

Arterial Anatomy in Calot's Triangle as Viewed through the Laparoscope

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The arterial anatomy in the Calot's triangle as seen during the laparoscopic dissection while performing laparoscopic cholecystectomy is quite different to what has been taught traditionally. The difference is easily visible and recorded because the image on the monitor during laparoscopy is 14 times the normal size, therefore, even very small abnormalities can be recognised with ease. The anatomy of Cystic artery was reviewed on four hundred consecutive laparoscopic dissections of Calot's triangle during laparoscopic cholecystectomies between December 1996 to December 2000 and it was noted that, the normal cystic artery was found in 66 percent cases. The most common abnormality was branching of cystic artery into a superficial and a deep branch, [20% cases.] A double or an accessory cystic artery [9% cases]. Cystic artery crossing in front of the common hepatic duct [4%] cases. Caterpillar hump or recurrent right hepatic artery in [1 percent] which infact is the most significant surgical abnormality.

Key words:

The anatomy of the Calot's triangle is frequently abnormal (Hand 73)⁵ and indeed the anatomical vagaries of this region have been recognised since the early 18th century (Michles 1955)⁸. Serious consideration of the arterial anatomy was first thought out by Mr. Calot's in 1891³ and since then numerous reports have been presented which have been showing deviation from the so called normal arterial anatomy and there have been fundamental difference of opinion regarding the basic detail.

This paper presents an account of magnified detailed images of the abnormalities seen in our study.

The normal anatomy

As traditionally taught, the cystic artery arises from the right hepatic artery in Calot's triangle approximately 80% of cases¹⁰. The solitary cystic artery is lying supero anterior to the cystic duct^{9,10}. After coming in the calot's triangle the cystic artery divides into a superficial and deep branch. The superficial branch runs along the peritoneal surface of the left side of the gall bladder and supplies the free peritoneal surface of the gall bladder. The deep branch of the cystic artery supplies the attached surface of the gall bladder and frequently anastomoses with small vessels in the fossa. for the Gall Bladder¹⁰. Fig.1.

Material and methods

This is a retrospective, non randomised temporal study based upon 400 laparoscopic dissections of Calot's triangle while performing Cholecystectomies. The study duration is between December 1996 to December 2000... 47 were male and 353 were female.

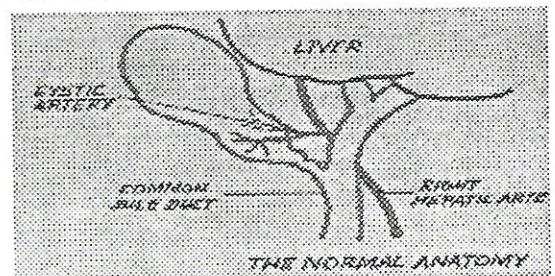


Fig. 1

The age range was between 14 to 90 years with the mean of 39 years.

Any vascular abnormality in the Calot's triangle was not only video recorded but also a detailed sketch was made showing main anatomic features of the course and relations of the right hepatic and cystic arteries.

The results were tabulated and then compared with those published in international literature.

Results

The most commonly deviation from the fore narrated normal anatomy was the early division of the cystic artery into an anterior and posterior branch in the Calots triangle and this was seen in 80 cases i.e. 20%. The anterior one supplied the peritoneal surface and the posterior one to the hepatic surface of the gall bladder. In these 80 cases the anterior branch was the lager one in 52 (65%) cases while the posterior had a bigger diameter in 28 (35%) cases.

The second common. anomaly was the accessory cystic artery or what appears to be double cystic artery originating from the right hepatic artery. Seen in 36 cases i.e. (9%). Fig;2

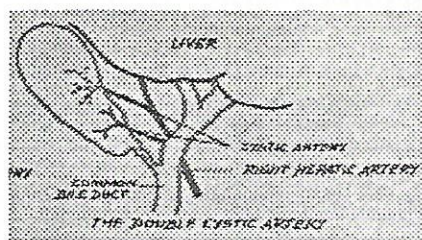


Fig:2
The third common anomaly was the cystic artery crossing in front of the common hepatic duct and then entry the Calot's triangle and was seen in 10 cases i.e. (4%).Fig:3

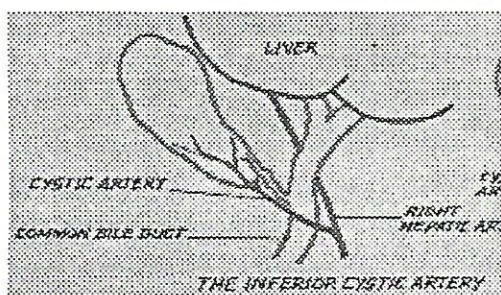


Fig 3.
Tortuous or caterpillar hump or recurrent right hepatic artery. was seen only in one percent i.e. four cases. Though rare but surgically this is the most significant abnormality as non recognition of this anomaly during surgical operations on gall bladder leads to serious complications^{6,7} and Fig;4.

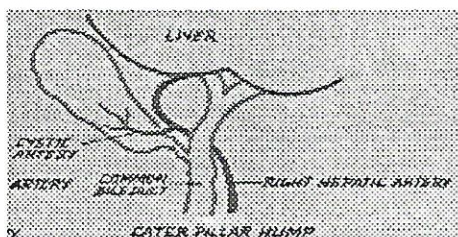


Fig 4.

Table 1.

Abnormality	No	%age
Early division of Cystic Artery	80	20
Accessory Cystic Or Double Cystic Artery.	36	9
Cystic artery crossing in front of Cystic Duct & Right Hepatic Duct.	10	4
Caterpillar Hump	4	1

Discussion & conclusion

There is a high incidence of arterial abnormalities in the Calot's triangle, In our series the collective incidence of abnormalities was 34%, various authors have reported an even higher incidence e.g.51.7% by Benson E.A. 53.5 by Hand in 1973^{3,5}. While Thomas B Hugh and Carol & H have reported them to be 28% and 25% respectively^{1,9}.

The anatomist and the surgeon will meet some anomaly in almost every third case which he dissects or operates. This is in keeping with the statement made by Hand in 1973 i.e. "It is difficult to know what is normal and what is abnormal.

In our study the most common abnormality was an early division on the cystic artery in the Calot's triangle into the anterior and posterior division in 20% cases. Although cystic arteries may vary greatly as regard to their anatomy with some arising from common hepatic artery or even from non hepatic branches of Coeliac trunk (Thames B. Hugh)⁹, but the early division results in two distinct cystic arteries, Phillips et al have also mentioned this early division. The cystic arteries can be differentiated from the cystic duct because of its smaller calibre and presence of arterial pulsations. Further careful dissection will demonstrate that cystic duct terminates by blending imperceptibly with infundibulum of gall bladder but that the cystic artery runs on to the surface of gall bladder^{2,4}.

The anterior and posterior branches both must be identified and ligated to avoid trouble some bleeding.

An accessory or double cystic artery was seen in 36 cases (9%) These differ from the previous anomaly due to the fact that they have a separate and independent origin from the right hepatic artery and are considerably smaller in size The influence has been reported to be 8% by Michles N A This very commonly runs low, Close to cystic duct and the gall bladder and may be torn,, bleeding may then obscure the operative field and hurried clamping may produce a disaster³.

The third common anomaly in our series was the cystic artery originating from right hepatic artery and crossing in front of the common hepatic duct to come into the Calot's triangle. It was seen in 10 cases i.e. 4%. This anomaly has been well documented by many authors, Carot E Scott and Thomes B. High have reported it to be 8% and 6% respectively. The later infact has termed this as the inferior cystic artery,

When Cystic artery arises outside the hepatobiliary triangle it usually passes ventral to the bile ducts and during its course it usually lies caused to the cystic duct⁶ In these patients when Calot's triangle is dissected, the Cystic artery is the first structure encountered is dissection of the inferior border of the triangle and in our experience

it is usually necessary to divide such arteries in order to visualise the Cystic duct.

The last common variety in our series was the Tortuous right hepatic artery or the Caterpillar hump it was seen only in four cases i.e. 1 percent, but the incidence has been reported to be 2-6% by Count E.H & Johnson E.V.) This anomaly is more common in the elderly (Michles N.A). This artery runs quite close to the Cystic duct and the gall bladder and may give rise to small multiple twrgrs that supply the gall bladder rather than a single cystic artery^{2,4}.

The Cater Pillar hump may be mistaken for a Cystic artery and can be tied which may be fatal in the presence of impaired Liver function. The artery is also especially vulnerable to injury during dissection which it run close to the gall bladder in the gall bladder r fossa and may lead to brisk bleeding from both ends and a clamp applied hurriedly in this situation may directly injure the common hepatic or common bile ducts.

How to recognise it - This anomaly is more common in the elderly, and during dissection an unusually large Cystic artery' is the first clue to this anomaly and the pulsations seen are much stronger than seen in a cystic artery.

Laparoscopic Surgery specially Cholecystectomy has rapidly gained acceptance in public. This requires careful dissection of the arterial and ductal components. The magnification and video imaging helps us in a more clear visualisation of the anatomy of the arteries in the Calot's triangle.

This paper clearly identifies four different type of abnormalities with thier incidence and percentages which will be quite helpful to the future surgeons who are adopting Laparoscopic C holecystectomy as the treatment

of choice for Gall Stone disease.

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