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REVIEW ARTICLE

Laparoscopic Ovarian Transposition in Rectal Cancer: More than Just Oncological Outcomes

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Abstract
Locally advanced rectal cancer (LARC) is treated with neoadjuvant chemoradiotherapy which down stages tumor and improves complete resection rates thus reducing local recurrences. Pelvic radiotherapy improves oncological outcomes; however, it is associated with ovarian irradiation and premature menopause. This has a consequence to fertility and hormone preservation in young women diagnosed with locally advanced rectal cancer. Laparoscopic ovarian transposition is an established method to preserve ovarian function. This review discusses the technique, indications, and limitations of laparoscopic ovarian transposition in young women requiring pelvic radiotherapy.

Keywords Laparoscopic ovarian transposition · Young women · Rectal cancer

Introduction

Colorectal cancer (CRC) is the third most commonly diagnosed cancer in males and the second in females worldwide [1]. There is a rising trend of colorectal cancers in developing countries compared to developed nations. The reasons could be changing diet and lifestyles causing increasing prevalence of risk factors [2]. More patients with CRC have rectal/rectosigmoid tumors as compared to colonic tumors. Also, the incidence of CRC is more in men than in women. While CRC affects men and women over 50 years, there is an increasing incidence of rectal cancer under the age of 40 years. Also, younger patients have locally advanced rectal cancer and more unfavorable tumor morphology than older population [3]. However, stage-specific oncologic outcomes are similar to those in older patients in published literature [3, 4].

Locally advanced rectal cancers are generally treated with short or long course of chemoradiation (25 or 50.4 Gy dose) with concomitant 5 fluorouracil/capecitabine followed by surgery. Preoperative treatment aims to improve R-0 resection in tumors with mesorectal fascia involvement, reduce local relapse, and possibly preserve sphincters in low tumors [5].

Effects of Cancer Treatment on Gonads

Ovaries are very sensitive to pelvic radiotherapy. A radiation dose of 20 Gy will lead to permanent loss of ovarian function. The dose is even less with advancing age due to diminishing primordial follicle reserve [6]. Methods to shield the ovary during pelvic radiotherapy might interfere with treatment or might not be foolproof and cumbersome. The effects of scatter radiation cannot be eliminated completely by shielding the ovary. In some cases, shielding might not be appropriate and may interfere with oncological outcome.

In an audit of patients diagnosed with rectal cancer [20], the mean age of patients diagnosed with rectal cancer was 45 years. Approximately 40% of women with rectal cancer were below 40 years of age and 20% were below 30 years of age. Young women when affected with cancer have the burden of dealing with cancer and also the potential harm cancer treatment can cause to the gonadal function. Loss of gonadal function in young women will lead to premature menopause, loss of reproductive and hormonal function, and reduced quality of life [8].

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Options for Preserving the Gonads/Eggs

Even though exogenous hormonal replacement treatment (HRT) is an option to alleviate the short- and long-term effects of hormone deprivation, it is not a practical option in a country like India. The long-term cost and compliance and inconvenience will have to be considered with HRT. Loss of ovarian function will affect young woman in conceiving her biological offspring. Ovarian tissue cryopreservation and oocyte preservation are an option if availability, success rate, and cost of cryopreservation technique are addressed [9].

Considering all the above disease and age-related factors, ovarian transposition is an attractive and feasible option. The technique is not popular for various reasons and the concerns are discussed in the review [10]. Surgical steps of laparoscopic ovarian transposition along with tips to improve the success rate of surgery are described in the review.

Disease Concerns

There are concerns of Krukenberg tumor in transpositioned ovaries [11]. In rectal cancer, the incidence of ovarian-only metastasis with/without peritoneal metastases is approximately 1% and ovarian-only metastasis is less than 1% [20]. The incidence of microscopic Krukenberg in a normal-looking ovary without peritoneal or other metastasis is rare. Laparoscopy allows for assessment of peritoneal disease. Ovaries and peritoneum are assessed by inspection during laparoscopic transposition and also following chemoradiotherapy during definitive surgery, and decision can be made to remove the ovaries if there is suspicion of Krukenberg tumor.

Concerns with Technique

Historically, concerns regarding delay in definitive treatment were due to laparotomy for transposition surgery. However, laparoscopic/robotic ovarian transposition prevents treatment

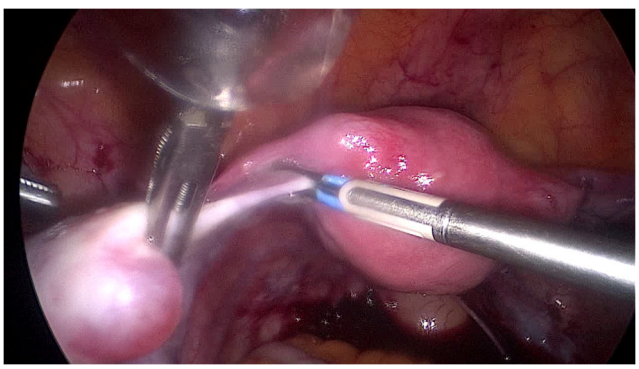

Fig. 1 Disconnecting adnexa from uterus

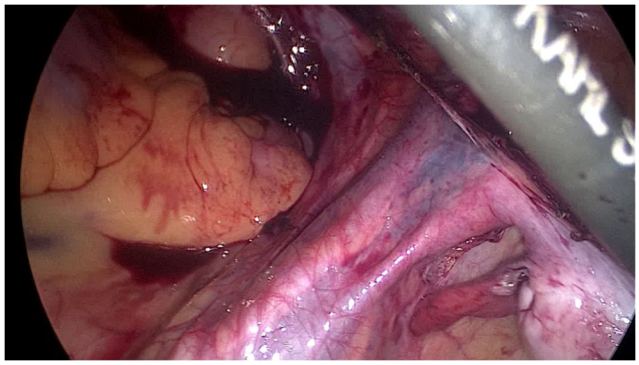

Fig. 2. Mobilization of Infundibulopelvic ligament

delays, allows early mobilization, and reduces the incidence of adhesion formation and ovarian cysts [12]. The success of the procedure depends on the distance of transposed ovaries from radiation field [13]. Ovaries are exposed to less than 10% of scatter radiation when positioned 3 cm away from the pelvic brim. Laparoscopy allows ovaries to be transpositioned 3–4 cm above umbilicus rather than just above the pelvic brim. Success rates can be improved by preventing torsion and gentle handling of infundibulopelvic ligament and transfixing the adnexa in the upper abdomen preventing it from dropping into the radiation field.

The success rate of ovarian transposition quoted in literature is variable from 50 to 80% [14–16]. The varying success rate is attributed to positioning of the ovaries just above the pelvic brim especially in open surgery, effects of scatter radiation, diminishing primordial follicle reserve in aging women, and so on. The safety and success rate of ovarian transposition in preserving hormone function has been widely described in young women with early cervical cancer. It has been described in series of case reports in nongynecological malignancy such as Hodgkin's lymphoma, locally advanced colorectal cancer, medulloblastoma, and other sarcomas requiring pelvic radiotherapy [12]. The largest requirement for laparoscopic ovarian transposition in a nongynecological setting would be colorectal cancer. This method is still underutilized and needs to be familiarized with colorectal surgeons and radiation oncologists [17, 16].

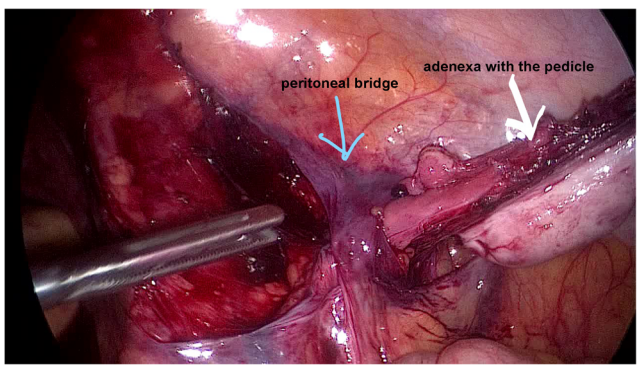

Fig. 3. Relation of ureter with Infundibulopelvic ligament at pelvic brim

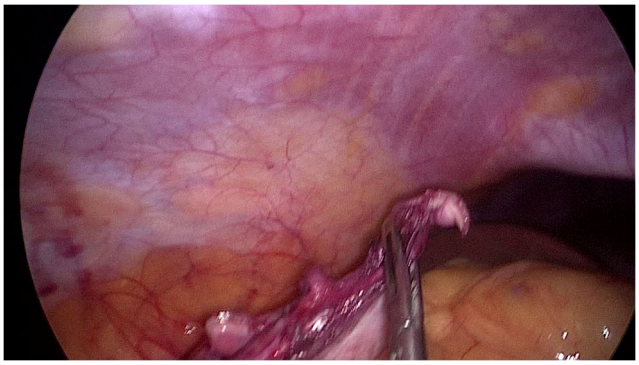

Fig. 4. Peritoneal bridge

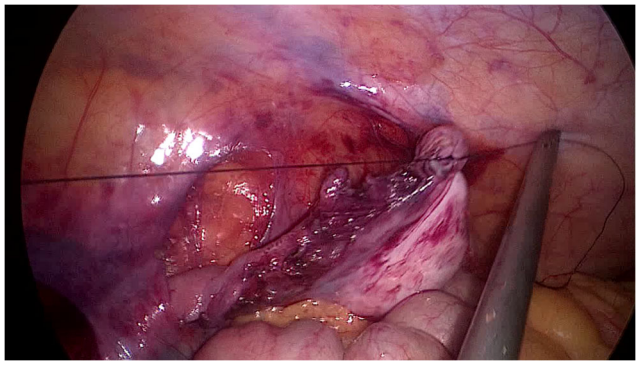

Fig. 6. Suturing the adnexa just under the liver

The publications on fertility and pregnancy rates are still low [18, 19]. Due to advances in fertility treatments along with surrogacy and biological donation of ovum with surrogacy, it is all the more important to discuss options with any young lady who presents with good prognostic colorectal cancer requiring chemoradiotherapy [20].

The surgical technique we have adopted at Tata Memorial Hospital, Mumbai, India, is as follows. The technique is a combination of steps learned from published literature, personal experience of ovarian transposition in gynecological oncology, and from surgical experts all over the world with a few modifications. Generally, women under the age of 35 with or without children are counseled for the procedure. Alternative methods such as hormone replacement therapy are discussed in women who have completed family. FSH and E2 levels are done in the preoperative period and are assessed for ovarian function following completion of definitive treatment for colorectal malignancy. They are tested for FSH and E2 during follow-up if needed. Menstrual periods resumed during follow-up is documented. The standard procedure of laparoscopic transposition is described below (please see pictures):

Port placement: Intraumbilical 10 mm/5 mm direct entry under direct visualization with laparoscopic camera. Two 5-mm ports in the right and left iliac fossa. One 10-mm port in the midline suprapubic area.

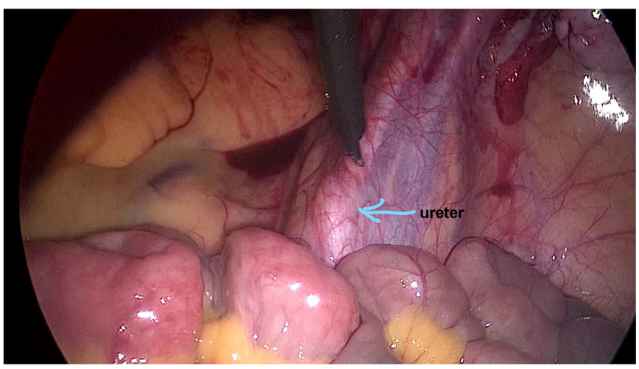

Fig. 5. Further mobilization of Infundibulopelvic ligament

Disease assessment: Inspection of the peritoneal cavity and ovaries for any evidence or suspicion of disease. If no obvious evidence of disease on the ovaries or peritoneal surface, we proceed with laparoscopic bilateral adenexal (ovary and fallopian tube) transposition.

Steps of surgery: There are four salient surgical steps as described below:

1. Disconnecting the adenexa (ovary and fallopian tube) from the uterus using energy source (bipolar or ligasure). Theoretically, keeping the fallopian tubes along with ovaries helps in improved vascularity as there are arterial and venous communication between them. Keeping the fallopian tube attached to the uterus while the ovary is hitched above the umbilicus will not help in spontaneous conception. Good length of ovarian ligament should be taken with adenexa. This helps in holding the pedicle during mobilization and also in suturing it to the parietal peritoneum and prevents unnecessary handling of the fallopian tube (Fig. 1).
2. Mobilization of the infudibulopelvic (IP) ligament from the pelvis. Careful handling to minimize kinking and torsion of the IP ligament to prevent bleeding, hematoma, and thrombosis. The IP pedicle is mobilized and moved above the pelvic brim completely so that the ovarian vessels are away from radiation field. Care taken to identify the crossing of the ureters from lateral to medial side at the pelvic brim (Figs. 2 and 3).
3. A peritoneal tunnel is made in the paracolic gutter and the adnexa is passed through it to prevent it from falling back into the pelvis following surgery (Fig. 4).
4. Suturing the ovarian ligament to the parietal peritoneum with 2-0 prolene 3–4 cm above the umbilicus. Care taken not to suture the fimbrial end of the fallopian tube to minimize fallopian tube retention cysts. Ligaclip is applied at the suture site for easy identification of ovaries on imaging (Figs. 5 and 6).

All the above steps are repeated on the other side.

In conclusion, laparoscopic ovarian transposition is an option to be considered in young women diagnosed with rectal cancer. Such women should be counseled and offered conservation of gonads where appropriate and professionals treating such women should be familiarized with the procedure.

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