Clinical Outcome Following Hemorrhoid Surgery: a Narrative Review

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Abstract Surgical therapy guarantees satisfactory results, which are significantly better than those obtained with conservative therapies, especially for Grade III and IV hemorrhoids. In this review, we present and discuss the results of the most diffuse surgical techniques for hemorrhoids. Traditional surgery for hemorrhoids aims to remove the hemorrhoids, with closure (Fergusson's technique) or without closure (Milligan–Morgan procedure) of the ensuing defect. This traditional approach is effective, but causes a significant postoperative pain because of wide external wounds in the innervated perianal skin. Stapled hemorrhoidopexy, proposed by Longo, has gained a vast acceptance because of less postoperative pain and faster return to normal activities. In the recent literature, a significant incidence of recurrence after stapled hemorrhoidopexy was reported, when compared with conventional hemorrhoidectomy. Double stapler hemorrhoidopexy may be an alternative to simple stapled hemorrhoidopexy to reduce the recurrence in advanced hemorrhoidal prolapse. Transanal hemorrhoidal dearterialization was showed to be as effective as stapled hemorrhoidopexy in terms of treatment success, complications, and incidence recurrence. However,

further high-quality trials are recommended to assess the efficacy and safety of this technique.

Keywords Hemorrhoids · Surgery · Indication · Resection · Stapler

Indication to Surgery

Anal cushions are normal structural components of the anal canal, serving as a conformable plug to ensure its complete closure. Hemorrhoids should be considered pathologic when symptomatic prolapse occurs. The need for treatment is influenced by the severity of symptoms.

Surgery is the most effective treatment for hemorrhoids and is particularly recommended in prolapsing piles during defecation that may be reduced manually (Grade III) and irreducible hemorrhoids (Grade IV) [1]. Other indications to surgery are failure of nonoperative management, patient preference, and concomitant conditions (such as fissure or fistula) that require surgery. Contraindications are generally relative. Surgical option should be carefully proposed if anesthesiologic risk is high, serious hemostatic, and/or coagulative disorders are present, and the presence of anal sphincter and/or continence impairment may lead to postoperative occurrence and/or worsening of incontinence. Caution is also required if Crohn's disease is present [2].

Techniques

Numerous methods have been proposed for the surgical therapy of hemorrhoids. At present anal dilatation and lateral internal sphincterotomy, based on the hypothesis that anal sphincter hypertone was an etiologic factors contributing to

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the disease, is abandoned because of unsatisfactory results and frequent complications.

Hemorrhoidectomy, performed with various techniques, focuses on resection of both internal and external hemorrhoids and ligation of the main supplying vessels. The rationale of these procedures is based on the theory that hemorrhoids are caused by vascular hyperplasia of the arteriovenous network within the anorectal submucosa.

In 1937, Milligan and Morgan described their technique to perform surgical excision of hemorrhoids. The hemorrhoid is dissected out from the underlying anal sphincter, the vascular pedicle is ligated, and the mucosal defects are left open and allowed to granulate by secondary intention. Different instruments are available to perform excision of the hemorrhoidal tissue, including electrocautery, scissors, scalpel, laser, bipolar scissors, linear staplers, radiofrequency, or harmonic scalpel.

Ferguson's (closed) hemorrhoidectomy was developed in 1952 in the USA. After excision of each hemorrhoid component, the ensuing defect is closed primarily.

Sir Alan Parks in 1956 described a technique, which dissects the submucosa containing the hemorrhoidal tissue with transfixation of the uppermost part of the pedicle. Reconstruction of the anal mucosa is done by fixing the mucosal flaps down to cover the wound, incorporating a largish bundle of internal sphincter. An area is deliberately left bare between the pedicle ligature and the mucosal fixation stitch.

Whitehead's hemorrhoidectomy, described by Whitehead in 1882, was devised to eradicate enlarged internal hemorrhoidal tissue in a circumferential fashion and to relocate the prolapsed dentate line, which is often a component of prolapsing hemorrhoids. At present, this procedure is rarely performed because of high complication rates, including stricture, loss of anal sensation, and development of mucosal ectropion.

Doppler guided hemorrhoidal artery ligation was first described in 1995 by Morinaga et al. It is performed using a specially designed proctoscope with an inbuilt Doppler probe that can locate feeding arteries; these vessels are then ligated using absorbable sutures. Disrupting the inflow to the vascular cushion is thought to reduce the size of the hemorrhoid.

Longo has recently proposed the use of a circular stapler instrument to perform hemorrhoidopexy. Thompson [3] suggested that the nature of hemorrhoids is the weakening and fragmentation of the tissue supporting the hemorrhoidal cushions, due to aging and repeated passage of hard stool, leading to their descent and prolapse. The technique aims at reducing the hemorrhoidal prolapse and transecting the superior hemorrhoidal arteries. Hemorrhoidal prolapse is resolved by repositioning the hemorrhoidal masses into the anal canal and by reducing the venous engorgement with transection of the feeding arteries and redundant mucosa. This technique results in a stapled mucosa anatomized in the rectum, at least 3 cm above the dentate line, where sensitive receptors are few.

Moreover, any dissection or trauma in the area of anal mucosa and anoderm is avoided.

Ligation-anopexy (a fixation of the mucosa and submucosa of the hemorrhoidal region to the underlying internal sphincter) and open hemorrhoidopexy without the use of stapler (fixation of the anal mucosa to the rectal wall with four Z-stitches after removal of a small rectal mucosa flap about 4 cm from the dentate line) were recently described [4, 5]. However, the preliminary results of these new techniques need to be confirmed on a larger number of patients, with a longer follow-up and comparisons with other established treatments.

Complications

Pain after surgery for hemorrhoids is a major worry. In order to reduce the postoperative pain, various excision techniques have been proposed. Chung et al. [6] conducted a prospective, double blinded study, comparing different excision techniques: harmonic scalpel hemorrhoidectomy, bipolar scissors hemorrhoidectomy, and regular scissors. The study showed that the harmonic scalpel was superior to the other methods in terms of postoperative pain and, consequently, patient satisfaction. Harmonic scalpel was confirmed to be superior with respect to bipolar electrocautery in two recent trials [7, 8]. Radiofrequency scalpel technique resulted in significantly less immediate postoperative pain after hemorrhoidectomy with respect to conventional diathermy techniques [9]. Two other randomized trials confirmed this finding [10, 11]. Radiofrequency scalpel was associated with less postoperative pain when compared with harmonic scalpel in one randomized controlled trial [12]. However, the added cost when performing the procedure with the radiofrequency scalpel should be considered. A recent meta-analysis did not demonstrate any difference in pain scores with regard to open and closed hemorrhoidectomy [13]. Other surgical strategies to reduce pain have been introduced, such as limiting the incision [14], suturing only the vascular pedicle without an incision [15], using a lateral internal sphincterotomy in conjunction with an external hemorrhoidectomy [16]. However, each strategy has had limited or mixed results. Proponents of hemorrhoidopexy with the use of circular staplers claim a reduction in postoperative pain and faster recovery as compared to conventional excision procedures. A meta-analysis confirmed both these advantages [17]. However, two recent meta-analyses, comparing the results of hemorrhoidopexy and conventional hemorrhoidectomy with radiofrequency scalpel, did not find any relevant difference in reduction of postoperative pain [18, 19]. Metronidazole administration was found to be effective in reducing postoperative pain [20, 21]. Local anesthetic infiltration after induction of anesthesia and before the surgical incision contributes to the improvement in pain

control after hemorrhoidectomy [22]. Recently, the use of a multivesicular liposomal formulation of bupivacaine, which can provide prolonged postsurgical pain relief, has been developed. Its efficacy in reducing postoperative pain was demonstrated in two randomized trials either with respect to placebo [23] or bupivacaine HCl [24]. Topical diltiazem showed a marginal benefit in reducing pain after surgery [25–27]. Glyceryl trinitrate ointment improved wound healing and reduced postoperative pain [28]. A recent randomized trial confirmed these results [29]. However, this benefit was not confirmed after stapled hemorrhoidopexy [30]. Injected botulinum showed superior efficacy compared to glyceryl trinitrate ointment [31]. However, a recent randomized trial failed to show a significant effect of botulinum on postoperative pain [32]. Topical sucralfate cream can both reduce pain and improve wound healing after open hemorrhoidectomy [33]. Direct application of very low doses of opioid agonist in the absorbable sponge dressing placed in the anus at the end of the surgical procedure is also effective [34]. Flavonoids may contribute to reduce postoperative pain [35, 36]. Regardless of the above mentioned methods used, effective postoperative pain management is required. Ketorolac has demonstrated considerable efficacy in managing posthemorrhoidectomy pain [37]. The use of stool softeners can help to avoid straining and to reduce the pain at the first postoperative bowel motion. Starting these 4 days before surgery may be beneficial [38]. The avoidance of bulky packs and dressings in the anal canal is also known to reduce post-surgical pain [39]. In conclusion, in order to reduce pain associated with hemorrhoids surgery, the following recommendation is supported by the evidence of the literature: local anesthetic infiltration, either as a sole technique or as an adjunct to general or regional anesthesia; combinations of analgesics (non-steroidal anti-inflammatory drugs, paracetamol, and opiates); and a stapled operation [40].

Postoperative hemorrhage is a relatively common complication. Bleeding in the immediate postoperative period is almost always due to inadequate intraoperative hemostasis. In the existing literature, this complication occurs in 4 to 25 % of cases [41–48]. Bleeding predominantly affects patients with fourth-degree hemorrhoids [49, 50]. Most bleeding complications occur during operation at the staple line and should be managed with suture of the bleeding points, after a careful inspection of the stapled suture line [49, 50]. After the introduction of the newer circular stapler (PPH03, Ethicon Endo-Surgery, Cincinnati, OH), which has a closed staple height of 0.75 mm, bleeding after stapled hemorrhoidopexy may be reduced because of an increase in compression on the rectal tissue and blood vessels. A significant reduction of intraoperative bleeding with the use of PPH03 compared with PPH01 (Ethicon Endo-Surgery, Cincinnati, OH) was reported in a recent randomized trial [51].

Another common complication after surgery for hemorrhoids is acute retention of urine. After conventional open

hemorrhoidectomy, the estimated incidence of urinary retention ranges from 0 to 34 % and from 0 to 22 % after stapled hemorrhoidopexy [52, 53]. In a meta-analysis comparing stapled hemorrhoidopexy and open hemorrhoidectomy, incidence of urinary retention was similar [54]. The expected reduction of postoperative urinary retention after stapled hemorrhoidopexy, caused by less postoperative pain, was not confirmed in the study by Senagore et al. [55], which showed that pain was not a risk factor for urinary retention.

Sepsis after surgery for hemorrhoids is uncommon, but it may be catastrophic. Cases of serious sepsis after both conventional and stapled hemorrhoidectomy were reported [56, 57]. Guidelines do not exist for prophylactic antibiotics in hemorrhoid surgery. However, we recommend routine use of prophylactic antibiotic therapy to avoid these life-threatening complications.

Anal stenosis is a narrowing of the anal canal. This narrowing may result from a true anatomic stricture or a muscular and functional stenosis. The main cause of anal stenosis is caused by overzealous hemorrhoidectomy. Removal of large areas of anoderm and hemorrhoidal rectal mucosa, without sparing of adequate mucocutaneous bridges, leads to scarring and a progressive chronic stricture. After conventional procedures, the incidence of anal stenosis is 0–6 % [58]. Stenosis caused by stapled hemorrhoidopexy is presumably rectal stenosis, since the causing event was a resection of rectal mucosa. One potential mechanism that might cause stenosis is ring dehiscence followed by submucous inflammation. Another theoretical cause is that the stapled ring is placed too deep in the anal canal and that the squamous skin cells react by scarring and shrinking. In a large study, anal stenosis was observed in only 0.8 % of cases [59].

Control of defecation involves a complex interaction of various factors. After hemorrhoid surgery, incontinence may result from sphincter lesions, loss of sensitive anoderm, and loss of reservoir (rectal resection, reduced rectal compliance due to rectal resection). Continence disorders following hemorrhoidectomy are reported to vary between 0 and 28 % [60]. The type of procedure used and the surgical expertise are important factors influencing the occurrence of these complications. The upper replacement instead of excision of the piles, carried out by stapled hemorrhoidopexy, should reduce postoperative incontinence, as hemorrhoids are important factors of anal continence. However, postoperative incontinence after stapled hemorrhoidectomy was reported in up to 28 % of cases [61]. In most patients, incontinence is transitory, due to excessive anal stretching secondary to circular anal dilator insertion [62]. At long-term follow-up, persistent continence problems were reported in a minority of patients with no significant difference with respect to conventional hemorrhoidectomy [61, 63–65]. Similarly, fecal urgency is a common complication especially soon after stapled hemorrhoidopexy. However, this complication is usually

transient and was present in 2.9 % of patients 2 years after operation [66].

Tenesmus, frequency, and fecal urgency are variably associated with hemorrhoid surgery and are usually transient and self-limiting. After stapled hemorrhoidopexy, a relevant percentage of patients develops a syndrome consisting of urgency for defecation, feeling of foreign body, and cramp-like anal pain of variant amplitude [67, 68].

Results

Traditionally, hemorrhoid surgery was considered a painful operation, and pain is still the main concern of the patients undergoing surgery. Stapled hemorrhoidopexy was recommended because of the short operative time, slight postoperative pain, and faster recovery. The advantages of this procedure were confirmed by a recent systematic review of randomized trials and a large trial comparing stapled and conventional hemorrhoidectomy [17, 69]. However, in the recent literature, a significant incidence of recurrence after stapled hemorrhoidopexy was reported. In studies evaluating stapled hemorrhoidopexy and conventional hemorrhoidectomy for Grade III and IV hemorrhoids with an adequate and systematic follow-up (>1 year), the incidence of recurrence was 0 to 26 % and 0 to 10.8 %, respectively; reoperation rate was up to 16.7 % after stapled hemorrhoidopexy [43, 46, 61, 63–65, 70–72]. After conventional Ferguson's hemorrhoidectomy, a redo surgery for recurrent hemorrhoids was necessary in 0.8 % of cases in a large series [73]. In a study with a minimum follow-up of 5 years, recurrence occurred in 18.2 % of patients, and reoperation was performed in 7.2 % of cases after stapled hemorrhoidopexy [49]. However, when long-term control of hemorrhoid-related symptoms was considered, no significant difference was found between stapled hemorrhoidopexy and conventional hemorrhoidectomy with exception of the presence of prolapse [49]. In a large part of patients with recurrence after stapled hemorrhoidopexy symptoms related to hemorrhoids are absent or moderate [49]. These data may explain why the higher incidence of recurrence after stapled hemorrhoidopexy does not affect the long-term results in terms of patient satisfaction. Long-term satisfaction with the Milligan–Morgan procedure was achieved in 67 % of patients in a large retrospective multicenter study [74]. After stapled hemorrhoidopexy, patient's satisfaction was up to 89.7 % [49]. Recurrence rate, reintervention, and complications are important outcome measures when assessing a procedure; however, quality of life and patient satisfaction are also important and need to be considered. A very recent study assessed quality of life, patients'

satisfaction, and patients' approval of the procedure and their willingness for a repeat procedure. The authors concluded that when compared with conventional hemorrhoidectomy stapled hemorrhoidopexy is favored by the patients [75].

According to some authors, recurrent rectal prolapse was significantly more frequent in patients with fourth-degree hemorrhoids, so that they may not represent an appropriate indication for stapled hemorrhoidopexy [49, 50, 76]. Actually, in patients with only third-degree hemorrhoids, recurrence is similar in both stapled hemorrhoidopexy and conventional hemorrhoidectomy [77]. The relative high percentage of recurrence after stapled hemorrhoidopexy in Grade IV hemorrhoids may be related to the increased probability of incomplete mucosal resection, which may occur when the volume of prolapsed tissue exceeds the volume of the stapler casing. Double stapling, according to the stapled transanal rectal resection proposed by Longo to treat obstructive defecation syndrome, allows achieving a more complete hemorrhoidopexy and may be appropriate for Grade IV hemorrhoids [78–80]. Repeated stapled hemorrhoidopexy can be performed safely and with satisfactory results in patients with recurrent hemorrhoids [81, 82].

Transanal hemorrhoidal dearterialization was showed to be as effective as stapled hemorrhoidopexy in terms of treatment success, complications, and incidence recurrence [83]. With an associated anopexy, this technique guarantees short-term results similar to conventional hemorrhoidectomy with a tendency to a higher persistence of hemorrhoid prolapse [84]. However, further high quality trials are recommended to assess the efficacy and safety of this technique.

Conclusion

Currently, there is a variety of surgical procedures that are available to treat hemorrhoids, and most have similar success rates. Stapled hemorrhoidopexy has gained a vast popularity, mainly because of reduced postoperative pain with respect to conventional hemorrhoidectomy. However, at present, the main issue with this technique is its durability. In particular, the high incidence of recurrence, especially in fourth-degree hemorrhoids, casts a serious doubt about its efficacy with respect to conventional hemorrhoidectomy. Double stapler hemorrhoidopexy may be an alternative to simple stapled hemorrhoidopexy in fourth-degree hemorrhoids. Further prospective studies are necessary to evaluate this new approach.

We believe that the surgeon should discuss with the patients the advantages and drawback of each surgical procedure and let the patient choose whether to accept a higher recurrence rate to take advantage of the short-term benefits of stapled hemorrhoidopexy.

References

- Rivadeneira DE, Steele SR, Ternent C, Chalasani S, Buie WD, Rafferty JL (2010) Standards practice task force of the American society of colon and rectal surgeons. Practice parameters for the management of hemorrhoids (revised 2010). *Dis Colon Rectum* 54:1059–1064. doi:10.1097/DCR.0b013e318225513d
- D'Ugo S, Franceschilli L, Cadeddu F, Leccesi L, Blanco Gdel V, Calabrese E, Milito G, Di Lorenzo N, Gaspari AL, Sileri P (2013) Medical and surgical treatment of haemorrhoids and anal fissure in Crohn's disease: a critical appraisal. *BMC Gastroenterol* 13:47. doi:10.1186/1471-230X-13-47
- Thomson WH (1975) The nature of haemorrhoids. *Br J Surg* 62:542–552
- Hussein HM (2001) Ligation-anopexy for treatment of advanced hemorrhoidal disease. *Dis Colon Rectum* 44:1887–1890
- Pakravan F, Helmes C, Baeten C (2009) Transanal open hemorrhoidopexy. *Dis Colon Rectum* 52:503–506. doi:10.1007/DCR.0b013e318197d703
- Chung CC, Ha JP, Tai YP, Tsang WW, Li MK (2002) Double-blind, randomized trial comparing harmonic scalpel hemorrhoidectomy, bipolar scissors hemorrhoidectomy, and scissors excision: Ligation technique. *Dis Colon Rectum* 45:789–794
- Abo-hashem AA, Sarhan A, Aly AM (2010) Harmonic scalpel compared with bipolar electro-cautery hemorrhoidectomy: a randomized controlled trial. *Int J Surg* 8:243–247. doi:10.1016/j.ijsu.2010.01.010
- Tsunoda A, Sada H, Sugimoto T, Kano N, Kawana M, Sasaki T, Hashimoto H (2011) Randomized controlled trial of bipolar diathermy vs ultrasonic scalpel for closed hemorrhoidectomy. *World J Gastrointest Surg* 3:147–152. doi:10.4240/wjgs.v3.i10.147
- Nienhuijs SW, de Hingh IH (2010) Pain after conventional versus Ligasure hemorrhoidectomy. A meta-analysis. *Int J Surg* 8:269–273. doi:10.1016/j.ijsu.2010.04.001, PMID: 20388563
- Gentile M, De Rosa M, Carbone G, Pilone V, Mosella F, Forestieri P (2011) LigaSure hemorrhoidectomy versus conventional diathermy for IV-degree haemorrhoids: is it the treatment of choice? A randomized. *Clinical Trial, ISRN Gastroenterol*. doi:10.5402/2011/467258, 467258
- Franceschilli L, Stolfi VM, D'Ugo S, Angelucci GP, Lazzaro S, Picone E, Gaspari A, Sileri P (2011) Radiofrequency versus conventional diathermy Milligan-Morgan hemorrhoidectomy: a prospective, randomized study. *Int J Colorectal Dis* 26:1345–1350. doi:10.1007/s00384-011-1216-6
- Kwok SY, Chung CC, Tsui KK, Li MK (2005) A double-blind, randomized trial comparing LigaSure and harmonic scalpel hemorrhoidectomy. *Dis Colon Rectum* 48:344–348
- Ho YH, Buettner PG (2007) Open compared with closed hemorrhoidectomy: meta-analysis of randomized controlled trials. *Tech Coloproctol* 11:135–143
- Ui Y (1997) Anoderm-preserving, completely closed hemorrhoidectomy with no mucosal incision. *Dis Colon Rectum* 40:S99–S101
- Patel N, O'Connor T (1996) Suture hemorrhoidectomy: a day-only alternative. *Aust N Z J Surg* 66:830–831
- Mathai V, Ong BC, Ho YH (1996) Randomized controlled trial of lateral internal sphincterotomy with haemorrhoidectomy. *Br J Surg* 83:380–382
- Shao WJ, Li GC, Zhang ZH, Yang BL, Sun GD, Chen YQ (2008) Systematic review and meta-analysis of randomized controlled trials comparing stapled hemorrhoidopexy with conventional hemorrhoidectomy. *Br J Surg* 95:147–160. doi:10.1002/bjs.6078
- Yang J, Cui PJ, Han HZ, Tong DN (2013) Meta-analysis of stapled hemorrhoidopexy vs LigaSure hemorrhoidectomy. *World J Gastroenterol* 19:4799–4807. doi:10.3748/wjg.v19.i29.4799
- Lee KC, Chen HH, Chung KC, Hu WH, Chang CL, Lin SE, Tsai KL, Lu CC (2013) Meta-analysis of randomized controlled trials comparing outcomes for stapled hemorrhoidopexy versus LigaSure hemorrhoidectomy for symptomatic hemorrhoids in adults. *Int J Surg* 11:914–918. doi:10.1016/j.ijsu.2013.07.006
- Carapeti EA, Kamm MA, McDonald PJ, Phillips RK (1998) Double-blind randomised controlled trial of effect of metronidazole on pain after day case haemorrhoidectomy. *Lancet* 351:169–172
- Ala S, Saeedi M, Eshghi F, Mirzabeygi P (2008) Topical metronidazole can reduce pain after surgery and pain on defecation in postoperative hemorrhoidectomy. *Dis Colon Rectum* 51:235–238. doi:10.1007/s10350-007-9174-3
- Vinson-Bonnet B, Coltat JC, Fingerhut A, Bonnet F (2002) Local infiltration with ropivacaine improves immediate postoperative pain control after hemorrhoidal surgery. *Dis Colon Rectum* 45:104–108
- Gorfine SR, Onel E, Patou G, Krivokapic ZV (2011) Bupivacaine extended-release liposome injection for prolonged postsurgical analgesia in patients undergoing hemorrhoidectomy: a multicenter, randomized, double-blind, placebo-controlled trial. *Dis Colon Rectum* 54:1552–1559. doi:10.1097/DCR.0b013e318232d4c1
- Haas E, Onel E, Miller H, Ragupathi M, White PF (2012) A double-blind, randomized, active-controlled study for post-hemorrhoidectomy pain management with liposome bupivacaine, a novel local analgesic formulation. *Am Surg* 78:574–581
- Silverman R, Bendick PJ, Wasvary HJ (2005) A randomized, prospective, double-blind, placebo-controlled trial of the effect of a calcium channel blocker ointment on pain after hemorrhoidectomy. *Dis Colon Rectum* 48:1913–1916
- Amoli HA, Notash AY, Shahandashti FJ, Kenari AY, Ashraf H (2011) A randomized, prospective, double-blind, placebo-controlled trial of the effect of topical diltiazem on post-hemorrhoidectomy pain. *Colorectal Dis* 13:328–332. doi:10.1111/j.1463-1318.2009.02138.x
- Sugimoto T, Tsunoda A, Kano N, Kashiwagura Y, Hirose K, Sasaki T (2013) A randomized, prospective, double-blind, placebo-controlled trial of the effect of diltiazem gel on pain after hemorrhoidectomy. *World J Surg* 37:2454–2457. doi:10.1007/s00268-013-2124-4
- Ratnasingham K, Uzzaman M, Andreani SM, Light D, Patel B (2010) Meta-analysis of the use of glyceryl trinitrate ointment after hemorrhoidectomy as an analgesic and in promoting wound healing. *Int J Surg* 8:606–611. doi:10.1016/j.ijsu.2010.04.012
- Franceschilli L, D'Ugo S, de Luca E, Cadeddu F, Milito G, di Lorenzo N, Gaspari AL, Sileri P (2013) Role of 0.4 % glyceryl trinitrate ointment after haemorrhoidectomy: Results of a prospective randomised study. *Int J Colorectal Dis* 28:365–369. doi:10.1007/s00384-012-1544-1
- Cross T, Bartlett L, Mushaya C, Ashour M, Ho YH (2012) Glyceryl trinitrate ointment did not reduce pain after stapled hemorrhoidectomy: a randomized controlled trial. *Int Surg* 97:112–119. doi:10.9738/CC92.1
- Patti R, Almasio PL, Arcara M, Sammartano S, Romano P, Fede C, Di Vita G (2007) Botulinum toxin vs topical glyceryl trinitrate ointment for pain control in patients undergoing hemorrhoidectomy: a randomized trial. *Dis Colon Rectum* 50:122
- Singh B, Box B, Lindsey I, George B, Mortensen N, Cunningham C (2009) Botulinum toxin reduces anal spasm but has no effect on pain after hemorrhoidectomy. *Colorectal Dis* 11:203–207. doi:10.1111/j.1463-1318.2008.01549.x
- Gupta PJ, Heda PS, Kalaskar S, Tamaskar VP (2008) Topical sucralfate decreases pain after hemorrhoidectomy and improves healing: a randomized, blinded, controlled study. *Dis Colon Rectum* 51:231–234
- Tegon G, Pulzato L, Passarella L, Guidolin D, Zusso M, Giusti P (2009) Randomized placebo-controlled trial on local applications of opioids after hemorrhoidectomy. *Tech Coloproctol* 13:219–224. doi:10.1007/s10151-009-0518-y

35. La Torre F, Nicolai AP (2004) Clinical use of micronized purified flavonoid fraction for treatment of symptoms after hemorrhoidectomy: Results of a randomized, controlled, clinical trial. *Dis Colon Rectum* 47:704–710
36. Ba-bai-ke-re MM, Huang HG, Re WN, Fan K, Chu H, Ai EH, Li-Mu MM, Wang YR, Wen H (2011) How we can improve patients' comfort after Milligan-Morgan open haemorrhoidectomy. *World J Gastroenterol* 17:1448–1456. doi:10.3748/wjg.v17.i11.1448
37. O'Donovan S, Ferrara A, Larach S, Williamson P (1994) Intraoperative use of Toradol facilitates outpatient hemorrhoidectomy. *Dis Colon Rectum* 37:793–799
38. London NJ, Bramley PD, Windle R (1997) Effect of four days of preoperative lactulose on posthaemorrhoidectomy pain: Results of a placebo-controlled trial. *Br Med J (Clin Res Ed)* 295:363–364
39. Ingram M, Wright TA, Ingoldby CJ (1998) A prospective randomized study of calcium alginate (Sorbsan) versus standard gauze packing following haemorrhoidectomy. *J R Coll Surg Edinb* 43:308–309
40. Joshi GP, Neugebauer EA (2010) PROSPECT Collaboration. Evidence-based management of pain after haemorrhoidectomy surgery. *Br J Surg* 97:1155–1168. doi:10.1002/bjs.7161
41. Chen HH, Wang JY, Changchien CR, Chen JS, Hsu KC, Chiang JM, Yeh CY, Tang R (2002) Risk factors associated with posthemorrhoidectomy secondary hemorrhage. *Dis Colon Rectum* 45:1096–1099
42. Bleday R, Pena JP, Rothenberger DA, Goldberg SM, Buls JG (1992) Symptomatic hemorrhoids: Current incidence of complications of operative therapy. *Dis Colon Rectum* 35:477–481
43. Boccasanta P, Capretti PG, Venturi M, Cioffi U, De Simone M, Salamina G, Contessini-Avesani E, Peracchia A (2001) Randomized controlled trial between stapled circumferential mucosectomy and conventional circular hemorrhoidectomy in advanced hemorrhoids with external mucosal prolapsed. *Am J Surg* 182:64–68
44. Mehigan BJ, Monson JR, Hartley JE (2000) Stapling procedure for haemorrhoids versus Milligan-Morgan haemorrhoidectomy: Randomized controlled trial. *Lancet* 355:782–785
45. Ho YH, Cheong WK, Tsang C, Ho J, Eu KW, Tang CL, Seow-Choen F (2000) Stapled hemorrhoidectomy—cost and effectiveness. Randomized, controlled trial including incontinence scoring, anorectal manometry and endoanal ultrasound assessment at up to three months. *Dis Colon Rectum* 43:1666–1675
46. Ganio E, Altomare DF, Gabrielli F, Milito G, Canuti S (2001) Prospective randomized multicentre trial comparing stapled with open haemorrhoidectomy. *Br J Surg* 88:669–674
47. Palimento D, Picchio M, Attanasio U, Lombardi A, Bambini C, Renda A (2003) Stapled and open hemorrhoidectomy: Randomized controlled trial of early results. *World J Surg* 27:203–207
48. Ng KH, Ho KS, Ooi BS, Tang CL, Eu KW (2006) Experience of 3711 stapled haemorrhoidectomy operations. *Br J Surg* 93:226–230
49. Ceci F, Picchio M, Palimento D, Cali B, Corelli S, Spaziani E (2008) Long-term outcome of stapled hemorrhoidopexy for Grade III and Grade IV hemorrhoids. *Dis Colon Rectum* 51:1107–1112. doi:10.1007/s10350-008-9333-1
50. Finco C, Sarzo G, Savastano S, Degregori S, Merigliano S (2006) Stapled hemorrhoidectomy in fourth degree haemorrhoidal prolapse: is it worthwhile? *Colorectal Dis* 8:130–134
51. Arroyo A, Pérez-Vicente F, Miranda E, Sánchez A, Serrano P, Candela F, Oliver I, Calpena R (2006) Prospective randomized clinical trial comparing two different circular staplers for mucosectomy in the treatment of hemorrhoids. *World J Surg* 30:1305–1310
52. Zaheer S, Reilly WT, Pemberton JH, Ilstrup D (1998) Urinary retention after operations for benign anorectal diseases. *Dis Colon Rectum* 41:696–704
53. Wilson MS, Pope V, Doran HE, Fearn SJ, Brough WA (2002) Objective comparison of stapled anopexy and open haemorrhoidectomy. *Dis Colon Rectum* 45:1437–1444
54. Lan P, Wu X, Zhou X, Wang J, Zhang L (2006) The safety and efficacy of stapled hemorrhoidectomy in the treatment of hemorrhoids: a systemic review and meta-analysis of the randomized controlled trials. *Int J Colorectal Dis* 21:172–178
55. Senagore AJ, Singer M, Abcarian H, Fleshman J, Corman M, Wexner S, Nivatvongs S (2004) Procedure for Prolapse and Hemorrhoids (PPH) Multicenter Study Group. A prospective, randomized, controlled, multicenter trial comparing stapled hemorrhoidopexy and Ferguson hemorrhoidectomy: Perioperative and one-year results. *Dis Colon Rectum* 47:1824–1836
56. Guy RJ, Seow-Choen F (2003) Septic complications after treatment of haemorrhoids. *Br J Surg* 90:147–156
57. McCloud JM, Jameson JS, Scott AN (2006) Life-threatening sepsis following treatment for haemorrhoids: a systematic review. *Colorectal Dis* 8:748–755
58. American Gastroenterological Association (2004) Technical review on the diagnosis and treatment of haemorrhoids. *Gastroenterology* 126:1463–1473
59. Ravo B, Amato A, Bianco V, Boccasanta P, Bottini C, Carriero A, Milito G, Dodi G, Mascagni D, Orsini S, Pietroletti R, Ripetti V, Tagariello GB (2002) Complications after stapled hemorrhoidectomy: Can they be prevented? *Tech Coloproctol* 6:83–88
60. Ommer A, Wenger FA, Rölfis T, Walz MK (2008) Continence disorders after anal surgery—a relevant problem? *Int J Colorectal Dis* 23:1023–1031. doi:10.1007/s00384-008-0524-y
61. Ganio E, Altomare DF, Milito G, Gabrielli F, Canuti S (2007) Long-term outcome of a multicentre randomized clinical trial of stapled haemorrhoidopexy versus Milligan-Morgan haemorrhoidectomy. *Br J Surg* 94:1033–1037
62. Ho YH, Seow-Choen F, Tsang C, Eu KW (2001) Randomized trial assessing anal sphincter injuries after stapled haemorrhoidectomy. *Br J Surg* 88:1449–1455
63. Smyth EF, Baker RP, Wilken BJ, Hartley JE, White TJ, Monson JR (2003) Stapled versus excision haemorrhoidectomy: Long-term follow-up of a randomized controlled trial. *Lancet* 361:1437–1438
64. Au-Yong I, Rowsell M, Hemingway DM (2004) Randomized controlled clinical trial of stapled haemorrhoidectomy vs. conventional haemorrhoidectomy: a three and a half year follow-up. *Colorectal Dis* 6:37–38
65. Picchio M, Palimento D, Attanasio U, Renda A (2006) Stapled vs open hemorrhoidectomy: long-term outcome of a randomized controlled trial. *Int J Colorectal Dis* 21:668–669
66. Schmidt J, Dogan N, Langenbach R, Zirngibl H (2009) Fecal urge incontinence after stapled anopexia for prolapse and hemorrhoids: a prospective, observational study. *World J Surg* 33:355–364. doi:10.1007/s00268-008-9818-z
67. Khubchandani I, Fealk MH, Reed JF III (2009) Is there a post-PPH syndrome? *Tech Coloproctol* 13:141–144
68. Efthimiadis C, Kosmidis C, Grigoriou M, Anthimidis G, Vasiliadou K, Baka S, Gerasimidou D, Basdanis G (2011) The stapled hemorrhoidopexy syndrome: a new clinical entity? *Tech Coloproctol* 15(Suppl 1):S95–S99
69. Nyström PO, Qvist N, Raahave D, Lindsey I, Mortensen N (2010) Stapled or Open Pile Procedure (STOPP) trial study group. Randomized clinical trial of symptom control after stapled anopexy or diathermy excision for haemorrhoid prolapsed. *Br J Surg* 97:167–176. doi:10.1002/bjs.6804
70. Racalbutto A, Aliotta I, Corsaro G, Lanteri R, Di Cataldo A, Licata A (2004) Hemorrhoidal stapler prolapsectomy vs Milligan-Morgan hemorrhoidectomy: a long-term randomized trial. *Int J Colorectal Dis* 19:239–244

71. Kairaluoma M, Nuorva K, Kellokumpu I (2003) Day-case stapled (circular) vs diathermy hemorrhoidectomy: a randomized controlled trial evaluating surgical and functional outcome. *Dis Colon Rectum* 46:93–99
72. Ortiz H, Marzo J, Armendariz P (2002) Randomized trial of stapled haemorrhoidopexy versus conventional diathermy haemorrhoidectomy. *Br J Surg* 89:1376–1381
73. Guenin MO, Rosenthal R, Kern B, Peterli R, von Flüe M, Ackermann C (2005) Long-term results and patient satisfaction after Ferguson's haemorrhoidectomy. *Dis Colon Rectum* 48:1523–1527
74. Jóhannsson HO, Graf W, Pählman L (2002) Long-term results of haemorrhoidectomy. *Eur J Surg* 168:485–489
75. Thaha MA, Campbell KL, Kazmi SA, Irvine LA, Khalil A, Binnie NR, Hendry WS, Walker A, Staines HJ, Steele RJ (2009) Prospective randomised multi-centre trial comparing the clinical efficacy, safety and patient acceptability of circular stapled anopexy with closed diathermy haemorrhoidectomy. *Gut* 58:668–678. doi:[10.1136/gut.2008.151266](https://doi.org/10.1136/gut.2008.151266)
76. Mattana C, Coco C, Manno A, Verbo A, Rizzo G, Petito L, Sermoneta D (2007) Stapled hemorrhoidopexy and Milligan Morgan hemorrhoidectomy in the cure of fourth-degree hemorrhoids: Long-term evaluation and clinical results. *Dis Colon Rectum* 50:1770–1775
77. Kim JS, Vashist YK, Thielges S, Zehler O, Gawad KA, Yekebas EF, Izbicki JR, Kutup A (2013) Stapled hemorrhoidopexy versus Milligan-Morgan hemorrhoidectomy in circumferential third-degree hemorrhoids: Long-term results of a randomized controlled trial. *J Gastrointest Surg* 17:1292–1298. doi:[10.1007/s11605-013-2220-7](https://doi.org/10.1007/s11605-013-2220-7)
78. Boccasanta P, Venturi M, Roviato G (2007) Stapled transanal rectal resection versus stapled anopexy in the cure of hemorrhoids associated with rectal prolapse. A randomized controlled trial. *Int J Colorectal Dis* 22:245–251
79. Naldini G, Martellucci J, Talento P, Caviglia A, Moraldi L, Rossi M (2009) New approach to large haemorrhoidal prolapse: Double stapled haemorrhoidopexy. *Int J Colorectal Dis* 24:1383–1387. doi:[10.1007/s00384-009-0750-y](https://doi.org/10.1007/s00384-009-0750-y)
80. Stuto A, Favero A, Cerullo G, Braini A, Narisetty P, Tosolini G (2012) Double stapled haemorrhoidopexy for haemorrhoidal prolapse: Indications, feasibility and safety. *Colorectal Dis* 14:e386–e389. doi:[10.1111/j.1463-1318.2012.02965.x](https://doi.org/10.1111/j.1463-1318.2012.02965.x)
81. Raahave D, Jepsen LV, Pedersen IK (2008) Primary and repeated stapled hemorrhoidopexy for prolapsing hemorrhoids: Follow-up to five years. *Dis Colon Rectum* 51:334–341
82. Festen S, van Geloven AA, Gerhards MF (2009) Redo procedure for prolapse and haemorrhoids (PPH) for persistent and recurrent prolapse after PPH. *Dig Surg* 26:418–421
83. Sajid MS, Parampalli U, Whitehouse P, Sains P, McFall MR, Baig MK (2012) A systematic review comparing transanal haemorrhoidal dearterialisation to stapled haemorrhoidopexy in the management of haemorrhoidal disease. *Tech Coloproctol* 16:1–8. doi:[10.1007/s10151-011-0796-z](https://doi.org/10.1007/s10151-011-0796-z)
84. Elmer SE, Nygren JO, Lenander CE (2013) A randomized trial of transanal hemorrhoidal dearterialization with anopexy compared with open hemorrhoidectomy in the treatment of hemorrhoids. *Dis Colon Rectum* 56:484–490. doi:[10.1097/DCR.0b013e31827a8567](https://doi.org/10.1097/DCR.0b013e31827a8567)