



The Efficacy and Safety of Endoscopically Guided Stapled Fundal Mini-Gastrectomy for the Treatment of Bleeding Fundal Varices: A Single Tertiary Care Center Experience

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Abstract: *Introduction:* Gastric varices develop in 5–33% of patients with portal hypertension. Gastric variceal bleeding is a major problem accused for a lot of deaths in cirrhotic sufferers, so its management and early prophylaxis is a must. Surgery turns into the only hope for patients with huge varices or resistant cases to repeated endoscopic management. Fundectomy and devascularization may be a good option in this class of patients. The aim of this study is to evaluate endoscopically guided stapled fundal minigastrectomy with periesophagogastric devascularization and splenectomy in treatment of gastric fundal varices. *Patients and methods:* This study included twenty two selected patients with gastric varices admitted to Gastroenterology, Liver and Laparoscopic unit, General surgery department, Tanta University Hospitals, during the period from January 2014 to January 2016. All cases were operated by endoscopically guided stapled fundal minigastrectomy with periesophagogastric devascularization and splenectomy. The evaluation included operative characteristics, operative findings and morbidity and postoperative complications. *Results:* The operative time ranged from 75 minutes to 180 minutes, with a mean of 106 ± 15 minutes. Intraoperative bleeding occurred in one patient (4.55%) due to injury of one of the retroperitoneal veins treated by underrunning sutures and blood transfusion. There was no operative or postoperative mortality and only one patient developed recurrent fundal varices (4.55%) without bleeding attacks during the follow up period. Follow up ranged from 1 to 2 years with a mean of 1.5 years. *Conclusion:* Endoscopically guided stapled fundal minigastrectomy with periesophagogastric devascularization is a safe and effective method in the treatment and prophylaxis of fundal varices, and should be used in treating bleeding fundal varices and in prophylaxis of huge ones.

Keywords: Fundal Minigastrectomy, Gastric Varices, Fundal, Devascularization, Peri-esophagogastric

1. Introduction

Gastric varices (GV) complicate 20% of patients with portal hypertension and once present, the risk of bleeding is about 10% per year [1]. The classification of gastric varices commonly used in clinical studies is that of Sarin; when the gastro-esophageal varices (GOV) are an extension of esophageal varices, they are categorized into two types: The most common are Type 1 gastro-esophageal varices (GOV1), which extend along the lesser curvature. Type 2 gastro-esophageal varices (GOV2) are those which extend along the fundus. Isolated gastric varices (IGV) occur in the absence of

esophageal varices and are also classified into two types. Type 1 (IGV1) are located in the fundus, and type 2 (IGV2) are located in the body, antrum, or around the pylorus.

Bleeding from the GOV1 is relatively straight forward with endoscopic injection sclerotherapy (EIS) or endoscopic variceal ligation (EVL), while it is still hard to control bleeding from fundic gastric varices, such as GOV2 and IGV1 [2]. The mortality rate of gastric variceal bleeding in cirrhotic patients has been reported to be 45%-55% [3]. The mortality of each episode of variceal bleeding is about 20 to 30 percent and as many as 70 percent of survivors have recurrent bleeding after their first variceal hemorrhage [4].

The options for management of gastric variceal hemorrhage are: endoscopic; in the form of endoscopic sclerotherapy, but it has been reported that traditional endoscopic injection sclerotherapy is ineffective for the treatment of isolated gastric varices [5]. Transjugular portosystemic shunt (TIPS) may be used as a salvage treatment when failed endoscopic management during attack of bleeding [6], as well as Balloon-occluded retrograde transvenous obliteration (B-RTO) for the treatment of bleeding fundic gastric varices [7] and surgery in the form of devascularization of the upper stomach with splenectomy may be an option in these urgent situations [8].

A clinical trial was done at Seoul National University, Korea (2004) performed an operation that combines periesophago gastric devascularization, splenectomy and fundectomy. The extent of fundal resection was limited to the engorged varix bearing area. The extent of the resection was determined by palpation under direct vision after the gastric wall was opened. Early results indicated that this operative method was effective in controlling fundal variceal bleeding. In addition, no recurrent gastric bleeding has been encountered among patients that survived this operation [9].

It was reported that to achieve control of gastric variceal hemorrhage, fundal mini-gastrectomy and splenectomy (for IGV 1) and with added devascularization of the gastroesophageal junction (for GOV2), could be considered a good alternative operative procedure. And, added that the endoscopic follow up proved that all fundal varices disappeared completely. Also, down grading of esophageal varices had occurred [10].

At present, the greatest indicator to the presence of esophago gastric varices is the endoscope with endoscopic screening being a nice approach [11]. However, recently a number of researches have confirmed the superiority of endoscopic ultrasound (EUS) over conventional endoscopy for the detection of gastric varices and analysis of the feeding vessel [12].

The aim of the work was to evaluate endoscopically guided stapled fundal minigastrectomy with periesophago gastric devascularization and splenectomy in treatment of gastric fundal varices.

2. Patients and Methods

This study included twenty two patients with gastric varices admitted to Gastroenterology, Liver and Laparoscopic unit, General surgery department, Tanta University Hospitals, during the period from January 2014 to January 2016.

An approval to this study was obtained from the ethical committee of the Tanta University Hospitals and an informed written consent was taken from all patients enrolled in the study. A thorough history, clinical examination and routine laboratory investigations as well as abdominal ultrasonography were performed for all patients included in the study.

Patients with Child's –Pough C and patients who were

unfit for general anesthesia were excluded from this study.

3. Operative Technique

Devascularization and splenectomy are performed as usual, then, the gastroscope is introduced into the stomach (intraoperatively) to determine the level and extent of the fundal varices. A non-crushing curved intestinal clamp is placed on the fundus guided by the endoscope until the fundal varices disappears totally in the endoscopic field. At this site of clamping, resection of the fundus bearing varices is done by straight GIA 90 PREMIUM stapler. After resection, the disappearance of fundal varices is confirmed by the endoscope, and exclusion of any intragastric bleeding, finally over sewing of the staple line with silk 2/0 is done. The operative steps are shown in figures (1-10).



Figure 1. Splenectomy and perigastric devascularisation.



Figure 2. The fundal varices appearing in the wall of the stomach using the light of intra-operative endoscopy.



Figure 3. Another picture showing fundal varices appears in the wall of the stomach by intra-operative endoscopic light.



Figure 4. Application of non-crushing intestinal clamp to the stomach wall after visualization of the fundal varices by intra-operative endoscopy.



Figure 5. Intra-operative endoscopic views of the fundal varices before application of intestinal clamp.

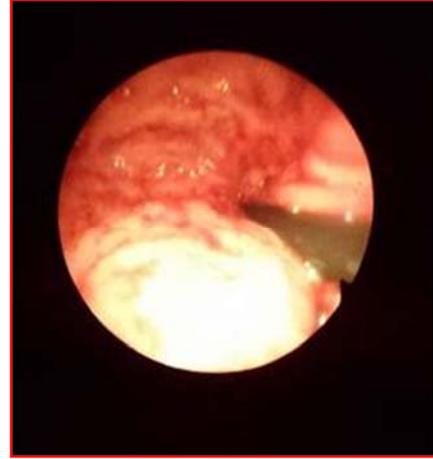


Figure 6. Endoscopic intra-operative view of the fundus after applying the intestinal clamp showing absence of fundal varices.

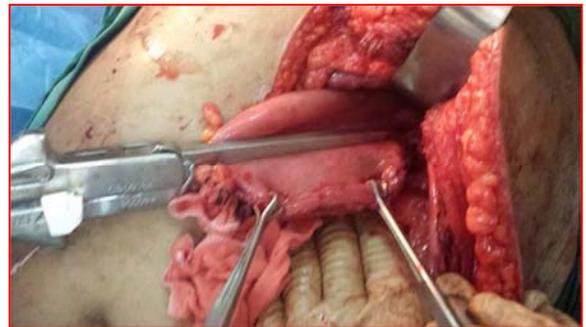


Figure 7. Application of the first linear stapler into the stomach to start fundectomy.



Figure 8. Application of second stapler into the stomach to complete fundectomy.



Figure 9. Showing oversewing of the staple line by secondary sutures with silk 2/0.

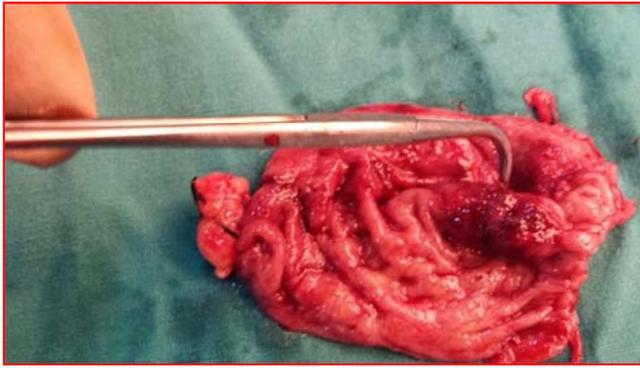


Figure 10. The fundal specimen after being opened to show the previously injected fundal varices in a case presented with bleeding.

Follow up period ranged from 1 to 2 years with a mean of 1.5 years, and was every 2 weeks for 3 months, then monthly thereafter. Follow up included clinical evaluation, laboratory investigations including liver functions, abdominal ultrasonography and upper endoscopy (After 3 months, 6 months and one year a follow up endoscopy was performed to detect recurrence).

4. Results

The age of our patients ranged from 32 to 66 years with a mean of 47.54 ± 5 years. Males constituted 72.7% of our patients (16/22) and 27.3% were females (6/22). Regarding hepatitis C reactivity 81.8% (18/22) were hepatitis C positive (HCV) and 18.2% (4/22) were HCV negative. None of our patients was reactive to hepatitis B virus. Only two patients suffered from co-morbidities in the form of diabetes and hypertension. Baseline characteristics of patients enrolled in the study are shown in table (1).

Table 1. Baseline Patient characteristics.

Patients (n = 22)			
Parameter		N	%
Sex	Male	16	72.7
	Female	6	27.3
Child-Pugh classification	Child-Pugh A	22	100
Diabetic	-ve	20	90.9
	+ve	2	9.1
HTN	-ve	20	90.9
	+ve	2	9.1
Renal	-ve	22	100
Cardiac	-ve	22	100
HBV	-ve	22	100
HCV	-ve	4	18.2
	+ve	18	81.8
HIV	-ve	22	100
Previous attacks of hematemesis with injection sclerotherapy	No	2	9
	1-3	10	45.5
	>3	10	45.5
Sarin Classification	IGV1	8	36.4
	GOV2	14	63.6

According to Child-pugh classification, all of our patients were child A. But regarding Sarin’s classification 63.6% (14/22) were GOV2 and 36.4% (8/22) were IGV1 and 45.5% (10/22) of them suffered more than 3 attacks of

hematemesis/melena with previous exposure to injection sclerotherapy, 45.5% (10/22) suffered one to three attacks, and two patients 9.1% presented to us without previous attacks of hematemesis or melena, diagnosed endoscopically to have risky large fundal varices.

The operative time ranged from 75 minutes to 180 minutes, with a mean of 106 ± 15 minutes. Most of our patients received 1-2 blood packs intraoperatively with mean of 1.4, and they also received from 6-12 units of platelets with a mean of 9.6 and from 2-3 units of plasma with mean of 2.45. There was one case (4.55%) of intraoperative bleeding. The operative time, intraoperative blood, plasma and platelets transfusion are shown in table (2).

Table 2. The operative time, intraoperative blood, plasma and platelets transfusion.

	minimum	mean	maximum
Operative time (minutes)	75	106+15	180
Intraoperative blood transfusion (packs)	1	1.4	2
Intraoperative platelet transfusion (units)	6	9.6	12
Intraoperative plasma transfusion (units)	2	2.45	3

Fourteen of our patients developed early postoperative ascites 63.7%, ten of them developed (Rim/ minimal) ascites (45.5%) and four of them developed (mild/ moderate) ascites (18.2%), but during follow up ultrasonography we recognized that all of them returned to the preoperative state with no intraperitoneal ascites.

As regard to other postoperative complications, only one patient developed wound infection which soon resolves by antibiotics therapy. Ten of our patients developed chest problems varying from simple cough to sympathetic pleural effusion. All of them resolved by medical treatment. Six patients developed sub-diaphragmatic collection in the splenic bed which was followed up by ultrasonography until totally resolved conservatively. Only one patient developed incisional hernia after four weeks from surgery and was operated after six months. No one of our patients developed recurrent attacks of hematemesis or melena during the period of follow up. Hospital stay ranged from 10-14 days with a mean of 12 ± 1.2 days. Postoperative complications are shown in table (3).

Table 3. Postoperative complications.

Complication	Number	Percent
Wound infection	1	4.55%
Chest problems	10	45.5%
Subdiaphragmatic collection	6	27.7%
Leakage from anastomotic site	zero	-----
Portal vein thrombosis	zero	-----
Incisional hernia	1	4.55%
Delayed gastric emptying	zero	-----
Peritoneal sepsis	zero	-----
Hepato renal failure	zero	-----
Recurrent hematemesis/melena	zero	-----
Mortality	zero	-----

Table 4. Platelet count Pre and postoperative.

Group	PLT		
	< 150	150 - 400	> 400
Preoperative	20	2	0
	91%	9%	0%
First 2-3days	10	10	2
	45.5%	45.5%	9%
First week	2	18	2
	9%	82%	9%
Second week	0	8	14
	0%	36.4%	63.6%
Third week	0	8	14
	0%	36.4%	63.6%
Fourth week	0	16	6
	0%	73%	27%
Three months	0	22	0
	0%	100%	.0%
Six months	0	22	0
	0%	100%	.0%
Chi-square	X2	88.056	
	P value	0.001	

During our follow up to the patients, the fundal varices totally disappeared in twenty one patients and recurrent fundal varices occurred in only one patient (4.55%). Follow up endoscopy after 6 months showing the suture line with no evidence of recurrent fundal varices is shown in figure (11).

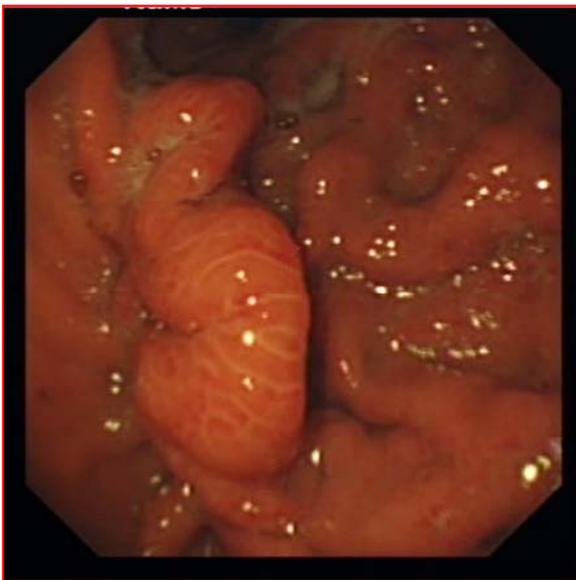


Figure 11. Follow up endoscopy after 6 months showing the suture line with no evidence of recurrent fundal varices.

As regard to Laboratory follow up data of our patients, all of our patients were presented to us by low hemoglobin percent at time of admission due to previous attacks of bleeding and a lot of them gave history of previous massive blood transfusion during their life time. Their hemoglobin percent at time of operation ranged from 10-12.7% with mean of 10.55%. A by follow up of the patients all of them are now with hemoglobin percent ranging from 11.5gm% to 13.5gm%.

Regarding liver enzymes, all of the patients were selected with normal liver enzymes values, then during the first

postoperative week 54.5% of them (12/22) developed slight elevation of liver enzymes which soon resolved after 3 months of follow up.

Regarding platelet count, 20 of our patients presented to us by platelet count less than 150,000 and two patients presented with platelet count between 150-400*10³ ranging from 68 to 254*10³ with mean of 109.45*10³. During the operation they received platelet units with range zero to 12 units and mean 8.54. And by the end of third month postoperative all of them returned to normal values and these values were maintained during the consecutive follow up studies.

5. Discussion

Development of gastro-esophageal varices is one of the most common and severe complications of portal hypertension. The prevalence of varices is about 50% among all cirrhotics. Which once are present, the risk of becoming large and the risk of bleeding is about 10% per year. Variceal hemorrhage will complicate the clinical course of chronic liver disease in about 30% of patients and accounts for 80 to 90 percent of bleeding in those patients [13].

The rationale of our study is that many patients who underwent injection sclerotherapy had successful initial control of the bleeding. Even that some of them had totally obliterated fundal varix during their endoscopic follow up or even totally disappeared. But unfortunately, although successful injection was done, it does not prevent the recurrence of fundal varix with another attacks of massive hemorrhage during a short period of time ranging from weeks to one or two months.

Matusmoto et al., 2004 also stated that if the varices were diffuse, complete obliteration would be difficult due to structural complexity and rapid flow [14]. *Kojima K., et al., 2005* Reported cases of retrograde abscess or splenic embolization after injection sclerotherapy and stated that embolic and thrombotic phenomena have been associated with large volume of injected material [15]. In addition, we believe that injection of such huge varices will increase the risk of uncontrollable bleeding.

In this study, twenty two portal hypertensive patients were selected with gastric fundal varices, with or without esophageal varices. All of our patients were classified as Child A according to Child-Pugh Classification. The study included 16 male and 6 female patients, with a mean age of 47.54 ± 5 years (range; 32: 66). The cause of cirrhosis was related to hepatitis virus C reactivity in nineteen of our patients (81.8%) and four patients were classified as idiopathic cirrhosis (18.2%). No one of our patients was reactive to hepatitis B virus.

In another study by *Hans et al., 2004*, they conducted their study on twenty three cirrhotic patients chosen carefully from the patients presented with variceal bleeding. There were 17 male and 6 female patients with mean age 54.8 years (range; 33-74). The cause of cirrhosis was identified in them to be alcoholic cirrhosis in 7 cases, hepatitis B in 12 patients,

Hepatitis C in 3 patients, and idiopathic cirrhosis in 1 [9].

In our study, there were three categories of patients according to the number of previous attacks of bleeding. Ten of our patients (45.5%) suffered more than 3 attacks of bleeding, ten patients (45.5%) suffered from 1-3 attacks and two (9.1%) were presented to us electively without any previous attacks of bleeding. These results agree with *Hashizume 2004*, who said that the commonest presentation of gastric varices is bleeding, and that it has a very high rate of recurrence [16].

According to the endoscopic findings, our study included fourteen (63.7%) patients with gastro-esophageal varices type II, and eight (36.36%) patients with isolated gastric varices type I. As regard the technique, in the study done by *Abd El-hady et al., 2011* they performed fundal minigastrectomy to all the patients and they determined the area of fundal varices through the visualization of engorged varix [10]. And, in the study done by *Hans et al., 2004* the extent of fundal resection was limited to the engorged varix bearing area. And in the small or medium sized gastric varices the extent of resection was determined by palpation under direct vision after the gastric wall was opened [9].

In our study, all the patients underwent endoscopically guided stapled fundal minigastrectomy. In which intraoperative endoscopy was available during the operation and the varices were visualized before insertion of the stapler, to avoid missing part of the varices or excessive gastric resection. That makes our study more safe and accurate.

The main purpose of Hassab's operation was to block the extramural inflow vessels; but even after devascularization, intramural and extramural engorged gastric varices remain and are often observed in the operative field. Therefore Hassab's operation, when used to treat gastric varices, has been combined with procedures that obliterate intramural varices, such as endoscopic injection sclerotherapy [17] or ligation of varices [18]. But when we performed periesophagogastric devascularization and excision of the fundal bearing area with its extramural and intramural gastric vessels, we did not need to combine the surgery with other procedures like endoscopic injection sclerotherapy or ligation. Regarding splenectomy it was performed initially in all the patients as they were all suffering from portal hypertension and most of them had splenomegaly, also splenectomy gave the advantage of recovery of the thrombocytic count of the patients into normal range.

Hans et al., 2004 stated that in their study they did not perform splenectomy in the first four cases to minimize the bleeding. But in their other cases they performed splenectomy to take the advantage of better operative field and also ligation of the short gastric veins for better devascularization and reducing the portal pressure [9]. In our work the operative time ranged from 75 minutes to 180 minutes, with a mean of 106 ± 15 minutes.

In the study of *Abd El-Hady et al., 2011* The operative time was calculated to be with range (60-80 mins) in the cases that they used the stapler in fundectomy with mean of 75 minutes and to be with range (90-120 mins) in the cases that they

performed fundectomy manually with a mean time of 110 mins added to both groups mean of 30 mins in the cases that they performed devascularization of the gastroesophageal junction (range 25-35 mins). The extra time needed for the endoscopic imaging does not outweigh the valuable visualization and precise variceal eradication [10].

In this study, there were no major complications intra-operatively or in our follow up to the patients. Only one patient (4.55%) suffered from massive bleeding intra-operatively due to huge retroperitoneal varices that was punctured while performing devascularization. Control of bleeding was done and the patient received blood to substitute the blood loss. Also one patient (4.55%) developed recurrent fundal varices during the follow up period.

Six cases (27.7%) developed sub-diaphragmatic collection in the splenic bed, and one patient (4.55%) developed wound infection. Ten (45.5%) of our patients developed chest problems varying from simple cough to sympathetic pleural effusion, all of them treated conservatively.

Abd El-Hady et al., 2011 reported that in their study there were six minor complications, including one case of wound infection (6%), one case of portal vein thrombosis (6%), two cases of delayed gastric emptying (12%), and two cases developed sub-diaphragmatic collection (12%) [10].

Hans et al., 2004 had only four minor complications in the form of two cases of wound infection (9%), one case of pneumonia (4.5%) and one case of delayed gastric emptying (4.5%). Also, all of them were treated conservatively without any surgical intervention [9].

As regard the hospital stay (10-14 days with a mean of 12 ± 1.2 days) it was relatively long because many cases required preoperative stabilization and postoperative support before discharge.

In our study there were no post-operative mortalities during the whole period of follow up. While in the study done by *Abd El-Hady et al., 2011* they reported two deaths among their patients (12%) during the early postoperative period at the third and ninth days, they attributed them to hepatorenal syndrome in one case and peritoneal sepsis in another case [10]. Also *Hans et al., 2004* reported six deaths (26.1%) among their patients, they attributed the cause of death to be hepatic failure in three cases, and sepsis due to anastomotic leak was the cause of death in one case. Respiratory failure due to methicillin resistant staphylococcus aureus (MRSA) pneumonia was the cause of death in one case. While respiratory failure due to aspiration pneumonia was the cause of death in another case [9].

In this study, only one patient developed recurrent fundal varices (4.55%), but he didn't develop hematemesis during the period of follow up and was done at the beginning of our experience. That agrees with the study of *Hans et al., 2004* and *Abd El-Hady et al., 2011* in which no recurrences or bleeding episodes due to gastric varices were recognized by follow up endoscopy in both studies. While in the study of *Hans et al., 2004* bleeding from esophageal varices was reported in one case in the eighth postoperative month. And in the study of *Abd El-Hady et al., 2011* bleeding due to esophageal varices

occurred in the ninth month. Both of them were successfully controlled by endoscopic sclerotherapy [9, 10].

Mansour (1996) also agrees with our study, in which he stated that no recurrence of gastric varices was detected during follow up of the patients, while two out of fifteen patients developed bleeding episodes due to esophageal varices, and they were controlled successfully with endoscopic sclerotherapy [19].

While *Nagy & Enaba, 2006* stated that in their study fifteen out of sixteen patients had no residual fundal varices during endoscopic follow up and only one patient had residual fundal varices [20].

The hemoglobin percent at time of operation ranged from 10-12.7% with mean of 10.55% and by 3 months follow up, hemoglobin percent ranging from 11.5gm% to 13.5gm%, liver enzymes, were elevated slightly during the first postoperative week 54.5% of them (12/22) and resolved after 3 months of follow up and finally regarding platelet count 20 of our patients presented to us by platelet count less than 150,000 all of them returned to normal values at three months postoperatively and these values were maintained during the consecutive follow up studies.

These results agree with *Abd El-Hady et al., 2011* who noticed downgrading of the Child-pough score of most of their patients [10].

Therefore, in conclusion, Endoscopically guided stapled fundal minigastrectomy with peri-esophagogastric devascularization is a safe and effective method in the treatment and prophylaxis of fundal varices, and should be a used in treating bleeding fundal varices and in prophylaxis of huge ones. However, more evaluation of this maneuver is needed in large number of patients to consider it as the best treatment for fundal gastric varices.

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