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Review

Total mesorectal excision for rectal cancer with emphasis on pelvic autonomic nerve preservation: Expert technical tips for robotic surgery

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ABSTRACT

The primary goal of surgical intervention for rectal cancer is to achieve an oncologic cure while preserving function. Since the introduction of total mesorectal excision (TME), the oncologic outcome has improved greatly in terms of local recurrence and cancer-specific survival. However, there are still concerns regarding functional outcomes such as sexual and urinary dysfunction, even among experienced colorectal surgeons. Intraoperative nerve damage is the primary reason for sexual and urinary dysfunction and occurs due to lack of anatomical knowledge and poor visualization of the pelvic autonomic nerves. The rectum is located concavely along the curved sacrum and both the ischial tuberosity and iliac wing limit the pelvic cavity boundary. Thus, pelvic autonomic nerve preservation during dissection in a narrow or deep pelvis, with adherence to the TME principles, is very challenging for colorectal surgeons. Recent developments in robotic technology enable overcoming these difficulties caused by complex pelvic anatomy. This system can facilitate better preservation of the pelvic autonomic nerve and thereby achieve favorable postoperative sexual and voiding functions after rectal cancer surgery. The nerve-preserving TME technique includes identification and preservation of the superior hypogastric plexus nerve, bilateral hypogastric nerves, pelvic plexus, and neurovascular bundles. Standardized procedures should be performed sequentially as follows: posterior dissection, deep posterior dissection, anterior dissection, posterolateral dissection, and final circumferential pelvic dissection toward the pelvic floor. In future perspective, a structured education program on nerve-preserving robotic TME should be incorporated in the training for minimally invasive surgery.

Contents

Abbreviations: TME, total mesorectal excision; IMA, inferior mesenteric artery.

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1. Introduction

The primary goal of surgical intervention for rectal cancer is to achieve an oncologic cure while preserving function. Since the introduction of total mesorectal excision (TME), the oncologic outcome has improved greatly in terms of local recurrence and cancer-specific survival [1]. However, there are still concerns regarding functional outcomes such as sexual and urinary dysfunction, even among experienced colorectal surgeons. Urinary dysfunction includes difficulty emptying the bladder and urinary incontinence. Male sexual dysfunction includes erectile dysfunction, absence of ejaculation, or retrograde ejaculation. Female sexual dysfunction includes diminished vaginal lubrication, dyspareunia, and inability or difficulty in achieving orgasm [2,3]. Urinary dysfunction has been reported in 0%–27% and sexual dysfunction in 11%–55% of patients after TME for rectal cancer [4–8]. Although preoperative chemoradiation therapy or adjuvant chemotherapy may deteriorate postoperative function, intraoperative nerve damage is the primary reason for sexual and urinary dysfunction [9,10]. Inadvertent surgical damage occurs due to lack of anatomical knowledge and poor visualization of the pelvic autonomic nerves [2,9].

To preserve sexual and voiding function after TME for rectal cancer, it is important to identify the pelvic autonomic plexus and neurovascular bundles during deep pelvic dissection [2,9]. Preservation of sexual and voiding functions is critical, especially in young patients. Adequate vision, traction, and countertraction are very important elements for successful TME and good functional outcomes in the surgical treatment of rectal cancer. However, pelvic autonomic nerve preservation with adherence to the TME principles is very challenging in a narrow or deep pelvis; thus, colorectal surgeons have struggled to overcome these surgical difficulties during pelvic dissection. Anatomically, the rectum is located concavely along the curved sacrum and both the ischial tuberosity and iliac wing limit the pelvic cavity boundary. At the level of the anorectal junction, there remains very limited space to obtain an adequate surgical view. Although difficult, surgeons should create surgical spaces and use dissection planes to perform a sharp pelvic dissection.

Recent developments in robotic technology provide a 3-dimensional surgical view, surgeon-operating camera system, filtering of tremor, and ergonomic instrumentation that facilitate fine dissection and stable traction. Unlike laparoscopy, a robotic camera is directly managed by an operating surgeon, and this is very similar to the environment of open surgery. Using the robotic system, the surgeon can view the desired area with optimal magnification and camera angle. Recently, the robotic system has been widely applied to pelvic surgery, and robotic TME for rectal cancer has shown comparable short-term and oncologic outcomes to open and laparoscopic approaches [11–14]. In terms of urinary and sexual dysfunction, there have been debates over the benefit of a minimally invasive approach such as laparoscopy compared to open TME [8,15–17]. In particular, urinary and sexual dysfunction after robotic TME for rectal cancer has not been studied extensively.

We believe that the enhanced surgical view with the 3-dimensional magnification and surgeon-operating camera system, and the more dexterous robotic instruments can facilitate preservation of the pelvic autonomic nerve, thereby achieving favorable postoperative sexual and voiding functioning after rectal cancer

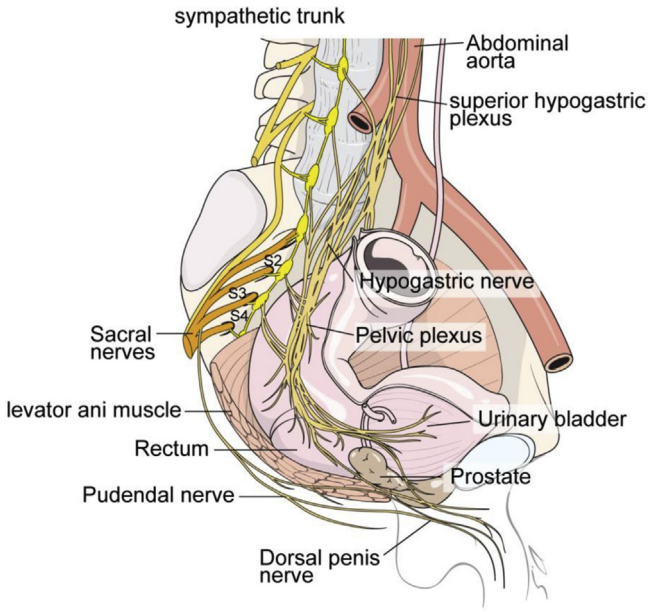

Fig. 1. Anatomy of pelvic autonomic nerves. The superior hypogastric plexus around the inferior mesenteric artery descends along the sacral promontory and bifurcates into hypogastric nerves. The paired hypogastric nerves run 1–2 cm medial to the ureters and enter the pelvis by crossing the common iliac arteries at the level of the first sacrum and then run along the posterolateral wall of the pelvis. The pelvic (inferior hypogastric) plexus is composed of the hypogastric and pelvic splanchnic nerves at the lateral pelvic wall. Numerous fine neurovascular bundles originate from the pelvic plexus and descend to the urogenital organ at the lateral corner of the seminal vesicle in the 10 o'clock and 2 o'clock directions.