# The Anatomical and Radiological Basis of the Operation Extrafascial Excision of the Rectum

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## Abstract

The operation of extrafascial excision dissects directly on the rectal fascia propria to remove the rectum and mesorectum within an intact fascial envelope. The studies contained in this thesis revolve around the recent finding that if a rectal cancer is contained within the fascia propria and the rectum is removed by extrafascial excision then local recurrence of the cancer will be exceptional. The thesis is presented in 4 parts as anatomical, radiological, clinical and operative sections.

Gross and microscopic examination of surgical specimens, post-mortem dissections and axial cross sectional anatomy images were used to define the anatomy of the fascia propria. It is shown to be a 150μm thick, collagen membrane completely surrounding the mesorectum. The hypogastric nerves and pelvic plexuses are embedded in the parietal fascia separated from the mesorectum and fascia propria by a loose areolar layer. A computerised three-dimensional model of the rectum and mesorectum has been generated based on 1mm axial cross sections of the anatomy of the area and axial MR scans offering the potential to visualise the rectum in its mesorectum preoperatively.

A systematic review of preoperative radiological staging has been reported comparing endorectal ultrasound, CT and MR imaging. The ability to determine the relation of the tumour to the fascia propria preoperatively has, however, not been previously explored. Cadaveric studies in this thesis have demonstrated that the fascia propria can be identified by axial CT and MR imaging. In a consecutive series of 43 patients with rectal cancer preoperative MR accurately predicted the relation of the deepest tumour invasion to this fascia.

In the third section extrafascial excision has been compared with conventional surgery at a single institution over a 16 year period. In a study population of 262 rectal cancer patients operated on with curative intent, extrafascial excision had a significantly lower local recurrence rate and prolonged cancer-free survival without an increase in cost or complication rates. Based on these studies a new description of the operation of extrafascial excision of the rectum is presented in the fourth section with emphasis on preventing complications.

This thesis has provided a new understanding of the surgical anatomy of the rectum and a novel management protocol for rectal cancer based on the relationship of the tumour to the fascia propria as detected by preoperative MR imaging.

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# Abbreviations

ACC – Accuracy
Ant R – Anterior resection
APR – Abdomino-perineal resection
°C – Degrees Celsius
cm – centimetres
CT – Computerised tomography
EFE – Extrafascial excision of the rectum
ES – Endorectal sonography
EVG – Verhoeff's method with van Gieson counterstain
F – female
FP – fascia propria
Gy – Gray
H&E – Haematoxylin and Eosin
HN – Hypogastric nerve
IMA – Inferior mesenteric artery
M – male
Ml – millilitres
mm – millimetres
MR – Magnetic resonance
MRI – Magnetic resonance image
NIH – National Institute of Health
NLR – Negative likelihood ratio
NPV – Negative predictive value
PLR – Positive likelihood ratio
PP – Pelvic plexus
PPV – Positive predictive value
S4 – Fourth sacral vertebrae
SD – Standard deviation
SEN – Sensitivity
SHP – Superior hypogastric plexus
SPE – Specificity
TME – Total mesorectal excision
TNM – Tumour, node, metastasis
UC – Ulcerative Colitis
UK – United Kingdom
µm – microns
USA - United States of America