Comparison of MRCP with Intraoperative Cholangiography in Paediatric Choledochal Cyst and Biliary Atresia

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Abstract

Background: Hepatobiliary and pancreatic disorders in children are infrequent and include Duct union (APBD - union), Extra hepatic biliary atresia (EHBA), Caroli's disease, primary sclerosing cholangitis, pancreas divisum and pancreatic duct abnormalities. A range of investigations have been used for evaluation of these disorders in children ranging from sonography, HIDA Scan computed tomography, ERCP, Cholangiography and MRCP. Among these MRCP is a non-invasive investigation which has the potential to delineate the hepatobiliary pancreatic ductal system pre-operatively to help surgeon in diagnosis and operative planning

Aims and objectives: The purpose of this study was to determine whether MRCP is feasible in paediatric age group patients and to look for the possible measures to optimize the pediatric MRI. Furthermore, we calculated sensitivity, specificity and accuracy of this test by comparing the results of this test with those of surgery and intra-operative cholangiogram (IOC).

Material and Methods: This study was a prospective and descriptive study between Oct - 2012 to Jan- 2015. We examined 50 consecutive children (28 boys and 22 girls), who were suspected of having pancreaticobiliary disease. Besides base line sonography, MRCP was performed in all patients. The findings of MRCP were compared with those of intraoperative cholangiography (IOC). HIDA was done in 20 patients with neonatal cholestasis and these results were also compared with IOC.

Results: A total of 50 children (7 neonates, 17 infants and 26 older children), 30 children with ductal dilatation and 20 children with cholestatic jaundice. The sensitivity, specificity and accuracy of MRCP were 50%, 75% and 60% respectively in detecting the APBD-union in our series. The sensitivity, specificity, accuracy, Positive predictive value and Negative predictive value of MRCP were 84.61%, 85.71% and 85%, 91.66% and 75% respectively in detecting biliary atresia. For patients with neonatal cholestasis, biliary atresia was excluded if there was visualization of normal extra-hepatic biliary system at MR cholangiography. The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of 99mTc-HIDA was 69.23%, 71.42%, 81.8%, 61.1% and 70% respectively. Sedation was required in patients in infants in 10 instances for an optimal MRCP in children. Out of 24 patients having age <1 year, oral Trichlorophos @ 50-100 mg/Kg was required in 6 instances and intravenous diazepam was needed in 4 patients.

Conclusion: MRCP is effective in delineated choledochal cyst type, and helpful in diagnosing related pancreaticobiliary anomalies, such as APBD-union. But more evaluation needs to be done to assess the MRCP ability to detect APBD-union. Furthermore from our preliminary results, we can conclude that BA can be ruled out if complete extrahepatic bile duct (EHBD) is delineated on MRCP. If EHBD is partially visualized, BA cannot be ruled out because atresia may involve only one part of EHBD. Non-visualization of entire EHBD is suggestive but is not synonymous of BA.

Key Words: Choledochal Cyst (CDC); Anomalous Pancreaticobiliary Ductal Union (APBD union); Magnetic resonance cholangiopancreatography (MRCP); Intra-operative cholangiogram (IOC)

Introduction

CDC is a congenital anomaly involving cystic dilatation of various ducts of biliary tree. Proper imaging plays an essential role in preoperative planning. Ultrasonography, computed tomography (CT) and radionuclide scintigraphy may be used initially for diagnosis. However, these techniques are inadequate for delineating the exact pathologic anatomy and APBJ. Endoscopic

retrograde cholangiopancreatography (ERCP) is the standard for diagnosis of APBD-union. Intra operative cholangiogram under fluoroscopy is the best investigation after ERCP that delineates the pancreato-biliary tree and is considered the confirmatory test in biliary atresia. IOC is the most frequently applied technique for intra-operative assessment of the pancreaticobiliary system. It presents high visualization rate of PBM but low detection rate of biliary variants in children with CDC. [1] Although ERCP

is the standard of reference for imaging the pancreaticobiliary system but there are specific advantages of MRCP over ERCP. We speculate that MRCP may replace diagnostic laparotomy and intra-operative cholangiography in jaundiced neonates in whom no bowel excretion is seen in cholescintigrams. Keeping in view the non-invasive nature of MRCP, this study was undertaken to look for usefulness of MRCP in neonatal cholestasis (EHBA, CDC, CBD anomalies). Furthermore MRCP was correlated with IOC findings.

The purpose of this study was to determine whether MRCP is feasible in paediatric age group patients and to look for the possible measures to optimize the pediatric MRI. Furthermore, we calculated sensitivity, specificity and accuracy of this test by comparing the results of this test with those of surgery and intra-operative cholangiogram (IOC).

Subjects and Methods

This study was a prospective and descriptive study between Oct - 2012 to Jan - 2015. We examined 50 consecutive children (28 boys and 22 girls), who were suspected of having pancreaticobiliary disease. Children diagnosed with choledochal cyst on ultrasound with or without jaundice and Persistent cholestasis in infancy. The patients were admitted in our department. Detailed history and examination was performed. After informed consent, these patients were subjected to MRCP for evaluation of hepatobiliary ductal abnormalities and relationship between biliary and pancreatic ductal system. In babies with persistent Cholestasis of infancy, 99mTc-HIDA scan was performed.

In patients aged 6 years and below, we used "sleep debt technique" devised by us, wherein parents were advised to discourage early sleeping and late rising of the child on the night preceding the MRI examination; this resulted in a significant sleep debt of 4 to 5 hours. On the next day, the child was provided milk /breast feed in the MRI suite and was encouraged to go to sleep which helped enough to allow an interrupted MR examination. Children between 6 months to 6 years were sedated with oral Trichlorophos (50-100mg/Kg/body weight and children <6 months were sedated by intravenous injection of Midazolam 0.5mg/Kg/ body weight when required.

IOC Techniques

After laparotomy and identification of CDC, IOC was performed by taking per string suture on GB fundus and injecting 76% Compound Diatrizoate Meglumine (diluted to half strength with normal saline). In case dye was seen going into the duodenum, next step was to clamp the duodenum and inject dye in head down position to delineate the proximal ductal system. The findings were documented on X-ray films (from the front to the posterior axis)

MR Imaging technique

All MR imaging examination were performed on 1.5-Tesla superconducting unit (Magnetom Avanto Siemens,

Erlangen, Germany), using a phased array body coil. We acquired a T₁ weighted fast low angle short FLASH sequences (TR/TE, 150/4.8mSec: flip angle, 75° acquisition matrix and T₂ weighted turbo spin-echo sequence) 2000/120: echo train length 15: acquisition matrix. 128 x 256: scan time 14 seconds to localize biliary and pancreatic tree.

Magnetic resonance cholangiopancreatography (MRCP) was performed using Fourier acquisition with single shot turbo spin echo (HASTE) sequences. All images were acquired without breath holding. Aware of results of sonography, we initially performed HASTE- sequence MRCP with acquisition of single slice at a slice thickness of 20-25 mm. MRCP at a thinner slice thickness of 3-5 mm was then performed in all patients to examine the details of response of interest. In all patients, coronal and oblique projections were acquired. The total imaging time for all examinations was within 15 minutes.

Evaluation of IOC and MRCP Images

Consultant radiologist evaluating the MRCP images were blinded to patient's clinical records and laboratory data. All the MRCP and IOC images were analysed and discussed in combined radio-surgical meet. The following criteria were defined to interpret the MRCP findings. Diagnostic criteria for biliary atresia were adapted from Bill *et al.* [2] Biliary atresia (BA) was diagnosed if any portion of the extra hepatic central biliary duct or common bile duct could not be delineated, regardless of whether the gallbladder was presented.

Statistical Method

Statistical analysis was performed using the Statistical Product and Service Solutions version 13 (SPSS Inc., Chicago, IL, USA) software. The categorical variables of the study have been shown in terms of frequency and percentages. The continuous variables of the study in terms of descriptive statistics like mean $\pm$ SD. The accuracy of the test has been shown in terms of sensitivity, specificity, Positive predictive value, negative predictive value and likelihood ratio. The Chi - square tests have been used to analyse the data. P-value less than 0.05 were considered significant. The appropriate Statistical charts have been used to present the data.

Results

In this study, a total of 50 children were included. Average age of patients with CDC was 4.42 ± 2.43 years with a range between 6 months to 12 years. There were 20 males and 10 female patients. Most common presentation of CDC in our series was pain abdomen in 16 (53.33%) cases followed by pain abdomen with jaundice in 7 (23.33%) and incidental finding in 7 (23.33%) cases. Forty (86%) children had hepatobiliary anomaly, which included CDC in 30 patients APBD-union in 18 and without APBD-union in 12 patients) and EHBA in 13 patients and 7 babies had normal hepatobiliary anatomy. Dilatation of the biliary tract was revealed by MRCP in all 30 patients with CDC. The level of dilatation determined on MRCP images corresponded with the results of surgery/IOC in all the 30 cases. In 12 out of 30 patients, anomalous connections between pancreatic and

biliary ducts were present and were picked on MRCP images. MRCP determined CDC in 30 patients, which included 24 Type -I and 6 cases of Type- IV CDC. Stones were located in CDC in three instances which were revealed on pre- operative MRCP also.

MRCP demonstrated the type of anomalous pancreaticobiliary ductal union (APBD-union) in 12 patients with age range between 2-10 Years and mean age of 5.99 ± 2.374). In 9 of these 12 patients, the anomalous pancreaticobiliary ductal union revealed by MRCP was concordant with those identified by surgery / intra-operative cholangiography. In 3 patients, the anomalous pancreaticobiliary ductal union could not be confirmed by surgery/intra-operative cholangiography (IOC) probably because of poor image qualities or non opacification of the pancreatic duct. MRCP did not reveal anomalous pancreaticobiliary ductal union in 18 patients who had age range between 6 months -12 years (mean age 3.22 ± 2.67) had markedly dilated choledochal cyst (Type-I - 11 patients and Type-IV - 7 patients). Out of 18 patients in whom MRCP findings were not suggestive of APBD-union, 9 of these patients, the anomalous pancreaticobiliary ductal union was confirmed by IOC (4-Type -I; 5—Type-IV), after resection of the choledochal cyst. In the remaining 12 patients IOC/surgery failed to depict the anomalous pancreaticobiliary ductal union.

Sensitivity, specificity and accuracy of MRCP in delineating anomalous pancreaticobiliary ductal union were 50%, 75% and 60% respectively. Positive predictive value (PPV) of MRCP in delineating anomalous pancreaticobiliary ductal union 75%. Negative predictive value (NPV) of MRCP in delineating anomalous pancreaticobiliary ductal union was 50 %. APBD -union was revealed in 8 patients with Type- I CDC whereas this union was not visible in 8 patients with Type -IV-a CDC. IOC revealed anomalous pancreaticobiliary ductal union in 18 patients only. Mean ALP level in our CDC patients was 98.84 IU/l with a range of 35-300 IU/L. In our study average size of CDC was $3.290 \text{ cm} \pm 0.514 \text{ cm}$ (range 1.6-10cms).

Twenty neonates and infants who had neonatal cholestatic jaundice were included in this study. Age range was between 20 days and 76 days, with a mean age of 46.45 ± 15.65 days. They included 13 males and 7 female neonates and infants. (Table: 10) There were 13 male and 7 female babies. The mean GGT levels were 226.85u/L with a range between 20-543 u/L. Average sizes of GB was $2.39 \pm 1.9 \text{ cms}$ (range 0.8-4.3 cms). IHD was seen in 11 cases, CHD in 8 and CBD in 8 babies. The overall diagnostic accuracy was 50%.

In our study ^{99}Tc -HIDA scan was performed in all the cases of neonatal cholestasis of infancy. In all cases of EHBA, findings were confirmed on laparotomy and intra- operative cholangiography. Two patients were diagnosed by IOC/ Surgical exploration as having Type- I biliary atresia; in which the distal bile duct was atretic and the common hepatic duct, gallbladder, and cystic duct were normal. Three patients were diagnosed by IOC, Surgical exploration as having Type -II biliary atresia; in which the common hepatic duct was atretic at different levels,

whereas the common bile duct, cystic duct, and gallbladder were patent or atretic. Eight patients were diagnosed by IOC/Surgical exploration as having Type -III biliary atresia; in which the entire extrahepatic biliary system, including the common hepatic duct, gallbladder, and common bile duct, was atretic.

Of the 12 patients whose MRCP findings were interpreted as having biliary atresia, 7 patients were confirmed as to have EHBA by intra-operative cholangiography (IOC)/ surgical exploration and 5 patients were confirmed as having no features of BA. Of the 8 patients whose MRCP findings were not consistent with EHBA. IOC/ Surgical exploration was used as the diagnostic gold standard for BA. The sensitivity, specificity, accuracy, positive predictive value (PPV), negative predictive value (NPV) of the MRCP was 84.61%, 85.71%, 85 %, 91.66% and 75 % respectively. [Table 1], [Table 2], [Table 3], [Table 4], [Table 5], [Table 6], [Table 7], [Table 8], [Table 9], [Table 10], [Table 11] and [Figure1], [Figure2], [Figure 3], [Figure 4], [Figure 5], [Figure6], [Figure 7], [Figure 8], [Figure 9], [Figure 10], [Figure 11].

Table 1: Distribution of age in Choledochal cyst patients

Group	Number	Percentage
0-6 months	2	6.66
7 - 12 months	2	6.66
13 months - 2 years	4	13.33
2 years-5 years	14	46.66
6 years-10 years	7	23.33
>10 years	1	3.33
Total	30	100

Table 2: Distribution of patients according to the ductal anomaly

Total no of patients included in the study		50
Patients with ductal abnormalities		43
CDC (n=30)	CDC with APBD- union	18
	CDC without APBD -union	12
Infantile Cholestasis (IC) (n=20)	EHBA	13
	Cholestasis due to causes other than EHBA	7

Table 3: Visualization rates of CDC, APBD -union, Biliary and Non-biliary atresia

	MRCP	IOC/ Surgery	P-value
CDC	(100%) 30/30	(100%) 30/30	-
APBD -union	(40%) 12/30	(60%) 18/30	0.121
Biliary atresia	(60%) 12/20	(65.00%) 13/20	0.744
Cholestasis due to causes other than EHBA	(40.00%) 8/20	(35%) 7/20	0.744

Table 4: Table showing type of CDC on MRCP

Type of CDC	Number	Percentage
Type- IV	6	20
Type -I	24	80
Total	30	100

Table 5: Correlation between MRCP findings with Intra-operative cholangiogram (IOC)/surgery findings

IOC /SURGERY (as gold standard)	MRCP			Total Count
		APBD- union	No-APBD- union	
	APBD- union	9	9	18
	No-APBD- union	3	9	12
Total Count		12	18	30

Table 6: Table showing age of the patients with cholestasis

Range (days)	Number	Percentage
20-30	4	20
31-40	3	15
41-50	5	25
51-60	3	15
61-70	4	20
71-80	1	5
Total	20	100

Table 7: Table showing GGT levels in patients with cholestasis

Range (u/l)	Number	Percentage
0-100	6	20
101-200	4	13.33
201-300	5	16.33
301-600	5	16.33
Total	20	100

Table 8: Duct visibility on MRCP in patients with cholestasis

Duct	Visible	Invisible
IHD	11	9
CHD	8	12
CBD	8	12

Table 9: Comparison of USG findings With Intra-operative Cholangiography (IOC) findings / surgical exploration

Ultrasonography (USG)	IOC /Surgery as Gold Standard			Count
		Features of Biliary atresia	No features of Biliary atresia	
	BA	9	6	15
	No features of BA	4	1	5
Count		13	7	20

Table 10: Table showing distribution of the type of biliary atresia on IOC/Surgery

Classification of Biliary Artesia		Description	No
Type -A	Type -III	Entire extrahepatic central biliary ducts (right, left, and common hepatic ducts) and common bile duct were not visible	8
Type -B	Type -II	Common hepatic duct was not visible, whereas the common bile duct, cystic duct, and gallbladder were visible	3
Type -C	Type -I	Distal bile duct was atretic and CHD, GB, cystic duct were normal	2

Table 11: Comparison of MRCP findings With Intra-operative Cholangiography (IOC) findings/surgical exploration

IOC /SURGERY (As Gold Standard)	MRCP			Count
		Biliary atresia	No features Biliary atresia	
	Biliary atresia	11	2	13
	No features of Biliary atresia	1	6	7
Count		12	8	20

Figure 1:MR cholangiopancreatographic image in a 7 year old female child with a Type-I choledochal cyst with Abnormal pancreaticobiliary duct –union (Yellow arrow), angle between distal common bile duct (short red arrow) and pancreatic duct (long red arrow)

Figure 4: IOC showing Type- IV choledochal cyst with APBD – union (Red arrow)

Figure 2: IOC showing Type- I CDC (star) with long common channel (APBD –union) - white arrow

Figure 5: MRCP in a 54-day-old baby with biliary atresia does not show any extrahepatic bile ducts. Except gallbladder (white arrow)

Figure 3: MRCP showing Type-IV CDC in an 11 year old child with both intrahepatic (Thin arrow) and extrahepatic duct dilatation (Thick arrow)

Figure 6: MIOC in same patient (Type- I biliary atresia) where MRCP failed to depict the hypoplastic intrahepatic ductules (red arrows), which are visible at intra-operative cholangiography GB-gallbladder (White arrow)

Figure 7: Infantile choledochal cyst lifted off the portal vein

Figure 10: completed portal dissection in a case of biliary atresia .Black arrows right and left extent of dissection. Portal plate (white arrow)

Figure 8: Portal structures after excision of choledochal cyst

Figure 11: Portoenterostomy being performed. Jejunum (Black Arrow)

Figure 9: Hepatico-jejunostomy completed

Discussion

Neonatal cholestasis is a very commonly encountered problem in Children but fortunately it is usually associated with non surgical pathology. Ultrasonography is considered as the first screening tool for all the patients of neonatal cholestasis [3]. Technique development offers a variety of algorithms for surveillance of biliary and pancreatic structures including intra-operative cholangiogram (IOC), MRCP and CT Cholangiopancreatography [4]. Differentiation of biliary atresia (BA) from infantile hepatitis (IH) remains a common diagnostic problem because both have similar clinical presentation such as jaundice, pale stools and hepatomegaly. Patients with BA require early surgical intervention at best within two months of age before liver cirrhosis sets in. Laparotomy and intra operative cholangiography can provide direct and definitive diagnosis. The therapeutic methods for BA and IH are completely different: the former is treated with surgical therapy, including the Kasai operation or liver transplantation, as early as possible, whereas the latter is treated with medical therapy.

Mean age of presentation in CDC patients was 4.42 ± 2.43 range 6 months – 12 years, WHICH WAS similar to reported by authors like Todani *et al* and de Vries *et al* [5,6]. Most common presentation of CDC in our series was pain abdomen in 16 (53.33%) cases followed by pain abdomen with jaundice in 7 (23.33%) and incidental finding in 7 (23.33%) cases, similar presentation was reported by [7] The classical triad of abdominal pain, lump and jaundice is not common in a series of CDC by authors like de Vries *et al* and Lee *et al* [6,8]. Twenty (80%) of patients had Type- I CDC and 6 (20%) cases had Type- IV cysts. These findings were similar to observations made by deVries JS *et al*, Jordan PH *et al* [6,9]. In our series, 28 patients of CDC were picked up on ultrasonography as cystic lesions of the biliary tree. Moreover it could not differentiate CDC from cystic biliary atresia, this limitation of USG was observed by other authors like Chin H M *et al* [10]. In our study average size of CDC was $3.290 \text{ cm} \pm 0.514 \text{ cm}$ (range 1.6-10cms). It has been suggested that there is a 97% confidence of choledochal cyst when the diameter of the common bile duct is greater than 1 cm, which was comparable to observations drawn from our series [8].

Out of 20 cases of cholestasis, 99mTc -HIDA scan was suggestive of BA in 11 cases. In 9 cases HIDA was not suggestive of BA. The sensitivity and specificity of scintigraphy in detecting obstruction range from 83% to 100% and from 33% to 100%, respectively [11]. Moyer *et al* study observed that scintigraphy had sensitivity and a specificity of 88.24% and 45.71% for diagnosing BA [11]. The accuracy of 99mTc -HIDA scan in our series was comparable to the data reported by Lin *et al*. [12] and Nadel [13], but higher than that by Gupta *et al* [14]. It is likely that the discrepant results between our series and across other studies may have arisen due to the variations in radiotracer used, premedication practices, imaging protocol, interpretative criteria, study timing (patient age), and operator experience. MRCP has developed rapidly over past recent past. Its potential application in paediatrics has followed the promising results in adult biliary disorders. We used two dimensional, long acquisition turbo spin sequences. This has been shown to be superior to gradient echo sequence in visualizing the biliary tree [15]. The type and extent of CDC determined by the MRCP correlated (100%) well with the findings IOC in all the 30 patients, this observation was same (100% correlation between the extent of CDC determined by MRCP and IOC) as reported by Kim *et al* [16]. Abnormal pancreaticobiliary duct union could be delineated by MRCP in 12 cases (40%) out of 30 choledochal cyst patients. Our findings were similar to that reported by authors like Huang S J *et al* [3], Anupindi S A *et al* [17] and Kim *et al* [16].

In our study, the sensitivity, specificity & accuracy of MRCP in delineating anomalous pancreaticobiliary ductal union was 69.23%, 82.35%, &76.66% respectively. In 12 (60%) of the twenty patients in a study by Kim *et al* [16] APBD-union was clearly visible on MRCP. One reason for this discrepancy could be greater proportion (80%) of type I CDC in our study patients, which decreases the chances of visualization of APBD –union due to the size of the cyst. Mean age of patients in whom APBD –union was found was higher than patients in whom this APBD

–union could be delineated (5.99 ± 2.374 years v/s 3.22 ± 2.776 years). This finding has also been endorsed by authors like Kim *et al* [16].

Results of previous study undertaken to determine whether MRCP can depict APBD- union associated with choledochal cyst has not been consistent [18]. These differences may be due to different age of patients and imaging techniques. In a study by Clan *et al*, APBD- union was not delineated in MRCP using 2-0 turbo fast spin-echo sequence with the maximum intensity-projection techniques. However, in paediatric patients, MRCP with half fourier acquisition of a single shot fast spin echo might increase the sensitivity of anomalous pancreaticobiliary duct union detection [19]. APBD -union was mainly seen in Type-I choledochal cyst, however to see a correlation between type of choledochal cyst and APBD -union was not possible due less number of the cases in our series, which is similar to that reported by Kamisawa *et al* [20].

Early diagnosis and younger age at time of surgery afford the patients with BA a higher likelihood of a relatively good outcome. Our preliminary data suggested that MRCP in small infants can provide images of the CBD and CHD. Although IOC can provide a direct definitive diagnosis, it is undesirable if alternative techniques are available. Furthermore, many reports have suggested that MRCP is a well established non-invasive modality for visualizing the biliary system, including the first branch of the intrahepatic biliary ducts, extrahepatic bile ducts, and gallbladder [21]. In our study, however, the first branch of the intrahepatic bile ducts was not visible on MRCP images but the main intrahepatic ducts were visible in 11 cases in cholestasis patients. This lack of visibility may have resulted from insufficient bile or the smaller diameter of the biliary duct in neonates and infants being too small. Thus, we used the visibility of the extrahepatic biliary ducts on MRCP images as the diagnostic criterion for non-BA. In contrast, we considered the absence of any portion of the extrahepatic biliary ducts as the diagnostic criterion for BA.

In our study of MRCP in neonatal cholestasis of infancy, 2 false positive cases were reported. A false positive diagnosis of biliary atresia in an infant with sclerosing cholangitis, in whom MRCP could not show extrahepatic bile ducts because of its small calibre, was reported by Guband *et al* [13]. Although it has been reported that a small gall bladder by MRCP can be considered highly suggestive of biliary atresia, [22] Matos *et al* states that biliary atresia could be ruled out if the extrahepatic bile duct is completely identified at MRCP [23]. In our study MRCP had a sensitivity, specificity and accuracy of 84.61%, 85.71 and 85% respectively, which was similar sensitivity (85%) to that reported by Yang *et al* [18] higher than reported by Norton *et al* [24].

There are problems of motion induced by respiration, bowel peristalsis, and inadequate sedation which is also a major cause of failed examination. Nonetheless, it is plausible to visualize ducts as small as 1mm in diameter; due to improvement in coil technology, increased speed of acquisition, refinements in respiratory compensation techniques that reduce motion artefacts and newer sequence [25,26]. Paediatric MR cholangio-pancreatography needs to be tailored to different body sizes and ages. The first

step toward such improvement is proper coil selection. Smaller children such as neonates and infants do not need a slab thickness of more than 2 mm. Thin section axial and coronal plane images as well as thick slabs in radiating coronal planes, should be acquired. Because neonates and infants usually have irregular breathing with ranging respiratory amplitude, 3-D FSE imaging with respiratory triggering may not be possible in many of these patients [27]. High cost, limited availability and time required for scanning are problems with MRCP, but it has the capacity to provide anatomic and pathologic details of biliary tract as demonstrated in our series. There are some problems in visualizing non dilated ducts on MRCP, especially for IHD as demonstrated in our study. Lack of signal, long reduced special resolution can make the visualization of ducts more difficult. Since it is difficult to achieve respiratory cycle with a regular rhythm and adequate amplitude in infants and small children.

Sedation

To obtain rapid and high-quality images, sedation is required for the patients who underwent MRCP. In children aged 6 years and below 'sleep debt' technique was used and was enough to make child asleep which was useful in 50% of the cases. In the remaining Children between 6 months to 6 years were sedated with oral trichlorophos (50-100 mg/Kg/BW) and children <6 months were sedated by intravenous injection of Midazolam (0.5 mg/Kg/BW). No side effects were detected in our patients. According to previous reports, however, the adverse effects of these sedative drugs included respiratory depression, airway obstruction, agitation, ataxia, vomiting, and cardiac arrhythmia. [28,29] Recently, Maitre et al. [30] reported that increased exposure to phenobarbital is associated with serious neurodevelopmental outcomes. Furthermore, chloral hydrate and phenobarbital also have limitations, such as unpredictable onset, long duration, and the lack of a reversal agent, which make them less-than-ideal sedatives.

Conclusion

Pediatric MR cholangio-pancreatographic examination is limited by small calibre ducts, poor signal, and patient motion, which creates artefact. There are problems of motion induced by respiration, bowel peristalsis, and inadequate sedation which is also a major cause of failed examination. Nonetheless, it is plausible to visualize ducts as small as 1mm in diameter; due to improvement in coil technology, increased speed of acquisition, refinements in respiratory compensation techniques that reduce motion artefacts and newer sequence.

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