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Case Report

Surgery Section

Laparoscopic Abdomino-perineal Resection Followed by Early Postoperative Acute Small Bowel Obstruction- A Case Report with Review of Literature

M VINOTH[1], ABHIJIT JOSHI[2]

ABSTRACT

Abdominoperineal Resection (APR) is a long established therapeutic surgical procedure for cancers of the lower rectum. With the advent of minimal access surgery, APR too has come under its ambit. The large pelvic peritoneal defect and raw area left behind, after dissection are unique to APRs. This report describes the case of a 75-year-old male patient diagnosed with low rectal cancer, who underwent a laparoscopic APR and developed an early post-operative adhesive acute small bowel obstruction. Having failed a trial of conservative management, the same was successfully managed by a re-look laparoscopy. The risk of post-operative adhesions decreases significantly with laparoscopy. APR (whether open or laparoscopic), is a unique operation that causes the formation of a large pelvic raw area, which is very prone to attracting small bowel adhesion/s. The advent of various anti-adhesion barriers (liquid and films) has helped in decreasing the incidence of adhesions. However, in spite of the availability of a wide array of options, there is no consensus among surgeons as to the most optimum agent. Ideally, a tension free closure of the pelvic peritoneal defect formed during APR should be attempted. Failing this, covering of the wide pelvic raw area by a dual mesh or an anti-adhesion barrier agent (fluid or film) or omentopexy have been reported as adhesion preventing manoeuvres. Interceed® promises to be a useful long term adhesion preventing barrier option.

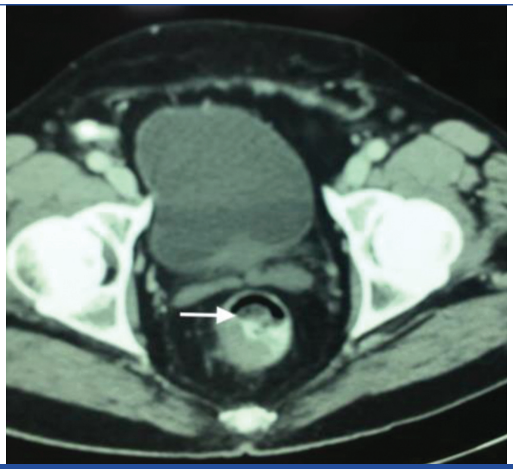
Keywords: Adhesions, Cancer, Interceed, Lower rectum

CASE REPORT

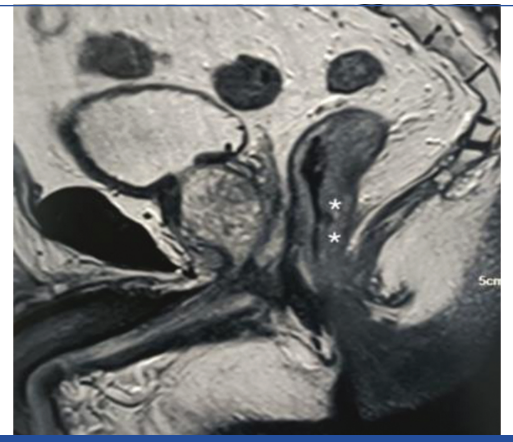
A 75-year-old male patient presented to the surgical outpatient department with a complaint of bleeding per rectum for three months. The bleeding was fresh red in colour, occurred after defecation, was scanty and was noticed 3-4 times a week. He was prescribed ointment Anovate® for local per rectal application by his family physician during this period, probably presuming a haemorrhoidal bleed. There was no history of vomiting and loss of appetite or weight. The patient was not on any medications and did not have any family history of cancer. He had no history of surgeries. He did not give any history of alcoholism, chronic smoking, drug dependence or any psychological condition.

A general examination revealed normal vitals and ruled out external lymphadenopathy. On abdominal examination, there was no organomegaly or a palpable lump. Rectal examination revealed a friable growth measuring 3×4 cm in size, 4 cm from the anal verge, which bled on touch. A Contrast Enhanced Computed Tomography (CECT) scan of the abdomen revealed 2.3×3.2×2.8 cm sized mass in distal rectum, about 3.5 cm from the anal verge which was locally invasive and sphincter sparing [Table/Fig-1]. Magnetic Resonance Imaging (MRI) of the pelvis revealed a 3.3 cm sized mid to distal rectal mass extending from 4 to10 o'clock position with serosal breach over 5 to 8 o'clock position and a prominent nodular extension at 8 o'clock position with Tumour Node Metastasis (TNM) stage $cT_3N_0M_0$ [Table/Fig-2]. The mass was at 3.2 cm from the anal verge, with sphincter (Puborectalis muscle) involvement at 6 o'clock position. A colonoscopic rectal biopsy was then performed [Table/Fig-3a]. It revealed a moderately differentiated adenocarcinoma with foci of necrosis. Routine laboratory tests were within normal range with a normal liver profile and serum carcino-embryonic antigen-4.16 ng/mL. The chest X-ray was normal.

The patient was then subjected to short protocol neo-adjuvant radiation therapy (25 Gray in 5 fractions) in an attempt to shrink the

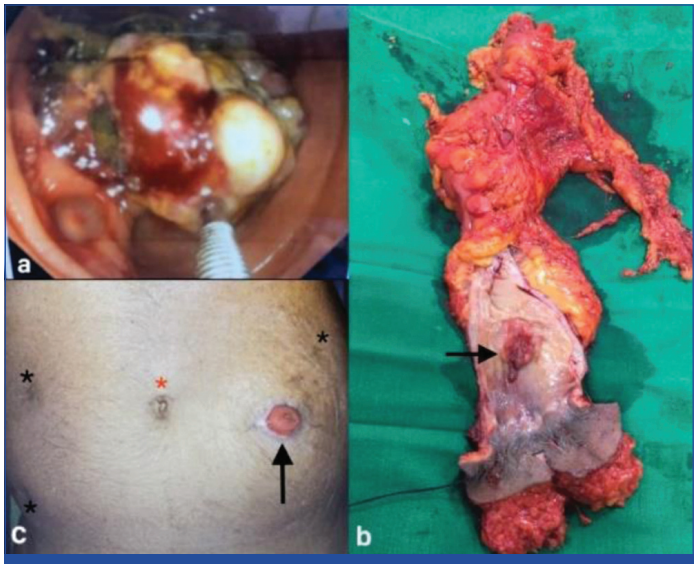


[Table/Fig-1]: Contrast Enhanced Computed Tomography (CECT) abdomen showing the distal rectal mass (white arrow).



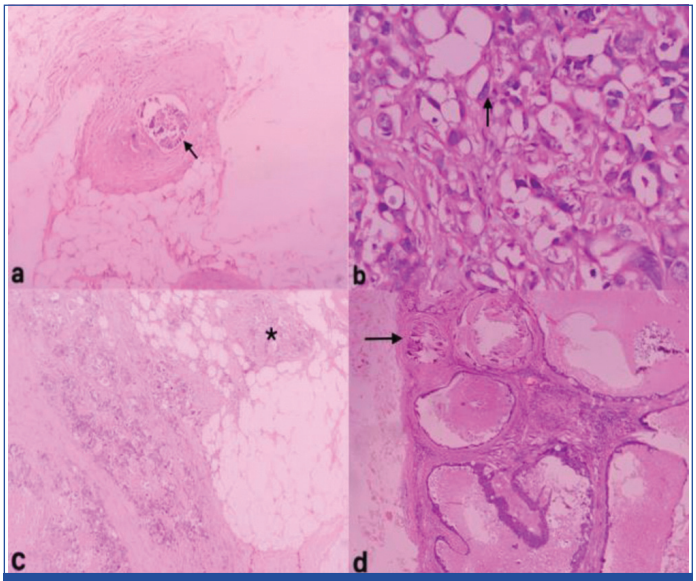
[Table/Fig-2]: Magnetic Resonance Imaging (MRI) Pelvis showing the distal rectal mass (white asterisks).

size of the mass to enable a possible anterior resection of the rectum instead of APR, but it did not yield any result. He was then planned, and taken for surgery (a laparoscopic conventional APR). The total laparoscopic abdomino-pelvic part was performed by a standard 5 trocar technique, adhering to well established oncological principles. The harmonic scalpel was used as the energy source and haemolock clips were used to control the Inferior Mesenteric Artery (IMA) and Inferior Mesenteric Vein (IMV). A classical medial to lateral dissection was performed, starting with skeletonisation and control at the root of IMA and IMV. Once the abdomino-pelvic dissection was over, the surgeon moved down in between the patient's legs to initiate the perineal dissection. After taking the purse string stitch around the anus, a circumferential incision was made around it and was deepened in layers. After freeing it completely, the specimen [Table/Fig-3b] was taken out from the perineal side and the perineal defect was suture-closed in multiple layers with simple interrupted sutures. Meticulous haemostasis was achieved and confirmed overall and especially over the pelvic raw area. After careful assessment, it was found that optimum tension free suture closure of the wide pelvic peritoneal defect was impossible. Rather than suturing it under tension, thereby inviting a probable partial suture line breakdown and small bowel incarceration within a narrower recess, it was decided to keep the peritoneal defect over the pelvic raw area wide open. One litre low molecular weight dextran was instilled as a liquid anti-adhesion barrier in the pelvis. An end colostomy was brought out at the widened left lower trocar site [Table/Fig-3c]. The left lower trocar site was originally planned carefully, at the beginning of surgery, to be at the midpoint of the left spino-umbilical line, since this would eventually become the site of the permanent end colostomy.



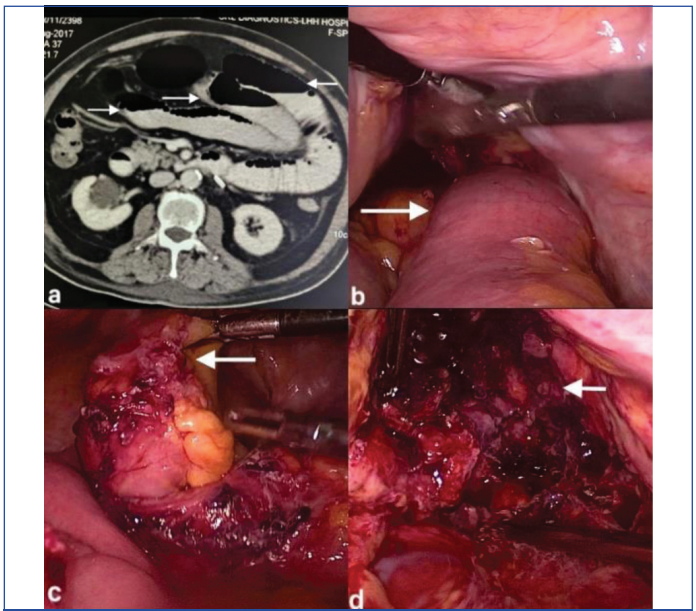
[Table/Fig-3]: (a) Endoscopic view of the rectal mass during biopsy; (b) Gross resected specimen showing the rectal mass along with the perineal skin; (c) Shows the port sites along with the colostomy (black arrow).

The final histopathological examination report revealed, an ulceroproliferative tumour measuring 2.7×2.5 cm, 32 cm from the proximal and 5.5 cm from the distal resection margins. It was 2 cm from the dentate line and was below the anterior peritoneal reflection. The non-peritonealised surface (circumferential resection margin) was grossly free of tumour and was 1.2 cm from the tumour. Total Mesorectal Excision (TME) was through the mesorectal fascia and the quality of TME was assessed to be complete. There were eleven lymph nodes in the specimen. Lympho-vascular tumour emboli were noted [Table/Fig-4a]. The TNM stage was $_{p}T_{3}N_{1b}$. Microscopy revealed areas of necrosis and neutrophilic infiltrate within the tumour [Table/Fig-4b]. The tumour invaded the subserosal fat (pT3) [Table/Fig-4c]. Microscopically, it also revealed a moderately differentiated adenocarcinoma of rectum; completely resected (R_0) with two (peri-colic nodes at the level of tumour) out of eleven lymph nodes (2/11) showing metastasis [Table/Fig-4d]. Both the longitudinal resection margins and the circumferential resection margins were free of the tumour.



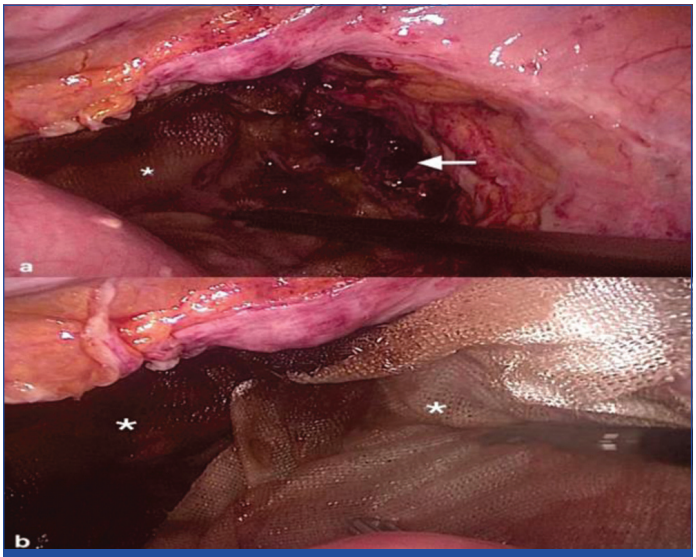
[Table/Fig-4]: Histopathological images (Haematoxylin-Eosin stain, Magnification: b-high power: 40X, a,c,d) low power:10X) showing: (a) Lymphovascular emboli(black arrow); (b) Solid areas of tumour with markedly pleomorphic cells, areas of necrosis & neutrophilic infiltrates (black arrow); (c) Tumour infiltrating the subserosal fat (black asterisk); (d) Lymph node showing metastasis of adenocarcinoma with perinodal extension (black arrow).

The patient had an uneventful immediate post-operative recovery. He passed flatus through the end colostomy on post-operative Day (POD) 3 and was started on liquid feeds, per orally, from POD 4. He developed abdominal distension and obstipation on POD 6. As per abdomen examination revealed a soft, distended, tympanic and hyperperistaltic abdomen. On investigation, Contrast Enhanced Computed Tomography (CECT) abdomen revealed dilated jejunal, proximal and mid ileal loops with collapsed distal ileal and large bowel loops [Table/Fig-5a]. On failing a trial of conservative management (nil per oral, intravenous fluids, continuous naso-gastric suction), he was taken up for a re-look laparoscopy on POD 9 (Grade III b, as per Clavien-Dindo classification). He was found to have an acute kink between the proximal 2/3rd and the distal 1/3rd of the small bowel [Table/Fig-5b], due to adhesion of an ileal loop with the pelvic raw area, created during the APR [Table/Fig-5c,d].



[Table/Fig-5]: (a) Contrast Enhanced Computed Tomograohy (CECT) abdomen showing dilated bowel loops with significant air-fluid levels; (b) First look laparoscopic picture of dilated small bowel loop. After dissection of the adhesion band; (c) Serosal surface of the adherent bowel loop; and (d) the whole pelvic raw area to which the bowel loop was adherent.

The adhesion was released carefully laparoscopically, avoiding injury to the adherent small bowel. Multiple(3) sheets of oxidised regenerated cellulose polysaccharide (Interceed®- Johnson & Johnson, New Brunswick, NJ, USA) were introduced and spread out so as to cover the entire pelvic raw area [Table/Fig-6a,b].



[Table/Fig-6]: (a&b) Interceed patches (white asterisks) being placed to cover the pre-sacral raw area (white arrow).

The colostomy started functioning on POD 4 of the second surgery and he was then started on oral feeds (initially liquid followed by semi-solid feeds), which he tolerated well. He was discharged on POD 7 of the second surgery and did not have any further episodes of intestinal obstruction. On his POD 10 outpatient department follow-up visit, all his operative wounds had healed well. He was then referred to the medical oncologist who initiated adjuvant chemotherapy (12 cycles of 5-Fluorouracil and Oxaliplatin). At the time of writing this paper, he was interviewed on phone, sixty-five months after his two surgeries and he continues to remain asymptomatic and disease free.

DISCUSSION

Optimum closure of the pelvic peritoneal defect during APR has shown to significantly reduce chances of delayed perineal wound healing, perineal wound infection, perineal hernia and ileus [1]. Also, it plays an important role in preventing radiation induced enteritis in patients who are given adjuvant radiation therapy; by cordoning off the small bowel from the field to be irradiated [2]. The age old dictum which has stood the test of time is to either close such defects perfectly in a tension free fashion or to keep the whole big defect widely open. This is because smaller defects left behind by sub-optimal suturing as well as suture line breakdown caused by undue tension on it; invite entrapment of small bowel, eventually risking possible strangulation and gangrene. The inherent radicality of the resection and pelvic dissection during APR creates a wide pelvic peritoneal defect. The perfect suture closure of this defect during open APR is relatively easier, though not always possible. However achieving this during laparoscopic APR is a technically demanding, tricky and sometimes an impossible task.

Post-operative abdomino-pelvic adhesions occurs in more than 90% of patients undergoing abdominal surgery [3,4]. The incidence of post-operative adhesions decreases by 45% in laparoscopies over open surgeries [5]. Incidence of re-intervention after laparoscopic colorectal surgeries is 2.5% [5]. Post-operative adhesions are of great significance as they can cause chronic abdominal/pelvic pain, female infertility and repeated bowel obstruction; requiring repetitive surgical interventions causing morbidity and thereby also increasing hospital costs [6]. In Sweden, the direct burden of hospital costs related to peritoneal adhesions has been estimated to be $13 million annually. In the United States, it is $1.3 billion [7]. Thus, peritoneal adhesions have a significant economic impact on any nation's healthcare structure. Naturally, an effective adhesion-preventing strategy will doubtlessly reduce complications, hospitalisations, avoidable surgeries and in general, hospital costs. The formation of these adhesions is due to an imbalance between the fibrinogenesis and fibrinolysis. The former dominates over the latter and leads to permanent adhesions. This is associated with tissue hypoxia secondary to peritoneal breach, and an inflammatory response that increases the population of adhesion laying fibroblasts which inhibit the degradation of the extracellular matrix and facilitate laying of mature collagen [7].

However, the exact patho-physiology of peritoneal adhesions remains controversial, despite many clinical and experimental studies conducted on animal subjects, till present day. Basically, peritoneal injury caused by surgery or infection initiates an inflammatory response with fibrinous exudate and fibrin formation. Fibrin formation is the direct result of activation of the coagulation cascade in the peritoneal cavity that results in conversion of prothrombin to thrombin, which in turn promotes conversion of fibrinogen to fibrin. Due to subsequent activation of the fibrinolytic system, plasminogen gets converted into plasmin which causes degradation of the fibrin. Also, proenzymes of Matrix Metalloprotease (MMP) help in degradation of the extracellular matrix of fibrin. But if this process is inhibited by tissue inhibitors of MMP, adhesions may form. After abdominal surgery, the balance between the coagulation cascade and fibrinolysis is tilted in favour of the coagulation cascade. This in effect is responsible for formation of adhesions [7].

Preventive strategies for peritoneal adhesions include minimisation of peritoneal damage by gentle tissue handling, striving for perfect haemostasis, continuous irrigation, use of fine, biocompatible suture materials, atraumatic instruments, starch free gloves and use of heated humidified carbon dioxide (CO_2) for pneumo-insufflation during laparoscopy instead of the cold dry CO_2 which is in current use. It is recommended to avoid tight peritoneal closure, as it may increase ischaemia and necrosis, thereby promoting decreased fibrinolytic activity and increased adhesions. Liquid or solid mechanical barriers may prevent adhesions by keeping the raw peritoneal surfaces separate during the 5-7 days required for peritoneal re-epithelialisation [7].

The direct repercussion of clinically significant pelvic small bowel adhesions is small bowel obstruction. This causes additional patient morbidity and sometimes mandates a surgical intervention in close succession to the primary operation, as happened in this case; despite of instilling a liquid anti-adhesion barrier in-situ. In this case, it was decided to leave the pelvic peritoneal defect wide open after concluding, post-careful evaluation, that it's optimum closure was not possible. To avoid post-operative adhesions and related complications in APR, several surgical manoeuvres have been propounded- primary peritoneal closure and drainage, omentoplasty, biological or synthetic mesh placement, placement of mechanical barriers such as polyethylene glycol(SprayGel®), the sheet of oxidised regenerated cellulose (Interceed®), sodiumhyaluronate based bio-resorbable membrane(Seprafilm®), liquid based hyaluronic acid and carboxymethyl cellulose solution (Guardix®), dextran, icodextrin etc., [8]. The hypoxic-mesenchymal stem cells are more potent in preventing the formation of adhesions than the normoxic mesenchymal stem cells, because of the release of several anti-inflammatory mediators particularly IL-10 [9]. The use of Seprafilm® significantly reduces the incidence of post-operative small bowel obstruction in patients undergoing colorectal surgery [10]. In one of the studies, transdermal electric stimulation to prevent the formation of intra-abdominal adhesions in combination with Seprafilm®

Authors (Ref.no.)	Journal (yr. of publication)/ type	Materials and methods	Broad conclusions	Specific therapy
1) Arung W et al., [7]	World J Gastroenterol (2011)/Review article	Pathophysiology of postoperative. Peritoneal adhesions elucidated	Prevention: careful tissue handling, Meticulous haemostasis, continuos irrigation, use of fine biocompatible suture materials, starch free gloves, avoiding unnecessary peritoneal dissection and closure of peritoneum, during laparoscopy use of heated humidified CO_2 instead of cold dry CO_2	*Liquid barriers: crystalloids, dextran, hyaluronic acid, icodextrin by hydroflotation *Mechanical barriers: Seprafilm(hyaluronic acid-carboxymethyl cellulose), Interceed (oxidised regenerated cellulose), e-Polytetrafluoroethylene (PTFE), polyethylene glycol Non-steroidal Anti-inflammatory Drugs (NSAIDs), steroids, Calcium channel blockers, fibrinolytic agents, anticoagulants, antioxidants, vitamins, antibiotics, selective immunosuppressors, hormones
2) Gomez GGV, et al., [6]	World J Surg and Surgical Res (2018)/Review article	Same as above	Same as above	*Same as 1) above+… *Methylene blue reduces adhesions *Neurokinin1 receptor antagonist anti-emetics (Aprepitant) reduce adhesions
3) Fischer A et al [14]	Nature (2020)/ Original research article	*Lineage tracing in mice used *Early events preceding scar Flavin Mononucleotide (FMN) studied by developing in-vitro assays	*Peritoneal adhesions occur from mesothelium and not from fibroblasts *Ca regulating effectors act as the main components of the early adhesion cascade	Bepridil (Ca channel blocker)
4) DeWilde RL and Trew G [15]	Gynaecological surgery (2007)/ Review article	Strategies for adhesion prevention and reduction elucidated	Same as 1)+reduce cautery time and aspirate aerosolised tissue foll. cautery, minimal use of dry towels/sponges	*Same as 1)+Polylactide (Surgiwrap) and gel barriers like Hyalobarrier (hyaluronic acid), Spraygel (synthetic PEG), Oxiplex (carboxymethyl cellulose+polyethylene oxide). *Crystalloids of limited use as barrier solutions as they rapidly get absorbed at 30-50 mL/hr, so completely absorbed within 24 hrs *Cost effectiveness of anti-adhesion barriers studied-agents costing 130 euros need to cause 26% reduction in adhesion related readmissions and those costing 300 euros ->60% *Surgeons who don't counsel patients. Re-risk of adhesions may put themselves at higher risk of litigation
5) Fortin CN et al., [16]	Human reproduction update (2015)/ Review article	Predisposing factors to postoperative adhesion development studied	Genetic polymorphism in Interleukin (IL)-1 receptor antagonist and plasminogen activator inhibitor-1, increased estrogen exposure, endometriosis, Diabetes Mellitus (DM), Metabolic syndrome, obesity, depression, alcohol bingeing, anti-Parkinson's medicines, oral hormone therapy, pregnancy, cancer	*This will help direct future research aimed at understanding mechanisms that underlie association of certain factors with adhesion development *This information will be crucial to formulate adequate preventive and therapeautic strategies

[Table/Fig-7]: Review of recent literature on barrier options against post-operative adhesions [6,7,14-16].

was studied and revealed that the combination of both of these modalities resulted in complete absence of adhesions [11]. Naito M et al., in their prospective randomised controlled study on the use of Interceed® in laparoscopic colo-rectal surgeries, concluded that it is valid and technically safe [12]. Watanabe J et al., in their prospective multi-center registry on the same subject, concluded that it is safe and may be useful in preventing post-operative adhesive small bowel obstruction [13]. However, there is no consensus on which prevention strategy is superior to others. The review of literature [Table/Fig-7] [6,7,14-16] touches upon the various evidence based anti-adhesion barrier options available.

CONCLUSION(S)

A large pelvic raw area develops after an APR performed for low rectal cancer. Sometimes, this cannot be covered comfortably by tensionless suture closure. This uncovered large raw area causes small bowel adhesions. As seen in this report, these adhesions can cause an acute kink in the course of the small bowel, thereby resulting in obstruction. Also, as seen in this paper, Interceed® is a good prophylactic mechanical barrier option to cover the pelvic raw area. Prophylactic use of Interceed® promises to save the patient from an additional morbidity and the healthcare infrastructure from additional fiscal burden. However, larger studies are needed to further validate and establish this.

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PARTICULARS OF CONTRIBUTORS:
1. Resident, Department of General and Laparoscopic Surgery, Dr. LH Hiranandami Hospital, Mumbai, Maharashtra, India.
2. Consultant, Department of General and Laparoscopic Surgery, Dr. LH Hiranandami Hospital, Mumbai, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
M Vinoth,
Resident, Department of General and Laparoscopic Surgery, Dr. LH Hiranandami Hospital, Powai, Mumbai-400076, Maharashtra, India.
E-mail: vinuvishnu93@gmail.com

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