

The Cystic Vein: The Significance of a Forgotten Anatomic Landmark

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ABSTRACT

The cystic vein, a portion of biliary anatomy whose insignificance in open gallbladder surgery led to its being relegated to mythology, has been rediscovered by the magnified view of laparoscopic surgery. Its presence is an important anatomic feature that helps distinguish between cystic duct and common hepatic duct, thus diminishing the risk of inadvertent bile duct injury during laparoscopic cholecystectomy.

Key Words: Cystic vein, Laparoscopic cholecystectomy, Bile duct injury.

INTRODUCTION

First performed in 1989, laparoscopic cholecystectomy quickly became the gold standard for surgical extirpation of the gallbladder. Soon after, reports began to emerge of an increased incidence of significant bile duct injuries.¹ Reported injury rates varied from 0.1% to 2.2% compared with 0.1% for open cholecystectomy.^{2,3} The increased rate of bile duct injury has been attributed to a steep learning curve for laparoscopic cholecystectomy.⁴ Subsequent referral to tertiary centers for repair of transected common bile ducts resulted in published series that outlined the mechanisms of injury.^{1,5,6}

Risk factors for iatrogenic injury to the common duct appear to be the surgeon's inexperience, patient obesity, scarring and acute inflammation.⁴ A common factor in the reported cases of bile duct injury is the misidentification of common duct for cystic duct, resulting in resection of a portion of the common bile and hepatic ducts and a right hepatic artery injury.⁵ Precautions suggested to decrease the possibility of bile duct injury have included: routine cystic duct cholangiography, cholecystocholangiography, confirmed identification of the junction of the cystic duct with the common bile and hepatic ducts and identification of the junction of the cystic artery with the right hepatic artery.

Our experience with laparoscopic cholecystectomy supports the importance of anatomic identification in the safe performance of the procedure and also suggests the presence of a useful and reproducible anatomic landmark which can help define a zone of safe dissection within the triangle of Calot.

METHODS

This study is derived from a single surgeon's experience with more than 300 laparoscopic cholecystectomies performed since 1991. All patients with acute or chronic gallbladder disease were considered for the laparoscopic approach with the exception of those with suspected gallbladder masses or neoplasm.

The anatomy of the biliary tree was defined prior to division of the cystic duct and artery. An operative cholangiogram was attempted in all patients. Cholangiograms were abandoned only if the lumen of the cystic duct would not accommodate the epidural catheter used for this purpose.

During 1996, patients were chosen in one of three representative categories as they randomly presented in the

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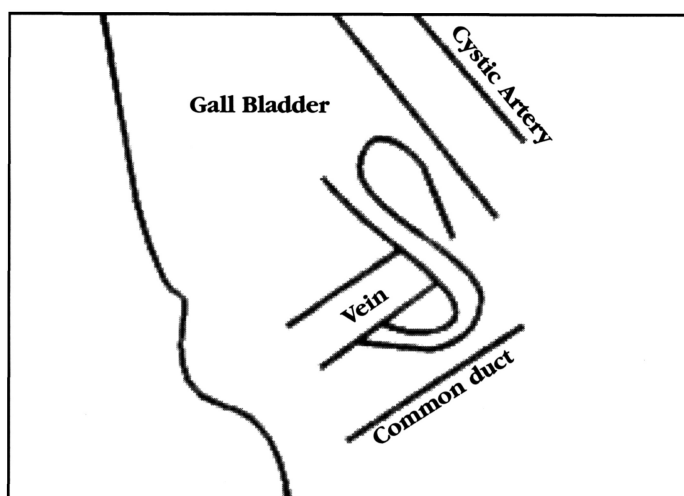


Figure 1. Case I: Acute chdeaystititis and multiple cystic veins.

course of our practice. These were chronic disease, acutely inflamed gallbladder and intra-operatively identified aberrant anatomy. These were used as descriptive case studies.

RESULTS

Case I:

I.M., a 67 year-old-female with biliary colic systems and ultrasound proven cholecystolithiasis, underwent outpatient laparoscopic cholecystectomy. Two 1 mm veins were demonstrated within the triangle of Calot between the cystic duct and cystic artery (**Figure 1**). They were divided with the Harmonic Scalpel (Ultracision).

Case II:

M.B., a 56-year-old female with biliary colic symptoms and cholecystolithiasis on ultrasound, underwent outpatient

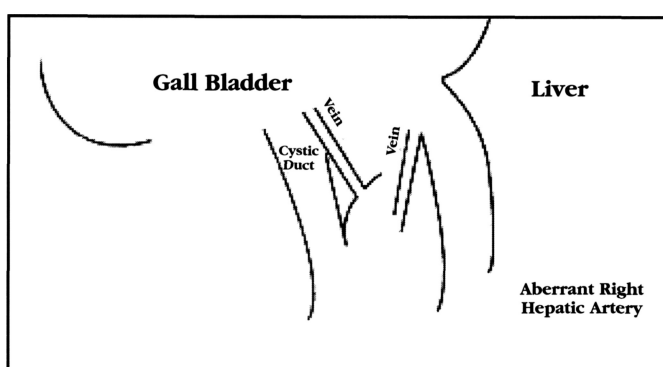


Figure 2. Case II: Cystic veins confluence with portal triad

laparoscopic cholecystectomy. An arterial structure within the triangle of Calot was identified. A small venous structure was found to be crossing it and extending to the gallbladder (**Figure 2**). Further dissection showed the artery to be an aberrant right hepatic artery with a short cystic artery identified later. The latter was ligated and divided uneventfully.

Case III:

N.M., a 49-year-old female, was admitted with acute abdominal pain, fever, leukocytosis and thickened gallbladder containing stones on ultrasound. The gallbladder was found to be inflamed and edematous at time of surgery. Dissection within the triangle of Calot demonstrated venous structures between the later confirmed cystic duct and artery (**Figure 3**). Cholecystectomy proceeded uneventfully.

Early in our experience with laparoscopic cholecystectomy, the presence of small tubular structures within the triangle of Calot became evident as being necessarily divided to proceed with the dissection. Among these was a structure that presented as a bridge between the cystic artery and duct; the division of which, unless controlled, resulted in insignificant but annoying bleeding. It quickly became a standard part of the procedure to clip or cauterize this ves-

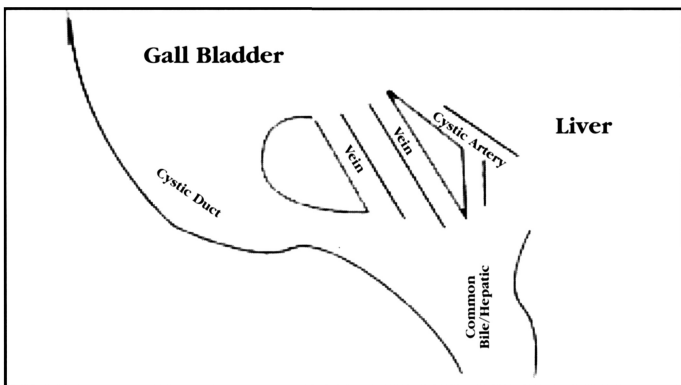
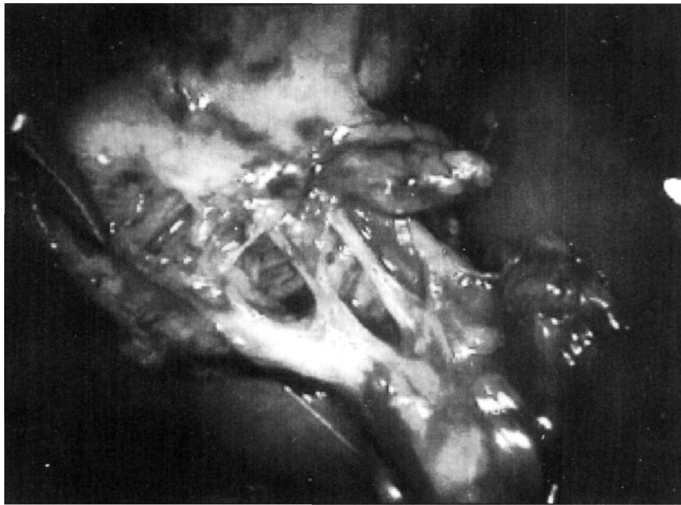


Figure 3. Case III: Acute cholecystitis and multiple cystic veins.

sel during the dissection. Its color and non-pulsatile bleeding when divided, indicated that this was a vein, ostensibly unnamed. Further experience established the presence of other veins consistently present within the triangle. It was subsequently determined that these venous channels were named as the cystic veins and their courses documented in early textbooks of anatomy.

CONCLUSIONS

A consistent anatomic feature during laparoscopic cholecystectomy has been the presence of venous twigs that run parallel to the cystic duct and perpendicular to the common bile duct, bridging the gap between cystic artery and cystic duct. As the veins do not cross the common hepatic duct, their presence can serve as an anatomic feature of a safe dissection space between the important structures of the triangle of Calot.

DISCUSSION

During surgical residency a common question intended to "trip up" junior residents during division of the cystic artery, has been to ask them to define the cystic vein. It is usually pointed out to the less assured that there is no cystic vein

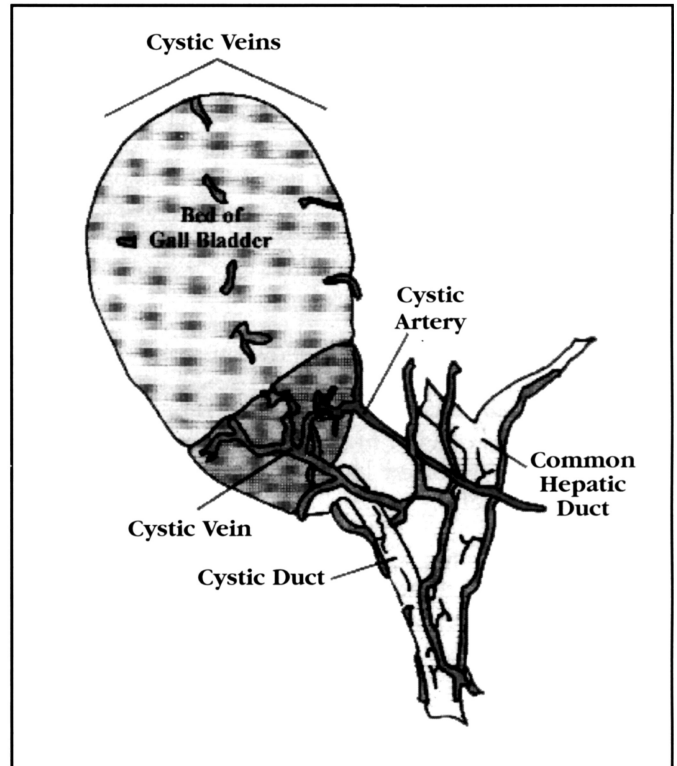


Figure 4. Cystic Veins within the Triangle of Calot (posterior view).

per se, but that the venous drainage is through the bed of the liver. In contradistinction to this, however, Grant's *Anatomy*, in illustrating the veins of the extrahepatic bile passages and gallbladder (Figure 4), clearly demonstrates venous drainage directly into the liver, and describes venous twigs which "cling to the passages"....join branches of the portal vein.⁶ Gray's *Anatomy of the Human Body* likewise describes cystic veins which join at the neck of the gallbladder to form either single or double cystic veins which flow along the cystic duct and upward along the hepatic ducts.⁷

Textbooks of surgery, however, do not assign much importance to the venous drainage of the gallbladder. The *Textbook of Surgery* edited by Sabiston reports only that the venous drainage of the gallbladder and extrahepatic ducts is into the portal vein.⁸ Schwartz's *Principles of Surgery* describes the venous drainage as "variable and generally does not run parallel with the arteries."⁹ Neither text has venous anatomy within the diagrams of the region. A prominent surgical atlas similarly omits all veins from its anatomic diagrams and does not describe operative management of these structures during the procedure.¹⁰

One of the differences between laparoscopic and open surgery is that magnification of the anatomy gives a new perspective to the dissection process. The magnified field of view demands meticulous attention to operative detail lest bleeding from a source not significant during open cholecystectomy, completely obscures the field during laparoscopic cholecystectomy.

This fractal* anatomic view uncovered the presence of venous structures within the triangle of Calot, which, if not clipped or cauterized prior to division, would obscure the operative field. Only with experience did we find the presence of the cystic veins to be constant. During difficult cases, the cystic veins can serve as a landmark for that space between cystic duct, cystic artery and common bile duct, that allows for safe handling and isolation of these vital structures.

A review of anatomy texts has shown that the cystic veins were known to classical anatomists. It was only later that, without apparent clinical relevance, a description of the cystic veins was omitted from surgical textbooks and their very existence devolved into a trick question for unsuspecting house staff.

I do not doubt that experienced laparoscopic surgeons have encountered these venous structures and are dealing with them on a regular basis, but that they exist as a reliable anatomic feature of the region is not well appreciated. Certainly it now can be pointed out that there is a constant cystic vein. Its importance, however, may lie in the fact that the cystic vein can serve as a landmark during a difficult laparoscopic cholecystectomy to decrease the risk of inadvertent bile duct injury.

* Fractal: Infinitely complex mathematical objects that have detailed structure at every level of magnification. Mandelbrot has suggested that mountains, clouds and other natural phenomena are fractal in nature.

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