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REVIEW

Doppler-guided ligation of hemorrhoidal arteries with mucopexy: A technique for the future



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Prolapse;
Recurrence;
Complication

Summary

Purpose: The transanal hemorrhoidal de-arterialization (THD) procedure is an effective treatment of hemorrhoidal disease. The ligation of hemorrhoidal arteries ("de-arterialization") can provide a significant reduction of arterial blood flow to the hemorrhoidal tissues. Plication of redundant rectal mucosa/submucosa ("mucopexy") can reposition prolapsing tissue to its original anatomical site. In this paper the surgical technique using a specific device (THD[®] Doppler) and peri-operative patient management are illustrated.

Methods: After appropriate clinical assessment, patients undergo the THD procedure under general or spinal anesthesia, in either the dorsal lithotomy or prone jackknife position. A specifically designed device is used. In all patients, THD is performed, consisting of selective ligation of hemorrhoidal arteries identified by Doppler and marked with a mucosal stitch overlying the artery. In patients with hemorrhoidal or mucosal prolapse, a mucopexy is also performed using continuous suture(s) that include the redundant prolapsing mucosa and submucosa.

Results: In long-term follow-up, THD results in resolution of symptoms in the majority of patients. The most common complication is transient but sometimes-painful tenesmus. Rectal bleeding occurs in only a very limited number of patients. There is little or no risk of fecal incontinence or chronic pain. Ano-rectal manometry and endo-anal ultrasound show no evidence of injury to physiologic sphincteric function.

Conclusions: THD is a safe procedure and is, at present, one of the most effective treatments of hemorrhoidal disease.

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Introduction

Despite the high prevalence of hemorrhoidal disease, no surgical technique can be considered the “gold-standard” of treatment at this time [1]. In the field of hemorrhoidal surgery, the Longo stapled hemorrhoidopexy [2] and Doppler-guided transanal hemorrhoidal de-arterialization (THD) (mostly performed with either THD[®] Doppler or DG-HAL technique) are recent and innovative techniques that can be considered as valid alternatives to conventional hemorrhoidectomy [3–5]. Of particular interest, recent studies concerning the pathophysiology of hemorrhoidal disease (HD) [6–9] have supported and encouraged the rapid adoption of techniques for ligation of hemorrhoidal arteries (with or without mucopexy of prolapsing rectal mucosa/submucosa). A number of techniques have been described using a variety of Doppler systems and surgical devices. Recent reviews [10,11] have evaluated the ensemble of these techniques and devices, with results that are somewhat conflicting. In this paper, we offer an overview of the technical and management aspects of one of the most commonly used techniques, the THD[®] Doppler procedure. In addition, data from the literature concerning techniques of THD and mucopexy for prolapsing rectal mucosa/submucosa are discussed.

Anatomical bases for Doppler-guided ligation of hemorrhoidal arteries and mucopexy

The aim of hemorrhoidal de-arterialization is to achieve a significant reduction in the arterial blood flow to the hemorrhoidal tissues, which is characteristically increased in patients with HD. The anatomical and physiological characteristics of hemorrhoids have not been fully elucidated. Microscopically, hemorrhoids consist of sinusoids (vascular structures without a muscular wall) [12]. Direct arterio-venous communications have been demonstrated histologically and radiologically, and some authors have noted a resemblance to erectile tissue [13]. Traditionally, hemorrhoids have been considered to be localized to the left lateral, right posterolateral and right anterolateral sites around the circumference of the anal canal; and yet, this configuration has been demonstrated in less than 20% of patients [14]. In reality, a wider network of arterial and venous vessels has been described [15]. Schuurman et al., in an autopsy study [6], found an average of eight tortuous thin submucosal arteries originating from the superior hemorrhoidal artery that supply the hemorrhoidal cushions, 2–3 cm above the dentate line. Smaller branches from these arteries also form a plexus in the rectal corpus cavernosum. In a more recent study [16], most arterial branches situated in the upper rectum (from 4–6 cm above the dentate line) were located outside the rectal wall, while 98% of the hemorrhoidal arteries in the lowest 2 cm were detected in the submucosa of the six sectors of rectal circumference (96.6% at 2 cm and 100% at 1 cm from the dentate line). Investigation of the arterial position within the rectal layers at various levels showed that the mean arterial depth decreased significantly from the highest to the lowest level, reaching the most superficial depth in the most distal 2 cm of the rectum where nearly all of the arteries had become submucosal. These features can be easily confirmed during Doppler-guided surgical procedures. The

Doppler signals vary with the artery’s position (perirectal, perforating the rectal muscle, or submucosal), the distance from the Doppler probe, and the direction of blood flow in relation to the ultrasound waves emitted by the probe. The proximity of the artery to the probe when the artery is located within the submucosa makes the Doppler signal higher than that perceived at more proximal sites.

Normally, the hemorrhoidal cushions are supported at the dentate line by the muscularis mucosa and are loosely attached to the internal sphincter. Moreover, the rectal submucosa supports the hemorrhoids to keep them within the anal canal at rest. During defecation the hemorrhoids and dentate line roll downward, favored by relaxation of the internal anal sphincter; the fecal bolus exerts shearing forces on the hemorrhoids, facilitating their physiologic prolapse. The internal hemorrhoids thus rotate outwards. However, the elasticity of the rectal submucosa helps to pull the hemorrhoids back up into the anal canal post-defecation. In patients with HD, the effects of altered defecation and other predisposing factors cause the rectal submucosa to progressively lose its elasticity, resulting in pathological hemorrhoidal prolapse. The progressive deterioration of both the connective tissue stroma (Parks’ ligaments) and anchoring system (Treitz’s muscle) play a major role in this process. The severity of prolapse is related to persistence of pathogenic factors, hemorrhoidal engorgement, and progressive loss of rectal submucosa elasticity.

The mucopexy (MP) that is often performed in combination with the THD technique consists of plication of rectal mucosa and submucosa that has been affected by the loss of elasticity. The hemorrhoidal tissue is reduced back up into the rectal ampulla and anchored in place, recovering its normal anatomic position. The scarring process induced by MP serves to affix the plicated mucosa and submucosa to the underlying rectal muscularis.

Patient assessment and pre-operative evaluation

Accurate assessment of the patient’s history and HD-related symptoms are mandatory. Ano-rectal examination and anoscopy should assess hemorrhoidal engorgement, bleeding, and prolapse of hemorrhoids and rectal mucosa/submucosa (both at rest and during straining), and the presence of anal skin tags. Moreover, other anal and/or rectal diseases, and functional disorders must be diagnosed/excluded. Endoscopic assessment of the colon and rectum should be performed according to the guidelines for colorectal cancer screening.

Indications

The THD procedure should be reserved to patients with active HD whose symptoms persist despite lifestyle/diet interventions, drug therapy, and minor office procedures. Indications for intervention should be based on the patient’s symptoms and physical findings. When hemorrhoidal bleeding is the principal complaint, de-arterialization alone with ligation of Doppler-identified hemorrhoidal arteries around the circumference of the low rectum is all that is needed. Usually, at least six arteries are identified and ligated using the THD[®] Doppler device. If bleeding is associated with hemorrhoidal or muco-hemorrhoidal prolapse, one or more MP should be performed in addition to the de-arterialization.

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