



HEPATIQ: AUTOMATED MEASURE OF LIVER AND SPLEEN VOLUMES CORRELATES WITH THE MANUAL METHOD

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ABSTRACT

Background and Aims: Simple tests such as spleen volumes per ideal body weight (SV/IBW) as an index of portal hypertension and hepatic volumes have been ignored as non-invasive methods for staging CLD. Hepatic and spleen volumes by MRI or CT in the A2ALL study (Everson, et al 2013 Liver Transplantation 19: 292-304) correlated closely with those calculated by SPECT calculation for HV ($r^2 = .86$) and SV ($r^2 = .90$). The SV/IBW > 2.5 cc/lb IBW (5.5 cc/kg) has 12X higher risk of ACO than patients with normal SV/IBW (HALT-C 2012; Hepat; 55:1019). The SV is a calculation (non-edging technique that is not affected by voxel size) measured by manually drawn regions of interest (ROI) on SPECT images is tedious. HEPATIQ is an automated computer program developed to make quantitative image analysis of SPECT images easier. The automated SV/IBW (SV/IBW-A) was correlated with manual SV/IBW (SV/IBW-M) and automated hepatic volume per IBW (HV/IBW-A) was correlated with manual HV/IBW (HV/IBW-M).

Methods: Sequential SPECT scans in 149 patients were used for comparison. SCAN: Patients were fed prior to IV injection of 5-6 mCi 99Tc sulfur colloid with subsequent SPECT/planimar images. HEPATIQ and Manual processed QLSS on summarized transaxial images was made for SV/IBW.

Results: SV/IBW-A (2.5+/-2.35) was strongly correlated with SV/IBW-M (2.45+/-2.40) ($r^2 = .98$; $p < .0001$). HV/IBW-A (10.0+/-3.12) was strongly correlated with HV/IBW-M (9.97+/-3.11) ($r^2 = .95$; $p < .0001$).

Conclusions: 1. SV/IBW-A and HV/IBW-A using HEPATIQ correlates closely with spleen and liver volumes processed manually. 2. SV/IBW-A is an additional parameter on quantitative liver spleen scan that is useful clinically and is now more available with the advent of HEPATIQ.

BACKGROUND

1. Gradual accumulation of fibrosis is the hallmark of progressive CLD eventually causing abnormal hepatic function, portal hypertension and carcinogenesis.

2. In the quantitative liver function test ancillary study of the prospective (HALT-C) (Hepatitis C Antiviral Long-term Treatment Against Cirrhosis) trial, baseline hepatic function measured via perfused hepatic mass (PHM) and portal hypertension measured via spleen volume per IBW (SV/IBW) on the sulfur colloid quantitative liver-spleen scan (QLSS) precisely predicted clinical outcomes (2010 Hep 51:585)

3. Liver and Spleen volumes by QLSS correlated closely with MRI / CT Volumes in the A2ALL prospective NIH Study.

3. HEPATIQ is a program that automates the QLSS in calculation of hepatic function and calculation of Liver and Spleen volumes.

HYPOTHESIS:

HEPATIQ measured volumes by automated QLSS image analysis will correlate with manual processing for volumes.

AIMS:

Determine whether the automated spleen (SV/IBW-A) and liver (SV/IBW-A) by HEPATIQ correlates with the standard volumes from manual Processing (SV/IBW-M and LV/IBW-M) method

PATIENTS:

- 149 sequential patients by Quantitative liver spleen scan (QLSS) .
- Liver Disease:** normal 7, HBV 25, HCV 52, NASH 20, PBC 7, ACAH 8, ALD 6, abnormal AST/ALT 15, post liver transplant (LT) 5, misc. 9.
- Clinical outcomes:** Prior ACO 7 (recovered by at least 2 years), VB 8, ascites 23 (8 refractory), hepatic encephalopathy 11, HCC 7, liver transplant (LT) in past 5 and death 2. 86 patients never had a ACO

METHODS

QLSS Protocol: Standard meal, IV Tc 99m Sulfur Colloid followed by SPECT reconstruction.

Volume calculations processed manually (V/IBW-M) and by HEPATIQ automatically (V/IBW-A)

- 3-D image is compressed to a 2-D image by a summarized transaxial image.
- ROI's are drawn around the liver and bone marrow to determine total counts in the hepar (Th) and spleen (Ts) both manually (traditional method) and by HEPATIQ
- A representative concentration (C) is determined on a single mid-organ frame through hepar (Ch) and spleen (Cs) both manually and by HEPATIQ
- volumes are calculated by dividing total counts by the concentration in the respective organs to determine the number of voxels and multiplying times the voxel volume (approximately .104 cc/voxel)
 $SV/IBW = [(Ts/Cs) \times .104] / IBW$
 $LV/IBW = [(Th/Ch) \times .104] / IBW$
 Where female IBW = (Ht in inches - 60) x 5 + 100
 male IBW = (Ht in inches - 60) x 6 + 106
- No edging techniques are used and the shape of the organ can not be determined by this technique.

STATISTICS

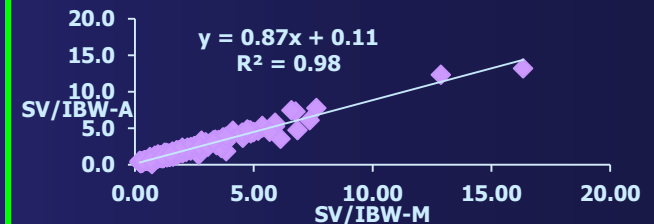
- Mean +/- standard deviation
- Students t-test of the means
- Linear regression analysis of the relationship between 2 variables

RESULTS:

	V/IBW-A (cc/lb IBW)	V/IBW-A (cc/lb IBW)	P
Spleen	2.5 (2.35)	2.45 (2.40)	NS
Hepatic	10.0 (3.12)	9.97 (3.11)	NS

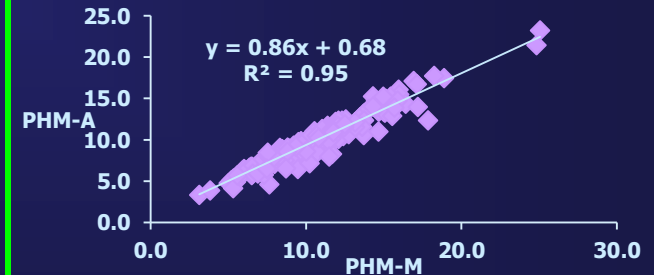
RESULTS:

The SV/IBW-A correlates closely with SV/IBW-M.



RESULTS:

The HV/IBW-A correlates closely with HV/IBW-M



CONCLUSIONS

- The HEPATIQ automated SV/IBW-A correlates closely with the manual volume method
- The HEPATIQ automated LV/IBW-A correlates closely with the manual volume method
- The calculation of volumes by a non-edging technique is convenient and accurate adding to the value of HEPATIQ in assessing the severity of liver disease and portal hypertension.