and the splenic hilum was 2.07±1.03 cm. They also found that body mass index was found to correlate with the pancreatic tail–splenic hilum distance. In our study, we found that the pancreatic tail was inferior to the level of the splenic hilum in 59.3 percent of the patients, superior to the level of the splenic hilum in 2.0 percent of the patients, and at the level of the hilum in 38.7 percent of the patients. The mean distance from the pancreatic tail to the splenic hilum was 13.1 ± 5.2 mm. Also, we found that the shortest distance between the pancreatic tail and the splenic hilum varies with respect to the level of the location of the pancreatic tail. In our study, we observed that there was an increased distance between the pancreatic tail and the splenic hilum when the tail of the pancreas was positioned superior to the level of the splenic hilum, in contrast to cases where the pancreatic tail was either at the same level as the splenic hilum or below it.

Conclusion

The operating surgeon should critically assess the anatomic details of the pancreatic tail in relation to the splenic hilum and the splenic hilar vascular pattern on CT imaging before splenectomy. CT imaging will provide a road map regarding the location of the pancreatic tail and the distance between these two organs. This information will be of great value to the surgeon in devising an efficient strategy to avoid injury to the pancreatic tail during splenectomy, especially with the laparoscopic approach. In conclusion, with the preoperative CT imaging details and efficient surgical dissection as close as possible to the splenic hilum, the potential injury to the pancreatic tail can be prevented.

Conflicts of interest

Authors declare no conflicts of interest.

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