Ureter and bony pelvis

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Boney Structures
Terminology: Boney Structures

- **Pubic Symphysis**: the junction of the pubic bones along the anterior midline; the boney eminence under the pubic hair.

- **Ischial Tuberosity**: the boney swelling of the ischium; what bears your weight in the sitting position.

- **Ischiopubic Ramus**: medial border of the obturator space.

- **Ischial Spine**: boney spur on the inside of the pelvis opposite the acetabulum.

- **Sacral Promontory**: upper area of the sacrum where there is a prominent curvature of the spine.

- **Coccyx**: boney terminus of the spinal column; “tailbone”
Case 1

- 41 year old
- Severe pelvic endometriosis
- 12 week size uterus
- Endometrioma on left ovary
- POD obliterated with bowel adhesions and dense endometriosis involving rectovaginal septum and uterosacral ligaments
- TLH and BSO done
Case 1

- Profuse bleeding from left uterine vessels
- Prolonged bipolar cautery used to secure haemostasis
- Cystoscopy at the end showed good excretion of urine from both ureters
- Presented at day 9 with fever and continuous watery vaginal discharge
- Pelvic CT revealed a urinoma in the pouch of Douglas and a dilated left ureter with flow of contrast ending in the urinoma.
Case 1

- A ureteric stent was inserted initially
- Required ureteric re-implantation eventually as healing was suboptimal.
Minimising Ureteric Injury at Laparoscopy
Avoiding Ureteric Injury at Laparoscopy
Aviation Accident Rate

Source: Boeing Statistical Summary of Commercial Jet Airplane Accidents 1959 - 2004
How common is it?

- Anything from 0.3 to 2%

- More than half of ureteric injuries occur in patients without significant risk factors
Why would you want to avoid damaging the ureter?

1. Patient morbidity
2. Financial implications
3. Medico-legal reasons
Clinical Implications of Ureteric Injury

- Increased initial operative time if recognised
- Return to theatre for subsequent procedures
- Need for prolonged catheter and stent drainage
- Urinary tract infection
- Fistula formation
- Loss of renal function
Increased investigations
  - Ultrasounds
  - CT scanning
  - DMSA scanning

Further surgery

In-patient care

Urology consults
Other cost: Stress
$600 000 to 1 million USD per case

In Canada, ureteric injuries account for 17% of non-obstetric legal actions against gynaecologists.
Canadian study

- Prevalence of urinary tract injury and the relative risk of litigation
- If there was an injury the relative risk of litigation was 91
- Only 18% of injuries were recognised intra-operatively

Scandanavian study

- 136 submitted claims concerning ureteric injuries
- Among these, 73 claims were approved (54%), and compensation paid.
- In 44 (32%) of these, the injury was caused by negligence.

Acta Obstet Gynecol Scand.
*Analysis of 136 ureteral injuries in gynecological and obstetrical surgery from completed insurance claims.*
Hove LD et al
Scandanavian study

- Failure to dissect the ureter despite indications for this procedure was the most common type of negligence.

- 34 (25%) patients suffered from chronic renal dysfunction on the affected side.

- Only 17 (13%) of the ureteral injuries were discovered during the procedure.
The ureter is your friend, find him, greet him and be happy!

Dr Abri de Bruyn
Ureter Histology

**Layers of the Ureter:**
- **Lamina propria**
- **Adipose tissue**
- **Transitional epithelium**
- **Middle circular layer of smooth muscle**
- **Inner layer of longitudinal muscle**
- **Submucosal connective tissue**
Ligation of gonadal vessels:
injury at pelvic brim during division of
ovarian vessels or resection of pelvic
mass adherent to ureters.

Pelvic dissection:
injury during lymph node
dissection as the ureter
traverses over the iliac vessels
near the apex of obturator fossa.

Ligation of uterine vessels:
injury as the ureter crosses
under the uterine artery during
hysterectomy.

Dissection of bladder / vagina:
injury at anterolateral fornix of
vagina near the insertion of the ureter
into the trigone.
Analysis of 136 ureteral injuries in gynecological and obstetrical surgery from completed insurance claims

LARS DAHLGAARD HOVE¹, JÖHANNES BOCK², JENSKROGH CHRISTOFFERSEN² & BENNY ANDREASSON³
When should you be most careful?

- LAVH 11%
- Pelvic Lymphadenectomy 7%
- Oopherectomy 10%
- TL 7%
- Excision of Endometriosis 7%
Recognise risk factors?

- Prior pelvic operations
- Endometriosis
- Inflammatory bowel disease
- Infection
- Extensive infiltrating cancers
- Unrecognized congenital anomalies
  - Duplicated ureter (1/125)
  - Retrocaval ureter, horse-shoe or pelvic kidney (1/400)
Procedures: Hysterectomy
39 year old

Fibroids

LAVH Munro Type 3

Laparoscopic dissection of portions of US ligaments

No endometriosis, PID, previous surgery

Uterus weighed 220g
Case 2

- Post op
- Abdominal discomfort
- Low grade fever
- Voiding difficulty
- Residual urine
- Discharged Day 10 with Foley
Case 2

- Returned 5 days later with complaint of increased girth
- US – ascites, no hydronephrosis and no ureteric jet
- IVP – damage to left lower ureter with extravasation of contrast
- At repair – left ureter necrotic with loss of integrity at a site 3cm proximal to ureterovesical junction
Abdominal vs Laparoscopic Hyst

Ureteric Injury

- 1 in 1000 for all hysterectomies
- 13.9 in 1000 for Laparoscopic Hyst
- 0.4 in 1000 for Abdominal Hyst
- Relative Risk 35

The ureter injury rate was as low after LH (0.3%), as it was after other types of hysterectomy.
Papers

Methods of hysterectomy: systematic review and meta-analysis of randomised controlled trials

Neil Johnson, David Barlow, Anne Lethaby, Emma Tavender, Liz Curr, Ray Garry

bmj.com 2005;330:1478
Figure 2 Meta-analysis of urinary tract (bladder or ureter) injury. Statistical pooling used fixed effects statistical model (no statistical heterogeneity present). AH=abdominal hysterectomy; VH=vaginal hysterectomy; LH=laparoscopic hysterectomy; LAVH=laparoscopic assisted vaginal hysterectomy; LH(a)=laparoscopic hysterectomy where laparoscopic procedures include sterile artery ligation; TLH=total laparoscopic hysterectomy.
Provided the surgeons are experienced in laparoscopic surgery, the risk of ureteral complications after laparoscopic hysterectomy is comparable with the rate of 0.2–0.4% observed when total hysterectomy takes place by laparotomy (Harkki-Siren et al., 1998; Mäkinen et al., 2001; Carley et al., 2002; Dorairajan et al., 2004; Vakili et al., 2005). This observation is essential, given that laparoscopic surgery ought to be considered as an alternative to laparotomy.
(Chapron and Dubuisson, 1995). In other words, the fact of carrying out a total hysterectomy by laparoscopy rather than by laparotomy does not increase the risk of ureteral complications.
for this operation. The risk of ureteral complications must no longer be used as an argument against the more widespread use of laparoscopic hysterectomy. The only real problem is that of training for surgeons in this technique in order to be able to reduce the number of hysterectomies carried out by laparotomy. Evaluation of the learning curve of laparoscopic hysterectomy demonstrates that the majority of major complications occur during the learning stage (Kreiker et al., 2004).
Tricks: Preventing ureteric injury at TLH

- Create a window over anterior and posterior broad ligaments to push the ureter inferiorly and laterally
- Uterine manipulator or myoma screw helps to push the uterus contralaterally
- Stents may make the ureters less pliable and more rigid thereby increasing the risk of injury during dissection
- Identify the ureter when you are doing an adnexectomy at the same time.
Preventing ureteric injury at TLH

- Be careful of extensive electrocautery at the level of the Uterine artery and Uterosacral ligaments.

- If you do get a bleeder – first clamp it with a locking grasper - wash – then do a short, accurate burst of diathermy.

- Do it at the middle of the lateral third of uterus at the ascending portion.

- Continue inside the uterine artery.
**Fig. 1** Identification of the uterine artery and ureter on the right side
Fig. 2 Transection of the uterine artery on the right side after the ureter was pushed medially
One of the key issues in laparoscopic hysterectomy is the ubiquitous use of electro-surgery in dissection, excision and division of tissue planes, pedicles and vessels. A comprehensive understanding of the principles of electro-surgery and its effects on tissue and surrounding structures is therefore a pre-requisite for safe laparoscopic hysterectomy. In our review, excessive electro-coagulation of the uterine vessels and cardinal ligaments near the ureter appeared to be the aetiology for the case of ureteric injury. We have learnt that in such precarious situations where bleeding appears profuse, an effective manoeuvre is to first clamp the bleeding site with a locking grasping forceps to stem the bleed. This temporary haemostatic manoeuvre then enables lavage of the area concerned in order to visualise the bleeding point clearly. Precise and short bipolar energy can then be delivered accurately and effectively to secure haemostasis with the least amount of lateral thermal spread. Indiscriminate use of electro-coagulation coupled with prolonged activation over a bleeding source in a pool of blood is highly ineffective and will only lead to more complications.
Procedures: Endometriosis
Endometriosis

- Thickened uterosacral ligaments more likely to injure ureter
- Always identify
- Be careful with cautery – use cold scissors rather
Procedures: Ovarian Cysts
Procedures: Fibroids
Procedures: Sacrocolpopexy
Other strategies: Stents
**Advantages**

- Easier to identify
- Ureteric Injury recognised if it occurs
- Pre-operative ureteral pathology detected

**Disadvantages**

- Extra time
- Cost
- May damage ureter when “palpating” it
- Tends to make the ureter less mobile
- Post–operative haematuria
RCT: Prophylactic Insertion in all major gynaecological surgery

Universal ureteral catheterisation is cost saving when the rate of ureteral injury during benign abdominal hysterectomy or radical hysterectomy is greater than 3.2%.

Other strategies: Cystoscopy
injury exceeded 2% for laparoscopic-assisted vaginal hysterectomy. This analysis was based only on the rate of ureteral injury and did not include bladder injury. Cost effectiveness was largely influenced by the incidence of ureteral injury and the cost of readmission to the hospital. These data combined with the minimal risk cystoscopy exposes to the patient mean procedures with elevated rates of injury to the lower urinary tract, such as vaginal surgery for pelvic organ prolapse and urinary incontinence\textsuperscript{12} and laparoscopic hysterectomy, would actually save money if cystoscopy were performed on a routine basis.\textsuperscript{6}
Routine cystoscopy cost-saving if injury rate > 2%

Based on incidence of injury and cost of re-admission
Energy Sources
Be aware that the harmonic still produces heat.

Safe operating distance has not yet been determined with some studies showing no coagulation necrosis outside of 3mm but other studies but this may be further in other studies
Danger areas

- When dissecting the Uterosacral-cardinal ligament complex
  - Be careful of using energy sources
  - Stay medial to uterosacral ligaments
Recognise your learning curve

The venial sin is injury to the ureter,
the mortal sin is failure of recognition

Dr Thomas Green of Boston
For Three Men
The Civil War
Wasn't Hell,
It Was
Practice!

CLINT EASTWOOD
"THE GOOD,
THE BAD &
THE UGLY"

LEE VAN CLEEF
ELI WALLACH

ALDO GIUFFRE / MARIO BREGA

SERGIO LEONE

UNITED ARTISTS

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The good, the bad and the ugly

- **The Good**
  - Avoiding

- **The Bad**
  - Injure but recognise

- **The Ugly**
  - Failure to recognise