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Ultrasonography in portal hypertension: A sensitive noninvasive test to demonstrate portal-vascular anatomy

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Summary: The accuracy of ultrasonography (US) in delineating the portal vascular anatomy was assessed clinically by the clinician in 30 cases of portal hypertension due to noncirrhotic portal fibrosis and extra hepatic portal venous obstruction. Ultrasonography detected portal vein block in 19 and in 11 patients it was found to be patent. These ultrasonic diagnoses were confirmed by spleno-portovenography (SPV) in all, except in 2 cases due to technical failure. Ultrasononic assessment of the splenic vein was found to be accurate in 93.3% (28/30) of cases. SPV also had similar accuracy of splenic vein assessment when compared with the surgical findings. In one patient, intraperitoneal haemorrhage was encounted following SPV, necessitating emergency surgery. Thus, US was found to be as accurate as splenoportovenography in the assessment of portal vascular anatomy. The imaging technique is cheap, easy, safe, and can be repeated as often as necessary. It should be the procedure of choice in assessing the anatomy of portal vascular system. *Gastroenterol Jpn 1989;24:442–445*

Key words: *portal hypertension; ultrasonography*

Introduction

Ultrasonography (US) has markedly improved the investigative yield in hepatobiliary diseases thereby limiting the use of invasive diagnostic techniques[1,2]. Clinicians have started using U.S. more frequently as a confirmatory test rather than for the sole purpose of screening[2]. Our center have reported US as a safe and reliable investigative technique for the diagnosis of site and nature of obstruction in patients of surgical obstructive jaundice[2] which has restricted the use of invasive techniques such as cholangiography, laparoscopy and magnetic resonance imaging in a vast proportion of our patients.

Portal hypertension presenting as upper gastrointestinal haemorrhage[3] is a major cause of admission into the gastroenterology ward of the All India Institute of Medical Sciences (AIIMS) New Delhi[4-5]. Non-cirrhotic portal fibrosis (NCPF) as well as extrahepatic portal venous obstruction (EHO) constitutes 55% of these patients of variceal hemorrhage[5]. Till 1984, splenoportovenography (SPV) was considered as an essential investigation in these patients in order to study the patency of the splenic vein and portal vein and to differentiate between EHO and NCPF as the underlying etiology of portal hypertension. Proximal splenorenal shunt is the treatment of choice in them with mortality of 1%, shunt blockage rate of 9% and 5-year survival of 83%[6]. It has become mandatory on the part of our surgeons to know the patency of the splenic vein before planning the surgical treatment. Splenoportovenography (SPV) and other accepted angiographic techniques which delineate the portal vascular anatomy are invasive procedures with a complication rate of 5% to 6%[7-8] and mortality rate

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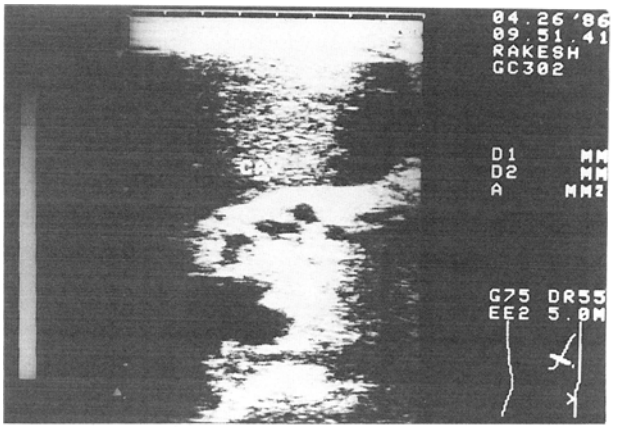

Fig. 1 US picture showing portal cavernoma, replacing the portal vein in a case of extrahepatic portal venous obstruction.

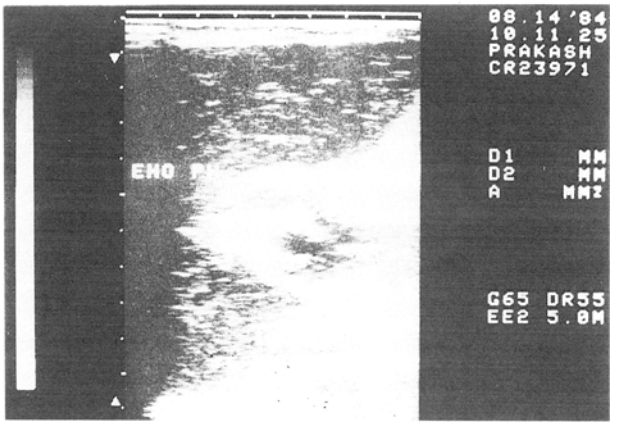

Fig. 2 U.S. picture showing thick fibrous tissue in the region of portal vein almost obliterating the portal vein in a case of extrahepatic portal venous obstruction.

of 0.1 to 6%[8-9]. The present study was planned to evaluate the role of US as a noninvasive, safe, and cheap technique in assessing the patency of splenic vein and portal vein in portal hypertension cases.

Materials and Methods

Patients clinically diagnosed as having portal hypertension due to NCPF or EHO attending the gastroenterology out-patient clinic of the AIIMS; India were included in the study. The following criteria were used to diagnose portal hypertension due to EHO or NCPF:

a) Moderate to large splenomegaly
b) Demonstrable esophageal varices by upper gastrointestinal endoscopy
c) Absence of overt hepatocellular dysfunction, e.g., ascites, jaundice, dependant edema, spiders or history of encephalopathy.
d) History of tolerance to the variceal haemorrhage, i.e., absence of development of features of hepatocellular dysfunctions following an upper gastrointestical hemorrhage.
e) Normal liver function profile, i.e., normal serum bilirubin, transaminase, serum protein, serum albumin and prothrombin time.
f) Normal liver histology.

Thirty patients diagnosed as having portal hypertension due to NCPF or EHO were included in the present series. All of them were subjected to ultrasonographic examinations in which a Toshiba-50A real-time grey scale linear scanner was used. One gastroenterologist performed the ultrasonography in these patients without any prior preparation. In five cases the scan was repeated on the next day because distended bowel loops precluded a proper ultrasonic examination on the first occasion. The portal vein was best visualized at the broadest point immediately distal to the junction of the splenic and superior mesenteric veins in the subcostal and transverse plane, with the patient in a right oblique and supine position. The portal vein visualization was confirmed by tracing it to the major bifurcation. The splenic vein was seen at the splenic hilum by a left subcostal and transverse scan and confirmed by tracing it to the formation of the portal vein. A diagnosis of portal vein block was entertained if, a) the portal vein was not seen and/or b) the portal vein was replaced by multiple channels (cavernoma, **Fig. 1**) and/or c) presence of a hyperechoic shadow suggestive of a thick fibrous band at the origin of the portal vein (**Fig. 2**). If the splenic vein was not seen on ultrasonography, it was considered to be blocked.

All 30 patients were subjected to SPV following ultrasonography. Of those, 22 patients had proximal end to side splenorenal shunt surgery.

Table 1 Patency of portal vein and splenic vein shown by ultrasonography and splenoportography

	Ultrasono-graphy	Splenoporto-graphy	Correlation of US with SPV
Poltal vein:			
Patent	11	10	100%
Blocked	19	18	100%
Splenic vein			
Patent	30	24	85%
Blocked	NIL	4	—
Total	30	28*	

* SPV 2 technical failures.

Table 2 Patency of spleenic vein shown by ultrasonography and splenoportography and correlation with surgical findings in operated cases

Spllnic vein	Ultrasono-graphy	Splenoporto-graphy	Surgical findings
Patent	22	16*	20
Blocked	NIL	4	2
Total	22	20*	22

* 2 technical failures.

The state of the splenic vein was evaluated in each of them at surgery. The gold standard for portal vein patency, was the SPV, whereas that for the splenic vein patency, was evaluation on laparotomy.

Results

There were 22 males and 8 females with a mean age of 21.15 Yrs (range- 8.5 Yrs to 39.4 Yrs). Ultrasonography revealed blocked portal vein in 19 and patency in the remaining 11 patients. Splenic vein block was not demonstrated in any of the patients. SPV was successful in 28 patients and in two the procedure was technically unsuccessful. SPV demonstrated a block in the portal vein in 18 and in the other 10 patients, it undicated patency. The SPV findings of portal vein patency and blockage were the same as the US Findings (**Table 1**). Eleven out of 19 patients diagnosed as having portal vein block had cavernoma at the origin of the portal vein.

Twenty-two patients underwent laparotomy for spleno-renal shunt during which the splenic vein status could be assessed by palpation. U.S. revealed a patent splenic vein in all these 22 patients, but SPV demonstrated a blocked splenic vein in 4 out of these 22 patients (**Table 2**). Two of these 4 patients with a SPV diagnosis of blocked splenic vein were found to have patent splenic vein at laparotomy and were subjected to a spleno-renal shunt surgery. splenic vein block was confirmed at surgery in the remaining two cases, which underwent splenectomy and devascularization. The rest of the 18 patients had spleno-renal shunt surgery and all had patent splenic veins, confirming the correct diagnosis of SPV and US (**Table 2**). Both the patients in whom SPV was technically unsuccessful also had spleno-renal shunt and were found to have a patent splenic vein at laparotomy (**Table 2**). One patient had massive intraperitoneal haemorrhage requiring emergency laparotomy following SPV.

Discussion

The present study demonstrates that US provided an accurate diagnosis of portal vein patency and block in comparison to the SPV findings (**Table 1**). It should, therefore, be considered as a reliable non-invasive investigation for the differential diagnosis of NCPF and EHO. This approach will be of great value in places where NCPF and EHO are major causes of portal hypertension, as in India[5,6]. At our center we prefer to treat by spleno-renal shunt surgery which had proved to be an effective therapy in these patients with preserved hepatic function and has a minimal mortality and morbidity rate with a five-year survival rate of 83%[6]. Therefore knowledge of the splenic vein status, has become a necessity in these portal hypertension case before performing splenorenal shunt surgery. US in the present series provided a correct diagnosis of the splenic vein patency in 93.3% (28/30) of cases. Diagnosis was wrong in 6.6% (2/30) cases where the sonogram suggested a

patent splenic vein which was found to be obstructed at surgery and also by SPV. Retrospective review of these two cases indicated that collateras in the hilum of the splen had provided the mistaken impression of the splenic vein. Thus, it is apparent that, in the location of the splenic vein, if the confugeration of the visible vein on US is abnormal in reference to the standard course of the splenic vein, the possibility of splenic vein block with a tortuous collateral providing a false impression of splenic vein should be kept in mind. Similar problems in the assessment of splenic vein patency was encountered in the few recently reported series[10-13]. In such a situation an SPV may be helpful to demonstrate a patent or blocked splenic vein. However, SPV also has its limitations and risks[8-9]. In the present series, it provided a false diagnosis of splenic vein block in 6.3% (2/28) cases which is explained by the flow phenomenon in which the injected dye into the splenic pulp is taken away by collaterals resulting in nonvisualization of the splenic vein[9]. US may be helpful in providing the correct diagnosis in this situation.

The invasiveness of SPV is associated with complications such as haemorrhage, shock and pain etc. in 5 to 6% cases[7,9] and even has a mortality rate ranging from 0.1% to 6%[7,8]. In the present series one patient had massive intraperitoneal bleeding from the splenic puncture site needing an emergency laparotomy. Besides, SPV is not indicated[7-9] in patients of portal hypertension with prolonged prothombin time, very low haemoglobin, with a previous splenectomy and small spleen[7-9]. Under these circumstances US being non-invasive, can be safely used.

The present study indicates that US should be used as a confirmatory investigation for the study of portal vein and spleenic vein in patients of NCPF and EHO nd a very small proportion of cases (6.6%) according to the present study may need an invasive test such as SPV.

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