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DISTAL SPLENORENAL SHUNT VERSUS PORTOCAVAL SHUNT (SARFEH) FOR THE MANAGEMENT OF SCHISTOSOMAL VARICEAL BLEEDING

By
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Objectives: *This prospective, controlled randomized study was designed to compare distal splenorenal shunt (DSRS) and 8-mm diameter portocaval shunt (Sarfeh) with extensive collateral ligation (PCS-CL) in the elective management of Child-Pugh class A and B schistosomal variceal bleeders.*
Subjects and Methods: *Thirty-six patients had DSRS and 38 had PCS-CL. Both groups were similar preoperatively regarding their clinical, biochemical, endoscopic and hemodynamic profiles. Patients were re-evaluated at two weeks and one year after surgery. Mean follow-up was 38.6 months.*
Results: *DSRS had a significantly higher operative index than PCL-CL (5.08 ±2.33 vs 1.57±0.74). No differences were observed regarding operative mortality (2.77% vs 2.63%), morbidity including ascites and encephalopathy, and survival (91.6% vs 92.1%). Rebleeding occurred more frequently after PCS-CL (15.79%) compared to DSRS (11.11%). At one year postoperatively, DSRS resulted in complete eradication of gastric varices and significant reduction of esophageal variceal size more than PCS-CL (P<0.05). Splenic size was significantly reduced after DSRS but not after PCS-CL (P<0.05). Colored duplex showed that both procedures significantly reduced portal vein flow volume and diameter, and maintained hepatopetal portal perfusion in all patients.*
Conclusions: *In the schistosomal population (1) Both DSRS and PCS-CL have low operative mortality and morbidity, (2) Both procedures maintain portal perfusion, have good long-term patient survival, and very low incidence encephalopathy, (3) DSRS is superior regarding variceal eradication, reduction of the rate of re-bleeding, and decrease of splenic size, and (4) PCS-CL is a good alternative if DSRS were not feasible.*

Key Words: Portosystemic shunt, portal hypertension, varices, schistosomal, hepatic fibrosis.

INTRODUCTION

Despite the efficiency of endoscopic therapy in decreasing variceal rebleeding[1-3], surgery still has a definite place for management of these challenging patients[4-8]. Total shunts, though effective in control of variceal hemorrhage, had an almost unacceptable high incidence of portosystemic encephalopathy (PSE) that threatened patient survival, especially in the non-alcoholic cirrhotics and schistosomal population[9-12]. The alternative approach of splenectomy with different gastroesophageal devascularization techniques[13-18] maintained portal flow, but at the expense of a high rebleeding rate[15,17,19-21]. With the potential advantage of preserving portal perfusion and hepatocyte function, the selective distal splenorenal shunt (DSRS)[22-24] offers an alternative procedure to splenectomy with gastro-esophageal devascularization, which is the most popular type of portal hypertensive surgery in Egypt[13]. However, dissection of the splenic vein in a length sufficient to anastomose it with the renal vein is a technically difficult step in the DSRS procedure, especially when there is associated chronic pancreatitis[25]. In the early eighties, Sarfeh et al[26] introduced the narrow-diameter portocaval shunt as an alternative treatment of variceal bleeding in cirrhotic patients, and showed similar results to those obtained with the DSRS.

The present study was conducted to compare the safety and effectiveness of DSRS versus 8-mm portocaval shunt (Sarfeh operation) plus extensive collateral ligation (PCS-CL) for the elective treatment of schistosomal portal hypertensive variceal bleeders.

SUBJECTS AND METHODS

Patient Population:

Between 1998 and 2000, a total of 178 patients with portal hypertension and history of schistosomal variceal hemorrhage were admitted to the Department of Surgery, Alexandria Main University Hospital. Patients who underwent emergency surgery because of uncontrollable hemorrhage (n=27), those with inadequate liver function i.e. Child-Pugh C (n=14), and non-shunted patients (n=59) were not included in the study. The remaining 88 patients were randomized by the closed-envelop method to either DSRS or PCS-CL of 44 patients each. After excluding dropouts, 36 patients were treated with DSRS (Group 1) and 38 with PCS-CL (Group 2). These constitute the study population of this study.

All patients included in the study fulfilled the following criteria: (1) history of intestinal schistosomiasis, (2) history of at least one major episode of variceal hemorrhage with a 4 to 6-week interval between the last attack and the date of surgery, (3) suitable veins for anastomoses, (4) no symptoms or signs suggestive of encephalopathy, and (5) no bilharzial cor-pulmonale. The preoperative clinical and biochemical data of the two surgical groups and their pathological subgroups were similar as shown in (Table 1).

Surgical Techniques:

Patients in group 1 had the standard DSRS with complete splenopancreatic disconnection as described by Warren et al[22,24]. The technique of the 8-mm ring-reinforced PCS-CL as described by Sarfeh et al[27] was applied for patients in group 2, with more extensive devascularization of the right and left gastroepiploic arcades. Complete interruption of the coronary system and devascularization of the lower 5-7 cm of the esophagus without transection were essential parts of the technique.

Pre- and Post-operative Evaluation:

Clinical and Biochemical Examinations. Thorough clinical evaluation was done with special attention to recurrent hemorrhage, jaundice, ascites, and encephalopathy. Clinical cardiopulmonary assessment, with echocardiography in selected cases, was performed before and after surgery for detection of bilharzial cor-pulmonale and pulmonary hypertension. Routine laboratory tests included hemogram, serum albumin, total bilirubin, prothrombin time, AST and ALT, serum urea and creatinine, serum electrolytes, and hepatitis markers.

Imaging and Hemodynamic Studies. Ultrasonography was used for assessment of liver and splenic size and detection of ascites. Doppler sonography was performed using real-time sonographic equipment with a 3.75-MHz sector array transducer with pulsed duplex and color Doppler capability (Toshiba SSH-160). Portal vein flow velocity, flow volume, and diameter, and patency of the inferior vena cava, portal, splenic, and left renal veins were assessed. The presence and number of porto-systemic collaterals were also recorded.

Endoscopic Examination. Upper gastrointestinal endoscopy was done before and at 2 weeks and one year after surgery to identify and grade[28] esophago-gastric varices, and to detect associated lesions. Urgent examinations were done for postoperative variceal bleeders.

Hepatic Pathology:

Pre-operative hepatic Tru-cut needle and/or intra-operative wedge biopsy were taken to determine the nature of the liver pathology. The histopathological criteria of pure schistosomal hepatic fibrosis were evident in only 22 patients (29.73%). The other 52 patients (70.27%) showed mixed bilharzial fibrosis and non-alcoholic cirrhosis.

Follow-up:

Patients were followed-up for a mean of 36.8 months (range 22-56 for survivors). Biochemical, endoscopic, imaging and hemodynamic studies were done at two weeks and at one year postoperatively. Some studies were repeated for individual patients as indicated.

Statistical Analysis:

Statistical analysis was performed using the SPSS/PC version 9 software. The Student t-test was used for comparison between two group means and the paired t-test for comparison between two means before and after intervention. Chi square (X2) test was applied for comparison between qualitative variables. Kaplan-Meier method was used to plot survival curves[29,30], which were compared among the surgical groups and the pathological subgroups, by the log-rank test[30]. Statistical significance was set at the 5% level.

RESULTS

Operative Index:

The mean operative index (operative time in hours multiplied by blood lost in liters) of DSRS (5.08±2.33) was significantly greater than that of PCS-CL (1.57±0.73) ($P<0.05$).

Operative Mortality and Long-term Survival:

One patient died peri-operatively after DSRS (2.78%) from multiple system organ failure and another died from hemostatic failure after PCS-CL (2.63%). Survival curves for the 2 surgical groups (Fig 1) showed similar commulative rates (DSRS 91.6%, PCS-CL 89.47%) with a mean follow-up of 38.6 months. Splitting of these commulative curves according to the underlying hepatic pathology revealed similar survival of schistosomal patients after DSRS (91.6%) compared to PCS-CL (90%) (Fig 2). Likewise, the subgroups with mixed pathology had similar survival rates of 91.6% after DSRS and 89.29% after PCS-CL (Fig 3). Causes of death in both groups are summarized in (Table 2).

Patient Morbidity:

The morbidity encountered in patients of both surgical groups is listed in (Table 3).

Shunt Thrombosis: Shunt occlusion (Fig 4), which was documented in a total of six patients, was less after DSRS (5.56%, 2/36) as compared to PCS-CL (10.53%, 4/38) though not to the level of significance (X2=0.13, P=0.72). Four of these six patients developed variceal rebleeding, one after DSRS and three after PCS-CL. Shunt patency in the remaining patients was documented after DSRS (Fig 5) and PCS-CL (Fig 6).

Recurrent Hemorrhage: Rebleeding developed in a total 10 patients (13.5%, 10/74). The onset ranged from one to 29 months after operation (mean 18.5±7.2). After DSRS, recurrent variceal bleeding occurred in four patients (11.11%). It was controlled with injection sclerotherapy in three patients but was fatal in one with thrombosed shunt. After PCS-CL recurrent hemorrhage occurred in six patients (15.79%). It resulted from esophageal varices in five patients, and was controlled with sclerotherapy in four but was fatal in the fifth (with thrombosed shunt). The sixth patient had a patent shunt and endoscopy revealed that bleeding was due to hypertensive gastropathy. The incidence of rebleeding was different between the two pathological subgroups, being 2.78% (1/36) for the schistosomal and 8.33% (3/36) for the mixed population after DSRS (X^2=0.26, P=0.606), and 5.26% (2/38) and 10.53% (4/38), respectively, after PCS-CL (X^2=0.18, P=0.67).

Ascites: Early post-operative ascites developed in 10 patients (27.78%) after DSRS and in nine patients (23.68%) after PCS-CL (P=0.68). Salt restriction and diuretic therapy controlled the ascites in most of these surgical patients within the first year, however, following DSRS, two patients required repeated paracentesis and one developed an ascitic fistula that healed after 3 months. At one year postoperatively, mild ascites was detected in four of DSRS (11.11%) and four of PCS-CL (10.53%) patients (P=0.769).

Encephalopathy: Two cases of portosystemic encephalopathy (PSE) were detected post-operatively following DSRS and only one case following PCS-CL (5.54% and 2.63%, respectively). Encephalopathy was mild in all cases and responded to dietary regulation.

Other Complications: In addition to ascitic fistula, two patients (one in each group) developed adhesive intestinal obstruction that resolved conservatively. One patient with PCS-CL had common bile duct injury during dissection of the portal vein, which was surrounded by excessive fibrosis. Repair of the duct with insertion of a T-tube was successfully performed.

Biochemical Data:

No statistically significant differences were observed between the post-operative serum levels of liver function tests in both groups, or between the pre- and post-operative levels within each group. In patients with hypersplenism, there was a significant rise of platelet count (Fig 7) and white cell count (Fig 8) after both procedures (P<0.01).

Splenic Size:

Splenic size as measured by ultrasound (the longitudinal axis of the spleen) showed significant reduction at one year after DSRS from a mean of 17.1±1.9 cm preoperatively to 12.9±1.1 cm postoperatively (t=12.228, P<0.01). On the contrary, preoperative splenic size (17.4±1.4 cm) was similar to that measured at one-year after PCS-CL (17.0±1.3 cm).

Hemodynamic Data:

Both DSRS and PCS-CL significantly (P<0.001) reduced portal flow volume. The mean percentage of reduction in flow after DSRS (31.26%) was statistically higher (P<0.05) than that observed after PCS-CL (21.97%). There was a significant decrease in the portal flow velocity postoperatively within each studied group, but the difference between both procedures was not statistically significant. A significant (P<0.001) decrease in the portal vein diameter was observed after both procedures, with no difference between both (Table 4).

Endoscopic Data:

Both DSRS and PCS-CL reduced endoscopic size of esophageal varices among survivors. Reduction of each preoperative grade was more significant after DSRS. The endoscopic disappearance of esophageal varices at one year postoperatively (Fig. 9) showed a significant (P=026) difference comparing DSRS (42.86%) to PCS-CL (21.62%) (Fig. 10). Complete disappearance of gastric varices at one year postoperatively was higher after DSRS (100%, 7/7) than after PCS-CL (66.67%, 8/12), though not to the level of statistical significance (P=0.256). Persisting gastric varices after PCS-CL (Fig. 11) was not the cause of rebleeding in any of the four patients.

Table (1) . ***Preoperative Clinical and biochemical profile of both surgical groups and pathological subgroups.***

Profile	*Total population*		*Pure SHF*		*SHF + Cirrhosis*	
	DSRS N=36	*PCS-CL* N=38	*DSRS* N=12	*PCS-CL* N=10	*DSRS* N=24	*PCS-CL* N=28
Clinical:						
- Age (years):	38.9±11.4	37.08±8.9	33.5±13.8	40.2±13.8	41.5±9.2	37.3±8.5
- Sex (M/F):	27/9	28/10	9/3	7/3	18/6	21/7
- No. of Bleeding attacks:	2.25±0.81	2.24±0.84	2.25±0.97	2.5±0.97	2.25±0.74	2.14±0.80
- Hepatomegaly:	22 (61.1%)	23 (60.5%)	6 (50.0%)	5 (50.0%)	16(66.7%)	18(64.3%)
- Mild Ascites:	3 (8.33%)	5 (13.16%)	1 (8.3%)	2 (20.0%)	2 (8.3%)	3 (10.7%)
- Hypersplenism:	16 (44.4%)	15 (39.47%)	4 (33.3%)	4 (40.0%)	12 (50.0%)	11 (39.3%)
Biochemical (LFTs):						
- Total Bilirubin (mg/dl):	1.2±0.39	1.19±0.41	1.24±0.46	1.22±0.51	1.18±0.36	1.19±0.39
- Albumin (g/dl):	3.21±0.43	3.42±0.39	3.28±0.33	3.33±0.43	3.23±0.47	3.45±0.39
- AST (IU/L):	25.61±7.97	24.5±7.75	25.67±0.33	26.1±8.63	25.58±8.31	23.93±7.63
- ALT (IU/L):	26.64±9.42	25.32±8.41	28.0±10.94	26.2±10.72	25.96±8.74	25.0±7.82
- Prothrombin activity (%):	67.36±6.59	67.85±2.63	69.42±7.63	67.8±6.83	66.42±6.01	67.71±6.87
Child-Pugh:						
- Class A:	26 (72.2%)	27 (71.1%)	8 (66.7%)	7 (70.0%)	18(66.7%)	20 (71.4%)
- Class B:	12 (27.8%)	11 (28.9%)	4 (33.3%)	3 (30.0%)	8 (33.3%)	8 (28.6%)

SHF: Schistosomal hepatic fibrosis, LFT: Liver function tests.
Quantitative data are presented as mean ± SD. All differences were not statistically significant

Table (2). ***Causes of Mortality in Both Groups***

Cause of Death	*DSRS (N=36)*		*PCS-CL (N=38)*	
	N	%	N	%
- MSOF	1	2.78	0	0
- Hemostatic Failure	0	0	1	2.63
- Hepatocellular Failure	1	2.78	2	5.26
- Variceal Hemorrhage	1	2.78	1	2.63
Total:	3	8.33	4	10.53

MSOF: Multiple systems organ failure

Table (3): ***Patient Morbidity in Both Surgical Groups:***

Patient Morbidity	*DSRS (N=36)*		*PCS-CL (N=38)*		*Test of Significance*
	N	**%**	**N**	**%**	
- Shunt Occlusion:	2	5.56	4	10.53	X^2=0.13, P=0.72
- Recurrent Bleeding:	4	11.11	6	15.79	X^2=0.06, P=0.83
- Postoperative Ascites:					
	10	27.78	9	23.68	X^2=0.16, P=0.68
* Early:	4	11.11	4	10.53	X^2=0.16, P=0.68
* Late (one-year):	2	5.56	1	2.63	X^2=0.07, P=0.96
- Post-shunt Encephalopathy:					
- Other Complications:	0	0	1	2.63	-
* CBD Injury:	1	2.78	1	2.63	-
* Adhesive SBO:	1	2.78	0	0	-
* Ascitic Fistula:					

CBD: common bile duct, SBO: small bowel obstruction

Table (4): ***Pre- and post-operative portal hemodynamics in both studied groups.***

Hemodynamic Parameter	*DSRS (N=36)*			*PCS-CL (N=38)*		
	Preop.	Postop	Paired t-test	Preop	Postop	Paired t-test
Flow volume (L/min).						
* Range:	1.43 - 2.60	1.05 - 1.78	t=10.663	1.13 - 2.95	0.81 – 2.19	t=9.122
* Mean ± SD:	1.93 ± 0.33	1.27 ± 0.19	P < 0.001	1.96 ± 0.54	1.46 ± 0.40	P < 0.001
Flow velocity (ml/sec).						
* Range:	10 - 19	8 – 18	t=0.497	9 – 20	8 – 32	t=1.683
* Mean ± SD:	13.37 ± 2.66	13.69 ± 2.53	P=0.623	16.30 ± 2.97	17.95 ± 5.28	P=0.101
PV diameter (mm):						
* Range:	10.5 - 20	8 - 15	t=10.873	13.5 – 25.5	9 - 17	t=9.550
* Mean ± SD:	16.06 ± 2.42	13.52 ± 2.81	P < 0.001	16.85 ± 2.63	14.60 ± 2.21	P < 0.001

PV= portal vein, Preop = preoperative, Postop = postoperative

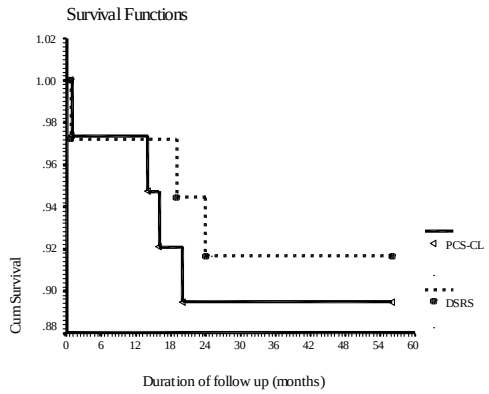

Fig. (1): Survival curves of patients after DSRS versus PCS-CL.

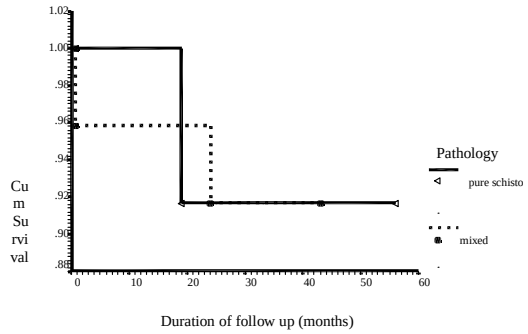

Fig.(2): Survival curves of patients with pure schistosomiasis versus those with mixed pathology after DSRS.

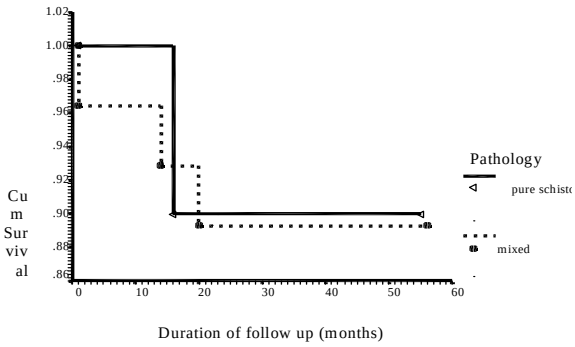

Fig. (3): Survival curves of patients with pure schistosomiasis versus those with mixed pathology after PCS-CL.

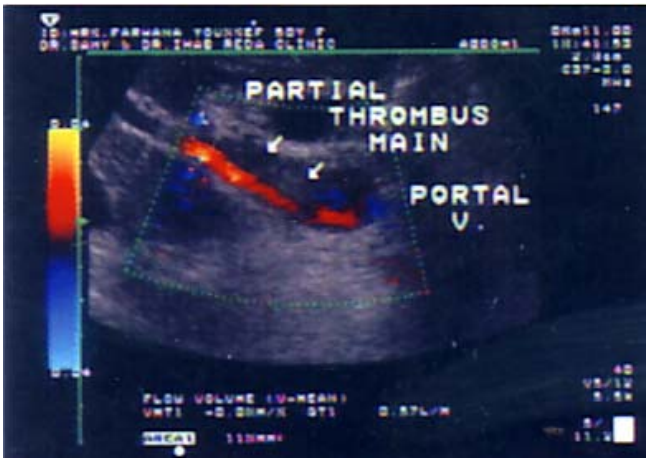

Fig. (4): Postoperative color Doppler showing partial shunt thrombosis of the portal vein after PCS-CL.

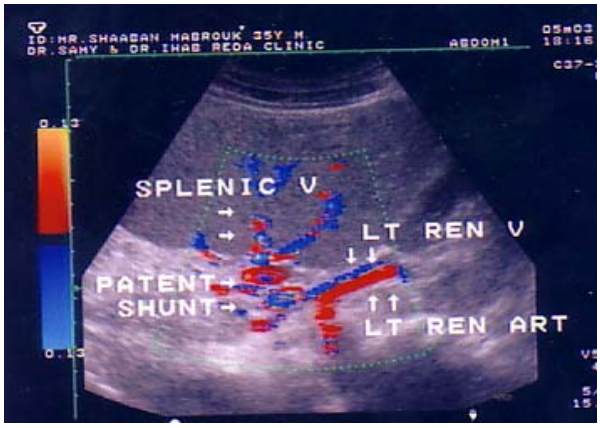

Fig. (5): Postoperative color Doppler showing flow through a patent DSRS

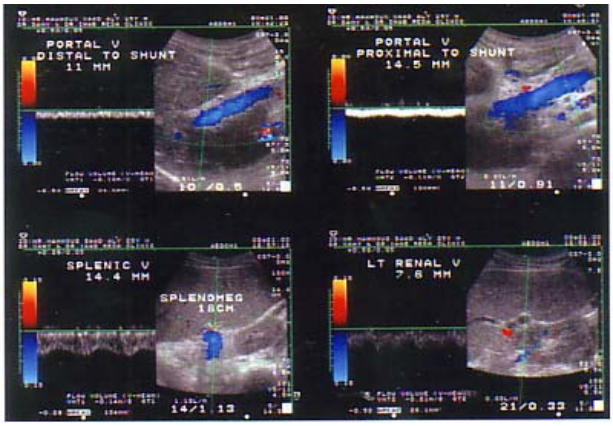

Fig. (6): Postoperative color Doppler showing evidence of patent PCS-graft (decreased flow in the portal vein distal to the shunt).

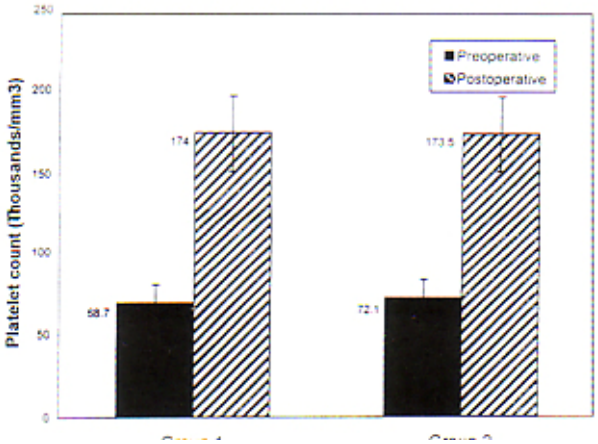

Fig. (7): Pre- and post-operative platelet count in both groups studied. Bars represent mean values and brackets represent standard deviation.

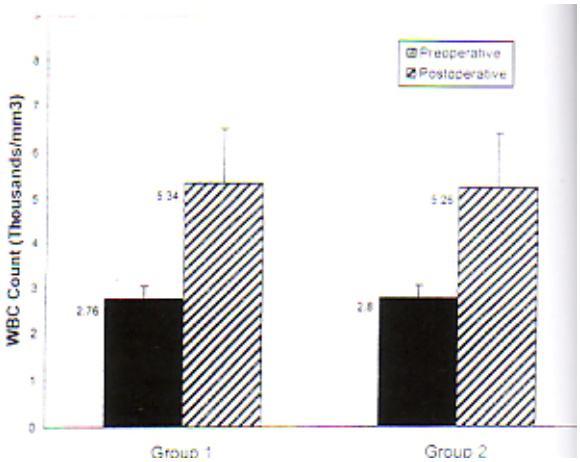

Fig. (8): Pre- and post-operative WBC count in both groups studied. Bars represent mean values and brackets represent standard deviation.

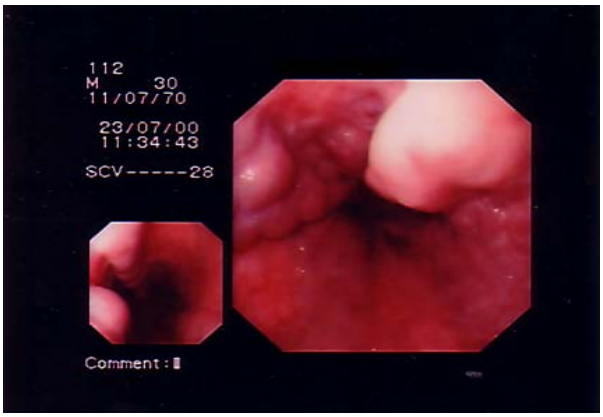

Fig.(9a): Preoperative endoscopic view showing extensive esophageal varices.

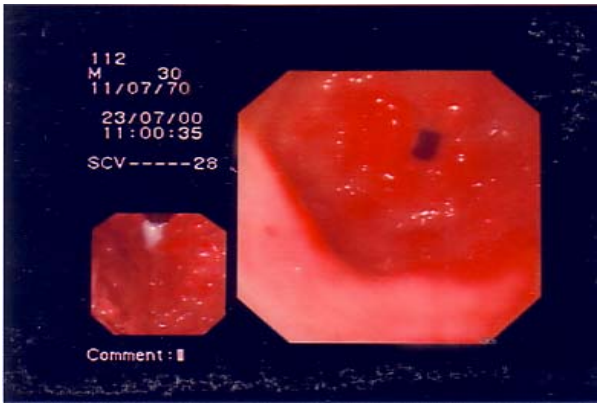

Fig. (9b): Postoperative endoscopic view of the same patient one year after DSRS. Notice complete disappearance of varices.

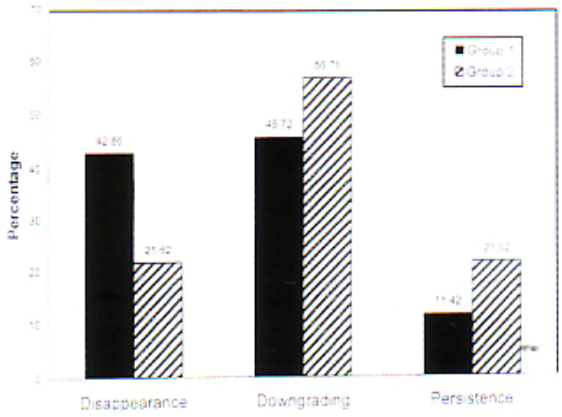

Fig. (10): Changes in esophageal varices by upper gastrointestinal fiberoptic endoscopy in both groups studied at one year postoperatively

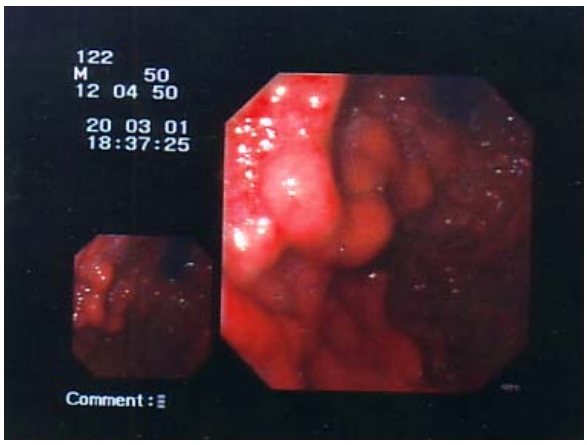

Fig. (11): Postoperative endoscopic view showing persistent gastric varices after PCS-CL.

DISCUSSION

Both procedures, DSRS[31] and PCS-CL[32], have the same aim to prevent variceal hemorrhage, maintain portal perfusion and preserve hepatocyte function. These objectives may be best evaluated in the schistosomal population where the uniformity of the hepatic fibrosis process may minimize the large number of variables inherent in patients with cirrhosis, particularly the alcoholic type[33]. In the Egyptian literature, the incidence of mixed fibrosis and cirrhosis is 50%[34] or more[35,36] and although about two-thirds of patients in this series had mixed pathology, none had alcoholic cirrhosis.

The operative index of DSRS was significantly greatgher than that of PCS-CL, which confirms the earlier reports of Sarfeh[37]. During DSRS, the enormous tortuous course of the splenic vein in the schistosomal population, requires more tedious dissection especially in the presence of pancreatitis. Moreover, special care is needed for proper alignment of the skeletonized splenic segment with the renal vein because of the increased risk of kinking the former, especially in the presence of a large schistosomal spleen. Interposition of a graft is a means of accomplishing technical ease and simplicity[25]. While some authors performed partial PCS without collateral ligation believing this to be unnecessary[38,39], it was part of our technique because it was believed that collateral ligation would significantly augment portal perfusion and preserve or enhance prograde blood flow[27,40-42].

Elective DSRS and PCS-CL were associated with similar low perioperative mortality. This further supports most of the worldwide published experiences with DSRS in

cirrhotic[43-45] and in schistosomal patients[46,47]. In Egypt, Gawish et al[48] reported no operative mortality with DSRS, while Ezzat et al[49] reported an operative mortality of only 1.7%. The low operative mortality after PCS-CL encountered herein conforms also to the Western experience in cirrhotics[38,39,50-54] and with the Egyptian reports in schistosomal patients[55,56]. The present study showed also a similar cumulative rate of patient long-term survival after DSRS and PCS-CL despite the higher rebleeding rate after the latter. Survival seems to be influenced by the hepatic functional reserve and type of liver pathology, being better for Child A/B patients and non-alcoholic cirrhotics[44,45,57-61]. In this study, no statistically significant difference in survival was found between those with SHF and those with mixed SHF and non-alcoholic cirrhosis.

Successful management of variceal bleeders is primarily threatened by the recurrence of hemorrhage. Each bleeding attack, if not fatal per se, adds to the liver insult and may precipitate hepatic failure. There was a higher incidence of rebleeding after PCS-CL during a mean follow-up of 3 years. This difference together with more significant reduction of the endoscopic variceal sizes and complete eradication of gastric varices indicate the superiority of DSRS in decompressing the gastroesophageal varices. Salam reported a 4% incidence of rebleeding after DSRS in schistosomal patients and attributed rebleeding to shunt occlusion[62]. The low rebleeding rates after DSRS among schistosomal patients in comparison to alcoholic cirrhotic patients, has been attributed to high flow across the shunt due to hyperdynamic splenic circulation in schistosomiasis[63]. Recurrent hemorrhage in both groups of patients was commonly associated with shunt occlusion. The lower incidence of shunt thrombosis in the DSRS group is not surprising. In this operation, a direct anastomosis is performed between the two vessels. If the splenic vein has a good diameter (more than 8 mm) [64], the probability of obstruction is low. The PCS uses a prosthetic graft which favors shunt thrombosis, though the advantages of PTFE have been stressed.

Maintenance of portal perfusion is essential for preservation of the metabolic integrity of hepatocytes. Duplex examination demonstrated prograde portal flow, and consequently good liver function, in all patients after both DSRS and PCS-CL. In accordance with our results, Henderson et al[65] reported that selective shunts have shown that they maintain portal blood flow in the early postoperative period in most patients, particularly non-alcoholics. Sarfeh and Rypins[66] demonstrated that the 8-mm PCS was able to maintain portal perfusion in most patients, whereas the 10-mm PCS had an unpredictable behavior and half of the patients lost portal liver perfusion.

The incidence of ascites following DSRS in the literature ranged from 10-56% in cirrhotic patients[44,45,57,67] and from 8-23% in schistosomal patients[49,68,69]. It was expected to be higher than that after PCS-CL due to the temporary ascitogenic effect of DSRS that results from extensive dissection with lymphatic interruption. However, ascites was clinically detected with similar incidence among survivors of both procedures. It may be caused by the operative trauma, which results in transient liver dysfunction[70-72]. It was usually transient and responded to medical therapy.

The quality of survival after selective shunt is essentially influenced by the development of encephalopathy. Both, DSRS and PCS-CL clearly reduced the incidence of clinical encephalopathy, which strongly supports the hemodynamic and metabolic advantages of both procedures. A review of more than 3700 cirrhotic patients undergoing DSRS showed an incidence of PSE of approximately 10%[73]. In patients with non-alcoholic cirrhosis, liver function has been maintained in most patients, with lower risk for encephalopathy[44,45,74]. In schistosomal patients, encephalopathy seems not to be a major problem. It ranged from 0[69] to 5.1%[49]. This low rate of encephalopathy following DSRS in schistosomal patients has been attributed to different hepatic pathology between schistosomiasis and alcoholic patients[33] with better preservation of hepatocyte function in the former. Similarly, the reported incidence of PSE after PCS-CL was lower in schistosomal patients[59] as compared to those with alcoholic cirrhosis[38-40,50].

The hypersplenism of portal hypertension occurs secondary to splenic congestion, intrasplenic sequestration and destruction of erythrocytes, leukocytes and platelets resulting in anemia, leukopenia, and thrombocytopenia[75]. All survivors with a patent shunt in both groups of this study who had evidence of preoperative hypersplenism, showed a significant permanent improvement of their thrombocytes and leukocytes post-operatively.

The large size of the spleen does not preclude the performance of shunt. Spleen size will reduce after shunting, presumably owing to relief of the high-pressure splenic vein into the low-pressure renal vein[69]. Furthermore, with the operative detection of massive splenic vascular adhesions, proceeding with splenectomy, as recommended by Sopers and Rikkers[76], may carry higher rates of surgical mortality and morbidity. Finally, the reported long-term risks of splenectomy may overweigh the better response of hypersplenism to shunt surgery, whether DSRS[77,78] or PCS[79].

Based on the data presented, it may be concluded that In the schistosomal population with pure hepatic fibrosis or mixed fibrosis and non-alcoholic cirrhosis (1) Both DSRS and PCS-CL have low operative mortality and morbidity, (2) both procedures maintain portal perfusion, have a good

long-term patient survival, and very low incidence encephalopathy, (3) DSRS is superior regarding variceal eradication, reduction of the incidence of re-bleeding, and decrease of splenic size, and (4) PCS-CL is a good alternative if DSRS were not feasible.

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