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CARDINAL LIGAMENT SURGICAL ANATOMY: CARDINAL RULES AT HYSTERECTOMY

Hypothesis / aims of study:
The published descriptions of anatomy of the CL, dating back to 1870, have differed with some authors, even recently, doubting or denying its existence. It has not been precisely mapped. The CL is thought to have a role in uterine support. Its roles at vaginal hysterectomy and in surgery for pelvic organ prolapse (POP) have not been clearly defined. This study aims to elucidate the anatomy of the cardinal ligament (CL) and its potential roles at hysterectomy and surgery for POP.

Study design, materials and methods:
Studies were performed by dissecting: (i) ten unembalmed cadaveric hemipelves; (ii) twenty-eight formalin-fixed cadaveric hemipelves. Ethics approval was obtained. Examinations concentrated on: (A) mapping the CL including relevant subdivision into sections; (B) describing the proximal and distal attachments of the CL; (C) Noting other surgically relevant observations including the relation of the CL to the ureter and major neurovascular structures.

Results:
(A) Subdivision: Our examinations led us to elucidate the following subdivision of the CL (total length averaging 10cm): (i) a *distal (cervical) section* of average 2.0cm thickness and 2.1cm in length; (ii) an *intermediate section* of average 3.4cm long, and 1.8cm wide running laterally (slightly posteriorly) from the uterine cervix; (iii) a *proximal (pelvic) section,* relatively thick, triangular-shaped (on cross-section), averaging 4.6cm long and 2.1cm wide (at its widest point).
(B) Attachments: Distally, the CL was attached to the lateral aspect of the cervix. Posteriorly, it was confluent with the attachment of the uterosacral (USL) ligament (*cardinal-uterosacral confluence - CUSC*). The CL merged caudally with the superior fascia of the levator ani. Cranially, it was separated from the parametrium by a strip of areolar tissue. Proximally, its triangular-shaped attachment to the lateral pelvic wall had, as its apex, the first branching of the internal iliac artery, and its base, the superior fascia of the levator ani.
(C) Intermediate section: Surgically important observations on this section were: (i) there were discernible ventral (vascular) and dorsal (neural) portions; (ii) the ureter entered this section, crossed superficially by the uterine artery and vein; (iii) frequently, there was a deep uterine vein separating the ureter from the neural structures of the dorsal portion; (iv) due to these important structures, this section is not suitable for use in surgery for POP.
(D) Distal (cervical) section: (i) There was no significant neural or vascular component; (ii) it would be safe for surgical use; (iii) the first pedicle of a vaginal hysterectomy would usually involve both CL and USL due to the confluence (*CUSC*) of the distal sections of both ligaments. Attachment of this pedicle to the vaginal vault (cuff at hysterectomy) has the potential for both lateral (via the CL to the pelvic sidewall) and posterolateral and superior (to the sacrum) surgical support.

Interpretation of results
The CL can be clearly identified, described and mapped, as the result of the sharp anatomical dissection methods used in this study. Its surgical role can also be clearly defined. The CL can be subdivided into 3 sections according to its attachments and relations. The distal attachment to the cervix is confluent with the USL forming the cardinal-uterosacral confluence (*CUSC*). This confluence is very suitable for surgical support of the vaginal vault at hysterectomy. This pedicle would not be subsequently accessible for other surgeries for POP. The intermediate section, containing vital neurovascular structures and
with the ureter immediately adjacent, is not suitable for surgical use. The proximal attachment is triangular-shaped and thick with a broad attachment to the pelvic side wall, indicating the potential overall strength of the CL.

Concluding message
Cardinal rules at hysterectomy are: (i) know the CL Anatomy; (ii) use the distal segment (as part of the CUSC) for vaginal vault support; (iii) surgically avoid the intermediate and proximal segments.

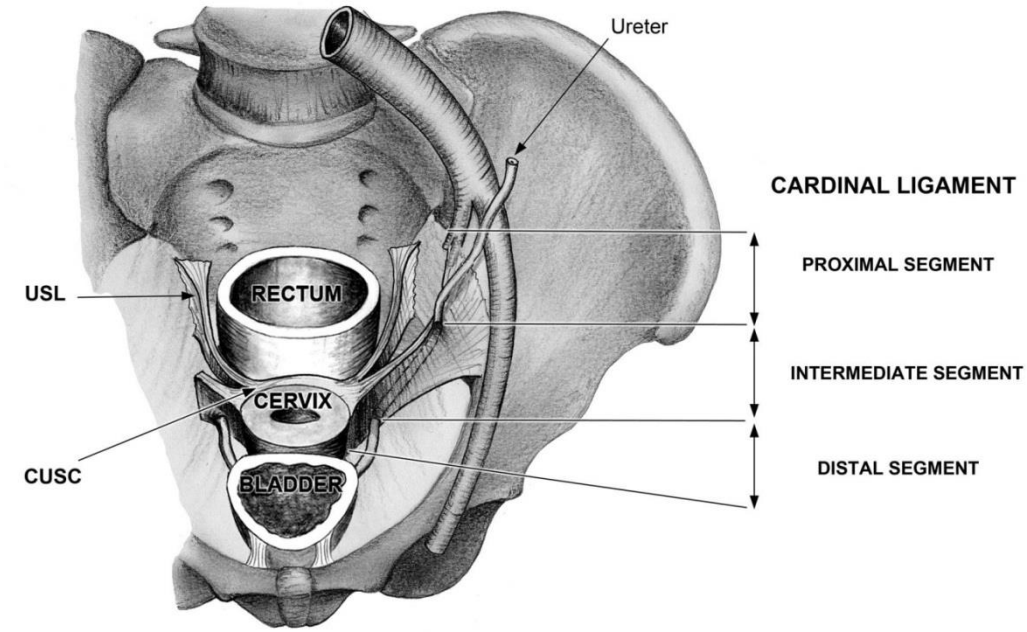

Figure 1: A schematic diagram demonstrating the subdivision of the CL into sections

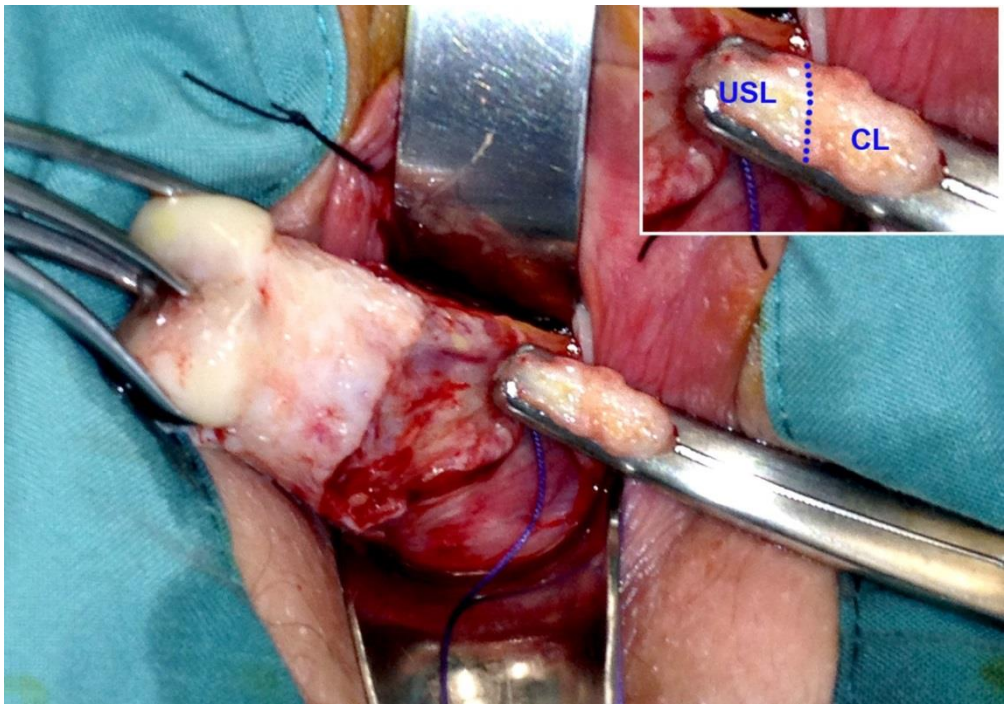

Figure 2: Operative view of the first pedicle of a vaginal hysterectomy showing the CL and USL (macroscopically distinguishable) forming the cardinal-uterosacral confluence (CUSC).

Disclosures
Funding: Nil relevant **Clinical Trial:** No **Subjects:** HUMAN **Ethics Committee:** University of New South Wales **Helsinki:** Yes **Informed Consent:** No