Stapled haemorrhoidopexy for the treatment of haemorrhoids: a review of our experience

Wiesław Pesta[1], Adam Wirkowski[2], Krzysztof Leksowski[3, 4]

[1]Clinical Department of General and Miniinvasive Surgery, Olsztyn University Hospital
[2]Department of General and Minimally Invasive Surgery, John Paul II Hospital of Bartoszyce
[3]Department of General, Thoracic and Vascular Surgery, Military Clinical Hospital of Bydgoszcz
[4]Chair of Public Health, Nicolaus Copernicus University of Toruń, *Collegium Medicum* of Bydgoszcz

Videosurgery and other miniinvasive techniques 2009; 4 (4): 147-153

Abstract

Introduction: *There have been a great number of articles published on the method of treatment for haemorrhoid disease with a circular stapler introduced by Longo. However, there are very few studies devoted to assessment of this procedure in the Polish literature.*
Aim: *To perform a retrospective evaluation of early and long-term results of surgical treatment with a circular stapler for haemorrhoid disease.*
Material and methods*: The study involved 141 patients operated on with a circular stapler for haemorrhoid disease (Longo's method): 69 (48.9%) were women and 72 (51.1%) men, aged from 25 to 75 (49.9 years old on average). The follow-up time from the surgery ranged from 1 to 6.7 years (mean 3.8 years).*
Results: *Complications occurred in 33 patients (23.4%) intra-operatively, in 10 (7.5%) during the early post-operative period, and late complications developed in 14 patients (9.9%). Seven patients (5.0%) required re-intervention mucoprolapsectomy after primary Longo's method operation. On the day of surgery 12 patients (8.5%) did not need any analgesics, 98 patients (69.5%) required only 1-4 doses of non-steroidal anti-inflammatory drugs (NSAIDs) and 43 (30.4%) needed additional weak opioids. None of the patients demanded analgesics from the fifth day on. Duration of hospitalization after the surgery ranged from 2 to 9 days, an average of 3.6 days. Time to return to normal activities of life ranged from 1 day to 4 weeks and averaged 10.8 days. The result of the treatment was assessed as very good or good in 127 patients (90.1%), sufficient in 6 patients (4.3%), and inadequate in 8 patients (5.7%).*
Conclusions: *Longo's method can be recommended for surgical treatment of haemorrhoid disease, and provides both short- and long-term satisfactory results.*

Key words: *haemorrhoids, haemorrhoidectomy, Longo procedure.*

Introduction

Haemorrhoid disease is a common ailment, which constitutes a serious clinical and social problem, especially in countries having a significant level of development. According to various sources it affects 4.4% of the USA population and 36.4% of the UK. In general, it is estimated that 5% of the population suffers from the disease, yet only 1/3 of patients seek examination and medical advice [1].

In the literature, there are many notions describing and comparing the effects of various surgical methods of treatment for haemorrhoid disease. This includes the broadly discussed method involving circular stapler

Address for correspondence:
Wiesław Pesta, MD, 30 Warszawska Avenue, 10-081 Olsztyn, phone +48 503 15 44 83, fax +48 89 542 32 34,
e-mail: wieslaw.pesta@vp.pl

application, introduced in 1998 by A. Longo. However, in Polish literature such data are scarce.

Aim

Retrospective assessment of early and long-term results of surgical treatment of haemorrhoid disease with a circular stapler was the aim of this analysis.

Material and methods

In the Department of General and Minimally Invasive Surgery of John Paul II Hospital between June 2001 and December 2006, one hundred and sixty-three patients were operated on with Longo's method for haemorrhoid disease. Data concerning the pre-operative period and hospital stay were obtained from the medical records. The post-hospital part of the study was questionnaire-based (Table I). Answers to questions from the questionnaire were noted while meeting the patient in person, which allowed all of the questions to be answered. Twenty-two patients were excluded from the study due to non-consent, lack of address data or death. Finally, 141 patients were analyzed, including 69 women (48.9%) and 72 men (51.1%) aged 25-75 years (mean 49.9). Time lag from the surgery was 1-6.7 years (mean 3.8 years). Admission of 121 patients (91.5%) was scheduled, while 12 patients (8.5%) needed emergency hospitalization. The cause of hospital admission was lower GI tract bleeding and/or secondary anaemia irresponsive to ambulatory treatment in 11 patients and strangulation of stage 4 haemorrhoids in one patient. Prior to the surgery, all patients underwent endoscopy, which revealed anal fissure, rectal polyp, sigmoid diverticula

Table I. Questionnaire form

Questionnaire

Data:

First and last name . . . . . .

Sex: ☐ Woman ☐ Man Age . . . . . .

Occupation/ lifestyle

1. How long after the surgery did it take you to resume normal living activity?

. . . . . .

2. Have you had any other surgery after having the Longo operation?

☐ No ☐ Yes, if yes:

What kind? . . . . . .

When? . . . . . .

For what cause? . . . . . .

3. Do you suffer from any ailment which you attribute to the Longo procedure?

☐ No ☐ Yes

If yes, please specify:

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

4. How would you rank the result of your Longo procedure?

Very good ☐ Good ☐

Satisfactory ☐ Unsatisfactory ☐

and sigmoid polyp in 9 patients (6.4%). One hundred and thirty-two patients (93.6%) were operated on under spinal anaesthesia. The remaining 9 (6.4%), for spinal column disorders, received local anaesthesia with 1% lidocaine and intravenous sedation. To avoid the risk of anal sphincter injury, no divulsion was made before introduction of an anoscope. A disposable single use PPH-33 stapler was applied in the first 42 patients, while in 112 patients a multiple-use EEA-31 stapler was used. No anal setonage or drainage was necessary after the surgery.

Results

One hundred and sixteen (82.3%) patients suffered from some concomitant disease. Most often, these were arterial hypertension, chronic venous insufficiency and peptic ulcer disease. Lifestyle was determined from the patient's current occupation and information provided and was classified as active in 60 (42.5%) and sedentary in 81 patients (57.5%). Body mass index ranged from 19 to 44 kg/m^2 (mean 27.2 kg/m^2). Duration of symptoms, according to the patient, ranged from 3 months to 50 years (mean 9.5). Periodic bleeding from the anus was the most common manifestation and occurred in 120 patients (85.1%). Anal discomfort described as itching and/or burning occurred in 115 patients (81.6%) and prolapse of the haemorrhoids on defecation, cough or forced exercise in 114 patients (80.9%). Altered defecation rhythm with constipation or alternating constipation/diarrhoea was present in 89 patients (63.1%). None of the patients suffered from faecal incontinence, yet 43 patients (30.5%) had temporary involuntary flatus. Difficulty in maintaining hygiene of the perianal region with soiling of underwear occurred in 109 patients (77.3%). Duration of the procedure from beginning of preparation of the operative field until placement of the wound dressing ranged from 10 to 60 min (mean 18.7 min). Intraoperative complications occurred in 33 patients (23.4%). In 24 patients (17%) it was haemorrhage, and incomplete excision of the full mucosa-submucosa circle in 9 (6.6%). Early post-operative complications – bleeding from staple lines – occurred in 10 patients (7.5%). Late complications occurred in 14 patients (9.9%) from the study group (Table II). Further surgery after the Longo procedure was necessary in 7 patients (5%), including 4 for recurrence of the disease, 2 for thrombosis and 1 for anal stricture.

Twelve patients (8.5%) did not need any analgesics, 98 (69.5%) required 1-4 doses of non-steroid anti-inflammatory drugs and 43 (30.4%) needed additional weak opioids. None of the patients required analgesia from the 5thpost-operative day on.

Total hospitalization time was 3 to 14 days (average 5.6 days). Causes of prolonged hospitalization, apart from postoperative complications, were concomitant diseases or necessity to extend pre-operative diagnostics. Hospital stay after the surgery (from the day of surgery until discharge) ranged from 2 to 9 days (mean 3.6 days). Resuming normal life activity took between one day and 4 weeks (average 10.8 days). Result of the therapy was assessed as good or very good by 127 patients (90.1%), satisfactory by 6 patients (4.3%) and unsatisfactory by 8 patients (5.7%).

Discussion

Many years have already passed since Prof. Longo published his primary results at the 6thWorld Congress of Endoscopic Surgery in Rome in June 1998. His

Table II. Late complications in patients operated on for haemorrhoid disease with Longo method

Complication	No. of patients	Time from surgery
Anal stricture	1 (0.7%)	14 days
External plexus thrombosis	3 (2.1%)	1 patient after 30 days and 2 patients after 60 days
Pain and urgent tenesmus	2 (1.4%)	For 14 days after surgery
Anal bleeding	3 (2.1%)	For 4 weeks after surgery
Gas incontinence	1 (0.7%)	For 7 days
Recurrence of the disease	4 (2.8%)	1 patient after 4 months, 2 patients after 9 months, 1 patient after 10 months

method has inspired vivid discussion since the very beginning. Many articles evaluating the results of stapled mucoprolapsectomy and comparing them with results obtained with other methods have been published in world literature. The majority of these papers show an advantage of Longo's method over traditional procedures, yet critical reports can also be found [2-11]. A widely accepted algorithm reserves operative treatment for the 3rd and 4th stage of haemorrhoid disease, recurrent disease and failure of treatment with other methods. Application of the Longo procedure in stage 2 disease remains controversial [12-15]. In the presented material patients with 2nd degree haemorrhoids operated on with Longo's procedure were unsuccessfully treated with conservative methods and chose this method from various surgical options offered, counting on a permanent solution to the problem. Acute haemorrhoid syndrome is considered a contraindication to surgery independent of the method due to the risk of complications [16]. There are, however, authors who think early surgical treatment ought to be undertaken [11]. Acute conditions in haemorrhoid disease are an indication for surgery according to 36.4% of Polish physicians [1]. In one of the presented patients admitted for strangulated stage 4 haemorrhoids, surgery was performed after previous conservative treatment and resolution of acute symptoms, which allowed a precise and safe procedure to be conducted. According to the questionnaire data obtained in 2004 from physicians involved in operative treatment of haemorrhoid disease, 11.7% of them use perioperative antibiotic prophylaxis and another 24.6% administer metronidazole [1]. In the presented material no antibiotic prophylaxis was given. We assumed that the acknowledged rarity of infectious complications of the surgical site does not justify such prophylaxis and preparation of the lower GI tract seems sufficient. This can be confirmed by the fact that none of our patients developed infectious complications, either local or generalized.

The most frequent intraoperative complication of stapled haemorrhoid surgery is bleeding from the suture line. It occurs in 36-66.5% of patients and is a result of imperfection of the mechanical suture, which is not always completely tight. This bleeding is usually insignificant and requires only placement of additional haemostatic sutures. Cases of significant bleeding are rarely described and call for blood transfusion in the post-operative course [17-20]. Our data confirm these observations. Only one patient suffered from massive bleeding from the mucosa-submucosa circle excision without simultaneous suturing of the tissue due to stapler failure. The bowel was anastomosed with interrupted suture and the patient did not require blood transfusion. Another intraoperative complication could be incomplete resection of the tissue ring due to inappropriate placement of the circular suture. Finally, blood flow into the internal haemorrhoidal plexus in the whole circumference is not reduced and does not cause effective pulling of haemorrhoids into the anal canal. Hence, the result of the surgery is incomplete. Placement of additional traction suture allows this complication to be avoided and is especially indicated in the 4thstage of the disease, where the size of the operative field can be very limited [1].

According to the original conception of Longo's method, this procedure does not have to be painful, as the surgery is performed within an area innervated autonomically, not somatically. Various figures can be found in the literature on occurrence of pain in the immediate post-operative period, from 45 to 100%, with severe pain ranging from 2.3 to 12% [20-25]. All authors agree that the extent of the pain is less and that the pain lasts shorter than after traditional surgery [4, 6, 7, 10, 26, 27]. As this study is purely retrospective, reliable assessment of post-operative pain with application of any scale was impossible, based on anamnesis taken a few years after the surgery. Due to the aforementioned limitations, we measured the extent and duration of pain with type, amount and time of administered analgesic drugs. The greatest need for painkillers was noted on the day of surgery. During the following days, both type and amount of these drugs were visibly reduced. The high percentage of patients who received narcotic drugs resulted from contra-indications for NSAID administration (peptic ulcer disease, GERD, hypertension). Chronic pain and painful tenesmus are additional problems. Both seem to result from poor surgical technique, i.e. from placement of circular suture too close to the dentate line, which occurred in the analyzed group.

Hospital stay is another factor used for assessment of various surgical methods. Shortening of the patient's hospital stay brings an economic benefit, and performing surgery in a one-day surgery scheme is a perfect advertisement for any method.

In some accounts Longo's procedure is described as one-day or ambulatory surgery [15, 16, 21, 23, 25, 28]. However, the one-day regimen seems feasible only in selected patients operated on with Longo's method. Considering the reality of our public health service functioning, one must remember that patients admitted to the hospital are not always completely diagnosed, with other causes of symptoms not excluded, especially large bowel tumour, and that in such cases no fast and perfect diagnosis is possible. Many patients suffer from concomitant conditions, not always controlled well enough to allow surgery on the day of admittance. Mean post-operative hospitalization time in the analyzed group was longer than the average time given by other authors. The differences may derive from the aforementioned causes and from imprecise determination of post-operative hospital stay in some of these papers [7, 8, 14, 21, 22, 28, 29].

Reports on early post-operative complications are diverse. Their percentage ranges from 6.4 to 25%, on average approximately 10% [16, 19, 21, 22, 28, 30-32]. Most often they involve bleeding from the staple line or from rough tool manipulation or anoscopedamaged mucosa. They are usually benign, selfresolving and require only observation and conservative treatment. Less often they call for surgical intervention or blood transfusion [1, 6, 12, 16, 19-25, 28, 31-33]. Hence, detailed control of the staple line and – if any doubt exists – placement of haemostatic suture are necessary before the end of the procedure. Such practice does not prolong the procedure significantly and greatly reduces the risk of haemorrhage.

Late post-operative complications occur, according to the literature, in 5-12% of patients [19, 21, 30-32]. These include bleeding, remnant haemorrhoids, chronic pain, gas or faecal incontinence, urgent tenesmus, anal stricture, anal fissure, thrombosis, intramural abscess, anal fistula, rectal pocket syndrome, and remaining skin tags at the anal verge. Gas or stool incontinence occurring in 0.2-3% and anal stricture in 0.8-2% of patients operated on with Longo's technique are serious complications [6, 19, 20, 24, 25, 28, 31-34]. Gas and/or faecal incontinence is usually temporary and rarely requires surgical intervention. Too low placement of the staple line is thought to be one of the causes [34]. In some patients it can also result from excessive anal sphincter distension during various manipulations with the operative anoscope due to the limited operative field. Anal stricture in some cases is symptom free and is only found accidentally on per rectum examination or endoscopy performed for other indications. If the stricture is not very narrow, repeated dilation can be tried [33]. Rectal pocket syndrome is a complication typical for Longo's procedure, not found after classic methods [35]. It is a syndrome related to formation of an intramural crypt at the staple line level, emptying into the GI tract. Patients complain of severe pain in the anal region and leak of faecal matter. This complication was not observed in the analyzed group of patients. Recurrence of the disease after Longo's procedure occurs in 2-12% of patients, yet there are reports of 0% recurrence as well as of 25% [12, 17, 19, 20, 24, 31]. In some publications comparing the results of Longo's procedure with classical methods, higher risk of symptom recurrence after stapler application is reported (8.6 vs. 1.5%) [9, 36]. However, studies unable to show a significant difference between the two methods can also be found in the medical literature [5, 7]. When looking at these data, a certain correlation of recurrence rate and number of operated patients and follow-up time can also be detected. In small groups, where several dozen patients were analyzed, the recurrence rate was usually relatively high and was probably related to insufficient experience. Length of follow-up is naturally of crucial significance, as recurrence occurs a few months or years later, and might be seen even decades later. Only further follow-up will enable its assessment.

An important factor in the assessment of any treatment modality, especially a surgical one, is patient satisfaction analysis. An opinion given after a minimum of 12 months from the surgery could reflect patients' satisfaction with the applied treatment, with regard to their life quality. In our material, the majority of patients assessed treatment results as very good or good. A few negative ratings were given by patients who developed complications. Our results are comparable to those found in the literature [18, 32]. When comparing the results of Longo's procedure with alternative methods of haemorrhoid treatment such as Barron's method or DGHAL (Doppler guided haemorrhoidal artery ligation), we do not see objective arguments showing a clear benefit of any of these options. Regarding bleeding, i.e. the most frequent intraoperative complication, Wałęga *et al*. [37] give the rate of

17 and 10.3% after DGHAL. Early complications occurred in 7.5% of patients after Longo's and in only 3% of patients after DGHAL procedures [38, 39], including early post-operative haemorrhage in 3.45% of patients after DGHAL [37], 32% after Barron's procedure [40] and 7.5% after Longo's. Late complications were seen in 3.9% of patients after DGHAL [38, 39], and 9.9% after Longo's method. Disease recurrence following DGHAL, according to Cantero *et al.* [38] and Faucheron and Gangner [39], was 6.7%, while we observed only 2.8% after Longo's procedure. Reoperation for haemorrhage and unresolved haemorrhoids after Barron's procedure in Bernal's material [40] was necessary in 13.8% of patients. After Longo's method this ratio was only 5%. Analysis of post-operative pain definitely indicates the benefit of DGHAL according to Wilkerson *et al.* [41], with only 6 vs. 69.5% after Longo's procedure. However, as mentioned above, this may result from too low placement of the circular suture.

Longo's method is definitely not a gold standard for treatment of haemorrhoid disease, as currently no such standard exists. Nevertheless, it is an advisable alternative to other surgical methods, with satisfactory short- and long-term effects.

References

1. Tchórzewski M, Dziki A, Hebda A. Sposoby leczenia hemoroidów w Polsce. Proktologia 2004; 5: 291-300.
2. Ascanelli S, Gregorio C, Tonini G, et al. Longo stapled haemorrhoidectomy versus Milligan-Morgan procedure: short- and long-term results of a randomised, controlled, prospective trial. Chir Ital 2005; 57: 439-47.
3. Bikhchandani J, Agarwal PN, Kant R, et al. Randomized controlled trial to compare the early and mid-term results of stapled versus open hemorrhoidectomy. Am J Surg 2005; 189: 56-60.
4. Dell'Abate P, Del Rio P, Soliani P, et al. Longo hemorrhoidopexy vs Milligan-Morgan hemorrhoidectomy: perspective analysis. G Chir 2005; 26: 443-5.
5. Ganio E, Altomare DF, Milito G, et al. Long-term outcome of a multicentre randomized clinical trial of stapled haemorrhoidopexy versus Milligan-Morgan haemorrhoidectomy. Br J Surg 2007; 94: 1306-7.
6. Ganio E, Altomare DF, Milito G, et al. Prospective randomized multicentre trial comparing stapled with open haemorrhoidectomy. Br J Surg 2001; 88: 669-74.
7. Gravié JF, Lehur PA, Huten N, et al. Stapled hemorrhoidopexy versus Milligan-Morgan hemorrhoidectomy: a prospective, randomized, multicenter trial with 2-year postoperative follow up. Ann Surg 2005; 242: 29-35.
8. Kirsch JJ, Staude G, Herold A. The Longo and Milligan-Morgan hemorrhoidectomy. A prospective comparative study of 300 patients. Chirurg 2001; 72: 180-5.
9. Mattana C, Coco C, Manno A, et al. Stapled hemorrhoidopexy and Milligan-Morgan hemorrhoidectomy in the cure of fourth-degree hemorrhoids: long-term evaluation and clinical results. Dis Colon Rectum 2007; 50: 1770-5.
10. Mosca F, Consoli A, Portale TR, et al. Milligan-Morgan hemorrhoidectomy and stapled mucoprolasectomy. Clinical comparison of the results. G Chir 2005; 26: 267-74.
11. Wong JC, Chung CC, Yau KK, et al. Stapled technique for acute thrombosed hemorrhoids: a randomized, controlled trial with long-term results. Dis Colon Rectum 2008; 51: 397-403.
12. Angelone G, Giardiello C, Prota C. Stapled hemorrhoidopexy. Complications and 2-year follow-up. Chir Ital 2006; 58: 753-60.
13. Fueglistaler P, Guenin MO, Montali I, et al. Long-term results after stapled hemorrhoidopexy: high patient satisfaction despite frequent postoperative symptoms. Dis Colon Rectum 2007; 50: 204-12.
14. Hetzer FH, Schäfer M, Demartines N, et al. Prospective assessment of the learning curve and safety stapler hemorrhoidectomy. Swiss Surg 2002; 8: 31-6.
15. Lim YK, Eu KW, Ho KS, et al. PPH03 stapled hemorrhoidopexy: our experience. Tech Coloproctol 2006; 10: 43-6.
16. Trzciński R, Dziki A. Czy rzeczywiście wiemy już wszystko o hemoroidach? Proktologia 2000; 1: 7-16.
17. Basdanis G, Papadopoulos VN, Michalopoulos A, et al. A randomized clinical trial of stapled hemorrhoidectomy vs open with Ligasure for prolapsed piles. Surg Endosc 2005; 19: 235-9.
18. Habr-Gama A, e Sous AH Jr, Roveló JM, et al. Stapled hemorrhoidectomy: initial experience of a Latin American group. J Gastrointest Surg 2003; 7: 809-13.
19. Nahas SC, Borba MR, Brochado MC, et al. Stapled hemorrhoidectomy for the treatment of hemorrhoids. Arq de Gastroenterol 2003; 40: 35-9.
20. Sobrado CW, Cotti GC, Coelho FF, et al. Initial experience with stapled hemorrhoidopexy for treatment of hemorrhoids. Arq Gastroenterol 2006; 43: 238-42.
21. Beattie GC, McAdam TK, McIntosh SA, et al. Day case stapled haemorrhoidopexy for prolapsing haemorrhoids. Colorectal Dis 2006; 8: 56-61.
22. Dixon MR, Stamos MJ, Grant SR, et al. Stapled hemorrhoidectomy: a review of our early experience. Am Surg 2003; 69: 862-5.
23. Esser S, Khubchandani I, Rakhmanine M. Stapled hemorrhoidectomy with local anesthesia can be performed safely and cost-efficiently. Dis Colon Rectum 2004; 47: 1164-9.
24. Oughriss M, Yver R, Faucheron JL. Complications of stapled hemorroidectomy: a French multicentric study. Gastroenterol Clin Biol 2005; 29: 429-33.
25. Plocek MD, Kondylis LA, Duhan-Floyd N, et al. Hemorrhoidopexy staple line height predicts return to work. Dis Colon Rectum 2006; 49: 1905-9.
26. Ho KS, Ho YH. Prospective randomized trial comparing stapled hemorrhoidopexy versus closed Ferguson hemorrhoidectomy. Tech Coloproctol 2006; 10: 193-7.
27. Cheetham MJ, Cohen CR, Kamm MA, et al. A randomized, controlled trial of diathermy hemorrhoidectomy vs. stapled hemorrhoidectomy in an intended day-care setting with longer-term follow-up. Dis Colon Rectum 2003; 46: 491-7.

28. Johnson DB, Di Siena MR, Fanelli RD. Circumferential mucosectomy with stapled proctopexy is a safe, effective outpatient alternative for the treatment of symptomatic prolapsing hemorrhoids in the elderly. Surg Endosc 2003; 17: 1990-5.
29. Sutherland LM, Burchard AK, Matsuda K, et al. A systematic review of stapled hemorrhoidectomy. Arch Surg 2002; 137: 1395-406.
30. Amosi D, Werbin N, Kashtan H, et al. Stapled hemorrhoidectomy – early experience in 30 patients. Harefuah 2003; 142: 654-8.
31. Jongen J, Bock JU, Peleikis HG. Complications and reoperations in stapled anopexy: learning by doing. Int J Colorectal Dis 2006; 21: 166-71.
32. Pessaux P, Tuech JJ, Laurent B. Morbidity after stapled haemorrhoidectomy: long-term results about 140 patients and review of the literature. Ann Chir 2004; 129: 571-7.
33. Lomanto D, Katara AN. Stapled haemorrhoidopexy for prolapsed haemorrhoids: short- and long-term experience. Asian J Surg 2007; 30: 29-33.
34. Pigot F, Dao-Quang M, Juguet F, et al. Low hemorrhoidopexy staple line does not improve results and increases risk for incontinence. Tech Coloproctol 2006; 10: 329-33.
35. Pescatori M, Spyrou M, Cobellis L, et al. The rectal pocket syndrome after stapled mucosectomy. Colorectal Dis 2006; 8: 808-11.
36. Nisar PJ, Acheson AG, Neal KR, et al. Stapled hemorrhoidopexy compared with conventional hemorrhoidectomy: systematic review of randomized, controlled trials. Dis Colon Rectum 2004; 47: 1837-45.
37. Wałęga P, Krokowicz P, Romaniszyn M, et al. Doppler Guided Haemorrhoidal Arterial Ligation with recto-anal-repair (RAR) for the treatment of advanced haemorrhoidal disease. Colorectal Dis 2009 [Epub ahead of print].
38. Cantero R, Balibrea JM, Ferrigni C, et al. Doppler-guided transanal haemorrhoidal dearterialisation. An alternative treatment for haemorrhoids. Cir Esp 2008; 83: 252-5.
39. Faucheron JL, Gangner Y. Doppler-guided hemorrhoidal artery ligation for the treatment of symptomatic hemorrhoids: early and three-year follow-up results in 100 consecutive patients. Dis Colon Rectum 2008; 51: 945-9.
40. Bernal JC, Enguix M, Lopez Gracia J, et al. Rubber-band ligation for hemorrhoids in a colorectal unit. A prospective study. Rev Esp Enferm Dig 2005; 97: 38-45.
41. Wilkerson PM, Strbac M, Reece-Smith H, et al. Doppler-guided haemorrhoidal artery ligation: long-term outcome and patient satisfaction. Colorectal Dis 2009; 11: 394-400.