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Research Article

Upper Biliary Confluence: Merging Pattern and Disposition Associated with Main Plane of Liver Functional Division

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Abstract: The aim of this study was to establish the merging patterns and dispositions of upper biliary confluence and to compare our findings with those of other investigators as applied to liver transplantation. We put our emphasis on the interpretation of our results in relation with the main plane of liver functional division. On 30 postmortem, adult human liver specimens, of subjects of both sexes, the injection-corrosive method was applied. By using magnifying lens, 27 acrylic porto-biliary casts of proper quality were observed to determine a merging pattern of right and left hemiliver ducts and disposition of upper biliary confluence related with main portal branches at bifurcation, as well as the disposition of main plane of liver functional division and presence or crossing with biliary ducts. Merging patterns of upper biliary confluence were statistically analyzed, by using of Kolmogorov-Smirnov's test of agreement for one sample. Summarized results of other anatomists and clinicians as well as our results are presented in a table. Some findings by their relative frequencies were compared. Our results for upper biliary confluence revealed a formation of common hepatic duct in 15 cases-55.6%, whereas in 11 cases-40.7% the right sectoral ducts separately joined opposite site and one case-3.704% was with extrahilar confluence of right and left sectoral ducts. Our summarized results and the results of other investigators have shown that the normal upper biliary confluence anatomy varied from 25 to 98% and variant or aberrant ones from 2 to 93.3%. They point out the absence only of right hepatic duct, right or left and absence of both right and left hepatic ducts at the same time. There was interauthors agreement only to the upper biliary confluence disposition. We have noted the difference within the dispositions of upper biliary confluence versus main plane of division and important crossing of this plane with biliary ducts. Upper biliary confluence anatomy appears in very variable degree of normal, variant or aberrant anatomy. Aberrant confluence of sectoral or segmental ducts from right or left hemilivers to duct of opposite site as applied to liver transplantation is in dependence not only by merging pattern, but also by interdisposition of upper biliary confluence and main plane of liver functional division.
Keywords: Upper biliary confluence, Biliary anatomy, Disposition, Main plane of liver functional division, Liver transplantation.

INTRODUCTION

The door of the liver i.e. porta hepatis and vasculo-biliary elements that create the liver pedicle are subject of many diagnostic and therapeutic procedures in radiologic, gastroenterologic and surgical practice.

Concerning the biliary ducts, this area is passing of intra to extrahepatic ducts that means their portal (hilar) upper biliary confluence (UBC). According to the literature this confluence was related with important anatomical variations for which the interest increased by introduction of living donor liver transplantation (LDLT) in the treatment of patients with end-stage liver disease. By using anatomical [1-4] and radio-diagnostic [5-11] methods, evaluation and classification of UBC anatomy, as an imperative in the donor selection, choosing the methods of the graft splitting and techniques for bile duct reconstruction, were done.

The proximal part of extrahepatic biliary ducts is involved in diseases which progression leads to obstructive jaundice and requires examination of presence, anatomical level, extent and cause of the jaundice, as well as seeks optimal examination procedure and post-operative follow-ups as follows: malignant perihilar biliary obstruction [12, 13], hilar cholangiocarcinoma [14], gallbladder carcinoma [15], primary lymphomas of gallbladder and extrahepatic bile ducts [16], fibrolamellar carcinoma of the liver [17], bile duct hepatocellular carcinoma without [18] or with bile duct thrombosis [19, 20], intrahepatic biliary cystic neoplasms, intrahepatic lithiasis treated by hepatic resection [21-22] and choledocholithiasis [23],

congenital dilations of the biliary tract [24], dilatation of the biliary and pancreatic ducts related with pancreatic cancer [25], differentiation of benign from malignant causes of biliary dilatation [26], pancreato-biliary disorders that involve the biliary system [27], bile duct injuries associated with laparoscopic cholecystectomy [28, 29], metastasis from other than hepatobiliary origin [30], cause not associated with any liver disease [31, 32], management of biliary complications of liver transplantation [33-35] and other. This wide spectrum of diseases involving a hilar biliary duct confluence and new approaches in the treatment of liver pathology have arosed our interest to investigate the anatomy of this part of the biliary system related with main portal branches at bifurcation and main plane of liver functional division.

MATERIALS AND METHOD

The material of our investigation consisted of 30 postmortem adult, human liver specimens, of subjects of both sexes. After a careful anatomic dissection of extrahepatic part of the portal triad elements an injection-corrosive method was applied. Colored acrylate was injected into the biliary system and uncolored one into the portal vein. Corrosion was made in the concentrated HCl acid. A total of 27 acrylic casts were of proper quality whereas the remaining had incomplete filling. The use of magnifying lens helped us to analyze the obtained porto-biliary casts and to determine a merging pattern of right and left hemiliver ducts i.e. UBC, its disposition related to main portal branches at bifurcation, the disposition of main plane of liver functional division and presence or crossing with biliary ducts.

For statistical analysis of frequencies of different modalities of biliary ducts confluence Kolmogorov-Smirnov's test of agreement for one sample (cluster sample) was used.

Summarized results of other anatomists and clinicians as well as our results are presented in a table. Some findings by their relative frequencies were compared.

RESULTS

A total of 27 acrylic casts under magnifying lens were observed and merging pattern of right and left hemiliver ducts was determined. On the basis of presence of hepatic ducts order the obtained findings were divided in two types, as shown in Table1.

Table 1. Merging pattern of right and left hemiliver ducts-UBC

Type 1-constituent ducts	**Ordinal number of specimens**	**Total (%)**
Modal type LHD + RHD	I, II, IV, VIII, IX, X, XII, XIII, XV, XX, XXI, XXVII, XXIX	13 (48.148)
Main Sg 3 duct prolonged into LSD and then into LHD + ASD prolonged into RHD	XXV	1 (3.704)
Main Sg 3 duct prolonged into LSD received MSD and then prolonged as LHD + LHD received as collateral RHD and then prolonged into CHD	XXX	1 (3.704)
Type 2-aberrant confluence of sectoral ducts		
LHD received as collateral PSD and distal to it ASD		
Both at the level of the hilum	III	
Both below the level of hilum	V, XI, XXII, XXVI	
Intraparenchymatous confluence of PSD and then ASD confluence at the level of the hilum	XXIII	
PSD confluence at the level of the hilum and distal to it ASD confluence below the level of the hilum	VII, XIV, XXVIII	9 (33.33)
Extrahepatic confluence of ASD and distal to it PSD, both into the LHD	XVI, XXIV	2 (7.41)
Extrahilar connection of PSD with LSD and distal to it MSD and then ASD confluence into the LHD	XVIII	1 (3.704)
Total		27 (100)

K-S Dmax=0.315<D (6 and 0.05)=0.521

We are going to compare our findings with those of other investigators in which the two similar classifications were used: Couinaud's [1] and Huang's [36]. All findings were summarized into two types of UBC, the normal and variant or aberrant one, and they are shown in Table 2.

Table 2: Upper biliary confluence-summarized classified types of biliary anatomy

Authors City Country	Year	Methods and type of biliary anatomy Normal anatomy-N Variant or aberrant anatomy-A	Total No. of cases
Claude Couinaud [1] Paris; France	1999	Injective-corrosive Absent-RHD N 57 (53.27%) A 50 (46.73%)	107
Masayuki Ohkubo *et al*. [2] Nagoya; Japan	2004	Surgical specimens (pressed flower method) Left or right-sided hepatectomy N 54 (98%) A 1 (2%) Absent-LHD N 81 (74%) A 29 (26%) Absent-RHD	 55 110
Jasmin Delic *et al*. [3] Tuzla; Bosnia and Herzegovina	2012	Macrodissection N 99 (99%) A 1 (1%) Absent-LHD N 99 (99%) A 1 (1%) Absent-RHD N 98 (98%) A 2 (2%)	 100
Dragica Jurkovikj [4] Skopje; Macedonia	2013	Injective-corrosive N 15 (55.56%) A 12 (44.44%) Absent-RHD (A 1 (3.7%) Absent-RHD and LHD)	27
Patrice Taourel *et al*. [37] Montreal; Quebec, Canada	1996	MRCP A 12 (9%) Aberrant RHD Contrast-enhanced cholangiography A 7 (8%) Aberrant RHD MRCP vs Contrast-enhanced cholangiography A 5 vs 7	139/171 93
Cheng YF *et al*. [5] Kaohsiung Hsien; Taiwan	1997	ERC A 105 (11%) Absent-RHD A 229 (24%) Absent-LHD A 334 (35%)	 958
Marc Webb *et al*. [6] Miami; FL and Philadelphia; PA	1998	IOC N 31 (42%) A 42 (58%)	73
Schroeder Tobias *et al*. [38] Essen; Germany	2002	MDCT-CA N 3 (25%) A 9 (75%) IOC vs MDCT-CA A 7 vs 9	12 7
Vivian S. Lee *et al*. [39] New York; USA	2004	All MRC images N 78 (72%) A 30 (28%) RH Lobe Mangafodipir Trisodium-enhanced MRC N 78 (100%) A 29 (97%) Conventional T2-weighted MRC N 73 (94%) A 15 (50%) Mangafodipir Trisodium-enhanced MRC vs IOC 47 (92%) vs 51 (100%) N 41 A 6/10 Variants Conventional T2-weighted MRC vs IOC 43 (84%) vs 51 (100%) N 38/41 A 5/10 Variants	108 108 108 51 51
Piyaporn Limanond *et al*. [7] Los Angeles; California	2004	IOC N 19 (73%) A 7 (27%) MRCP N 17/19 A 5/7	26/22
Juan R Ayuso [8] Barcelona; Spain	2004	OC N 9 (36%) A 16 (64%) Mn-DPDP enhanced MRC N 10 (40%) A 15 (60%)	25/25
Joon Seok Lim *et al*. [40] Seoul; Republic of Korea	2005	T2-weight MRC alone vs IOC vs Surgical Findings 11 vs 11 (100%) vs 10 (90.9%) Combined set Standard T2-weighted MRC and Gadobenate	11

		Dimeglumine-enhanced T1-weighted MRC 11 (100%) and 11 (100%) A 2 (18.18%)	11
Robin D Kim *et al*. [9] Toronto; Ontario, Canada	2005	MRC N 16 (53.3%) A 14 (46.7%) IOC N 17 (56.7%) A 13 (43.3%)	30/30
Perdita Wietzke-Braun *et al*. [41] Gottingen; Germany	2006	ERC A 14 (93.3%) Variants RHD 2 (13.3%) Present; 12 (80%) Absent LHD Absent in one donor liver IOC 7 (38.9%) grafts had one duct 7 (38.9%) grafts had two ducts 4 (22.2%) grafts had three ducts	15 18
Renato Vianna Soares *et al*. [10] Parana and Gracas Curitiba, PR, Brazil	2006	MRC-donors N 30 (90.9%) A 3 (9.1%)	33
Koichiro Uchida *et al*. [11] Sapporo; Japan	2010	3-D CT Scan N 55 (50%) A 55 (50%)	110

Disposition of UBC related to main portal branches at bifurcation appeared as follows:

1. In front of the portal bifurcation
   a) Below the anterior borders of right and left portal vein branches: specimens with ordinal number I, XIII and XV-3 cases 11.11%.
   b) Above the level of anterior borders of right and left portal vein branches: specimens with ordinal number III and XXIII-2 cases 7.41%.
2. In front of the left portal vein branch
   a) Below the level of initial part of anterior border from transverse part of left portal vein branch: specimens with ordinal number II, V, X, XI, XXI, XXII and XXIX-7 cases 25.93%.
   b) Below the level of previously mentioned border: specimen with ordinal number IV-1 case 3.704%.
   c) Below the level of anterior border from transverse part of left portal vein branch at junction of middle with medial 1/3: specimen with ordinal number XXX-1 case 3.704%.
3. In front of the portal trunk: specimens with ordinal number VII, VIII, IX, XII, XVI, XVIII, XX, XXIV, XXV, XXVI, XXVII and XXVIII-12 cases 44.44%.
4. In front of the right portal vein branch: specimen with ordinal number XIV-1 case 3.704%, Fig. 1 A, C and D.

The comparison of our results obtained for UBC disposition related to main portal branches and those presented by Claude Couinaud [42] is shown in Table 3.

Table 3: Comparison of our UBC disposition findings with those by Claude Couinaud [42]

Authors	Disposition in front of the RPVB	Disposition in front of the LPVB	Disposition in front of the portal trunk	Total No. of cases
Claude Couinaud	6 cases 5.88%	38 cases 37.25%	58 cases 56.86%	102
Present study	1 case 3.7%	9 cases 33.3%	17 cases 63%	27

Also, we determined the disposition of main plane of liver functional division in relation to the portal bifurcation and compared the findings with those described by Couinaud [1] (Table 4).

Table 4: Comparison of our findings for main plane of liver functional division disposition with those presented by Claude Couinaud [1]

Authors	Disposition right to the PB	Disposition at the level of PB	Disposition left to the PB	Total No. of cases
Claude Couinaud	40 cases 38.83%	36 cases 34.95%	27 cases 26.11%	103
Present study	2 cases 7.41%	11 cases 40.74%	14 cases 51.85%	27

As a result of differences in dispositions of UBC and main plane of liver functional division, concerning the merging patterns and collaterals of UBC ducts, during observation of porto-biliary acrylic casts on certain cases we found the biliary elements that lied into or crossed this plane of division.

In the cases of modal type of merging pattern the crossing was by:

- LHD with collaterals from Sg 1 and Sg 4b (specimens with ordinal number I, XII and XIII)
- RHD (specimens with ordinal number XV and XXI)
- ASD and distal to it PSD (specimen with ordinal number IV in which PSD was in infraportal disposition)
- PSD and distal to it ASD (specimens with ordinal number XXIX)
- Sg 1 duct (in specimen with ordinal number VIII as a collateral of LHD)
- LHD with collateral from Sg 1 left portion and RHD lied into plane of division (in specimen with ordinal number XXVII, at the level of portal bifurcation)
- the biliary elements did not cross in the specimens with extrahepatic UBC (specimens with ordinal number II, IX, X and XX)

In cases of aberrant type of merging pattern in which PSD was proximal to the ASD the crossing was by:

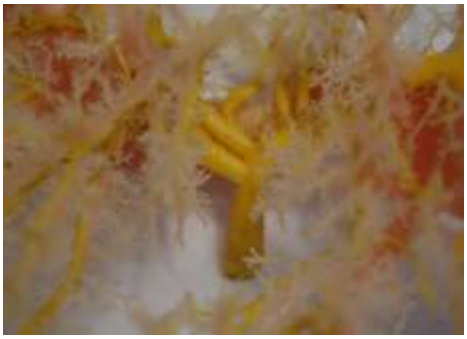
- LHD (specimens with ordinal number III and XXVI, in the number XXVI the forming of LHD was later on the plane of division and with collateral from Sg 9b)
- PSD (specimens with ordinal number V and VII, in the number V in PSD entered a common stem of Sg 1 right portion duct and Sg 9b duct)
- PSD and common stem of Sg 1 right portion duct and Sg 9b duct as a collaterals of LHD lied into plane of division (specimen with ordinal number XXVIII)
- PSD and LHD with collateral from Sg 9b lied into plane of division (specimen with ordinal number XIV), Fig. 1 A and C.
- PSD, ASD and LHD lied into plane of division (specimen with ordinal number XXIII)
- The biliary sectoral ducts did not cross in the specimens with extrahepatic UBC (specimens with ordinal number XI and XXII, in the number XXII Sg 1 duct was a collateral of PSD)

In cases of aberrant type of merging pattern in wich ASD was proximal to the PSD the crossing was by:

- LHD (specimen with ordinal number XVI with collateral from Sg 1 left portion and Sg 4b i.e. MSD)
- the biliary sectoral ducts did not cross in the specimen with extrahepatic UBC (specimen with ordinal number XXIV)

In cases with unusual confluence of sectoral ducts the crossing was by:

- PSD (specimen with ordinal number XXX with collateral from Sg 1 left portion in which Sg 9b duct entered)
- LHD and MSD (specimen with ordinal number XXV)
- only right portion duct of Sg 1 which was a collateral of LSD (specimen with ordinal number XVIII).



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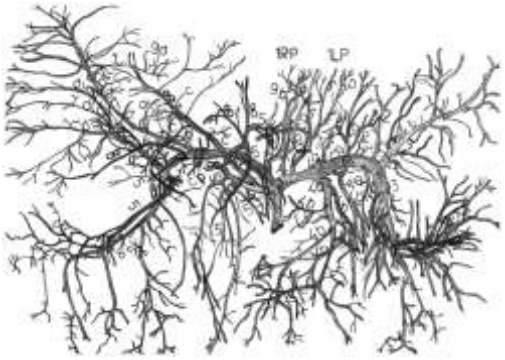

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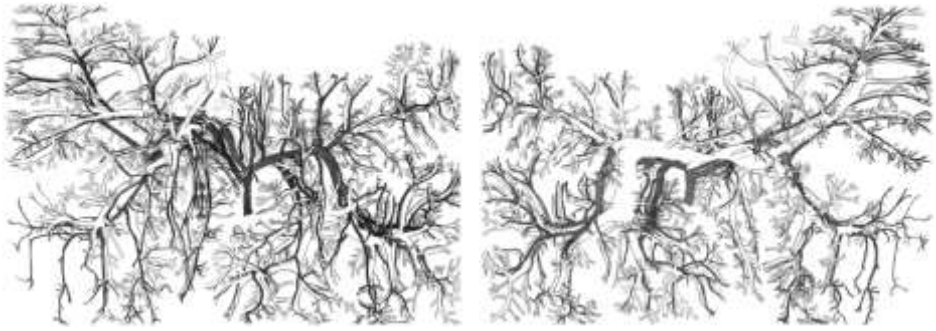

C **D**

Fig. 1: (A) Diaphragmatic appearance of porto-biliary acrylic cast No. XIV with aberrant confluence of PSD at the level of the hilum and of ASD below the hilum both into the LHD. Proximally to the right sectoral ducts confluence into LHD enter Sg 9b and Sg 1 ducts, whereas PSD receivs collateral from Sg 9b. In the main plane of liver functional division (with disposition in front of portal bifurcation) PSD, LHD and collateral from Sg 9b into LHD lie. (B) Schematic drawing of biliary tree. Biliary segmental ducts are numbered according to Couinaud's segmentation [1] from 1 to 9 (Sg 9 subsegments as 9 b, c and d; 1RP-Sg 1 right portion; 1LP-Sg 1 left portion; s-superficial; p-profound and cp-caudate process). (C) Schematic drawing of diaphragmatic appearance of porto-biliary acrylic cast. (D) Schematic drawing of visceral appearance of porto-biliary acrylic cast

DISCUSSION

Our results for UBC anatomy revealed that in spite of normal junction of right and left hepatic ducts into common hepatic duct in very high percent (11 cases-40.7%) the right sectoral ducts separately joined opposite site i.e. left hepatic duct (Table 1). The use of K-S test of agreement for one sample showed no statistically significant differences between cumulated relative frequencies obtained with investigation and those which were expected for single modalities of merging.

This high percent of aberrant UBC anatomy gave us the idea to examine this hilar biliary confluence and to compare our results with those of other anatomists and clinicians whose reports were part of the preharvest assessment protocol of potential liver donors [1-3, 5-11, 37-41].The differencies between the Couinaud's [1] and Huang's [36] classifications of right ductal system presented difficulties in the classification.

Couinaud [1]

a= unique duct non a= duplicated duct (partial or total duplication)
b= trifurcation (L+RPM+RL)
c= caudal entrance of the right lateral (posterior) duct
d= caudal entrance of the right paramedian (anterior) duct
e= right paramedian (anterior) duct into the left hepatic duct [caudal entrance of the right lateral (posterior) duct]
f= right lateral (posterior) duct into the left hepatic duct

Huang [36]

Type A1: normal bifurcation (62.6%)
Type A2: trifurcation variant (19%)
Type A3: aberrant drainage of right posterior duct into left main duct (11%)
Type A4: aberrant drainage of right posterior duct into common hepatic duct (5.8%)
Type A5: aberrant drainage of right posterior duct into cystic duct [=caudal entrance of the right paramedian (anterior) duct]
g and h= on the right two segmental and one sectoral ducts
(L+RPM+RL)-Left+ right paramedian+ right lateral

As presented in Table 2 where UBC anatomy (normal and variant or aberrant) is shown, the normal anatomy varied from 25 to 98% and the variant or aberrant anatomy from 2 to 93.3%.

This discrepancy was probably caused by different methods of investigations and their accuracy and by the size related differences of the study material.

On contrary to Couinaud's and Huang's classification based only on the right ductal system and reported findings about absence only of RHD [1, 37], other literature data indicated absence of RHD or LHD [2, 3, 5, 41] and one case in our investigation [4] was absence of RHD and LHD at the same time.

Detailed preoperative evaluation of hilar anatomy was crucial in LDLT, not only to avoid ligation or resection of accessory grafts ducts, but also to reconstruct the graft duct with the recipient's common hepatic duct in a more appropriate way. For grafts with normal anatomy (Type A1) a single anastomosis was made between the graft duct and the recipient hepatic duct or jejunal loop. This type was anatomically simplest to deal within hepatobiliary surgery and was ideal for harvesting partial liver grafts in LDLT. In donors with biliary variations of trifurcation, the LHD and RPHD draining to he left hepatic duct or common hepatic duct, grafts were always harvested with double ducts. When the two openings were adjacent, the reconstruction has been achieved with a unification

ductoplasty. However, when the two openings were distant, double D-D anastomosis or double RYHJ anastomosis was a preferable choice [43].

LDLT for selected adults was introduced in Europe, in Essen, Germany in 1998. LDLT in adults required either a right or left hepatectomy to supply sufficient functional hepatic mass to the recipient. In this procedure, the native liver of the recipient was removed and replaced orthotopically with either the right or left lobe of the liver from a living donor. Additional experience with both procedures and split-liver and pediatric liver transplantation was desirable [44].

Adult LDLT using the right lobe was a successful procedure, with graft and patient survival similar to those in cadaver full-organ transplantation. Postoperative morbidity, mainly caused by biliary leak, was directly related to the number of ducts and type of anastomosis [45].

Also, at the University of Colorado Health Sciences Center (Denver, CO) the use of right-lobe graft was the preferred donor procedure and retrospective review about recipient survival, graft survival and donor and recipient complications between August 1997 and February 2001 was performed [46].

The Recanati/Miller Transplantation Institute (New York) began to offer LDLT to children in 1993 and to adults in 1998. The author reported his experience with 109 cases of whom fifty children (18 years or younger) received 47 left lateral segments and 3 left lobes and 59 adults received 50 right lobes and 9 left lobes [47].

A survey of the numbers of centers and the numbers of liver transplantation performed in adults and children the United States between 1997 and 2000 was done [48].

Major advances in the field of liver transplantation have led to an increase in both graft and patient survival rates. Despite the increased graft survival rate, biliary complications lead to significant postoperative morbidity and even mortality. Subsequent modifications in the technique led to the creation of choledochocholedochostomy (duct-to-duct) and choledocho- jejunostomy (duct-to-jejunum), which resulted in better performance. Moreover, these techniques have been included as the standard ones in most centers. A Roux-en-Y choledochojejunostomy or a hepaticojejunostomy was used in patients receiving split liver transplantation (SLT) and LDLT when there was a significant difference in the size of the donor and recipient ducts or when there were multiple biliary orificies for anastomosis. As to the biliary complications, the biliary leaks reported in LDLT were from the cut surface and at the site of the anastomosis, whereas the biliary strictures were of multifactorial etiology. Differentiation of anastomotic from nonanastomotic (hilar or intrahepatic) stricture was important for management and prognosis. Nonanastomotic strictures would have been treated non-surgically using the same endoscopic and percutaneous techniques as those used for anastomotic strictures. However, due to the underlying etiological factors, graft dysfunction and involvement of multiple ducts were common [33].

At the National Cancer Center of South Korea a new technique of tailored telescopic reconstruction (TTR) of the bile duct for reducing bile duct complications in LDLT was introduced. The hilar plate covering the right and left hepatic ducts was bisected lengthwise through the right or left hepatic duct opening to make a funnel-shaped top, into which the donor hepatic duct was telescoped to match the recipient bile duct in size, and duct-to-duct (DDR) was performed in the inner tissue of good vascular integrity of the recipient bile duct without redundancy. TTR of the bile duct resulted in excellent outcomes with respect to minimization of biliary complication and can be recommended as a preferred method for biliary reconstruction in LDLT [49].

Authors from Integris Baptist Medical Center, Nazih Zuhdi Transplant Institute (Oklahoma City, USA) stated that peroral cholangioscopy with its limitations led to further research regarding development of SpyScope technology. SpyScope used in evaluation of pre and post liver transplant biliary problems allowed direct visualization of biliary strictures and SpyScope/SpyBite were found to be technically superior to conventional cholangiogram with better sampling than brushing obtained by ERCP [50].

Wietzke-Braun [41] concluded that biliary anatomy in living liver donors was highly variable, but it has not to be exluded from donation.

The comparison of our coefficients with those reported by Couinaud [42] about disposition of UBC in relation to the main portal branches has schown agreement in all observed site of disposition (Table 3).

However, the comparison of our coefficients to the disposition of main plane of liver functional division in relation to the main portal branches with those by Couinaud [1] showed no agreement at the dispositions right and left to the PB (more frequently left to the PB according to our findings and more frequently right to the PB according to Couinaud [1]).

Our findings revealed substantial difference within the dispositions of UBC versus the disposition of main plane of division (predominantly in front of the portal bifurcation and portal trunk versus the disposition in front of the transverse part of left portal vein branch).

From this point of view we have noted that bile duct transpositions were not caused only by merging pattern

i.e. bile duct route to opposite site, but by interrelation of both UBC and main plane of division disposition.

There is a large number of articles reporting on aberrant confluence of right sectoral or segmental ducts into the left hepatic duct as a right-left transposition [1-3, 5-11, 39-41] and rarely as a left-right transposition [3, 5, 11, 41].

Concerning the interrelation of both UBC and main plane of liver functional division dispositions we have observed the crossing of main plane of division in hilar area: on the casts with normal (modal) biliary anatomy confluence by LHD and by Sg 1 ducts (transposition from left to right), by RHD and by ASD and PSD in casts with very short RHD (transposition from right to left); on the casts with aberrant confluence of right sectoral ducts into left hepatic duct when PSD was proximal to the ASD by LHD (transposition from left to right) and by PSD (transposition from right to left); on the casts with aberrant confluence of right sectoral ducts into left hepatic duct when ASD was proximal to the PSD by LHD (transposition from left to right) and on the casts with unusual confluence of sectoral ducts by PSD (transposition from right to left), by LHD and MSD (transposition from left to right) and by Sg 1 right portion duct (transposition from right to left).

The other important finding was the presence of biliary ducts into the main plane of division as constituent ducts and as collaterals, especially from Sg 1 and Sg 9 (Fig.1 A-D).

According to the opinion of many clinicians around the world this variant or aberrant UBC anatomy may be useful in LDLT with adequate and modified operative techniques, but in accordance with our view of transposition they require changes of the line of transection even if there are collaterals of significant caliber to be exluded.

CONCLUSION

Upper biliary confluence anatomy appears in very variable degree of normal, variant or aberrant anatomy. Aberrant confluence of sectoral or segmental ducts from right or left hemilivers to duct of opposite site as applied to liver transplantation is in dependence not only by the merging pattern, but also by the interdisposition of UBC and main plane of liver functional division.

Abbreviations: LHD-Left Hepatic Duct, RHD-Right Hepatic Duct, Sg-segment, LSD-Lateral Sectoral Duct, ASD-Anterior Sectoral Duct, MSD-Medial Sectoral Duct, CHD-Common Hepatic Duct, PSD-Posterior Sectoral Duct, K-S Kolmogorov-Smirnov's test of agreement for one sample, MRCP-Magnetic Resonance Cholangiopancreatography, ERC-Endoscopic Retrograde Cholangiography, IOC-Intraoperative Cholangiography, MDCT-CA Multidetector Computed Tomographic Cholangiography, MRC- Magnetic Resonance Cholangiography, RH-Right Hepatic, OC-Operative Cholangiography, Mn-DPDP enhanced MRC Mangafodipir Trisodium Enhanced Magnetic Resonance Cholangiography, 3-D CT Scan Three-Dimensional Computed Tomography Scan, RPVB-Right Portal Vein Branch, LPVB-Left Portal Vein Branch, PB-Portal Bifurcation, RPHD-Right Posterior Hepatic Duct, D-D Duct-to-Duct, RYHJ-Roux-en Y Hepaticojejunostomy, DDR-Duct-to-Duct Reconstruction, ERCP-Endoscopic Retrograde Cholangiopancreatography

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