Variations in the union of the ductus cysticus with the ductus hepaticus communis

Ductus cysticus'un ductus hepaticus communis ile birleşimi

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ÖZET: *Kolesistektomi genel cerrahi kilniklerinde en sık kullanılan batın operasyonlarından birisidir. Ekstrahepatik safra yollarının anatomik değişikliklerinin bilinmesi postkolesistektomi komplikasyonlarını en aza indirecektir. Bu amaçla postmortem 150 karaciğerde, ductus cysticus, ve ductus hepaticus communis'in birleşme tipleri, porta hepatis ve fossa vesica biliaris disseke edilerek araştırıldı. Ductus hepaticus ve ductus cysticus'un dar açıyla birleştiği "angular tip" 66(%45.3) örnekte, "paralel birleşen tip" 60(%40) örnekte saptandı. Ductus hepaticus communis'in ductus cysticus ile porta hepatis'den normalden daha uzakta birleşen tip 8 (%5.3) örnekte, ductus cysticus ductus hepaticus dexter'e açıldığı tip 6 örnekte görüldü. Ductus hepaticus accessorius 8(%5.3) örnekte, ductus subvesicularis 2 (%1.3) örnekte tespit edildi. Ductus cysticus'un ductus hepaticus communis ile birleşme lokalizasyonu açısından incelendiğinde, ductus cysticus 75(%50) örnekte ductus hepaticus communis'in önünden 55(%36.6) örnekte ductus hepaticus communis'in arkasından 10 (%6.6) örnekte ise spiral olarak birleştiği görüldü. Sonuç olarak bu çalışmada sağlanacak bilgi birikiminin bölgeye yapılacak cerrahi girişimin başarı oranını yükseltebileceği kanısına varıldı.*

Anahtar kelimeler: **Ductus cysticus, ductus hepaticus communis, ductus choledochus, safra kesesi**

SUMMARY: *Cholecystectomy is one of the most commonly performed abdominal operations in general surgery. A knowledge of the variable anatomy of the extrahepatic biliary tree is important for the general surgeon, because failure to recognize anatomic variations may result in a significant ductal injury. In this research, the ductus cysticus and types of union of the ductus cysticus with the ductus hepaticus communis were studied in 150 human livers. We observed different forms of the union of these ductus. Angular union was demonstrated in 66 specimens, parallel union was demonstrated in 60 specimens, ductus hepaticus accessorious in 8 specimens and subvesicular duct in 2 specimens. High fusion of the ductus hepaticus dexter and sinister with the ductus cysticus was evident in 8 specimens. In 6 specimens ductus cysticus entered the ductus hepaticus dextra. Abnormal patterns of the ductus cysticus may occur with sufficient frequency to be of importance during cholecystectomy. Based on this findings, it was concluded that knowledge of anatomic variations may enhance succes during surgery.*

Key words: **Ductus cysticus, ductus hepaticus communis, ductus choledochus, vesica fellea**

CHOLECYSTECTOMY is one of the most commonly performed abdominal operations in general surgery. A knowledge of the variable anatomy of the extrahepatic biliary tree is important for the general surgeon, because failure to recognize anatomic variations may result in a significant ductal injury (2,4,9,12). The ductus cysticus averages about 4 (1-8) cm in length and 3 mm (1-9) in width. It usually passes horizontally or angles slightly inferior to join the ductus hepaticus communis in forming the ductus choledochus. Less commonly, the ductus cysticus passes upward, medially and downward before joining the ductus hepaticus communis. The course of the ductus cysticus may be tortuous, frequently running parallel or crossing ductus hepaticus communis and entering the ductus choledochus on the left (5-7,9,10,14,16).

Among the complications of ductal trauma are biliary fistula, bile peritonitis, abcess, stricture, obstructive jaundice and hepatic failure (2,4,13). Moving from this point the authors of this paper investigated the different morphologic features of the union of the ductus cysticus with the ductus hepaticus communis.

MATERIAL and METHOD

A total of 150 adult livers were studied, of which 75 were fresh postmortem specimens at autopsy,

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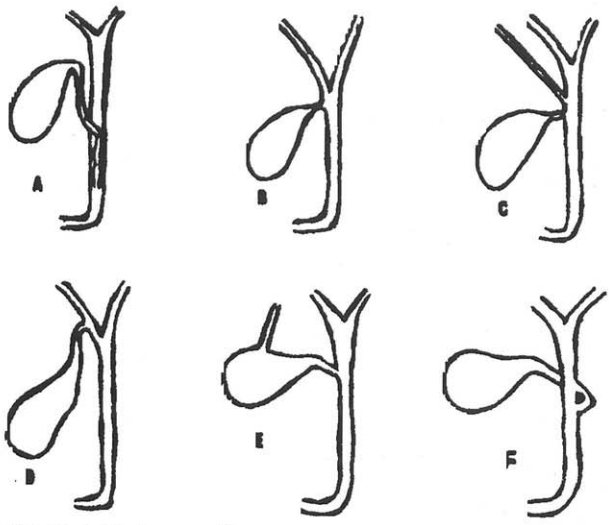


Figure 1. *Duct anomalies*

a. Long duct. cys. with low fusion with duct. chol.
b. Abnormally high fusion of duct. cys. with duct. hepaticus communis (trifurcation).
c. Duct. hepaticus accessorious.
d. Duct cys. entering duct. hepaticus dexter
e. Duct cholecystohepaticus
f. Type of spiral left entry

Figure 2. *Medium angular and anterior entry of duct. cys (DC).*

the remaining 75 were from dissection room cadavers in the university Department of Anatomy. These livers were harvested from people who had expired from cholecystectomy that would not result in anatomic changes in liver. The livers were isolated by the division of the facies diaphragmatica. After removal each liver was undertaken macroscopic dissection to identify the union of ductus cysticus with the ductus hepaticus communis. The portahepatis and fossa vesica biliaris were dissected. All anatomic variations were recorded and the specimens were photographed from this area.

RESULTS

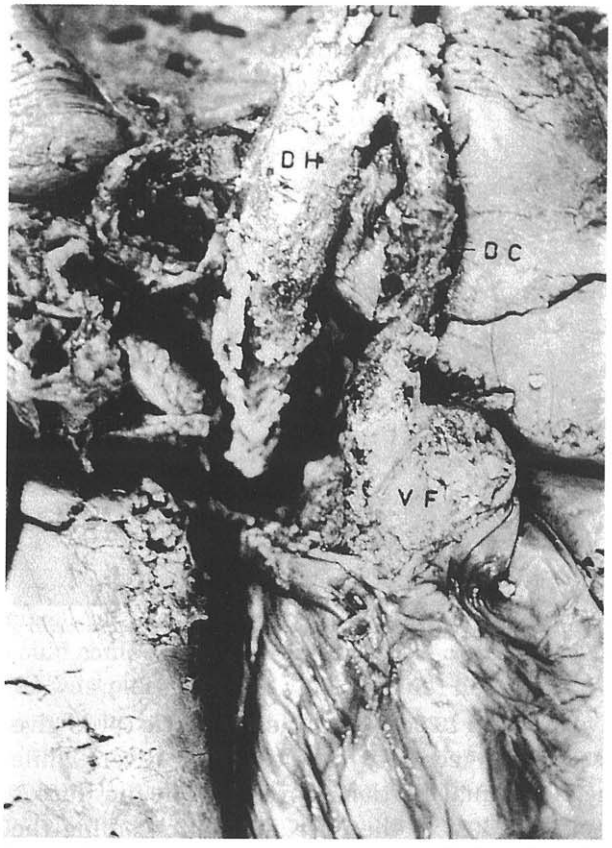
Following the macroscopic examination of the union of the ductus cysticus with the ductus hepaticus communis obtained from postmortem materials, we classified the various forms on the basis of Fig. 1. The first type consisting of a normal angular union was evident in 66(45.3%) specimens. The angular union was characterized by a short (1 cm), a medium (3 cm), or a long (6 cm) ductus cysticus which at times was slightly crooked upward or downward at its beginning. A short ductus cysticus of the angular union was demonstrated in 14 (9.3%) of the specimens. A medium ductus cysticus of the angular union was found in 40(26.7) of the specimens (Fig. 2) and a long angular union was showed in 12(8%) of the specimens. Angle of which one was acute in all specimens.

The parallel second type was found in 60(40%) specimens. The ductus cysticus was bound at times laterally and posteriorly to the hepatic duct by connective tissue for a short distance (1 to 5 cm) constituting short parallels or for a long distance rendering long parallels. Short parallel ductus cysticus was demonstrated in 10(6.6%) specimens. Medium parallel ductus cysticus was showed in 18 (12%) specimens.

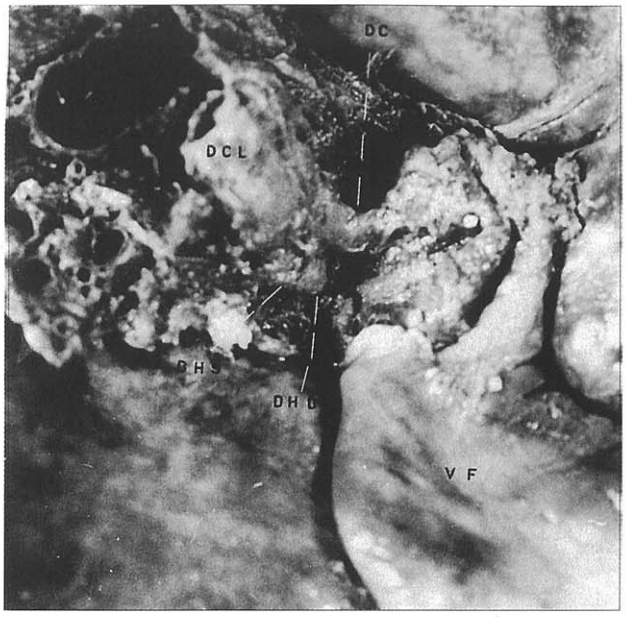
In 32(21.3%) cases, a long ductus cysticus characterized by a low fusion with ductus hepaticus communis was observed (Fig 1-a, Fig.3). In these cases the ductus cysticus was invariably longer than normal. It ran a longside or parallel to the ductus hepaticus communis, fusing with it either anteriorly or at its left hand border. In this type a variable length of ductus cysticus was tightly bound down to the ductus hepaticus communis before the two actually fused.

The other type was abnormally high fusion of the ductus hepaticus dexter and sinister with the ductus cysticus (Fig. 1-b, Fig. 4). This type was demonstrated in 8(5.3%) specimens.

Furthermore it has been observed that in 8(5.3%) specimens of ductus hepaticus accessorious, the ductus hepaticus accessorious was dangerously close to the ductus cysticus. It was short, it crossed it in a caudal direction and ran parallel



Resim 3. *Long parallel and low fusion with duct. hepaticus comm. (DHC) and right entry of union of duct. cys.*



Resim 4. *Abnormally high fusion of duct. cys. with duct. choledochus (DCL) and anterior entry.*

with it. After the ductus hepaticus communis has divided into its main right and left branches, any of the extrahepatic bile ducts were course caudal to the division point of the ductus hepaticus communis to join it or its right or left branch (Fig. 1-c). In 6(4%) specimens, the ductus cysticus entered the ductus hepaticus dexter (Fig. 1-d). There are sufficient cases where the ductus cysticus joined the ductus hepaticus dextra anteriorly (4 specimens), posteriorly (1 specimen) (Fig. 5) and to the left (1 specimen) to warrant the statement that the ductus cysticus was open anywhere along the course of the ductus hepaticus dextra.

Subvesicular duct was shown in 2(1.3%) specimens. A subvesicular duct coursed under the vesica fellea mostly to its lateral side. It was also dangerously close to the ductus cysticus. The subvesicular ducts were of smaller calibre than the ductus cysticus and drained into the ductus hepaticus dexter (Fig. 1-e, Fig. 6).

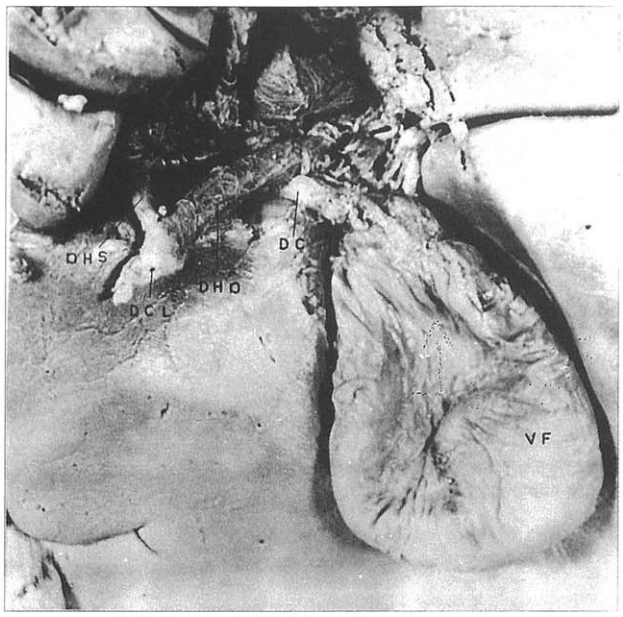
The ductus cysticus joined the ductus hepaticus on the right side in 75 specimens (Fig. 3), anteriorly in 10 specimens (Fig. 2), posteriorly in 55 specimens. In the spiral type included the two arrangements of the ductus cysticus in which, instead of leading directly into right side of the ductus hepaticus communis, it wound around it, either anteriorly in 2 specimens and posteriorly in 8 specimens (Fig. 5).

DISCUSSION

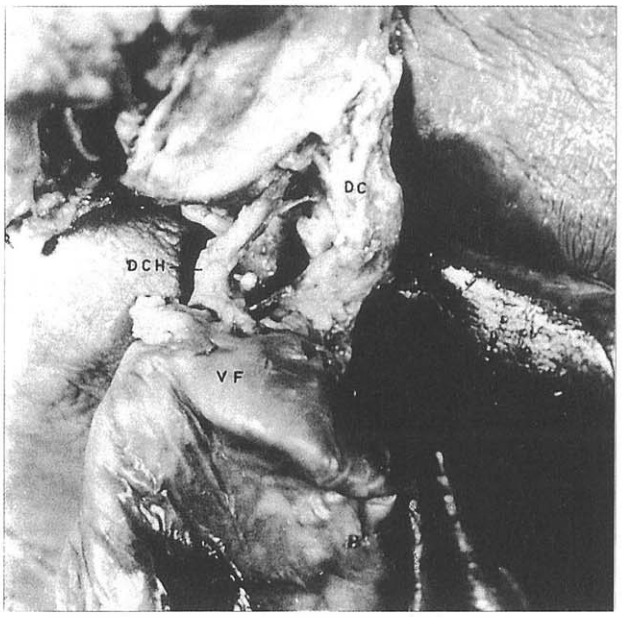
In this investigation we demonstrated different types of anastomosis between the ductus cysticus and the ductus hepaticus communis. There is a high incidence of anatomical abnormality in the disposition and relation of the extrahepatic bile duct. The exact incidence of all types of anomalies of the ductus cysticus is unknown (3). The surgeon will meet some anomaly in every other case upon which he operate.

The angular entry of ductus cysticus to ductus hepaticus communis is the most common type estimated to be present in 63%-75% of cases. The ductus cysticus joins the ductus hepaticus communis on the right side in 80% of cases, usually at an acute angle, although variations occur in the degree of angulation. The junction may be at a right angle or at an oblique angle (5,7,9,10,11,15,16).

The long and short parallel types of ductus cysticus occur in more than one-third of cases; the short parallel occurs in 26%. The commonest duct anomaly is a long ductus cysticus with abnormally low fusion with the ductus hepaticus commu-



Resim 5. *Duct. cys. entering duct. hepaticus dexter (DHD) and anterior spiral entry of duct. cys.*



Resim 6. *Duct. cholecystohepaticus (DCH) and posterior entry of duct. cys.*

nis. Long parallel ductus cysticus over 4 cm in length have been reported in 6-8.6% cases (2,5,7,9,15). The ductus cysticus is reported to join the ductus hepaticus dexter in 0.6-1.5% cases (2,15). Less frequently, the ductus cysticus, ductus hepaticus dexter and ductus hepaticus sinister may join at the same level. Although most ductus cysticus is 2 to 4cm length, aproximatly 8-20% of ductus cysticus is less than 2cm (7,9,11,15,16). The absence of the ductus cysticus is extremely rare (1,6,8,11,17). Ductus cysticus accessorious has been reported in 10-31% cases (2,7,9,11,15,16,17). In 10%, they joined the ductus hepaticus communis in 3.5%, the ductus hepaticus dexter and in 1% the ductus choledochus. In 2%, the ductus cysticus drained into an accessory duct which joined the ductus hepaticus communis. In one instance, 2 ductus hepaticus accessorious join the ductus hepaticus communis. The ductus cysticus joins the ductus hepaticus communis, on the right side in 80% of cases, anteriorly in 10% of cases and from the left side in 8% of cases (7,9,11,14,15,16). Our findings thus far are similar to findings of previous papers.

Variations in the union of the ductus cysticus and the ductus hepaticus communis are clearly explained by the sequence of embryological development. The diverticulum hepaticum arises from the ventral side of the developing duodenum during the fourth embryonic week. A maze of branching and anastomosing cell cords grow out from the ventral surface of the progressivly enlarging diverticulum hepaticum. These hepatic cords give rise to the secretory tubules of the liver, while their proximal portions develop from the ductus hepatici. Most of the ductus hepatici joining the diverticulum are absorbed except, those more proximal ones which coalesce to form the future ductus hepaticus communis. Eventually, the distal end of the diverticulum forms the vesica fellea, the intermediate part, the ductus cysticus and the proximal portion known as the ductus hepatopancreaticus forms the ductus choledochus. Incomplete absorbtion of these multiple primordial extrahepatic ducts is thought to give rise to ductus cysticus accessorious and account for abnormalities in the pattern of the postnatal biliary system. Boyden suggested that the embryonic biliary duct system undergoes a solid stage which later develops a lumen. Hollowing out of this solid stage may be by reabsorbtion or vacuolisation. In the latter, vacuoles which are arranged end to end, produce a lumen by coalescence.

The low junction of the ductus hepaticus as well as the ductus hepaticus accessorious represents the retention of the embryonic pattern of primordial ductus hepatici joining the various parts of the developing diverticulum hepaticum. Developmentally, the long parallel course of the ducts may be explained by the theory of a double row of vacuolation which occurs during the embryonic solid stage of the ducts, resulting in a double lumen (11).

In a long ductus cysticus with low fusion with the ductus hepaticus communis, vigorous traction on the ductus cysticus may produce marked angulation and denting of the ductus hepaticus communis and the ductus choledochus which may then be caught in a clamp. Furthermore, overdiligent efforts to meticulously dissect the ducts apart so as to put "a flush tie" on the ductus hepaticus communis could well result in either immediate direct injury to the ductus hepaticus communis or delayed damage if a length of this duct is devascularized (2,4).

Abnormally high fusion of the ductus hepaticus dexter and sinister with the ductus cysticus entering at the confluence, either the ductus hepaticus dexter and sinister may be damaged during ductus cysticus ligation; furthermore any denting effect at the trifurcation produced by traction could compromise the lumen at the confluence if a tie was placed(2,4,15). The ductus, hepaticus accessorious is an extra bile duct from the liver entering most commonly the ductus hepaticus communis. If such a duct was damaged in advertently at operation, bile leakage would contaminate the field. If such injury went unrecognized at operation, postoperative bile leakage might produce biliary peritonitis, subphrenic abscess, biliary fistula and later development of ductus choledochus stricture. In cases of the ductus cholecystohepaticus are similar to those of failing to recognize and inadvertently dividing a ductus hepaticus accessorious. The possible danger of ductus cysticus entering the ductus hepaticus dexter, is mistaken for the ductus cysticus and is tied off and divided where it joins the ductus hepaticus sinister (2,4,15).

The subvesicular ducts are often filamentous and hard to detect. Largely restricted to the vesica felea, because of their small calibre it may be mistaken for dense strands of fibrous tissue or nerves and accordingly can be torn or severed readily during cholecystectomy, causing disconcerting postoperative jaundice.

The standard technique in open cholecystectomy is to identify the union of the ductus cysticus with the ductus hepaticus communis, which may be difficult in patients with extrahepatic bile duct abnormality. These extrahepatic bile duct anatomical abnormalities may have some bearing on stone formation, though current theories which indicate that the main defect is in the quality of bile secreted by the liver appear to make this suggestion untenable (2,11). We conclude that according to our results in the postmortem specimens, the union of the ductus cysticus with the ductus hepaticus communis is variable. These anomalies should be recognized at the time of operation by careful and meticulous dissection.

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