TME and autonomic nerve preservation techniques: based on Video and Cadaveric anatomy
Goals of Surgery for Rectal Cancer

- **Optimal Curative Surgery**
  - Curative resection
    - Low rate of recurrence
    - Long term survival
  - Safety
  - Good quality of life
    - Anal sphincter preservation
    - Appropriate rectal reservoir
    - Preservation of sexual and urinary function
Why TME?
Excellent knowledge of the complex pelvic anatomy is a prerequisite to optimize the oncological and functional outcome of rectal cancer.

- The anatomy of Mesorectum and the pelvic floor
- The fascia anatomy of the rectum
- Neurovascular structures surrounding the rectum
- Technical tips when perform lower pelvic dissection.
- **Sequential step by step procedures for optimal pelvic dissection**
The Anatomy of the Mesorectum
Mesorectal fascia on MRI: Crucial for CRM involvement
Mesorectal fascia

Falu lasarett, 2006
Total mesorectal excision
The Pelvic Floor and the shape of the mesorectum

Figure 5. Pelvic floor images on MRI coronal axial view
A. steep coning down of pelvic floor with narrow angle, B. Gradual coning down of pelvic floor with wide angle
The pelvic floor
TME Dissection plane

- **Denonvilliers’ fascia** = Rectogenital fascia
- **Rectal proper fascia** = Fascia propria of the rectum = Visceral (endo)pelvic fascia
- **Presacral fascia** = Parietal (endo)pelvic fascia
- **Waldeyer’s fascia** = Rectosacral fascia
The mesorectal fascia allows nerve preservation in TME, but it varies in thickness and shows gap. Most prominently at the anterolateral lower rectum, this site has a high risk of incomplete TME.
Posterior pelvic dissection
Deep posterior pelvic dissection

Rectosacral fascia
Deep posterior dissection
Anterior pelvic dissection
Denonvilliers’ fascia is one entity and adherent to the mesorectal fascia: implication for the anterior plane in TME? Kraima AC et al. EJSO 41(2015) 738-745

Whole mount microscopic section of adult pelvis
- multilayered condensation of collagen and smooth muscle fibers
- The lateral edge, autonomous nerve
- The neurovascular bundle is at risk during the dissection of the anterolateral mesorectum
- Sharp dissection on the mesorectal fascia is needed.
- Small nerves between the prostate or vagina and DVF
- Surgical plane anterior to DVF will OK for preserving ANP

Figure 1. This figure shows the relationship of DVF to the seminal vesicles (SV) and prostate (P). The inferior hypogastric plexus (arrow located laterally to the mesorectal fascia in window a). The arrows in detail window a.I show the lateral edges of DVF at the lowest arrow points out the part that fuses with the mesorectal fascia (arrowhead). The arrows in detail window a.II show that DVF is at the mesorectal fascia (arrowhead). At inferior levels, nerves (N) are located in the interspinous space (star in detail window b.I) which is located between the fascia (lower arrow) and mesorectal fascia (arrowheads). The prostate fascia fuses with the endopelvic fascia (upper arrow). The rightness that DVF and the mesorectal fascia are continuous. The arrow in window b.II shows that DVF cannot be distinguished separately from the (arrowheads). ME: Millers’ elastin, MT: Munic in’s tunic, G: obturator internus muscle, Ac: apex of prostate, R: rectum, M: mesorectum windows a and b: 8 mm, windows a.I and a.II: 800 μm, window b.I: 2 mm and window b.II: 1 mm.

Figure 2. This figure illustrates the lateral edges of DVF at the prostatic base (P). Detail window a.I shows the multi-layered lateral edges. Between these layers, small nerve fibres can be detected (arrows). Note the close relation of DVF with the outer longitudinal layer of the rectal wall (OLL). The arrow in detail window a.II shows that at high magnification DVF is as closely related to the prostatic fascia as to the mesorectal fascia (arrowhead). ME: Millers’ elastin, LAM: levator anae muscle, R: rectum, M: mesorectum, ICL: inner circular layer of the rectal wall. Scale bars in window a: 8 mm, window a.I: 2 mm, window a.II: 300 μm.
Posterolateral & anterolateral pelvic dissection

- Inferior hypogastric nerve
- Neurovascular bundle
- Pelvic plexus
- Seminal vesicle
- Neuromuscular bundle
Lateral edges of Denonvillers’ fascia

Seminal Vesicles

Mesorrectum

Rectum

Prostate

nerve

Denonvillers’ fascia
Anterolateral pelvic dissection toward the pelvic floor
Final deeper pelvic dissection toward the pelvic floor
Three dimensional reconstruction of the pelvic autonomic network. Kraima AC, Int J Gyc Cancer 2016;26;959-966

FIGURE 4. Three-dimensional reconstruction of the pelvic autonomic network. Three-dimensional reconstruction of the pelvic autonomic network of the fetus aged 14 weeks. The bladder is depicted in light blue, the uterus in dark blue, the rectum in purple, the ureter in green, and the autonomic nerves in yellow. A, Posterolateral view, in which the arrow indicates the nerve fibers from the middle part of the IHP surrounding the distal ureter. B, Anterolateral view, in which the distribution of nerve fibers in relation to the distal ureter can be explored. The upper arrow shows the plexus located on top of the ureter in the superficial layer of the VUL, whereas the lower arrow points out nerve fibers running in the deep layer of the VUL.

FIGURE 5. Pelvic autonomic network in relation to the different extensions of the parametrium. The parametrium can be divided into 4 surgical extensions based on the Leiden TNM classification system. Ventral (V) 1, superficial layer of the VUL; V2, medial part of the deep layer of the VUL; V3, lateral part of the deep layer of the VUL. Lateral (L) 1, medial to the ureter; L2, between the ureter and pelvic side wall; L3, until the pelvic side wall. Caudal (C) 1, above the ureter; C2, above the deep uterine vein; C3, below the deep uterine vein. Dorsal (D) 1, between the uterus and rectum; D2, at the anterior rectal border; D3, halfway of the rectal circumference. Note that the ureter passes through the lateral, ventral, and upper caudal parametria. The IHP is located in the dorsal, lateral, and upper caudal parametria, caudal to the ureter. The vesical plexus is located in the ventral parametrium in V1 and V2 superiority and inferiorly to the distal ureter.
Superior hypogastric nerve plexus

Fig. 2. Schematic representation of the superior hypogastric plexus and its neural in- and outflow structures. A: abdominal aorta, RV: renal vein, AAP: abdominal aortic plexus, RA: renal artery, LSN: lumbar splanchnic nerve, IMA: inferior mesenteric artery, IMP: inferior mesenteric plexus, VCI: vena cava inferior, SC: sympathetic chain, SHP: superior hypogastric plexus, CIA: common iliac artery, CIV: common iliac vein, U: ureter, HN: hypogastric nerves, EIA: external iliac artery, IIA: internal iliac artery. b) shows the multiple segments taking out during autopsies. Segment 1 represents the AAP; 2 represents the IMP; 3 and 4 represent the LSN 1, 2 and 3; 5 and 6 represent the superior and inferior part of the SHP; 7 and 8 represent the HN.
Autonomic nerve preservation

1. Superior hypogastric plexus
   - High or low ligation of IMA

2. Hypogastric nerve
   - Posterolateral pelvic dissection

3. Pelvic plexus
   - Division of lateral ligament

4. Neurovascular bundle
   - Division of Denovillier’s fascia

Autonomic nerve preservation

**Pelvic plexus**

**Superior hypogastric nerve**

**Inferior hypogastric nerve**
Autonomic nerve preservation
Summary and Conclusion

- Sharp pelvic dissection along the anatomical embryological plane combined pelvic AN preservation
  - Named anatomical landmark should be identified
  - The cylindrical shape of the distal mesorectum kept in mind to avoid + CRM
  - 3 dimensional concept and approach for optimal pelvic dissection
  - Neuroanatomy for autonomous pelvic nervous system should be understood.
- Pelvic diaphragm and its shape
Thank you for your kind attention
Robotic & Laparoscopic Animal Workshop
Summary of optimal TME for maximal oncologic and functional outcomes

• **Posterior approach**
  – Inferior hypogastric nerve and the mesorectal fascia

• **Anterior approach**
  – Division of peritoneum and D. fascia, mesorectum and rectovaginal septum

• **Anterolateral approach**
  – NVB spared and into the pelvic floor

• **Deep posterior approach**
  – Division of rectosacral fascia and into the coccyx level

• **More deep anterior approach**
  – More mobilize rectum from the adj. organ and pelvic plexus

• **Dissection to the level of pelvic floor**
  – Anococcygeal lig. PR and Levator ani muscle and fascia
Cadavar workshop
Tumor Specific Mesorectal Excision for Rectal Cancer Workshop

Update and Debate on Standard Colorectal Surgery

TSME Workshop
10th Anniversary