

Pattern and magnitude of cystic artery variations among Saudis in Aseer Region: Descriptive approach

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Abstract

Background: Cystic artery injury is a common complication during laparoscopic cholecystectomy, which transfers laparoscopic surgery to open surgery. If surgery is performed incorrectly, injury to the extra hepatic bile duct or intra-abdominal organs is un-avoidable. The reported rate of changing to open surgery because of blood vessel injuries is approximately 0%-1.9% during laparoscopic cholecystectomy.

Aim: To assess the pattern and magnitude of cystic artery variations by laparoscopy among patients undergone laparoscopic cholecystectomy in southern region, Saudi Arabia.

Material and Methods: A descriptive approach was used including all patients undergone cholecystectomy procedures in Aseer Central Hospital and Military Hospital in Khamis Mushayt. Anatomic variations of the cystic artery were viewed during laparoscopic or open cholecystectomy procedures and recorded by the surgeon. The course, origin and length of the cystic artery was recorded besides patients' demographic data.

Results: The study included 199-cases with ages ranged from 13 to 97 years old and mean age of 47.7 18.6 years old. Exact of 94.5% of the cases were females. As for cystic artery variation, only two cases (1%) recorded abnormality. The abnormality was more among females at middle ages.

Conclusions: The study revealed that cystic artery variations recorded among Saudi patients in southern region was very rare as only 2-cases out of about 200-cases were positive for cystic artery variations.

Keywords: Cystic artery variation, abnormality, hepato-biliary vascular supply, laparoscopic surgery, cholecystectomy

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Introduction:

In the classic arrangement, occurring with a frequency of approximately 70%, a singular cystic artery originates from the geniculate flexure of the right hepatic artery in the upper portion of the hepatobiliary triangle.¹ A site of origin from a more proximal or distal portion of the right hepatic artery is also considered relatively normal. When superficial and deep branches of the cystic artery do not share a common origin it is defined as a double cystic artery occurring with a frequency of 15%.

The deep branch consistently arises from the

right hepatic artery which is generally also the source of origin of the superficial branch, however in some cases it has been found to initiate from the anterior segmental artery, middle hepatic artery, left hepatic artery, superior mesenteric artery, gastro-duodenal artery or retroduodenal artery.^{2,3}

Due to the upwards trend of laparoscopic-cholecystectomy during the past decade, slightly less invasive surgery has progressed due to advances in video scopic technology, instrumentation, and surgical techniques.⁴⁻⁷ Currently, laparoscopic cholecystectomy is widely used as

Table 1: Personal data of patients sampled for cystic artery variation

Personal data	No	%
Age in years		
<30 years	36	18.%
30-49	77	38.%
50+	86	43.%
Gender		
Male	11	5.5%
Female	188	94.4%
Hospital		
KAH	23	11.6%
Armed Forces Hospital Southern Region (AFHSR)	119	59.8%
King Faisal Military Hospital-Khamis Mushat (KMH)	57	28.6%

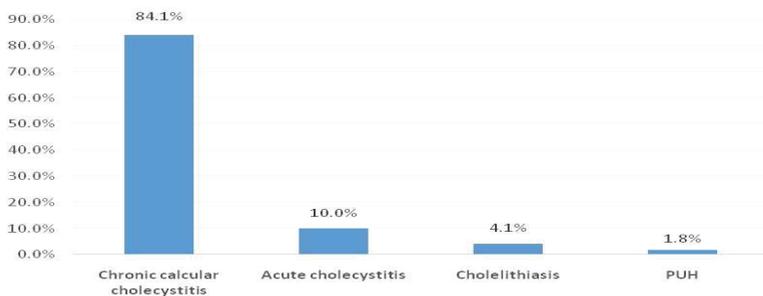


Figure 1. Clinical diagnosis for cases included for assessing cystic artery variations

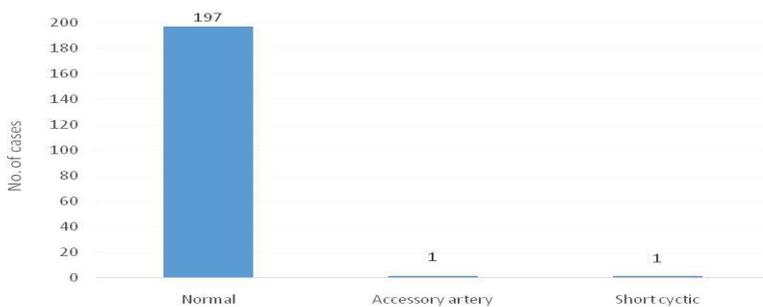


Figure 2. Cystic artery variation among sampled cases in Abha city, Saudi Arabia

the main management method among cases of Cholelithiasis.⁸⁻¹⁰ Iatrogenic biliary injury and arterial hemorrhage were initially the most recorded complications.¹¹⁻¹⁴ The cystic artery is the second most common arterial variation of the hepatic pedicle after the right hepatic artery.¹⁵ Also, the frequency of conversion of laparoscopic surgery to open attributable to injury to the cystic artery alone is 1.5 per 1,000 procedures.¹⁷

Due to a lack of knowledge of the laparoscopic anatomy of the gallbladder pedicle. Therefore, the laparoscopic surgeon has to deal with the new anatomical variations and must be aware of the possible arterial and biliary variants. The current study aimed to assess cystic artery variations among cases undergone hepatobiliary surgeries in Abha city, southern Saudi Arabia.

Material and Methods:

A descriptive approach was used including all patients undergone cholecystectomy procedures in Aseer Central Hospital and Military Hospital in Khamis Mushayt for 5-months after having their informed consent. These are the two main tertiary hospitals in the southern region of Saudi Arabia. Anatomic variations of the cystic artery were viewed during laparoscopic or open cholecystectomy procedures and recorded by a hepatobiliary surgeon. After every surgery the course, origin and length of the cystic artery was recorded besides patients’ demographic data. All variations in the course, origin and length of the cystic artery was recorded and confirmed by endoscopic visualization.

Data analysis: After data were extracted, it was revised, coded and fed to statistical software IBM SPSS version 22. All statistical analysis was done using two tailed test. Descriptive analysis based on frequency and percent distribution was done for all variables including demographic data, clinical diagnosis and cystic artery variations. Univariate relations patients’ bio-demographic data and cystic artery variations was tested using cross tabulation method.

Results:

The study included 199 cases with ages ranged from 13 to 97 years old and mean age of 47.718⁶ years old. Exact of 94.5% of the cases were females and 59.8% were admitted to Armed Forces Hospitals Southern Region (AFHSR) hospital (Table1).

With regard to diagnosis (figure 1), 84.1% of the cases complained of chronic calcular cholecystitis while acute cholecystitis was recorded among 10% of the cases and 4.1% had Cholelithiasis.

Table 2: Distribution of cystic artery variations according to cases personal data

Personal data	Variation					
	Normal		Accessory artery		Short cystic	
	No	%	No	%	No	%
Age in years						
<30 years	35	97.0%	1	2.8%	0	0.0%
30-49	76	98.0%	0	0.0%	1	1.3%
50+	86	100.0%	0	0.0%	0	0.0%
Gender						
Male	11	100.0%	0	0.0%	0	0.0%
Female	186	98.9%	1	0.5%	1	0.5%
Diagnosis						
Chronic calcular cholecystitis	141	98.6%	1	0.7%	1	0.7%
Gall bladder stone	0	0.0%	0	0.0%	0	0.0%
Cholelithiasis	7	100.0%	0	0.0%	0	0.0%
Acute cholecystitis	17	100.0%	0	0.0%	0	0.0%
PUH	3	100.0%	0	0.0%	0	0.0%

As for cystic artery variation, only two cases (1%) recorded abnormality. First case was accessory artery and the second cases had short cystic artery as shown in Figure-2.

On relating the two cases variations with the personal data (Table 2) it was clear that accessory artery was recorded among female patient below the age of 30 years and complained of chronic calcular cholecystitis. As for short cystic, it was recorded among female patient aged 30-49 years (exact of 48 years) and complained of Chronic calcular cholecystitis.

Discussion:

Laparoscopic cholecystectomy is the gold standard technique for treatment of symptomatic cholelithiasis and acute cholecystitis. However, it has a high risk of iatrogenic injury to bile duct and cystic artery. To avoid such iatrogenic injury to bile duct and vascular structures, a surgical strategy was advised by Strasberg France involving three steps. First step is blind dissection of Calot's triangle including hepatoduodenal ligament. Second step involves mobilization of lower part of gallbladder. Third step include identification and isolation of two main structures that is cystic duct and artery. This forms the basis for the infundibular approach for removing gall bladder with cauterization from neck upwards.

This is the most common approach used for removing gall bladder and provides a good visual access to the surgeon. This strategy is known among surgeons as the critical view of safety.

The first step in critical view of safety is the most significant part of the procedure as it deals with the blind dissection in Calots triangle. As with any other blind procedure, this blind dissection poses risk of vascular damage as the relevant artery is not visible during this step. This vascular damage causes obstruction of field of vision leading to increased risk of further iatrogenic injury to biliary tree. All this menace may result in conversion to open cholecystectomy.

The course, length and position of cystic artery are highly variable and are thus prone to iatrogenic injury. In order to avoid such complication it is essential to perform careful blunt dissection in Calots triangle during laparoscopic and open cholecystectomy. In view of these results we can postulate that it is safe to dissect the peritoneum anterior to the cystic duct as this is the area with least prevalence of cystic artery.

Variation in anatomy of cystic artery has been studied in several studies previously. A number of prominent and historic studies on this topic are from an age when CT and MR imaging was not performed routinely and laparoscopy was not common. However our study was conducted on a larger sized population and comparable sample size.

Our study was conducted specifically on laparoscopic patients and the anatomy was documented after achieving critical view of safety. After reviewing literature and comparing the results of our study, we postulate that anterior position of cystic artery in relation to cystic duct should be considered the least common anatomical variation during laparoscopic visualization.

The thorough knowledge of anatomy of extrahepatic biliary tract arterial supply and its variation is crucial. This knowledge helps in reducing the unwanted bleeding that might result in obscuring the vision causing damage to other

biliary and vascular structures. Iatrogenic injury to common bile duct and cystic artery can be avoided by careful dissection at Calots triangle and hepatoduodenal ligament.

It is thus essential to establish a safe zone for the blind dissection where the cystic artery can be present least likely. This study provides evidence for this step to be carried out safely without bleeding the cystic artery. As a first step in achieving critical view of safety, blind dissection in Calots triangle can be safely started anterior to the cystic duct thus reducing the chance of injury to cystic artery. Young surgeons can benefit from these findings in overcoming fear of complications and the learning curve associated with laparoscopic approach.

Conclusions:

The study revealed that cystic artery variations recorded among Saudi patients in southern region was very rare as only 2-cases (1%) out of about 200 cases were positive for cystic artery variations. One cases had short cystic artery and the other had accessory artery shortcoming.

A larger scale study including more sample is advised to be conducted for more exploration regarding the incidence of cystic artery variation.

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Role and contribution of authors:

Ahmad alhazmi, collect the data, references and did the initial writeup.

Mohammed Jalwi Karkaman, collected the data, references and also helped in introduction and discussion writing.

Awdah Abdulrahman Alkhatami, collected the data and helped in introduction writing.

Abdulrahman Jalwi Korkoman, collected the references and helped in discussion writing.

Jalawi Abdulrahman Korkoman, critically review the article and made final changes.

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