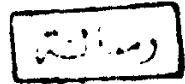


# THE ROLE OF NITROGLYCERINE IN THE MANAGEMENT OF ANAL FISSURE

THESIS

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T. A.

BY

TAHER AHMED MASSOUD  
(M.B. B.CH)

58500  
H. Boshnak  
A. Abdel Aziz

UNDER SUPERVISION OF

**Prof. Dr. HUSSEIN ABDEL ALIEM BOSHNAK**

Professor Of General Surgery  
Ain Shams University

**Prof. Dr. AHMED ABDEL AZIZ ABOU ZEID**

Assistant Professor Of General Surgery  
Ain Shams University

**Dr. ASHRAF ABDEL MOGHNY MOSTAFA**

Lecturer of General Surgery  
Ain Shams University

A. Ashraf

FACULTY OF MEDICINE  
AIN SHAMS UNIVERSITY

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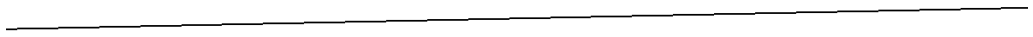




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The ano-rectal junction is situated 2-5 cm in front and slightly below the tip of the coccyx. Sudden change in diameter and in direction occurs at the ano-rectal junction, where the rectum terminates and the anal canal begins (Gray 1982). Although the anal canal is a short passage, only 3-4 cm long, yet it is of the greatest surgical importance because of its role in the mechanism of rectal continence and because of its role in certain diseases (Goligher, 1980).

*The lining epithelium of the anal canal.*

The lining epithelium of the anal canal consists of an upper mucosal and lower coetaneous covering, separated by the line of anal valves 2cm. from the anal orifice and opposite the upper third of the internal sphincter. This level is called the *pectinate line*. (Fowler, 1957). The valves represent the remnant of the proctodeal membrane, above each valve there is a small pocket known as anal sinus or crypt of Morgagni (Goligher, 1985).

The anal canal above the pectinate line is thrown in several longitudinal folds known as the columns of Morgagni.

The mucosa above the pectinate line is lined by several layers of cuboidal cells, but below the pectinate line the anal canal is lined by a modified skin devoid of hairs, sebaceous and sweat glands (Fowler, 1957) & (Goligher, 1985).

The anal crypts are of surgical importance. In each crypt open the duct of one anal gland. Foreign material may become lodged in the crypts obstructing the ducts of the anal glands and causing ano-rectal suppuration (Philip & Gordon, 1992).

The pectinate line marks the division between the portal circulation above and caval circulation below, above this line the nerve supply is from the autonomic nervous system, while the somatic nervous system supply below the line, so it is sensitive (Richard and Nelson 1993). Also lymph drainage above the pectinate line drains to the inferior mesenteric nodes, where as below the line drains to the inguinal nodes (Siddarth and Ravo, 1988).

### Anal glands

Parks (1961) described Four to eight glands. Each gland opens directly into the apex of an anal crypt. Some crypts have 2 glandular openings, about half of the crypts have no glands.

The glands have a short tubular portion in the submucosa, which branches into the ramifying ducts. Some glands enter the internal sphincter and others cross it to the intersphincteric longitudinal layer, they never extend above the anal valve and they have no secretory function. They appear to be simply blind out growth of the anal crypt and may provide an avenue of infection to the submucous and intersphincteric space with the result of an abscess or fistula formation (Goligher and Huges 1985).

### ANAL SPHINCTERS

The anal canal is always closed except for passage of flatus and faeces, it is held closed by sphincteric tube of muscles. The muscles are in two distinct sphincteric entities internal and external, each occupying two thirds of the canal so that they overlap at the middle third (Last, 1984).

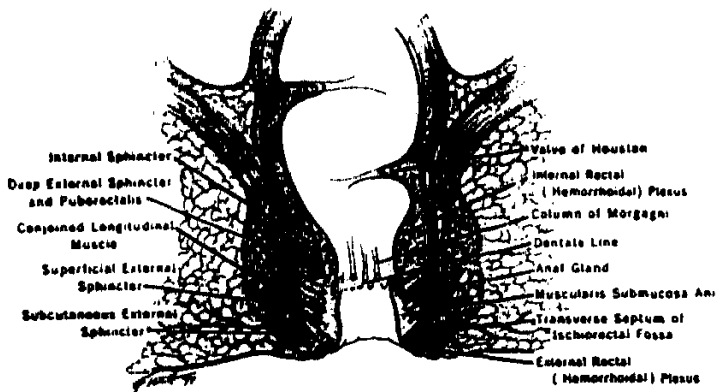


## INTERNAL ANAL SPHINCTER

The internal anal sphincter (IAS) is the inner, involuntary, smooth muscle component of the anal sphincter complex and it represents the thickened downward continuation of circular muscle of the rectum. It extends from the anorectal ring to 1 to 1.5 cm below the dentate line.

The caudal extent of the internal anal sphincter is medial and just proximal to the lowest parts of the external anal sphincter. A palpable groove at this level is an important surgical landmark, termed the intersphincteric groove. In its lower part the internal anal sphincter is traversed by fibers from the conjoined longitudinal muscle that gain insertion just below the anal valves, forming the mucosal suspensory ligament. Anal gland ducts traverse the internal anal sphincter and some of which terminate in the intersphincteric plane (Fig 1).

The internal anal sphincter is in a continuous state of tonus and intermittently displays slow and ultraslow waves. The frequency of these waves is highest in the distal canal, (Hancock, 1976) which may serve to keep the distal anal canal empty of fecal matter to prevent stimulation of the sensitive epithelium (Sorensen *et al.*, 1989)



**Fig . 2 . Coronal section of the rectum and anal canal showing sphincter muscles and the lining of anal canal .**

***From Goligher (1984)***

These waves persist even after curarization (Hancock, 1975) and are displayed by isolated strips of the internal sphincter (Penninckx, *et al.*, 1992) suggesting their origin in the internal anal sphincter.

Anal ultraslow waves are often absent in patients with idiopathic incontinence (Sangwan *et al.*, 1995). Balloon dilation of the rectum elicits a relaxation response from the internal anal sphincter, termed the rectoanal inhibitory reflex (RAIR)

#### INNERVATION OF THE INTERNAL ANAL SPHINCTER

In vitro studies on strips on human internal anal sphincter have identified excitatory alpha-adrenoreceptors, inhibitory beta-adrenergic receptor, inhibitory or biphasic cholinergic receptors and inhibitory non-cholinergic non-adrenergic receptors (NCNA) (Park *et al.*, 1966 and Friedmann, 1968).

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#### RECTO ANAL INHIBITORY REFLEX (RAIR)

Electric field stimulation results in relaxation of isolated strip of internal anal sphincter. Because electric field stimulation induced relaxation are not blocked by tetrodotoxin (adenoceptor blockers) or cholinergic antagonists, they are probably the result of stimulation of the

NCNA inhibitory nerves (Burleigh, *et al.*, 1979). Adenosine triphosphate and vasoactive intestinal polypeptide (VIP) have been suggested as the possible NCNA neurotransmitters. Although VIP causes relaxation of sphincter muscle strips and a rich supply of VIP nerves has been demonstrated in the human internal anal sphincter their involvement as the mediator of the recto anal inhibitory reflex is unproven (Ferri, *et al.*, 1988).

Nitric oxide (NO) may be a NCNA neurotransmitter. Studies proved that relaxation induced by inhibitory nerve stimulation could be mimicked by application of exogenous NO. such relaxation can be abolished by NO synthase inhibitors and NO scavengers (Sanders, 1992).

Rattan *et al.*, (1992) demonstrated that the recto-anal inhibitory reflex can be inhibited by administration of NO synthase inhibitors *in vivo*. O'Kelly *et al.*, (1994) suggested that NO synthase is present in human myenteric plexus. These NO producing nerves divided and ramify in the internal anal sphincter and their axons are associated with the smooth cells of the internal anal sphincter.

The beaded appearance of the axons in the internal anal sphincter indicate that NO synthase is present

in these varicosities. These data provide anatomic evidence that NO may be the mediator of the recto anal inhibitory reflex.

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## INVESTIGATIONS OF THE INTERNAL ANAL SPHINCTER

### (A) Manometric evaluation of the internal anal sphincter

Computerized manometry has been a useful investigative tool in evaluating internal anal sphincter function (Coller and Sangwan 1995).

### (B) Electricmyographic assessment of the internal anal sphincter (EMG):

Evaluation of the internal anal sphincter by use of surface electrodes (Wankling *et al.*, 1968) had provided new insights into internal anal sphincter physiology. Recently it was suggested that there might be a link between the electric and mechanical activity of the internal anal sphincter.

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### (C) Internal anal sphincter imaging:

Endorectal ultrasonography (ERUS) is capable of imaging the external anal sphincter and internal anal sphincter with a high degree of accuracy and is considered an advance in the evaluation of the anal sphincters.

## THE INTERNAL ANAL SPHINCTER IN DISEASES

### *The internal anal sphincter in fecal incontinence*

Duthie and Bennett, (1963) suggested that internal anal sphincter relaxation permits discrimination of rectal contents by permitting them to come in contact with the sensitive anal mucosa. The role of internal anal sphincter in anal continence may be limited to that of a fine tuner of continence to gas and liquids, an assumption supported by the clinical observation that the internal anal sphincter can be divided completely in patients with anal fissure or fistula with only minor disturbance of control of flatus or liquid stool

Lestar *et al.*, (1986) considered that it must play a more significant role in preserving continence, but internal anal sphincter is unable to close the anal canal completely even when maximally contracted.

### *The internal anal sphincter in sphincter-saving surgery*

The anal canal resting pressure is reduced after low anterior resection, coloanal anastomosis, restorative procto-colectomy and mucosectomy (Pescatori *et al.*, 1984). This unequal decrease in anal resting pressure is because the internal anal sphincter is present for only a variable part of the distal anal canal.

This compromise of the resting anal tone may result from operative trauma to the autonomic nerve supply of the internal anal sphincter, intra-operative anal stretch, and ~~traumatic injury to the upper part of the internal anal sphincter~~ or excision of the internal hemorrhoidal plexus.

Furthermore, recovery of the anal pressure may not occur for one year after the operation (Williams *et al.*, 1980). The risk of operative trauma to the internal anal sphincter had led several workers (Lavery *et al.*, 1989 and Johnston, 1987) to preserve the anal transitional zone to limit such damage, resulting in higher postoperative resting pressures.

#### *The internal anal sphincter and fissure*

Association between the internal anal sphincter and anal fissures is well known, but the cause and effect relationship is controversial. Most studies reveal high anal pressures in patients with fissures (Nothmann *et al.*, 1974 and Arabi *et al.*, 1977), and ~~these high pressures are assumed a consequence of~~ anal fissures.

Recent studies have led to a reappraisal of the role of the internal anal sphincter as a cause of anal fissures.