Hemorrhoids are a very common anorectal disorder defined as the symptomatic enlargement and abnormally downward displacement of anal cushions. Hemorrhoids become pathognomonic due to the degenerative change of supportive tissue within the anal cushions, vascular hyperplasia, and hyperperfusion of hemorrhoidal plexus. Early grades of hemorrhoids (Grade I and II) can be effectively treated with dietary and lifestyle modifications, pharmacological treatment, and different office-based procedures. Surgical intervention is indicated in symptomatic and advanced grades of hemorrhoids. Although hemorrhoidectomy is still considered as the gold standard, more recently, newer approaches like Ligasure and ultrasonic hemorrhoidectomy, stapled hemorrhoidopexy, and doppler-guided hemorrhoidal artery ligation have been used with a desirable success. However, post-procedural pain and disease recurrence remain the most challenging problems. This article deals with the pathophysiology and evidence-based approach to hemorrhoidal diseases.

Key words: hemorrhoids, pathophysiology, management

INTRODUCTION

It has been proved that hemorrhoidal tissue is physiological and represents a part of the anal continence mechanism, which is located in the anal canal and distal rectum. The hemorrhoidal tissue is described as vascular cushions embedded in a stroma of connective tissue and smooth muscle fibers situated within the anal canal. This complex fulfills four main functions. The three cushions in the anal canal provide maintenance of the anal continence, they provide 15%–20% of resting anal pressure, protect the sphincter mechanism during evacuation and they form a compressible lining, facilitating closure of the anal canal. The smooth muscle acts as a supportive structure, forming a fibro-elastic network within the plexuses. The vascular structure in these cushions is named as the corpus cavernosum recti and is also known as plexus hemorrhoidalis and is supplied by a complex structure of blood vessels.

According to these concepts, practically everybody should have hemorrhoids, as they grow older. Hemorrhoids are normal parts of the human body and should be considered pathologic only if they become symptomatic or grow extremely large. While hemorrhoids are considered as a normal physiological structure, the question arises that why these hemorrhoids become diseased to cause symptoms. Several mechanisms have been suggested to explain the onset of hemorrhoidal disease.

THEORIES AND MECHANISMS OF SYMPTOMATIC HEMORRHIOIDS

The mechanical "sliding and lining" theory: Treitz was the first to describe the anchoring connective tissue and smooth muscle deriva from the longitudinal conjoined muscle and partly from the internal sphincter into the submucosa of the anal canal. He described how these layers of meshwork acted as supporting scaffold to the hemorrhoidal venous plexus, thereby supporting the mucosa itself and preventing it from prolapsing into the anal canal while passing stools.

This theory corresponds to our clinical experience where "hemorrhoids" are indeed a mucoanal prolapse rather than vascular pathology. It is notable that the prolapse may involve only a single cushion or it may be circumferential. Despite the anatomical, histological and clinical evidence of mucoanal prolapse it is still debated whether mucoanal prolapse or vascular enlargement is the core event of hemorrhoidal disease.
The laxity of the anchoring system of the hemorrhoidal cushion results in greater mobility of the hemorrhoids, which can then move downward during the situations where the intrarectal pressure is raised such as during defecation. At the maximum point, the suspensory ligament and the anchoring tissues are ruptured and the internal hemorrhoids are permanently prolapsed at the anal verge. Laxity of support tissue leads to distention of the vascular component with resultant increase in the size of the hemorrhoids.

This mobilization and distension results in fragilization of the mucosa covering the internal hemorrhoid. This leads to bleeding which does not come from the vascular structures of the hemorrhoidal cushion but rather from the vessels of the mucosa. Mobilization of the internal hemorrhoidal mass may be accompanied by keratinization of the mucosa above the dentate line, giving it a whitish appearance.

_Hemodynamic theory:_ Thomson illustrated that the presumed enlargement of the hemorrhoidal veins were normal structures. He emphasized that the hemorrhoidal venous plexus is present from birth and found in every adult as normal parts of the human body. It was thought that elevation of the venous pressure results in the development of hemorrhoids. Internal hemorrhoids may be caused by a backflow of venous blood. This backflow could be the result of increased intra abdominal pressure during pregnancy or straining at stools.

Few sphincter abnormalities have been shown by anorectal manometry in patients with symptomatic hemorrhoids. The most common was an increase in the anal resting pressure.

Morgagni believed that the human upright posture could cause hemorrhoids. Several other circumstances such as lack of valves in the portal vein or even a rise in abdominal pressures were thought to contribute the development of hemorrhoids. Recently, an increased caliber and greater arterial flow of the terminal branches of the superior rectal artery was demonstrated and correlated with the presence of hemorrhoids. The increased caliber was also demonstrated to be associated with advancing age.

In another study, it was found that a network of submucosal vessels exhibiting multiple thickened venous vessels separated by distinct sphincter-like constrictions characterized the anorectal vascular plexus. The coordinated filling and drainage of the anorectal vascular plexus is regulated by intrinsic vascular sphincter mechanisms, and both morphological and functional failure of this vascular system may contribute to the development of hemorrhoidal disease.

In older age groups, the anchoring connective tissue system degenerates and the fibers are broken loose. The hemorrhoids are detached from the internal sphincter and slide downward. The anoderm also becomes loose and bulges into the anal canal or around the anal opening. This evidence suggests that hemorrhoidal disease is merely the outward manifestation of their downward displacement.

Another study proposed that hemorrhoids can be thought of as a localized vascular disturbance, and some of the changes observed in these lesions are processes that are known to be influenced by mast cells in other sites. When mast cells reach target tissues, they release various mediators from their granules. Biogenic amines, in particular histamine and leukotrienes, induce vasodilation and vascular permeability. Enzymes, consisting mainly of tryptase and chymase, can promote vascular breakdown or vessel wall weakness, leading to tortuosity and/or neovascularization. Platelet-activating factor enhances thrombocytic aggregation and vasodilatation. It was found that there is a significant increase in mast cells in association with hemorrhoids compared to normal tissue from the same site.

From various studies, it has been proved that the prevalence of hemorrhoids in the entire population is already high by the age of 30. The anchoring mechanism of the rectal mucosa deteriorates with advancing age. Deterioration of the connective tissue fibers in individuals may differ. It may be hereditary. In certain persons hemorrhoids may appear earlier than in others. Sooner or later, everybody will have hemorrhoids; however, not everybody will have symptoms of the hemorrhoids.

**APPROACH TO HEMORRHNOIDS**

Since the cushions assist in continence; the hemorrhoids should be treated as conservatively as possible. If bleeding is the main complaint, the responsible hemorrhoid maybe recognized by its inflamed appearance or friable surface and perhaps most appropriately dealt with. If prolapse needs treatment, redundant tissue only should be excised. If only one cushion is prolapsing, then it is the only "hemorrhoid", which needs excision.

Most patients with symptomatic hemorrhoids can be successfully treated by minor procedures and can avoid the need for extensive surgical interventions. Treatment is often aimed at relieving symptoms rather than improving the appearance of the anal canal. Patients with hemorrhoids can be distinguished into two groups: (1) young people, usually men, whose main symptom is bleeding and anal discomfort; and (2) older patients or women, in whom prolapse is the principal complaint. It has been found that a procedure aiming at relieving anal spasm is most suitable for patients with anal pain and bleeding, whereas fixation of the mucosa is most appropriate for patients with prolapsing piles.

**OUTPATIENT TREATMENT**

Interventional procedures are performed in the office to treat grade 1 hemorrhoids unresponsive to conservative methods; and for second and third degree hemorrhoids. Treatment is directed at the base or pedicle of the hemorrhoid, which lie above the dentate line. If performed correctly, these procedures are almost painless. Various office procedures like injection sclerotherapy; ablation using various forms of heat, rubber band ligation and hemorrhoidal artery ligation are aimed at restoration of the
prolapsed or congested hemorrhoids back into the anal canal by submucosal fibrosis and fixation.

The consensus on proposing appropriate treatment option rely on following issues - (1) the aim of treatment should be induction of fibrosis to replace the hemorrhoidal cushions back to their normal position, (2) only the internal hemorrhoids should be treated through office procedures, (3) hemorrhoids need not be treated unless they produce symptoms, (4) only those far-advanced hemorrhoids in which there has been extensive fragmentation of the supportive connective tissue need be treated surgically, and (5) treatment should be adjusted according to the stage of the hemorrhoids.

**Injection sclerotherapy** - Injection sclerotherapy for hemorrhoids has been practiced for approximately 100 years and gives considerable relief for varying periods of time. This is an effective and safe method of treating Grade I and II hemorrhoids. The injection causes a fibrous tissue reaction in the submucosa of the upper anal canal and lower rectum. It causes shrinkage of tissue by necrosis and adhesion as a result of the ensuing inflammatory reaction. A combination of sclerotherapy and rubber band ligation has also been found to be effective in controlling rather large hemorrhoids.

Many different substances have been used as sclerosant, which include Polidocanol, Ethanol, Sodium, Phenol, n-dodecane, Fibrin Foam, Biotrol, Epinephrine, Tetracycline, Ethoxysclerol, Sotradecol foam, quinine, a combination of aluminum potassium sulfate and tannic acid called as Zione, and 23.4% saline; but sterilized almond oil containing 5 percent phenol is the most common sclerosant used. The injection is placed in the submucosa of the upper anal canal, well above the sensitive epithelium. Following rigid sigmoidoscopy, the hemorrhoids are visualized on proctoscopy and the proctoscope is advanced until the hemorrhoidal tissue has almost disappeared from the lumen. Three 5-ml injections of 5 percent phenol in Almond Oil are administered submucosally just above the bulk of hemorrhoidal tissue using a special syringe, with the bevel of the needle facing the mucosa. Correctly performed, the technique produces elevation and pallor of the mucosa without significant discomfort to the patient.

**RUBBER BAND LIGATION**

Outpatient ligation of symptomatic hemorrhoids was first described by Blaisdell in the 1950s. Barron popularized the technique using a modified version of the Blaisdell in 1963 and is the most commonly used outpatient treatment for hemorrhoids.

The rubber band, which is made of soft elastic or latex, is applied to the base of the hemorrhoidal cushion by a device which sucks or grasps the hemorrhoidal mass and dislodge the expanded band from a pile banding gun which recoil back and get snugly fitted to the pedicle of the hemorrhoid to stranglelate a ‘polyp’ of the insensitive mucosal or submucosal part of the pile above the dentate line. This band serves two purposes. One, it reduces the excessive bulk of the disrupted anal cushions, and two; it encourages adhesion of the hemorrhoid distal to the band to the underlying internal sphincter through an inflammatory reaction.

Procedure - The procedure is performed through the proctoscope, which is inserted and placed about 1-2 cm. above the dentate line using K-Y gel as a lubricant. The hemorrhoidal cushion is allowed to prolapse into the lumen of proctoscope. The prolapsing mass is then grasped with a forceps or is sucked into the ligator. A suction ligator is better in comparison to the conventional apparatus, as this does not require an assistant. With the surgeon holding the proctoscope in one hand, using low-pressure vacuum suction, the hemorrhoid pedicles are drawn into the rubber band barrel flush on to the mucosa with the hand-gun like apparatus, which is held comfortably in the other hand.

It is important that the patient should not experience any pain when the cushion is sucked. But if pain is experienced, then the grasping should be done in a more proximal position. The tissue is drawn into the drum of the ligator until it is taut, and the gun is fired to expel the rubber O-ring with an inner diameter of about 1 mm around the base of the hemorrhoid. The strangulated hemorrhoid becomes necrotic and sloughs off, while the underlying tissue undergoes fixation by fibrotic wound healing. This usually requires a week or 10 days’ time.

Usually all the hemorrhoidal cushions can be ligated in the same session. Few reports mention that multiple ligation of hemorrhoids are fraught with more pain and bleeding and should be performed in succession by banding one or at the most two hemorrhoids in one sitting.

It is wise to watch the patients treated by rubber band ligation in the outpatient clinic for 1-2 h following the procedure, in order to detect any early complication as hemorrhage and pain. The patients should be informed about the progress of the treatment i.e. fall of the necrosed hemorrhoidal nodule and that they will experience some discomfort and bleeding for the next few days. The patients are discharged with an advice for high residue diet, mild laxative to soften the stool, local anal hygiene, avoidance of straining, and information concerning early and late complications.

**USE OF DIFFERENT FORMS OF HEAT FOR HEMORRHOID TREATMENT**

The application of heat or cold is a well-known method in the treatment of hemorrhoids. The former, using electrocoagulation, has not been widely practiced for many years because of the high complication rate. Cryotherapy has its proponents, but is often uncomfortable for the patient, time-consuming for the surgeon, and may be associated with complications such as severe mucous discharge, ulceration, and incontinence if sphincter damage occurs. Few others are relatively safe and effective like the photocoagulation, laser, and radiowaves.

**Infrared photocoagulation** - Infrared photocoagulation is used as an instrumental treatment for bleeding hemorrhoids. During this procedure the tissue is coagulated by infrared radiation. For treatment, mechanical pressure
and radiation energy are applied simultaneously to ablate the blood supply to the hemorrhoidal mass. Infrared radiation causes protein coagulation over an area of 3 mm and to a depth of 3 mm; this is immediately visible as a white spot at the point of application. Over the course of the next one to four weeks, a small ulcer, which heals by cicatrization, appears. Presumably, this process reduces the blood flow to the hemorrhoid followed by a tethering of the mucosa to the underlying tissues. The apparatus (Redfield Corporation, NJ, USA) produces infrared radiation from a 14-volt Wolfram-halogen projector bulb surrounded by a gold-plated reflector and focused by a photoconductor. The tip of the instrument is protected by a polymer-coated cap to prevent adherence to the tissues. The power supply unit has a built-in timing device that allows variation in the duration of radiation. A one second pulse is used in the treatment of hemorrhoids. The infrared probe is applied to the base of the hemorrhoid at the site normally used for injection sclerotherapy. At least three points of spot weld is produced at the pedicle of the site normally used for injection sclerotherapy. The infrared probe is applied to the base of the hemorrhoid at the site normally used for injection sclerotherapy. At least three points of spot weld is produced at the pedicle of each hemorrhoid, and then the probe is angled through 90° in a clockwise direction for the second application. Up to six points can be coagulated per hemorrhoid, along the base, depending on its size.

**Laser** - Both Nd: YAG and CO₂ lasers have been used to coagulate first-degree and second-degree hemorrhoids by using the flat contact probe. This is applied around the hemorrhoid in a rosette fashion similar to infrared coagulation. The power used is between 5 and 10 W for two to three seconds, with a coaxial water flow. The Nd: YAG laser is an extremely powerful instrument that can destroy muscle in addition to hemorrhoids. Laser therapy is expensive and potentially dangerous, and advantages generally have not been substantiated by controlled clinical trials.

**Direct Current electrotherapy (hemorrhoidolysis)** - Direct current therapy (Ultroid technologies, Florida) is applied via a hand-held probe. It is claimed that all degrees of hemorrhoids are amenable to this therapy. A grounding plate is placed on the patient’s thigh and direct current applied through a probe placed via a proctoscope with the probe held in place for ten minutes. The probe is initially placed over the mucosa over the hemorrhoid base, and the current is increased to 2 mA. After increasing the current slowly to the maximum tolerable level, it is gently pushed through the mucosa into the hemorrhoidal tissue. The current is then increased to 10 to 16 mA. To hold an anoscope and probe in place for ten minutes seems a bit much. Because of the time taken to treat each hemorrhoid, it is seldom possible to treat more than one hemorrhoid at each outpatient visit. Subsequent visits the remaining hemorrhoids are similarly treated, and if necessary, any pile that has not resolved after one treatment is retreated. A prospective, crossover trial of direct current electrotherapy found no difference between medical therapy and the use of this modality.

**Bipolar Coagulation** - Griffith used a bipolar probe called Bicap® (Circon, Santa Barbara, CA) to treat first degree and second-degree hemorrhoids. The basis of using bipolar coagulation is to induce tissue destruction, ulceration and ultimately fibrosis by local application of heat. Bipolar diathermy is applied via a proctoscope using a hand-held probe controlled by a foot switch. The probe is placed directly onto the hemorrhoid, above the white line. Tissue coagulation occurs almost immediately when the probe is activated. All visible hemorrhoidal tissue are treated at each session, but care is taken to avoid circumferential injury. Bipolar diathermy has the advantage of multiple applications to the same site as it produces little further penetration of the tissues due to changes in the electrical properties of the eschar. Bipolar diathermy produces smoke during hemorrhoid treatment, which may obscure the operator’s view.

**Cryosurgery of hemorrhoids** - The concept of cryosurgery for hemorrhoids is to induce cellular destruction by rapid freezing followed by rapid thawing of the hemorrhoidal tissue. Liquid nitrous oxide and carbon dioxide are used to produce this freezing. The liquid nitrogen circulates through a system of tubes and cools the tip of the cryoprobe to freezing temperature.

For internal hemorrhoids, freezing is done for 1 to 3 minutes, while for the external hemorrhoids it is for more than 2 to 4 minutes. Postoperatively, 2 to 3 hours after freezing, the hemorrhoids swell and become red and a discharge appears which at the beginning is serosanguineous but later it becomes purulent. The discharge lasts until 14 days, and then it gradually decreases. A popular method twenty years ago, cryosurgery has fallen out of favor because of the pain and possible complication involved.

The Hemor-Rite® cryotherapy device is designed for the direct application of cold therapy to the external and internal hemorrhoidal masses. It is claimed that direct application of cold can provide immediate relief of pain, itching, and inflammation due to vasodilatation and analgesic effects of this device. The device is made up of two plastic parts which is freeze for 3 hours before being inserted in the anal canal and is kept for 6 minutes to repeat the process thrice daily. However, the maneuver is cumbersome and is not favored by many.

**Radiowave Coagulation** - The radiofrequency generating unit uses a disposable probe with an electrical current flowing between two flat electrodes (positive and negative) aligned at the tip. Activating the unit for two seconds in three or four areas of the same hemorrhoid complex effectively coagulates the vessels. Radiowaves use much lower temperatures than classic diathermy with less lateral thermal damage and therefore causes less postoperative pain. Use of radiowaves gives an almost bloodless operating field and shortens the coagulating time. This, however, is a new technique with limited experience and the instrument is expensive.

**NEWER AND INNOVATIVE TREATMENT OPTIONS FOR HAEMORRHOIDS**

HET bipolar ablation - HET™ Bipolar System is a new tissue ligation device, for the treatment of symptomatic grade I or grade II internal hemorrhoids. It is a modified
anoscopewith built-in tissue legating bipolar forceps, a light source, and tissue temperature monitoring mechanism. The hemorrhoid pedicle is clamped with incorporated tissue forceps, and ablated with bipolar energy to obscure hemorrhoidal vasculature.

**The hemorplex procedure** - HemorPex System is a single use device, which is based on the principle of dearterializing hemorrhoidopexy. This technique can be performed without anesthesia or with local anesthesia, and allows the patient to return immediately to his activities. The procedure is indicated for prolapsing types of hemorrhoids, especially 2nd and 3rd degree. The device is made of two parts. One is a fixed part, which remains in contact with the anoderm and the sensitive mucosa of the anal canal, and the second is a rotating operative part, which includes the window through which the suture stitches are made on the hemorrhoid.

**Doppler guided hemorrhoidal laser procedure (HeLP)** - The HeLP™ procedure utilizes lasers and doppler assistance for completing the process. First, a proctoscope is passed into the anal canal, to which is attached a disposable doppler probe. It identifies the branches of the superior hemorrhoidal arteries above the dentate line. Then, localized laser energy is applied using the fiber hand piece to each one of the sub mucosal branches of the hemorrhoidal artery to lead to photocoagulation.

**Atomizing hemorrhoids** - Hemorrhoidal atomization uses an innovative wave form of electrical current where a specialized electrical probe excises or vaporizes one or more cell layers at a time, reducing the hemorrhoids to minute particles of fine mist or spray which are immediately vacuumed away. The hemorrhoids are essentially disintegrated into an aerosol of carbon and water molecules. Results are similar to those reported with laser hemorrhoidectomy except that there is less bleeding using the atomizer and that the atomizer costs less. The procedure is suitable for hemorrhoids of grades I, II and III without the need for hospital stay and comparative published data is awaited. Presently, this treatment is offered exclusively only in Arizona, USA.

**Surgical treatment of hemorrhoids** - The surgical principles of hemorrhoidectomy comprise the elimination of the prolapsing vascular cushions alone or in combination with relocation of the squamous epithelium, thus reconstructing the anal canal.

**Milligan-Morgan Procedure** - The Milligan-Morgan procedure is considered as the gold standard for hemorrhoid surgery. It is by far the most popular open procedure for advanced grades of symptomatic hemorrhoids, which aims at eliminating the vascular cushions. The hemorrhoidal node is grasped per anum with a clamp. Lateral traction away from the anus causes the anal mucosa to be visible up to the mark of the dentate line. This area is marked with a second clamp. By drawing the clamp outward in the anal canal by pressure of an index finger, a V-like cut is made in the skin of the anus, ending approximately at the dentate line. The mucosa and submucosa containing the hemorrhoidal tissue is dissected, leaving the internal sphincter untouched. The hemorrhoidal plexus, which now swings free on its pedicle, is then transfixed tightly above the proximal clamp and is resected. Care is taken to leave intact at least 8 to 10 mm of anal mucosa and skin between the wound of the hemorrhoidal cushions for purposes of regeneration and sensorial continuity. Finally, any redundant skin is trimmed and the wounds external to the anal canal are left open. Today, most surgeons excise the pedicles with monopolar diathermy because it bleeds less.

**Ferguson’s closed hemorrhoidectomy** - In contrast to Milligan-Morgan hemorrhoidectomy, where the wounds of surgical dissections are left open to heal by secondary intention, the Ferguson hemorrhoidectomy is aimed at anatomical reconstruction of the anal canal. This is done by primary closure of all the wounds created after removal of the hemorrhoidal cushions. This procedure is more popular in the US. Both methods are effective forms of treatment; in theory wound closure should offer faster healing, but this has not been shown consistently. Wound dehiscence after excision of three piles prolongs healing after closed surgery. Closed hemorrhoidectomy offers no advantage regarding postoperative pain, but performed carefully it leads to less puritus and discharge.

**Whitehead hemorrhoidectomy** - Since its first description in 1882, the Whitehead hemorrhoidectomy has earned a reputation as a radical procedure for circumferential prolapsed hemorrhoids. This procedure ensues excision of the entire hemorrhoid bearing area of the anal canal as a tubular segment, the entire edge of rectal mucosa then being sutured circumferentially to the skin of the anal canal. This procedure has been found to be effective in circumferential prolapse or bleeding hemorrhoids, and in strangulated or gangrenous hemorrhoids.

However, the approach has been criticized because it is time-consuming and causes considerable blood loss, disturbed continence, ectropion of the rectal mucosa, and stricture formation, and now being used rarely by surgeons. More recent modifications, such as a circular incision, anodermal flap graft, or sliding skin flap graft, reduce the risk of complications associated with the primary method, but the results remain unsatisfactory.

**NEWER APPROACHES TO HEMORRHOIDECTOMY**

Recent advances in instrumental technology and use of various energy sources have provided new alternatives in hemorrhoidectomy. These include bipolar scissors, which are dissecting scissors incorporating a bipolar cautery device, use of radiofrequency, and ultrasonic waves. The bipolar cautery allows better hemostasis, while the scissors serve the usual dissecting function during surgery.

**Harmonic Scalpel** (UltraCision, Ethicon Endo-Surgery, Inc., Cincinnati, OH) is a new instrument that makes use of a different energy source to carry out hemorrhoidal dissection. The Harmonic Scalpel vibrates at 55,500 Hz per second, with the blade traveling 50 to 100 microns per stroke. The Harmonic Scalpel cuts by two mechanisms. First, rapid vibrations disrupt hydrogen
bonds within the protein structure, leading to the formation of a coagulum that seals coapted vessels up to 5 mm in diameter. There is minimal tissue desiccation, char formation, and zone of thermal injury compared with electrosurgery. A second cutting mechanism is known as cavitational fragmentation, in which low-density tissues are disrupted, leading to separation of anatomic tissue planes. The second effect is brought about by cavitational bubbles produced by vaporizing fluids at low (37°C) temperatures, which potentially minimizes thermal injury and associated energy transfer.

Because the instrument operates at temperature less than 100°C, it is associated with less undesirable tissue trauma. The Harmonic Scalpel results in a minimal lateral thermal injury, and this is believed to be the reason for the diminished postoperative discomfort.

Various comparative studies have not found any specific advantage of this device in postoperative pain, fecal incontinence, operative time, or complications compared with traditional closed hemorrhoidectomy. The operating time is said to be much longer than the conventional techniques, mainly because the hemostasis is time consuming and less effective.

The Ligasure™ Vessel Sealing System (Tyco Healthcare, Boulder, CO) is another device that uses a combination of pressure and electrical energy, enabling coagulation of vessels with minimal surrounding thermal spread and limited tissue charring. The instrument is proposed to cause bloodless excision of hemorrhoids with minimal tissue trauma, thus claiming reduced postoperative pain and wound healing time (29).

During this procedure, the anus is dilated by using an Eisenhammer retractor and the Milligan-Morgan hemorrhoidectomy is performed for all the quadrants. Ligasure is applied across the skin tags, then the hemorrhoids, and finally the pedicles. The feedback sensor signals completion of coagulation. Coagulated tissue is excised with scissors. Repeated applications of Ligasure are needed for complete excision of the hemorrhoids. The procedure did not include pedicle ligation, use of diathermy, or anal tampon at the end of the procedure.

The procedure may result in a significant reduction in operative time and blood loss, but it may not confer any advantage over the conventional operation in terms of postoperative pain, length of hospital stay, or time taken to return to work or normal activity. Similarly, long-term evaluation of outcomes and morbidity are not available.

Another significant disadvantage with the LigaSure system (as has been noted with all new techniques) is the expense incurred. The list price of the disposable electrode is quite high and represents a direct addition to the cost of the procedure (30).

Laser hemorrhoidectomy - The energy of the Nd-YAG laser can penetrate water and be absorbed by the tissue, inducing a thermal effect, which damages the tissue, and then the effect of photocoagulation is achieved. On the other hand, the CO₂ laser has a good cutting or vaporization property. Considering the effects of these two types of lasers, hemorrhoidectomies using these devices were proposed in early 21st century from various centers. However, the initial enthusiasm was seriously tempered because of various factors and the cost component of the device. This technique is proposed as a painless procedure with a shortened healing time; however, no documented studies support these claims. It has no advantages over standard techniques; it is also quite expensive and no less painful. The use of lasers for performing hemorrhoidectomy is almost abandoned nowadays.

**STAPLED HEMORRHOIDOPEXY**

In 1998 Longo presented the procedure for prolapsing hemorrhoids (PPH), also known as stapled hemorrhoidopexy, as a new treatment. A circular stapling gun is used to excise a doughnut of mucosa from the upper anal canal and lift the hemorrhoidal cushions back within the canal (31). This results in resection of excessive internal hemorrhoidal tissue, pexy of the internal hemorrhoidal tissue left behind, and interruption of the blood supply from above. Stapled hemorrhoidopexy can be done as an outpatient procedure, using local anesthesia with intravenous sedation.

As this procedure avoids a cutaneous incision it was assumed to cause less postoperative pain and a faster recovery than conventional excision. Evidence shows that stapled hemorrhoidopexy is a less painful procedure, with a shorter inpatient stay and faster return to work.

Stapled hemorrhoidopexy does not directly affect the external tissue. Reports have described shrinking of external hemorrhoidal tissue after stapling, probably from decreased blood flow. Good results from stapled hemorrhoidopexy combined with judicial excision of occasional skin tags also have been reported. However, stapling increases operative costs; advanced surgical skills are necessary; and there is a learning curve. Stapled hemorrhoidectomy may cause a full-thickness excision of the rectal wall and injuries to the anal sphincter, and it does not allow for the treatment of concomitant anal disease (32).

Stapled hemorrhoidopexy is a safe technique for the treatment of hemorrhoids but carries a significantly higher incidence of recurrences and additional operations compared with conventional hemorrhoidectomy. It is the patient’s choice whether to accept a higher recurrence rate to take advantage of the short-term benefits of stapled hemorrhoidopexy.

Stapled hemorrhoidopexy has resulted in potential serious morbidity and even mortality in the immediate postoperative period. As the procedure has spread in popularity around the world, so too, it appears, have these severe, life-threatening complications. The reported complication rates are as high as 31%. Although some complications are similar to conventional hemorrhoidectomy, most are specifically technique-related. Stapled hemorrhoidopexy presents unusual and challenging complications (33). These complications are often heralded by abdominal pain, urinary retention, and fever. Surgeons should be aware of all of the potential complications and
associated warning signs and symptoms of stapled hemorrhoidopexy. Abuses should be minimized and longer-term studies are needed to further clarify its role.

**DOPPLER GUIDED HEMORRHOIDAL ARTERY LIGATION**

Also known as transanal hemorrhoidal dearterialization, this procedure represents a new approach to the treatment of internal hemorrhoids. With this device selective ligation of the arteries supplying the hemorrhoids can be done after identifying them using an ultrasound sensor. The procedure can be performed on ambulatory patients under local anesthesia. An anoscope is used which incorporates a Doppler head. The superior hemorrhoidal arteries are identified under guidance of the arterial Doppler sound and ligated through a window located just above the Doppler head. The procedure requires about 30 minutes. This procedure is less painful with earlier return to work. But as it has high recurrences in prolapsing hemorrhoids (more than 15%), it is now supplemented with hemorrhoidal mucopexy where few transfixing sutures are applied over the hemorrhoidal cushion to control prolapse.

**PROBLEMATIC ISSUES REGARDING DOPPLER GUIDED HEMORRHOIDAL ARTERY LIGATION**

1. Aigner et al. conducted several studies on the anatomic variations of the hemorrhoidal arteries and showed that arteries that supply the hemorrhoidal cushions are at much distal level than located by the Doppler and thus cannot be ligated by hemorrhoid artery ligator.

2. The hemorrhoid artery ligator device has a wide diameter, which might have a dilatating effect when being inserted and kept in the anal canal (for 20-30 minutes). This might be reducing the resting pressure and improving the venous outflow of the hemorrhoidal cushions.

3. Anatomic studies have shown that hemorrhoids are arteriovenous cushions: by ligating the main vessels the smaller hemorrhoidal vessels will hypertrophy in time and symptoms could recur.

4. Anatomical studies also show that during the ligation procedure not all arteries are found and ligated. Therefore a question arises about the precise effect of the artery ligation and the effectiveness of the ultrasound doppler tool in the ligation procedure. Due to the ligation it seems that beside ligation of several arteries some kind of anoxepxy is performed, which possibly contributes to the effect of the ligation procedure.

**HEMORRHOID LIGATION PROCEDURES**

Sporadic reports of suture fixation of prolapsing hemorrhoids have claimed fair outcome of the procedure in advanced grades of hemorrhoids. These procedure of ligation of hemorrhoidal cushion has a long history and are termed with various nomenclatures like "pil suture", "obliterative suture technique", "ligation and anopexy", and "ligation under vision", "transanal hemorrhoidopexy", "hemorrhoidal plication", "radiowave ablation and mucosal fixation" etc.

**CONCLUSIONS**

This paper has covered data pertaining to the etiology and pathogenesis as well as the office procedures and surgical treatments of hemorrhoids. The first line of therapy for any hemorrhoidal complaint remains conservative management with increased fluid and fiber intake and appropriate modification of toileting behavior. Bleeding in grades 1 and 2 hemorrhoids that does not respond to this can be satisfactorily and safely managed with office-based therapies; some grade 3 hemorrhoids would also respond to this. If patients come to surgery, traditional hemorrhoidectomy is favored either as an open or a closed technique with some advantage for diathermy and for the LigaSure device with a reduction in stapled hemorrhiodopexy because of delayed recurrence, particularly where the original hemorrhoids were large. PPH and THD are associated with less postoperative pain and lower complication rates; however, both had higher postoperative recurrence rates.

Despite the common nature of hemorrhoids there is little comparative operative data with established and accepted outcomes. It is hoped that newer and better designed trials will provide high quality data which directs therapy in accordance with disease presentation and severity.

**SUMMARY**

**PATOFIZIOLOGIJA HEMORROIDALNE BOLESTI I PRISTUP NJENOM LEÊENJU**

Hemoroidi su vrlo čest anorektalni poremeæaj koji se definiše kao simptomatsko uveæanje i abnormalna distalna dislokacija analnih jastuèa. Hemoroidi postaju patognomonièi zbog degererativnih promena u potpornom tkivu analnih jastuèa, vaskularne hiperplazije i hiperperfuzije hemoroidnih pleksusa. Rani stadijumi bolesti (gradus 1 i 2) mogu se uspeæno leèiti dijetetskim reùimom i prilagoðavanjem naèina æivota, lekovima i raznim ambulantnim postupcima.

Hirurško leèenje je indikovano u odmaklim stadijumima bolesti. Prem da se hemoroidektomija još uvek smatra „zlatnim standardom“, u skoroj vreme æeljeni uspeh su pokazale novije metode, kao što su: podvezivanje i ultrazvuèna hemoroidektomija, staplerska hemorroidopeksija i doplerom voðeno podvezivanje hemoroidnih arterija.

Meñutim, postoperativni bol i recidiv bolesti ostaju kao najizazovniji problem. Ovaj rad razmatra patofiziologiju i savremene pristupe hemoroidnoj bolesti.

Kljuène reèi: hemoroidi, patohistologija, pristup
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