*Mem. Inst. Oswaldo Cruz*, Rio de Janeiro, Vol. *87*, Suppl. IV, 143-147, 1992

# THE VALUE OF ULTRASONOGRAPHY IN ASSESSMENT OF PORTAL HYPERTENSION IN HEPATOSPLENIC SCHISTOSOMIASIS

M. F. ABDEL WAHAB & G. ESMAT

Department of Tropical Medicine, Faculty of Medicine, Kasr El Aini Hospital, Cairo University, 7 Road 207, Cairo, Egypt

*Ultrasonography can reveal most of the manifestations of portal hypertension complicating hepatosplenic schistosomiasis. However, direct demonstration of gastroesophageal varices by ultrasonography is still very difficult. An attempt was done to correlate sonographic features of portal hypertension with the degree of fibrosis to screen patients having varices and predicting their chance of bleeding. The results obtained were found to be consistent with the esophagogastric endoscopy and with history of hematemesis. Four parameters were used, size of spleen, degree of periportal fibrosis, presence of collaterals and portal vein diameter. A pilot field survery was also done adopting the same principle.*

Key words: ultrasound – portal hypertension – schistosomiasis

Hepatosplenic schistosomiasis is the most important form of morbidity caused by *Schistosoma mansoni*. It is characterized by hepatic periportal fibrosis, portal venous obstruction and splenomegaly. Portal hypertension, the main complication, often results in esophageal varices and recurrent hematemesis.

Evaluation of the degree of portal hypertension is an essential part in the work up of these patients. Trans-splenic portal manometry, percutaneous splenoportography, retrograde hepatic vein cathaterization and other invasive techniques have been used for such evaluation. However, some of these techniques are risky to the patients, expensive, and time consuming. They cannot be carried out except in especially equiped centers.

Ultrasonography has become a very valuable non-invasive tool for studying pathophysiological changes in schistosomiasis. It can demonstrate the characteristic schistosomal periportal fibrosis (Abdel-Wahab, 1982), as well as assess dilatation and patency of the portal and splenic veins (Abdel-Wahab & Mahmoud, 1987) and can clearly differentiate between schistosomal fibrosis and post hepatitic cirrhosis in patients who have bled from esophageal varices (Homeida et al., 1988; Abdel-Wahab et al., 1989). Excellent sensitivity and specificity were shown in comparative studies between ultrasonography and wedge hepatic biopsy in diagnosis of schistosomal hepatic fibrosis (Abdel-Wahab et al., 1989).

Numerous abnormalities associated with portal hypertension can be demonstrated by ultrasonography such as dilatation of the portosystemic collaterals (Dokmeci et al., 1981). Patients suspected of having portal vein thrombosis can also be demonstrated (Vasile & Grenier, 1985).

We confirmed the reliability of the portal vein diameter as an indication of the degree of portal hypertension. Positive correlation between portal vein diameter and splenic manometric reading was shown (Abdel-Latif et al., 1981). The same finding was also demonstrated with manometric measurements directly from portal vein during surgery. We encountered portal vein thrombosis in 3% of studied cases (Abdel-Wahab & Mahmoud, 1987). Demonstration of surgical splenorenal shunts by ultrasound was successful (Abdel-Wahab et al., 1979).

Gastro-esophageal varices, on the other hand, could be demonstrated by ultrasonography in only a minority of patients (Medhet et al., 1988).

This study was supported by Schistosomiasis Research Project grant 02-02-12. and ONR grant N000-14-77-G0045.

TABLE I

Correlation between the different sonographic parameters with esophageal variceal grade

| Score / Parameter | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| Hepatic fibrosis grade | Absent | GI | GII | GIII |
| P. V diameter | 14 | 14-17 | > 17 mm | – |
| Spleen size | normal | < 5 cm[a] | > 5 cm | – |
| Collaterals | Absent | Present | – | – |

*a:* size below costal margin.

TABLE II

Specificity of the ultrasonographic changes detected when compared to histopathology of the hepatic wedge biopsy

| Pathology (wedge biopsy) | Schisto 19 | Combined 11 | Cirrhosis 19 | Indefenile – |
|---|---|---|---|---|
| Sonography | | | | |
| Schisto. | 16 | 1 | – | 1 |
| Cirrhosis | – | – | 18 | – |
| Combined (Sch. + Cirr.) | 2 | 10 | 1 | – |
| Indefinte | 1 | – | – | – |

The sensitivity of ultrasonography for detection of hepatic schistosomiasis is $\frac{29 \times 100}{30} = 97\%$ and the specificity is $\frac{18 \times 100}{20} = 90\%$.

TABLE III

Collaterals

| | Porto-graphy | Ultra-sonography |
|---|---|---|
| Paraumiblical vein | 42.8% | 63.3% |
| Coronary vein | 57% | 28% |
| Splenic hilum collaterals | 14.3% | 80% |
| Others | 14.3% | 30% |

The aim of this study is to assess the value of ultrasonography in detection of features of portal hypertension in hepatosplenic schistosomiasis and correlation of these findings to the degree of fibrosis of the liver. These simplified methods when applied in epidemiologic studies may be a reliable screening test for detection of individuals who are high risk upper GI bleeders.

## PATIENTS AND METHODS

*Subjects* – 130 patients with ages ranging from 9 to 70 years, hospitalized at Department of Tropical Medicine, University of Cairo, 309 school children and 146 adult individuals from Sobtas Village in the center of Nile delta were the subject of this study.

Medical history, clinical assessment and parasitological examinations were done for all individuals.

The hospitalized patients had histopathologic study of the liver (surgical wedge in 50 and needle biopsy in 80 patients). Upper gastrointestinal endoscopy was done for all hospitalized patients. Varices were graded into four grades depending on their severity (Thakeb et al., 1987).

Ultrasonographic examination was performed on all individuals using a real time machine (ADR 4000 S/L). Examination included assessment of the liver size, grading of hepatic fibrosis according to the mean thickness of peripheral portal tracts. (Abdel-Wahab et al., 1992).

Grade I: mean thickness from 3 to 5 mm.

TABLE IV

Collaterals vs varices

| Grade of varices | Number | P. V diameter | PV pressure | PUV diameter | Coron. V diameter |
|---|---|---|---|---|---|
| 0 | 3 | 1.9 | 29 | 0.6 | - |
| I | 2 | 1.9 | 31.8 | 0.5 | – |
| II | 6 | 1.8 | 32.3 | 0.8 | – |
| III | 4 | 1.6 | 36.5 | 0.6 | 0.5 |
| IV | 1 | 2.1 | – | – | 0.6 |

TABLE V

Degree of dilatation of PUV vs manometry

| PUV dilatation | No | PUV diameter (mm) | Portal pressure ml saline |
|---|---|---|---|
| Minimal | 8 | 0.40 ± 0.5 | 30 ± 0.8 |
| Moderate | 10 | 0.7 ± 0.2 | 32 ± 2.8 |
| Marked | 1 | 1.9 | 48 |

Grade II: mean thickness from > 5 to 7 mm.
Grade III: mean thickness > 7 mm.

Portal vein diameter was measured midway between its entrance into the porta hepatis and its bifurcation within the liver. The splenic vein was measured in the midline in upper abdomen.

The spleen was evaluated for size and echo pattern. It was considered enlarged if its lower pole exceeded the left midaxillary line on quiet respiration or dipped below the costal margin in deep inspiration. The distance the lower pole extended below the costal margin was measured.

Portosystemic collaterals were searched for in their appropriate sites: the coronary vein was identified and measured in the region of the lesser curvature of the stomach.

A sonographic score based upon grade of periportal fibrosis, portal vein diameter, spleen size and collaterals was calculated for each patient. Analysis of data also included correlation between the different sonographic parameters with esophageal variceal grade. Table I demonstrates the score given corresponding to each parameter.

## RESULTS

Tables (II to VIII), summarize the various findings. Table II demonstrates the specificity of the ultrasonographic changes detected when compared to histopathology of the hepatic wedge biopsy. Table III shows that the three main collaterals discovered by ultrasonography were patent paraumblical vein, coronary vein, and splenic hilum collaterals. Coronary vein is the most important since it denotes esophageal varices grade III and IV (Table IV), however sensitivity of ultrasound in detection of this collateral is very low compared to splenoportography. The degree of dilatation of paraumblical vein showed positive correlation with portal hypertension as measured by portal manometry (Table V). Table VI shows the other parameters (portal vein diameter and spleen size) in the different degrees. Applying the score as mentioned before (Table I), it was found that the more advanced the portal hypertension features the higher the score, the more advanced the degree of varices and the possibility of bleeding (Table VII). Low scores were associated with no varices, while high scores were associated with advanced grades of varices and hematemesis. Applying the same principle in the field, school children were found to have consistently low scores while high scores were seen in adults only (Table VIII).

## DISCUSSION

Our findings confirmed later by Cerri et al. (1984) and Fattar et al. (1984) indicated that schistosomal hepatic fibrosis can be diagnosed by ultrasound. It provides an accurate non-invasive procedure for the diagnosis of schistosomal hepatic fibrosis with less false negative results being unaffected by sampling errors. Grading of periportal fibrosis according to the thickness of the peripheral portal tracts correlated well with the signs of portal hypertension (Abdel-Wahab et al., 1992).

Bleeding from oesophageal varices is the most important complication of hepatosplenic schistosomiasis. The incidence of haematemesis

TABLE VI

Portal vein diameter and size of spleen vs grade of peri-portal fibrosis

| Grade of fibrosis | I | II | III | P |
|---|---|---|---|---|
| No of cases | 20 | 15 | 8 | – |
| Extension of the spleen below costal margin (mean) | 4.4 ± 3 | 9.7 ± 6 | 12.1 ± 7.5 | < 0.01 |
| Portal vein diameter | 14.9 ± 2.5 | 18 ± 2.8 | 20 ± 4.3 | < 0.001 |

TABLE VII

Correlation between endoscopic and sonographic findings and the result of the variceal score

| | No. varices | GI &II | GIII &IV | P |
|---|---|---|---|---|
| No. of patients | 12 | 20 | 11 | |
| Grade of fibrosis | | | | |
| Grade I | 11 (92%) | 9 (45%) | 0 (0%) | |
| Grade II | 1 (8%) | 10 (50%) | 4 (31%) | < 0.001 |
| Grade III | 0 (0%) | 1 (5%) | 7 (69%) | |
| Spleen (> 5 cm) | 1 | 14 | 7 | < 0.01 |
| PV | 14.25 ± 2.9 | 16.95 ± 2.6 | 19.7 ± 3.8 | < 0.001 |
| Collaterals | 0 | 5 | 6 | |
| Hematemasis (history) | 0 | 4 | 11 | |
| Sonographic score | 1-3 2.66 ± 0.65 | 3-6 4.7 ± 1.12 | 5-8 6 ± 0.9 | < 0.001 |

TABLE VIII

Ultrasonography score in field application

| Score | Adults (146) | Children (309) |
|---|---|---|
| 1 | 22% | 68% |
| 2 | 24% | 22% |
| 3 | 23% | 6.5% |
| 4 | 20% | 2% |
| 5 | 5.5% | 1% |
| 6 | 4.5% | 0% |

is generally estimated to be 10 to 20% among diagnosed patients with hepatosplenic schistosomiasis (Abdel-Wahab, 1982). The larger the varices the more likely are they to bleed (Sherlock, 1989). Oesophagoscopy is the standard technique used for the diagnosis of oesophageal varices and determination of the risk of haematemesis. Yet, because of discomfort, patients and some physicians are reluctant to have this procedure performed. Thus, a non-invasive inexpensive technique that permits early identification of varices, particularly the large ones which are more likely to bleed, would markedly improve medical care. Ultrasonography, a non-invasive and readily available technique, gives valuable information for the diagnosis of liver disease and evaluation of portal hypertension.

Direct demonstration of gastro-oesophageal varices by ultrasonography is very difficult (Medhet et al., 1988). Therefore, many studies have correlated associated sonographically detectable features with the presence and degree of portal hypertension and oesophageal varices: (a) portal vein diameter (Abdel-Latif et al., 1981); (b) splenic length (Medhet et al., 1988); (c) presence of portosystemic anastomoses (Subramanyam et al., 1983). However, none of these sonographic parameters, when used singly, have provided good sensitivity or specificity for detecting the presence and degree of varices.

The sonographic grade of portal tract thickness gave a very good correlation with varices. However, because of only three grades, overlap prevents reliable prediction of varices or the risk of haematenesis (Abdel-Wahab et al., 1992). Therefore, we constructed an ultrasonographic variceal score using four sonographic detectable parameters independently associated with portal hypertension,

oesophageal varices and bleeding. This score had the best correlation with the degree of oesophageal varices and could accurately identify cases having large varices and haematemesis. Thus this scoring system can be used in screening patients with hepatosplenic schistosomiasis to identify those most likely to have large varices and those who are at risk of haemorrhage.

Recent epidemiological research of schistosomiasis are interested in the study of morbidity caused by this chronic infection. Prevalence and severity of morbidity determine the magnitude of schistosomiasis problem in any given community and how it can affect the socioeconomic development. Until recently, assessment of morbidity in the field was dependent upon clinical examination of the liver and spleen, a method which does not give precise evaluation nor prediction of the clinical status either on the individual or community levels. Since ultrasonography is portable, the natural extension of clinical epidemiological studies is to apply this technique directly in community-based studies. The recent introduction of ultrasonography in the field studies permits a more accurate assessment of morbidity by measuring the liver and spleen sizes, measurement of periportal fibrosis and detection of sonographic signs of portal hypertension.

Application of the suggested score in field studies, where endoscopy cannot be performed on a wide scale, will provide several benefits among which are the following: (a) It can direct the need of endoscopy, thus doing endoscopy for only those with higher scores, assumed to have large varices; (b) The score can help in selection of patients at risk of haematemesis where prophylactic sclerotherapy may be considered; (c) A more accurate determination of the problem of varices and haematemesis will help the health authorities to be ready to face the problem.

We do not conclude that the sonographic score replaces endoscopy in detecting varices, but it can direct the need for endoscopy, especially when this procedure is not readily available in smaller communities.

## REFERENCES


ABDEL-LATIF, Z.; ABDEL-WAHAB, M. F. & EL-KADY, N. M., 1981. Evaluation of portal hypertension in cases of hepatosplenic schistosomiasis using ultrasound. *JCU, 9:* 409-412.

ABDEL-WAHAB, M. F., 1982. *Schistosomiasis in Egypt.* CRC Press Inc., Boca Raton, Florida, USA.

ABDEL-WAHAB, M. F.; EL-KADI, N. M. & ARAFA, N. M., 1979. Distal splenorenal shunts (Warren operation): B mode and real-time ultrasonographic assessment. *Egypt. J. Bilh., 6:* 21-26.

ABDEL-WAHAB, M. F.; ESMAT, G.; FARRAG, A.; EL-BORAEY, Y. & STRICKLAND, G. T., 1992. Grading of hepatic schistosomiasis by the use of diagnostic ultrasound. *Am. J. Trop. Med., 46:* 403-408.

ABDEL-WAHAB, M. F.; ESMAT, G.; MILAD, M.; ABDEL-RAZEK, S. & STRICKLAND, G. T., 1989. Characteristic sonographic pattern of schistosomal hepatic fibrosis. *Am. J. Trop. Med. Hyg., 40:* 72-76.

ABDEL-WAHAB, M. F. & MAHMOUD, S. S., 1987. Schistosomiasis mansoni in Egypt. *Clin. Trop. Med. Comm. Dis., 2:* 371-395.

CERRI, G. G.; ALVES, V. A. F. & MAGALHÃES, A., 1984. Hepatosplenic schistosomiasis mansoni ultrasound manifestations. *Radiology, 153:* 777-780.

DOKMECI, K. A.; KIMURA, K.; MATSUTONI, S.; TSUCHIYA, Y. & OKUOLA, K., 1981. Collateral veins in portal hypertension. Demonstration by sonography. *A. J. R., 137:* 1173.

FATTAR, S.; BASSIONY, H.; STAYANATH, S.; VASILEVA, T. & HANNA, R. M., 1984. Characteristic sonographic features of schistosomal periportal fibrosis. *A. J. R., 143:* 69-71.

HOMEIDA, M.; ABDEL-GADIR, A. F.; CHEEVER, A. W. et al., 1988. Diagnosis of pathologically confirmed Symmer's periportal fibrosis by ultrasonography: a prospective blinded study. *Am. J. Trop. Med. Hyg., 38:* 86-91.

MEDHET, A.; IBER, F. L.; DUNNE, M. & BAUM, R., 1988. Ultrasonographic findings with bleeding and non bleeding easophageal varices. *Am. J. Gastroenterol., 83:* 58-63.

SHERLOCK, S., 1989. *Diseases of the liver and biliary system.* 8th ed: Blackwell Scientific Publications, Oxford.

SUBRAMANYAM, B. R.; BALTHAZAR, E. J.; MADAMBA, M. R.; RAGHAVENDRA, B. M.; HORRII, S. C. & LEFLEUR, R. S., 1983. Sonography of portasystemic collaterals in portal hypertension. *Radiology, 146:* 161-166.

THAKEB, F.; ALY, Y. A.; EL-FIKI, A.; TAHA, H. & EL-ROOBY, A., 1987. The study of the oesophagus by endoscopy and radiology after sclerotherapy. *J. Egypt. Med. Assoc., 70* (suppl.): 51-60.

VASILE, N. & GRENIER, P., 1985. Portal thrombosis: dynamic CT features and course. *Radiology, 154:* 737.