Review Article

The Surgical Management of Haemorrhoids – A Historical Perspective

Keval Patel, Samuel Stefan, Syed Naqvi, Jim. S. Khan

SUMMARY

Haemorrhoids have affected people since ancient time. First documented treatment for haemorrhoids reported from the Egyptian papyrus. Indeed, Ebers' papyrus dated at 1550 BC, described the use of topical astringents to ease haemorrhoidal pain. More recently, the Milligan-Morgan haemorrhoidectomy and office procedures such as rubber-band ligation have been developed to improve patients' symptoms. However, these treatments have accompanying problems, for example the haemorrhoidectomy is known to be a profoundly painful operation and office procedures have high recurrence rates and are only suitable for minor haemorrhoids. The development of stapled haemorrhoidopexy and Transanal Haemorrhoidal Dearterialisation (THD) procedures, present the opportunity to treat all grades of haemorrhoids, with improved post-operative pain, whilst maintaining a low recurrence rate. This article places these more modern techniques in the context of the long history of surgical treatments for haemorrhoids and reviews the latest literature comparing operative haemorrhoidectomy, stapled haemorrhoidopexy and THD. A systematic review was carried out to retrieve articles describing history of surgical management of haemorrhoids and studies comparing three modern treatments for haemorrhoids (Haemorrhoidectomy, Stapled haemorrhoidectomy, and THD) were reported.

KEYWORDS: Haemorrhoids, Stapled haemorrhoidectomy, Transanal haemorrhoidal dematerialization.

INTRODUCTION

This review article summarises the studies presenting history of surgical management of haemorrhoids. A PubMed search was carried out with the key words of haemorrhoids, history, and surgery and article reporting historical management of haemorrhoids. References in these papers were manually checked and explored for further information. Three surgical modalities for the management of haemorrhoids (Haemorrhoidectomy, Stapled haemorrhoidectomy and THD) were analysed in detail and studies presenting clinical outcomes of these methods were included in this review. First documented treatment for haemorrhoids comes from the Egyptian papyrus. Edwin Smith in 1700 BC describe the use of an ointment of great protection made of Acacia leaves, ground, titurated and cooked together, smear a strip of fine linen there with and place in the anus, that was helpful in treating haemorrhoid.[1] Other archaeological artifacts also depict the struggle faced by early surgeons in relieving the symptoms of haemorrhoids. Indeed, the Ebers' medical Papyrus, dated at 1550 BC outlines the use of topical astringent lotions to treat haemorrhoids.[2] Around 400BC Hippocrates published his treatise "on haemorrhoids" where he described the perceived pathophysiology of haemorrhoids (the improper distribution of bile and phlegm to the anal veins) and a surgical means to their remedy.[3] Hippocrates suggested several techniques to cure the patient of their haemorrhoids. One method was to apply seven to eight heated iron rods to the "forced out anus." Hippocrates was clearly concerned with recurrence as, in his treatise he described that the anus should be forced out as much as possible to ensure that no haemorrhoidal tissue remains.[2] Of note, Hippocrates was the first to document use of a speculum to inspect the anal canal. Additionally, Hippocrates suggested the use of an assistant to hold down the arms and legs of the patient as he found the pain produced during the procedure helpful, due to patients' tendency to strain after the start of treatment, thus aiding the surgeon in removal of haemorrhoidal tissue in its entirety.[3] Hippocrates was also concerned with post-operative care and detailed the preparation of boiled lentils and

Dr. Keval Patel (MRCS)
Specialist Trainee
Portsmouth Hospitals NHS Trust, UK
Dr. Samuel Stefan (MRCS)
Clinical Fellow
Portsmouth Hospitals NHS Trust, UK
Dr. Syed Naqvi (FRCS)
Consultant Surgeon
Portsmouth Hospitals NHS Trust, UK
Dr. Jim. S Khan (PhD, FRCS)
Consultant Surgeon
Portsmouth Hospitals NHS Trust, UK
Honorary Reader
Anglia Ruskin University, Cambridge, UK

Correspondence:
Dr. Jim. S Khan
Email: jim.khan@porthosp.nhs.uk

tares (a weedy plant) for topical application postoperatively. Similar descriptions of operations have been found in the scripts of ancient cultures from across the globe.[2] In the late 2nd Century Galen, a Roman physician described using a thread to tie off piles (likely to be the external portion of haemorrhoids only) resulting in shriveling and necrosis of the external haemorrhoid.[2] Additionally, Indian texts written in the 4th and 5th Centuries describe the use of clamps and cautery for the operative treatment of haemorrhoids.[1,2]

The Indian Susruta Samhita, an ancient Sanskrit text dated between the fourth and fifth century ad, described treatment procedures comparable to those in the Hippocratic treatise, but with advancement in surgical procedures and emphasis on wound cleanliness.[1]

Operative technique of choice of some ancient surgeons were the circumferential ligature, encompassing the haemorrhoidal tissue. However, other eminent surgeons' use of sharp dissection and/or cautery of haemorrhoids.[2] For the subsequent millennium there would be few major advances in the operative treatment of haemorrhoids, save John of Arderne's, treatise on haemorrhoids and fistula-in-ano in the 14th century. Arderne recognised that haemorrhoids could vary in their severity and classified them into internal and external haemorrhoids.[2] Furthermore, Arderne documented the need for different treatment methods for each type, a strategy that remains in use today.[1]

In 1892, Mathews advocated the use of one part phenol, two parts olive oil as an injectable sclerosant to treat symptomatic haemorrhoids.[4] The sclerosant was to be injected to the haemorrhoidal pedicle, creating a fibrous reaction that would destroy the haemorrhoidal blood supply, causing haemorrhoidal tissue to necrose then slough away with faecal movement.[5] Sclerosant injection has been common place for over a century and varying compositions of sclerosant have been proposed. Currently, 5% phenol dissolved in peanut oil is the most commonly used in the UK.[4] However, sepsis, retroperitoneal abscesses and urological complications have all been reported following injection. Despite this, a recent survey of colorectal surgeons found that sclerosant injection is the treatment of choice for 1st degree haemorrhoids.[5]

OPERATIVE HAEMORRHOIDECTOMY

It wasn't until 1935 that Milligan and Morgan described their eponymous haemorrhoidectomy, as a treatment for large 2nd, 3rd and 4th degree haemorrhoids. The operation involves dissection of the internal and external haemorrhoidal tissue (including the pedicle) in addition to ligation of the haemorrhoidal artery in order to reduce the rate of recurrence. Milligan and Morgan described the necessity of maintaining "at least a ¼ inch of anal mucous membrane and skin" as a mucosal bridge between haemorrhoids to aid re-epithelialization and prevent stricture formation.[6]

Soon after, Ferguson and Heaton developed the "Closed Haemorrhoidectomy".[7] Their description involves careful preoperative preparation, with a fluid diet for the preceding day and a strict regimen of laxatives and enemas administered to empty the rectum. The operative dissection is similar to that described by Milligan and Morgan however, the key difference is the retention of the length of the pedicle stitch, which is later used to close the anal mucosa and skin. This procedure is postulated to result in reduced post-operative pain and an earlier return to work and is therefore popular amongst surgeons in the USA.[6,7]

That conventional surgical teaching dictates anal wounds should never be closed, has led many surgeons to question whether the Ferguson haemorrhoidectomy resulted in an increased rate of post-operative infection and therefore increased post-operative pain.[7] Indeed the choice of open vs. closed haemorrhoidectomy remains a topic of much debate, with some studies showing improved post-operative pain in closed haemorrhoidectomies[8], some studies finding no difference[9,10] and others favoring the open haemorrhoidectomy.[11]

Recent modifications to the haemorrhoidectomy allow for the use of point diathermy[12], laser[13], ligature [14,15] and harmonic scalpel.[16] However, despite these modifications, operative principles have remained unchanged. Thus, the excisional haemorrhoidectomy became the unchallenged gold-standard operation for 3rd and 4th degree haemorrhoids for the majority of the 20th Century, with the Milligan-Morgan (MM) haemorrhoidectomy remaining popular in the UK and the closed haemorrhoidectomy commonly used throughout the USA.[6] Despite the haemorrhoidectomy being the gold standard treatments for haemorrhoids, Bleday et al.[17] recommended that just under 10% of haemorrhoidal patients presenting to colorectal surgeons should be offered haemorrhoidectomy and it should be only offered to patients with 3rd and 4th haemorrhoids. This is in part due to the significant complication and morbidity rates associated with haemorrhoidectomy. Traditional haemorrhoidectomy has been associated with a low rate of recurrence. Indeed, Van de Stadt[18] followed up 507 patients for 46 months post MM haemorrhoidectomy, finding none that required further surgery in that time. Additionally, reported hemorrhage rates following conventional

haemorrhoidectomy are low. Indeed, a prospective follow up of 1,988 patients showed that bleeding occurred in only 8.4% of cases, with major hemorrhage, requiring further surgery accounting for only 2.4% of the total number of cases.[17] However, conventional haemorrhoidectomy is also known for being notoriously painful and, some argue, the reason that many patients avoid consulting their colorectal surgeon[19]. Indeed, as many as 28.8% of patients complain about significant post-operative pain following open haemorrhoidectomy.[20] Though many methods have been suggested to reduce post-operative pain, for example lateral sphincterotomy[20], metronidazole[7], anal dilation[21], etc., post-operative pain remains a significant concern following conventional haemorrhoidectomy.

OFFICE PROCEDURES

More recently still, there has been an upsurge of interventional treatments for haemorrhoidal disease, targeted at avoiding formal haemorrhoidectomy and its associated pain. Rubber band ligation was first described by Blaisdell in 1958, whereby a rubber band is placed on the pedicle of the haemorrhoidal tissue above the dentate line, resulting in necrosis of haemorrhoidal tissue and its eventual sloughing, akin to the threads used by Galen, thereby alleviating the patients' symptoms. Rubber bands replaced the traditional ligature as they could maintain pressure on the haemorrhoidal pedicle for longer periods and thus, reduced the incidence of post-operative bleeding[22]. Barron later modified Blaisdell's technique by introducing the Barron ligator, enabling a quick interchange of bands. The rubber band ligation of haemorrhoids could be performed in seconds and without the need for general anesthetic, significantly reducing the anxiety, pain and apprehension of patients when visiting a colorectal surgeon[19]. However, rubber-bands are extremely painful if placed below the dentate line and cannot deal with the cutaneous portion of the haemorrhoid.

Continuing the search for "office" based treatments for haemorrhoids, Lewis (1969) suggested that cryotherapy could be utilized to treat haemorrhoids. He described using nitrous oxide for internal haemorrhoids and liquid nitrogen for the skin component. Neither treatment required sedation nor analgesia and treatment occurred in the office setting. However, in addition to a high recurrence rate, haemorrhoidal oedema severe enough to warrant admission was reported following cryotherapy. Infrared coagulation was proposed by Neiger in 1979. By using a pulse of infrared radiation to the base of the haemorrhoidal pedicle (where sclerosant would be injected for injection treatment of haemorrhoids), immediate shriveling of the haemorrhoids resulted, therefore avoiding the swelling associated with cryotherapy whilst still achieving office based treatment of haemorrhoids. Despite this, infrared coagulation often requires more secondary treatment than rubber-band ligation therapy.[23] Despite the many advantages of "office" procedures to treat haemorrhoids, their success rates remain low, with some studies quoting long-term failure rates of 30% for the treatment of internal haemorrhoids by rubber band ligation[23-25] and even higher recurrence rates for sclerotherapy and infrared coagulation.[23, 26]

STAPLED HAEMORRHOIDOPEXY:

In 1998, Longo introduced the stapled Procedure for Prolapse and Haemorrhoids (PPH), otherwise known as stapled haemorrhoidopexy.[27] By using a circular stapling device to ligate and remove haemorrhoidal mucosa, external haemorrhoidal tissue would be retracted back into the anal canal, whilst concurrently interrupting haemorrhoidal blood supply and causing necrosis of the remaining haemorrhoidal tissue. Consequently, stapled haemorrhoidopexy is suitable for the treatment for 3rd and 4th grade haemorrhoids as well as smaller haemorrhoids. As no anal canal scars are left exposed, patients can expect to experience less post-operative pain than conventional haemorrhoidectomy and hence, an earlier return to work.[28,29] Indeed, recent meta-analysis of 29 RCT's revealed that post-operative pain control at 24 hrs is better in stapled haemorrhoidopexy than conventional haemorrhoidectomy[30] and a meta-analysis of 10 trials showed an earlier return to work for patients undergoing stapled haemorrhoidopexy compared with those undergoing conventional haemorrhoidectomy.

Additionally, meta-analyses of 6, 9 and 13 RCTs showed statistically significantly shorter operative time for stapled haemorrhoidopexy when compared to conventional haemorrhoidectomy.[30,31,32] Additionally, several individual RCT's show an improvement in outcomes for incontinence with stapled haemorrhoidopexy.[33-37] Despite this, three separate meta-analysis of 7, 18 and 4 RCT's, could not demonstrate statistically significant difference for incontinence rates between patients undergoing stapled haemorrhoidopexy and conventional surgery. Several studies have reported that stapled haemorrhoidopexy confers an increased risk of early or peri-operative bleeding when compared with conventional surgery.[34] Indeed, Nisar et al.[32] meta-analysis of 7 RCT's

indicated a statistically significant reduction in peri-operative bleeding for patients undergoing traditional surgery. Additionally, Shao et al.[31] found that early post-operative bleeding was more likely following stapled haemorrhoidopexy than conventional haemorrhoidectomy in a meta-analysis of 21 RCT's. Indeed Shao et al.[31] found that several RCT's described the need for additional suture material to the staple line. Despite this difference in early post-operative bleeding, Laughlan et al*.'s*[30] meta-analysis of 21 RCT's showed no statistically significant difference when pooling, short (<1month), medium (>1month and <36 months) and long-term (36 month) bleeding outcomes, postulating therefore, that bleeding risk must be reduced with stapled haemorrhoidopexy in the long-term, to account for the equality in total bleeding found by their systematic review. Higher recurrence rates have been reported following stapled haemorrhoidopexy patients when compared to conventional haemorrhoidectomy. Indeed, Nisar et al.[32] found recurrence rates to be higher for stapled haemorrhoidopexy after an average follow up of 15.9 months in a meta-analysis of 9 RCT's (11.8% vs. 0% for 3rd degree haemorrhoids and 50 vs. 0 for 4th degree haemorrhoids). Similarly, in a meta-analysis of 21 studies, Shao et al.[31] found recurrent prolapse rates to be almost twice as high following stapled haemorrhoidopexy than after conventional surgery, in addition, they report an increased need for surgery though this did not reach statistical significance.[31] Therefore, though stapled haemorrhoidectomy offers some advantages, i.e. that it allows for day surgery treatment, reduced post-operative pain and an earlier return to work, it has a higher recurrence rate than traditional surgery. Furthermore, Martisons et al.[29] remind us that stapled haemorrhoidopexy is unable to treat concomitant peri-anal disease e.g. fissures, skin tags, etc., without requiring further surgery or an additional procedure, thereby negating some of the benefits of stapled haemorrhoidopexy.

DOPPLER GUIDED HAEMORRHOIDAL ARTERY LIGATION

The previously described high failure rates of office treatments for haemorrhoids may be due to the novel understanding of the role of arterial flow in the pathogenesis of haemorrhoids[24]. Sun et al.[38] describe how haemorrhoidal vascular hyperplasia leads to distension of the vascular plexus. Destruction of the muscular and connective tissue then follows, resulting in further vascular in-flow and out-flow imbalance and consequently, further laxity of haemorrhoidal connective tissue. However, Giordano et al.[39] argue that the precise initiating mechanisms of haemorrhoids remain controversial. They argue that vascular hyperplasia, internal anal sphincter tone, connective tissue degeneration, impaired venous drainage, arteriovenous shunts within haemorrhoidal vasculature, or a combination of the above reasons could each initiate haemorrhoidal disease. However, several studies have shown that vascular hyperplasia has been shown to have a significant role in haemorrhoidal development[38] and Giordano et al.[39] concede that reducing blood flow to haemorrhoidal tissue may result in haemorrhoidal shrinkage and consequently, symptomatic improvement.

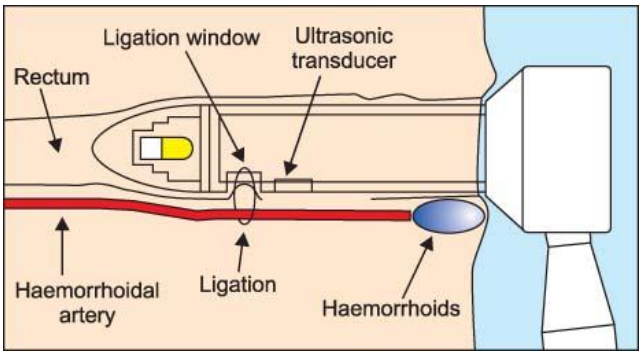
In 1995, Morinaga et al.[40] described using a miniature Doppler probe to identify the haemorrhoidal artery, developing the "Doppler Guided Haemorrhoidal Artery Ligation" (DGHAL), also known as the Transanal Haemorrhoidal Dearterialisation (THD). During THD, a modified ultrasound probe is used to identify the branches of the superior haemorrhoidal artery. Upon Doppler identification, ligatures are used, through a window in the probe, to tie off the arteries 2-3cm above the dentate line[39]. An average of five superior rectal artery branches require ligation, though the true number of contributing arteries can range from one to eight vessels[41]. Despite the operation revolving around the ligation of arterioles, post-operative bleeding rates for THD appear to be low, with Giordano et al.[39] reporting an early post-operative bleeding rate of only 4.3% (86/1986) in a systematic review of 17 RCT's. Additionally, Giordano et al.[39] report an incontinence rate of 0.4% (3/693) and that 1st day post-operative pain was only present in 18.5% of patients (353/1905)[39]. Indeed, return to work was swift with patients taking on average only 2-3 days of recuperation prior to recommencing work[39].Additionally, Giordano et al.[39] report a 9.0% recurrence rate overall (96/1065) however, the RCT's reviewed had variable periods of follow up, ranging from 3-79 months. Of these, Dal Monte et al.[42] had the longest patient follow up, ranging from 22-79 months. Despite this, they too reported recurrence rates of 8.7% (19/219 patients)[42], indicating consistency amongst reported recurrence rates (at approximately 9%) for patients undergoing THD. However, failure rates are considerably higher in grade IV haemorrhoids[43] for example, Scheyer et al.[44], found 59.3% recurrence rate (16/27 patients) for patients with 4th degree haemorrhoids at 18 month follow up and Dal Monte et al.[42] found a recurrence rate of 26.7% for patients with 4th grade haemorrhoids at a mean follow up of 46months. Therefore, Giordano et al.[39] concluded that THD was safe and efficacious in treating 2nd and

3rd degree haemorrhoids but, not for 4th degree haemorrhoids.

COMPARISON STUDIES

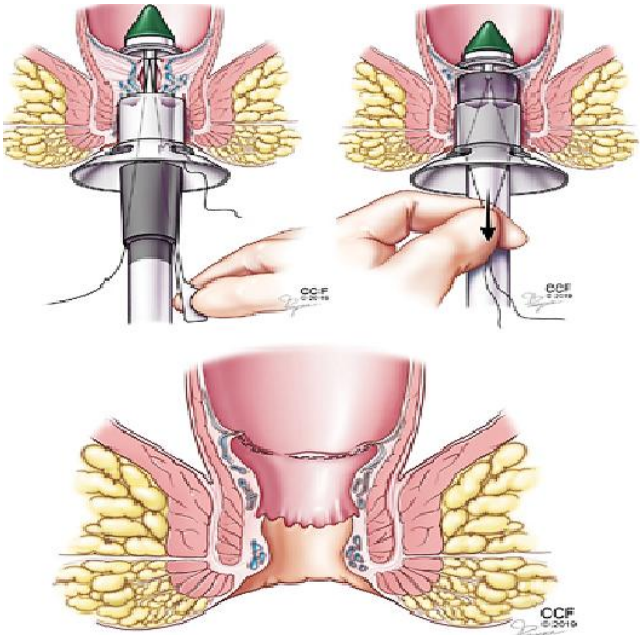
These novel techniques represent exciting innovations in the treatment of an age old problem. Indeed, several studies have attempted to compare and contrast the benefits of THD versus stapled haemorrhoidopexy.

Figure 1: Transanal haemorrhoid artery dearterialisation approach



https://synapse.koreamed.org/ViewImage.php?Type=F&aid=11146&id=F2&afn=37_JKSS_79_2_116&fn=jkss-79-116-g002_0037JKSS

Figure 2: Stapled haemorrhoidectomy



https://www.mdedge.com/ccjm/article/206851/gastroenterology/hemorrhoids-range-treatments/page/0/3

Festen et al.[45] describe a RCT of 41 patients allocated to either THD or stapled haemorrhoidopexy, concluding that THD and stapled haemorrhoidopexy provide similarly low recurrence rates in the short-term (measured by a resolution of symptoms 6 weeks post-operatively). However, as Teo et al.[46] point out, Festen et al.[45], had few patients in each group, mismatched haemorrhoidal severity between the groups and furthermore, had followed up patients for only six weeks. Despite these failures, other recent publications of abstracts presented at conferences corroborate Festen et al.[45] initial findings. Indeed, Altomare et al.[47] report early results of an RCT consisting of 172 patients and, they too found reduced post-operative pain in the initial post-operative week for patients undergoing THD, whilst finding similar recurrence rates between THD and stapled haemorrhoidopexy after a mean follow up of 15 months.

CONCLUSION

Haemorrhoids have afflicted humans for millennia and their treatment has been notoriously painful. Through surgical innovation, novel approaches to the pre, intra and postoperative management of haemorrhoids have greatly improved patients experience of the disease. Traditional treatment options have varied, with some providing good post-operative pain control, early return to work and high patient satisfaction[48,49], whilst others provided a low recurrence rate[23]. However, that one particular treatment is not widely accepted implies that none are likely to be significantly more efficacious than its counterparts. Therefore, innovative treatments are sought that will once again change the face of surgical management of this longstanding disease.

Stapled Haemorrhoidopexy and Transanal Haemorrhoidal Dearterialisation may deliver such promises. Indeed, both techniques give short-term benefits in terms of reduced post-operative pain and increased suitability for day-case surgery and hence have increased in popularity. However, recurrence rates remain higher than traditional haemorrhoidectomy and robust evidence, with high quality studies conducted with long-term follow up, particularly for THD, are required.

Conflicts of Interest: None.

REFERENCES

1. Agbo SP.Surgical management of hemorrhoids. J Surg Tech Case Rep. 2011; 3(2):68-75. doi: 10.4103/2006-8808.92
2. Ellesmore S, Windsor AC. Surgical History of Haemorrhoids. In Mann C.V. (eds) Surgical Treatment of Haemorrhoids. Springer; London. 2002;19- 24. doi.org/ 10.1007/978-1-4471-3727-6_1.

3. Adams F. On Hemorrhoids by Hippocrates. Adelaide: eBooks@ Adelaide; 2007. Available from: http://ebooks . adelaide.edu.au/h/hippocrates/hemorrhoids/.
4. Mathews JM. A treatise on the disease of the rectum, anus and sigmoid flexure. [S.l.]: H. Kimpton; 1892.
5. Al-Ghnaniem R, Leather AJ, Rennie JA. Survey of methods of treatment of haemorrhoids and complications of injection sclerotherapy. Ann R Coll Surg Engl. 2001 Sep;83(5):325-328.
6. Milligan E, Morgan C, Jones L, Officer R. Edward Thomas Campbell Milligan 1886–1972. Diseases of the Colon & Rectum. 1985;28(8):620-628.
7. Ferguson JA, Heaton JR. Closed hemorrhoidectomy. Dis Colon Rectum. 1959 Mar-Apr;2(2):176-179.
8. Hosch SB, Knoefel WT, Pichlmeier U, Schulze V, Busch C, Gawad KA, et al. Surgical treatment of piles: prospective, randomized study of Parks vs. Milligan-Morgan hemorrhoidectomy. Dis Colon Rectum. 1998 Feb;41(2):159-164.
9. Carapeti EA, Kamm MA, McDonald PJ, Chadwick SJ, Phillips RK. Randomized trial of open versus closed day-case haemorrhoidectomy. Br J Surg. 1999 May;86(5):612-613.
10. Arbman G, Krook H, Haapaniemi S. Closed vs. open hemorrhoidectomy--is there any difference? Dis Colon Rectum. 2000 Jan;43(1):31-34.
11. Gençosmanoğlu R, Şad O, Koç D, İnceoğlu R. Hemorrhoidectomy: Open or Closed Technique? Diseases of the Colon & Rectum. 2002;45(1):70-75.
12. Andrews BT, Layer GT, Jackson BT, Nicholls RJ. Randomized trial comparing diathermy hemorrhoidectomy with the scissor dissection Milligan-Morgan operation. Dis Colon Rectum. 1993;36(6):580-583.
13. Wang JY, Chang-Chien CR, Chen JS, Lai CR, Tang RP. The role of lasers in hemorrhoidectomy. Dis Colon Rectum. 1991; 34(1):78-82.
14. Jayne DG, Botterill I, Ambrose NS, Brennan TG, Guillou PJ, O'Riordain DS. Randomized clinical trial of Ligasure™versus conventional diathermy for day-case haemorrhoidectomy. British Journal of Surgery. 2002;89(4):428-432.
15. Nienhuijs S, de Hingh I. Conventional versus LigaSure hemorrhoidectomy for patients with symptomatic Hemorrhoids. Cochrane Database Syst Rev. 2009(1):CD006761.
16. Tan J, Seow-Choen F. Prospective, randomized trial comparing diathermy and Harmonic Scalpel® hemorrhoidectomy. Diseases of the Colon & Rectum. 2001;44(5):677-679.
17. Bleday R, Pena JP, Rothenberger DA, Goldberg SM, Buls JG. Symptomatic hemorrhoids: current incidence and complications of operative therapy. Dis Colon Rectum. 1992;35(5):477-481.
18. Van de Stadt J, D'Hoore A, Duinslaeger M, Chasse E, Penninckx F. Long-term results after excision haemorrhoidectomy versus stapled haemorrhoidopexy for prolapsing haemorrhoids; a Belgian prospective randomized trial. Acta Chir Belg. 2005;105(1):44-52.
19. Barron J. Office ligation treatment of hemorrhoids. Dis Colon Rectum. 1963;6:109.
20. Diana G, Guercio G, Cudia B, Ricotta C. Internal sphincterotomy reduces postoperative pain after Milligan Morgan haemorrhoidectomy. BMC Surg. 2009;9:16.
21. Mortensen PE, Olsen J, Pedersen IK, Christiansen J. A randomized study on hemorrhoidectomy combined with anal dilatation. Dis Colon Rectum. 1987;30(10):755-757.
22. Blaisdell PC. Office ligation of internal hemorrhoids. Am J Surg. 1958;96(3):401-404.
23. MacRae HM, McLeod RS. Comparison of hemorrhoidal treatment modalities. A meta-analysis. Dis Colon Rectum. 1995;38(7):687-694.
24. Felice G, Privitera A, Ellul E, Klaumann M. Doppler-guided hemorrhoidal artery ligation: an alternative to hemorrhoidectomy. Dis Colon Rectum. 2005;48(11):2090-2093.
25. Forlini A, Manzelli A, Quaresima S, Forlini M. Long-term result after rubber band ligation for haemorrhoids. Int J Colorectal Dis. 2009;24(9):1007-1010.
26. Johanson JF, Rimm A. Optimal nonsurgical treatment of hemorrhoids: a comparative analysis of infrared coagulation, rubber band ligation, and injection sclerotherapy. Am J Gastroenterol. 1992;87(11):1600-1606.
27. Longo A. Treatment of hemorrhoids disease by reduction of mucosa and hemorrhoidal prolapse with a circular suturing device: a new procedure. 6th World Congress of Endoscopic Surgery, Pts 1 and 2. 1998:777.
28. Madiba TE, Esterhuizen TM, Thomson SR. Procedure for prolapsed haemorrhoids versus excisional haemorrhoidectomy--a systematic review and meta-analysis. S Afr Med J. 2009;99(1):43-53.
29. Martinsons A, Narbuts Z, Brunenieks I, Pavars M, Lebedkovs S, Gardovskis J. A comparison of quality of life and postoperative results from combined PPH and conventional haemorrhoidectomy in different cases of haemorrhoidal disease. Colorectal Dis. 2007;9(5):423-429.
30. Laughlan K, Jayne DG, Jackson D, Rupprecht F, Ribaric G. Stapled haemorrhoidopexy compared to Milligan-Morgan and Ferguson haemorrhoidectomy: a systematic review. Int J Colorectal Dis. 2009;24(3):335-344.
31. Shao WJ, Li GC, Zhang ZH, Yang BL, Sun GD, Chen YQ. Systematic review and meta-analysis of randomized controlled trials comparing stapled haemorrhoidopexy with conventional haemorrhoidectomy. Br J Surg. 2008;95(2): 147-160.
32. Nisar PJ, Acheson AG, Neal KR, Scholefield JH. Stapled hemorrhoidopexy compared with conventional hemorrhoidectomy: systematic review of randomized, controlled trials. Dis Colon Rectum. 2004;47(11):1837-1845.
33. Pavlidis T, Papaziogas B, Souparis A, Patsas A, Koutelidakis I, Papaziogas T. Modern stapled Longo procedure vs. conventional Milligan-Morgan hemorrhoidectomy: a randomized controlled trial. Int J Colorectal Dis. 2002;17(1):50-53.
34. Correa-Rovelo JM, Tellez O, Obregon L, Miranda-Gomez A, Moran S. Stapled rectal mucosectomy vs. closed hemorrhoidectomy: a randomized, clinical trial. Dis Colon Rectum. 2002;45(10):1367-1374; discussion 74-75.

35. Mehigan BJ, Monson JR, Hartley JE. Stapling procedure for haemorrhoids versus Milligan-Morgan haemorrhoidectomy: randomised controlled trial. Lancet. 2000 4;355(9206):782-785.
36. Senagore AJ, Singer M, Abcarian H, Fleshman J, Corman M, Wexner S, et al. A Prospective, Randomized, Controlled Multicenter Trial Comparing Stapled Hemorrhoidopexy and Ferguson Hemorrhoidectomy: Perioperative and One-Year Results. Diseases of the Colon & Rectum. 2004;47(11):1824-1836.
37. Basdanis G, Papadopoulos VN, Michalopoulos A, Apostolidis S, Harlaftis N. Randomized clinical trial of stapled hemorrhoidectomy vs open with Ligasure for prolapsed piles. Surg Endosc. 2005;19(2):235-239.
38. Sun WM, Peck RJ, Shorthouse AJ, Read NW. Haemorrhoids are associated not with hypertrophy of the internal anal sphincter, but with hypertension of the anal cushions. British Journal of Surgery. 1992;79(6):592-594.
39. Giordano P, Overton J, Madeddu F, Zaman S, Gravante G. Transanal hemorrhoidal dearterialization: a systematic review. Dis Colon Rectum. 2009;52(9):1665-1671.
40. Morinaga K, Hasuda K, Ikeda T. A novel therapy for internal hemorrhoids: ligation of the hemorrhoidal artery with a newly devised instrument (Moricorn) in conjunction with a Doppler flowmeter. Am J Gastroenterol. 1995;90(4):610-613.
41. Thomson WH. The nature of haemorrhoids. Br J Surg. 1975;62(7):542-552.
42. Dal Monte PP, Tagariello C, Sarago M, Giordano P, Shafi A, Cudazzo E, et al. Transanal haemorrhoidal dearterialisation: nonexcisional surgery for the treatment of haemorrhoidal disease. Tech Coloproctol. 2007;11(4):333-338; discussion 8-9.
43. Theodoropoulos GE, Sevrisarianos N, Papaconstantinou J, Panoussopoulos SG, Dardamanis D, Stamopoulos P, et al. Doppler-guided haemorrhoidal artery ligation, rectoanal repair, sutured haemorrhoidopexy and minimal mucocutaneous excision for grades III–IV haemorrhoids: a multicenter prospective study of safety and efficacy. Colorectal Disease. 2010;12(2):125-134.
44. Scheyer M, Antonietti E, Rollinger G, Mall H, Arnold S. Doppler-guided hemorrhoidal artery ligation. Am J Surg. 2006;191(1):89-93.
45. Festen S, van Hoogstraten M, van Geloven A, Gerhards M. Treatment of grade III and IV haemorrhoidal disease with PPH or THD. A randomized trial on postoperative complications and short-term results. International Journal of Colorectal Disease. 2009;24(12):1401-1405.
46. Teo J-Y, Kam M-H, Eu K-W. Letter to the editor on the article "Treatment of grade III and IV haemorrhoidal disease with PPH or THD. A randomized trial on postoperative complications and short-term results". International Journal of Colorectal Disease. 2010;25(11):1385.
47. Altomare D, Infantino A, Bottini C, Gentile M, Buonanno M, Hoch J, et al. Prospective Randomized Multicenter Study Comparing Stapler Hemorrhoidopexy (Sh) with Doppler-Guided Transanal Hemorrhoid Dearterialization (Thd) for Iii-Degree Hemorrhoids. Diseases of the Colon & Rectum. 2010;53(4):580.
48. Steinberg DM, Liegois H, Alexander-Williams J. Long term review of the results of rubber band ligation of haemorrhoids. Br J Surg. 1975;62(2):144-146.
49. Marshman D, Huber PJ, Jr., Timmerman W, Simonton CT, Odom FC, Kaplan ER. Hemorrhoidal ligation. A review of efficacy. Dis Colon Rectum. 1989;32(5):369-371.

Author's Contribution:

Dr. Keval Patel	Searched material from data bases, literature review and writing of initial draft of manuscript and approving final version.
Dr. Samuel Stefan	Literature review, writing manuscript and approving final version.
Dr. Syed Naqvi	Literature review writing manuscript and approving final version.
Dr. Jim S. Khan	Main concept of manuscript, helped in manuscript drafting, revised all intellectual content. Accountable for providing information.