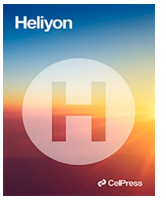
Heliyon 10 (2024) e28465

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon



Research article

Modified whitehead hemorrhoidectomy versus partial hemorrhoidectomy for fourth-degree circular mixed hemorrhoids: A retrospective analysis

Xie Liu [a,1], Bo Sheng [a,1], Jianbo Zhang [a,1], Jijian Wang [a], Jun Yu [a], Guanggang Zhang [b], Fengshun Dai [c], Heng Su [c], Jingsong Xu [c], Wei Hu [c], Tong Li [a,*], Peng Zhu [a,**]

[a] Department of Gastrointestinal Surgery, The Second Affiliated Hospital of Chongqing Medical University, Chongqing, 400010, China
[b] Department of General Surgery, The People's Hospital of Chongqing City, Chongqing, 400014, China
[c] Department of General Surgery, the Renmin Hospital of Wushan County, Chongqing, 404700, China

ARTICLE INFO

Keywords:
Hemorrhoid
Whitehead hemorrhoidectomy
Anal stricture
Mucosal ectroption

ABSTRACT

Background: Grade IV circular hemorrhoids are difficult to treat. We aim to describe the modified whitehead hemorrhoidectomy procedure and to assess the effectiveness and safety of this procedure for grade IV circular hemorrhoid patients.

Methods: Patients with grade IV circular hemorrhoids who underwent modified Whitehead hemorrhoidectomy and partial hemorrhoidectomy for fourth-degree circular mixed hemorrhoids were retrospectively reviewed. Clinical data were extracted from the database at our institution, and long-term postoperative complications were assessed through repeated outpatient examinations and telephonic communication.

Results: A total of 205 patients were included in this study. The mean operative time was 59.2 ± 13.8 min. The average hospital stay was 4.6 ± 1.0 days. For postoperative complications, 66 (32.2%) patients had urinary retention, 10 (4.9%) patients had a sense of incomplete rectal emptying, 5 (2.4%) patients had anal incontinence, and 6 (2.9%) patients had wound infection. For long-term postoperative complications, 3 (1.5%) patients experienced mild to moderate anal stricture, 2 (1%) patients experienced mucosal ectropion, they all had smooth recoveries, and none of them needed secondary surgery. None of these patients had a hemorrhoid recurrence. A total of 205 patients who received modified Whitehead hemorrhoidectomy and 161 who received partial hemorrhoidectomy were included. There were no residual hemorrhoids in patients who received modified Whitehead hemorrhoidectomy, and none had hemorrhoid recurrence. Fifty-eight patients who received partial hemorrhoidectomy had hemorrhoidal residues, and 19 patients experienced hemorrhoid recurrence. After modified Whitehead hemorrhoidectomy, 3 patients developed anal stenosis, and 2 had mucosal ectropion. Four patients developed anal stricture after partial hemorrhoidectomy, and none had mucosal ectropion. They all had smooth

* Corresponding author. Department of Gastrointestinal Surgery, The Second Affiliated Hospital of Chongqing Medical University, 76 Linjiang Road, Chongqing, 400010, China.
** Corresponding author. Department of Gastrointestinal Surgery, The Second Affiliated Hospital of Chongqing Medical University, 76 Linjiang Road, Chongqing, 400010, China.
E-mail addresses: lovelitong@126.com (T. Li), zupeng@cqmu.edu.cn (P. Zhu).
[1] Authors contributed equally to this manuscript.

https://doi.org/10.1016/j.heliyon.2024.e28465
Received 15 November 2022; Received in revised form 19 March 2024; Accepted 19 March 2024
Available online 20 March 2024

recoveries, and none of them needed a secondary surgery. For the mean duration of surgery, postoperative bleeding, postoperative pain, wound infection, sense of incomplete rectal emptying, anal incontinence, and urinary retention, no statistically significant differences were found between the two groups.

Conclusions: Compared with partial hemorrhoidectomy, modified whitehead hemorrhoidectomy is an effective and safe surgical procedure and does not significantly increase the risk of anal stenosis and mucosal ectropion for grade IV circular hemorrhoid patients. Prospective randomized controlled trials are needed to verify our results.

1. Introduction

Hemorrhoids are one of the most common medical and surgical disease processes encountered in both industrialized societies and developing counties [1,2]. In addition, symptoms related to hemorrhoids are very common. Dietary modification, counseling regarding defecation habits and office-based procedures (banding, sclerotherapy and infrared coagulation) could help most patients relieve hemorrhoid symptoms [3,4]. However, for grade 3–4 hemorrhoid patients, surgical treatments are often unavoidable [5,6].

The Milligan-Morgan operation, 3-quadrant hemorrhoidectomy and stapled hemorrhoidopexy are the most diffusely employed surgical procedures for hemorrhoid patients [7,8]. However, for patients with extensive, circumferential, prolapsing, mixed hemorrhoids, none of these surgical procedures would achieve satisfactory results, and patients may even receive secondary surgeries for residual hemorrhoids [9].

Whitehead's hemorrhoidectomy was first introduced by Whitehead in 1882, and the procedure recommended performing an en bloc excision of circular hemorrhoids along with the mucous membrane covering them [10]. As the "pile-bearing area" was removed, few patients had symptom recurrence [11]. However, the incidence of anal stricture and mucosal ectropion was reported to be very high, and most surgeons thus refused to perform this operation [12,13]. "Whitehead's hemorrhoidectomy" disappeared from the 1930s–1970s. In the 1990s, a good-to-glowing effect of Whitehead's hemorrhoidectomy was again reported, and nightmarish complications, such as anal stricture and mucosal ectropion, were then attributed to a misunderstanding of the anal anatomy and maloperation [14]. However, Whitehead's hemorrhoidectomy is still seldom applied to hemorrhoid patients because of the complex procedure and the concern for serious complications [15].

Partial hemorrhoidectomy (three quadrant hemorrhoidectomy) is currently the preferred treatment for fourth-degree circular mixed hemorrhoids in most medical centers. In our opinion, Whitehead's hemorrhoidectomy is an ideal procedure for end-stage circular hemorrhoids. We modified this operation to make it much easier to perform. In this study, we retrospectively reviewed the clinical data of patients undergoing modified Whitehead hemorrhoidectomy and compared them with those of patients undergoing partial hemorrhoidectomy to investigate the safety and efficacy of modified Whitehead hemorrhoidectomy.

2. Materials and Methods

Consecutive patients with stage 4 circular mixed hemorrhoids who underwent modified Whitehead's hemorrhoidectomy or partial hemorrhoidectomy (three quadrant hemorrhoidectomy) between 2007 and 2021 were evaluated retrospectively. Informed consent was obtained from all patients. Approval was obtained from the ethics committee of our hospital (the Second Affiliated Hospital of Chongqing Medical University, Chongqing, China). The study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki (6th revision, 2008) as reflected in a priori approval by the institution's human research committee. The exclusion criteria were as follows: 1. patients with malignant tumors; 2. patients with inflammatory bowel diseases; 3. patients with a history of anal surgeries; and 4. patients with untreatable diseases that could obviously increase abdominal pressure (such as intractable constipation, severe chronic obstructive pulmonary disease, and severe prostatic hyperplasia).

The following data were collected: patient demographics (general conditions), type of anesthesia, duration of the operation, intraoperative bleeding, postoperative VAS score, time to first defection, postoperative complications (bleeding requiring intervention, stricture, urinary retention, wound infection, fever, and a sense of incomplete rectal emptying), hospital stay, time to return to normal activities and recurrent hemorrhoids.

Hypertonic saline and phlebotonics were used to relieve edema before surgery. Due to severe hemorrhoidal edema, most patients did not undergo colonoscopy. However, we recommend a colonoscopy 4 months after surgery. In the postoperative period, ibuprofen and codeine phosphate tablets or Calfax were used for pain control, polyethylene glycol powder and wheat cellulose were used to soften stool, phlebotonics such as diosmin were used to control edema, and a regular sitz bath was advised to clean the wound. Patients were discharged after their first defect, and they were invited for weekly follow-up until the wound healed. After that, patients were followed up every 3 months in the first year and yearly thereafter. Rectal digital examinations (RDEs) were performed at each follow-up (after the wound healed). For patients with suspected stricture, an RDE was advised three times a week.

2.1. Statistical analysis

SPSS statistics version 22.0 (IBM, USA) was used to perform statistical analysis. Categorical data are presented as numbers by percentages, and continuous data are presented as the mean or median.

2.2. Surgical technique

We placed relatively strict restrictions on the inclusion criteria for patients: 1. Patients with thrombosis hemorrhoids; 2. Hemorrhoid incarceration time exceeding 24 h; 3. The diameter of hemorrhoids exceeds 2 cm(Fig. 1[A]).

Material preparation: 1. An absorbent gauze roll (Fig. 1[B]) with a diameter of 2–3 cm and a length of 3–4 cm; 2. 100 ml of adrenaline saline; and 3. An absorbable suture material was used.

Major surgical steps.

1. The whole gauze roll was inserted into the anal canal(Fig. 1[C]), and then approximately 20% of the length of the gauze roll was withdrawn from the anal canal. The inner hemorrhoids were exposed to the surgeon. We then sutured the hemorrhoid to the gauze roll with 3-0 stitches.
2. Adrenaline saline was injected into the subcutaneous tissue around the hemorrhoids(Fig. 1[D]). Adrenaline saline helped to separate the hemorrhoid from both the perianal skin and the internal anal sphincter and to decrease intraoperative bleeding(Fig. 1[E]).
3. The skin around the hemorrhoids was incised, the hemorrhoid was separated from the perianal skin, and the surgeon continued to separate upward and divide the hemorrhoids from the internal anal sphincter. The upper limit of the separating plane was 1–1.5 cm above the lower margin of the internal anal sphincter, just around the dental line(Fig. 1[F]).
4. Approximately one-quarter of the hemorrhoids were cut from the rectal mucosa, and the rectal mucosa was sutured to the corresponding perianal skin(Fig. 1[G]). This procedure was repeated until the whole circular hemorrhoid was cut off (Fig. 1[H]) and the rectal mucosa was sutured to the skin (Fig. 1[I-J]).

The surgical procedures of partial hemorrhoidectomy have been widely reported and will not be discussed here [16,17].

3. Results

3.1. Patient characteristics

A total of 280 patients who underwent modified Whitehead hemorrhoidectomy (included in the modified Whitehead group) and 223 patients who underwent partial hemorrhoidectomy (included in the Partial hemorrhoidectomy group) met the inclusion criteria; however, 75 patients in the modified Whitehead group and 62 in the partial hemorrhoidectomy group were lost to follow-up. Our average length of follow-up was 8.2 ± 2.4 months. In the end, 205 patients in the modified Whitehead group and 161 in the partial hemorrhoidectomy group were used for data analysis.

There were 115 male and 90 female patients in the modified Whitehead group, and the average age was 56 ± 6.7 years. In the partial hemorrhoidectomy group, 80 patients were males, 81 were females, and the average age was 55.5 ± 8.5 years. The average

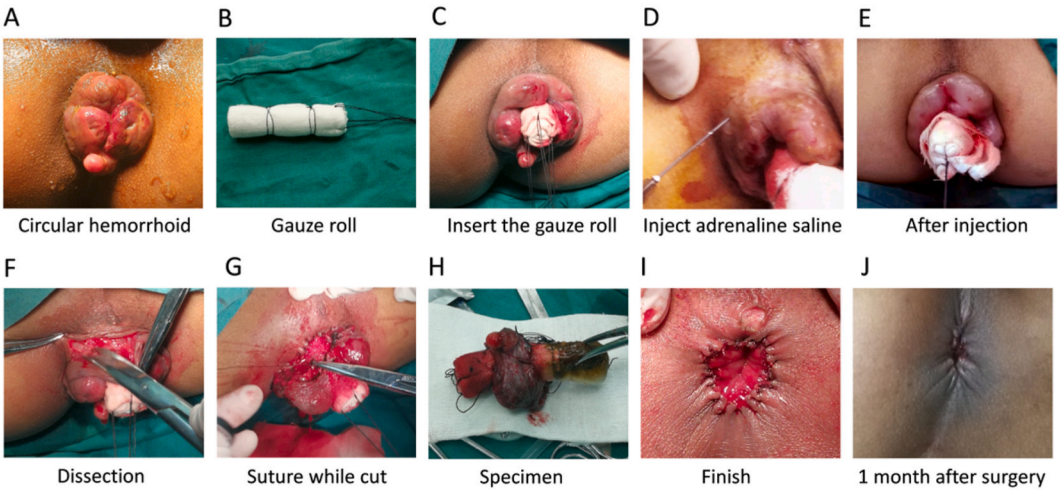


Fig. 1. Major surgical steps: Patient's(*A*)circular hemorrhoid before surgery.1.The whole (*B*)gauze roll was (*C*)inserted into the anal canal and then approximately 20% of the length of the gauze roll was withdrawn from the anal canal. The inner hemorrhoids were exposed to the surgeon. We then sutured the hemorrhoid to the gauze roll with 3-0 stitches. 2.(*D*)Adrenaline saline was injected into the subcutaneous tissue around the hemorrhoids. (*E*)Adrenaline saline helped to separate the hemorrhoid from both the perianal skin and the internal anal sphincter and to decrease intraoperative bleeding. 3.(*F*)The skin around the hemorrhoids was incised, the hemorrhoid was separated from the perianal skin, and the surgeon continued to separate upward and divide the hemorrhoids from the internal anal sphincter. The upper limit of the separating plane was 1–1.5 cm above the lower margin of the internal anal sphincter, just around the dental line. 4.Approximately one-quarter of the hemorrhoids were (*G*)cut from the rectal mucosa, and the rectal mucosa was sutured to the corresponding perianal skin. This procedure was repeated until the (*H*)whole circular hemorrhoid was cut off and (*I*)the rectum mucosa was sutured to the skin.Patient's(*J*) anus 1 month after surgery.

duration of hemorrhoid history was 19.0 ± 8.7 years, 110 (53.7%) patients had thrombotic hemorrhoids, and the baseline characteristics are listed in Table 1.

No significant differences regarding basic clinical data were found between the two groups (Table 1).

3.2. Surgical procedure

All of the surgeries were performed by Professor Peng Zhu's team. In the modified Whitehead group, a total of 161 (78.5%) patients received general anesthesia, and 44 (21.5%) patients received spinal anesthesia. The average operation time was 59.2 ± 13.8 min. The average intraoperative bleeding was 52.5 ± 14.8 ml. During the postoperative period, the average visual analog score (VAS) was 2.87 ± 0.73 on POD1, 2.20 ± 0.69 on POD3 and 1.34 ± 0.49 on POD 5; the average time to defection was 3.2 ± 0.9 days; the average hospital stay was 4.6 ± 1.0 days; and the average time to return to normal activities was 16.6 ± 3.7 days. In the partial hemorrhoidectomy group, a total of 102 (63.4%) patients received general anesthesia, and 59 (36.6%) patients received spinal anesthesia. The average operation time was 50.3 ± 8.1 min. The average intraoperative bleeding was 51.9 ± 13.7 ml. During the postoperative period, the average visual analog score (VAS) was 2.52 ± 0.81 on POD1, 2.17 ± 0.58 on POD3 and 1.29 ± 0.52 on POD 5; the average time to defection was 3.1 ± 0.8 days; the average hospital stay was 5.1 ± 0.8 days; and the average time to return to normal activities was 15.4 ± 4.2 days (Table 2).

3.3. Postoperative complications

In the postoperative period, in the modified Whitehead group, wound bleeding (>100 ml) occurred in 4 (2.0%) patients. In the partial hemorrhoidectomy group, wound bleeding (>100 ml) occurred in 3 (1.9%) patients, and they were treated by gauze compression and blood transfusion. In the modified Whitehead group, 66 (32.2%) patients had urinary retention, among them, there were 45 male patients, and our analysis shows that 28 of these 45 patients have received spinal anesthesia. Ten (4.9%) patients had a sense of incomplete rectal emptying. In the partial hemorrhoidectomy group, 38(23.5%) patients had urinary retention, among them, there were 29 male patients, and our analysis shows that 22 of these 29 patients received spinal anesthesia. Eight (5.0%) patients had a sense of incomplete rectal emptying. We mainly used a hot compress and catheterization to manage urinary retention. We used polyethylene glycol 4000 powder or paraffin oil to treat poor defecation. In the modified Whitehead group, 5 (2.4%) patients had anal incontinence. In the partial hemorrhoidectomy group, 4 (2.4%) patients had anal incontinence, they were treated by levator ani exercise, and they all had a good recovery several months later. Wound infection occurred in 6 (2.9%) patients in the modified Whitehead group and occurred in 5 (3.1%) patients in the partial hemorrhoidectomy group, and they were treated with a sitz bath. Three (1.5%) patients experienced mild to moderate anal stricture 4 months after surgery in the modified Whitehead group, 4 (2.4%) patients experienced mild to moderate anal stricture 4 months after surgery in the partial hemorrhoidectomy group, they were treated with regular RDE (three times a week) and a sitz bath, and none of them needed secondary surgery. In the modified Whitehead group, 2 (1.0%) patients experienced mucosal ectropion, and "baby powder" was advised for external application. None of these patients received a secondary surgery. The 30-day morbidity and long-term morbidity are shown in Table 2.

3.4. Symptom relapse

There were no residual hemorrhoids in patients who received modified Whitehead hemorrhoidectomy. Of the patients who underwent partial hemorrhoidectomy, 58 had hemorrhoidal residues, and 4 underwent reoperation to remove the lesion. Among patients with no obvious hemorrhoid residue, there was no recurrence of hemorrhoids in the modified Whitehead group, but 19 patients in the partial hemorrhoidectomy group experienced haemorrhoid recurrence, and 2 of them received additional operations (Table 2).

4. Discussion

Our experience showed that modified Whitehead's hemorrhoidectomy is a useful and safe treatment for grade 4 circumferential mixed hemorrhoid patients. The procedures are relatively easy to perform, and the operation is worth popularizing.

Milligan-Morgan hemorrhoidectomy and stapled hemorrhoidopexy are widely used for hemorrhoid patients [18,19]. Early studies

Table 1
Baseline characteristics.

	Modified Whitehead	Partial hemorrhoidectomy	P value
Gender			0.406
Male	115	80	
Female	90	81	
Age (years)	60.0 ± 9.5	55.5 ± 8.5	0.382
History of hemorrhoids (years)	19.0 ± 8.7	18.3 ± 3.9	0.443
Symptom duration	12.4 ± 4.6	12.3 ± 3.9	0.763
Accompanied thrombosis hemorrhoids	110 (53.7%)	59 (36.4%)	0.037
Average VAS scores	2.09 ± 0.73	1.92 ± 0.74	0.763
Average length of follow up(months)	8.2 ± 2.4	7.8 ± 2.7	0.284

Table 2
Postoperative complications.

	Modified Whitehead	Partial hemorrhoidectomy	P value
Types of anesthesia			0.373
General anesthesia	161 (78.5%)	102 (63.4%)	0.442
Male	83(40.4%)	57(35.4%)	
Female	78(38.0%)	45(28.0%)	
Spinal anesthesia	44 (21.5%)	59(36.6%)	0.568
Male	32(15.6%)	41(25.5%)	
Female	12(5.9%)	18(11.2%)	
Mean duration of surgery (Minutes)	59.2 ± 13.8	50.3 ± 8.1	0.307
Intraoperative bleeding (mL)	52.5 ± 14.8	47.9 ± 13.7	0.067
Average VAS score			0.386
POD1	2.87 ± 0.73	2.52 ± 0.81	
POD3	2.20 ± 0.69	2.17 ± 0.58	
POD5	1.34 ± 0.49	1.29 ± 0.52	
Average time to first defection (days)	3.2 ± 0.9	3.1 ± 0.8	0.335
Average hospital stay (days)	4.6 ± 1.0	5.1 ± 0.8	0.086
Average time to back to normal activities (days)	16.6 ± 3.7	15.4 ± 4.2	0.174
Hemorrhoids residue	0	58	0.001
Hemorrhoids recurrence	0	19	0.001
Postoperative complications (30 day morbidity)			
Bleeding need intervention	4 (2.0%)	3(1.9%)	0.102
Wound infection	6 (2.9%)	5(3.1%)	0.183
Sense of incomplete rectal emptying	10 (4.9%)	8(5.0%)	0.282
Anal incontinence	5 (2.4%)	4(2.4%)	0.196
Urinary retention	66 (32.2%)	38(23.5%)	0.046
Male	45(22.0%)	29(18.0%)	
Female	11(5.4%)	9(5.6%)	
Postoperative complications (long term morbidity)			
Anal stricture	3 (1.5%)	4(2.4%)	0.653
Mucosal ectropion	2 (1.0%)	0(0%)	0.001

reported that stapled hemorrhoidopexy was associated with less pain and faster recovery than Milligan-Morgan hemorrhoidectomy [20,21]. However, staple hemorrhoidopexy does not address external hemohaemorrhoids, and patients who received this surgery were significantly more likely to have recurrent hemorrhoids in the long term [22]. Moreover, stapled hemorrhoidopexy may lead to some unique complications, such as rectovaginal fistula, staple line bleeding, and stricture at the staple line [23]. To date, excisional hemorrhoidectomy remains the first-line treatment for stage 3–4 symptomatic hemorrhoids.

However, Milligan-Morgan hemorrhoidectomy and even 3-quadrant hemorrhoidectomy could not achieve ideal results for patients with stage 4 circumferential hemorrhoids, especially for those accompanied by thrombotic hemorrhoids [24,25]. And most patients may have to receive additional surgery to eliminate residual hemorrhoids. How to best manage end-stage circular hemorrhoids remains a challenge for anorectal surgeons.

Whitehead's hemorrhoidectomy, so-called circular hemorrhoidectomy, is in fact a reasonable surgical procedure for end-stage circular hemorrhoid patients [26]. However, the implementation and generalization of this operation was unsatisfactory. The reasons may be that first, the previously reported incidences of anal stricture and mucosal ectropion were very high, and second, the surgical procedures were difficult to master. By consulting a large number of studies, we agree with Bonello [10] that serious postoperative complications were indeed caused by a misunderstanding of the anal anatomy. Most authors who reported anal stricture and mucosal ectropion had excised the hemorrhoid at the white line but not the dental line, and the dental line was approximately 1.5 cm above the white line [27]. Misoperation may lead to secondary wound healing and anal stricture and mucosal ectropion thereafter. In our center, the incidences of anal stricture and mucosal ectropion are very low, and we thus consider Whitehead's hemorrhoidectomy a safe surgical procedure.

In this study, urine retention was the most common morbidity (32.2% versus 23.5%) within 30 days after surgery. We suppose that the high incidence of urine retention may be related to the following causes: 1. Most patients with urinary retention received spinal anesthesia, which may lead to urinary retention; 2. Most of the patients with urinary retention were elderly men who may have mild prostatic hyperplasia. 3. This is a retrospective study, which may cause selection bias. For postoperative pain, some authors have reported that laser hemorrhoidoplasty can reduce postoperative pain [28,29]. We are interested in this technique, and we will investigate its safety and efficacy in the future.

As the original procedures of Whitehead's hemorrhoidectomy were complicated, we modified them and made them easier to perform. The major steps can be seen in the Materials and Methods section. Here, we emphasize two details: 1. A gauze roller was inserted into the anus and then gently withdrawn. This step helped us to conveniently expose the inner hemorrhoids. 2. Inject enough adrenaline saline around the hemorrhoids (usually 80–100 ml). Adrenaline saline separates the hemorrhoids from the surrounding tissues, especially the internal anal sphincter, and reduces intraoperative bleeding. The average operation time in our department was 59.2 ± 13.8 min, which is comparable to other studies, indicating that our surgical procedures are not worse than other types of modified operations.

The limitations of this study include 1. Due to the fact that many data sources are subjective feelings of patients, there are certain

limitations in the reliability and universality of the research results. 2. The small sample size and short duration of this study have limited the representativeness of the research results.The drawbacks of this study include 1. the high incidence of loss to follow-up and 2. the lack of a control group. In this study, 137/503 patients were lost to follow-up, mainly for the following reasons: 1. Most patients lived in remote rural areas with inconvenient transportation; 2. Some patients' contact information has changed and cannot be contacted; 3. This study was a retrospective study, and some patient information was lost. However, more prospective randomized controlled trials to identify the effectiveness and safety of this surgery should be conducted in the near future.

5. Conclusions

Modified Whitehead's hemorrhoidectomy has excellent effects for grade 4 circular mixed hemorrhoids, and the incidence of anal stricture and mucosal ectropion after surgery is very low. However, more prospective randomized controlled trials are needed to confirm this conclusion.

Finding information

This study is funded by the Science and Health Joint Project of Chongqing, China (NO. 2020MSXM052).

Informed consent

Informed consent was obtained from all the patients.

Ethical approval

Approval was obtained from the ethics committee of the authors' institution(2020NO.404).

Declarations

None.

Data availability statement

Data will be made available on request.

CRediT authorship contribution statement

Xie Liu: Writing – review & editing, Writing – original draft. **Bo Sheng:** Writing – original draft, Investigation, Data curation. **Jianbo Zhang:** Methodology, Investigation, Data curation. **Jijian Wang:** Methodology, Data curation. **Jun Yu:** Investigation, Data curation. **Guanggang Zhang:** Investigation, Data curation. **Fengshun Dai:** Investigation, Data curation. **Heng Su:** Investigation, Data curation. **Jingsong Xu:** Investigation, Data curation. **Wei Hu:** Investigation, Data curation. **Tong Li:** Writing – review & editing, Software, Investigation, Formal analysis. **Peng Zhu:** Supervision.

Declaration of competing interest

We declare that we have no financial and personal relationships with other people or organizations that can inappropriately influence our work, there is no professional or other personal interest of any nature or kind in any product, service and/or company that could be construed as influencing the position presented in, or the review of, the manuscript entitled "Modified whitehead hemorrhoidectomy versus partial hemorrhoidectomy for fourth-degree circular mixed hemorrhoids: a retrospective analysis".

Acknowledgments

None.

References

[1] D.F. Altomare, S. Giuratrabocchetta, Conservative and surgical treatment of haemorrhoids, Nat. Rev. Gastroenterol. Hepatol. 10 (9) (2013) 513–521.
[2] R.A. Ganz, The evaluation and treatment of hemorrhoids: a guide for the gastroenterologist, Clin. Gastroenterol. Hepatol. 11 (6) (2013) 593–603.
[3] R. Muldoon, Review of American society of colon and rectal surgeons clinical practice guidelines for the management of hemorrhoids, JAMA Surg 155 (8) (2020) 773–774.
[4] Y. Tokunaga, H. Sasaki, T. Saito, Evaluation of sclerotherapy with a new sclerosing agent and stapled hemorrhoidopexy for prolapsing internal hemorrhoids: retrospective comparison with hemorrhoidectomy, Dig. Surg. 27 (6) (2010) 469–472.
[5] M.A. Qarabaki, G.A. Mukhashavria, G.G. Mukhashavria, N.G. Giorgadze, Circular vs. three-quadrant hemorrhoidectomy for end-stage hemorrhoids: short- and long-term outcomes of a prospective randomized trial, J. Gastrointest. Surg. 18 (4) (2014) 808–815.

[6] G.M. Onur, T. Dinc, V. Ozer, B. Yildiz, M. Cete, F. Coskun, Randomized controlled trial comparing the effects of vessel sealing device and Milligan Morgan technique on postoperative pain perception after hemorrhoidectomy, Dig. Surg. 32 (4) (2015) 258–261.
[7] A. Wald, A.E. Bharucha, B. Limketkai, A. Malcolm, J.M. Remes-Troche, W.E. Whitehead, et al., ACG clinical guidelines: management of benign anorectal disorders, Am. J. Gastroenterol. 116 (10) (2021) 1987–2008.
[8] B.A. Grotenhuis, J. Nonner, E. de Graaf, P.G. Doornebosch, Implementation of a new high-volume circular stapler in stapled anopexy for hemorrhoidal disease: is Patient's short-term outcome affected by a higher volume of resected tissue? Dig. Surg. 35 (5) (2018) 406–410.
[9] R.A. Pol, W.C. van der Zwet, D. Hoornenborg, B. Makkinga, M. Kaijser, S.M. Eeftinck, et al., Results of 244 consecutive patients with hemorrhoids treated with Doppler-guided hemorrhoidal artery ligation, Dig. Surg. 27 (4) (2010) 279–284.
[10] J.C. Bonello, Who's afraid of the dentate line? The Whitehead hemorrhoidectomy, Am. J. Surg. 156 (3 Pt 1) (1988) 182–186.
[11] G.A. Mukhashavria, M.A. Qarabaki, Circumferential excisional hemorrhoidectomy for extensive acute thrombosis: a 14-year experience, Dis. Colon Rectum 54 (9) (2011) 1162–1169.
[12] B.G. Wolff, C.E. Culp, The Whitehead hemorrhoidectomy, An unjustly maligned procedure, Dis. Colon Rectum 31 (8) (1988) 587–590.
[13] D.A. Caplin, I.J. Kodner, Repair of anal stricture and mucosal ectropion by simple flap procedures, Dis. Colon Rectum 29 (2) (1986) 92–94.
[14] G. Maria, G. Alfonsi, C. Nigro, G. Brisinda, Whitehead's hemorrhoidectomy. A useful surgical procedure in selected cases, Tech. Coloproctol. 5 (2) (2001) 93–96.
[15] H.C. Lin, Q.L. He, W.J. Shao, X.L. Chen, H. Peng, S.K. Xie, et al., Partial stapled hemorrhoidopexy versus circumferential stapled hemorrhoidopexy for grade III to IV prolapsing hemorrhoids: a randomized, noninferiority trial, Dis. Colon Rectum 62 (2) (2019) 223–233.
[16] G.A. Mukhashavria, M.A. Qarabaki, Surgical technique tailored to advanced haemorrhoids, Tech. Coloproctol. 13 (2) (2009) 151–155.
[17] H.C. Lin, D.L. Ren, Q.L. He, et al., Partial stapled hemorrhoidopexy versus circular stapled hemorrhoidopexy for grade III-IV prolapsing hemorrhoids: a two-year prospective controlled study, Tech. Coloproctol. 16 (5) (2012) 337–343.
[18] G. Zhang, R. Liang, J. Wang, M. Ke, Z. Chen, J. Huang, et al., Network meta-analysis of randomized controlled trials comparing the procedure for prolapse and hemorrhoids, Milligan-Morgan hemorrhoidectomy and tissue-selecting therapy stapler in the treatment of grade III and IV internal hemorrhoids(Meta-analysis), Int. J. Surg. 74 (2) (2020) 53–60.
[19] G. Ohana, B. Myslovaty, A. Ariche, Z. Dreznik, R. Koren, L. Rath-Wolfson, Mid-term results of stapled hemorrhoidopexy for third- and fourth-degree hemorrhoids–correlation with the histological features of the resected tissue, World J. Surg. 31 (6) (2007) 1336–1342.
[20] J.S. Kim, Y.K. Vashist, S. Thieltges, O. Zehler, K.A. Gawad, E.F. Yekebas, et al., Stapled hemorrhoidopexy versus Milligan-Morgan hemorrhoidectomy in circumferential third-degree hemorrhoids: long-term results of a randomized controlled trial, J. Gastrointest. Surg. 17 (7) (2013) 1292–1298.
[21] K.S. Towliat, S. Mehrvarz, N.S. Mousavi, R. Erfanian, Milligan-morgan hemorrhoidectomy vs stapled hemorrhoidopexy, Trauma Mon. 16 (4) (2012) 175–177.
[22] B.R. Davis, S.A. Lee-Kong, J. Migaly, D.L. Feingold, S.R. Steele, The American society of colon and rectal surgeons clinical practice guidelines for the management of hemorrhoids, Dis. Colon Rectum 61 (3) (2018) 284–292.
[23] W.C. Cirocco, Life threatening sepsis and mortality following stapled hemorrhoidopexy, Surgery 143 (6) (2008) 824–829.
[24] K. Erzurumlu, K. Karabulut, G.S. Ozbalci, I.A. Tarim, G. Lap, B. Gungor, The Whitehead operation procedure: is it a useful technique? Turk J Surg 33 (3) (2017) 190–194.
[25] A. Arezzo, V.Pescatori M. Podzemny, Surgical management of hemorrhoids. State of the art, Ann. Ital. Chir. 82 (2) (2011) 163–172.
[26] S.K. Efetov, Y.S. Medkova, Y.E. Kitsenko, K. Ong, I.A. Tulina, P.V. Tsarkov, Step-by-step open excisional haemorrhoidectomy for grade IV circular haemorrhoidal disease - a video vignette, Colorectal Dis. 22 (10) (2020) 1452–1453.
[27] E. Granet, An anorectoplasty for extensive and complicated hemorrhoids, Surgery 34 (1) (1953) 72–87.
[28] L. Brusciano, C. Gambardella, G. Terracciano, G. Gualtieri, M. Schiano di Visconte, et al., Postoperative discomfort and pain in the management of hemorrhoidal disease: laser hemorrhoidoplasty, a minimal invasive treatment of symptomatic hemorrhoids, Updates Surg 72 (3) (2020) 851–857.
[29] L. Brusciano, C. Gambardella, S. Tolone, G. Del Genio, G. Terracciano, et al., An imaginary cuboid: chest, abdomen, vertebral column and perineum, different parts of the same whole in the harmonic functioning of the pelvic floor, Tech. Coloproctol. 23 (6) (2019) 603–605.