

## ANATOMY OF THE UTEROSACRAL LIGAMENT (USL)

### Hypothesis / aims of study

This study aims to elucidate and expand current knowledge of the anatomy of the uterosacral ligament (USL).

The published descriptions of anatomy of the USL have differed widely. It has not been precisely mapped. The surgical literature has noted the USL to be a dense, strong band of connective tissue. However, cadaveric and histological studies have generally demonstrated no condensed ligamentous structures. There is some consensus on the USL's neurovascular contents and the cervical and vaginal (though not the sacral) attachments of the ligament.

### Study design, materials and methods

Studies were performed on: (i) ten unembalmed cadaveric pelvis (observation only); (ii) one unembalmed pelvis (observation, dissection and histology); (iii) five formalin-fixed pelvis (dissection).

Four tissue blocks (1cm x 2cm) of the ligament were taken from one unembalmed pelvis starting from its cervical attachment, sampling the ligament at four equidistant points along its vertical extent. Five-micron thick sections were cut and stained with hematoxylin-eosin as well as trichrome (to demonstrate elastic fibers).

Examinations concentrated on (A) mapping the USL including relevant subdivision into sections; (B) describing the proximal and distal attachments of the USL; (C) Noting other surgically relevant observations including the relation of the USL to the ureter; (D) describing the histological appearances of the thickest part of the USL.

### Results

**(A) Subdivision:** Our examinations lead us to elucidate the following subdivision of the USL (total length around 12-13cm): (i) a **distal (cervical) section** of 5-20mm thickness and generally 2-3cm in vertical length; (ii) an **intermediate section** of around 5cm length, up to 1-2cm wide when placed under tension, and for the most part 5mm thick (thinning proximally), running postero-laterally from the level of the uterine isthmus, curving around the rectum towards the sacrum; (iii) a relatively thin **proximal section** of around 5-6 cm.

**(B) Attachments:** Distally, the USL was attached to the posterior aspect of the cervix and vaginal dome. This attachment spread to the lateral aspects of the cervix and vaginal dome where it was confluent with the attachment of the cardinal ligament (uterosacral-cardinal ligament complex). The USL merged caudally with the lateral ligament of the rectum. Proximally, its diffuse sacral attachment extended: (i) vertically from the sacrococcygeal joint to S3 (with the sacrouterine fold of peritoneum extending to S2 and at times S1) and (ii) transversely from the pelvic sacral foramina medially to 5cm lateral to the sacro-iliac joint where it was attached to fascia overlying piriformis and levator ani.

**(C) Intermediate section:** Surgically useful observations on this relatively unattached section are (i) this section is best seen when under tension; (ii) even at its closest proximity to the ureter (at the junction with the cervical section) it is still at least 2.3-2.7cm from that structure; (iii) medial traction on the intermediate section as might occur with midline plication with the contralateral ligament will also cause its anterior and superior displacement.

**(D) Histology:** Stripped of the peritoneum, the USL was seen as a collection of fatty tissue and dispersed strands of fibrous tissue investing the vessels and nerves destined for the cervix and upper vagina. Histological sections of the thickest (cervical) section showed small arteries and veins, numerous nerves intermingled with thin bands of collagen and elastic fibers and fatty tissue. Smooth muscle fibres were rarely observed. Collagen fibres decreased in number from the upper border of the ligament. This differed greatly from the macroscopic appearance when put under tension. In all pelvis, fresh or embalmed, the ligament, under tension, became a dense, well defined structure. In 2 hemipelvis, it was however visible as a dense ligamentous structures after excision of fatty tissue.

### Interpretation of results

The USL can be subdivided into 3 sections according to thickness and attachments. The distal attachment to the cervix is confluent with the cardinal ligament forming the uterosacral-cardinal ligament complex. The proximal attachment is diffuse and thin, extending to S3, though the overlying sacrouterine fold of peritoneum may extend to S2 or S1. The relatively unattached intermediate section is wide, still thick, well-defined when placed under tension and suitable for surgical use. It is at least 2.5cm from the ureter. The strength of the USL is perhaps derived not only from the ligament itself, but also from the addition of extraperitoneal connective tissue.

### Concluding message

The USL can be subdivided into 3 sections according to thickness and attachments. The intermediate section is suitable for surgical use.

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<b>Was this study approved by an ethics committee?</b>	<b>No</b>
<b>This study did not require ethics committee approval because</b>	<b>Cadveric Observational Study</b>
<b>Was the Declaration of Helsinki followed?</b>	<b>Yes</b>
<b>Was informed consent obtained from the patients?</b>	<b>No</b>