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Research Article

Hepatobiliary Scintigraphy as an Diagnostic Tool in the Evaluation and Differentiation of Biliary Atresia from Neonatal Hepatitis

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Abstract

Purpose: This study aims to evaluate the role of hepatobiliary scintigraphy in diagnosing biliary atresia, neonatal hepatitis, and idiopathic cholestasis.

Methodology: 99mTc-labeled iminodiacetic acid (IDA) derivatives are a radiopharmaceutical that provides not only morphological and functional information of the liver, but also assesses the degree of obstruction in the bile ducts of biliary tract and gallbladder obstruction. Analyses also included measurement of gallbladder ejection fraction (GBEF), and in selected cases pharmacological interventions with phenobarbital and ursodeoxycholic acid were used to increase diagnostic specificity.

Results: A retrospective analysis was performed on 50 cases referred from January 2010 to February 2017. Of the total 50 cases analyzed (41 newborns and 9 children aged 4.5 months to 3 years), 34 infants (68%) had neonatal cholestasis secondary to neonatal hepatitis. 7 infants (14%) were diagnosed with biliary atresia, and 9 pediatric cases (18%) had normal scintigraphy results. Normal GBEF values (>35%) were identified in 35 cases (70%), while in 8 cases (16%) GBEF was intermediate (22-34%).

Discussion: This method offers high sensitivity for detecting hepatobiliary tract disorders. When combined with pretreatment with phenobarbital and ursodeoxycholic acid, it significantly increases the specificity of the diagnosis in differentiating neonatal hepatitis from biliary atresia.

Keywords: Hepatobiliary Scintigraphy; 99mTc-HIDA; Neonatal Cholestasis; Biliary Atresia; Phenobarbitone; Ursodeoxycholic Acid

Introduction

Neonatal cholestasis poses a significant diagnostic and therapeutic challenge. These conditions often present with jaundice, pale stools, and hepatomegaly, requiring accurate differentiation between biliary atresia (B.A) and neonatal hepatitis (N.H), as treatment strategies differ significantly [1]. Biliary atresia (B.A.) is a rare disease a condition characterised by inflammation and obstruction of bile ducts biliary of unknown origin that presents in the neonatal period. It is the most frequent surgical cause of cholestatic jaundice in this age group. Untreated, this condition leads to cirrhosis and death within the first years of life [2,3].

Hepatobiliary scintigraphy with 99mTc-HIDA is an important diagnostic modality for the treatment of neonatal cholestasis and plays a key role in the differential evaluation and management of these patients. This method has high sensitivity and specificity for the functional assessment of the biliary system and liver [4].

Early differentiation of these two entities is of utmost importance since surgical treatment of biliary atreisa would be very successful in the early stages of the disease [5].

Methods

This retrospective study analyzed data from 50 pediatric cases referred for hepatobiliary scintigraphy between January 2010 and February 2017. Patients were categorized based on age, clinical presentation, and scintigraphic findings (41 neonates and 9 children aged 4.5 months to 3 years). The radiotracer used was 99mTc-HIDA, which was administered intravenously at a dose of 18.5 MBq per kilogram of body weight, with maximum dose of 92.5 MBq for infants. Images were recorded with a Siemens dual-head gamma camera for one hour and, with static images taken up to 24 hours in cases of delayed tracer clearance.

For patients with suspected biliary obstruction, pretreatment with phenobarbital (5 mg/kg for 5 days) and ursodeoxycholic acid was used to improve diagnostic specificity [3].

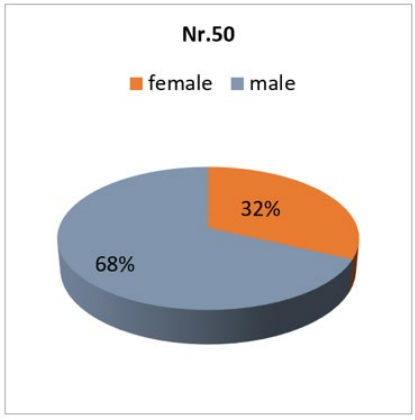
Data analysis

The imaging protocol for cholescintigraphy has become fairly standardized [12]. A 60-s blood flow phase (1- to 3-s frames) is optional. After the flow study, 1-min dynamic images are acquired for the remaining 59 min.

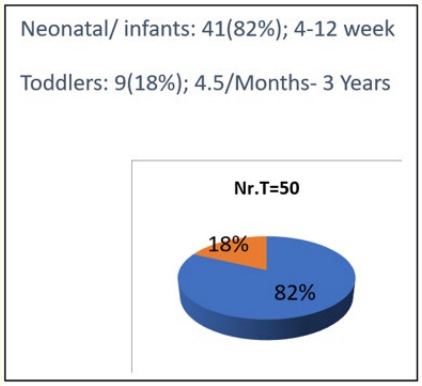
The main parameters assessed were hepatic tracer uptake, intrahepatic and extrahepatic duct visualization, gallbladder filling, and Gallbladder ejection fraction GBEF (GBEF a measure of gallbladder function. A GBEF >35-40% was considered normal [8].

Results

A retrospective analysis was performed on 50 cases referred from January 2010 to February 2017. Of the total 50 cases analyzed 34 (68%) were male and 16 (32%) were female, 41(82%) newborns were neonates aged 4-12 weeks and 9 (18%) were children aged 4.5 months to 3 years). Of these 34 infants (68%) had neonatal cholestasis secondary to neonatal hepatitis(N.H), 7 infants (14%) were diagnosed with biliary atresia(B.A), and 9 pediatric cases (18%) had normal scintigraphy results. Normal GBEF values (>35%) were identified in 35 cases (70%), while in 8 cases (16%) GBEF was intermediate (22-34%) (Graphic 1 and 2).



Graphic 1: 34 (68%) were male and were female.



Graphic 2: Were neonates aged.

Diagnoses

Neonatal hepatitis (N.H) was diagnosed in 34 cases (68%), with 4 classified as severe.

Biliary atresia (B.A) was confirmed in 7 cases (14%), with 2 inconclusive (Figure 1 and Graphic 3).

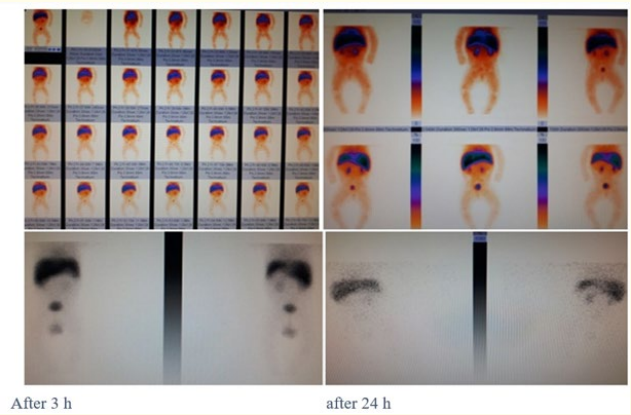
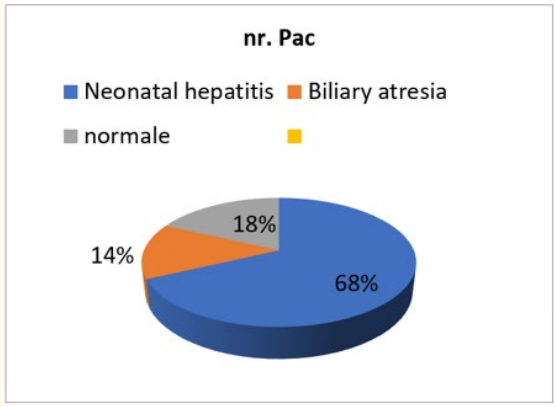


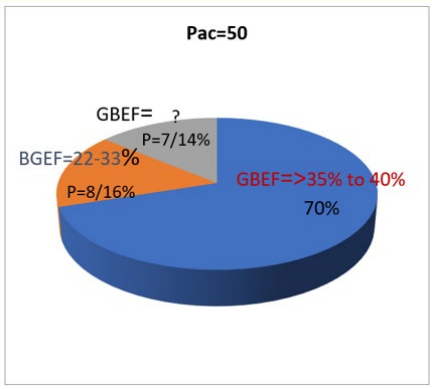
Figure 1: Image showing lack of radioactive tracer in duodenum in biliary atresia.



Graphic 3: Demonstrate B.A in 7 cases (14%).

Normal scintigraphy findings were observed in 9 cases (18%) (Graphic 3).

GBEF: Normal GBEF >35% was observed in 35 cases (70%). Reduced GBEF (22–34%) was noted in 8 cases (16%), while in 7 cases (14%), GBEF could not be measured (Graphic 4).



Graphic 4: Demonstrate Normal GBEF >35% was observed in 35 cases (70%).

Overdue obstruction of biliary pathways and intestinal transit with normal liver function may have other causes than partial obstruction. In case return to biliary duct and transit through the intestine in 60 minutes is seen up to 20% of healthy persons, due to a hypertension of the occipital muscle of Oddi [10] (Figure 2).

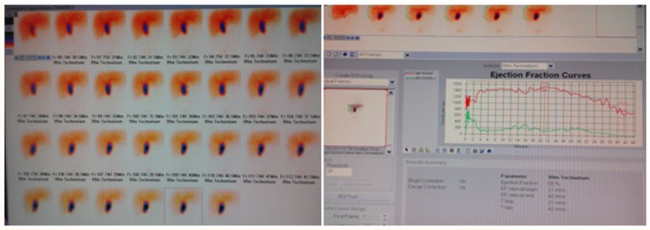


Figure 2: Sincalide administration can sometimes cause delayed biliary-to-bowel transit, leading to preferential bile flow into the gallbladder instead of the bowel. This effect can mimic pathological conditions and should be interpreted carefully in the clinical context.

In the setting of good hepatic function and biliary clearance, nonfilling of the gallbladder is diagnostic of acute cholecystitis but must persist on delayed images for up to 4 h [13] or for 30 min after morphine infusion [14].

Gallbladder filling after 1 h with normal biliary-to-bowel transit is usually due to chronic cholecystitis [15]. The presence of intestinal transit before gallbladder filling during the first hour of imaging is

also suggestive of chronic cholecystitis [16]. Delayed gallbladder filling is caused by a functional resistance to flow through the cystic duct, often due to viscous concentrated bile within the gallbladder, gallstones, chronic mucosal thickening, and fibrosis. Visualization of the gallbladder by the end of the first hour after these patients are pretreated with cholecystokinin is considered evidence for a functional mechanism [17] (Figure 3). Other scintigraphic findings suggestive of chronic cholecystitis include delayed biliary-to-bowel transit with normal gallbladder filling [18].

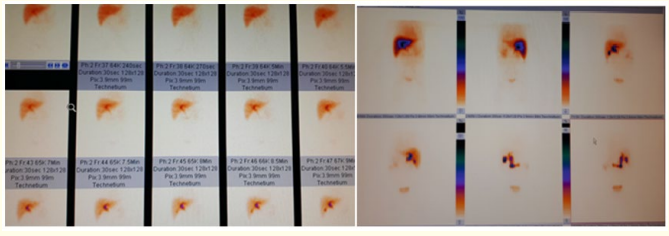


Figure 3: Cholescintigraphy demonstrates the primary underlying pathophysiology of chronic cholecystitis, that is, obstruction of the cystic duct, and thus the 99mTc-HIDA radiopharmaceutical cannot enter the gallbladder, include delayed bile-to-bowel transit with normal filling of the gallbladder. The presence of intestinal transit before filling the gall bladder after the first hour of images suggests cholecystitis chronic acalculose [11].

This delay is also common in patients with chronic cholecystitis, where gallbladder function is often impaired. Furthermore, various hepatobiliary diseases and some medications can affect this process by contributing to a decrease in the rate of gallbladder emptying and the passage of bile into the intestine.

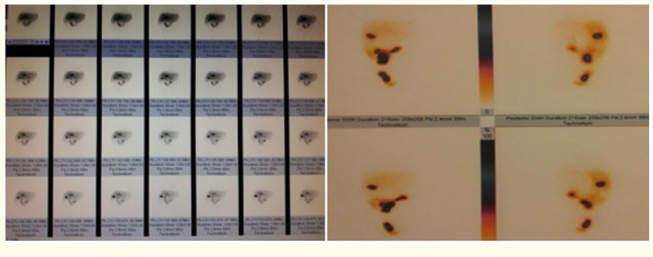


Figure 4: Sc.Hepatobiliare (HIDA) scan shows continuous gallbladder activity, despite the liver and radiotracers excretion clearance in the biliary trunk, after the ration of fatty food.

A functional delay in intestinal transit occurs in up to 50% of patients who take sincalide to stimulate gallbladder emptying before cholescintigraphy. This occurs due to contraction of the gallbladder and the negative pressure created within it, which results in preferential flow of bile through the cystic duct into the gallbladder rather than through the common bile duct into the intestine.

.....Sincalide administration can sometimes cause delayed biliary-to-bowel transit, leading to preferential bile flow into the gallbladder instead of the bowel. This effect can mimic pathological conditions and should be interpreted carefully in the clinical context.

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Discussion

Hepatobiliary scintigraphy, using radiotracers such as 99mTc-HIDA, represents a valuable tool for the diagnosis of complex hepatobiliary disorders, provides morphological and functional insights into the liver and biliary system [9]. It has high sensitivity for identifying abnormalities of the liver and biliary system, but the specificity of this imaging modality is quite low, which limits its use in daily practice [6]. However, the specificity can be significantly increases by Pre- or post-treatment with phenobarbital and ursodeoxycholic acid of scintigraphic findings by stimulating hepatic tracks. This is in line with the existing literature [7].

Neonatal and idiopathic cholestasis in infants and children represent significant diagnostic challenges.

This study highlights its utility in differentiating biliary atresia in a pediatric population, a condition that requires surgical intervention, focusing on its role in distinguishing between obstructive and nonobstructive causes of cholestasis from neonatal hepatitis, often managed medically.

The results demonstrate the importance of measuring GBEF in differentiating between pathologies.

Limitations

The retrospective nature and single-center design may limit the generalizability of findings.

Conclusion

Along with pharmacological interventions, hepatobiliary scintigraphy is an invaluable diagnostic tool in the evaluation of neonatal and idiopathic cholestasis functional allow for the accurate differentiation of biliary atresia from neonatal hepatitis, guiding appropriate management strategies.

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