

Iatrogenic impotence and rectal dissection

I. Lindsey and N. J. McC. Mortensen

Department of Colorectal Surgery, John Radcliffe Hospital, Headington, Oxford OX3 9DU, UK
(e-mail: lindseylinz@yahoo.com and resnaith@hotmail.com)

Colorectal surgeons are becoming ever more aware of the details of the surgical anatomy of the rectum and surrounding pelvic structures in the drive to improve not only the oncological but also the functional outcome of pelvic surgery. In the past, impotence after proctectomy has been overattributed to non-surgical factors, such as the presence of a stoma or the fear of recurrent cancer. Higher impotence rates in ileostomists have never been demonstrated¹ and there is now increasing recognition of the role of parasympathetic nerve injury.

Traditionally, subjective assessment methods (interview or questionnaire) have been used to explore impotence after proctectomy, but recent objective evaluation has proved illuminating. Nocturnal penile tumescence monitoring, assuming that nocturnal erections during rapid eye movement sleep are equivalent to sexually induced erections, strongly supports the aetiological role of parasympathetic nerve injury. Patients with impotence after proctectomy for rectal cancer or inflammatory bowel disease have a significantly reduced number of tumescent events when monitored for two nights, compared with matched potent controls². Intriguingly, the phosphodiesterase type 5 inhibitor sildenafil (Viagra; Pfizer, Tadworth, UK) helps impotent patients with diminished nocturnal tumescent activity (and thus parasympathetic nerve damage) more than those with preserved activity². Sildenafil works by augmenting the vasodilator effect of parasympathetic neural tone on the choke arterioles governing inflow to the erectile cavernous chambers of the penis. It requires the presence of at least some intact and functioning parasympathetic nerve fibres to exert its effect³, and is generally less effective when profound neural injury underlies impotence⁴. This finding supports the role of parasympathetic nerve injury and, in particular, suggests that the neural lesion in postproctectomy impotence is frequently partial.

Where does this nerve injury take place? It is difficult to be certain about where most injuries occur, but there are four key zones of risk of autonomic nerve damage. The risk of sympathetic nerve damage occurs in the abdomen during ligation of the inferior mesenteric artery pedicle, and high in the pelvis during initial posterior rectal dissection adjacent to the large hypogastric nerves. Lower down, risk to the parasympathetic nerves occurs while dissecting laterally

near the pelvic plexus, and during deep dissection of the anterior aspect of the rectum away from the seminal vesicles and prostate near the cavernous nerves.

Accumulating evidence suggests that most trauma to parasympathetic nerves occurs during deep anterior dissection. First, published impotency rates after abdominoperineal excision are consistently higher than after anterior resection for rectal cancer, reflecting a deeper rectal dissection⁵. Second, operations for rectal cancer that involve rather than spare the anterior rectal quadrant are associated with a higher rate of impotence⁶. Third, impotency rates after close rectal *versus* mesorectal excision for inflammatory bowel disease are the same when a close rectal dissection is used immediately behind the prostate in an otherwise mesorectal technique⁷; this suggests the importance of the anterior dissection. Finally, in the Singapore trial of laparoscopically assisted *versus* open surgery for rectal cancer, published in this edition of *BJS*⁸, impotency rates were tenfold higher after laparoscopically assisted surgery, yet ejaculatory and bladder dysfunction were equivalent in the two groups. This indicates that nerve injury takes place distal to the origin of nerves supplying motor function to the bladder, distal to the pelvic plexus, i.e. injury affects the cavernous nerves during anterior dissection (which is generally the most technically difficult point to obtain good retraction and vision during laparoscopic deep pelvic dissection in men).

In the authors' opinion, injury to the pelvic plexus is uncommon unless it is tented up during ligation of the so-called 'lateral ligaments', a technique on the wane with declining belief in this anatomical concept⁹. Urological studies have established the anterior cavernous nerves as central to the development of erectile dysfunction after pelvic surgery¹⁰. These small nerves are extremely close during anterior dissection, yet are not visualized. They arise as branches from two discrete neurovascular bundles that sit just anterior to the lateral borders of Denonvilliers' fascia between the rectum and the prostate and seminal vesicles. Anterior dissection deep in the pelvis can be especially difficult, particularly in a male with a bulky tumour, and occasionally troublesome bleeding requires diathermy control. The mesorectal plane is also slightly less well defined anteriorly than posteriorly. It is not difficult to imagine how these small nerves may be damaged.

It seems important to define the principal zone of injury so that suitable steps may be taken to prevent postproctectomy impotence. The choice of surgical plane for anterior rectal dissection is a factor within the surgeon's control; it has an influence on impotence and should be better defined. A consensus has been reached regarding the anatomy of the planes of posterior and lateral rectal dissection (mesorectal plane), but this is not the case anteriorly. What planes are available anteriorly; can the surgeon easily differentiate them; and which should be used and when? There are three planes, and dissection within them involves resection of none, some, or all of the structures lying between the anterior rectal wall and the prostate and seminal vesicles. The planes are, respectively, characterized by the anterior mesorectum, the fascia propria of the rectum, and Denonvilliers' fascia.

The close rectal dissection plane, immediately on the rectal musculature within the mesorectal fat, is not a natural anatomical plane. Some will favour this dissection for inflammatory bowel disease, but it is technically difficult and is probably required only behind the prostate to minimize impotence⁷. The mesorectal plane, immediately outside the fascia propria, is an anatomical plane that should be familiar to the colorectal surgeon; it is the standard plane used in operations for rectal cancer. Dissection in this plane separates the fascia propria of the rectum from Denonvilliers' fascia, which is left intact on the prostate and seminal vesicles and not the anterior surface of the rectum¹¹. An anterior mesorectal dissection remains posterior to Denonvilliers' fascia with the cavernous bundles relatively protected by it. Use of the extramesorectal plane, exposing and staying immediately on the prostate and seminal vesicles, results in a resection of Denonvilliers' fascia which can be identified on the anterior surface of the extraperitoneal rectum¹¹. As dissection is conducted in the plane anterior to Denonvilliers' fascia, the risk of damage to the cavernous nerves is theoretically highest. While some surgeons recommend the routine use of this plane, in the authors' opinion it should be used only when the risk of leaving a tumour-positive anterior resection margin is high (when the tumour threatens the anterior circumferential margin).

Sexual dysfunction in women after rectal surgery has not received much attention, and the surgical anatomy of the autonomic nerves and corresponding autonomic nerve lesions are poorly understood. This area presents considerable opportunities for further research. In men the plane of anterior rectal dissection is now known to be critical with respect to sexual function; it should be defined relative to Denonvilliers' fascia and the anterior mesorectum.

Maximum preservation of the cavernous nerves, when possible, is especially important as a result of the advent of modern pharmacological agents for impotence that act by amplifying otherwise suboptimal function in these nerves¹².

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