



How to find Denonvilliers' fascia during laparoscopic TME

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Received: 12 February 2019 / Accepted: 8 March 2019 / Published online: 24 April 2019
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Total mesorectal excision (TME) has been performed widely for mid-low rectal cancer. Previous studies have suggested that optimal TME for rectal cancer is anterior to Denonvilliers' fascia (DF), because there is usually no surgical plane posterior to DF [1]. The bilateral edges of DF are perilously close to the converging neurovascular bundles. To avert damage to the neurovascular bundles, the lateral edges of Denonvilliers' fascia should be identified and preserved by a U-shaped cut. However, some studies revealed that during dissection anterior to DF, there was a great risk of intraoperative damage of neurovascular bundles resulting in postoperative urogenital dysfunction [2]. In a previous study, we showed that TME in laparoscopic resection for mid-low rectal cancer dissection posterior to DF permitted better preservation of urogenital function [3]. Therefore, we suggest that dissection anterior to DF in TME for rectal cancer should be reconsidered and we propose that in patients with early-stage (T1, T2) mid-low rectal cancer in the anterior wall, and in all patients with posterior rectal cancer dissection should be carried out posterior to DF to protect the pelvic nerves and prevent postoperative urogenital dysfunction.

However, intraoperative identification of DF is difficult. To identify DF, we carefully studied both four cadavers and ten videos of laparoscopic resection for rectal cancer. In the cadaveric study, we found that there was a plane between DF and the fascia propria of the rectum (Fig. 1a). In our previous experience, we found that dissection at the lowest level of the peritoneal reflection can enter this surgical plane. However, due to intraoperative traction and countertraction on the rectum, the fusion of the fascia is mobile and not always located at the lowest level of peritoneal reflection. Thus, we carefully studied videos of laparoscopic resection for rectal cancer, and discovered a white thickened line located at the lowest level of peritoneal reflection in all cases (Fig. 1b).

Regardless of mobilization of the peritoneal reflection, dissection above this marker line resulted in entry anterior to DF (Fig. 1c). In this surgical plane, both seminal vesicles were visible and the surface of the rectum was extremely smooth, which meant DF had been resected together with the rectum (Fig. 1d). On the contrary, dissection below this marker line led to entry posterior to DF (Fig. 1e). In this surgical plane, the seminal vesicles were not visible, since they were covered with the thickened and bright DF (Fig. 1f).

In our multicenter randomized controlled trial (Clinical-Trial.gov ID: NCT02435758), which is still in progress, we compare the effect of dissection anterior or posterior to DF on protection of urogenital function during laparoscopic resection for mid-low rectal cancer in selected male patients. Patients are randomized allocated to two groups: the experimental group (preservation of DF, i.e., dissection posterior to DF) and control group (resection of DF, i.e., dissection anterior to DF). A total of 126 patients have been included to date. In these cases, we have experienced the usefulness of this white thickened line for identifying DF.

According to embryological studies, there are several hypotheses regarding the origin of DF. Some researchers reported that DF was formed with peritoneal fusion. However, others believed that peritoneal fusion did not occur and DF did not originate from the pelvic cul-de-sac of the peritoneum [4]. A recent study considers DF as a tension-induced structure rather than a fusion fascia [5]. Whether peritoneal fusion or tension induced, DF is the outcome of fusion or compression, which could certainly form a thickened structure.

In conclusion, we believe that the white thickened line at the lowest level of the peritoneal reflection is the origin of DF. This important surgical marker line facilitates intraoperative identification of DF. Dissection below this line helps posterior entry to DF.

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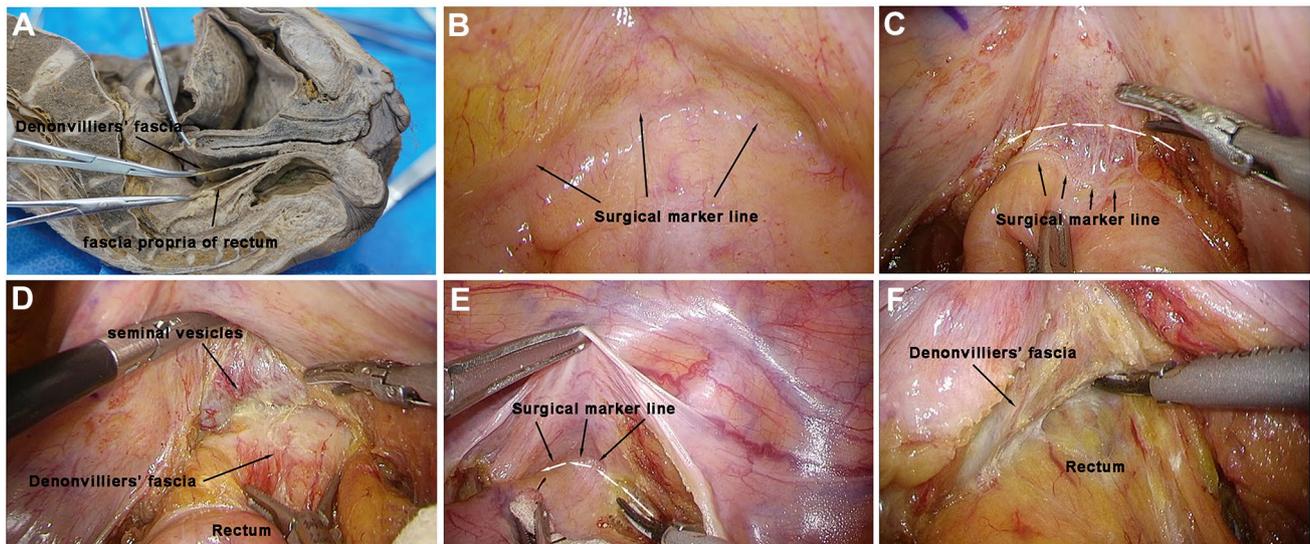


Fig. 1 **a** The plane between Denonvilliers' fascia and the fascia propria of rectum found in the cadaveric study. **b** The white thickened line at the lowest level of the peritoneal reflection. **c** Dissection above the marker line (black arrow for the surgical marker line, white dot line for surgical approach). **d** The surgical plane anterior to Denon-

villiers' fascia and both seminal vesicles. The surface of rectum is extremely smooth. **e** Dissection below the marker line (black arrow for the surgical marker line, white dot line for surgical approach). **f** The surgical plane posterior to Denonvilliers' fascia, with the thickened and bright Denonvilliers' fascia covering the seminal vesicles

Funding Pearl River S and T Nova Program of Guangzhou (201806010007); Natural Science Foundation of Guangdong Province (2017A030313505); Wu Jieping Medical Foundation (320.2710.1808); Sun Yat-sen University (2015016); Sun Yat-sen University (18ykpy04).

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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