

# Prostato-sacral Ligament, description of a new anatomy in males, its clinical significance and anatomic similarity to female anatomy

AHMED FARAG<sup>1</sup>, SAHAR EMM NASR<sup>1</sup>, MOHAMED YEHIA ELBARMELGI<sup>1</sup>, AMAL A. FARAG<sup>1</sup>, PETER PETROS<sup>2</sup>

<sup>1</sup> Kasralainy faculty of medicine, Cairo University.

<sup>2</sup> University of NSW. Professorial Department of Surgery

**Abstract: Background and Aim:** The uterosacral ligament (USL) has become an increasing focus of interest in terms of its use for surgical support in the management of pelvic organ prolapse. Description of an equivalent ligament in males is lacking. Our aim is to describe a new Ligament in males which was found during rectal resection using the trans-anal Total mesorectal excision “Ta TME” which we called Prostato-sacral ligament and its clinical significance. **Methods:** The Transanal Total Mesorectal Excision “TaTME” technique was done in 46 patients from January 2017 till April 2018 for rectal resection. The group included 27 males and 19 Females “Age range = 31 - 72 years , Mean= 34.13 years. In the present work we describe a new ligament in males – which we encounter during the operation- that has the same anatomic orientation to the female anatomy. **Results:** Histologic studies revealed the musculo-tendinous structure of the newly described ligament with abundant blood vessels, elastic fibers and nerves with great similarity to female Utero-sacral ligament. It forms a very important landmark for rectal resection using the new TaTME approach. It can also explain the cause of chronic pelvic pain as a striking similarity to female utero-sacral ligament was noticed. **Conclusion:** To the best of the authors’ knowledge this is the first time for this ligament to be described and histologically studied in the Literature. The Surgical and medical significance had been discussed.

**Keywords:** Ligament; Pelvis; Pain; Utero-sacral; Prostato-sacral; Transanal; TME

## What this paper add to literature?

This research add to the literature a description of a new ligament in male pelvis which we called Prostato-sacral ligament with a striking similarity to female anatomy (Utero-sacral ligaments). This ligament is suggested as a landmark of the proper dissection plane during Ta TME and can explain chronic Pelvic pain in males.

## INTRODUCTION

The Uterosacral ligament (USL) has become an increasing focus as it has been used with different surgical techniques for support in the management of pelvic organ prolapse<sup>1-2</sup> There are a lot of variations in the description of the anatomy of USL in the published literature. The main point of controversy is the proximal attachment and whether it is connected to the sacrum<sup>3-5</sup> or attached to the sacrospinous ligament and the coccygeus<sup>6</sup>.

Some authors<sup>3,5</sup> distinguish between the USL and the so-called cardinal ligament (CL). Other authors<sup>1,7</sup> refer to that as the less defined term “uterosacral-cardinal ligament complex”.

In the surgical literature the USL is described as a dense, strong band of connective tissue. However, these non condensed ligamentous structures were not demonstrated in the cadaveric and histological studies<sup>7</sup>.

In males, a sacrogenital fold was described as a continued tissue to the upper ends of the seminal vesicles and the bladder; on either side of the rectum it forms the pararectal fossa, which varies in size to accommodate the distension of the rectum. Anterior to the rectum the peritoneum forms the rectovesical excavation, which is limited laterally by peritoneal folds extending from the sides of the bladder to the rectum and sacrum. These folds are known from their position as the rectovesical or sacrogenital folds. However this was considered not a true ligament but just a peritoneal fold<sup>8</sup>.

**Aim of work:** In the present work we describe a real ligament which we named the Prostato-Sacral ligament as a male equivalent to the female utero-sacral ligament, based on our findings during the new technique of Trans-anal Total Mesorectal incision “Ta TME” and the value of such ligament as an important landmark for proper circumferential resection margin for rectal cancer during such new procedure.

## PATIENTS AND METHODS

The transanal total Mesorectal “Ta TME” technique was done

in 46 patients from January 2017 till April 2018 for rectal resection. The group included 27 males and 19 females. During the operation biopsies were taken from the newly described ligaments and microscopic histological examination was done using H&E stains, Masson’s trichrome collagen stain, Orcein elastic stain and modified Palmgren’s method for nerve fibres and this is compared to the known description of female Utero-sacral ligament or uterosacral-cardinal ligament complex described in literature.

## RESULTS

Age distribution ranges from 31 to 72 years. Mean age was 34.13 years.

This study ends up into 27 male patients and 19 female patients inserted in this study. Among the 27 male patients who are the group of main interest 24 patients were operated upon for mid and low rectal cancer. They had had a Laparoscopic Trans Abdominal – Trans Anal approach, “LATA approach”<sup>9</sup>. Two patients had had Proctocolectomy with Ileo-anal pouch anastomosis, one for familial adenomatous polyposis and one patient for Ulcerative Colitis with high grade dysplasia. Another case had advanced Rectal Polyp with high Intra-epithelial neoplasia, which couldn’t be removed endoscopically.

Six cases among the male cancer patients had an intersphincteric resection before proceeding to the Ta TME of the resection. Patients with FAP and UC had anal mucosectomy for 4 cm before proceeding with Ta- TME.

We used the technique of TaTME<sup>9</sup> during the anterior and posterior dissection guided by the Denonvillier’s fascia between the rectum and prostate in males and between the rectum and posterior vaginal wall in females anteriorly. Posteriorly we used the Waldeyer’s fascia as a posterior limit of our rectal resection avoiding injury of such fascia in order to avoid subsequent massive bleeding from the presacral plexus of veins.

Laterally we used the technique described by Mike<sup>10</sup> to see the parietal pelvic peritoneum and go up into the pelvis until we meet the dissected pelvic planes which were dissected laparoscopically until we divide the so-called lateral ligaments of the rectum while visualizing and preserving the hypo-gastric nerves on both sides.

As we connect the lateral planes that have developed transanally with the anterior plane, we could visualize the uterosacral ligaments (USL) on both aspects of the midline i.e with the vagina in-between the USLs (Figure 1 a) and a similar ligament in ma-

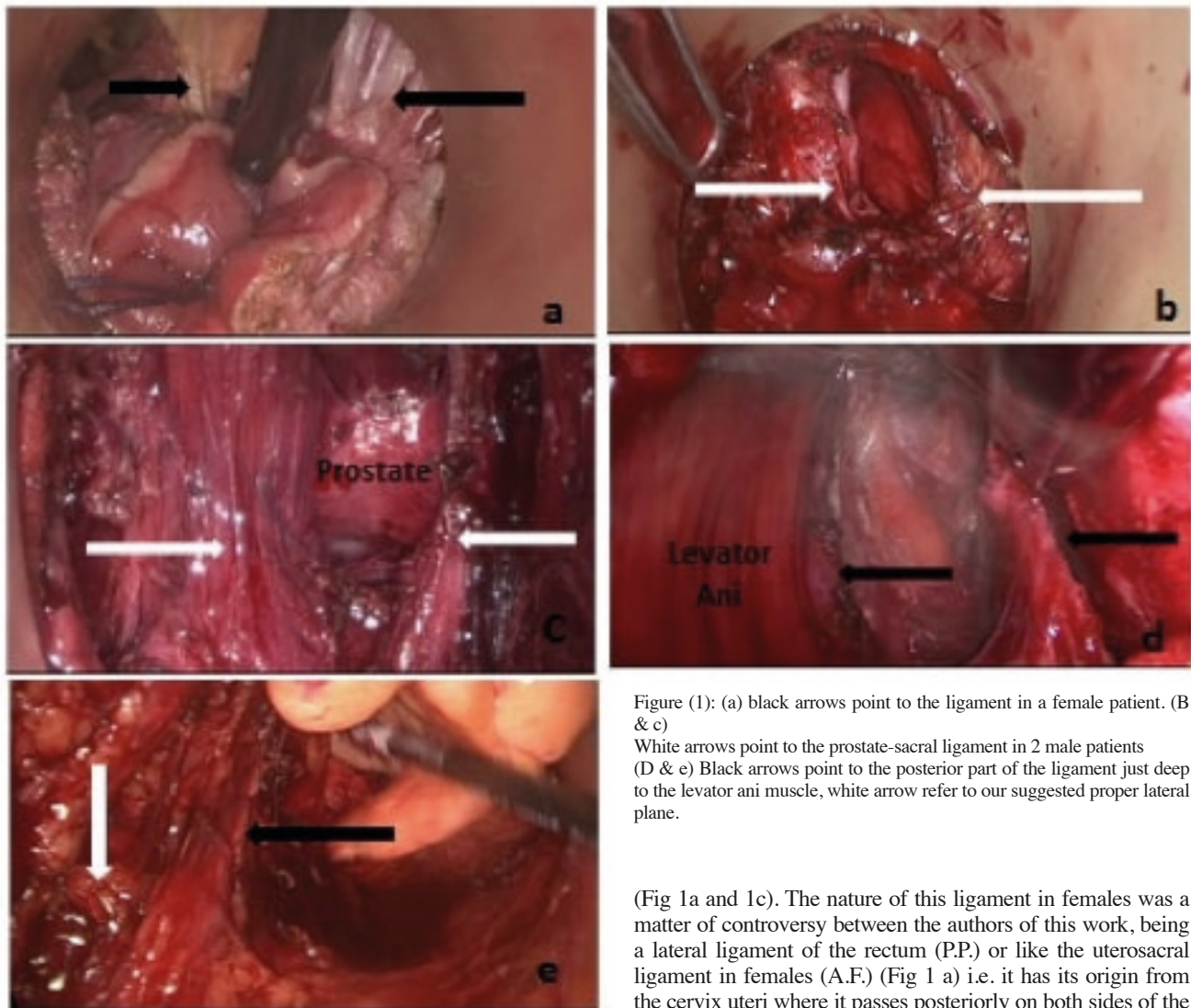


Figure (1): (a) black arrows point to the ligament in a female patient. (B & c) White arrows point to the prostate-sacral ligament in 2 male patients (D & e) Black arrows point to the posterior part of the ligament just deep to the levator ani muscle, white arrow refer to our suggested proper lateral plane.

les with the prostate between them in males. (Fig 1 b) This ligament looked to be attached to the prostate on both sides of the prostatic sulcus in most of the cases (25 cases) (Fig 1 b), and to come directly from the pubis without being attached to the prostate in only 2 cases. (Figure 1 c)

Connecting the posterior dissection plane with the lateral dissection planes shows the posterior part of the USL in females and its equivalent ligament in males as it approaches the sacrum at the S 3-4 level (Fig 1d and Fig 1e). In between the anterior and posterior parts of both ligaments, the ligaments are fused with the fascia propria of the rectum on both sides before both become thinned out as they leave the fascia propria of the rectum on their way to their posterior attachment.

Specimens from the studied ligament were obtained during Ta-TME & fixed in 10% buffered formula saline for 5 days and then processed for preparation of paraffin blocks. Preparation of 6  $\mu$ m paraffin sections were done. These sections were stained by H&E, Masson's trichrome collagen stain, Orcein elastic stain and modified Palmgren's method for nerve fibres (Fig 2) in paraffin-embedded material<sup>11</sup>. The biopsies revealed collagen bundles, with scarred smooth muscle fibers and scattered blood vessels, a lot of Elastin and nerve fibers. This has a great similarity to Utero-sacral ligament (USL) or the "uterosacral-cardinal ligament complex" described in females.

## DISCUSSION

In the present work we describe a new ligament in the male which has the same anatomic orientation to the female anatomy

(Fig 1a and 1c). The nature of this ligament in females was a matter of controversy between the authors of this work, being a lateral ligament of the rectum (P.P.) or like the uterosacral ligament in females (A.F.) (Fig 1 a) i.e. it has its origin from the cervix uteri where it passes posteriorly on both sides of the rectum before gaining its posterior attachment, which is still a matter of controversy<sup>1-7</sup>.

In males it starts on both sides of the median sulcus of the prostate (Fig 1b) in 25 out of the studied 27 patients (92.6%). In the remaining 2 male patients "7.4 %" (Fig 1c), it arises from the conjoined ischio-pubic ramus without obvious attachment to the prostate. In all the studied 27 patients, and in all the female patients, the ligament passes lateral to the rectum being fused with the lateral margin of the mesorectum before leaving it as it thins out to be attached posteriorly similar to the uterosacral ligament (Fig 1d and Fig 1e).

Histologic studies revealed its Musculo-tendinous structure with abundant blood vessels, elastic fibers and nerves (Fig 2).

The Significance of such ligament is many folds, including dividing the inner pelvic space "the TME holly plane" into an innermost plane between the 2 ligaments which includes the rectum and mesorectum an outer part lateral to this ligament. However the dissection medial to this ligament would be very close to the lateral circumferential margin of the TME plane and will not connect easily with the proper TME medial plane developed by abdominal dissection as the dissection proceed from below upwards in the TA-TME technique. The proper dissection plane has to be developed lateral to the prostatosacral ligament in males and the uterosacral ligament in females between those ligaments and pelvic fascia (Fig 1e) taking both the ligaments medially and the fascia laterally, as the landmarks for the proper TME plane which will connect the dissection plane from below with the proper TME holly plane developed abdominally.



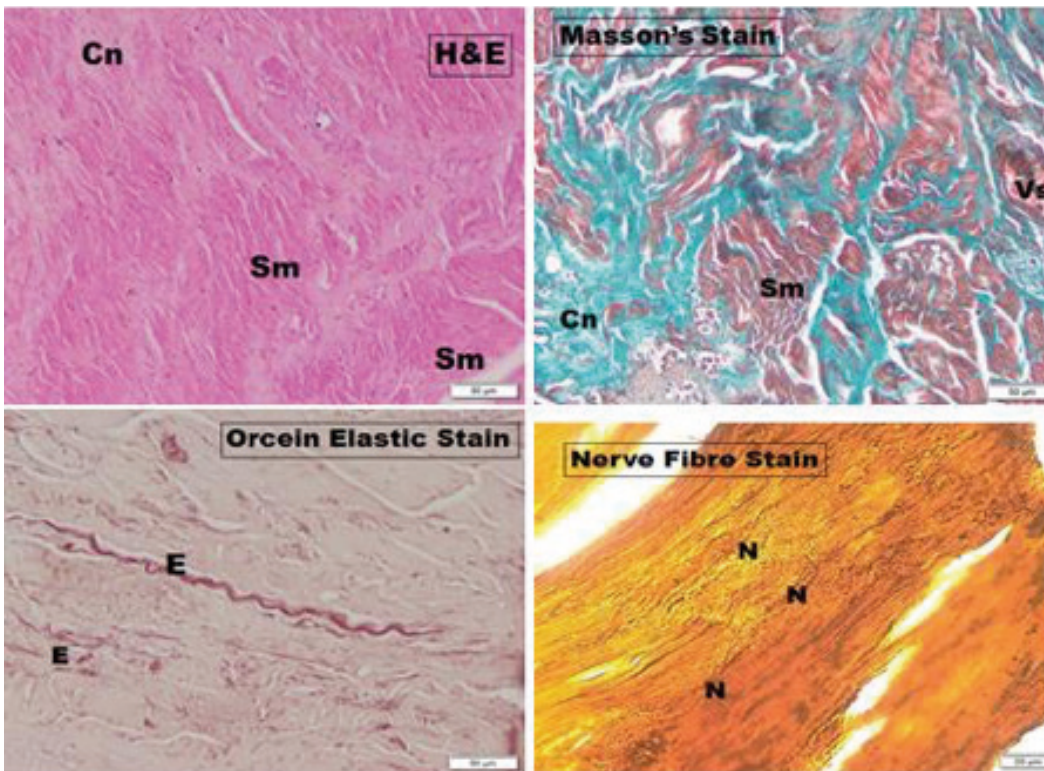


Figure (2): Histologic studies in a male revealed its Musculo-tendinous structure With abundant blood vessels, elastic fibers and nerves, Using H&E Masson's trichrome collagen stain, Orcein elastic stain and modified Palmgren's method for nerve fibres.

Failure to see such ligaments and dividing them as part of the radical resection of the rectum may jeopardize the lateral circumferential resection margin.

In addition the ligament may play an important role in fixation of the rectum in normal controls and its repair can be done as a treatment of rectal prolapse as is used in females for uterine and vaginal prolapse<sup>1,2</sup>.

Another important application is that the laxity of such ligament may be the cause of chronic pelvic pains in males an equivalent situation to cases of chronic pelvic pains due to laxity of such ligament in females, where the repair of such a ligament have been adopted to treat such pains in females<sup>13</sup>.

In conclusion, to the best of the authors' Knowledge this is the first time for this ligament to be described and histologically studied in the literature and it represents a very important landmark for rectal resection using the new Ta-TME approach. It can also explain the cause of chronic pelvic pain as a striking similarity to female anatomy was noticed.

#### REFERENCES

1. Dwyer PL, Fatton B. Bilateral extraperitoneal uterosacral suspension: a new approach to correct posthysterectomy vaginal vault prolapse. *Int Urogynecol J* 2008; 19:283–292
2. Fatton B, Dwyer PL, Ahtari C, Tan PK. Bilateral extraperitoneal uterosacral vaginal vault suspension: a 2 year 2009
3. Buller JL, Thompson JR, Cundiff GW, Sullivan LK, Schön, Ybarra MAS, Bent AE. Uterosacral ligament: description of anatomic relationships to optimize surgical safety. *Obstet Gynecol* 2001; 97(6):873–879
4. Blaisdell FE. The anatomy of the sacro-uterine ligaments. *Anat Rec* 1917; 12:1–42.
5. Campbell R. The anatomy and histology of the sacrouterine ligaments. *Am J Obstet Gynecol* 1950; 59:1–12
6. Umek WH, Morgan DM, Ashton-Miller JA, DeLancey JOL. Quantitative analysis of uterosacral ligament origin and insertion points by magnetic resonance imaging. *Obstet Gynecol.*

- 2004; 103(3):447–451
7. Ramanah R, Parratte B, Arbez-Gindre F, Maillet R, Riethmuller D. The uterosacral complex: ligament or neurovascular pathway? *Anatomical and histological study of fetuses and adults.* *Int Urogynecol J* 2008; 19:1565–1570
8. Henry Gray (1825–1861). *Anatomy of the Human Body.* 1918. <http://www.bartleby.com/107/pages/page1154.html>
9. Buchs NC, Nicholson GA, Ris F, Mortensen NJ, and Hompes R: Transanal total mesorectal excision: A valid option for rectal cancer? *World J Gastroenterol.* 2015 Nov 7; 21(41): 11700–11708. PMID: PMC4631971. PMID: 26556997
10. Makio Mike. *Laparoscopic Colorectal Cancer Surgery. Operative Procedures Based on the Embryological Anatomy of the Fascial Composition.* By Igaku-Shoin Ltd., Tokyo Japan. 2012
11. Suvarna S.K, Layton C, Bancroft JD. *Bancroft's theory and practice of histological techniques . 7<sup>th</sup> edition Churchill Livingstone Elsevier , 2013:187-358.*
12. Braun, NM, Theobald PV. Chronic Pelvic Pain Caused by Laxity of the Uterosacral Ligaments: Are the Posterior Fornix Syndrome and the Allen– Masters Syndrome Synonyms? *Pain Medicine.* 2016; 17 (2): 370–371. <https://doi.org/10.1111/pme.12876>
13. Petros PE Severe Chronic Pelvic Pain in Women May Be Caused By Ligamentous Laxity in the Posterior Fornix of the Vagina Aust. *NZ J Obstet Gynecol* 1996; 36: 3: 351-4.

#### DISCLOSURE STATEMENTS

Acknowledgement goes directly to Cairo University which completely funded this study.

The study was approved by the Research Ethics Committee of Cairo University.

All authors declare that they do not have any financial and personal relationships with other people or organizations that could inappropriately influence (bias) their work.

Correspondence:

dr.yeho@yahoo.com