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Case report

Use of a tissue expander to protect small bowel during radiotherapy in a cervical cancer patient with severe Crohn's disease

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1. Introduction

Radiation therapy plays a critical role in the treatment of cervical cancer, and chemoradiation is the treatment of choice in patients with advanced cervical cancer. However, the dose of radiation that can be delivered to the pelvis is limited by the variations in normal tissue tolerance of other intra-pelvic structures (small and large bowels, rectums, and bladders) to radiation. Target radiation treatment doses exceed the maximal value of small bowel radiation tolerance, leading to acute toxicity (diarrhea, abdominal cramps, and nausea (Geller et al., 2009)). Late complications of radical radiotherapy for cervical cancer arise in 5–15% of patients (Hamberger et al., 1983); the toxic effects of radiation on the bowel can lead to fibrosis, constriction, and stenosis (Geller et al., 2009). These risks increase with patient history of prior abdominal surgery, smoking, pelvic inflammatory disease, and diabetes (Berek and Hacker, 2009). In the absence of these risk factors, the small bowel can tolerate radiation doses to 30 Gy; the risk of small bowel obstruction rises rapidly at doses greater than 60 Gy, and reaches 100% at doses greater than 70 Gy (Berek and Hacker, 2009). Patients with inflammatory bowel disease are at an even greater risk of acute and chronic radiation-induced injury, with one study finding an overall incidence of severe enteric toxicity at 46% (Willett et al., 2000). Here we describe the case of a patient with cervical cancer and severe inflammatory bowel disease, in whom a saline-filled tissue expander was placed prior to radiotherapy with the goal of removing the small bowel from the radiation field.

2. Case

A 40-year old woman presented to her family doctor with a one month history of abnormal vaginal bleeding and pelvic pain. Her medical history was significant for a 24-year history of Crohn's disease which had been managed surgically as she could not tolerate her medications for various reasons. Over a period of 12 years she had undergone 11 segmental resections. Fourteen years prior to consultation, she had a bowel resection with incidental right salpingo-oophorectomy and subtotal hysterectomy, ostensibly because of adhesions between the bowel and uterus and adnexa. At the time the patient presented to her family doctor, she had not had a Pap smear for fourteen years, as she was not aware that she still had a cervix.

A Pap smear was performed and cytology showed a high-grade squamous intraepithelial lesion (HSIL). On colposcopy, an endocervical curettage also showed HSIL, and a biopsy taken in a loop electrosurgical excision procedure showed extensive poorly-differentiated squamous cell carcinoma. A bimanual exam revealed a 5–6 cm mass palpable in the upper vagina.

On MRI, a 5-cm mass was seen infiltrating the remnant of the cervix, with extension into the parametria and proximal half of the vagina (FIGO Stage IIB). Enlarged, irregular pelvic lymph nodes were seen, although it was unclear whether these were related to her malignancy or Crohn's disease. A PET scan showed intense radiotracer in the cervical malignancy with multiple metabolically active parailiac lymph nodes bilaterally, consistent with nodal metastases. Both small and large bowels were FDG-avid.

The size of the malignancy and the suspicious pelvic lymph nodes made this patient a candidate for radical radiotherapy with cisplatin chemotherapy; however, there was concern that her Crohn's disease would be aggravated with radiation.

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Table 1
Examples in the Literature of Pelvic Prosthesis Insertion in Order to Prevent Radiation Enterotoxicity.

Author and year	Number of patients	Indication	Tissue expander (TE) filled to: (cm^3)	Mesh	Radiation enteritis	Complications due to prosthesis
Sugarbaker 1983	1	Unspecified	1000	Prosthetic mesh	none	none
Lasser 1986	9	Rectal cancer	?	?	none	none
Cuttat 1991	4	Rectal cancer	500	?	none	none
Herbert 1993	14	Endometrial, colorectal, anal cancer	450–850	none	Statistical decrease in enteritis in patients with TE placement (compared to 63 patients not receiving TE)	Ileus (n = 1) Bowel perforation after removal of TE (n = 2) Perineal dehiscence in patient with transvaginal placement of TE in pelvic exenteration (n = 1)
Delaloye 1994	18	Cervical cancer	350–400	Vicryl mesh	none	Hydronephrosis (n = 1) Constipation (n = 1)
Hoffman 1998	58	Sarcomas; endometrial, vaginal, cervical, rectal, colon, anal cancer	450–1500	none	none	Abscess (n = 4), fistula (n = 4),TE extrusion (n = 1), TE deflation (n = 3)
Sezeur 1999	22	Retroperitoneal sarcoma, pelvic cancer	600	Vicryl mesh	none	Heaviness (n = 1) Flank pain (n = 2) Bowel injury during positioning of tissue expander (n = 1)
Burnett 2000	7	Cervical cancer	960–1200	none	none	Adhesions of bowel to implant (n = 1) PE (n = 1)
Abhyankar 2005	1	Retroperitoneal rhabdomyosarcoma	250	Vicryl mesh	none	none
Holmebakk 2006	1	Retroperitoneal recurrence of colorectal cancer	500	none	none	none
White 2007	33	Sarcomas, endometrial, vaginal, colon, rectal cancer	700	Dexon mesh	none	Cystitis (n = 1) Ileus (n = 1)
Angster 2010	2	Cervical cancer, retroperitoneal sarcoma	400 500	none	none	none
Geller 2009	10	Cervical cancer	720	none	none	Migration implant (n = 1) Vesicovaginal fistula (n = 1) Enterocutaneous fistula (n = 1) Rectovaginal fistula (n = 1)
McKay 2011	1	Prostate cancer	350	none	none	none
Valle 2011	28	Cervical cancer	?	none	none	Fever (n = 4), periprosthetic hemorrhage effusion (n = 2)
Perez-Munoz, 2014	20	Pelvic Ewing's sarcoma	~500	none	none	Mild diarrhea (n = 1)

A new protocol of neoadjuvant chemotherapy (cisplatin and taxol weekly for six weeks) was offered, with the intention of shrinking the tumor. If adequate shrinkage of the tumor resulted, laparotomy with pelvic node dissection and radical trachelectomy could be performed. A tissue expander would be placed in the pelvis in order to move the bowel out of the radiation field. After surgery, we planned to administer external beam radiotherapy.

An MRI performed on completion of the neoadjuvant chemotherapy showed significant shrinkage of the lesion, but it appeared to be very close (if not infiltrating) to the rectum. Trachelectomy with colostomy was proposed, but the patient refused to consent to colostomy. Therefore only laparotomy with pelvic lymphadenectomy was performed. At this time, a tissue expander (filled with 600 cm^3 of normal saline) was inserted into the pelvis, and a Vicryl mesh hammock was placed to prevent the small bowel from sliding down around the expander. Pathology resulted showing two of nine pelvic lymph nodes being positive for metastatic squamous cell carcinoma.

External beam radiotherapy using an intensity modulated technique was started 17 days after pelvic lymph node dissection and placement of the tissue expander. A dose of 45 Gy was delivered in 25 fractions over five weeks to a volume containing the primary cancer, upper vagina, paracervical tissues and lymph node areas at risk. Cis-platin 30 mg/m^2 was given weekly during this treatment. A boost dose of 20 Gy in ten fractions over two weeks was then delivered to the cervical stump. Interstitial brachytherapy was not used as it would not have been possible to encompass the entire cervical stump in the high dose volume that can be achieved with interstitial needles without puncturing the prosthesis.

During the five weeks of radiotherapy, the patient developed bilateral deep vein thromboses, a small pulmonary embolism, and a right renal vein thrombosis, requiring the placement of an inferior vena cava filter. She had severe pain and edema in both legs; it was unclear whether this was secondary to her thromboses or the tissue expander. At the completion of radiotherapy, she underwent laparotomy to remove the tissue expander, and on examination under anesthesia prior to laparotomy, a very small, low rectovaginal fistula was seen. It was distal to the lower edge of the radiation field and thought to be a pre-existing, previously undiagnosed consequence of her Crohn's disease. It may explain the patient's history of occasional incontinence when her stools were loose. The fistula spontaneously resolved shortly after. The patient has not developed any symptoms of radiation enteritis to date, and approximately eight months after removal of the tissue expander, she is well with no recurrence of her cervical malignancy.

3. Comment

In 1983, Sugarbaker was the first to describe insertion of a silicone breast implant into the pelvis, with a small bowel suspended above the radiation field by a prosthetic mesh sling (Sugarbaker, 1983). To our knowledge, there have been more than 200 cases since 1983 describing insertion of tissue expanders (TEs) into the pelvis to protect the small bowel from radiation (Table 1). These cases include gynecologic malignancies, colorectal and prostate cancers, and abdominal sarcomas.

The benefit of TEs include easy insertion and removal, lack of adherence to bowel or peritoneum, resistance to degradation by radiation, and being similar in density to human tissue, thereby not altering isodose distribution of radiation (McKay et al., 2011). However, radiation cystitis and proctitis remain common, as the TE does not protect the urinary bladder, ureters, or rectum. In addition, the TE exerts a mass effect on surrounding structures (colon, ureters, urinary bladder, iliac vessels), which may lead to thromboembolism (Burnett et al., 2000), a sensation of heaviness (Sezeur et al., 1999), hydronephrosis and constipation (Delaloye et al., 1994). These risks increase with the size of the TE (McKay et al., 2011).

It is difficult to deduce what role the TE may have played in our patient developing multiple thromboembolisms, since malignancy, Crohn's disease, chemotherapy, and radiotherapy all increase the risk of thromboembolic events. On reviewing the literature, TE volumes between 250 and 1500 cm^3 have been reported; only one study (7) reported a thromboembolic event, while using volumes between 960 and 1200 cm^3 (Table 1). While the tissue expander we used was no larger than many ovarian masses, and by no means tightly wedged in the pelvis, we would consider using a smaller TE volume in the future.

In the largest published study (Hoffman et al., 1998) of TE placement to date, Hoffman et al. describe enterocutaneous fistula development in four of 58 patients; three patients developed fistulae after TE removal, and one prior to removal. Two of these fistulae (one pre-TE removal, one post-) were associated with abscesses that had formed around the TE. Geller et al. (Geller et al., 2009) describes three of ten patients developing fistulae: the first, a vesicovaginal fistula that formed while the TE was in situ, the second a rectovaginal fistula eighteen months after removal of the TE, and the third an enterocutaneous fistula associated with an abscess while the TE was in situ. Our patient was found to have a tiny rectovaginal fistula prior to the period of radiotherapy; however, this formed outside of the radiation field, and healed spontaneously shortly thereafter. As per Hoffman's study, the incidence of infection, abscess formation, and fistulization with tissue expander placement are 7% (Hoffman et al., 1998). However, we believe this fistula pre-dated the placement of the tissue expander, and was secondary to her Crohn's disease.

We elected to place both a tissue expander with a Vicryl mesh hammock because of reports of TE migration and loops of the small bowel slipping down into the radiation field (Geller et al., 2009). Several studies (Sezeur et al., 1999; Delaloye et al., 1994) have described the concomitant use of a Vicryl mesh hammock with a TE. Of eighteen patients described by Delaloye et al. (Delaloye et al., 1994), one experienced constipation and the other transient bilateral hydronephrosis. Of twenty-two patients described by Sezeur et al. (Sezeur et al., 1999), two experienced flank pain (necessitating deflation of the TE between radiation sessions), and one required the TE to be removed because of an infection secondary to an injury to the bowel caused during TE positioning. Some authors (Dasmahapatra and Swaminathan, 1991; Rodier et al., 1991) have described the use of a Vicryl mesh alone, however the drawback to this method is that mesh degrades approximately one month after placement, necessitating early radiotherapy. This is not always possible, especially in patients with a complicated postoperative course (Sezeur et al., 1999).

To our knowledge, this is the first description of a case in which a tissue expander was placed to reduce the risk of radiation enteritis in a patient with inflammatory bowel disease. The overall complication rate associated with TE placement has been estimated to range between 5 and 40% (Geller et al., 2009) based on major prospective trials. Given the risks of TE, this therapeutic strategy can be considered for patients at a high risk for radiation toxicity as illustrated in this patient with multiple prior surgeries and inflammatory bowel disease.

4. Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Conflict of interest statement

The authors have no conflicts of interest to report.

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