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RAPID COMMUNICATION

Cost saving by reloading the multiband ligator in endoscopic esophageal variceal ligation: A proposal for developing countries

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Abstract

AIM: To assess the cost savings of reloading the multiband ligator in endoscopic esophageal variceal ligation (EVL) used on the same patient for subsequent sessions.

METHODS: This single centre retrospective descriptive study analysed patients undergoing variceal ligation at a tertiary care centre between 1st January, 2003 and 30th June, 2006. The multiband ligator was reloaded with six hemorrhoidal bands using hemorrhoidal ligator for the second and subsequent sessions. Analysis of cost saving was done for the number of follow-up sessions for the variceal eradication.

RESULTS: A total of 261 patients underwent at least one session of endoscopic esophageal variceal ligation between January 2003 and June 2006. Out of 261, 108 patients (males 67) agreed to follow the eradication program and underwent repeated sessions. A total of 304 sessions was performed with 2.81 sessions per patient on average. Thirty-two patients could not complete the programme. In 76 patients (70%), variceal obliteration was achieved. The ratio of the costs for the session with reloaded ligator *versus* a session with a new ligator was 1:2.37. Among the patients who completed esophageal varices eradication, cost saving with reloaded ligator was 58%.

CONCLUSION: EVL using reloaded multiband ligators for the follow-up sessions on patients undergoing variceal eradication is a cost saving procedure. Reloading the ligator thus is recommended especially for developing countries where most of the patients are not health insured.

Key words: Esophageal varices; Reloading; Multiband ligator; Eradication; Cost saving

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INTRODUCTION

Variceal hemorrhage is a major cause of death among patients with cirrhosis, carrying historically, a mortality rate of up to 50% before the advances in medicine[1,2]. Even with the advent of intensive care, vasoactive medications, and endoscopic therapies, the risk of death with variceal hemorrhage is still about 20% per episode[3,4].

Band ligation of esophageal varices is indicated as a primary prophylaxis for large varices and as a secondary prophylaxis for patients who have bled from varices[5]. It is the endoscopic procedure of choice to prevent recurrent variceal hemorrhage and eradicate varices which usually requires 3-4 sessions[6,7]. Endoscopic variceal ligation (EVL) is an expensive procedure, especially for patients from lower socioeconomic class in developing countries where health insurance and reimbursement systems are not as developed as in other countries. Most of the expenses are due to the high costs of the single polyband ligator use. Thus, reloading this ligator and re-using it for subsequent sessions on the same patient would substantially reduce costs, while also improving compliance to the eradication program as most of the patients are not covered by a health care scheme.

The aim of this study is to review the patients in the eradication program for esophageal varices and estimate the cost saving by using the reloaded band ligator to achieve this purpose.

MATERIALS AND METHODS

A retrospective analysis on 261 patients who had undergone EVL as primary or secondary prophylaxis between 1st January 2003 and 30th June 2006 was performed.

Saeed's Six Shooter Multi-Band Ligator (Cook Medical Inc, Bloomington, IN) was used for variceal ligation[8]. After each session all the accessories of the ligator were disinfected in glutaraldehyde solution (Cidex, Johnson & Johnson) by standard protocols. The band ligator was then reloaded with six hemorrhoidal bands for the 2nd and subsequent sessions on the same patient. We used hemorrhoidal band ligator for reloading barrel of the variceal ligator[9]. The procedure was approved by the Infection Control Committee of the hospital.

The procedures were performed by physicians experienced in the techniques of endoscopic ligation and sclerotherapy. Informed consent was obtained from the patients. Endoscopy was carried out under topical or pharyngeal anesthesia and sedation with intravenous midazolam if needed. Ligation was performed beginning at the most distal discernible extent of a variceal column and proceeding proximally. Subsequent endoscopic therapy sessions with EVL or combination therapy were performed at 14 to 21 d intervals until the varices were eradicated or reduced to grade one. Recurrent bleeding mandated unscheduled intervention.

Method for reloading

The plaited string or trigger cord of the multiple band ligator becomes separated into two threads near the barrel. Each thread has six beads at regular intervals starting from the tip of the thread. These threads are passed through the barrel of the multiple band ligator from its scope-end side and delivered from the transparent rim side. The banding apparatus is now loaded. The metal cone of the hemorrhoidal ligator is loaded with a band, and then fitted in to the cylinder of the hemorrhoidal ligator and the rubber band rolled from the cone to the cylinder. The cone is removed after charging the cylinder. The first tip (bead) of each thread is brought at the base of the transparent cap and held in position. The transparent rim of the barrel is slid into the cylinder and the handle of the hemorrhoidal ligator is closed to push off the band from the cylinder onto the barrel of the variceal ligator. The band is positioned to the base of the barrel's transparent portion above the first pair of beads. The next pair of beads is now brought above the first band, wrapping the portion of thread between the first and second bead on the barrel by repositioning second beads to 180 degrees. When the two beads are in position above the first band, the second band is applied. In this way all the bands are mounted on the barrel which is now ready for reuse.

RESULTS

A total of 261 patients underwent at least one session of EVL between January 2003 and June 2006. Patients undergoing sclerotherapy were not included in the study.

Out of 261, 108 patients agreed to follow the eradication program with reloaded band ligator and underwent a total of 304 sessions. Sixty-seven (62%) patients were males. They underwent 2.81 sessions on average. Twenty patients came only for one follow up session, while 12 patients underwent more than one follow-up session but did not complete esophageal varices eradication. Thus, a total of 76 (70%) patients participating in the program achieved eradication. These 76 patients completed esophageal varices eradication in 215 sessions (average 2.83). The reloaded ligator was used in a total of 139 follow-up sessions. The ratio of costs for the session with the reloaded ligator *versus* a first session with a new ligator was 1:2.37. Among the patients who completed the program and achieved eradication of esophageal varices, cost saving with reloading was 58% (Table 1).

Table 1 Cost savings after the first session in 76 patients who completed the eradication of varices. Cost is in US Dollars (1 US Dollar = 61 Pakistani Rupees)

	Reloaded band after first session	New six shooter used each time
Cost of EGD	91.8	91.8
Cost of bands/ligator	6.56	140.82
Cost of single follow up session	98.36	232.62
Cost of bands in 139 follow up session	911.47	19573.93
Total cost of 139 follow-up sessions	13672.13	32334.59
Average cost savings per patient	245.56	
Cost comparison	1	2.37
Overall cost saving	58%	
Cost saving in band ligators	95%	

Cost of EGD includes both the costs of the technical (i.e. equipment and facility costs) and professional fees.

The etiologies of esophageal varices among the patients in the eradication program included hepatitis C in 49 (64.5%), hepatitis B in 3 patients (3.9%), hepatitis B & D in 6 (7.9%), non-B non-C in 16 (21.1%), and alcoholic liver disease in 2 patients (2.6%).

DISCUSSION

Cirrhosis and complications of portal hypertension rank among the top 10 leading causes of death worldwide[10]. The prevalence of esophageal varices in patients with cirrhosis ranges from 12% to 90% and the average risk of bleeding from 14% to 78%, depending on the patient population studied[11]. Esophageal varices are the most common cause of significant gastrointestinal bleeding secondary to portal hypertension[12]. The acute mortality of variceal hemorrhage has been reported to be 15%-50% and the overall mortality within 1-4 years as high as 70%-80% in those with cirrhosis. Furthermore, once varices have bled, the risk of rebleeding is reported to be as high as 70%-80%.

Treatment of patients with esophageal varices includes the prevention of the initial bleeding episode (primary prophylaxis), the control of active hemorrhage, and the prevention of recurrent bleeding after a first episode

(secondary prophylaxis), for which several modalities have been used including endoscopic sclerotherapy and band ligation.

EVL is superior to sclerotherapy, and is considered to be the endoscopic treatment of choice for bleeding varices[8]. Placing a rubber band around the variceal vein induces venous obstruction followed by mucosal inflammation, necrosis, and obliteration of the variceal vein. The single-shot mechanism of the ligation device is inherently inefficient, and makes the procedure tedious. It also requires overtube placement, associated with discomfort and complications[13-15]. Multiple-band ligation devices make band ligation easier and more efficient, allowing the consecutive application of 5 to 10 bands without removing the endoscope.

Reuse of equipment will always be cheaper than using new equipment. The issue becomes important when patients have to pay for all medical costs themselves and are not covered by a health care plan. The main issue is safety of reusable equipment. There were no band ligator failures or other complications noted in our patients with reloaded equipment. Very occasionally an extra band slipped off while deploying. There were no infection issues in these patients. Reuse of 'disposable' medical equipments may be a source of infection for HBV, HCV, and HIV in less developed countries. We disinfected the disposable items of the ligator with glutaraldehyde according to the standard recommendations and closed in a sealed bag with a label of patient's identification details and stored in an allocated dry place in the endoscopy suite. On arrival of the patient, the bag was opened and the ligator was reloaded with aseptic precautions to be used on the same patient. It is not too difficult to reload the band ligator. The process takes about five minutes

Variceal eradication was achieved in 70% of the patients enrolled in our eradication program. A wide range of success rates in eradication of esophageal varices has been reported in several studies. In the study by Stiegmann *et al*[16], variceal obliteration occured in 27 patients of 64 (42%) while in the study by Lo *et al*[17] varices were eradicated in 74%. Cost savings of the whole procedure using reloaded band ligator were 58%. Cost saving of the ligators, if reloaded equipment was used, was 95%. The band ligator was virtually free as only the costs of the rubber bands was charged. Rest of the expenses was related to the endoscopy and recovery.

In conclusion, EVL using reloaded polyband ligators for the follow-up sessions on patients undergoing variceal eradication is a cost effective procedure and may be recommended for developing countries.

COMMENTS

Background

Band ligation of esophageal varices is indicated as a primary prophylaxis for large varices and as a secondary prophylaxis for patients who have bled from varices. It is the endoscopic procedure of choice to prevent recurrent variceal hemorrhage and to eradicate varices. It usually requires 3-4 sessions using multiband ligator and applying up to six bands each time. Endoscopic variceal ligation (EVL) is an expensive procedure, especially for patients from lower socioeconomic class in developing countries.

Research frontiers

Instead of using new multiband ligator for each session, reloading the ligator and using it for subsequent sessions on the same patient would substantially reduce the costs.

Related publications

Not much published work related to this aspect is available. We described the method of reloading of the variceal multiple band ligator using hemorrhoidal banding apparatus (letter). *J Pak Med Asso* (JPMA) 2000; 50: 285-286.

Innovations and breakthroughs

Cost saving of the whole procedure using reloaded band ligator was 58% of the cost had new ligator been used. The band ligator is virtually free as only the cost of the rubber bands is charged. Rest of the expenses is related to the endoscopy and recovery.

Applications

EVL using reloaded polyband ligators for the follow-up sessions on patients undergoing variceal eradication is a cost effective procedure and may be recommended for developing countries.

Terminology

Multiband ligator is a device used to ligate esophageal varices, allowing the consecutive application of six rubber bands without removing the endoscope.

Peer review

This article reports Pakistanis experience about EVL using reloaded multiband ligator. I have a great experience about this procedure in my department. It is indicated for the third world countries. This is a nice, simple, and short paper with a clear point.

REFERENCES

1 **Graham DY**, Smith JL. The course of patients after variceal hemorrhage. *Gastroenterology* 1981; **80**: 800-809
2 **D'Amico G**, Luca A. Natural history. Clinical-haemodynamic correlations. Prediction of the risk of bleeding. *Baillieres Clin Gastroenterol* 1997; **11**: 243-256
3 **El-Serag HB**, Everhart JE. Improved survival after variceal hemorrhage over an 11-year period in the Department of Veterans Affairs. *Am J Gastroenterol* 2000; **95**: 3566-3573
4 **Chalasani N**, Kahi C, Francois F, Pinto A, Marathe A, Bini EJ, Pandya P, Sitaraman S, Shen J. Improved patient survival after acute variceal bleeding: a multicenter, cohort study. *Am J Gastroenterol* 2003; **98**: 653-659
5 **Grace ND**. Diagnosis and treatment of gastrointestinal bleeding secondary to portal hypertension. American College of Gastroenterology Practice Parameters Committee. *Am J Gastroenterol* 1997; **92**: 1081-1091
6 **Avgerinos A**, Armonis A, Manolakopoulos S, Poulianos G, Rekoumis G, Sgourou A, Gouma P, Raptis S. Endoscopic sclerotherapy versus variceal ligation in the long-term management of patients with cirrhosis after variceal bleeding. A prospective randomized study. *J Hepatol* 1997; **26**: 1034-1041
7 **Saeed ZA**, Stiegmann GV, Ramirez FC, Reveille RM, Goff JS, Hepps KS, Cole RA. Endoscopic variceal ligation is superior to combined ligation and sclerotherapy for esophageal varices: a multicenter prospective randomized trial. *Hepatology* 1997; **25**: 71-74
8 **Saeed ZA**. The Saeed Six-Shooter: a prospective study of a new endoscopic multiple rubber-band ligator for the treatment of varices. *Endoscopy* 1996; **28**: 559-564
9 **Abbas Z**. Reloading of the variceal multiple-band ligator using haemorrhoidal banding apparatus. *J Pak Med Assoc* 2000; **50**: 285-286
10 **Grace ND**. Diagnosis and treatment of gastrointestinal bleeding secondary to portal hypertension. American College of Gastroenterology Practice Parameters Committee. *Am J Gastroenterol* 1997; **92**: 1081-1091

11 **Zoli M**, Merkel C, Magalotti D, Marchesini G, Gatta A, Pisi E. Evaluation of a new endoscopic index to predict first bleeding from the upper gastrointestinal tract in patients with cirrhosis. *Hepatology* 1996; **24**: 1047-1052
12 **Jutabha R**, Jensen DM. Management of upper gastrointestinal bleeding in the patient with chronic liver disease. *Med Clin North Am* 1996; **80**: 1035-1068
13 **Soehendra N**, Binmoeller KF. Is sclerotherapy out? *Endoscopy* 1997; **29**: 283-284
14 **Goldschmiedt M**, Haber G, Kandel G, Kortan P, Marcon N. A safety maneuver for placing overtubes during endoscopic variceal ligation. *Gastrointest Endosc* 1992; **38**: 399-400
15 **Hoepffner N**, Foerster E, Menzel J, Gillessen A, Domschke W. Severe complications arising from oesophageal varix ligation with the Stiegmann-Goff set. *Endoscopy* 1995; **27**: 345
16 **Stiegmann GV**, Goff JS, Michaletz-Onody PA, Korula J, Lieberman D, Saeed ZA, Reveille RM, Sun JH, Lowenstein SR. Endoscopic sclerotherapy as compared with endoscopic ligation for bleeding esophageal varices. *N Engl J Med* 1992; **326**: 1527-1532
17 **Lo GH**, Lai KH, Cheng JS, Hwu JH, Chang CF, Chen SM, Chiang HT. A prospective randomized trial of sclerotherapy versus ligation in the management of bleeding oesophageal varices. *Hepatology* 1995; **22**: 466-471

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