

Characterization of Hepatobiliary Scintigraphy using Linear Equations

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Abstract: *Hepatobiliary radionuclide imaging is typically performed to assess the acute or chronic cholecystitis. Occasionally, initial 1 h imaging reveals an obstructive pattern of radiopharmaceutical distribution with non-visualization of the hepatic or extra-hepatic (EH) bile ducts, gallbladder and small intestinal activity. One hundred and thirty five infants under 12 months of age (65 females and 70 males) with were studied at Nuclear Medicine department in Royal care center of Khartoum Hospital 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 there is linear relationship between counts at 5 minute up to 60 using 5 minute interval, which start at 1.2 counts/minute up to 1.5 counts at 60 minute. In conclusion we noted that a strong direct relationship between these time were the strength of these relation decreased with increasing the time interval.*

Keywords: Hepatobiliary Scintigraphy, 99mTc HIDA, Jaundice

1. Introduction

A mathematical technique known as deconvolutional analysis was used to provide a critical and previously missing element in the computations required to quantitate hepatic function scintigraphically. This computer-assisted technique allowed for the determination of the time required, in minutes, of a labeled bilirubin analog (99mTc-disofenin) to enter the liver via blood and exit via bile. This interval was referred to as the mean transit time (MTT). The critical process provided for by deconvolution is the mathematical simulation of a bolus injection of tracer directly into the afferent blood supply of the liver.

HIDA (Hepatobiliary) scans very useful tool for evaluating the liver, gallbladder, and biliary system is called the Hepatobiliary (HIDA) scan. This scan demonstrates not only liver function, but also the function of the gallbladder. It is commonly used to diagnose abnormal function of the gallbladder. It also examines the gallbladder and the ducts leading into and out of the gallbladder. Many people have gallstones without ever having symptoms. However, these stones can cause acute abdominal pain by obstructing the gallbladder and the flow of bile. This is a very simple test to determine if gallbladder is obstructed. In this test the patient receives an intravenous injection of a radioactive material called hydroxy iminodiacetic acid (HIDA). This material is taken up by the liver and excreted into the biliary tract. In a healthy person, this material will pass through the bile ducts and into the cystic duct to enter the gallbladder. It will also pass into the common bile duct and enter the small intestine, from which it eventually passes out of the body in the stool.

Hepatobiliary scintigraphy using Tc99m-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 99mTcHIDA 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.

2. Material and Method

One hundred and thirty five patients (65 females and 70 males) with the average age 5.5 month underwent to get Tc99m_HIDA Scintigraphy. Which were being taken during 2012 to 2015 from the Nuclear Medicine department in Royal Care Center of 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 (counts Vs time), to Characterization of hepatobiliary diseases. Finally the results were being analyzed by using (SPSS) program version 21.0

3. Patient preparation

For hepatobiliary Scintigraphy the patients asked stop taking medication if found (stopped for 24-hr before the study, as well as to ensure patient NPO 2–14 hours before exam (usually 4–6 hours, 2 hours for infants). And explain the procedures (usually runs ~1 hour but baseline). After the injection the dynamic study immediately started as follows (2 sec/frame for 60 seconds, then immediate blood pool image for flow study and 60 sec/frame for 60–90 minutes for dynamic Studies).

4. Procedure

Place the patient in supine position, camera anterior (or left anterior oblique), liver in upper left quadrant of field of view (FOV). Position the liver in middle FOV to acquire immediate heart shadow image, and then move camera to put the liver in upper left quadrant of FOV for remaining images. ROIs can be drawn around heart and heart/liver to ascertain

Volume 5 Issue 8, August 2016

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radiotracer clearance from blood pool.

Then every 5 minutes up to 60 minutes, giving a better visualization of the radiotracer washout from the liver. If patient can hold still for 60 minutes. Stop dynamic at 30 to 45 minutes if gallbladder and bowel present then acquire to 90 minutes if not. Acquire a right lateral (RLAT) static if gallbladder presents. Other useful images may be taken from oblique's, laterals, posterior or using pinhole collimators and magnified views for children.

5. Results and Discussion

This study carried out to characterize the hepatobiliary disease in NM images using Linear equations. There are various methods for the quantitative analysis of time-radioactivity curves by ^{99m}Tc-HIDA liver scintigraphy, ranging from simple methods such as the accumulation rate in the liver and the clearance rate. The study sample consisted of one hundred and thirty five patients (70male, 65 female) their age ranged from 1 up-to 14 month. The weight of the patient ranged between 2.5-12.2 Kg, which represents normal body parameter distributions.

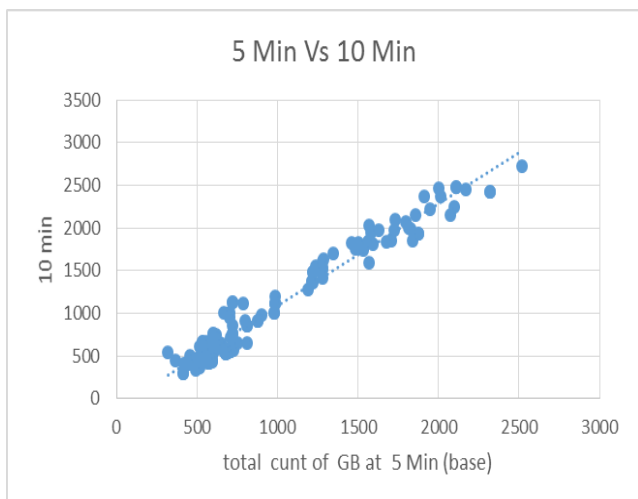


Figure 1: Time activity curve at time 5 Min base time Vs 10 Min

$(y = 1.1976x - 107.01, R^2 = 0.9585)$

Figure 1. Showed strong correlations were seen between counts and time in comparison of the initial count started in 5 min and the counts 10 min. The count from 5 mint to 10 mint increase by 1.2 count for every one mint increment in X-value.

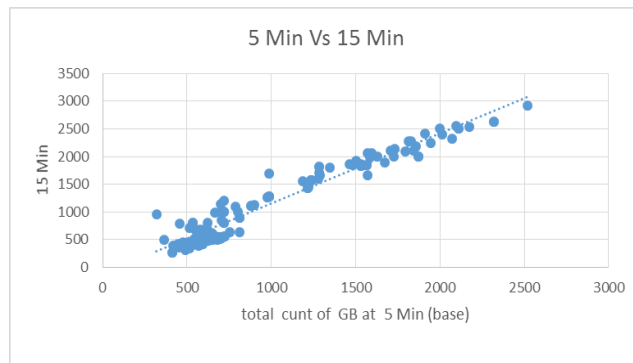


Figure 2: Time activity curve at time 5 Min Vs 15 Min

$(y = 1.273x - 123.57, R^2 = 0.9402)$

Figure 2. Demonstrate strong correlations were seen between counts and time in comparison of the initial count started in 5 min and the counts 15 min. The count from 5 mint to 15 mint increase by 1.3 count factor of 15 mint curve.

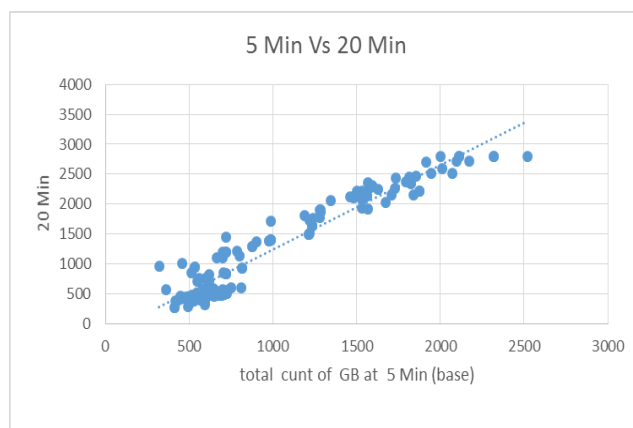


Figure 3: Time activity curve at time 5 Min Vs 20 Min

$(y = 1.4144x - 176.61, R^2 = 0.9169)$

A strong correlation were seen between counts and time in comparison of the initial count started in 5 min and the counts 20 min. The count from 5 mint to 20 mint increase by 1.4 count (Figure 3).

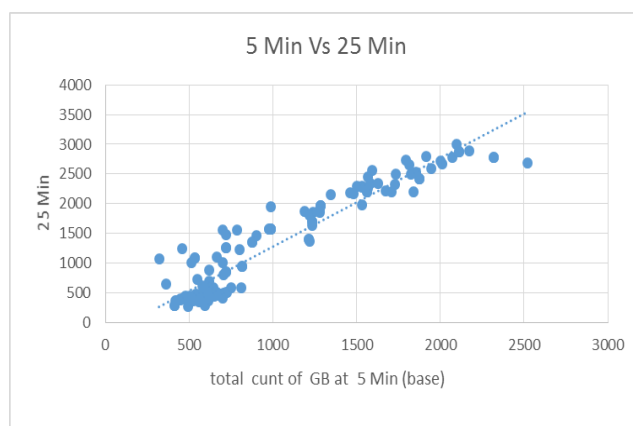


Figure 4: Time activity curve at time 5 Min Vs 25 Min

$(y = 1.489x - 210.68, R^2 = 0.8873)$

A strong correlation were seen between counts and time in comparison of the initial count started in 5 min and the counts 25 min. The count from 5 mint to 20 mint increase by 1.5 count as showed in (Figure 4).

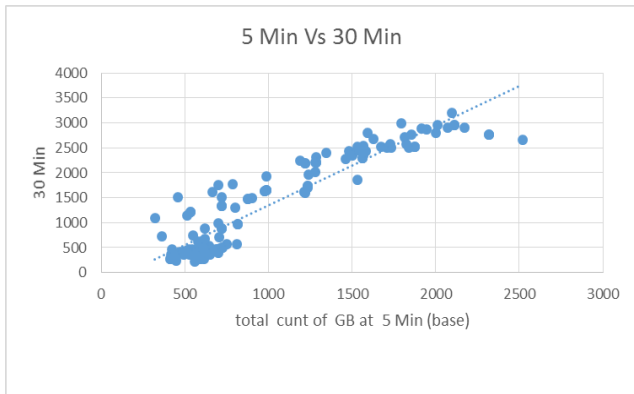


Figure 5: Time activity curve at time 5 Min Vs 30 Min

$(y = 1.5949x - 248.05, R^2 = 0.8519)$

A strong correlation were seen between counts and time in comparison of the initial count started in 5 min and the counts 30 min. The count from 5 mint to 30 mint increase by 1.6 count (Figure 5).

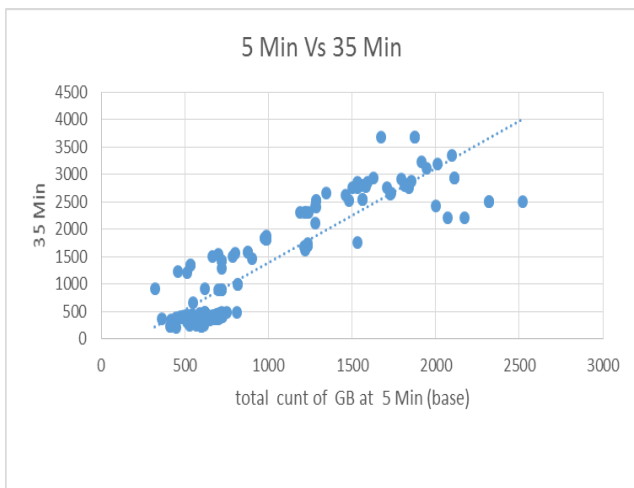


Figure 6: time activity curve at time 5 Min Vs 35 Min

$(y = 1.7293x - 343.71, R^2 = 0.8033)$

A strong correlation were seen between counts and time in comparison of the initial count started in 5 min and the counts 15 min. The count from 5 mint to 35 mint increase by 1.7 count (Figure 6).

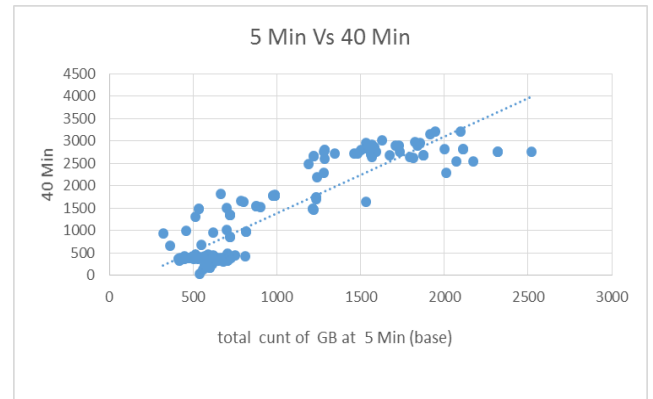


Figure 7: time activity curve at time 5 Min Vs 40 Min

$(y = 1.7133x - 328.06, R^2 = 0.7929)$

A strong correlation were seen between counts and time in comparison of the initial count started in 5 min and the counts 40 min. The count from 5 mint to 40 mint increase by 1.7 count (Figure 7).

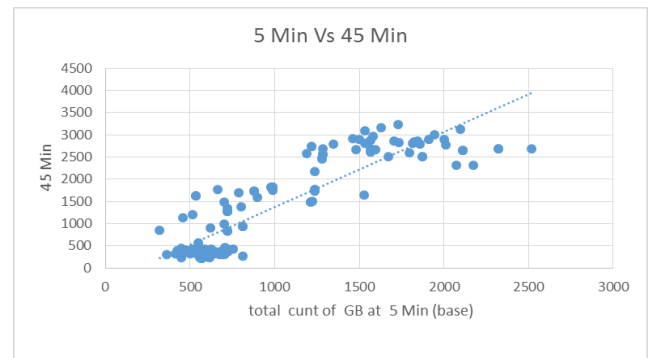


Figure 8: time activity curve at time 5 Min Vs 45 Min

$(y = 1.6943x - 320.7, R^2 = 0.7773)$

A strong correlation were seen between counts and time in comparison of the initial count started in 5 min and the counts 15 min. The count from 5 mint to 45 mint increase by 1.7 count (Figure 8).

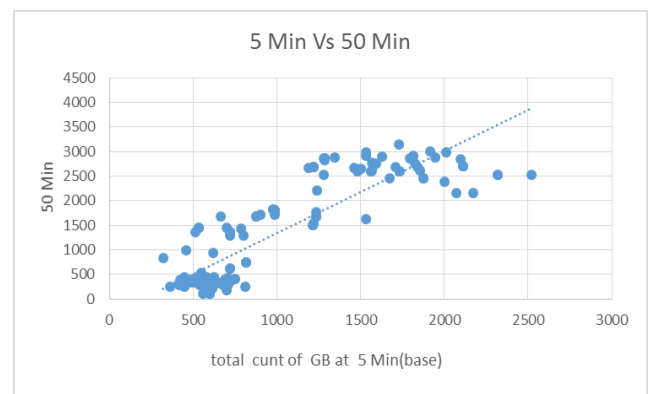


Figure 9: time activity curve at time 5 Min Vs 50 Min

$(y = 1.6697x - 338.21, R^2 = 0.7551)$

A strong correlation were seen between counts and time in comparison of the initial count started in 5 min and the counts 15 min. The count from 5 mint to 50 mint decrease by 1.6

count (Figure 9).

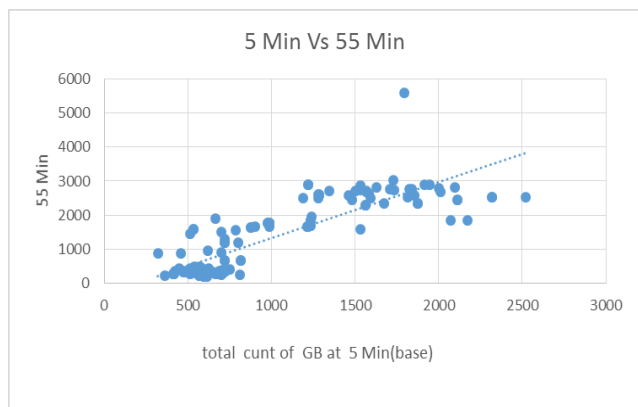


Figure 10: time activity curve at time 5 Min Vs 55 Min

$(y = 1.6417x - 312.09, R^2 = 0.711)$

A strong correlation were seen between counts and time in comparison of the initial count started in 5 min and the counts 15 min. The count from 5 mint to 55 mint decrease by 1.6 count (Figure 10).

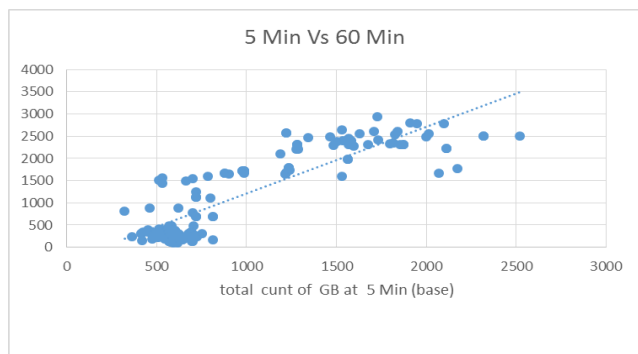


Figure 11: time activity curve at time 5 Min Vs 60 Min

$(y = 1.4953x - 282.73, R^2 = 0.7492)$

A strong correlation were seen between counts and time in comparison of the initial count started in 5 min and the counts 60 min. The count from 5 mint to 60 mint decrease by 1.5 count (Figure 11).

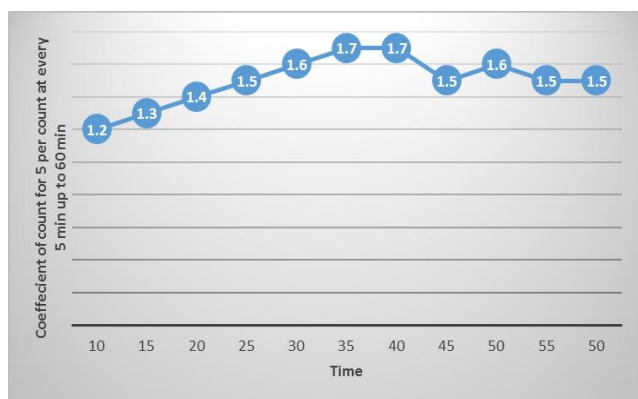


Figure 12: show Coefficient of count for 5 per count at every 5 min up to 60 min

As we can see in Figure 12 the increases reach a platue at 40 minute from this point up to 60 minute it shows slight

decreases but still more the base count at 5 minute.

6. Conclusion

Hepatobiliary scintigraphy should be used as part of the overall evaluation of neonates and infants with neonatal cholestasis and jaundice. This study carried out to characterize of hepatobiliary Scintigraphy using Linear equations. The result of this study showed that there is linear relationship between count at 5 minute and time from 10 to 60 using 5 minute interval, Figure (1 to 11) demonstrate this relationship; which start at 1.2 counts/minute at 10 minute up to 1.5 at 60 minute.

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