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Anatomical variations of the common bile duct by endoscopic retrograde cholangiopancreatography and magnetic resonance Cholangiopancreatography. Is it different?

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Abstract:

Introduction: Endoscopic retrograde cholangiopancreatography (ERCP), magnetic resonance cholangiopancreatography (MRCP), computerized tomography (CT) cholangiography, and/or intraoperative cholangiography can all be used to identify biliary anatomy. There is a shortage of studies that compare ERCP and MRCP in the detection of anatomical variations.

Aim of the study: To compare ERCP findings versus MRCP in the detection of anatomical variations of the biliary tree in the Egyptian population.

Subjects and Methods: The study was a prospective descriptive comparative study that included fifty patients submitted to ERCP at Fayoum University Hospital from February 2020 to September 2021.

Results: According to the Huang classification, type A1 is found in 36% (n = 18), type A2 in 28% (n = 14), type A3 in 24% (n = 12), type A4 in 8% (n = 4), and type A5 in 4% (n = 2), with no statistical differences between MRCP and ERCP in the detection of variations.

Conclusion: The Type A1 variant, according to the Huang classification, is the most common anatomical finding. MRCP is a sensitive and specific modality in detecting biliary anatomical variations.

Keywords: ERCP; MRCP; Biliary anatomy.

1. Introduction

Bile duct anomalies are commonly identified during cholecystectomy and liver transplantation and may predispose to serious complications [1].

Biliary anatomy identification is very important before hepatobiliary surgeries to avoid bile duct injury which is more common in laparoscopic interventions due to the proximity of common bile duct (CBD), cystic duct (CD) and common hepatic duct (CHD) [2].

MRCP is a safe radiological technique for noninvasively visualizing the pancreaticobiliary tree with no need for the injection of contrast material [3].

ERCP is the standard technique for the treatment of various CBD diseases [4].

2. Subjects and methods

2.1. Subjects

It included fifty patients submitted to ERCP in Fayoum University Hospital from February 2020 to September 2021.

Inclusion criteria

- Significant CBD dilatation > 7 mm by ultrasound.

Exclusion criteria

- Marked Ascites.
- Patients who suffer from cluster phobia.
- Patients with cardiac pacemakers, insulin pumps and cochlear Implant, in addition to other general contraindications of MRI.
- Severe cardiac or pulmonary diseases.
- Refusal of the procedure or absent consent.
- Severe coagulopathy or bleeding tendency (INR > 1.5- Platelet count <50,000/µl).
- Patients with previous hepatobiliary surgery, liver injury or destructive biliary disease.

2.2. Methods

All patients were subjected to the following:

- History taking and thorough clinical examination.
- Laboratory investigations: CBC, creatinine, FBS, INR, ALT, AST, Total, direct bilirubin level, GGt and alkaline phosphatase level.
- Chest X-ray and ECG.
- Anesthesiologist consultation for fitness.
- MRCP study.
- ERCP under general anesthesia and intubation.

ERCP and MRCP results were used to evaluate the anatomical classification of the right and left hepatic ducts, and the Huang classification was used to interpret the results [5].

MRCP equipment

We employed a Toshiba Titan 1.5 T MR Scanner with a circular surface coil for improved resolution. Subsequently, spectral pre-saturation inversion recovery (SPIR) fat suppression was used to reduce the background intensity. Additionally, we employed a breathing monitoring device to ascertain the exact moment to initiate a single shot scan.

Technique

Before MRCP, patients were instructed to fast for a minimum of six hours to enhance gastric emptying and GB filling, decrease intestinal motility, and increase appropriate vision by reducing unnecessary fluid signals from the gut. Survey balance sequences in the sagittal, coronal, and axial planes were acquired. Before the examination, axial T1W (T1 weighted), T2W (T2 weighted), and T2 SPAIR (Spectral attenuated inversion recovery) images of the abdomen were obtained, along with coronal T2W images with slice thicknesses of 6-7 mm. The biliary system was appropriately localized and the MRCP slabs were planned using axial T2W as a guide. We used two techniques in the scan: I-Respiratory triggered, three-dimensional (3D) MRCP with maximum intensity projection (MIP reconstruction). II-Breath Hold, Two Dimensional (2D) and Single shot MRCP. Data was interpreted by an expert radiologist.

ERCP technique

- Fluoroscopy: Genoray Oscar Classic was used for screening and taking plain films.
- Duodenoscopy: We used Olympus 240 and Pentax ED-3490TK video duodenoscope.

The procedure was performed (while patients were fasting for 6 hours) under general anesthesia, ERCP was then performed by two experienced endoscopists while patients were in the prone position.

Results for MRCP and ERCP obtained from both techniques were compared.

2.3. Statistical analysis:

Data was gathered, coded and translated into English to manipulate data easily, and double-entered into Microsoft Access. SPSS software version 18 running

on Windows 7 was used for data analysis. • Basic descriptive analysis using percentages and numbers for qualitative data; arithmetic means for measuring central tendency; standard deviations for quantifying parametric data; and inferential statistical tests. For quantitative parametric data: Paired t-test in comparing two dependent quantitative data. For qualitative data, the Chi-square test to compare two or more two qualitative groups. Bivariate correlation test to test the association between variables. The level $P \leq 0.05$ was considered the cut-off value for significance.

3. Results

This study was a prospective descriptive comparative study that included fifty patients submitted to ERCP in Fayoum University Hospital from February 2020 to September 2021.

This study included fifty patients (22 males and 28 females) with a mean age of 49.5 ±15.3 years (range 21–80 years). A baseline characteristic of the studied group is shown in **Table 1**.

Table 1: Baseline characteristics of study participants (N=50).

Variable [a]	
Age [a]	49.50 years ±15.38
Hb [a]	12.89 gm/dl±1.83
Tlc [a]	7.67 /cmm±3.47
Plt. [a]	260.68 /cmm±74.77
Creatinine [a]	0.92 mg/dl±0.31
FBS [a]	121.48 gm/dl±45.54
INR [a]	1.05±0.12
Alt [a]	110.09 U/L±142.35
Alp [a]	221.80 U/L±189.38
Ast [a]	96.84 U/L±131.54
Total bilirubin [a]	4.59 mg/dl±5.13
Direct bilirubin [a]	3.17 mg/dl±3.98
GGT [a]	91.56 U/L±104.13

[a] Data are given in mean (M) and standard of deviation (SD). Hb: hemoglobin, TLC: total leucocytic count, PLT: platelet, ALT: alanine transaminase, AST: aspartate transaminase, INR: international normalized ratio, FBS: fasting blood sugar, GGT: gamma glutamyl transferase, ALP: alkaline phosphatase.

The anatomical classification of the right and left hepatic ducts was assessed by ERCP and MRCP records. The data was interpreted according to Huang's classification as shown in **Figure 1.**

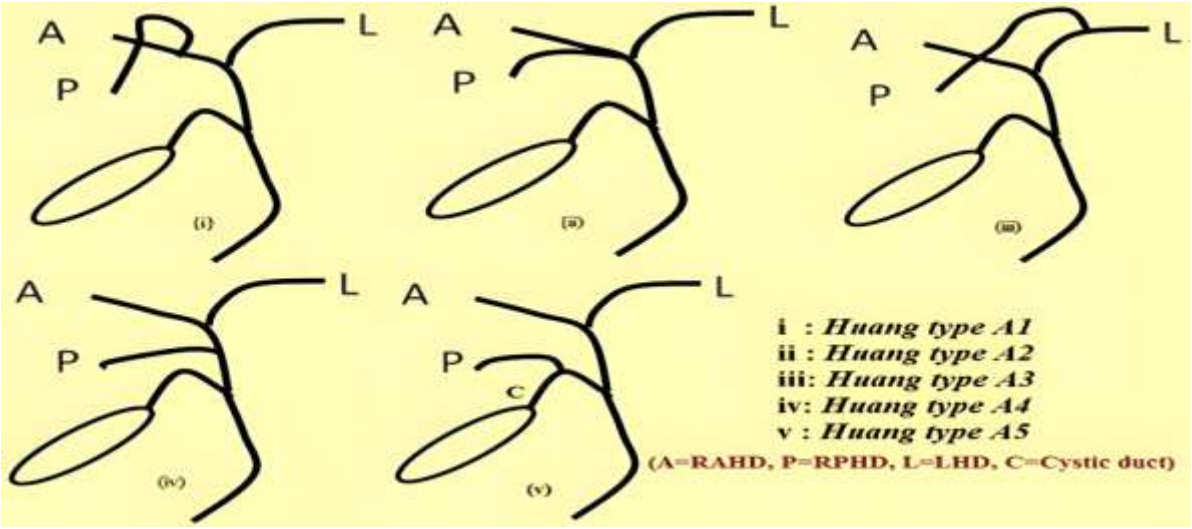

Figure 1: Huang classification.

Different findings by MRCP and ERCP are shown in **Table 2** including anatomy classified according to Huang classification and different CBD pathologies. There is no statistical difference between MRCP and ERCP in detecting biliary anatomical variants.

Table 2: ERCP anatomy versus MRCP anatomy in the studied group (N=50).

Variable	ERCP	MRCP	*P-value*
Type A1	18 (36%)	20 (40%)	0.992
Type A2	14 (28%)	13 (26%)	
Type A3	12 (24%)	11 (22%)	
Type A4	4 (8%)	4 (8%)	
Type A5	2 (4%)	2 (4%)	

Pancreatitis occurred in 3 patients (6%) and bleeding in 1 patient (2%) **(Figure 2**).

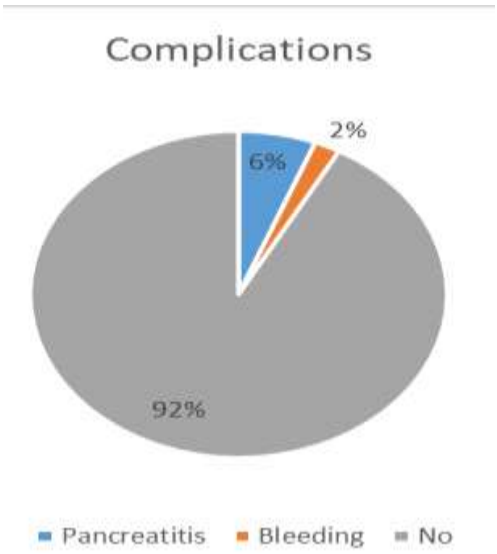

Figure 2: Endoscopic complications of the studied group (N=50):

4. Discussion

In this study, the ERCP study revealed that the type A1 variant by Huang classification is the commonest in 18 patients (36%) followed by type A2 in 14 patients (28%) then type A3 in 12 patients (24%) and type A4 and A5 are rare variants in 4 patients (8%) and 2 patients (4%) respectively. In a study done by Tawab and Taha, they used MRCP to identify variable anatomical types in the Egyptian population in 106 patients and found that Huang type A1 is the commonest: 63.2% (n= 67), Huang A2: 10.4% (n = 11), Huang A3: 17% (n= 18) (Fig. 5), Huang A4: 7.5% (n= 8) and Huang A5: 1.9% (n= 2) (Fig. 7). Total frequency for non-Huang A1 (i.e. A2, A3, A4 and A5) was 36.8% [6]. In their study, Abdelgawad and Eid employed MRCP to evaluate biliary anatomical variants in Egyptian patients. They also included 20 liver donors in a pre-operative evaluation before liver transplantation and discovered that 16 donors (80%) were type A1, one donor (5%), type A2, Two donors (10%), type A3, and one donor (5%), type A4 [7]. Barsoum and her colleagues performed a study in the Cairo radiology center and included 50 potential LDLT donors to study anatomical variants by MRCP and they found that 30 donors (60%) were type A1, three donors (6%) were Type A2, 15 donors (30%) were Type A3, two donors (4%) were Type A4 and none were Type A5 [8]. Reffat et al performed a study including 54

potential living donor liver transplantation (LDLT) donors at Benha University hospitals. They used MRCP to assess biliary anatomical variants using the Yoshida classification. They found that 40 candidates (74.04%) have bifurcation of the right and left ducts which coincides with type A1 Huang classification, right posterior intrahepatic duct joins the left hepatic duct. They both join the right hepatic duct to form the common hepatic duct (Huang type A3), which is found in 9 candidates (16.66%). The least common was the trifurcation pattern (Huang type A2), seen in five candidates (9.25%) [9]. Our study agrees with these studies, the commonest anatomical variant in the Egyptian population is Huang type A1 whereas types A4 and A5 are rare variants. In all previous studies the prevalence of type A1 is around or more than two-thirds of the studied group, while our result revealed that only 36% is type A1; this is due to the small numbers of these researchers.

In a study conducted in Southern Iran, Taghavi et al. used ERCP to detect anatomical variants in 362 patients. They discovered that most patients had type A1 Huang classification in 45% (163 patients), and 78 patients (21.5%) had type A2 Huang. 48 patients (13.3%) had type A3 Huang. Thirteen patients (3.6%) had type A4. No patient fits the type 5 description [10].

Using ERCP, Huang et al. discovered that 63% of Chinese people are classified as type A1 [5]. In their comparison of intraoperative cholangiography and MRCP in the North American population, Kapoor et al. discovered that the percentages of type A1, A2, A3, A4, and A5 were, respectively, 63%, 0%, 8%, 8%, and 0% [11]. According to two studies conducted on Turkish citizens, 8–29% of people have type A1 [12].

We found that the anatomical findings are comparable between MRCP and ERCP; the differences are only in 2 cases (4%). In a German study, Wietzke-Braun et al. evaluated the anatomical characteristics of 18 living donors by comparing MRCP and ERCP. They found that ERCP was safer and more effective than MRCP in identifying biliary variations before liver transplantation [13]. Tawab and Taha compared intraoperative cholangiogram and MRCP findings in 21 patients and discovered that 20 patients (95.2%) had similar classification in both intraoperative and MRCP findings, while one case (4.8%) was assigned as Huang type A2 at MRCP

but found to be type A3 at intraoperative findings [6].

Complications occurred in our study in 4 cases (8%), of which 3 cases (6%) developed acute pancreatitis and 1 case (2%) developed bleeding.

The incidence of post-ERCP pancreatitis is found to be 1.6 to 15% in several large clinical trials [14].

Ethical approval and consent to participate: The ethical committee of our university hospital & Faculty of Medicine approved this study numbered, all the patients were informed about the drug and the possible drawbacks.

Conclusions

The type A1 variant by Huang classification is the commonest anatomical finding in the Egyptian population, MRCP can be safely used for the detection of various biliary anatomy in patients without the need for invasive manoeuvres. We recommend further studies with a large scale of patients are recommended to assess the biliary and pancreatic duct anatomical variations in the Egyptian populations.

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