Characterization of Hepatobiliary Scintigraphy using Quantification Analysis

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Abstract: ***Serial scintigraphy images following injection of [99^{m}Tc] (IDA) compounds such as [99mTc] diisopropy Hminodiaceticacid (HIDA) provide qualitative information about liver function. We have investigated approaches for quantitatively describing liver function in terms of the kinetics of HIDA extraction and excretion by the liver cell. One hundred and thirty five infants under 12 months of age (65 females and 70 males) were studied in Nuclear Medicine department in Royal care center at Khartoum state during the years 2012-2015, 99mTc HIDA scan was administered intravenously, and images were obtained for up to 24 hours or until gastrointestinal excretion was noted. The result of this study showed that the most effected age was (3 to 6) month. The absorption of radiopharmaceutical (Tc99m HIDA) from 5mint until 35 mint. Shows slight decreases execrations of radiotracer from 35 mint up 60 mint but still more the base count at 5 minute. Hepatobiliary scintigraphy should be used as part of the overall evaluation of neonates and infants with neonatal cholestasis and jaundice.***

Keywords: hepatobiliary Scintigraphy, 99mTc HIDA absorption, extraction.

1. Introduction

Development of 99mTc-labeled iminodiacetic acid (IDA) derivatives provided us with an elegant way of studying key elements of hepatobiliary physiology and pathophysiology (Loberg et al. 1976). This area of diagnostic scintigraphy allows for depiction of liver blood flow, hepatocellular function, bile formation and excretion, as well as biliary tract integrity and dynamics. It further sheds light on gastrointestinal tract motility and patency as bile travels along, or in some less fortunate instances, outside its lumen. Hepatobiliary radiopharmaceuticals witnessed one of the most prolific and fruitful developments detailed elsewhere (Krishnamurthy and Turner 1990; Hladic and Norenberg 1996).

Hepatobiliary scintigraphy using 99mTc-HIDA is widely used for evaluation of hepatic function and functional reserve, and various methods for the quantitative analysis of time-activity curves. The reliability of the time-activity curve used to determine accumulation of count by continuous dynamic 99mTc-HIDA over the 60 minutes following injection to evaluate the counts taken per mints from five min to sixty min and to determine the relationship between the time and average of counts. By far the most common analytical application to HBS is quantitation of GBEF. It is the difference in GB counts, corrected by the background activity, between its maximal and minimal intensity, as a percent of the former. While a simple calculation, care should be taken to confirm that the GB region of interest (ROI) contains the GB throughout this imaging segment. It is common for the GB to change orientation, typically with the fundus moving in the cranial direction, assuming a more horizontal position. Such motion may cause a partial escape of GB outside the ROI, which is commonly drawn on the early image and applied to the entire image set, leading to an erroneously higher GBEF. Patient motion can have a similar effect by moving the GB outside a stationary ROI. An inappropriately positioned background ROI that includes bowel activity may occasionally lead to an erroneous result. Another common problem with a stationary GB ROI is an unintentional inclusion of nearby bowel activity that moves into the ROI towards the end of the study. It is sometimes necessary to apply individual GB and background ROIs to the pre-CCK and the image with least GB activity**.**

2. Material and Methods

One hundred and thirty five patients (65 females and 70 males) with the average age 5.5 month underwent Tc99m HIDA Scintigraphy. Which were being taken during 2012 to 2015 from the Nuclear Medicine department in royal care hospital in Khartoum. The data were being collected practically and from records of children, which were being referred to nuclear medicine department. The variables were being used for patients social background (age, sex and weight), and the (counts Vs time), to Characterization of hepatobiliary diseases. Finally the results were being analyzed by using (SPSS) program version 10.00.

2.1 Hepatobiliary Scintigraphy Technique

Ensuring an optimal scintigraphic result starts with proper patient preparation. It is well recognized that biliary flow and GB motility is a complex process that can be dramatically altered by a multitude of variables. Ideally, the patient is instructed to avoid opiates and opioid drugs and fasting for 4–24 h prior to the test. It is preferred that the last pre-test meal (a bedtime snack) contains a significant fatty component if it can be tolerated by the patient. This would empty the GB, rendering it in the state of refilling at the start of scintigraphy the following morning. Our institutional routine hepatobiliary scintigraphy (HBS) includes an optional rapid blood flow (scintiangiography) phase, and a slower dynamic (hepatobiliary) phase. and a slower dynamic (hepatobiliary) phase. Optimal resolution and counting statistics can be obtained by acquiring images in a 128×128 matrix size. The framing rate for the scintiangiography phase is one frame per second for a total of 60 s, while the subsequent images are acquired at one frame per 15 s for 1 h. The flow is best viewed by re-framing the rapid phase into 3–5 s per displayed frame, while the slower dynamic phase is re-framed into 2–4 min per displayed frame.

The scintiangiography phase may reveal gross abnormalities of the heart and the aorta, such as cardiomegaly or aneurisms (Stryker and Siegel 1997). Liver blood flow via the hepatic artery is typically faint, as it represents only 25% of overall blood circulation through the organ. Activity in the liver begins to accumulate more rapidly upon recirculation, as blood returns via the portal vein 3–5 s later. It is just before the portal phase that a focal blush signals a lesion with arterial hypervascularization, such as hepatocellular carcinoma, adenoma, or focal nodular hyperplasia. Conversely, decreased flow can be seen in hypovascular lesions exemplified by an abscess and a cyst (Yeh et al. 1973). Next is the hepatocellular or parenchymal imaging phase. The first 8-10 min of imaging offers a window into the functional hepatocellular integrity. Normally, the blood pool activity in the heart clears completely by the eighth minute (it may be faintly seen on the first 4-min image), with the tracer concentrated densely in the liver.

3. Result and Discussion

This study carried out to Characterization of hepatobiliary scintigraphy using quantification analysis for infant patient. The weight of the patient ranged between 2.5-12.2 Kg, which represents normal body parameter distributions.

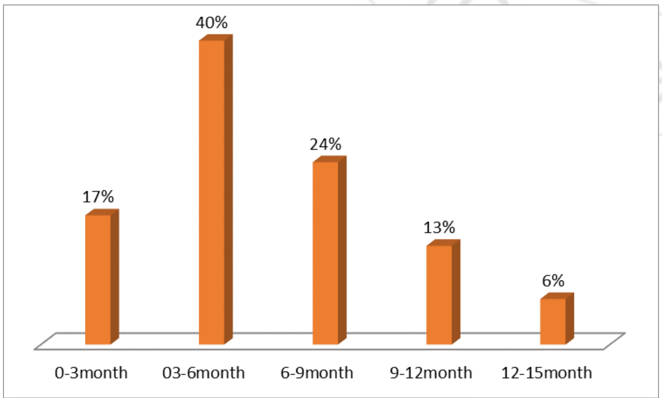

Figure 1: shows the frequency and percentage of the sample distributed based on age.

Assessment of the hepatobiliary system by nuclear medicine techniques in the infant < 12 mo of age is usually indicated to help determine the etiology of jaundice. The majority of cases occur in children in the first 3-6 month of life (finger 1). This article primarily addresses the use of hepatobiliary scintigraphy in the neonatal period, but it also identifies other conditions that can occur in the first 12 mo of life.

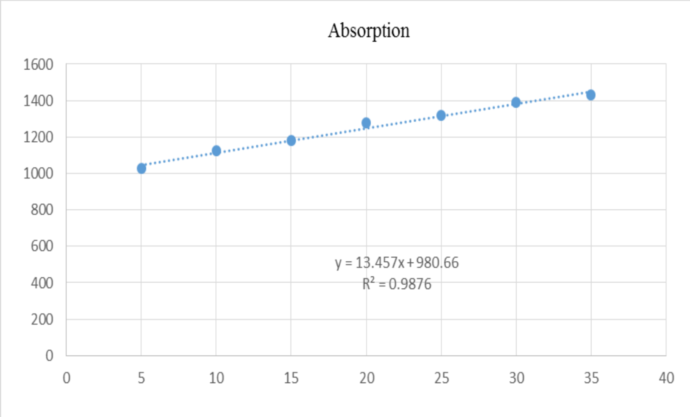

Figure 2: show the absorption of radiopharmaceutical (Tc^{99m} HIDA).

A number of parameters are calculated from the time activity curves generated from the ROIs placed over the heart (activity in the circulation), liver, hepatic hilum, CBD, and duodenum. The whole liver activity curve analysis initially involved determination of time to the maximal activity (T-max) and halftime of clearance (T1/2) from T-max (Gilbert et al. 1987), which is a measure of bile formation and/or impedance to its flow. The absorption of radiotracer uptake started from 5 mint until to 35 mint.

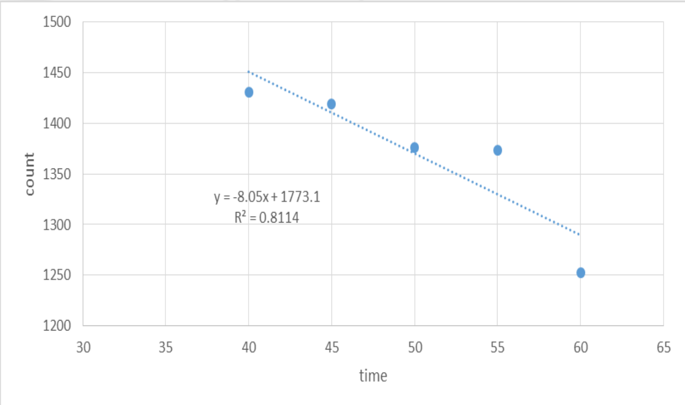

Figure 3: Show the secretion of radiopharmaceutical (Tc99m HIDA)

Figure 3 showed the hepatic activity washout, also called percent of radiotracer excreted, can be expressed by a percent clearance from Tmax to a specific time (typically at 30, 45, 60, and 90 min).

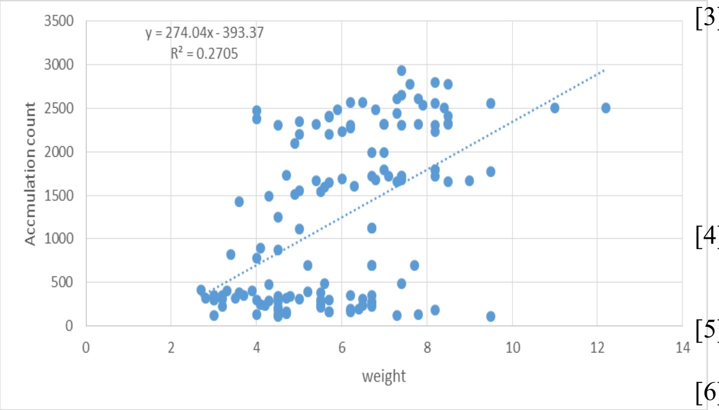

Figure 4: Show the weight Vs accumulation counts

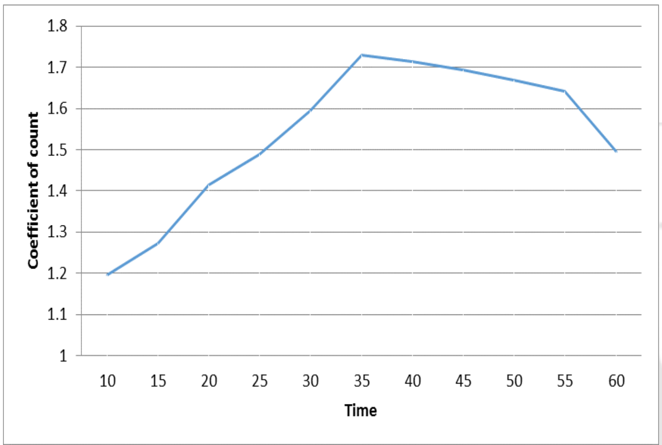

Figure 5: Show Coefficient of count for per count Vs time every 5 min up to 60 min

As we can see in Figure 5 the absorption of radiopharmaceutical (Tc99m HIDA). From 5mint until 35 mint .shows slight decreases execrations of radiotracer from 35 mint up 60mint but still more the base count at 5 minute.

4. Conclusions

Assessment of the hepatobiliary system by nuclear medicine techniques in the infant < 12 mo of age is usually indicated to help determine the etiology of jaundice this study carried out to Characterization of hepatobiliary scintigraphy using quantification analysis for infant patient. The result of this study showed that the most effected age between 3 to 6 month. the absorption of radiopharmaceutical (Tc99m HIDA) From 5mint until 35 mint .shows slight decreases execrations of radiotracer from 35 mint up 60mint but still more the base count at 5 minute.

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