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FREQUENCY OF VARIOUS ANATOMICAL VARIATIONS OF THE CYSTIC DUCT IN PATIENTS WITH CHOLELITHIASIS: A DESCRIPTIVE STUDY

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Abstract:
Objective: To determine the frequency of various anatomical variations of the cystic duct in patients with cholelithiasis.

Material and methods: The present study was carried out at Mohammad College of Medicine Peshawar. The study comprised adult patients of both genders who underwent open cholecystectomy between August 2022 and August 2023. A standardized proforma was developed to encompass many aspects of patient information, such as demographics, medical history, clinical examination details, pertinent diagnostic tests, intraoperative observations, and postoperative problems. The statistical analysis of the data was conducted using SPSS version 24.

Results: Mean age was 42.84 ±14.33 years, males were 37.1% and females were 62.9%. Most common anatomical variation was lateral insertion 42.4%, after lateral insertion medial insertion was second most common variation 21.2% followed by high insertion 16.5%. Anatomical variations and gender were not associated (P = 0.41).

Conclusion: In summary, it can be concluded that among patients with cholelithiasis, the prevailing anatomical variation of the cystic duct was lateral insertion, observed in 42.4% of cases, followed by medial insertion at 21.2%, and high insertion at 16.5%.

Keywords: Cholelithiasis, Bile duct, Anatomical variations, Frequency

INTRODUCTION:

Cholelithiasis, commonly known as gallstone disease, is a prevalent gastrointestinal disorder that affects millions of individuals worldwide. It occurs when solid particles, known as gallstones, form within the gallbladder[1]. One of the key anatomical structures involved in cholelithiasis is the cystic

duct, which connects the gallbladder to the common bile duct. While the pathophysiology and clinical management of cholelithiasis are well-documented, the anatomical variations of the cystic duct in patients with this condition have received increasing attention in recent years. Understanding these variations is crucial for clinicians, as it can significantly impact the diagnosis and surgical management of cholelithiasis [2, 3].

The cystic duct is a narrow tube that serves as a conduit for bile to flow from the gallbladder to the common bile duct, eventually reaching the small intestine [4]. Its anatomy is typically described as having a consistent course and branching pattern. However, numerous studies have revealed that variations in cystic duct anatomy are more common than previously thought, and these variations can be of paramount clinical significance in the context of cholelithiasis [5, 6].

One of the well-documented anatomical variations of the cystic duct is its course and length. The conventional anatomy of the cystic duct involves a relatively short duct that runs parallel to the common hepatic duct before merging with it to form the common bile duct [7]. However, some individuals may exhibit a longer, tortuous cystic duct that can take unexpected routes, making it challenging for surgeons to locate and safely remove gallstones during laparoscopic cholecystectomy [8, 9].
The junction point is typically described as "cystic duct triangle," and variations in its location, size, and shape have been reported. These variations can affect the ease of surgical access during gallstone removal and increase the risk of bile duct injury [10]. The presence of anatomical variations in the cystic duct raises several clinical implications for patients with cholelithiasis. Firstly, accurate preoperative imaging and detailed surgical planning become essential to identify and navigate these variations effectively[11, 12].
Cholelithiasis is a common gastrointestinal condition; the anatomical variations of the cystic duct in affected patients deserve special attention. These variations can significantly impact the diagnosis and surgical management of gallstone disease. The goal of this study was to determine the frequency of various anatomical variations of the cystic duct in patients with cholelithiasis. Clinicians, radiologists, and surgeons must collaborate to ensure accurate preoperative assessment and safe surgical interventions for patients with cystic duct anomalies. As our understanding of these variations continues to evolve, it is crucial to stay updated on the latest research and clinical guidelines to provide the best possible care to individuals with cholelithiasis.

MATERIAL AND METHODS:

The present descriptive study was conducted at Mohammad College of Medicine Peshawar. The study spanned from August 2022 to August 2023. A sample size of 170 adult patients, comprising individuals of both genders, was examined using a consecutive sampling technique for data collection. The study received proper approval from the institutional review board of the college.

Data was gathered from the patients using a structured form that included a comprehensive medical history, thorough clinical examination, and first investigations such as an abdominal scan. The inclusion criteria encompassed individuals who had been diagnosed with cholelithiasis and later underwent open cholecystectomy for management. The study eliminated individuals who had acute cholecystitis, jaundice, intercurrent diseases, were deemed ineligible for general anesthesia, or had challenging anatomical definition due to adhesions. Prior to the surgical procedure, informed agreement was obtained from all patients, and they were then admitted to the hospital one day in advance. The conventional open cholecystectomy operation was performed on all of the cases. A meticulous dissection was conducted to examine the anatomy of Calot's triangle, with particular attention given to identifying the common hepatic-cystic duct junction and investigating the presence of any suspected variations in the cystic duct. Postoperative follow-up was conducted for all patients who underwent surgery to monitor for any potential complications. The findings were documented on a data collection form and subsequently subjected to analysis using the statistical

software SPSS version 24. A Chi-Square test was employed to investigate the association between categorical variables, with statistical significance denoted by a p-value of less than 0.05.

RESULTS:

Patients' mean age in our study was 42.84 ±14.33 years, the age range in our study was 20 to 70 years. Frequency of male patients was 37.1% while female patients was 62.9%. The mean duration of stay at hospital was 1.98±0.82 days. Regarding the anatomical variations of cystic duct, lateral insertion was seen in 42.4% patients, medial insertion was seen in 21.2% patients, low medial insertion was seen in 3.5% patients, parallel course of the cystic duct 5.3%, high insertion 16.5%, short cystic duct 0.6%, aberrant insertion was observed in 1.8% patients, posterior insertion was seen in 1.2% patients while anterior insertion was observed in 6.5% patients and other variations were observed in 1.2% patients. Table 2 demonstrates the stratification of various anatomical variations with gender, we could not find a significant difference between anatomical variations and gender (P = 0.41).

Figure 1 Gender distribution

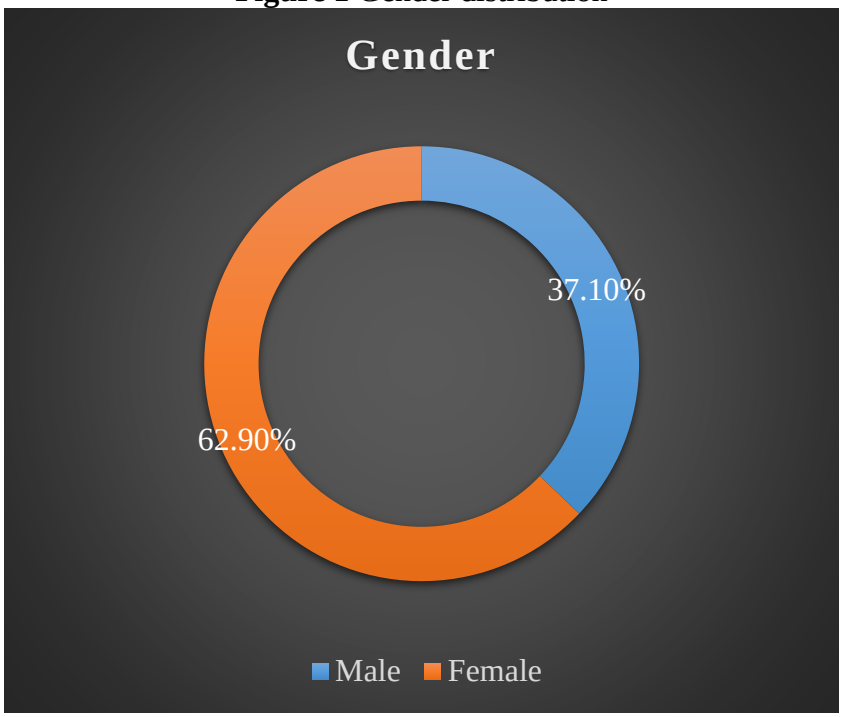

Table 1 Anatomical variations

Anatomical variations	Frequency	Percent
Lateral insertion	72	42.4
Medial insertion	36	21.2
Low medial insertion	6	3.5
Parallel course of the cystic duct	9	5.3
High insertion	28	16.5
Short cystic duct	1	.6
Aberrant insertion	3	1.8
Posterior insertion	2	1.2
Anterior insertion	11	6.5
Other variations	2	1.2
Total	170	100.0

Table 2 Stratification of anatomical variations with gender

		Gender		Total	P value
		Male	Female		
Anatomical Variations	Lateral insertion	32	40	72	0.41
		44.4%	55.6%	100.0%	
	Medial insertion	9	27	36	
		25.0%	75.0%	100.0%	
	Low medial insertion	1	5	6	
		16.7%	83.3%	100.0%	
	Parallel course of the cystic duct	4	5	9	
		44.4%	55.6%	100.0%	
	High insertion	12	16	28	
		42.9%	57.1%	100.0%	
	Short cystic duct	0	1	1	
		0.0%	100.0%	100.0%	
	Aberrant insertion	0	3	3	
		0.0%	100.0%	100.0%	
	Posterior insertion	1	1	2	
		50.0%	50.0%	100.0%	
	Anterior insertion	4	7	11	
		36.4%	63.6%	100.0%	
	Other variations	0	2	2	
		0.0%	100.0%	100.0%	
Total		63	107	170	
		37.1%	62.9%	100.0%	

DISCUSSION:

The study and establishment of the anatomy and variations of the biliary system have been extensively explored. However, comprehending and anticipating this system remains tough due to the intricate embryonic processes and the close closeness of the primary organs involved. In order to effectively address both surgical and medical objectives, it is imperative to possess a comprehensive understanding of the anatomical structure and variations of the place in question. One significant factor contributing to bile duct injury is the inability to accurately discern the anatomical structure of the duct, particularly in cases with anatomical variations.[13] The inadvertent misidentification of the common bile duct (CBD) as the cystic duct during laparoscopic and open cholecystectomies is a significant and concerning complication known as total transaction of the CBD.[14]

Variations may not always be attributable to congenital factors. The biliary tract is susceptible to iatrogenic injury, which can occur during both open and laparoscopic surgical procedures. These interventions have the potential to alter the morphology of the biliary tract and give rise to distinct variations. Iatrogenic damage has the potential to manifest as several adverse outcomes, including the formation of adhesions, tissue thickening, inflammation, and bleeding. Consequently, these complications may necessitate surgical interventions such as liver resection, cholecystectomy or liver transplantation with live donors.[15]

Previous studies have identified many variants of the cystic duct, focusing on its length, course, and point of attachment with the common hepatic duct (CHD). Several clinically significant varieties of cystic duct anatomy can be identified.[16] These variations encompass a range of anatomical anomalies, such as the cystic duct's lower insertion, its alignment in parallel with the common hepatic duct, the adoption of an anterior or posterior spiral course accompanied by medial insertion, the absence or brevity of the cystic duct (defined as a length less than 5 mm), unconventional drainage patterns of the cystic duct into the right or left hepatic duct, the presence of atypical or

accessory intrahepatic ducts converging into the cystic duct, and the occurrence of dual cystic ducts.[17]

Ultrasonography (USGs), computed tomography (CTs), and cholescintigraphies are integral components in the assessment of potential biliary abnormalities. Conventional magnetic resonance imaging (MRI) sequences enable further assessment of the biliary system and its neighboring structures. Nevertheless, mrcpare employed for the purpose of assessing inconclusive observations, offering a thorough and non-invasive evaluation of the biliary tract and gallbladder. The utilization of MRCP is prevalent in assessing the biliary tree, often serving as a substitute for diagnostic Endoscopic Retrograde Cholangiopancreatography and Percutaneous Transhepatic Cholangiography in numerous patients.[18]

The present study observed that the mean age of the participants was 42.84 ±14.33 years. Minimum age was 20 while maximum was 70 years. The gender distribution revealed that there were 37.1% males and 62.9% females. The study conducted in Pakistan revealed that the patients had comparable demographic characteristics.[19]

We observed that the most common variation in our study was lateral insertion which was found in 42.4% of the total patients. This is in accordance to a study which also reported lateral insertion to be the most common variation found in their patients[12]. A study conducted on Turkish population also reported the same findings, in agreement with the Turkish study, we found medial insertion the second most frequent variation 21.2% followed by high insertion 16.5%. The rest of the variations are also comparable with the aforementioned Turkish study.[20]

The acquisition of knowledge pertaining to the anatomical structure of the biliary system, coupled with the ability to discern variances within said system, would undeniably confer significant advantages upon surgeons. This enhanced understanding would ultimately result in a notable decrease in the occurrence of difficulties during surgical procedures. Nevertheless, the task of categorizing the many variances and carrying out comparative analyses among a substantial cohort of patients poses significant challenges. The current investigation, which involved a sample size of 170 patients, provides insights into the primary anatomical site variances.

CONCLUSION:

In summary, it can be concluded that among patients with cholelithiasis, the prevailing anatomical variation of the cystic duct was lateral insertion, observed in 42.4% of cases, followed by medial insertion at 21.2%, and high insertion at 16.5%. The accurate knowledge about the anatomy of cystic duct is important for a precise surgical intervention.

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