ORIGINAL ARTICLE

THE ANATOMICAL RELATIONSHIP OF CYSTIC ARTERY TO CALOT'S TRIANGLE

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ABSTRACT

Objective: To study the origin of cystic artery and its anatomical variations related to Calot's triangle.

Material and Methods: A retrospective analysis of surgical anatomy data of the patients who underwent surgeries for different lesions in the hepatobiliary region was carried out between August 2013 and October 2014 at Peshawar Institute of Medical Sciences (PIMS) Hayatabad, Peshawar, Khyber Pakhtunkhwa (KP), Pakistan. Evaluation of data entry into Excel was done, using validity checks, following which it was exported to SPSS version 19.0 for analysis.

Results: It was observed that in 61 (92.4%) of the cases the origin of cystic artery was normal i.e. from right hepatic artery and variations were seen in the remaining 5(7.6%) of cases. It was also noted that in 44(66.5%) of patients, cystic artery entered the Calot's triangle, while in 21(32%) of patients the course of the cystic artery was outside the Calot's triangle. Most of the cystic arteries that were passing through the Calot's triangle had their origin from the right hepatic artery 42(95.5%), while 2 cases were of common hepatic artery origin (4.5%).

Conclusion: Further research should be conducted in order to understand the anatomical variations of cystic artery to avoid injuries to the blood vessels and biliary system while performing various hepatobiliary procedures.

Key Words: Cystic artery, Normal Variation, Anatomy, Calot's triangle.

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INTRODUCTION

Calot's triangle is an important anatomical landmark especially during cholecystectomy, first described by Jean-François Calot, a French surgeon in 1891[1]. Calot's triangle is bounded by cystic duct, right hepatic duct and lower edge of the liver[2]. In 1992, Hugh gave Calot's triangle a new name called hepatobiliary triangle, with small cystic arteries known as Calot's arteries which supply the cystic duct[3]. A good knowledge of Calot's triangle is important for both types of cholecystectomies i.e. conventional and laparoscopic[4]. While approaching Calot's triangle, proper identification of arteries present in this area is important as it will avoid accidental injury or ligation of vessels which do not supply the gall bladder but are important for liver vascularization[5]. While dissecting the hepatobiliary region, instruments play a key role to make cut clean. Instruments like electroangulating hook may affect the extrahepatic biliary tree or vessels around Calot's triangle by causing unidentifiable iatrogenic burns[6].

Cystic artery a branch of right hepatic artery arises within Calot's triangle and courses posterior to the common hepatic duct[2]. Cystic artery may also originates from middle hepatic artery, gastroduodenal artery or left hepatic artery[7]. Knowledge regarding the anatomical variations of cystic artery and its branches are important as its uncontrolled bleeding increases the risk of intraoperative lesions to important biliary and vascular structures[8].

Laparoscopic cholecystectomy has now become the gold standard method for the treatment of gall bladder disease. One of the common complications of laparoscopic cholecystectomy is injury of common bile duct (CBD). It is therefore, important for surgeons to have a detailed knowledge regarding the vascular anatomy of this region to avoid haemorrhage in the Calot's triangle[9]. So, it is important for surgeons while

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performing laparoscopic cholecystectomy to have a detailed knowledge about anatomy of the cystic artery and its variations[10].

The main objective of this research is to provide a detailed study of the level of origin and variations of the cystic artery with respect to Calot's triangle to minimize the risk of injury to blood vessels and the biliary system during various hepatobiliary procedures.

MATERIAL AND METHODS

A retrospective analysis of surgical anatomy data of patients who underwent surgery for different lesions in the hepatobiliary region was carried out between August 2013 and October 2014 at Peshawar Institute of Medical Sciences (PIMS) Hayatabad, Peshawar, Khyber Pakhtunkhwa (KP), Pakistan. The study population included 66 patients who underwent surgery related to gall stones, choledochoduodenostomy for common bile duct, and cholecystojejunostomy for carcinoma of head of pancreas and laparotomy for perforated duodenal ulcers. The data included demographic characteristics and the operative findings i.e. cystic artery origin and its relation to Calot's triangle. Data collection were then done and analysed.

Data were retrieved from patient files containing surgical notes. Evaluation of the data entry into Excel was done using validity checks, following which it was exported to SPSS version 19.0 for analysis. Summary statistical calculation was done for continuous variable, while for categorical variables the frequencies were calculated. Three cases were excluded due to extensive adhesions present within Calot's triangle.

RESULTS

Sixty-six patients having different hepatobiliary procedures were included in the study: of these 56% (n=37) were males. The age of the patients ranged from 20 to 65 years with a mean of 42.5 years: 57% (n=38) of patients were aged between 20 and 40 years. It was observed that in 92.4% (n= 61) of cases the origin of the cystic artery was normal, i.e. from right hepatic artery: variations were seen in the remaining 7.6% (n=5) of cases (Figure 1).

It was noted that in 66.5% (n=44) of cases the cystic artery passed through Calot's triangle, while in 32% (n=21) the course of the cystic artery was outside Calot's triangle. There was only one case in which cystic artery was absent (Figure 2). In most cases the cystic arteries passing through Calot's triangle had their origin from right hepatic artery (95.5%, n=42), while in 2 cases (4.5%) it arose from the common hepatic artery. The majority of cystic arteries passing outside Calot's triangle had their origin from the right hepatic artery (90.5%, n=19), however the common hepatic artery gave origin in 9.5 % (n=2) of cases (Figure 3).

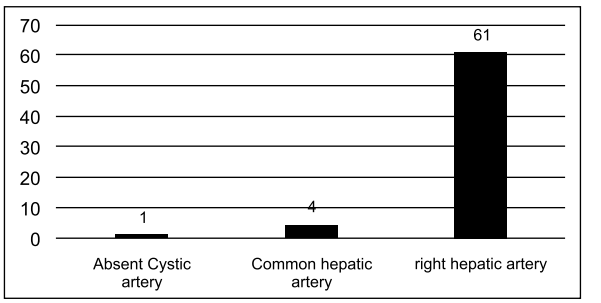

Figure 1: Origin of Cystic artery

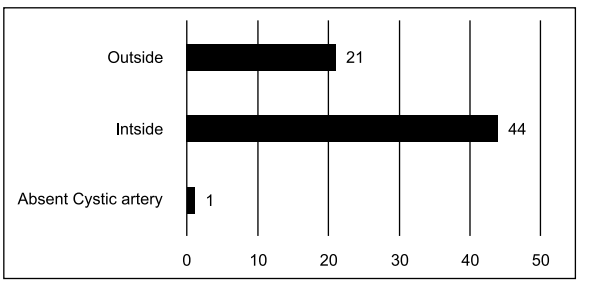

Figure 2: Anatomical variations of cystic artery in relation of Calot's triangle

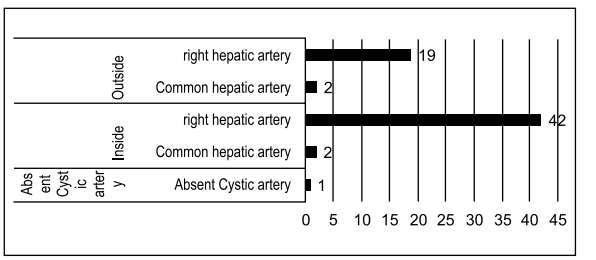

Figure 3: Frequencies of origin of cystic artery in relation to Calot's trinagle

DISCUSSION

It is always difficult for surgeons to perform surgery in the hepatobiliary region due to the variability of the anatomy of structures in this region. Therefore detailed knowledge of the relevant anatomy is of paramount importance. Anatomical variations of cystic artery also contribute to the occurrence of major post-operative complications[11]. Care must be taken by interventional radiologists while carrying out transcatheter interventional treatment of the liver when anatomic variations of the cystic artery are present[12].

In almost 70-80% individual's it was noticed that cystic artery arose as a branch of the right hepatic artery, but variations are quite frequent[13]. According to this study the most common source of the cystic artery is from the right hepatic artery i.e. 92.4% while Flisinski et al[14] observed in 82.3%, Pushpalatha et al[15] in 50% and Mlakar et al[16] in 51.9% of livers. It was also observed that 6.1% of cystic arteries had their origin from the common hepatic artery, greater than those highlighted by Khalil et al[17] i.e. 2%.

In this study it was observed that in 66.5% (n=44) of individuals the cystic artery passed through Calot's

triangle, while in 32% (n=21) the course of the artery was outside Calot's triangle, almost similar to the observations reported by Tejaswi et al[18] and Michels[19]. Cystic artery was found absent in one case in our study. This finding was also highlighted in one of the Chinese studies conducted by Ding Y-M et al[20] in which they found almost similar results i.e. absent cystic artery in 2.5% of patients and labelled it as "Cystic artery originating directly from the liver parenchyma".

CONCLUSION

From this study it can be concluded that further research should be conducted in order to understand the anatomical variations of the cystic artery to avoid untoward injuries to blood vessels and the biliary system during various hepatobiliary procedures.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

Badshah M: Idea and bibliography.
Soames R: Idea and bibliography.
Nawab J: Data collection.
Baloch FA: Typing and data analyzer
Khan J: Follow up.
Hasnain J: Statistics.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.