Intraabdominal Challenges Affecting Abdominal Wall Reconstruction

Jennifer Movassaghi Moffett, M.D.¹ Uri Gedalia, M.D.² Amy Shengnan Xue, M.S.³ Lior Heller, M.D.³

¹Division of Surgical Oncology, Michael E.DeBakey Department of Surgery, Baylor College of Medicine; and General Surgery, Houston, Texas

²Private Practice, Houston, Texas

³Division of Plastic Surgery, Baylor College of Medicine, Houston, Texas

Address for correspondence and reprint requests Lior Heller, M.D., Baylor College of Medicine, Medical Building, 1977 Butler Blvd., Suite E6.100, Houston, TX 77030 (e-mail: lheller@bcm.edu).

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Abstract

Keywords

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Abdominal wall defects may arise from trauma, infection, and prior abdominal surgeries, such as tumor resections. Although ideally reconstruction should be accomplished as soon as possible to restore the integrity and function of the abdominal wall, it is not always a viable option. A successful reconstruction must take into consideration the local environment of the defect, as well as the global condition of the patient. Therefore, it is imperative that a multidisciplinary team be involved to optimize the patient's care, particularly when a defect is complicated by a wound infection, an abscess, a fistula, or a neoplasm. Our goal in this article is to explore the challenges evoked by each of these special situations, and review the necessary steps for successful management.

Annually, more than 200,000 reconstructions of large abdominal wall defects are performed in the United States. These defects present a unique challenge for surgeons. Most cases require a multidisciplinary approach to restore proper function and integrity of the abdominal wall. Such a team approach should include general surgeons, plastic and reconstructive surgeons, anesthesiologists, nutritionists, as well as pre- and postoperative rehabilitation experts. Many contributing factors have been linked to the formation of abdominal wall defects, specifically previous abdominal surgeries, traumatic injuries leading to one or more intraabdominal pathologies, infection and abscess formation, radiation changes, fistula formation, and gross anatomic defects as a result of tumor resection.

Optimal reconstructive results require a successful repair at the first attempt because the risk for incisional hernia increases with each additional repair. Timing of reconstruction depends on the resolution of any acute or subacute inflammation caused by the underlying pathology. The surgical team must address the complexity of the underlying pathology as well as the patient's general condition during

preoperative evaluation to avoid and reduce incidence of postoperative complications, including prosthetic mesh infection, mesh disintegration due to urine or fecal leaks, and need for reoperation.

Infection and Intraabdominal Abscesses

An infected surgical field, due to skin and/or intraabdominal infection(s), can be detrimental to an attempted repair of the abdominal wall defect. These two distinct entities require different approaches in treatment. Identifying and controlling the source of the infection is the mainstay of management.

Wound and Skin Infections

Infection of the skin structures can affect abdominal wall reconstruction adversely by injecting the underlying mesh and/or repair with bacteria. This may cause breakdown of the repair and hinder possible reattempts at reconstruction. Because wounds have a 40% chance of recolonization despite complete healing, the use of antibiotics should depend on the

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clinical status of the wound and the patient, instead of solely on culture results.¹ After identifying the source of infection, it may be helpful to assess for possible deeper penetration of the infection using computed tomography (CT). Depending on the size, depth, and etiology of the infected area, various techniques (such as surgical debridement, negative pressure dressings, or the more conventional wet-to-dry dressings) may be implemented to control the spread of infection and bring the area to a point where reconstruction is possible. Broad-spectrum intravenous antibiotic therapy should be initiated until culture specificities and sensitivities are available.

Intraabdominal Infections (Diffuse Infections, Abscesses, and Organ-Specific Abscesses)

Most cases of intraabdominal infection are caused by perforation or leakage after a gastrointestinal anastomosis, or severe inflammation and infection of an intraabdominal organ, including appendicitis, hepatic abscesses, secondary pancreatic infections and diverticulitis, all of which may necessitate surgical exploration and drainage. The vast majority of such abscesses can be effectively diagnosed via abdominal CT imaging and drained percutaneously. Surgical intervention is necessary in patients with multiple abscesses or abscesses in proximity to vital structures. In particular, closure of the abdominal wall in patients with secondary pancreatic infections is a significant challenge, as 10 to 15% of these patients develop severe necrotizing pancreatitis, requiring repeated debridements.¹ In this case, abdominal wall reconstruction is delayed until the infection is contained.

Fistulas

Enterocutaneous Fistulas

Postoperative fistulas are a common, but dreaded complication of intraabdominal interventions, and account for 75 to 85% of the enterocutaneous (EC) fistulas. They are most often associated with operations performed for inflammatory bowel disease, malignancy, and adhesiolysis and can result from unintentional enterotomy, erosion caused by synthetic mesh, or leakage from an anastomotic site. The remaining 15 to 25% of the EC fistulas are spontaneous fistulas caused by malignancy, radiation injury, inflammatory bowel disease, diverticulitis, appendicitis, perforated ulcer disease, or ischemic bowel.² Studies have shown that a concomitant abdominal wall defect is the strongest negative prognostic factor for spontaneous fistula closure.⁴

Fistulas are often linked with infection, tissue ischemia, close contact with biomaterials, recurrent malignancy, radiation damage, as well as local factors such as scarring, fibrosis, and dense adhesions, which can increase the risk of iatrogenic enterotomies during repeat operations. Recurrent fistulas are associated with a higher level of morbidity and mortality as further surgical exploration and violation of abdominal wall increase the risk for additional complications (►Fig. 1).³

Once an EC fistula has been identified, radiographic investigation is crucial to define the precise location of the fistula, its anatomic tract, abscess cavities, and any associated dis-

ruption of the bowel wall. This is typically accomplished with fluoroscopic fistulography. The initial step for treating EC fistulas includes treatment of any coexisting infections with appropriate antibiotic therapy, percutaneous or open drainage of all fluid collections, wound care, control of fistula drainage, and optimization of the patient's nutritional status.¹ Of note, patients with an EC fistula without evidence of sepsis or a localized infection do not require prophylactic antibiotics as doing so can promote the selection of highly resistant bacteria.²

Most sources recommend delaying surgery for at least 4 to 6 months in patients with EC fistulas to decrease morbidity and mortality.^{2,4} Management should involve a stepwise approach with the primary focus on treatment of sepsis, drainage of fluid or purulent collections, correction of electrolyte imbalance and malnutrition, optimizing the patient's preoperative status, as well as allowing the patient's abdominal wall to heal with minimal inflammation. The SOWATS [sepsis, optimization of nutritional state, wound care, anatomy (of the fistula), timing of surgery, and surgical strategy] guideline provides detailed protocol in each of the above criterion for treatment of enterocutaneous fistulas.⁵ Only after these associated comorbidities have been addressed should repair of the fistula be addressed, and the reconstructive surgeon proceed with definitive abdominal wall repair.

Special precautions should be taken to preserve skin integrity of areas surrounding a high-output fistula to decrease local irritation and infection, as an intact abdominal wall is necessary for subsequent abdominal closure. Skin protection can be accomplished with a variety of barriers, adhesives, and wound drainage bags with the ultimate goal of drainage containment while facilitating patient mobility and comfort.

Timing is a primary concern in abdominal wall closure in patients with EC fistulas. It is important to remember that repair of the fistula takes precedence and the plastic surgeon must be cautious in attempting abdominal repair that may hinder a future, more definitive reconstruction. Candidates for definitive abdominal repair at time of fistula excision include patients with small defects and no underlying risk factors for incisional hernias such as marked obesity, malnutrition, and history of prior incisional hernias. In the event that closure of the abdomen with direct approximation or other reconstructive technique is feasible, the abdominal wall may be left open intentionally. In this case, temporary coverage such as a wet to dry dressings, with a split thickness skin graft followed by a staged reconstruction is indicated.³

Vesicocutaneous Fistula

Vesicocutaneous (VC) fistulas usually occur as a result of procedures such as hysterectomies, bladder resections, and suprapubic catheterizations. Postoperative irradiation for bladder and prostate carcinomas, as well as trauma and vesical calculi may also play a role in the formation of VC fistulas. In cases of complete bladder resection with neobladder reconstruction (involving small bowel resection and formation of an ileal conduit and anastomosis of both ureters to the conduit) the presence of multiple anastomoses

Figure 1 (A) A 34-year-old man with a history of pancreatitis, currently with jejunal cutaneous fistulas and recurrent ventral hernia after first repair with Gortex mesh. (B) Fascia defect after removal of the mesh and the hernia sac. (C) The mesh and the hernia sac were removed during surgery, which caused injury to the small bowel in three areas. (D) Fascia is located after minimally invasive component separation, and the porcine acellular dermal matrix (PADM) was applied in an underlay fashion. The tunnels, through which the minimally component separation was achieved, can be seen in this image. (E) Patient 2 months after surgical repair.

predispose for fistula formation. The constant leakage of urine results in maceration, and eventual destruction of skin with ensuing infection, discomfort, and malodor.

An intravenous urogram (IVU), voiding cystourethrogram (VCU), and cystoscopy are useful in making the diagnosis. Other cross-sectional imaging modalities, such as CT scans and magnetic resonance imaging (MRI) are needed if the

fistulous tract is complicated and malignancy cannot be ruled out with routine imaging modalities.

The primary management of VC fistulas has been open surgery; however, if detected earlier in its course, they can be managed with an indwelling Foley catheter instead. If the VC fistula is large, infectious or neoplastic in origin, open surgical management with excision of the fistulous tract interposed

Figure 2 A 78-year-old patient, with a history of abdominal wound dehiscence after cystectomy and neobladder reconstruction, underwent fascia closure with biologic mesh. A urine leakage developed after application of the biologic mesh and caused mesh disintegration.

with a myocutaneous flap is ideal for treatment. VC fistulas of infectious origin may be treated at the time of the definitive abdominal wall repair. An open abdominal wound with a suspected VC fistula should be repaired with temporary coverage until fistula is ruled out with appropriate imaging studies. As a rule, all fistulas must be repaired prior to a definitive abdominal wall reconstruction, especially in cases of complex defects requiring bioprosthetic meshes. Urine exposure can cause weakness and disintegration of the biological mesh (→ Fig. 2).

Neoplasm

In evaluating reconstruction in patients with neoplastic processes, timing has minimal effect on the considerations as resection and reconstruction can typically be performed in a single stage. However, due to the complexity of reconstruction resulting from massive resection defects, this scenario deserves further discussion. A multidisciplinary team, involving surgical oncology and plastic surgery, is crucial for management of these patients.

There are additional factors requiring consideration in the surgical reconstruction in patients with a history of neo-

plasm. First, recent chemotherapy may inhibit wound healing thus making the timing of treatment a special factor in reconstruction. Second, prior radiation treatment can cause tissue injury, increased tissue friability, as well as formation of abdominal wall defects.⁶ Acute radiation to a wound causes small vessel stasis and occlusion, leading to local ischemia and decreased tensile strength in the tissue. Ionizing radiation has been found to directly impede fibroblast proliferation and cause irreversible damage to exposed skin and tissue.⁷ As a result, surgical planning for a previously irradiated patient should include mobilization of distant flaps to allow use of nonirradiated tissue.⁸

Conclusion

Acquired abdominal wall defects can arise from tumor resection, trauma, infection, and radiation damage. Ideally, immediate reconstruction is the best approach. Unfortunately, it may not be possible in all cases, thus temporary coverage or staged abdominal wall reconstruction may be necessary. A cooperative approach between the plastic surgeon and the general surgeon is crucial in managing patients with abdominal wall defects and their associated complications. Implicit to this process is resolution of all intraabdominal pathologies prior to proceeding with abdominal wall reconstruction. Preoperative stabilization of wound infection and optimization of nutritional status are essential to the success of abdominal wall reconstruction. Optimal surgical outcome depends on the seamless collaboration of a multidisciplinary team and reconstructive techniques individualized to each patient based upon tissue requirements and comorbidities.

References

- 1 Bradley EL III, Allen K. A prospective longitudinal study of observation versus surgical intervention in the management of necrotizing pancreatitis. *Am J Surg* 1991;161(1):19–24, discussion 24–25
- 2 Rohrich RJ, Lowe JB, Hackney FL, Bowman JL, Hobar PC. An algorithm for abdominal wall reconstruction. *Plast Reconstr Surg* 2000;105(1):202–216, quiz 217
- 3 Szczerba SR, Dumanian GA. Definitive surgical treatment of infected or exposed ventral hernia mesh. *Ann Surg* 2003;237(3):437–441
- 4 Lowe JB III. Updated algorithm for abdominal wall reconstruction. *Clin Plast Surg* 2006;33(2):225–240, vi
- 5 Visschers RGJ, Olde Damink SW, Winkens B, Soeters PB, van Gemert WG. Treatment strategies in 135 consecutive patients with enterocutaneous fistulas. *World J Surg* 2008;32(3):445–453
- 6 Graves G, Cunningham P, Raaf JH. Effect of chemotherapy on the healing of surgical wounds. *Clin Bull* 1980;10(4):144–149
- 7 Miller SH, Rudolph R. Healing in the irradiated wound. *Clin Plast Surg* 1990;17(3):503–508
- 8 Cohen M, Grevious M. The use of muscle flaps for the management of recalcitrant gastrointestinal fistulas. *Clin Plast Surg* 2006;33(2):295–302