Scholars Journal of Applied Medical Sciences (SJAMS)

Sch. J. App. Med. Sci., 2015; 3(2B):662-668 ©Scholars Academic and Scientific Publisher (An International Publisher for Academic and Scientific Resources) www.saspublishers.com

ISSN 2320-6691 (Online) ISSN 2347-954X (Print)

DOI: 10.36347/sjams.2015.v03i02.027

Review Article

Biliary Merging Patterns of the Caudate Lobe: A Review Report

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Abstract: Concerning the previous anatomical knowledge and requirements of current hepato-pancreato-biliary practice it was our aim to enhance the anatomy knowledge of the caudate lobe biliary drainage. Using the injection-corrosion method we made 27 acrylic porto-biliary casts of proper quality from 30 post-mortem, adult human liver specimens. During the observation under a magnifying glass a portal vascular segmentation was determined along with intrahepatic merging patterns of biliary ducts. In segment 1, the biliary drainage appeared as a confluence of segmental ducts from two distinct portions, left and right. According to their merging patterns we found a separate confluence of both portions in 16/27 casts, their common confluence in 7/27 casts, and a combined confluence in 4/27 casts. The total number of ducts, based on their ending manner of confluence, was 1 in 11 cases, 2 in 9 cases, and 3 in 4 cases. The confluence of both portion ducts was most frequently into the same collecting duct (11/27), then into different collecting ducts (9/27), and rarely it was a combined confluence (3/27), on contrary to the confluence only from one portion, left or right (4/27). Drainage into ducts of different order was also observed: the first (left and right hepatic duct), the second (posterior and anterior right sectoral ducts, left lateral sectoral duct), and the third order (segment 2 duct). These anatomical data addressing the key elements in the liver hilum are important when performing caudate lobectomies or when performing it in combination with major liver resection.

Keywords: Liver, Caudate lobe, Bile duct, Intrahepatic, Anatomy .

INTRODUCTION

It was discovered many years ago that caudate lobe is an independent liver lobe designated as segment 1. Its outflow veins directly enter the retrohepatic portion of the inferior vena cava. The inflow elements, grouped into Glisson's pedicles, into variable number from 2-4, originate from both hemilivers, but predominantly from the left one. Biliary ducts are mainly presented with the same number of ducts as are the portal veins, but most often two ducts form one common stem prior to their confluence into the left hepatic duct [1].

Goldsmith & Woodburne [2] described the caudate lobe as an individual area. If compared to both branches that arise from the right and left branch of the portal vein towards this area, arteries and duct can also have bilateral origin.

Based on the discoveries and division of the caudate lobe given by Kumon [3], and in addition to the requirements of the surgical anatomy of this lobe Sasada *et al.* [4] defined the complete caudate lobectomy as complete resection of Spiegelian lobe, paracaval portion and caudate process. According to their opinion, there are 3 ways how to approach and resect the caudate lobe: isolated caudal lobectomy,

combined resection of the liver and caudate lobe and transhepatic anterior approach by splitting parenchyma of the liver.

Having in mind these former and recent anatomic discoveries presented by Kogure *et al.* [5], Craina *et al.* [6], and Lee *et al.* [7], as well as the current hepato-pancreatic-biliary practice, it was our aim to give a review survey of caudate lobe biliary drainage and to enhance the complex and variable anatomy of this liver lobe.

MATERIALS AND METHODS

Intrahepatic biliary drainage along with portal vascular ramification were investigated on a series of 30 post-mortem adult human liver specimens. Injection-corrosion method was used to make acrylic portobiliary casts. The obtained casts were observed under a magnifying glass in order to determine portal segmentation of each specimen and to analyze biliary drainage. The modalities of portal and biliary ramifications were illustrated with diagrams. Of the total number of obtained specimens, the larger number (27/30) were of proper quality and only these specimens were further analyzed.

Biliary drainage of segment 1 was examined through segmental collecting ducts from its left and right portion. Ducts were differentiated into superficial and profound according to their location in relation to external area of the caudate lobe and the liver itself.

The analysis of biliary merging patterns of the caudate lobe was made by determining the following paragraphs:

• into ducts of which the functional hemiliver is the confluence of ducts from both portions of segment 1

- ending manner of confluence of the left and right portion caudate lobe segmental ducts
- differentiating of collecting ducts
- total number of merging ducts
- order of collecting ducts.

RESULTS

The obtained findings are illustrated in Table-

1.

Table 1: Caudate lobe-merging patterns of left (1LP) and right (1RP) portions ducts of Segment 1 s-superficial duct; p-profound duct; stem (s+p); Sg-segment; cp-caudate process; pp-papillary process

Ordinal number	Ducts which drain caudate lobe left portion	Ducts which drain caudate lobe right portion
of specimen		
Ι	I(1) 1LP $(s+p) + Sg2$ duct = common stem	I(1) 1RP (s+p) into Left Hepatic Duct
	into Left Lateral Sectoral Duct	
	I(2) 1LP (p) into Left Lateral Sectoral Duct	
II	II(0)	II(1) into Right Posterior Sectoral Duct
III	III(1) 1LP (p) into Left Hepatic Duct	III(1) 1RP (p) into Left Hepatic Duct
		III(2) 1RP (s+p) into Right Posterior
		Sectoral Duct
IV	IV(1) 1LP (s) into Left Hepatic Duct	IV(1) 1RP (s) into IV(2) 1LP (s+p)
	IV(2) 1LP (s+p) into Right Hepatic Duct	IV(2) 1RP (p) + Sg9c duct = common stem
		into IV(2) 1LP (s+p)
		IV(3) 1RP (p) into Right Anterior Sectoral
		Duct
V	V(1) 1LP (s) into Sg2 duct	V(1) 1RP (s) + Sg9b duct = common stem
	V(2) 1LP (s) into Left Lateral Sectoral Duct	into Right Posterior Sectoral Duct
VII	VII(1) 1LP (s) into Left Lateral Sectoral	VII(0)
	Duct	
	VII(2) 1LP (p) into Left Lateral Sectoral	
	Duct	
VIII	VIII(1) 1LP (s) + 1RP (p) = common stem	VIII(1) 1RP (p) + 1LP (s) = common stem
	into Left Hepatic Duct	into Left Hepatic Duct
		VIII(2) 1RP (p) + $VIII(3)$ 1RP (p) =
		common stem into common stem of ILP +
IV	$\mathbf{W}(1) = 1\mathbf{I} \mathbf{D} (\mathbf{a} + \mathbf{a}) + \mathbf{C} = 0\mathbf{h} + \mathbf{h} + \mathbf{c}$	IRP
IX	IX(1) ILP (s+p) + Sg9b duct = common stam into L aft Hanatia Duct	IX(0)
v	Stem into Left Hepatic Duct $\mathbf{Y}(1)$ 1L $\mathbf{P}(n)$ into $\mathbf{S}(n)$ duct	V (0)
Λ	X(1) 1LF (s) into Sg2 duct X(2) 1LP (s+p) + Sg0h duct = common stem	$\Lambda(0)$
	A(2) ILF (s+p) + Sg50 duct = common stem into L eff Henatic Duct	
VI	XI(1) 11 P (s) into Sg2 duct	$\mathbf{YI}(1)$ 1PP (s) + cn duct - common stem
	XI(1) ILI (3) IIIO 3g2 duct	AI(1) $IKI (s) + cp ddct = common steminto L eft L steral Sectoral Duct$
XII	XII(1) 11 P (n) + $XII(2)$ 11 P (s) = common	XII(1) 1RP(n) + XII(2) 1RP(s) = common
7111	stem into I eft Henatic Duct	stem into common stem of 11 P
	XII(3) 1LP (n) into common stem	XII(3) 1RP (s) + $XII(4)$ 1RP (n) + cn duct =
		common stem + Sg9b duct = common stem
		into Right Posterior Sectoral Duct
XIII	XIII(1) 1LP (p) + XIII(2) 1LP (s) + XIII(3)	XIII(1) 1RP (p) + cp duct = common stem
	1LP(s) = common stem into Left Lateral	into Right Posterior Sectoral Duct
	Sectoral Duct	
	XIII(4) 1LP (p) into Left Lateral Sectoral	
	Duct	
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Duct Duct XVII(2) 1LP (s) into Right Anterior Sectoral Duct XVIII(1) 1LP (p) + XVIII(1) 1LP (s) = common stem into Left Lateral Sectoral Duct XVIII(1) 1LP (p) into Sg2 duct XX(1) 1RP (s) into Right Posterior Sectoral Duct XXI XX(1) 1LP (s) + XXI(1) 1RP (s) = common stem into Right Hepatic Duct XX(1) 1RP (s) + XXI(2) 1LP (s) way 1RP (s) way = newly formed stem into old common stem XXI(1) 1LP (s) + XXI(2) 1LP (s) way 1RP (s) way = newly formed stem into old common stem XXII XXIII (1) 1LP (s) into Right Posterior Sectoral Duct XXII(1) 1RP (s) into Right Posterior Sectoral Duct XXIII XXIII(1) 1LP (s) into Left Hepatic Duct XXII(2) 1RP (s) into 1LP (s) XXII(1) 1RP (s) + XXII(1) 1RP (s) = common stem into 1LP duct formed by pp duct + cp duct draining into 1LP (s) XXIIV XXIIV(1) 1LP (s) into Left Hepatic Duct XXIV(2) 1LP (p) into Left Hepatic Duct XXIV(2) 1LP (s) into common stem of XXV(1) 1RP (s) + XXIV(2) 1RP (p) = common stem into Left Hepatic Duct XXV(1) 1RP (s) + XXV(2) 1RP (p) = common stem into Left Hepatic Duct XXVI 1RP (s) + XXV(2) 1RP (p) which drains into Left Hepatic Duct XXVI 1RP (s) the point Left Hepatic Duct XXVI 1RP (s) into Left Hepatic Duct XXVI(1) 1RP (s) into Left Hepatic Duct XXVII 1RP (s) into Left Hepatic Duct XXVII 1RP (s) into Left Hepatic Duct XXVII 1RP (s) into Right Posterior Sectoral Duct as follows: XXVI(1) 1RP (s) into Left Hepatic Duct XXVII 1RP (s) into Right Posterior Sectoral Duct as follows: XXVII(1) 1RP (s) into Left Hepatic Duct XXVII XVIII 1LP (s) into Left Hepatic Duct XXVII XVIII 1LP (s) into Left Hepatic Duct XXVIII XVIII 1LP (s) into Left Hepatic Duct XXVIII XVIIII 1LP (s) into Left Hepatic Duct XXVIII XVIIII 1	Λ V Ι	Duct	Duct
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XVIII XVIII(1) 1LP (p) + XVIII(1) 1LP (s) = common stem into Left Lateral Sectoral Duct XVIII(1) 1RP (p) into common stem of 1LP XX XX(1) 1LP (p) into Sg2 duct XX(1) 1RP (s) into Right Posterior Sectoral Duct XXI XX(1) 1LP (s) +XXI(1) 1RP (s) = common stem into Right Hepatic Duct XX(1) 1RP (s) + XXI(1) 1LP (s) = common stem into Right Hepatic Duct XXII XXII(1) 1LP (s) way and ductule + XXI(2) 1RP (s) way = newly formed stem into old common stem XXI(1) 1RP (s) into Right Posterior Sectoral Duct XXIII XXIII(1) 1LP (s) into Sg2 duct XXIII(1) 1RP (s) into Right Posterior Sectoral Duct XXIV XXIV(1) 1LP (p) into Left Hepatic Duct XXIV(2) 1LP (p) into Left Hepatic Duct XXIV(3) 1LP (s) + XXIV(1) 1RP (s) = common stem into Left Hepatic Duct XXIV(3) 1LP (s) + XXIV(2) 1RP (p) = common stem into Left Hepatic Duct XXIV(1) 1LP (s) + XXIV(2) 1RP (p) = common stem into Left Hepatic Duct XXVV XXVI One duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVI(1) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVIII XXVIII (1) LP (s) into Left Hepatic Duct XXVII XXVIII (1) LP (s) into Left Hepatic Duct XXVII XXVIII XXVIII (1) 1LP (s) into Left Hepatic Duct XXVIII XXVIII 1RP (s) into Left Hepatic Duct XXVIII 1RP (s) into Right Posterior Sectoral Duct XXVIII 1RP (s) into Left Hepatic Duct XXVIII 1RP (s) +		Duet	
XVIIIXVIII(1) ILP (p) + XVIII(1) ILP (s) - common stem into Left Lateral Sectoral DuctXXII(1) ILP (p) into Sg2 ductXXII(1) IRP (s) into Right Posterior Sectoral DuctXXIXXI(1) ILP (s) + XXI(1) IRP (s) = common stem into Right Hepatic Duct XXI(2) ILP (s) way and ductule + XXI(2) IRP (s) way = newly formed stem into old common stem into Right Hepatic Duct XXII(2) ILP (s) way and ductule + XXI(2) IRP (s) way = newly formed stem into old common stem and ductule = newly formed stem into old common stem into Right Posterior Sectoral DuctXXIII(1) IRP (s) into Right Posterior Sectoral DuctXXIIIXXIII(1) ILP (s) into Sg2 ductXXIII(1) IRP (s) into Right Posterior Sectoral DuctXXIII(1) IRP (s) + XXIII(2) IRP (s) = common stem into Left Hepatic Duct XXIV(2) ILP (p) into Left Hepatic Duct XXIV(2) ILP (p) into Left Hepatic Duct XXIV(1) IRP (s) + XXIV(2) IRP (p) = common stem into Left Hepatic Duct XXV(1) IRP (s) + XXIV(2) IRP (p) = common stem into Left Hepatic Duct XXV(2) ILP (p) into Left Hepatic Duct XXVI(1) IRP (s) + XXIV(2) IRP (p) = common stem into Left Hepatic Duct XXVI(1) ILP (s) XXVI(2) ILP (s) XXVI(2) ILP (s) XXVI(2) ILP (s) XXVII(1) ILP (s) into Left Hepatic DuctXXVII(1) IRP (s) into Right Hepatic Duct XXVII(1) IRP (s) into Right Hepatic Duct XXVIII (1) ILP (s) into Left Hepatic DuctXXVIIXXVIII (1) ILP (s) into Left Hepatic Duct XXVIII (1) ILP (s) into Left Hepatic Duct XXVIII (1) ILP (s) into Left Hepatic DuctXXVIII(1) IRP (s) into Right Hepatic DuctXXVIIIXXVIII (1) ILP (s) into Left Hepatic Duct XXVIII (1) ILP (s) int	VVIII	$\frac{\mathbf{V}_{\mathbf{U}}}{\mathbf{V}_{\mathbf{U}}} = \frac{\mathbf{V}_{\mathbf{U}}}{\mathbf{U}_{\mathbf{U}}} + \frac{\mathbf{V}_{\mathbf{U}}}{\mathbf{U}_{\mathbf{U}}} + \frac{\mathbf{V}_{\mathbf{U}}}{\mathbf{U}_{\mathbf{U}}} + \frac{\mathbf{U}_{\mathbf{U}}}{\mathbf{U}_{\mathbf{U}}} + \frac{\mathbf{U}_{\mathbf{U}}}{\mathbf{U}} + \frac{\mathbf{U}_{\mathbf{U}}}{\mathbf{U}_{\mathbf{U}}} + \frac{\mathbf{U}_{U$	VVIII(1) 1PP (n) into common stem of 1LP
DuctXXXX(1) ILP (p) into Sg2 ductXX(1) IRP (s) into Right Posterior Sectoral DuctXXIXXI(1) ILP (s) +XXI(1) IRP (s) = common stem into Right Hepatic Duct XXI(2) ILP (s) way and ductule + XXI(2) IRP (s) way = newly formed stem into old common stemXXI(1) IRP (s) + XXI(1) ILP (s) way and ductule = newly formed stem into old common stemXXIIXXIIIXXIII ILP (s) into Right Posterior Sectoral DuctXXIII (1) ILP (s) into Sg2 ductXXII(1) IRP (s) + XXII(2) ILP (s) way and ductule = newly formed stem into old common stemXXIIXXIII XXIII (1) ILP (s) into Sg2 ductXXIII(1) IRP (s) + XXIII(2) IRP (s) = common stem into ILP duct formed by pp duct + cp duct draining into ILP (s) XXIII(3) ILP (s) into Caft Hepatic Duct XXIV(3) ILP (s) into Caft Hepatic Duct XXIV(3) ILP (s) into Caft Hepatic Duct XXIV(3) ILP (s) into Cammon stem + XXIV(2) IRP (p) = common stem into Left Hepatic Duct XXV(1) ILP (s) into Caft Hepatic Duct XXV(1) ILP (s) into Caft Hepatic Duct XXV(2) ILP (p) into Left Hepatic Duct XXV(1) ILP (s) into Caft Hepatic Duct XXV(1) ILP (s) into Caft Hepatic Duct XXV(1) ILP (s) into Left Hepatic Duct XXV(1) ILP (s) XXVI(2) ILP (p) into Left Hepatic Duct XXVI(1) ILP (s) XXVI(2) ILP (s) XXVI(2) ILP (s) XXVI(2) ILP (s) XXVI(2) ILP (s) XXVI(2) ILP (s) XXVI(2) ILP (s) XXVI(1) ILP (s) into Left Hepatic DuctXXVIOne duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVI(2) ILP (s) XXVI(2) ILP (s) XXVI(2) ILP (s) XXVI(2) ILP (s) XXVI(2) ILP (s) XXVI(2) ILP (s) XXVIII IXVIII ILP (s) into Left Hepatic DuctXXVIIIXXVIII ILP (s) into Left Hepat		AVIII(1) 1LF (p) + $AVIII(1)$ 1LF (s) =	$\mathbf{X} \mathbf{V} \mathbf{H}(1) \mathbf{T} \mathbf{K} \mathbf{F}(\mathbf{p})$ into common stem of TEF
XX XX(1) 1LP (p) into Sg2 duct XX(1) 1RP (s) into Right Posterior Sectoral Duct XXI XXI(1) 1LP (s) + XXI(1) 1RP (s) = common stem into Right Hepatic Duct XXI(1) 1RP (s) + XXI(2) 1LP (s) way and ductule + XXI(2) 1RP (s) way = newly formed stem into old common stem XXII XXIII XXIII (1) 1LP (s) into Right Posterior Sectoral Duct XXI(1) 1RP (s) into Right Posterior Sectoral Duct XXIII XXIII (1) 1LP (s) into Sg2 duct XXIII(1) 1RP (s) into Right Posterior Sectoral Duct XXIII(1) 1RP (s) into Right Posterior Sectoral Duct XXIV XXIII (1) 1LP (s) into Left Hepatic Duct XXIV(2) 1LP (p) into Left Hepatic Duct XXIV(2) 1RP (s) = common stem + XXIV(2) 1RP (s) = common stem + XXIV(2) 1RP (p) = common stem into Left Hepatic Duct XXVV(1) 1RP (s) + XXVV(2) 1RP (p) = common stem into Left Hepatic Duct XXVV(1) 1RP (s) + XXV(2) 1RP (p) = common stem into Left Hepatic Duct XXVV(2) 1LP (p) into Left Hepatic Duct XXVV(1) 1RP (s) + XXV(2) 1RP (p) = common stem into Left Hepatic Duct XXVV(1) 1RP (s) + XXV(2) 1RP (p) = common stem into Left Hepatic Duct XXVV(2) 1LP (p) into Left Hepatic Duct XXVV(1) 1RP (s) + XXVV(2) 1LP (p) into Left Hepatic Duct XXVV(1) 1RP (s) + XXVV(2) 1RP (p) = XXVV1(2) 1RP (p) = XXVV1(2) 1RP (s) = XXVVII 1 (RP (s) + XXVV1(1) 1RP (s) + XXVVII 1 (RP (s) + XXVVII 1 (RP (s) + p) duct = common stem into Left Hepatic Duct XXVII XXVIII 1LP (s) into Left Hepatic Duct XXVVII(1)		Duet	
XA XX(1) ILP (p) find Sg2 duct XX(1) IRP (s) into Right Posterior Sectoral Duct XXI XXI(1) ILP (s) + XXI(1) IRP (s) = common stem into Right Hepatic Duct XXI(1) IRP (s) + XXI(2) ILP (s) way and ductule + XXI(2) IRP (s) way + XXI(2) ILP (s) way and ductule + XXI(2) IRP (s) way + XXI(2) ILP (s) way + XXI(2) ILP (s) way + XXI(2) ILP (s) way + XXI(1) ILP (s) into Right Posterior Sectoral Duct XXIII XXIII XXIII(1) ILP (s) into Sg2 duct XXII(1) IRP (s) into Right Posterior Sectoral Duct XXIII XXIII(1) ILP (s) into Sg2 duct XXIII(1) IRP (s) into Right Posterior Sectoral Duct XXIII(1) IRP (s) into Right Posterior Sectoral Duct XXIII XXIII(1) ILP (s) into Left Hepatic Duct XXIV(2) ILP (p) into Left Hepatic Duct XXIV(2) ILP (p) into Left Hepatic Duct XXIV(1) IRP (s) + XXIV(2) IRP (p) = common stem into Left Hepatic Duct XXV XXVI XXV(1) ILP (s) into common stem of XXV(1) IRP (s) + XXV(2) IRP (p) = common stem into Left Hepatic Duct XXV(1) IRP (s) + XXV(2) IRP (p) = common stem into Left Hepatic Duct XXVI One duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVI(1) ILP (s) into Left Hepatic Duct XXVII(1) IRP (s) into Right Hepatic Duct XXVII XXVIII XXVIII ILP (s) into Left Hepatic Duct XXVIII(1) IRP (s) into Right Hepatic Duct XXVIII (1) IRP (s) into Right Posterior Sectoral Duct XXVII Cone duct of Sg1 by magistral way both, left and right posterior Sec	VV	Duct XX(1) 1LD (n) into Se2 dust	VV(1) 1DD (a) into Dialt Destarian Contanal
XXI XXI(1) 1LP (s) + XXI(1) 1RP (s) = common stem into Right Hepatic Duct XXI(2) 1LP (s) way and ductule + XXI(2) 1RP (s) way = newly formed stem into old common stem XXI(1) 1RP (s) + XXI(2) 1LP (s) way and ductule = newly formed stem into old common stem XXII XXIII XXII(1) 1LP (s) into Right Posterior Sectoral Duct XXII(1) 1RP (s) into Right Posterior Sectoral Duct XXIII XXIII(1) 1LP (s) into Sg2 duct XXIII(1) 1RP (s) + XXII(2) 1RP (s) = common stem into 1LP duct formed by pp duct + cp duct draining into 1LP (s) XXIV(2) 1LP (p) into Left Hepatic Duct XXIV(2) 1LP (p) into Left Hepatic Duct XXIV(2) 1LP (s) + XXIV(2) 1RP (s) = common stem + XXIV(2) 1RP (p) = common stem into Left Hepatic Duct XXVV XXV XXVV11 1LP (s) into common stem of XXV(1) 1RP (s) + XXV(2) 1RP (p) = common stem into Left Hepatic Duct XXV(1) 1RP (s) + XXV(2) 1RP (p) = common stem into Left Hepatic Duct XXVI XXVV11 ILP (s) into common stem of XXV(1) 1RP (s) + XXV(2) 1RP (p) e XXV(1) 1RP (s) + XXV(2) 1RP (p) = common stem into Left Hepatic Duct XXVI One duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVIII 1RP (s) into Left Hepatic Duct XXVIII(1) 1RP (s) into Right Hepatic Duct XXVII XXVIII (1) 1LP (s) into Left Hepatic Duct XXVIII(1) 1RP (p) + XXVIII (P) (P) = common stem into Left Lateral Sectoral Duct XXVIII (1) 1RP (s) + XXIX(2) 1RP (s) = common stem into Left Lateral Sectoranl Duct	ΛΛ	XX(1) ILP (p) Into Sg2 duct	AA(1) IRP (s) Into Right Posterior Sectoral
XAI(1) ILP (5) + XAI(1) IRP (5) = common stem into Right Hepatic Duct XXI(2) ILP (s) way and ductule + XXI(2) IRP (s) way = newly formed stem into dight Hepatic Duct XXII XXII(1) ILP (s) into Right Posterior XXII XXIII IIP (s) into Sg2 duct XXIII XXIII(1) ILP (s) into Sg2 duct XXIII XXIII(1) ILP (s) into Sg2 duct XXIV XXIV(1) ILP (p) into Left Hepatic Duct XXIV XXIV(1) ILP (p) into Left Hepatic Duct XXIV XXIV(2) ILP (p) into Left Hepatic Duct XXIV XXIV(1) ILP (s) + XXIV(2) IRP (s) = common stem into Left Hepatic Duct XXIV(1) IRP (s) + XXIV(2) IRP (p) = XXV XXVIV IIP (s) into Left Hepatic Duct XXV XXV(1) ILP (s) into Left Hepatic Duct XXV XXVII ILP (s) into Left Hepatic Duct XXVI Ned cut of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVIII XXVIII ILP (s) into Left Hepatic Duct XXVIII XXVIII (I) ILP (s) into Left Hepatic Duct XXVII One duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVIIII	VVI	$\mathbf{V}\mathbf{V}\mathbf{I}(1) 1\mathbf{I}\mathbf{D}(2) + \mathbf{V}\mathbf{V}\mathbf{I}(1) 1\mathbf{D}\mathbf{D}(2) = common$	$\mathbf{V}\mathbf{V}\mathbf{I}(1) 1\mathbf{D}\mathbf{D} (a) \mathbf{V}\mathbf{V}\mathbf{I}(1) 1\mathbf{I}\mathbf{D} (a) = \mathbf{V}\mathbf{V}\mathbf{I}(1)$
XXIII XXIIII XXIIII XXIIIII XXIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	ΛΛΙ	AAI(1) ILP (s) + $AAI(1)$ IRP (s) = collinion stem into Right Happing Dust	AAI(1) IRP (8) + $AAI(1)$ ILP (8) =
IRP (S) way enwly formed stem into old common stem and ductule = newly formed stem into old common stem XXII XXII(1) ILP (s) into Right Posterior XXII(1) IRP (s) into Right Posterior XXIII XXIII(1) ILP (s) into Sg2 duct XXIII(1) IRP (s) into Right Posterior XXIII XXIII(1) ILP (s) into Left Hepatic Duct XXIII(1) IRP (s) + XXIV(2) ILP (s) = common stem into Left Hepatic Duct XXIV XXIV(2) ILP (p) into Left Hepatic Duct XXIV(1) IRP (s) + XXIV(2) IRP (p) = common stem into Left Hepatic Duct XXV XXV(2) ILP (s) into Common stem of XXV(2) ILP (s) into Left Hepatic Duct XXV(1) IRP (s) + XXIV(2) IRP (p) = common stem into Left Hepatic Duct XXV XXV(1) ILP (s) into common stem of XXV(2) ILP (s) into Left Hepatic Duct XXV(1) IRP (s) + XXV(2) IRP (p) = common stem into Left Hepatic Duct XXVI One duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVI(2) ILP (s) XXVI(2) ILP (s) XXVI(2) ILP (s) XXVI(2) ILP (s) XXVI(2) ILP (s) XXVI(2) ILP (s) XXVIII IRP (s) into Right Hepatic Duct XXVIII XXVIII ILP (s) into Left Hepatic Duct XXVIII IRP (p) + XXVIII IRP (p) = common stem into Left Lateral Sectoral Duct XXVIII IRP (s) into Right Hepatic Duct XXVIII XXVIII ILP (s) phy duct = common stem into Left Hepatic Duct XXVIII IRP (s) + XXII(2) IRP (s) = common stem into Left Lateral Sectoral Duct XXVIII IRP (s) + XXII(2) IRP (s) = common s		Stell Into Kight Repair Duct VVI(2) 11 D (a) way and ductule + $VVI(2)$	$\frac{1}{2} \sum_{i=1}^{n} \frac{1}{2} \sum_{i=1}^{n} \frac{1}$
TRY (s) way = newry formed seem into out and ducture = newry formed seem into out XXII XXII(1) 1LP (s) into Right Posterior common stem XXIII XXIII(1) 1LP (s) into Sg2 duct XXII(1) 1RP (s) into Right Posterior XXII XXIII (1) 1LP (s) into Sg2 duct XXIII(1) 1RP (s) + XXIII(2) 1RP (s) = XXIV XXIV(1) 1LP (p) into Left Hepatic Duct XXIV(1) 1RP (s) into 1LP (s) XXIV XXIV(2) 1LP (p) into Left Hepatic Duct XXIV(1) 1RP (s) + XXIV(2) 1RP (p) = common stem into Left Hepatic Duct XXV(1) 1RP (s) + XXV(2) 1RP (p) = common stem into Left Hepatic Duct XXV(1) 1RP (s) + XXV(2) 1RP (p) = XXVI XXV(1) 1LP (s) into common stem of XXV(1) 1RP (s) + XXV(2) 1RP (p) = XXVI One duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVI(1) 1RP (s) into Right Hepatic Duct XXVII XXVIII (1) ILP (s) into Left Hepatic Duct XXVIII(1) 1RP (s) into Right Hepatic Duct XXVIII XXVIII (1) ILP (s) into Left Hepatic Duct XXVIII (1) 1RP (p) + XXVIII (P) (p) = XXVIII XXVIII (1) ILP (s) into Left Hepatic Duct XXVIII (1) 1RP (s) into Right Hepatic Duct XXVIII XXVIII (1) ILP (s) into Left Lateral Sectoral Duct XXVIII (1		AAI(2) ILP (8) way and ducture + $AAI(2)1DD (a) way = navely formed stem into ald$	AAI(2) IRP (8) way + $AAI(2)$ ILP (8) way
Common stemCommon stemXXIIXXII(1) ILP (s) into Right Posterior Sectoral DuctXXIII(1) IRP (s) into Right Posterior Sectoral DuctXXIIIXXIII(1) ILP (s) into Sg2 ductXXIII(1) IRP (s) + XXIII(2) IRP (s) = common stem into ILP duct formed by pp duct + cp duct draining into ILP (s) XXIV(2) ILP (p) into Left Hepatic Duct XXIV(3) ILP (s) + XXIV(1) IRP (s) + XXIV(2) IRP (p) = common stem + XXIV(2) IRP (p) = common stem into Left Hepatic DuctXXVXXV(1) ILP (s) into common stem of XXV(1) IRP (s) + XXIV(2) IRP (p) = common stem into Left Hepatic DuctXXVXXV(1) ILP (s) into common stem of XXV(1) IRP (s) + XXV(2) IRP (p) = common stem into Left Hepatic DuctXXVXXV(1) ILP (s) into common stem of XXV(1) IRP (s) + XXV(2) IRP (p) = common stem into Left Hepatic DuctXXVIOne duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVI(2) ILP (s) XXVI(2) ILP (s) XXVI(2) IRP (s) XXVI(2) IRP (p) XXVI(2) IRP (s) XXVI(2) IRP (s) XXVI(2) IRP (s) XXVIII IRP (s) into Left Hepatic DuctXXVIIXXVIII (1) ILP (s) into Left Hepatic Duct XXVIII IRP (s) XXVIII IRP (s) into Left Hepatic DuctXXVIIIXXVIII(1) ILP (s) into Left Hepatic Duct XXVIII IRP (p) = XXVIII IRP (p) XXVIII IRP (p) + XXVIII IRP (p) = common stem into Left Lateral Sectoral DuctXIXXXXIIXXIXI (1) ILP (s) into Right Posterior Sectoral Duct (triple) into Left Hepatic DuctXXXXXXII ILP (s) into Right Posterior Sectoral Duct (triple) into Left Hepatic DuctXXXXXXIII ILP (s) into Right Posterior Sectoral DuctXXXXXXXII ILP (s) into Right Po		i RP (s) way = newly formed stem into old	and ductule = newly formed stem into old
XXIII XXIIII XXIIII XXIIII XXIIII XXIIIII XXIIIIIII XXIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	VVII	VVII(1) 11 D (a) into Dight Destarior	VVII(1) 1DD (c) into Dight Destarion
Sectoral Date Sectoral Date XXIII XXIII(1) 1LP (s) into Sg2 duct XXIII(1) 1RP (s) + XXIII(2) 1RP (s) = common stem into 1LP duct formed by pp duct + cp duct draining into 1LP (s) XXIV(2) 1LP (p) into Left Hepatic Duct XXIV(2) 1LP (p) into Left Hepatic Duct XXIV(3) 1LP (s) + XXIV(1) 1RP (s) = common stem into Left Hepatic Duct XXIV(1) 1RP (s) + XXIV(3) 1LP (s) = common stem into Left Hepatic Duct XXV XXV(1) 1LP (s) into common stem of XXV(1) 1RP (s) + XXV(2) 1RP (p) which drains into Left Hepatic Duct XXV(1) 1RP (s) + XXV(2) 1RP (p) = common stem into Left Hepatic Duct XXVI One duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVI(2) 1LP (s) XXVI(2) 1RP (s) XXVII(1) 1LP (s) into Left Hepatic Duct XXVIII(1) 1RP (s) into Right Hepatic Duct XXVII XXVIII (1) 1LP (s) into Left Hepatic Duct XXVIII(1) 1RP (p) + XXVIII (1) 1RP (p) = common stem into Left Lateral Sectoral Duct XXVIII(1) 1RP (p) + XXVIII 1RP (p) = common stem into Left Lateral Sectoral Duct XXIX XXXIX 1XX(1) 1LP (s) + pp duct = common stem into Left Hepatic Duct XXXIII(1) 1RP (s) + XXII(2) 1RP (s) = common stem into Left Lateral Sectoral Duct XXIX XXXIX 11LP (s) + pp duct = common stem into Left Hepatic Duct XXXIII 11 RP (s) = XXII(2) 1RP (s) = common stem into Right Posterior Sectoral Duct XXX XXXII 1LP (s) into Right Posterior XXXII 11 RP (s) into Right Posterior		AAII(1) ILP (s) Into Right Posterior	Sasteral Dust
XXIII XXIII(1) ILP (s) into 3g2 duct XXIII(2) IRP (s) + XXIII(2) IRP (s) = common stem into ILP duct formed by pp duct + cp duct draining into ILP (s) XXIV XXIV(1) ILP (p) into Left Hepatic Duct XXIV(2) ILP (p) into Left Hepatic Duct XXIV(3) ILP (s) + XXIV(1) IRP (s) = common stem into Left Hepatic Duct XXIV(1) IRP (s) + XXIV(2) IRP (p) = common stem into Left Hepatic Duct XXV XXV(1) ILP (s) into Common stem of XXV(1) IRP (s) + XXV(2) IRP (p) which drains into Left Hepatic Duct XXV(1) IRP (s) + XXV(2) IRP (p) = common stem into Left Hepatic Duct XXVI One duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVI(2) ILP (s) XXVI(2) IRP (s) XXVIII XXVIII (1) ILP (s) into Left Hepatic Duct XXVIII XXVIII (1) ILP (s) into Left Hepatic Duct XXVIII XXVIII XXVIII (1) ILP (s) into Left Hepatic Duct XXVIII XXVIII(1) ILP (s) into Left Hepatic Duct XXVIII XXVIII(1) ILP (s) into Left Hepatic Duct XXVIII XXVIII XXVIII (1) ILP (s) + pp duct = common stem into Left Hepatic Duct XXVIII(1) IRP (s) + XXIX(2) IRP (s) = common stem into Left Lateral Sectoral Duct XXIX(1) IRP (s) into Right Posterior Sectoral Duct XXX XXX(1) ILP (s) into Right Posterior XXXII (1) IRP (s) into Right Posterior	VVIII	Sectoral Duct VVIII(1) 11 P. (a) into Sa2 duct	$\mathbf{X} \mathbf{Y} \mathbf{H} (1) 1 \mathbf{D} \mathbf{D} (2) \mathbf{V} \mathbf{Y} \mathbf{H} (2) 1 \mathbf{D} \mathbf{D} (2) \mathbf{D} \mathbf{U} (2) \mathbf{U} \mathbf{U} \mathbf{U} \mathbf{U} \mathbf{U} \mathbf{U} \mathbf{U} \mathbf{U}$
Common stem into LP duct formed by pp duct + cp duct draining into LP (s)XXIVXXIV(1) 1LP (p) into Left Hepatic Duct XXIV(3) 1LP (s) + XXIV(2) 1RP (p) = common stem + XXIV(2) 1RP (p) = common stem into Left Hepatic DuctXXIV(1) 1RP (s) + XXIV(2) 1RP (p) = common stem into Left Hepatic DuctXXVXXV(1) 1LP (s) + XXV(2) 1RP (p) = common stem into Left Hepatic DuctXXV(1) 1RP (s) + XXV(2) 1RP (p) = common stem into Left Hepatic DuctXXVXXV(1) 1RP (s) + XXV(2) 1RP (p) which drains into Left Hepatic DuctXXV(1) 1RP (s) + XXV(2) 1RP (p) = common stem into Left Hepatic DuctXXVIOne duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(3) 1RP (p) XXVI(2) 1LP (s) XXVIII 1LP (s) into Left Hepatic DuctXXVIII(1) 1RP (s) into Right Hepatic DuctXXVIIXXVIII (1) 1LP (s) into Left Hepatic DuctXXVIII(1) 1RP (s) into Right Hepatic DuctXXVIIIXXVIII (1) 1LP (s) into Left Hepatic DuctXXVIII(1) 1RP (s) into Right Hepatic DuctXXVIIIXXVIII (1) 1LP (s) into Left Lateral Sectoral DuctXXVIII(1) 1RP (s) + XXIII (p) = common stem into Left Lateral Sectoral DuctXXIXXXIX(1) 1LP (s) into Right Posterior Sectoral DuctXXX(1) 1 RP (s) into Right Posterior Sectoral DuctXXXXXXII 11 LP (s) into Right PosteriorXXXII 1 RP (s) into Right Posterior	АЛШ	AAIII(1) ILF (8) IIIO Sg2 duct	AAIII(1) IKF (S) + $AAIII(2)$ IKF (S) -
XXIV XXIV(1) 1LP (p) into Left Hepatic Duct XXIV(2) 1LP (p) into Left Hepatic Duct XXIV(3) 1LP (s) + XXIV(1) 1RP (s) = common stem + XXIV(2) 1RP (p) = common stem into Left Hepatic Duct XXIV(1) 1RP (s) + XXIV(2) 1RP (p) = common stem into Left Hepatic Duct XXV XXV(1) 1LP (s) into common stem of XXV(1) 1RP (s) + XXV(2) 1RP (p) which drains into Left Hepatic Duct XXV(1) 1RP (s) + XXV(2) 1RP (p) = common stem into Left Hepatic Duct XXV XXV(1) 1LP (s) into common stem of XXV(1) 1RP (s) + XXV(2) 1RP (p) which drains into Left Hepatic Duct XXV(1) 1RP (s) + XXV(2) 1RP (p) = common stem into Left Hepatic Duct XXVI One duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVI(2) 1RP (p) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1LP (s) XXVI(2) 1LP (s) XXVI(2) 1LP (s) into Left Hepatic Duct XXVIII(1) 1RP (s) into Right Hepatic Duct XXVII XXVIII (1) 1LP (s) into Left Hepatic Duct XXVIII(1) 1RP (s) into Right Hepatic Duct XXVII XXVIII (1) 1LP (s) into Left Hepatic Duct XXVIII(1) 1RP (s) into Right Hepatic Duct XXVIII XXVIII (1) 1LP (s) + pp duct = common stem into Left Hepatic Duct XXVIII(1) 1RP (s) + XXII(2) 1RP (s) = common stem into Left Lateral Sectoral Duct XXIX XXIX(1) 1LP (s) + pp duct = common stem into Left Hepatic Duct XXII(1) 1RP (s) into Right Posterior Sectoral Duct XXXX XXXX(1) 1LP (s) into Right Posterior XXII(1) 1 RP (s) into Right Posterio			duct is an duct draining into 1LP (a)
XXIVXXIV(1) 1LP (p) into Left Hepatic Duct XXIV(2) 1LP (p) into Left Hepatic Duct XXIV(3) 1LP (s) + XXIV(1) 1RP (s) = common stem + XXIV(2) 1RP (p) = common stem into Left Hepatic DuctXXIV(1) 1RP (s) + XXIV(2) 1RP (p) = common stem into Left Hepatic DuctXXVXXV(1) 1LP (s) into common stem of XXV(1) 1RP (s) + XXV(2) 1RP (p) which drains into Left Hepatic DuctXXV(1) 1RP (s) + XXV(2) 1RP (p) = common stem into Left Hepatic DuctXXVXXV(1) 1LP (s) into common stem of XXV(2) 1LP (p) into Left Hepatic DuctXXV(1) 1RP (s) + XXV(2) 1RP (p) = common stem into Left Hepatic DuctXXVIOne duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVI(2) 1RP (p) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVIIIXXVII(1) 1RP (s) into Right Hepatic DuctXXVIIXXVIII XXVIIIXXVIII(1) 1LP (s) into Left Hepatic DuctXXVIII(1) 1RP (s) into Right Hepatic DuctXXVIIXXVIII XXVIII 1RP (s) common stem into Left Lateral Sectoral DuctXXVIII(1) 1RP (s) into Right Posterior Sectoral Duct into Left Hepatic DuctXXIXXXIX(1) 1LP (s) + pp duct = common stem + Sg2 duct = Left Lateral Sectoral Duct (triple) into Left Hepatic DuctXXIII 1 RP (s) into Right Posterior Sectoral DuctXXXXXXII 1 1LP (s) into Right Posterior Sectoral DuctSectoral DuctXXXII 1 RP (s) into Right Posterior			duct + cp duct draining into TLP (s) XXIII(2) 1PP (c) into 1LP (c)
XXIV XXIV(1) ILP (p) into Left Hepatic Duct XXIV(2) 1LP (p) into Left Hepatic Duct XXIV(2) 1LP (s) + XXIV(1) 1RP (s) = common stem into Left Hepatic Duct common stem + XXIV(2) 1RP (p) = common stem into Left Hepatic Duct XXV XXV(1) 1LP (s) into common stem of XXV(1) 1RP (s) + XXV(2) 1RP (p) which drains into Left Hepatic Duct XXV(1) 1RP (s) + XXV(2) 1RP (p) = common stem into Left Hepatic Duct XXVI One duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVI(1) 1LP (s) XXVI(2) 1RP (p) XXVI(2) 1RP (p) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVIII XXVII(1) 1RP (s) into Right Hepatic Duct XXVIII XXVIII XXVIII(1) 1LP (s) into Left Hepatic Duct XXVIII XXVIII(1) 1LP (s) into Left Hepatic Duct XXVIII XXVIII(1) 1LP (s) into Left Hepatic Duct XXVIII XXVIII XXVIII(1) 1LP (s) into Left Hepatic Duct XXVIII XXVIII(1) 1LP (s) exponent stem into Left Hepatic Duct XXVIII(1) 1RP (p) + XXVIII 1RP (p) = common stem into Left Lateral Sectoral Duct XXIX XXIX(1) 1LP (s) + pp duct = common stem into Left Hepatic Duct XXIX(1) 1RP (s) + XXIX(2) 1RP (s) = common stem into Right Posterior Sectoral Duct XXX XXX(1) 1LP (s) into Right Posterior XXX(1) 1 RP (s) into Right Posterior Sectoral Duct	VVIV	VVIV (1) 11 D (p) into I oft Honotic Duct	$\frac{1}{2} \frac{1}{2} \frac{1}$
XXIV(2) ILP (s) Hito Left Hepatic Duct XXIV(2) IRP (p) = common stem + XXIV(2) IRP (p) = common stem into Left Hepatic Duct XXV XXV(1) ILP (s) into common stem of XXV(1) IRP (s) + XXV(2) IRP (p) which drains into Left Hepatic Duct XXV(1) IRP (s) + XXV(2) IRP (p) which common stem into Left Hepatic Duct XXVI One duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVI(1) ILP (s) XXVII One duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVI(2) IRP (p) XXVI(2) IRP (p) XXVI(2) IRP (s) XXVI(2) IRP (s) XXVI2) IRP (s) XXVI(2) IRP (s) XXVI2) IRP (s) XXVI(2) IRP (s) XXVII XXVIII (1) ILP (s) into Left Hepatic Duct XXVIII(1) IRP (p) + XXVIII (1) ILP (s) = common stem into Left Lateral Sectoral commonstem + Sg9b duct = common stem into Left Hepatic Duct XXIX XXIX(1) ILP (s) + pp duct = common stem into Right Posterior Sectoral Duct XXXX XXX(1) ILP (s) into Right Posterior Sectoral Duct	ΛΛΙΥ	XXIV(1) ILF (p) into Left Hepatic Duct XXIV(2) ILP (p) into L oft Hepatic Duct	AAIV(1) IRF (s) + $AAIV(3)$ ILF (s) =
XXV(3) ILF (s) + XXIV(1) IRF (s) - common stem into Left Hepatic Duct XXV XXV(1) ILP (s) into common stem of XXV(1) IRP (s) + XXV(2) IRP (p) which drains into Left Hepatic Duct XXV(1) IRP (s) + XXV(2) IRP (p) = XXVI One duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVI(1) ILP (s) XXVI(2) ILP (p) XXVI(1) ILP (s) XXVI One duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVI(2) ILP (s) XXVI(1) ILP (s) XXVI(2) ILP (s) XXVI(2) ILP (s) XXVI(2) ILP (s) XXVI(2) ILP (s) XXVI(2) ILP (s) XXVI(2) ILP (s) XXVII XXVIII (1) ILP (s) into Left Hepatic Duct XXVIII(1) IRP (s) into Right Hepatic Duct XXVII XXVIII (1) ILP (s) into Left Lateral Sectoral Duct XXVIII (1) IRP (p) + XXVIII IRP (p) = XXIX XXIX(1) ILP (s) + pp duct = common stem + Sg2 duct = Left Lateral Sectoral Duct XXIX(1) IRP (s) + XXIX(2) IRP (s) = XXXI XXXI(1) ILP (s) into Right Posterior Duct XXX XXX(1) ILP (s) into Right Posterior Sectoral Duct		XXIV(2) ILF (p) into Left frepatic Duct XYIV(2) ILF (c) + $XYIV(1)$ 1PD (c) -	common stem into L off Hopstic Duct
Common stem into Left Hepatic Duct XXV XXV(1) 1LP (s) into common stem of XXV(1) 1RP (s) + XXV(2) 1RP (p) which drains into Left Hepatic Duct XXV(1) 1RP (s) + XXV(2) 1RP (p) = common stem into Left Hepatic Duct XXVI One duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVI(1) 1LP (s) XXVI(1) 1RP (p) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1LP (s) XXVI(2) 1LP (s) XXVII XXVII(1) 1LP (s) into Left Hepatic Duct XXVII(1) 1RP (s) into Right Hepatic Duct XXVII XXVIII XXVIII 1LP (s) into Left Hepatic Duct XXVII(1) 1RP (p) + XXVIII 1RP (p) = common stem into Left Lateral Sectoral Duct XXVII(1) 1RP (p) + XXVIII 1RP (p) = common stem into Left Lateral Sectoral Duct XXIX XXIX(1) 1LP (s) + pp duct = common stem + Sg2 duct = Left Lateral Sectoral Duct (triple) into Left Hepatic Duct XXIX(1) 1RP (s) into Right Posterior Sectoral Duct XXX XXXI(1) 1LP (s) into Right Posterior XXX(1) 1 RP (s) into Right Posterior		AAIV(3) ILI $(3) + AAIV(1)$ IRI $(3) =$	common stem mito Lett Treparte Duct
XXV XXV(1) ILP (s) into Common stem of XXV(1) IRP (s) + XXV(2) IRP (p) which drains into Left Hepatic Duct XXV(2) ILP (p) into Left Hepatic Duct XXV(1) IRP (s) + XXV(2) IRP (p) = common stem into Left Hepatic Duct XXVI One duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVI(1) ILP (s) XXVI(1) ILP (s) XXVI(2) IRP (s) XXVI(2) IRP (s) XXVI(2) IRP (s) XXVI(2) ILP (s) XXVI(2) ILP (s) XXVI(2) ILP (s) XXVII XXVIII ILP (s) into Left Hepatic Duct XXVII(1) IRP (s) into Right Hepatic Duct XXVII XXVIII XXVIII(1) ILP (s) into Left Hepatic Duct XXVIII(1) IRP (p) + XXVIII(1) IRP (p) + XXVIII IRP (p) = common stem into Left Lateral Sectoral Duct XXVIII(1) IRP (p) + XXVIII IRP (p) = common stem into Left Lateral Sectoral Duct XXIX XXIX(1) 1LP (s) + pp duct = common stem + Sg2 duct = Left Lateral Sectoral Duct (triple) into Left Hepatic Duct XXIX(1) 1RP (s) + XXIX(2) IRP (s) = common stem into Right Posterior Sectoral Duct XXX XXXI(1) ILP (s) into Right Posterior Sectoral Duct		common stem into L aft Henstic Duct	
XXV(1) IRP (s) HX V(2) IRP (p) With drains into Left Hepatic Duct XXV(1) IRP (s) HXV(2) IRP (p) with drains into Left Hepatic Duct XXVI One duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: common stem into Left Hepatic Duct XXVI(1) ILP (s) XXVI(1) ILP (s) XXVI(2) IRP (p) XXVI(2) IRP (p) XXVI(2) IRP (p) XXVI(2) IRP (p) XXVI(2) IRP (s) XXVI(2) IRP (p) XXVI(2) IRP (p) XXVII XXVIII INP (p) XXVII XXVIII (1) ILP (p) + XXVIII(1) ILP (s) = common stem into Left Hepatic Duct XXVIII (1) IRP (p) = XXVII XXVIII (1) ILP (s) + pp duct = common stem into Left Hepatic Duct XXIX XXIX(1) ILP (s) + pp duct = common stem XXIX(1) IRP (s) = Common stem into Left Hepat	XXV	XXV(1) 1LP (s) into common stem of	XXV(1) 1RP (s) + $XXV(2)$ 1RP (n) -
XXV(1) IXI (s) + XXV(2) IXI (p) which drains into Left Hepatic DuctCommon stem into Left Hepatic DuctXXVIOne duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVI(1) 1LP (s) XXVI(1) 1RP (p) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1LP (s) XXVI(2) 1LP (s) XXVI(2) 1LP (s) XXVI(4) 1RP (s) cp ductXXVIII (1) 1RP (s) into Right Hepatic DuctXXVIIXXVIII XXVIII (1) 1LP (s) into Left Hepatic DuctXXVIII(1) 1RP (s) into Right Hepatic DuctXXVIIXXVIII (1) 1LP (p) + XXVIII (1) 1LP (s) = common stem into Left Lateral Sectoral DuctXXVIII (1) 1RP (p) + XXVIII 1RP (p) = common stem into Left Lateral Sectoral DuctXXIXXXIX(1) 1LP (s) + pp duct = common stem + Sg2 duct = Left Lateral Sectoral Duct (triple) into Left Hepatic DuctXXIX(1) 1RP (s) + XXIX(2) 1RP (s) = common stem into Right Posterior Sectoral DuctXXXXXX(1) 1LP (s) into Right Posterior Sectoral DuctXXX(1) 1 RP (s) into Right Posterior Sectoral Duct	ΛΛΥ	XXV(1) 1EF (s) into common stem of $XXV(1)$ 1EP (s) + $XXV(2)$ 1PP (n) which	(1) IKI $(3) + XXV(2)$ IKI $(p) =$
XXV(2) 1LP (p) into Left Hepatic Duct XXVI One duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVI(1) 1LP (s) XXVI(2) 1RP (p) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1LP (s) XXVI(2) 1LP (s) XXVI(4) 1RP (s) cp duct XXVII(1) 1RP (s) into Right Hepatic Duct XXVII XXVII XXVII(1) 1LP (s) into Left Hepatic Duct XXVII XXVII(1) 1LP (p) + XXVIII(1) 1LP (s) = common stem into Left Lateral Sectoral Duct XXVII(1) 1RP (p) + XXVIII 1RP (p) = common stem into Left Lateral Sectoral Duct XXIX XXIX(1) 1LP (s) + pp duct = common stem + Sg2 duct = Left Lateral Sectoral Duct (triple) into Left Hepatic Duct XXIX(1) 1RP (s) + XXIX(2) 1RP (s) = common stem into Right Posterior Sectoral Duct XXX XXX(1) 1LP (s) into Right Posterior Sectoral Duct XXX(1) 1 RP (s) into Right Posterior Sectoral Duct		drains into L eft Henatic Duct	common stem into Lett Tiepatie Duct
XXVI(2) The (p) file bett fugate back XXVI One duct of Sg1 by magistral way both, left and right portions, drains into Right Posterior Sectoral Duct as follows: XXVI(1) 1LP (s) XXVI(2) 1RP (p) XXVI(2) 1RP (s) XXVI(2) 1LP (s) XXVI(2) 1LP (s) XXVI(4) 1RP (s) cp duct XXVII XXVII(1) 1LP (s) into Left Hepatic Duct XXVII(1) 1RP (s) into Right Hepatic Duct XXVII XXVIII(1) 1LP (s) into Left Hepatic Duct XXVII(1) 1RP (p) + XXVIII 1RP (p) = common stem into Left Lateral Sectoral Duct XXVIII(1) 1RP (s) + XXVIII 1RP (p) = common stem into Left Lateral Sectoral Duct XXIX XXIX(1) 1LP (s) + pp duct = common stem + Sg2 duct = Left Lateral Sectoral Duct (triple) into Left Hepatic Duct XXII(1) 1RP (s) + XXII(2) 1RP (s) = common stem into Right Posterior Sectoral Duct XXX XXX(1) 1LP (s) into Right Posterior XXX(1) 1 RP (s) into Right Posterior		XXV(2) 11 P (n) into I eft Henatic Duct	
AXVI Fore duct of bg1 by mightle will bold, fettions, drains into Right Posterior Sectoral Duct as follows: XXVI(1) 1LP (s) XXVI(1) 1LP (s) XXVI(2) 1RP (s) XXVI(2) 1RP (s) XXVI(2) 1LP (s) XXVI(2) 1LP (s) XXVI(2) 1LP (s) XXVII XXVII(1) 1LP (s) into Left Hepatic Duct XXVII XXVIII (1) 1LP (s) into Left Hepatic Duct XXVIII XXVIII(1) 1LP (p) + XXVIII(1) 1LP (s) = common stem into Left Lateral Sectoral Duct XXIX XXIX(1) 1LP (s) + pp duct = common stem into Left Hepatic Duct XXIX XXIX(1) 1LP (s) + pp duct = common stem into Left Hepatic Duct XXIX XXIX(1) 1LP (s) + pp duct = common stem into Right Posterior Sectoral Duct XXX XXX(1) 1LP (s) into Right Posterior Sectoral Duct Sectoral Duct	XXVI	One duct of Sg1 by magistral way both left	
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	11/1/1	Sectoral Duct	Sectoral Duct

Biliary segmental ducts of each specimen are numbered with Arabic numerals into brackets.





Fig. 1: Presents a case with confluence of both left and right portions into duct that drained left hemiliver as combined confluence (common confluence by collateral flow of 1IP duct into stem of 1RP ducts and separately by proper duct of 1LP) into the same collecting duct i.e. into the left hepatic duct. (A) Visceral view of the caudate area selected from under B. Arrows: dotty arrow-1RP superficial duct; thin arrow-1RP profound duct; thick arrow-1LP superficial duct; long dash arrow-1LP profound duct; (B) Visceral view of the specimen XXV portobiliary cast; (C) Schematic drawing of the visceral appearance of caudate area selected from under D,
(D) Schematic drawing of the visceral appearance of specimen XXV portobiliary cast; (E) Scheme to the anterior (diaphragmatic) appearance of the biliary tree from this case. Segmental ducts are numbered from 1 to 9 (b, c and d) with Arabic numerals.

DISCUSSION

Generally in the literature the most common types of vascular biliary anatomy of caudate lobe are presented as well as its classification in different morphological types.

According to Kogure *et al.* [5] many combinations of portal branches were found in the caudate lobe but the patterns of portal branching were classified into two types. In the first one the territories of the first-order portal branches were clearly divided into two areas distinctly separated by the intersegmental plane (67.4%), and the second one (32.6%) in which one of the first-order portal branches simultaneously supplied two areas. Both types were related to the Spiegel lobe and the paracaval portion.

The study of Craina *et al.* [6] conducted on 100 liver corrosive casts has confirmed the classic drainage of caudate lobe by 2 biliary ducts. However, the number of caudate lobe ducts was in the range of 0 to 3 and 24 morphological types were determined as follows: no biliary duct in 3% of the cases, a single duct in 13% by 2 morphological types, two ducts in 66% by 8 morphological types and three ducts in 18% by 6 morphological types.

New consideration on liver anatomy was given by Couinaud [8] presenting the anatomy of the liver dorsal sector on a series of 101 liver casts. This sector consisted of a left dorsal sector (segment 1), which means the caudate lobe and a right dorsal sector (segment 9). Left dorsal sector duct was the only one in 23 casts with confluence into the left hepatic duct, and not so often into the duct of the segment 2 and another 3 with confluence in the right lateral (posterior) duct.

Recent literature reports from clinical practice related to surgical procedures during isolated complete caudal lobectomy for liver tumors include ligation of caudate portal triad. Yang *et al.* [9] reported that three to five caudate portal triads branching from the left and right hepatic pedicle junction into the caudate lobe.

The subject of this study was biliary drainage of segment 1 or the classical caudate lobe known as Spiegel's lobe.

Of the observed 27 acrylic portobiliary casts, 23 were with evident 2 constituent portions – left and right, versus 3 cases with only left portion and 1 case with absent biliary elements from the left portion. Drainage modality of both distinct portions from segment 1 for each individual specimen is presented in Table 1, and one of them is illustrated by Fig. 1.

According to the obtained modalities it may be concluded that caudate lobe biliary drainage on the investigated material appeared mostly as confluence:

- Of both portions into ducts that drained left hemiliver forming a common stem, either via collateral flow or separately by proper ducts in 10 cases (37.037%)
- Of both portions into ducts that drained right hemiliver, also as a separate or common confluence and especially by magistral way in 4 cases (14.81%)
- Separately from each portion into ducts of corresponding hemiliver and additionally by confluence of either right or left portion into opposite hemiliver in 4 cases (14.81%)
- Of the ducts of the left portion into ducts of the left hemiliver, whereas of the ducts of the right portion into ducts of the right hemiliver in 5 cases (18.52%)
- Only of the right portion duct into the right hemiliver duct in 1 case (3.704%)
- Only of the left portion ducts into the left hemiliver ducts in 3 cases (11.11%).

Similar to our findings are the results obtained by Gupta et al. (1977), [10] in which the caudate lobe and process formed a separate subsegment on the basis of the pattern of their blood supply and biliary drainage. As segments of the caudate lobe the left and the right portion and the caudate process were drained in different percentage in the right or left ductal system.

Having in mind this subdivision of the segment 1 and practical importance of liver hilum we analyzed the ending manner of segmental ducts from both portions and it was found a separate confluence of both portions in 16/27 casts, their common confluence in 7/27 casts, and a combined confluence in 4/27 casts.

The analysis according to the confluence of both portion ducts showed that it was most frequently into the same collecting duct (11/27), then into different collecting ducts (9/27); there was a combined confluence in 3/27 and one-sided in 4 cases.

The results obtained in this study also confirmed a variable total number of collecting ducts from segment 1, of which from both portions 11 cases had 1 duct, 9 cases had 2 ducts and 4 cases had 3 ducts.

Of special importance is also the drainage distribution. In the Couinaud's series [8] it was in the left liver duct in 60/101 casts, in the upper biliary confluent in 3 casts, whereas in the right liver ducts in 67 casts, of which in 56 livers a duct from the left dorsal sector entered the right lateral (posterior) duct.

Our results are similar with the findings reported in the study of Craina *et al.* [6]. They revealed a number of 199 biliary ducts with confluence in the right hepatic duct (65/199 or 32.66%), in the superior biliary confluent (10/199 or 5.03%), and in the left hepatic duct (124/199 or 62.31%).

Drainage of ducts of the segment 1 in our specimens was into ducts of all 3 orders: hepatic- left and right, sectoral – right, anterior and posterior, and left lateral, and segment order - segment 2 duct.

From surgical point of view these notions about biliary anatomy of the caudate lobe are important pre-, periand postoperative determinants. Different biologies requiring caudate resection led to differences in operative techniques and outcomes as reported by Philips et al. [11]. However, hilar chlonagiocarcinoma biliary anatomy rather than liver disease was the main focus of the evaluation. The dominant caudate bile duct generally drained to within 1 cm of the hilum, but of the described variations in caudate duct anatomy, most had involved drainage to the hilum or right posterior bile duct. Thus caudate lobectomy was usually necessary to enable complete resection of involved bile duct-Anaya et al. [12]. The importance of complete excision of the caudate lobe in resection of hilar cholangiocarcinoma was previously pointed out by Dinant et al. [13]. Tsao et al. [14] recommended the cholangiogram-based strategy in the treatment of hilar surgical cholangiocarcinoma and according to the cancer extent they recommended the major hepatic resections with caudate lobectomy and bile duct resection, as well as, an independent caudate lobectomy with bile duct resection and an extrahepatic bile duct resection alone.

Also, using hanging maneuver by three Glisson's pedicles and three hepatic veins during various anatomic liver resections Kim et al. [15] performed four major hepatectomies in combination with caudate lobectomy. Primary liver cancer in caudate lobe was successfully resected by Wen et al. [16] while performing an isolated caudate lobectomy either a combined partial right hepatectomy or a combined left lobectomy. Mesohepatectomy lateral was an oncologically adequate procedure for selected patients with perihilar cholangiocellular carcinoma and compromised liver function. The tumor frequently infiltrated the parenchyma of the caudate lobe or/and invaded its bile duct-Malago et al. [17].

In the study conducted by Sakamoto *et al.* [18] the pattern of infiltration at the proximal border of hilar bile duct carcinoma was presented. The involved layers and the routes of invasion of the carcinomas were investigated histologically. The involved layer at the proximal border of the cancer was classified as the mucosal, submucosal-intramural, or submucosal-extramural layer. The routes of invasion were categorized into four types: direct, lymphatic, venous, and perineural invasion. Continuous cancer cell invasion with fibrous stroma was defined as direct invasion.

In the study performed by Vellar on post-mortem livers the anatomy of the venous drainage of the intrahepatic and extrahepatic bile ducts was established. These marginal vessels gave branches which entered the hepatic substance superiorly: segment IV, segment V, the caudate lobe and the caudate process. Other branches joined the hilar venous plexus which then entered the caudate process or joined the caudate portal venous branches. These veins may provide a pathway for a cholangiocarcinoma to metastasize either by tumor emboli or permeation to segment 1 and 4 [19].

Historically, intrabiliary growth of metastatic liver tumors has been associated with colorectal primaries. Estrella *et al.* [20] identified two patterns of intrabiliary growth: colonization of the bile duct, with replacement of the normal biliary epithelium and growth along an intact basement membrane, and tumor "plugs" within the bile duct lumen. Intrabiliary growth was highly specific to metastatic colorectal carcinomas in 41 (3.6%) of 1144 versus 3 (0.7%) of 452 noncolorectal tumors.

Based on the presented observations from hepatopancreatic-biliary practice as well as on the notions about dissociation among the courses of the bile duct, hepatic artery and portal vein in the human liver, as suggested by Lee *et al.* [7] treatment of these triad components during surgery has to be done independently.

CONCLUSION

The caudate lobe biliary drainage appears as a confluence of segmental ducts from two distinct portions-left and right. According to their merging patterns it may be a separate, common and combined drainage of both portions, as well as drainage into ducts of different order (first, second and even third). In number of 1 to 3 they enter the ducts only of left or right hemiliver or of both.

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