Urological Complications of Colorectal Surgery

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Introduction

• Close anatomical proximity of the colon and rectum to urinary tract and its innervation

• Overall incidence of urogenital injury

• Commonest in gynaecological surgery
  – Incidence of ureteric injury in gynaec surgery is around 1-2%
  – Up to 70% of all ureteric injuries caused by gynaec surgery
Introduction

• In Colorectal Surgery the urogenital tract is most at risk of injury during
  – Surgery for locally invasive colorectal malignancy
  – Advanced inflammatory bowel conditions
  – Previous history of pelvic irradiation
  – Presence of fibrosis or adhesions
  – Previous pelvic surgery
  – Radical pelvic lymphadenectomy performed

• Development of new surgical techniques such as TME, nerve-sparing dissection and greater understanding of the regional anatomy
Commonest urological complications of Colorectal surgery

- Functional complications
  - Injury of the pelvic nerves during mobilisation of the rectum
  - Neurogenic bladder
  - Various degrees of severity and duration

- Sexual dysfunction

- Injury to the ureter

- Injury to the bladder

- Less common – enterovesical, urocutaneous fistulae
Acute Retention of Urine

- Frequent complication of operation on the sigmoid colon and anorectum
- Cause remains uncertain
  - Inability to pass urine in the supine position
  - Pain inhibits micturition
  - Presence of concomitant BPH and some degree of LUTS
- Urethral catheter for few days; adequate analgesia; early mobilisation
- α-blockers
- TURP
  - Displaced prostate at a different angle to resectoscope
  - No rectum to allow finger to support prostate during resection
Anatomical Considerations and Functional/Sexual complications of Colorectal Surgery

• Anatomy of the hypogastric nerves and pelvic plexuses to explain cause of urinary and sexual dysfunction and to try and reduce their incidence.

• Detrusor and sphincters receive autonomic and somatic innervation (sympathetic, parasympathetic, pudendal nerves)

• Parasympathetic S2-S4
• Sympathetic T10-L2
• Sympathetic roots form **Hypogastric Plexus (B)** at level of **Aortic bifurcation (A)**

• Hypogastric nerves (C) lateral to ureter and internal iliac vessels

• Pelvic autonomic plexus (D) at lateral pelvic wall

• Parasympathetic fibres run along nervi erigentes to reach **inferior hypogastric plexus (E)** located anterior and lateral to the rectum
4 main areas identified as “high risk” for neuronal damage during rectal mobilisation and excision

1. **Hypogastric plexus** (aortic bifurcation) during high ligation of the Inferior Mesenteric Artery

2. **Injury to the pelvic plexus** during lateral dissection
   - Division of the lateral ligaments carrying nerves from pelvic plexus to rectum
   - Injury to *inferior hypogastric plexus*
   - Dissection in the extrafascial plane
   - Medial traction on rectum can “tent” pelvic plexus
4 main areas identified as “high risk” for neuronal damage during rectal mobilisation and excision

3. **Cavernous nerves** during anterior mobilisation of the rectum where the anterior rectal wall is only separated from prostate and seminal vesicles by fascia of Denonvilliers

4. **Nervi erigenti** during mobilisation of the rectum posteriorly
TME and Autonomic Nerve Preservation

• Headle et al 1982
• Gold standard for treatment of rectal carcinoma
• Nerve sparing technique (Enke et al 1992)
• Significant reduction in functional urinary problems and erectile dysfunction

• Dissection in the *Holy Plane* or *Extrafascial dissection*
Extrafascial dissection
### Functional Urinary Complications

- 24-32% of patients after Colorectal Surgery
- Incidence highest after AP resection

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Functional Urinary Complications

- Operative injury to pelvic autonomic nerves
- Clinical manifestations vary according to location and extent of injury
- Permanent lesions following complete transection of main nerves
- Transient dysfunction following traction or diathermy injury of the main nerves or complete transection of the peripheral branches
- Only 10% of functional urinary complications are permanent
Functional Urinary Complications

• Clinical symptoms following autonomic nerve injury
  – Bladder atony with overflow incontinence and loss of sensation of bladder fullness
  – Urge incontinence due to overactive bladder
  – Stress incontinence secondary to damage to sphincter innervation
  – Voiding dysfunction secondary to Detrusor-Sphincter-Dyssynergia
  – UTI
  – Mixed picture
Functional Urinary Complications

- Recovery of lower urinary tract function to coincide with successful micturition following removal of urinary catheter
- Apparent successful micturition following Colorectal Surgery is not always indicative of recovery of normal bladder function (Chaudri et al 2006)

- High index of suspicion after difficult surgery
- Ultrasound bladder residual at least
- **Urodynamic assessment** ASAP in patients who develop neurogenic bladder
- Early detection and appropriate treatment paramount in order to prevent permanent impairment
Sexual Dysfunction following Colorectal Surgery

- Injury to pelvic plexus, particularly pelvic splanchnics
- Incidence of impotence following AP resection 15-92%
- Nerve preserving surgery – better potency rates 14-73%
- Retrograde ejaculation in males
- Pain or discomfort during intercourse; inability to achieve orgasm
- With TME and ANP sexual function rates are improving
- 57% of those undergoing AP resection and 85% undergoing LAR were able to maintain pre-op sexual function (Enke et al 1997)
Sexual Dysfunction following Colorectal Surgery

- Age significantly influences post-op sexual function
- >60 years highest risk
- High prevalence of atherosclerosis, HT, DM, use of cardiac / anti HT medication

- Adjuvant or neoadjuvant radiotherapy further compounds risk of ED
Ureteric Injury in Colorectal Surgery

- 61 departments in Poland
- 452 ureteral injuries
  - 73 % iatrogenic
  - 18 % blunt trauma
  - 7 % penetrating trauma
- Of the 340 iatrogenic injuries
  - 73 % gynecological origin
  - 14 % general surgical
  - 14 % urological

Dobrowolsky, BJU Int. 2002
Ureteric Injury in Colorectal Surgery

- AP resection and LAR general surgical procedures most commonly associated with ureteric injury (0.3-6%)
- Inguinal hernia repair
- Removal of retrocecal appendix

- Ureter most vulnerable during
  - Division of lateral ligament during mobilisation of rectum
  - Mobilisation of right or left colon during hemicolecction
  - Ligation of inferior mesenteric artery

- Distal ureter affected in >90% of cases
Situations in which ureter is at increased risk of injury

- Reoperative surgery
- Distorted normal anatomy after radiotherapy, ureter caught up in neoplastic mass or inflammatory bowel masses in diverticulitis, ulcerative colitis or Crohn’s disease
- Grossly dilated, tortuous, displaced ureter
- Congenital abnormalities of the ureter e.g double ureter
Types of iatrogenic ureteric injury
Blood supply of the ureter

- Renal artery: 30.7%
- Testicular / ovarian artery: 7.7%
- Aorta: 15.4%
- Internal iliac artery: 8.5%
- Umbilical and superior vesical artery: 12.8%
- Inferior vesical artery: 12.9%

*Anson and McVay: Surgical anatomy. Saunders (1984)*

Unnecessary extensive mobilisation could result in devascularisation of the ureters with risk of postoperative strictures!
Recognition/presentation of ureteric injury

- The Golden Rule is **Early recognition**
- The Cardinal Sin is not to recognise the injury
- **Time of diagnosis is most important independent factor determining outcome**

- Best prognosis in those diagnosed intra-op and treated appropriately
- Only 30-45% of iatrogenic ureteral injuries diagnosed early
- Nephrectomy
  - early diagnosis 2.4%
  - late diagnosis 18.4%
What should one look out for?

- Ureteric injuries which are missed following Colorectal Surgery may present with:
  - Loin pain
  - Paralytic ileus
  - Fever
  - Urine in the drain
  - Sepsis
  - Raised Creatinine
  - Haematuria
  - Urocutaneous Fistula
  - Anuria

- 3-14 days post-op
- Manifestations due to stricture years post-op
Intra-op identification

• Surgical exploration of retroperitoneum with direct visualisation of wall of ureter
  ligation
  contusion
  haemorrhage
  disruption

• i.v indigo carmine or methylene blue with inspection for ureteral dye leakage
Diagnosis of missed injuries

- Ultrasound: dilatation of upper urinary system
- IVP: delayed renal function, ureteric dilatation or deviation, extravasation of contrast, non-visualisation of ureter
- Contrast CT: dilated upper urinary system, urinoma
- Retrograde: most sensitive radiographic study, allows stent placement
- Aspirate from drain or wound for Cr and Urea estimation
Prevention of ureteral injuries

- First identify and directly visualise it
- Do not divide vascular pedicles esp Inferior Mesenteric Artery before having identified position of ureter
- Characteristic appearance and writhing movement when pinched with forceps may be absent in dilated obstructed ureter
- Sling ureter once identified
- Look for ureter cranial to field of operation
- Mobilise up to splenic/hepatic flexure
- Pre-op imaging to map course of ureter; identify any anatomical abn.
To stent or not to stent

• Prophylactic stenting at start of operation and removal immediately after if identification of ureter anticipated to be difficult

• Controversial

• Increased operating time, potential ureteric injury, infection, increased overall cost

• <1% complication rate

• Anaesthetic time increased only by few minutes

• Benefits and time saved in facilitating identification of ureter and preventing injury greatly outweigh minimal risks
To stent or not to stent

• Should be performed in difficult cases

• Laparoscopic colorectal procedures – manual tactile localisation not possible

• In case of ureteric injury stent important in management

• Infrared illuminated stents
Treatment of iatrogenic ureteric injury

- Aims
  - early identification
  - reconstruction of ureteric continuity
  - preservation of renal function

**Therapeutical plan**

**Intraoperatively observed lesions**
- Immediate reconstructive surgery – depending on the op. situation
- Best results

**Postoperatively diagnostized lesions**
- Initial nephrostomy stent
- Later open (laparoscopic) reconstruction within a time interval of (6) 8 - 12 weeks
Treatment of ureteric injury

- Each case on its own merits depending on type of injury, type of surgery performed, comorbidity

- Endoscopic management first when possible (Retrograde + stent)

- Nephrostomy and wait

- Immediate exploration
Principles of ureteral reconstruction

- Debridement of ends to fresh tissue
- Spatulation of ureteric ends
- Tension-free closure
- Closure over a stent
- Watertight closure using absorbable sutures
- Placement of an external, non-suction drain
- Isolation of repair with peritoneum or omentum

- Type of repair procedure chosen depends on nature and site of injury
Treatment options by location of injury

- **Upper third**
  - uretero-ureterostomy (end to end)
  - uretero-calicostomy
  - transuretero-ureterostomy

- **Middle third**
  - uretero-ureterostomy
  - transuretero-ureterostomy
  - Boari flap

- **Lower third**
  - neoimplantation
  - psoas hitch

- **Total loss of ureter**
  - ileal interposition
  - autotransplantation

- **Nephrectomy**
Uretero-ureterostomy

(end-to-end anastomosis)

- Ureteral end should be debrided and freshed
- The end are spatulated
- Internal JJ stent
- Closure interrupted 4-0 Polyglactin
- Bladder catheter: 2 days
- Stent: 6 weeks
Ureterocalicostomy

- Amputation of the lower pole of the kidney
- Ureter end debrided, spatulated
- Interrupted 4-0 Polyglactin
- Catheter: 2 days, stent: 6 weeks
Transuretero-ureterostomy

- Upper part of effected ureter transposed across midline
- 1,5 cm ureterotomy, medical aspect of contralateral ureter
- Stent, watertight anastomosis (4-0 Polyglactin)
- Catheter: 2 days, stent: 6 weeks
Boari flap 1.

Mobilisation of the bladder flap
(length : width = 3 : 2)

Anti-reflux implantation
through submucosal tunnel
Boari flap 2.

Running suture
4-0 Polyglactin
Ureteral stent 6 weeks
Catheter 2 days
Psoas Hitch

Mobilisation of the bladder incision of frontal bladder wall fixation to M. psoas (Cave: to N. femoralis)

Anti-reflux implantation, Stent for 6 weeks

Running suture Catheter for 2 days
Ileal interposition
Take home messages

• During surgery on the colon and rectum one must always be aware of the risk of injury to the urogenital tract and the associated morbidity this brings along

• Pre-op counselling; pre-op urological workup

• Importance of thorough understanding of regional anatomy and use of autonomic nerve sparing techniques
Take home messages

• Early diagnosis and appropriate management is key to successful outcome and to prevent permanent disability

• Golden rule and Cardinal sin; always maintain a high index of suspicion

• Pre-op imaging, prophylactic stenting extremely important adjuncts to careful surgical dissection to always visualise the ureter.
Thank you
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