Transabdominal gastroesophageal devascularization with versus without esophageal stapler transection in the control of variceal bleeding in cirrhotic patients

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Aim
The aim of the study was to assess the efficacy and safety of adding esophageal transection to the devascularization operation in controlling variceal bleeding.

Patients and methods
A total of 115 patients with acute variceal bleeding who finally needed surgery were included in this study. They were divided into two groups: group I included 32 patients who underwent transabdominal gastroesophageal devascularization and esophageal transection and group II included 83 patients who underwent transabdominal gastroesophageal devascularization only. Survivors were followed up for at least 3 years by endoscopy to check for recurrence of esophageal varices.

Results
The incidence of early bleeding, residual varices, and recurrent varices was significantly lower in group I than in group II and there was no statistically significant difference in both early and late morbidity and mortality between the two groups.

Conclusion
Esophageal stapling is a safe and effective procedure for both short-term and long-term control of bleeding varices.

Keywords:
esophageal varices, gastro-esophageal devascularization, stapler transection

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Introduction

Acutely bleeding portal hypertension remains a medical and surgical challenge. Endoscopic treatment remains the mainstay for the initial control of actively bleeding esophagogastric varices. However, about 10–15% of patients fail to respond to emergency sclerotherapy, and this subgroup of patients has a particularly poor prognosis with high mortality rates [1].

Treatment options in such cases consist of transjugular intrahepatic portosystemic shunt, surgical shunting, devascularization procedures, and liver transplantation with variable success rates. However, transjugular intrahepatic portosystemic shunt and liver transplantation may not be readily available at all centers, and surgical shunting requires special expertise. Transabdominal gastroesophageal devascularization and esophageal transection (TAGEDET) is the most favored emergency procedure for the control of continued bleeding after failed endoscopic therapy [2–5].

The objective of this study was to compare the short-term and long-term results of the two surgical procedures, a modified devascularization procedure with stapler esophageal transection (group I) and a devascularization procedure without stapler transection (group II), to assess the efficacy and safety of esophageal transection.

Patients and methods

Between June 2008 and June 2011, all patients admitted to Zagazig University Hospitals with esophageal variceal bleeding who needed surgical intervention were enrolled in this study.

Inclusion criteria

(1) Patients above 18 years of age and below 70 years.
(2) All patients with bleeding esophageal varices due to portal hypertension diagnosed with endoscopy.
(3) Patients subjected to surgery either due to failure of endotherapy and pharmacotherapy to arrest bleeding or due to hypersplenism.
(4) Patients who consented to the operation and were willing to join this research work.

Exclusion criteria

(1) Age below 18 years and above 70 years.

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(2) If the origin of bleeding was not variceal — for example, concomitant portal gastropathy, erosive gastroduodenitis, or peptic ulcer.
(3) If portal hypertension was not due to cirrhosis.
(4) If the patient was unfit for or refused surgery.
(5) Patients who responded to endotherapy and/or pharmacotherapy and were not candidates for surgery.
(6) Patients who were lost during the follow-up period.

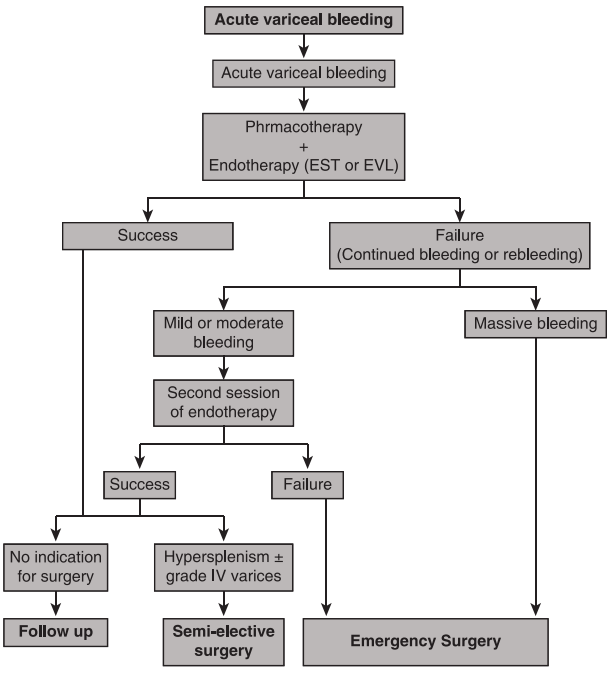
This research work was approved by the ethical committee of our Department of Surgery and Faculty of Medicine, Zagazig University.

Preoperative care

All patients were initially admitted to the emergency unit in our hospital (the hematemesis ward) where they were rapidly resuscitated with intravenous fluids, blood and plasma transfusion when needed, and infused with vasopressin at a rate of 0.1–0.4 U/min or somatostatin (sandostatin) at a rate of 50 μg/h. Gastric lavage was performed immediately to assess the amount of bleeding, to clean the stomach for endoscopy, and to lessen the incidence of encephalopathy. Once the patient was resuscitated, upper gastrointestinal (GI) endoscopy was performed to confirm the diagnosis of bleeding varices and to rule out any other cause. Then endotherapy, either endoscopic sclerotherapy or endoscopic variceal ligation, was performed in the same setting to arrest bleeding, and the patient was returned to the observation ward where conservative measures were continued and full laboratory and imaging investigations were ordered to evaluate organ functions, degree of anemia, risk of encephalopathy, and the stage of cirrhosis. Patients were classified according to Child–Pugh classification into Child A, B, or C.

Some patients continued to bleed or bled again after initial arrest of bleeding during this observation period. If the bleeding was massive, a Sengstaken–Blakemore tube was applied and kept inflated in place during transfer of the patient to our emergency unit of surgery where he or she was prepared for emergency surgery; if the bleeding was mild or moderate the patient underwent another trial of endotherapy, but if the procedure failed again he or she was transferred to emergency surgery.

Also, if pharmacotherapy and/or endoscopic therapy succeeded in arresting bleeding, but there was marked hypersplenism or grade IV varices with high risk of rebleeding, the patient was transferred to our Department of Surgery and prepared for semielective surgery. Again, patients who responded to pharmacotherapy/endotherapy and did not need surgical intervention were discharged from the hospital on regular sessions of endotherapy and were not included in this study. Our approach to manage cases of acute variceal bleeding is explained in the following algorithm:



Patients were classified into two groups:

Group I: Patients who underwent transabdominal gastroesophageal devascularization and esophageal transection (TAGEDET) when stapler was available and the intraoperative conditions were favorable for esophageal stapling (supple esophagus).

Group II: Patients who underwent transabdominal gastroesophageal devascularization (TAGED) only if marked edema and friability of the esophagus or fibrosis and adhesions around the abdominal esophagus interfered with esophageal stapling.

Thus, esophageal stapler transection was attempted whenever possible. If successful, the patient was placed in group I; otherwise, TAGED alone was performed and the patient was placed in group II.

Operative work

All patients were operated upon by the same surgical team following the same surgical principles and under the same facilities. All patients underwent TAGED, and in group I patients esophageal transection was added. TAGED was performed by complete

devascularization of the lesser curvature and most of the greater curvature of the stomach together with transhiatal devascularization of the lower 6–10 cm of the esophagus. This entails dissection–ligation of the left gastric, short gastric, left gastroepiploic veins, and all paraesophageal collaterals. In group I patients, esophageal stapler transection was added. After complete mobilization of the esophagus, the two vagal trunks, or at least the posterior one, were identified and preserved. Then a small anterior gastrotomy about 3–5 cm from the cardia was made and an end-to-end anastomotic circular stapler of size 25–29 mm (Ethicon) was introduced smoothly through the gastrotomy into the lower esophagus. After tying the lower esophagus over the anvil of the stapler and closing the device to the level of safety firing, the device was fired to transect and anastomose the esophagus about 2–3 cm above the cardia. After removal of the device the transected doughnut was assessed for completion, and the lower esophagus was reassessed for integrity of the anastomosis before closure of the gastrotomy in two layers. Pyloroplasty was not needed and was not performed as we wanted to preserve at least one vagal trunk. Splenectomy was routinely performed in all cases unless already splenectomized before. Liver biopsy was routinely obtained. Tube drains were left near the anastomosis and the laparotomies were closed over Jackson Pratt suction drains.

In one case, during digital dissection of the esophagus, perforation of the esophagus occurred and therefore we divided the esophagus above the perforation between two intestinal clamps; the lower segment of the esophagus, harboring the perforation, was removed and the cardia was closed in two layers and the distal end of the esophagus was closed around the anvil of the stapler using purse-string suture. Then, anastomosis between the esophagus and the fundus of the stomach was performed using the circular stapler.

Postoperative care

Postoperatively, all patients were immediately transferred to the ICU in our hospital where they were closely monitored. Full laboratory investigations were ordered in the second postoperative day (POD). Blood transfusion was resorted to only if hemoglobin fell below 8 g%. If early signs of encephalopathy developed, patients were put on an antiencephalopathy regimen (hepamerz intravenous infusion, aminoleban, etc.). Oral feeding was withheld for 3 days in group I, in which esophageal transection was performed, but allowed once intestinal motility was regained in group II. When survivors were surgically stable, they were transferred to the inpatient wards of the surgical department where they completed their postoperative regimen.

Patients who bled again were transferred back to the emergency unit of hematemesis, where conservative measures were resumed and patients were prepared to have an upper GI endoscopy to diagnose the source of rebleeding and managed accordingly.

All survivors underwent upper GI endoscopy before their discharge on the 21st POD or later. Esophageal varices detected at the discharge endoscopy session were regarded as residual varices.

Follow-up

Survivors were followed up in the outpatient clinic of our unit on regular visits every 3 months in the first year and then every year in the next 2 years. In each follow-up visit, the patient was examined clinically and fully investigated and an upper GI endoscopy was performed. Esophageal varices that appeared at the follow-up endoscopy but not detected at discharge were regarded as recurrent varices.

Statistical analysis

The patients' demographic and clinical data were expressed as frequencies for qualitative data. Quantitative data were summarized as mean, SD, and range. Group comparison between the devascularization procedure with/without esophageal transection with respect to rates of postoperative morbidity and mortality was made with Pearson's c^2-test, Fisher's exact test, and the unpaired Student t-test, as applicable on an intention-to-treat basis. A P value less than 0.05 was taken as significant.

Results

This study, including the minimum 3 years' follow-up period, extended from June 2008 to June 2014. Out of 3212 patients admitted to the emergency unit in Zagazig University Hospitals with acute variceal bleeding from June 2008 to June 2011, only 133 patients needed surgical intervention and were enrolled in this research. However, 18 patients were excluded later: two patients had associated severe portal gastropathy, three patients had associated peptic ulcerations, three patients were not cirrhotic (as proven on liver biopsy) and their portal hypertension was due to another cause, one patient died intraoperatively, and nine patients were lost during the follow-up period. Thus, only 115 patients were finally included in this study, comprising 86 men and 29 women, their ages ranging from 24 to 68 years, with a mean age of 47 ± 9.6 years. All patients were cirrhotic with hepatitis C virus-positive markers. The demographic, clinical, and investigative data are shown in Table 1.

After resuscitation, all patients underwent a session of endotherapy; 104 (90.4%) patients had endoscopic sclerotherapy and 11 (9.6%) patients had endoscopic variceal ligation (Photos 1 and 2). Bleeding stopped in 98 (85%) patients and these patients were transferred to semiselective surgery because of hypersplenism and/or grade IV varices with high risk of rebleeding. The remaining 17 (15%) patients either continued to bleed (three patients) or rebled after initial arrest of the bleeding (14 patients). Three of them had massive bleeding and were transferred to emergency surgery on a Sengstaken–Blakemore tube, and the remaining 14 patients underwent another trial of endotherapy. Five patients responded well and were transferred to semielective surgery, whereas nine patients had profuse bleeding and were transferred to emergency surgery. Thus, all patients underwent at least one session of endotherapy and finally we had 12 (10.4%) patients who required emergency surgery and 103 (89.6%) patients who underwent semiselective surgery. According to the surgical procedure, patients were divided into two groups:

Table 1 Demographic, clinical, and investigative data

Data	Group I (TAGEDET) (*N* = 32)	Group II (TAGED) (*n* = 83)	*P* value
Age (mean ± SD) (years)	48 ± 5.6	46 ± 6.1	0.42
Sex (male and female)	22–10	58–25	0.45
Comorbid disease			
Diabetes mellitus	3	5	0.39
Cardiac troubles	1	2	0.62
Renal troubles	0	1	0.72
Cerebrovascular disease	2	1	0.18
Stage of cirrhosis			
Child class A	14	25	0.18
Child class B	11	35	0.44
Child class C	8	22	0.88
Variceal bleeding episodes			
1–3	24	56	0.43
4–5	6	26	0.17
>5	2	1	0.18
Grade of varices			
Grade I and II	9	21	0.75
Grade III and IV	23	62	
Type of endotherapy			
EST	27	77	0.15
EVL	5	6	
Source of bleeding			
Esophageal varices	26	68	0.93
Gastric varices	6	15	
Time of surgery			
Emergency surgery	3	9	0.56
Semielective surgery	29	74	

EST, endoscopic sclerotherapy; EVL, endoscopic variceal ligation; TAGED, transabdominal gastroesophageal devascularization; TAGEDET, transabdominal gastroesophageal devascularization and esophageal transection.

Group I included 32 (27.8%) patients who underwent TAGEDET.

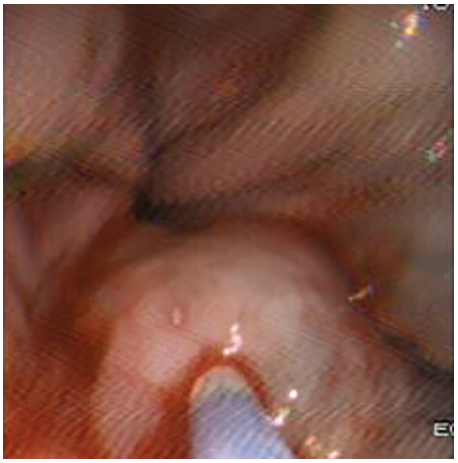
Group II included 83 (72.2%) patients who underwent TAGED only.

Although selection of patients for the two groups was not random and depended on the feasibility of the stapling procedure, statistical analysis of the demographic, clinical, and investigative data showed no significant differences between the two groups, thus ensuring that they were well-matched and amenable to comparative study.

Operative data

The mean operative time was 3.1 h (range 1.5–6 h). It was significantly longer in the emergency group than in the semiselective group. Also, it was significantly longer in group I than in group II (3.9 vs. 2.5 h). The

Photo 1



Endoscopic sclerotherapy (EST).

Photo 2

Endoscopic variceal ligation (EVL).

mean amount of perioperative blood and/or packed red blood cells transfusion was 3.2 U (range 1–10 U). Again, it was significantly larger in the emergency group than in the semielective group (4.2 vs. 2.1 U) but it showed no statistically significant difference between group I and group II. Splenectomy was routinely performed in all cases unless the patient had been splenectomized before (three cases). There was only one intraoperative mortality that occurred before completion of the procedure, which was excluded from the study (Table 2).

Early postoperative morbidity and mortality

Acute bleeding was controlled in all cases. The mean duration of ICU stay was 4.5 days (range 1–12 days). The mean duration of hospital stay was 32 ± 12 days (range 21–52 days). Hospital stay was statistically longer among emergency cases than among semiselective ones and in group I than in group II (Table 3).

Eighteen patients developed encephalopathy postoperatively. There was a statistically significantly higher incidence of encephalopathy among emergency cases than among semielective ones. Fifteen patients recovered well, whereas three patients developed hepatorenal syndrome and died within POD 6–18.

Early bleeding (within 30 days postoperatively) occurred in 15 (9.6%) patients: one (3.1%) patient in group I and 14 (16.8%) in group II. Endoscopy revealed the source of bleeding in each case (Photos 3 and 4): bleeding was from the anastomotic line in one case and from residual varices in the remaining cases. The bleeding anastomotic line responded to conservative measures, whereas

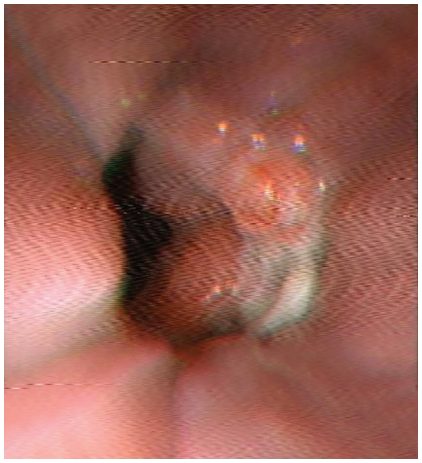
Table 2 Operative data of the patients

Data	Group I (*n* = 32)		Group II (*n* = 83)		Group I vs. group II (*P* value)	Emergency vs. elective (*P* value)
	Emergency (*n* = 3)	Elective (*n* = 29)	Emergency (*n* = 7)	Elective (*n* = 76)		
Operative time (mean ± SD) (h)	4.1 ± 1.2	3.8 ± 1.1	2.9 ± 0.9	2.1 ± 0.5	0.000	0.04
Blood transfusion (mean ± SD) (units/patient)	4.1 ± 1.1	2.1 ± 1.2	3.9 ± 0.9	1.9 ± 0.8	0.3	0.000
Splenectomy (number of patients)	3	28	6	75	0.62	0.24

Table 3 Early postoperative morbidity and mortality

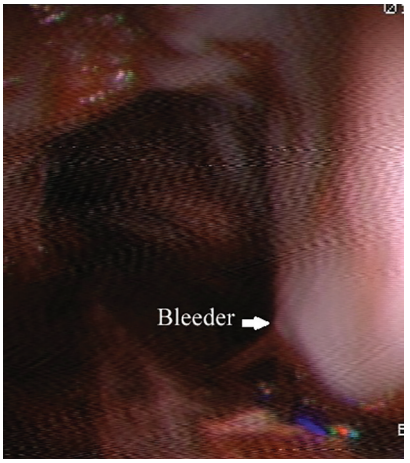
Early morbidity and mortality	Group I (*n* = 32)		Group II (*n* = 83)		Group I vs. group II (*P* value)	Emergency vs. semielective (*P* value)
	Emergency (*n* = 3)	Elective (*n* = 29)	Emergency (*n* = 9)	Elective (*n* = 74)		
Hospital stay (days)	44 ± 5.2	32 ± 6.1	38 ± 7.3	28 ± 4	0.000	0.000
Encephalopathy	2	4	6	6	0.57	0.000
Early bleeding	1	0	2	12	0.04	0.19
Subphrenic collection	1	0	1	3	0.68	0.02
Anastomotic leakage	0	1	0	0	—	—
Residual varices	1	0	3	15	0.01	0.097
Operative mortality	1	0	2	3	0.53	0.001

Photo 3



Bleeding from the staple line.

Photo 4



Bleeding from residual varices.

bleeding residual varices were endoscopically injected. Thirteen patients responded well and the bleeding stopped, whereas the remaining two patients continued to bleed and died. There was a statistically significantly higher incidence of early bleeding in group II than in group I.

There were five (4.3%) reported cases of subphrenic collections in the splenic bed in our series: four in group II and one in group I. They were managed conservatively. In two of them the collection disappeared under conservative measures and the other three needed ultrasound-guided drainage: two of them were cured and one needed surgical drainage; however, she died on the 29th POD from sepsis and hepatorenal failure. Subphrenic collection occurred more frequently in the emergency group than in the semielective patient group but there were no statistically significant differences between group I and group II regarding the incidence of subphrenic collection.

Discharge endoscopy picked up 19 (16.5%) cases of residual varices: one (3.1%) case in group I and 18 (21.6%) cases in group II. There was no significant difference in the incidence of residual varices between emergency and semielective groups, but there was a statistically higher incidence of residual varices in group II than in group I. All cases of residual varices were managed conservatively and discharged on regular visits for endoscopic follow-up.

Leakage from anastomosis, in group I, occurred only in one (3.1%) case, which was managed conservatively and stopped spontaneously.

The total number of early mortality cases (within 30 days postoperatively) was six (5.2%). Operative mortality was statistically higher in the emergency group (25%) than in the semielective group (2.9%), but it did not show statistically significant difference between group I (3.1%) and group II (6%).

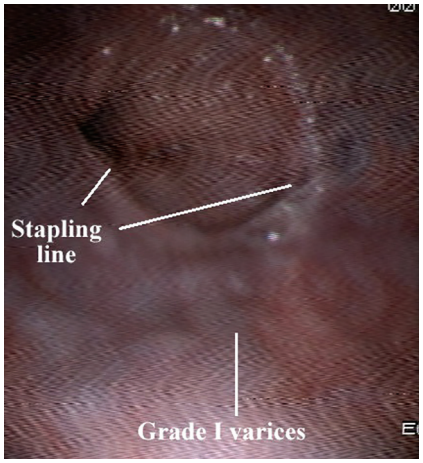
Late morbidity and mortality

The mean follow-up period was 4.2 ± 0.9 years; however, with respect to late results in this study, endoscopic examination showed recurrent varices in 22 (19.4%) cases: two (6.2%) cases in group I and 20 (24%) cases in group II (Photos 5 and 6). There was a statistically significantly higher incidence of recurrent varices in group II than in group I. All patients went on regular endoscopic follow-up. Only one patient needed resurgery and underwent fundectomy for his bleeding recurrent gastric varices. He recovered well postoperatively, but 4 months later we discovered a hepatocellular carcinoma on his computed tomographic scan and he died 5 months later (Tables 4 and 5).

Twenty-three (20%) patients developed liver cell failure with encephalopathy and ascites throughout the follow-up period. Five patients died in the first 3 years. Three other patients underwent liver transplantation: two patients survived and one patient died 1 month postoperatively.

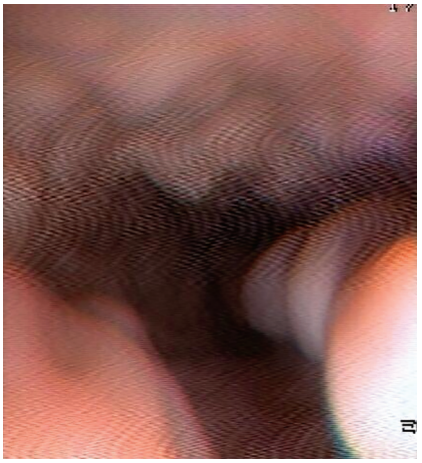
Three patients developed hepatocellular carcinoma during the first 3 years of follow-up and all died 6–11 months from the time of diagnosis. Fifteen patients showed hemorrhagic portal gastropathy at endoscopy and they were managed conservatively with proton pump inhibitors, inderal and others; three patients died of bleeding attacks complicated with shock and hepatorenal failure. There was no statistically significant

Photo 5



Recurrent varices 3 years after transabdominal gastroesophageal devascularization and esophageal transection (TAGEDET).

Photo 6



Recurrent varices 3 years after transabdominal gastroesophageal devascularization (TAGED).

Table 4 Late morbidity

Late morbidity	Group I (*n* = 32) [*n* (%)]	Group II (*n* = 83) [*n* (%)]	*P* value
Recurrent esophageal varices (at last endoscopy)			
Grade I and II	2 (6.2)	13 (15.6)	0.02
Grade III and IV	0 (0)	7 (8.4)	
Liver cell failure	4 (12.5)	11 (13.2)	0.59
Hepatocellular carcinoma	1 (3.1)	2 (6.2)	0.62
Portal gastropathy	5 (15.5)	10 (12)	0.4
Anastomotic stricture	2 (6.2)	—	—
Incisional hernia	11 (34.3)	26 (31.3)	0.75

Table 5 Risk factors for late mortality

Risk factors	Late mortality [*n* (%)]	*P* value
Child classification		
Child A (*n* = 39)	1 (5.1)	0.002
Child B (*n* = 46)	3 (10.8)	
Child C (*n* = 30)	8 (50)	
Timing of surgery		
Emergency (*n* = 12)	2 (16.6)	0.45
Semielective (*n* = 103)	10 (9.7)	
Type of operation		
TAGEDET (*n* = 32)	3 (9.3)	0.81
TAGED (*n* = 83)	9 (10.8)	

TAGED, transabdominal gastroesophageal devascularization; TAGEDET, transabdominal gastroesophageal devascularization and esophageal transection.

difference between the two groups regarding the incidence of both hepatocellular carcinoma and portal gastropathy.

Two patients developed stricture at the anastomosis in group I. Both of them underwent endoscopic dilatation and did well with repeated sessions.

Thirty-seven (32.1%) patients developed incisional hernia at the sites of laparotomies but only 23 (20%) patients underwent hernioplasty. It is worth mentioning that 57 (49.5%) patients had associated paraumbilical hernias and 29 (25%) patients had associated inguinal hernias on first presentation.

The late mortality from 30 days to 3 years postoperatively was represented by 12 (10.4%) patients. Mortality was statistically not affected by the time of surgery or the type of operation performed but it had a very strong correlation with Child classification of the patients (Table 5). The overall mortality, early and late postoperative mortality, was represented by 18 (15.6%) patients.

Discussion

Patients in whom endotherapy has failed will eventually resort to second-line salvage treatment in the form of surgery for immediate and long-term control of variceal bleeding. The modified Sugiura procedure is among the most favored emergency surgical procedures because of a low rate of encephalopathy and variceal rebleeding. Yet, controversies exist regarding its long-term results [6,7]. In this study, we tried to compare the short-term and long-term results of the two procedures, TAGEDET and TAGED.

There were no differences in demographic, clinical, and investigative data between the two groups; this ensures absence of bias in either group.

In our study, endotherapy together with pharmacotherapy achieved a success rate of about 85% in controlling bleeding varices, which correlates well with the figures recorded by many studies [1,8–13].

It was not surprising that operative time was longer in group I than in group II because of the extra time needed to apply the stapler and close the gastrotomy. Also the hospital stay is longer in group I because of the additional time required for the patients to return to a traditional diet after the stapling procedure and as we tried to delay the discharge endoscopy as needed to ensure sound healing of the staple line.

Encephalopathy, subphrenic collections, and subsequently early mortality were more common among emergency patients than among semielective ones. This may be attributed to many factors such as the injurious effect of the preoperative shock, the effect of the blood in the intestine, inadequacy of sterilization measures in the emergency unit, and the lack of good preoperative preparation of the patient under emergency conditions.

The incidence of early bleeding, residual varices, and recurrent varices was lower in group I than in group II. Moreover, residual and recurrent varices that occurred in group I were of grade I and II, which rarely bleed and are usually managed conservatively, a fact that proves that adding esophageal stapling to the devascularization procedure adds more control of the variceal bleeding both in the short and long term. This disagrees with the results of many studies [14–17] that concluded that esophageal stapler transection is not mandatory in the performance of the modified devascularization procedure and that residual intramural varices can be safely obliterated with combined endotherapy (1–2 sessions only) and propranolol.

The incidence of esophageal stapling-related complications was minimum. Leakage occurred in one (3.1%) case, and bleeding from the stapling line also occurred in one (3.1%) case; both stopped spontaneously on conservative measures. Anastomosis

stricture occurred in two (6.2%) cases and responded to endoscopic dilatation. These figures are lower than those recorded by many studies. Leakage from anastomosis was seen in 6–22% of cases [7,18–22], bleeding from the anastomosis line was as high as 50% [11,21], and stricture was seen in 10–28% of cases [19,22–24]. This may be due to the improvement in the quality of new generations of circular staplers and because of the greater experience of surgeons in the use of staplers.

There was no significant difference in the incidence of other morbidities such as encephalopathy, subphrenic abscess, incisional hernias, and portal gastropathy between group I and group II. Also, there was no significant difference in both early and late mortalities between the two groups. These previous data ensure the relative safety of the esophageal stapling procedure and its little impact on patients' morbidity and mortality.

Child classification of the patient appears to be the most important prognostic factor determining both early and late mortality.

Conclusion

Adding esophageal stapling to the devascularization operation improves both short-term and long-term control of bleeding varices without significant increase in morbidity and mortality.

Recommendation

We recommend repetition of this study on a larger number of patients in multiple surgical centers and gathering of data to conduct a meta-analytic study that can establish surgical guidelines for management of bleeding gastroesophageal varices, which are the nightmare of patients with portal hypertension.

Acknowledgements

Conflicts of interest

None declared.

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