

# Biliary tree variants among potential living liver donors, our experience at King Hussein Medical Center

*Abdelhamid Adwan\* ,Jameel Shawaqfeh\* , Maysoun Banihani\**

## ABSTRACT

**Objective:** To assess the frequency of biliary tree variants of potential liver donors presented to King Hussein Medical Center.

**Methods:** This is a retrospective study done at KHMC on 120 patients aged between 20-45 years presented to KHMC as potential liver donors , MRCP was performed as part of their preoperative evaluation , studies were reviewed by radiologists and results analyzed using simple statistical methods .

**Results:** Of the 120 donors 82 had normal biliary tree anatomy (type I). 21 had anatomical variation which is around 31% .the most common anomaly was type III followed by type II then the other rare variants that will be discussed in details later.

**Conclusion:** Biliary tree anatomy may have a lot of variation that may interfere with liver transplant surgeries and this made preoperative evaluation of biliary tree a mandatory step . MRCP proved to be highly sensitive and dependable way of assessment of biliary tree The commonest anomalies were type III followed by Type II

**Key words:** Liver donor, biliary tree, variant, MRCP

JRMS 2016 September 23(3):64-67/ DOI: 10.12816/0029075

### Introduction

Hepatobiliary surgeries show dramatic increase in frequency and complexity and among these procedures is liver transplantation .A major cause of morbidity and mortality in liver transplant surgeries is biliary complications , this can be reduced by accurate preoperative evaluation of the biliary tract anatomy.<sup>(1)</sup>

Biliary anatomy is subject to a lot of variations that might interfere with surgical procedures and increase the risk of post-operative complications .

Magnetic resonance cholangiopancreatography ( MRCP ) is a safe non-invasive reliable method for investigation of biliary tree anatomy.<sup>(2,3)</sup>

In this study we aim to demonstrate the incidence of biliary variations among potential living liver donors presented at

King Hussein medical center (KHMC)

### Methods

This is a retrospective study done at KHMC , royal medical services done between June 2009 - August 2015 .

In this study a total of 120 potential living liver donors aged between 20-45 years were examined by a standard MRCP protocol for preoperative evaluation . Studies were reviewed by radiologists and results analyzed.

The exam was included in study if the 3<sup>rd</sup> order branches of biliary tree were visualized .

The MRCP protocol used as following , thin slab axial HASTE , thick slab coronal HASTE and T2 3D sequence with post processing and multiplanar imaging and MIP images . studies were done using

From Department of:

\*Radiology at Royal Medical Services

Correspondence should be addressed to: Dr. Abdelhamid Aladwan E-mail: abdaladwan@hotmail.com

Manuscript Received Nov 13, 2015. Accepted Aug 14, 2016.

Siemens avanto 3 tesla machine .

## Results

Of the 120 potential liver donors 82 had normal biliary tree anatomy (type I) which accounts for about 68.4% , 15 had type III = 12.5% , 10 had type II around 8.3% and the other types collectively account for 10.8% . results are shown in the following chart A :

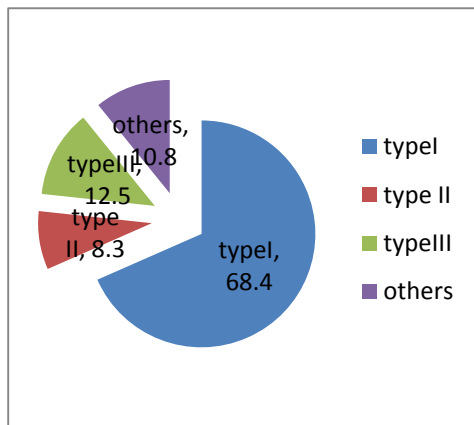


Chart A : showing the distribution of biliary variants

## Discussion

In spite of recent advances in hepatobiliary surgical techniques biliary related complications still remain a major cause of morbidity and mortality . studies state that in liver transplant surgeries the incidence of biliary complications might reach up to 25% , 10% of them fatal . (ref 3,4,6)

Misidentifications of the exact biliary anatomy can affect both the perioperative management and the patient prognosis .

The advances in imaging modalities such as CT and MRI proved beneficial and contributed much to the planning of hepatobiliary surgeries and evaluate post operative complications .

MRCP play a core role in evaluation of biliary system.

It enables rapid , noninvasive and reliable evaluation of both biliary and pancreatic ducts . another advantage is that MRCP is performed without the need for contrast medium and it does not require a lengthy preparation .

The use of 3 tesla MRI machines gives a high signal to noise ratio compared to 1.5 tesla machines and this aid to depict fine anatomical details .

Using a multiplanar imaging and 3-D images , both the radiologist and the surgeon can refer to and plan the proper procedure and can evaluate relations to adjacent structures .

Normal biliary tree anatomy is when the duct draining the posterior segments of right liver lobe ( RPD ) join the duct draining the anterior segments of right lobe (RAD ) to form Right hepatic duct ( RHD ) and this duct will join the left hepatic duct ( LHD ) to form common hepatic duct ( CHD) <sup>(4)</sup> as shown in MRCP figure 1 below :



Fig. 1: showing normal biliary tract anatomy (type 1)

Biliary tract variations are common and many classification systems are used. <sup>(1,3,5,6)</sup> in our study we use

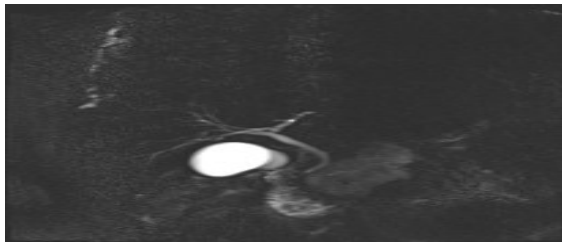
Yoshida classification system shown in fig 5 (11).

Type II is when there is trifurcation formed by union of RAD , RPD and LHD as shown in figure 2



Fig. 2: showing type II trifurcation

Type III which is the 2<sup>nd</sup> most common type is when the RPD drain directly into the LHD as below in figure 3

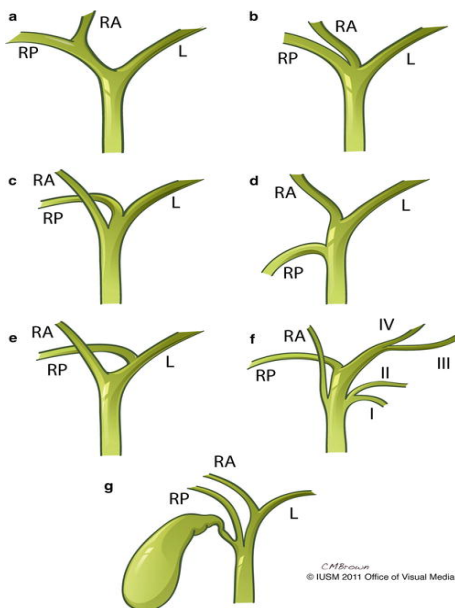


**Fig. 3:** showing type III RPD drain into LHD  
Other types (IV – VII) are less common and among them type IV is the commonest and it is when the RPD join the CHD directly mistaken for cystic duct as in figure 4 :



**Fig. 4:** showing type IV RPD join the CHD directly

Biliary tree is subject to wide range of anomalies and each case should be studied thoroughly . Examples of rare variants are shown below with diagram



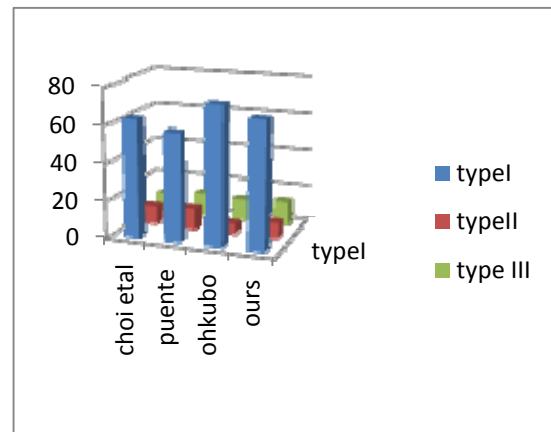
**Fig. 5:** Yoshida classification of biliary variants

In our study normal biliary anatomy was found in 68.4% .

The importance of preoperative knowledge of biliary anatomy type is essential to avoid complications . for example if a patient had type III anomaly where the RPD drain into LHD underwent Left hepatectomy without attention to the anatomy he will end with losing his left liver lobe and half of his Rt lobe as well. (7-10)

In type IV the fear is to mistake the RPD with the cystic duct which might lead to potentially life threatening complications. (10) In multiple similar studies , the incidence of type I range from 57 – 74 % , with type III being the 2<sup>nd</sup> most common variant 10 – 17 % .

Below is a diagram B comparing results of several similar studies to our study :



**Diagram B:** comparison between results of our study and similar studies

### Conclusion

Biliary tree variation is common accounting for about one third of population .

Some variants interfere with surgical procedures and are associated with increased morbidity and mortality .

MRCP is sensitive reliable method for preoperative assessment of biliary tree.

Commonest anomalies were type III followed by type II.

Each case should be examined thoroughly and discussed prior to any hepatobiliary surgery .

## References

1. **Sin-Yi Lyu , Kuang-Tse Pan, et al.** common and rare variants of the biliary tree , *J radiol sci* 2012 ; 37: 59-67
2. **Jin Woo Choi , Tae Kyoung Kim, et al.** anatomic variation in intrahepatic bile ducts , *Korean j radiol* 4 (2) , june 2003
3. **D.Picone, G . lo Re , et al.** anatomic variants of the biliary tree at MRCP : still too rarely reported , poster no C-1053 from ECR 2015 congress
4. **M. S Abdelgawad .** biliary tract variants in potential liver donors evaluation by MRCP , *Egyption j of rad and neuclear medicine* , 2012 43 ( 53-57
5. **K . A. Hussain, et al.** anatomical variations and congenital anomalies of extrahepatic biliary system . *J Pak med ass* Vol 60 no 2 feb 2010
6. **Koenraad J. Mortele .** anatomic variants of the biliary tree . MRCP findings , *AJR* : 177 , august 2001
7. **Chandio A , Javaid A .** biliary tract variations and its correlation with clinical presentations , *surg. Curr. Res* vol 4 issue 6 2014
8. **T Hyodo, et al.** CT and MR cholangiography advantages and pitfalls in perioperative evaluation of biliary tree , *british j of radiology* 85 ( 2012 ) 881-896
9. **J Ressurreicao, et al.** normal anatomy and anatomic variants of biliary tree and pancreatic ductal system at MRCP , poster 1696 ECR 2014
10. **Onofrio a catalano.** vascular and biliary variants in the liver , *radiographics* vol 28 no 2 mar-apr 2008
11. **Temel taker, Fatih akisic.** gallbladder and biliary tree anatomy, variants and cystic lesion ; *abdominal imaging*.pp1241-12