

## Superiority of laparoscopic rectal surgery: Towards a new era

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### Abstract

While laparoscopic colon surgery has been established to some degree over this decade, laparoscopic rectal surgery is not standard yet because of the difficulty of making a clear surgical field, the lack of precise anatomy of the pelvis, immature procedures of rectal transaction and so on. On the other hand, maintaining a clear surgical field *via* the magnified laparoscopy may allow easier mobilization of the rectum as far as the levator muscle level and may result less blood loss and less invasiveness. However, some unique techniques to keep a clear surgical field and knowledge about anatomy of the pelvis are required to achieve the above superior operative outcomes. This review article discusses how to keep a clear operative field, removing normally existing abdominal structures, and how to transact the rectum and restore the discontinuity based on anatomical investigations. According to this review, laparoscopic rectal surgery will become a powerful modality to accomplish a more precise procedure which has been technically impossible so far, actually entering a new era.

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**Key words:** Laparoscopic surgery; Rectum; Anatomy;

### INTRODUCTION

Since its advent in 1991<sup>[1]</sup>, laparoscopic colonic resection has drawn much interest worldwide and many modifications and improvements have been reported<sup>[2-7]</sup>, yielding great benefits for the patients involved. Over the last decade, several reports on randomized controlled trials have been published around the world which provide evidence for equivalence between laparoscopic and open surgery in the treatment of colon cancer<sup>[8-13]</sup>. However, all of these studies were limited to the colon, sigmoid colon or right side of the colon, with none comparing these techniques for cancer of the rectum. On the other hand, recent studies have focused on laparoscopic surgery for rectal cancer. While some of these studies have investigated laparoscopic surgery for colon cancer, a number of single-institute, cohort studies have focused on the advantages of this technique in rectal surgery<sup>[14-17]</sup>. Evidence for the visual superiority that this technique affords through the use of optical instruments, however, has so far been based on the experience of individual surgeons and none from multicenter, randomized, control trials is yet available. Rectal surgery must be considered in relationship to oncological care, regardless of the technique used, and much attention now is paid to increasing operative safety and outcomes in terms of

such care. For a long time now, much effort has gone into improving techniques so as to avoid impairment of urinary, sexual and anal function following rectal cancer surgery<sup>[18-23]</sup>.

Preservation of the anus is the biggest hope of most rectal cancer patients, making this the biggest priority among surgeons too. One purely surgical development in this respect is the indication for intersphincteric resection in cases of very low rectal cancer located close to the dentate line<sup>[24-26]</sup>. Neoadjuvant chemo-radiotherapy is also used to preserve the anus and for local control<sup>[27,28]</sup>. In this editorial, I would like to consider the potential of laparoscopic surgery in overcoming such difficulties and providing improved outcomes.

## ANATOMY OF PELVIS IN RECTAL MOBILIZATION

Laparoscopy offers superb visualization of the pelvis. However, there is still a need for new procedures for removal of the small bowel, sigmoid colon, ovary and uterus. The Trendelenburg position is necessary for removal of the small bowel and a variety of techniques are required for retraction of the sigmoid colon. The magnification offered by the laparoscope allows the surgeon a clear view of the inner regions of the pelvis. There is no doubt that this enhanced view in combination with fundamental investigation allows more precise anatomical recognition, as will be described later. A number of reports have been published on the relationship between the anatomy of the pelvis and rectal surgery. Kinugasa *et al*<sup>[29-31]</sup> investigated surgical planes in the anterior and posterior aspects of the pelvis using fresh cadaver specimens. While some later studies concurred with Kinugasa regarding the posterior plane, others did not and the matter remains controversial<sup>[32,33]</sup>. In a study on the fascial structures posterolateral to the rectum, Kinugasa reported the existence of a provisionally termed “pre-HGN fascia” between the fascia propria of the rectum (FPR) and the parietal presacral fascia covering HGN. This pre-HGN fascia lies very close to the FPR and is so thin that it appears almost contiguous with the FPR at the third and fourth sacral vertebrae. He also stated that use of a surgical plane on the parietal presacral fascia runs the risk of injury to the pelvic plexus, presacral vein and other structures. This hypothesis, however, remains unverified and in the procedure for total mesorectal excision advocated by Heald *et al*<sup>[34]</sup>, mobilization on this plane is the norm due to difficulties in separating the FPR and pre-HGN fascia. Separation of these planes would result in injury to the FPR, making this unacceptable in terms of oncological safety.

In contrast, anterior to the rectum, the structures of Denonvillier's fascia and its relationship with the FPR have been investigated in many studies<sup>[32,33]</sup>. Although Denonvillier's fascia is used in descriptions of operative surgery, confusion exists with regard to the precise

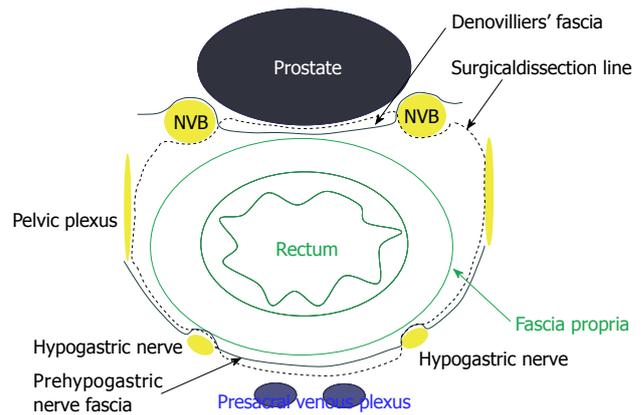


Figure 1 Scheme of the pelvic anatomy.

relationship between Denonvillier's fascia and the FPR. Lindsey *et al*<sup>[32]</sup> proposed three possible surgical planes for anterior resection in total mesorectal excision according to circumferential tumor location. He also stated that the Denonvillier's fascia should be left on the prostate and seminal vesicles during routine anatomic anterior resection. In some cases in which the tumor is located on the anterior or circumferential rectum, this plane should be resected with the specimen. Kinugasa *et al*<sup>[29]</sup> also advocated leaving Denonvillier's fascia on the prostate and seminal vesicles, citing improved safety in terms of preservation of autonomic nerves in the pelvis. When the surgical dissection plane is placed anterior to the Denonvillier's fascia, this plane continues anterior to the neurovascular bundles and pelvic plexus (Figure 1).

## RECONSTRUCTION

Double stapling technique is now the standard method for reconstruction after rectal resection and most low rectal cancer patients are candidates for anus-preserving surgery using this technique<sup>[35]</sup>. Even in open surgery, anastomotic leakage is the most feared and difficult complication for both surgeon and patient. Generally speaking, the rate of anastomotic leakage with double stapling technique in open rectal surgery is 8%-10%<sup>[36,37]</sup>. Nobody knows how this compares with the leakage rate with laparoscopic surgery in such cases. However, during the early days of laparoscopic surgery, it has to be admitted that inexperience with this approach may have meant that rectal transection was not carried out in a satisfactory environment in many cases. The use of multiple stapling cartridges for transection implies that the rectum is divided, resulting in poor sealing and compromised vascular supply to the stump<sup>[17]</sup>. Some studies have reported the experiences of individual surgeons and the techniques employed for transection of the rectum with less than two cartridges<sup>[38,39]</sup>. Conventional devices employed in open surgery have been used for transection of the rectum under pneumoperitoneum<sup>[38,40]</sup>. Some recent reports advocate the use of an endostapler in pure laparoscopic

surgery for transaction of the rectum<sup>[39,41]</sup>. A number of studies, not limited to laparoscopic surgery, have reported risk factors for anastomotic leakage in rectal cancer surgery<sup>[42-47]</sup> and these have included the degree of anastomosis, age, male sex, smoking, diabetes, cardiovascular disease, obesity and preoperative radiochemotherapy among others. It has yet to be shown that laparoscopic surgery yields a lower rate of anastomotic leakage than open surgery. However, there is no doubt that laparoscopic rectal surgery provides a magnified field of view, allowing a more accurate and finer technique, even in the very narrow and deep confines of the pelvis, resulting in more favorable outcomes than open surgery.

Rectal washout before transaction to avoid increase in anastomotic recurrence is another issue related to this technique. Maeda *et al*<sup>[48]</sup> reported the importance of rectal wash out before transaction of the rectum in cancer patients. On the other hand, some reports have argued against rectal wash out, even in cancer patients<sup>[49-51]</sup>. Despite no objective evidence that rectal wash out decreases anastomotic recurrence, this entity after double stapling technique has been approved. Rectal wash out before transaction may even be possible with new and unique laparoscopic procedures, even for very low level tumors<sup>[58,52]</sup>.

## ANUS PRESERVATION

Recent studies have reported intersphincteric resection for low rectal cancer, even in cases where hand-sewn anastomosis *via* the anus is necessary. This technique was reported in the early 1990s in open surgery<sup>[24-26]</sup>. Since then, short-term outcomes, including anal function, and long-term outcomes, according to the spread of indications for advanced cancer, have been discussed. How far partial or total intersphincteric resection is required from the anal verge may influence postoperative bowel habits. Such factors may play an important role from an oncological viewpoint as well. This operation has been tried laparoscopically in recent studies<sup>[53-58]</sup>. Magnification of the lower pelvis allows safe and easy mobilization of the rectum as far as the levator muscle or the intersphincteric space from the abdominal side. Once this ultra-low mobilization of the rectum has been carried out from the anterior side, per-anum dissection of the rectum can easily be performed while partially preserving the internal or external sphincter. Local recurrence is another factor that must be taken into consideration with this procedure, especially with the laparoscopic approach. The rate of local recurrence after this operation has been reported to be approximately 2.5%<sup>[59]</sup> to 10%<sup>[60]</sup>, and may be influenced by the stage of the primary rectal cancer. Is the laparoscopic approach for this operation beneficial? Some authors maintain that abdominal laparoscopic dissection of the rectum *via* the abdomen allows better magnification of the surgical field than anal dissection<sup>[61,62]</sup>.

In using this technique for advanced rectal cancer, especially by laparoscopy, rate of local recurrence remains

an unsolved issue. Saito *et al*<sup>[60]</sup> reported that most cases of local recurrence were histological T3.

## CONCLUSION

Laparoscopic rectal surgery is now entering a new era and many case-matched control studies and new technical trials are under way. To achieve technically safe and oncologically sufficient outcomes, the magnification of anatomy that laparoscopy allows will play an important role in the further development of surgical expertise.

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