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Lower Oesophageal Sphincter Pressure Changes After Treatment of Bleeding Varices by Devascularization and by Sclerotherapy

MOHAMED S. HAFEZ, M.D.; MOSTAFA A. SOLIMAN, M.D.;
NADER A. ABULATA, M.D., F.R.C.S. and
YASSIN M. YASSIN, F.R.C.S.

The Departments of Surgery, Faculty of Medicine, Cairo University and Military Medical Academy.

Abstract

This prospective controlled study included 3 groups of 20 patients each. The first group (G.A.) were apparently healthy volunteers. The second and third groups (G.B. & G.C.) were patients with bleeding oesophageal varices treated by elective splenectomy-devascularization operation and by elective, chronic, endoscopic sclerotherapy, respectively. Lower oesophageal sphincter (LES) pressure and oesophageal motility pattern were performed to the control group and to the two treatment groups before and 2 months after therapy. The surgery and the repeated ethanolamine oleate injections resulted in minimal changes in the oesophageal manometric tracing. The LES resting and closing pressures were not affected. The mean relaxation time in both groups did not change and was comparable to that of the control group. In G. (B) incomplete relaxation was noticed in 3 patients postoperatively compared to one preoperatively. Prolonged relaxation occurred in 3 patients compared to none and incoordination occurred in 7 compared to 2. These changes, however, were statistically insignificant. In G. (C), 4 patients showed incomplete relaxation compared to none in the presclerotherapy assessment. Five patients recorded incoordinated LES response compared to one. These abnormalities were also of no statistical significance. In G. (C) also sclerotherapy resulted in increased frequency of tertiary, secondary and spontaneous non-propulsive peristalsis in most patients (90%). However, these abnormal contractions did not take a special pattern. They were not associated with dysphagia, and the upper endoscopies were free. Nevertheless, further studies by pH monitoring, oesophageal radionucleotide scan and neuro-histopathology are recommended. As a side issue in this study, the LES resting and contraction pressures in oesophageal varices groups were significantly lower than the control group.

Introduction

THE lower oesophageal sphincter (LES) plays an important role in the prevention of gastroesophageal reflux [1,2]. Acid clearance of the oesophagus is the role of the peristalsis, aided by gravity [3]. Both functions are directly related to the integrity of the oesophageal muscles, and possibly to the intact nerve supply.

Bleeding oesophageal varices is the commonest form of upper gastro-intestinal haemorrhage in Egypt [4-7]. Many surgeons are directed increasingly at local therapeutic procedures [8,9]. Splenectomy and gastro-esophageal devascularization is the most prevalent operation practised in Egypt for the control of this condition [10]. Endoscopic injection sclerotherapy has also gained a very widespread acceptance, being the only non-surgical method that can eradicate the varices [11-14].

As a matter of fact, it is the only practical therapeutic option for patients unfit for surgery.

Since the operation of splenectomy and devascularization involves potential trauma and denervation to the lower oesophagus, functional changes are expected to occur. Chronic injection sclerotherapy, whether by the perivariceal or the intravariceal technique, results in progressive fibrosis of the lower oesophagus, which may interfere with the LES motility.

The aim of this work it to study the LES pressure and motility pattern changes after splenectomy and devascularization, and after a curative course of endoscopic injection sclerotherapy, in patients with bleeding oespohageal varices. The pre- and post-therapy results will be also compared with a control group of normal volunteers.

Patients and Methods

The study included 3 groups of 20 patients each. The patients were admitted and treated in Kobry Al-Kobba General Melitary Hospital and Kasr Al-Aini Hospital.

A. *Control Group*: This included 20 volumteers admitted for minor surgical procedures. Otherwise they were apparently healthy. They were not complaining of dyspepsia or heartburn. They were not bilharzial and not cirrhotic. They had normal barium meal and upper endoscopic findings. They were studied for their LES pressures and oesophageal motility pattern for comparison with the two therapeutic groups.

B. *Surgery Group*: They were 20 patients with bleeding oesophageal varices, who were found fit for elective splenectomy and devascularization operation.

C. *Sclerotherapy Group*: They were 20 patients with bleeding oesophageal varices treated by elective endoscopic injection sclerotherapy.

The patients with oesophageal varices, after the full clinical examination, were subjected to the investigations necessary for their condition. Patients who presented in active bleeding were resuscitated and treated conservatively by medical supportive measures and glypressin. For those who needed tamponade therapy by Sengstaken-Blakemore tube, the study was conducted, at least, one month after that. Manometric study of the oesophagus was performed preoperatively (group B) and before starting injection sclerotherapy (group C). It was repeated 2 months after surgery and 2 months after obliteration of the varices by sclerotherapy.

The manometric study was done using an open tip, tri-lumen, proximal transducer, continuously water perfused catheter system (Lectromed). The apparatus consists of:

1. A thin-walled, polyvinyl catheter containing 3 tubes. Each tube has an internal diameter of 0.3 cm, and ends with a 0.3 cm lateral opening. The openings are 5 cm apart, and are radially oriented at 120° to each other.
2. A long term, low rate, triple syringe perfusion pump.
3. Three electromagnetic, pressure transducers.
4. A mercury-in-rubber, swallow transducer.
5. A chest respiration transducer.
6. A thermographic recorder which compliﬁes x 6, and is connected to the 5 transducers.

The nature of the procedure was explained to the patients. They were instructed to stop all medications 24 hours before the test, and to fast 12 hours. The catheter was passed through the nose while the patient was sitting. It was pushed until all the 3 openings were inside the stomach. The proximal ends of the tubes were connected to the corresponding transducers, which were placed at the level of the midaxillary line. The mercury-in-rubber swallow transducer was placed around the neck over the Adam's apple. The belt of the chest respiration transducer was fixed around the patient's upper abdomen.

While the patient was supine, the perfusion pump was switched on, and the recorder was adjusted. The catheter was then slowly withdrawn until the LES was located. The latter was examined first by the most proximal channel, and thereafter by the next 2 channels. After the LES had been satisfactorly assessed, the catheter, was pulled at 1 cm intervals, so that the body of the oesophagus could be studied. During the whole procedure, the patient was asked to swallow one or more times at each interval.

The study emphasized on the LES resting, relaxation and contraction pressures, as well as the relaxation time. The coordination between the oesophageal body per-

istalsis and the response of the LES, essentially with swallowing was also noticed. Any artifact such as retching sneezing or talking was noted on the recording as they occur.

The technique of splenectomy and devascularization was standardized to all group B patients [15,16], with the modification that, on the lesser curvature, a highly selective type of vagoligation was adopted preserving the nerves of Laterjet.

The endoscopic injection sclerotherapy in group C followed the intravariceal technique [17]. Injection was done through a flexible fiberoptic endoscope. A bolous of 3 - 8 ml of 5% ethanolamine oelate was injected into each varix, commencing at the lower ends of the variceal columns. An average of 5 ml of the sclerosant was injected in each venepuncture, with a maximum of 20 ml in all. Reinjection was performed weekly for a maximum of 3 sessions. Further sessions were carried out at one-month intervals, so long that, there were residual varices. Earlier or additional injections were done in cases of rebleeding. Once endoscopy revealed that the varices had been eradicated, then manometric study of the oesophagus was arranged to be done 2 months after the last injection session. Follow up endoscopy was carried out every 6-12 months.

Results

1. *The control Group (Group A) :*

The twenty control subjects were all males, aged between 23 to 41 years, with an average age of 25.6 years. They had a mean resting LES pressure of 20.00 ± 3.71 mm Hg. The mean post-deglutition relaxation pressure was 0.0 ± 5 mm Hg. Mean maximum contraction pressure was 44.10 ± 6.13 mm Hg. The mean relaxation time was 7.10± 2.12 seconds. They all had coordinated manometric pattern (Table 1).

2. *The surgery Group (Group B) :*

The twenty patients were all males. Their ages ranged between 20 and 40 years. The average age was 27.4 years, which was statistically comparable with the control group.

The preoperative mean resting LES pressure was 12.80 ± 6.58 Hg, which was significantly lower than the control group ($p < 0.05$). The relaxation was complete (< 5 mm Hg) in all, except one patient (5%), with insignificant difference from the control group. The mean post-deglutition closing pressure was 25 ± 10.66 mm Hg, which was significantly lower than the control group ($p < 0.05$). The mean relaxation time was 6.30 ± 2.10 seconds, which was comparable to the control group. There was incoordination in the LES relaxation-contraction with swallowing in 2 patients (10%), but without statistical difference from the control (Table 1 & 2).

The post-operative oesophageal manometric studies done 2 months after splenec-

tomy-devascularization revealed 12.05 ± 6.78 mm Hg mean resting LES pressure and 24.50 ± 12.33 mm Hg mean contraction pressure. The figures were rather similar to the preoperative values. Three patients recorded incomplete relaxation (15%) comparing to one preoperatively; an insignificant difference. Although 3 patients (15%) showed prolonged relaxation post-operatively, the mean relaxation time remained comparable to the preoperative time and the control group time (7.55 ± 2.38). The incidence of prolonged relaxation was also insignificant. There were 7 cases (35%) of incoordinated LES reaction with peristalsis, which still was not statistically higher than the preoperative incidence (10%), but it was significantly higher than the control group (Table 1- 2). The computer did not suggest correlation between the three abnormal findings, namely incomplete relaxation, prolonged relax/ *ation and incoordination. These disorders were distributed in 9 patients (45%).

3. *The Sclerotherapy Group (Group C) :*

This group included 20 male patients. The average age was 39.6 years (range 29-55 years), which was statistically higher than the control group ($p < 0.05$). The 20 patients received a total of 71 injection sessions. The range was between 2 and 7 sessions and the average was 3.55 sessions per patient.

Before commencing sclerotherapy, the mean resting LES pressure was 13.00 ± 6.16 mm Hg, and the mean closing pressure was 24.20 ± 11.11 mm Hg. Both were significantly lower than the control value ($p < 0.05$). Relaxation was complete in all patients. The mean relaxation time was 7.90 ± 3.50 seconds, with one patient showing prolonged relaxation; an insignificant difference from the control. There was incoordination in relaxation of the LES in one patient, which was also insignificant (Tables 1 & 2).

Two months after completion of injection sclerotherapy, the mean values of the resting and closing pressure of the LES did not change appreciably. They became 12.70 ± 5.99 mm Hg and 23.75 ± 14.06 mm Hg respectively. Relaxation became incomplete in 4 patients (20%), but still without statistical difference. The mean relaxation time did not change much (7.70 ± 2.80 seconds), and prolonged relaxation remained confined to one patient. Incoordination of the LES was recorded in 5 patients (25%) instead of one. This was not a significant change, but the incidence (25%) was significant in comparison to the control group. The LES disorders occurred in a total of 8 patients (40%) (Tables 1 - 2).

The post-sclerotherapy oesophageal manometry showed also increased frequency of the abnormal oesophageal body peristalsis. There were increased tertiary waves in 10 patients (50%), secondary waves in 9 patients (45%) and spontaneous non-propulsive contractions in 7 patients (35%). The high rates of these abnormal

Table (1): The Man LES Resting and Closing Pressures and the Mean LES Relaxation Time in the Control Group and in the Two Treatment Groups Before and After the Therapy.

The Mean LES	Control G. (G. A)	Surgery G. (G. B)		Sclerotherapy G. (G. C)	
		Before	After	Before	After
Resting pressure (mm Hg)	20.00 ± 3.71	12.80 ± 6.58	12.50 ± 6.78	13.00 ± 6.16	12.70 ± 5.99
Closing pressure (mm Hg)	44.10 ± 6.13	25.10 ± 10.66	24.50 ± 12.33	24.20 ± 11.11	23.75 ± 14.06
Relaxation Time (seconds)	7.10 ± 2.12	6.30 ± 2.10	7.55 ± 2.38	7.90 ± 3.50	7.70 ± 2.80

Table (2): The Abnormal LES Relaxation and Coordination in the Control Group and in the Two Treatment Groups Beffore and After the Therapy.

The Abnormal Motility of the LES	Control G. (G. A)	SurgeryG. (G. B)		Sclerotherapy G. (G. C)	
		Before	After	Before	After
Incomplete Relaxation	-	1	3	-	4
Prologed Relaxation	-	-	3	1	1
Incoordination	-	2	7	1	5

waves were observed in 18 of the 20 patients (90%).

Discussion

The abdominal oesophagus receives symphathetic fibers from the coeliac ganglion and parasympathetic innervation by the vagal trunks. The latter is of central importance in the control of oesophageal motor activity [18]. Khan [19] suggested that the response of the LES to an increase in the intraabdominal pressure is mediated

through a vagal reflex. Besides, Goyal [20] testified that relaxation of the LES is mediated by purinergic motor fibers carried in the vagus.

The changes in the LES after splenectomy-devascularization, in this trial, were not marked. As a matter of fact, there was no change in the maximum resting or contraction pressure. The same result was reported by Ancona et al [21] after the much more aggressive Sugiura operation [22]. On the contrary, Spence et al. [23] found significant decrease in the LES resting and contraction pressures after the same procedure. To the best of our knowledge, there are no published reports after the Egyptian splenectomy and devascularization operation.

In the present study, after surgery, there was, however, an increased incidence in the abnormal relaxation of the LES, in the form of incomplete relaxation (15%), prolonged relaxation (15%) and incoordination (35%). Spence et al. [23] who had similar findings after Sugiura operation, accused the fibrosis of the stappling anastomosis. In our series, oesophageal fibrosis cannot be a sufficient explanation, because it is not expected to be pronounced without oesophageal transection. Another possible cause for these relaxation defects of the LES is affection of the function of the autonomic nerve supply. These postulations, however, are lacking objective proof. The explanation, interpretation and clinical relevance of these changes need further studies and prolonged follow-up. Neverthless it is important to reemphasize that these changes were statistically insignificant.

The perivariceal injection sclerotherapy of the oesophageal varices aims at creation of mucosal, submucosal and perivenous fibrosis. It is very likely, that an inadvertent deeper injection induces fibrosis of the musculosa as well [24, 25]. The aim of the intravariceal injections is to occlude and obliterate the varices. It seems, however, that inevitably an amount of the sclerosant leaks out of the vein, or is virtually injected outside [12, 26, 27].

This extravasation serves by causing fibrosis in the same principle as in the deliberate paravariceal sclerotherapy.

With repeated injections, progressive fibrosis develops, and it may affect the oesophageal motility. Ogle et al. [28] were the first to publish a study on this subject. They noticed reduction in both the resting and closing LES pressures. They reported also impaired acid clearance, without increased gastro-esophageal reflux. On the contrary, others [29-31] fount that the LES pressure had not been affected by sclerotherapy. Though, they reported abnormalities in the oesophageal body motility and impaired acid clearance.

This work corroborated the results of most of the previous studies in two points. First, after sclerotherapy there was no change in the LES pressure. Second, there

was increase in the frequency of the abnormal peristalsis in 90% of the patients. These were non-propulsive waves, secondary waves and tertiary waves. The importance of these abnormal contractions is not clear. They occur with variable frequency in normal individuals. They can be induced by swallowing. They increase in different situations including irritability [32, 33]. On the other hand, as mentioned above, in many studies, they were associated with impaired acid clearance. In the present study they did not show any specific pattern. The affected patients were not suffering from dysphagia. They did not have detectable oesophagitis or oesophageal stricture. Neverthless, acidity study of the oesophagus was not done, and there was no adequate long-term follow up.

Other changes noticed in the post-sclerotherapy patients in this series were incoordination in 25% and incomplete relaxation in 20%, but with statistical insignificance. In previous similar studies, significant increase in incoordination was reported by Soderlund et al. [31] and incomplete relaxation by Bretagne et al. [34].

Since fibrosis is the main chronic adverse effect of sclerotherapy, it will be the first suspected cause of any oesophageal motility changes. Neverthless, destruction of any of the intrinsic oesophageal nervous elements by the irritant sclerosant is another possible etiology. This postulation is supported by the fact that rather similar disorders were recorded in the postoperative group. Again the exact offending cause, the pathogenesis and the practical implications of these changes require further investigations and prolonged follow up. Oesophageal radionucleotide scan and neuro-histopathology may ahead the list.

As a side issue in this study, the maximum resting and closing pressures of the LES were significantly lower in the patients with history of bleeding oesophageal varices than the normal control group. This finding supports the hypothesis displayed by Miskowiak [35], linking the mechanism of variceal formation and bleeding to the LES pressure. He proposed that, since the venous drainage of the mucous and submucous veins of the lower oesophagus pass through the muscle coat, the tone in the LES may therefore be influential. The rationale of this theory and its applications are, however, outside the domain of this work.

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