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ORIGINAL ARTICLE

Long-term manometric study of anal sphincter function after hemorrhoidectomy

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Abstract
Background and aim Data on maximum resting pressure (MRP) and maximum squeeze pressure (MSP) changes after hemorrhoidectomy are not univocal and follow-up of patients undergoing surgery is mostly short-lived. The aim of this study was to prospectively examine during 1-year follow-up the long-term manometric results of MRP, MSP, and ultra slow wave activity (USWA) within a set of patients undergoing Milligan–Morgan hemorrhoidectomy as compared to healthy controls.
Materials and methods Twenty patients with hemorrhoids of third and fourth degree were enrolled and anorectal manometry was performed preoperatively, on the 5th day, and after 1, 6, and 12 months after surgery.
Results On the 5th and 30th day after hemorrhoidectomy, USWA was slightly increased as compared to preoperative status. Six and 12 months after surgery, patients with USWA were significantly less in comparison to preoperative assessment without differences with healthy subjects. After surgery, MSP values were not significantly different to baseline values. On the 5th postoperative day after hemorrhoidectomy, MRP was significantly greater than baseline preoperative values. Thirty days after surgery, MRP values were similar to those detected preoperatively, but still significantly increased as compared to healthy subjects. After 6 and 12 months, MRP values were significantly lower than those detected during preoperative phase and comparable to healthy subjects.
Conclusions Our data support that Milligan–Morgan hemorrhoidectomy induces a complete resolution of typical manometric alterations of disease and that the excision of anal cushions is responsible only for mild and transient alteration of anal continence.

Keywords Hemorrhoidectomy · Maximum resting pressure · Ultra slow waves activity

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Introduction

Hemorrhoids are normal structures constituted by connective tissue cushions surrounding direct arterovenous communications between terminal branches of rectal arteries and veins [1]. The term of hemorrhoids usually identifies signs and symptoms following distal displacement of anal cushions caused by fragmentation and degenerative changes in the submucosal tissue of the anal canal. The cushions serve as a conformable plug to ensure complete closure of the anal canal and contribute approximately to the 15–20% of maximum resting pressure (MRP) [2]. Several studies have shown an elevation of MRP and increased ultra slow waves activity (USWA) in patients with hemorrhoids when compared with controls [3]. On the contrary, data regarding maximum squeeze pressure (MSP) are conflicting [3]. Moreover, it is not clear whether elevated resting pressure is caused by or due to enlarged hemorrhoids [4].

Milligan–Morgan hemorrhoidectomy is considered the most effective and safest procedure to treat third and fourth degree hemorrhoids because it is simple to perform, effective in results, and carries low incidence of immediate and long-term complications with low economical costs.[5] Published data regarding MRP and MSP changes after hemorrhoidectomy are not univocal and follow-up of patients is mostly short-lived.

The aim of this study was to prospectively examine the long-term manometric results of MRP, MSP, and USWA within a set of patients undergoing Milligan–Morgan hemorrhoidectomy matched for age and sex with control individuals, during 1 year follow-up.

Materials and methods

Twenty patients with hemorrhoids of third and fourth degree were included in this study. In all subjects, a rectosigmoidoscopy was performed before surgery and patients with concomitant anal diseases were excluded. None of them received oral antithrombotic drugs or had decompensated diabetes. No patient assumed drugs that could modify anal sphincter tone during the period of study, and subjects with previous anal operation were excluded. Every subject gave a written informed consent and the local ethical committee and the departmental internal review board approved the study.

All patients undergoing to Milligan–Morgan hemorrhoidectomy using conventional instruments for dissection and a monopolar coagulator for hemostasis. The vascular pedicle was transfixed by an absorbable suture. A Park's anal retractor was used with minimal stretching of the anus. One senior surgeon carried out all operations, on a standard anesthesiologic procedure.

Before surgery, all patients received a small volume phosphate–saline enema. During the first 2 weeks after operation, patients took variable doses of psyllium fiber. A laxative preparation (sennosides) was given orally to subjects who had not yet passed stools 3 days after surgery. Enemas, suppositories, and all rectal manipulations other than anorectal manometry were avoided. Immediately after surgery, all patients received 100 mg diclofenac intramuscular for analgesia and were instructed to take only 100 mg nimesulide tablets as requested.

In all patients, an anorectal manometry was performed preoperatively, on the 5th day, and after 1, 6, and 12 months after surgery. The anorectal manometry was carried out by a manometric sensor with 2.1 mm external diameter with four circle orifices and with a latex microballon at its extremity (Marquat C87, Boissy, St-Leger, France) connected to a polygraph (Narco, Byo-System MMS 200, Houston, TX, USA), using the station pull-through method with perfusion of normal saline with the patient lying in the right lateral position.

On manometry, MRP and MSP were defined as maximum pressure detected, respectively, on resting and after voluntary contraction, and USWA as pressure waves with frequency of less than 2/min and a amplitude greater than 25 cm H_2O.

In all patients, immediate and long-time complications (bleeding, incontinence, anal stenosis, and urinary retention) were recorded. Anal incontinence was assessed using the Pescatori grading system: A, incontinence for flatus and mucus; B, liquid stool; C, solid stool; and 1 for occasional, 2 for weekly, and 3 for daily [6]. The control group comprised 12 healthy subjects (six male, 42.3±13.4 years) previously not reported symptoms related to any anorectal diseases.

Statistical analysis

The data were analyzed by standard statistical methods and the results were expressed as means±SD. Differences between continuous data were compared using Student's *t* test for paired and unpaired samples, whereas differences between percentages were analyzed using Chi-square test. Probability values of less than 0.05 were considered significant.

Results

Age, gender, anesthesiologic grading [7], number of piles excised degree of hemorrhoids, and duration of disease are reported in Table 1. No intraoperative complications or bleeding were observed and no transfusion or reoperation was done. Postoperative course was regular in all patients.

During manometry, USWA was present only in one of 12 healthy subjects (8.3%) and in 11 of 20 patients (55%) with hemorrhoids ($p<0.01$). On the 5th and 30th day after

Table 1 Patients demographics

Variable	
Age (years)	46.3±12.9
Male/female	8/12
Anesthesiologic grading (ASA)	
I	9
II	7
III	4
Hemorrhoidal degree	
III/IV	12/8
Resected piles	3.2±0.3
Disease duration (years)	4.1±1.9

Data are means±standard deviations or number of patients

hemorrhoidectomy, one more subject showed the presence of USWA (Fig. 1). Six and 12 months after hemorrhoidectomy patients with USWA were significantly less in comparison to preoperative assessment, without differences with healthy subjects. On the 5th day, we found a strong association between highest MRP values and occurrence of USWA (Fig. 2).

In normal subjects, MRP and MSP values were 77.0±11.6 and 118.1±38.1 mmHg, respectively. Among patients, preoperative values of MRP were significantly higher (86.0±13.6, p=0.036) as compared to healthy subjects, whereas MSP values were only slightly increased (127.8±31.8, p=0.32). After surgery, MSP values were not significantly different as compared both to preoperative levels and healthy subjects (data not shown).

On the 5th day after hemorrhoidectomy, MRP was significantly greater as compared to baseline preoperative values (p=0.007) (Fig. 3). One month after surgery, MRP values were similar to those detected preoperatively, but still significantly increased as compared to healthy subjects (p=0.01). After 6 and 12 months, MRP values were significantly reduced as compared to those detected in preoperative phase (p=0.014 and p=0.016, respectively), and comparable to healthy subjects (p=0.25).

Six patients, reported anal incontinence after surgery. Among these six subjects, according to the Pescatori grading system [6], two patients were classified as A2, while four were classified as A3. Anal incontinence of any degree was short-lived and disappeared within 3 weeks from surgery. Urinary retention was observed in two patients. Stenosis, bleeding, and recurrences were never observed during the follow-up.

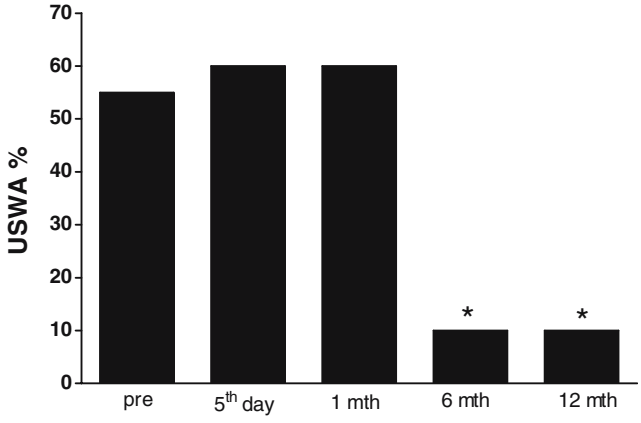

Fig. 1 Ultra slow wave activity (USWA) express in percent in patients before and after hemorrhoidectomy. Significant differences vs preoperative values: *p<0.001 Student's t test was used to compare among means

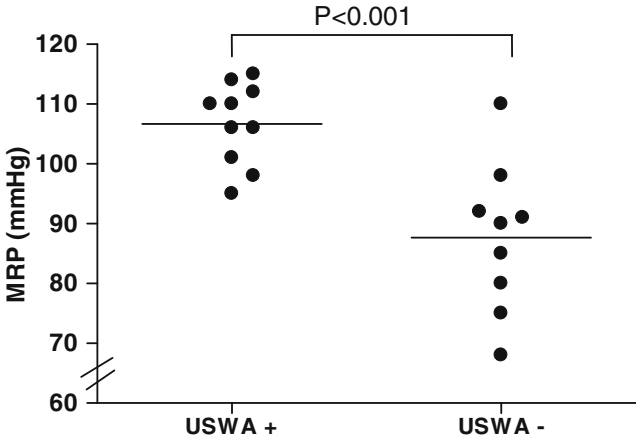

Fig. 2 Association among maximum resting pressure (MRP) on the 5th day and the presence (+) or absence (−) of ultra slow wave activity (USWA). Significant differences among USWA+ and USWA−: p<0.001 Student's t test was used to compare among means

Discussion

Hemorrhoids are symptomatic in approximately 4% of the general population and in half of American people over 50 year [8]. In spite of the great spreading of this disease, some aspects of pathophysiology of hemorrhoidal disease still remain unclear. The presence of USWA and MRP increase is the most common manometric alterations described in patients with hemorrhoids. Previous studies have demonstrated that MRP is mainly determined by anal sphincter function, while MSP is entirely attributable to external one [9]. It has been previously shown that USWA persists under anesthesia in presence of anal external sphincter paralysis and is associated with the highest anal pressure [10]. On the contrary, there is no correlation between anal manometric findings and degree of hemorrhoids or duration of related symptoms [11], whereas elevate pressure levels predispose to bleeding and prolapse of hemorrhoids [11].

It is not known if increased of MRP is cause or effect in the pathogenesis of hemorrhoidal disease. Shafik [12]

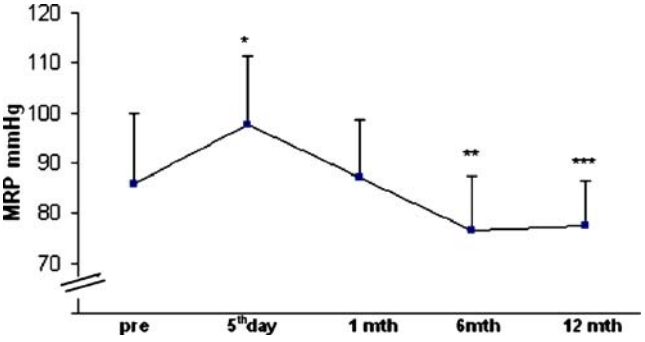

Fig. 3 Maximum resting pressure (MRP) of the anal canal before and after hemorrhoidectomy. Data are expressed as mean±SD. Significant differences vs preoperative values: *p=0.007; **p=0.014; ***p=0.016. Student's t test was used to compare among means

stated that increased basal pressure of anal canal is probably due to constricting effect of fibrous anorectal band, found on microscopic examination. Sun et al. [13] suggested that abnormal high pressures of anal canal in patients with hemorrhoids may be related to increased vascular pressure in the anal cushions. Other studies suggest that increased sphincter tone is maintained by presence of hemorrhoidal masses, possibly due to reflex tonic contraction of internal and external anal sphincter caused by its prolonged stimulation [14]. According to this findings, it has been observed that rubber band ligation are not associated with any reduction of preoperative sphincter pressure [15–17].

Data about modifications of anal pressure after hemorrhoidectomy are not univocal. In some studies with short follow-up, it has been reported that both MRP and MSP did not show significant modifications after hemorrhoidectomy [18, 19]. On the other hand, other studies reported a significant reduction of MRP and MSP values after surgery as compared to preoperative status [17, 20–23]. There are only two manometric studies that investigated anal pressure after 1 year because hemorrhoidectomy [24, 25]. In both reports, MRP values significantly decreased during the first months after operation reaching levels similar to those detected in healthy subjects. However, 1 year after surgery, the behavior MRP was different: in Read's study, MRP values remained similar to healthy subjects [25], whereas in Alper's study, it was observed that a progressive increase of pressure, significantly reduced as compared to preoperative values, but significantly increased as respect to healthy subjects [24]. These authors suggested that MRP reduction, soon after surgery, was related to anal stretching caused by use of bivalve retractor [24], whereas the progressive rise after 1 year was due to healing process of damaged anal sphincter. Although relationships between recurrent disease and elevation of resting pressure after long-term follow-up are fully understood, elevated pressure after 1 year reflects the recurrence of basic pathophysiology of hemorrhoids [24].

The results of our study has clearly shown that MSP is slightly increased in patients with hemorrhoids and was not modified after hemorrhoidectomy. On the contrary, MRP is significantly increased in patients affected by hemorrhoids; after 5 days from surgery, pressure values further increased but they declined during 1 year follow-up reaching levels similar to those detected in healthy subjects.

In similar way it has been observed in patients with hemorrhoids an elevated USWA that significantly decreased after hemorrhoidectomy reaching values similar to healthy subjects, suggesting a possible relationship with increased MRP [21]. The temporary reduction of postoperative sphincter tone, as we obtained with the intrasphincter injection of botulinum toxin [26], and with the topical application of 0.2% glyceryl trinitrate ointment [27], seems to be useful because it accelerates wound healing and induces postoperative pain reduction either on resting and during defecation.

In conclusion, our data support that Milligan–Morgan hemorrhoidectomy induces a complete resolution of typical manometric alterations of disease and that the excision of anal cushions is responsible only of mild and transient alteration of continence. Further studies are necessary to clarify the mechanisms that vicariate the function of anal cushions.

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