Anal and Perineal Injuries

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Abstract

With increased use of explosive devices in warfare, anal trauma is often seen coupled with more complex pelviperineal injury. While the associated mortality is high, casualties that survive are often left with disabling fecal incontinence from damage to the anosphincteric complex. After resolution of the acute insult, the initial evaluation mandates a thorough physical exam, including endoscopic evaluation with rigid proctoscopy and flexible sigmoidoscopy, as well as adjunctive testing, specifically anal manometry and endoanal ultrasound. First-line therapy favors bulking agents and antidiarrheals, in conjunction with biofeedback, due to a minimal risk profile. Surgical options range from direct sphincter repairs to complex anosphincteric reconstruction with widely variable results. Most recently, burgeoning therapies in the treatment of fecal incontinence, including sacral nerve stimulation and magnetic anal sphincters, offer excellent alternatives with promising long-term outcomes. In summation, the goal of all interventions is the re-establishment of bowel continence, but, in its absence, permanent fecal diversion for devastating fecal incontinence is a reasonable option with excellent patient satisfaction scores.

Keywords

- anal and perineal trauma
- anosphincteric complex
- fecal incontinence

The focus on the approach to traumatic and/or iatrogenic injuries to the colon and rectum has led to excellent discussion in the field over the last several decades; namely, the use of primary repair, drainage, and fecal diversion.¹ However, less emphasized in the same discussion has been the management of anal and perineal trauma. The earliest authors on this subject espoused a “wait-and-see” strategy due to the high mortality from concomitant injuries, as well as an uncertainty of long-term functional outcomes. However, based on experiences within the military, early debridement with wound coverage and/or reconstruction due to decreased risk of pelvic sepsis and the desire to maintain sphincter function is being recommended.² In this article, we will discuss the current management of anal and perineal trauma in both complex

battlefield injuries and isolated trauma to the region, more commonly found in the civilian population.

Anatomy

The perineum is structurally complex and is often incorrectly defined as the area between the vagina (in women) or scrotum (in men) and anus. In fact, this describes only the perineal body. Anatomically, the perineum refers to the entirety of the pelvic outlet below the level of the levator ani, bound anteriorly by the ischial rami and pubic symphysis, laterally by the ischial tuberosities, and posteriorly by the sacrotuberous ligaments and coccyx. The region approximates a diamond shape but can be subdivided into two

Fig. 1 Anatomy of the female perineum with the urogenital and anosphincteric triangles delineated.

triangles—the urogenital triangle anteriorly and the anosphincteric triangle posteriorly (► Fig. 1).

Types of Anal and Perineal Injuries

Traumatic injuries can be isolated and/or low-energy, involving only the anal sphincters or, alternatively, part of a high-energy polytrauma injury complex. The following section describes the demographics of these injury patterns and the initial recommended management for these very different patient populations. Between these two extremes lies a gray area where the optimal management strategy remains less clear (► Fig. 2).

High-Energy (Battlefield) Injuries

With the increased use of improvised explosive devices (IEDs) in combat operations in Iraq and Afghanistan, the military has seen a shift in injury pattern, yielding the current “signature injury”—bilateral transfemoral amputa-

tion with complex pelvic and perineal trauma.³ While blast injuries are rarely seen in civilian practice, between 2003 and 2010 in Afghanistan, these casualties presented to the UK Military at a rate of up to three a day.³ Isolated perineal injury was identified in 5.4% of patients, most commonly to the urogenital tract, as opposed to the anosphincteric complex. For isolated perineal injuries, mortality rates approached 18%, while complex pelvipereineal injury had a mortality rate upward of 70%.

The concept of “operating room resuscitation” is central to the treatment of high-energy anal and perineal injuries.⁴ A stepwise approach to intraoperative decision-making is provided by Kudsk and Hanna² and begins with proper patient positioning. Although prone jackknife positioning likely affords optimal exposure for elective surgery on the anosphincteric complex, due to concomitant intra-abdominal injuries and instability of the pelvis, the patient should be positioned in lithotomy with stirrups. Endoscopic examination, via both rigid proctoscopy and flexible sigmoidoscopy, with thorough evaluation of the urogenital tract is necessary to determine if urinary or fecal diversion is needed up front. Nonviable perineal tissue should be debrided at the initial exploration, otherwise pelvic sepsis may ensue. Kudsk and Hanna² recommend debridement combined with irrigation for a minimum of 3 consecutive days to decrease the chance of infection. Additionally, since the location of the wounds makes bedside management challenging, it is best if the patients are returned to the operating room daily to allow complete exposure and inspection.

Derived from a review of U.S. Military registries from 2003 to 2011, Glasgow et al⁵ advocated that attempts at early anoplasty in polytrauma patients should only be limited to marking of retracted sphincter ends for future identification, as initial anal repairs did not alter the need for permanent colostomy. Unfortunately, an unsalvageable perineum offers few options other than radical debridement. If the anosphincteric complex has been destroyed, abdominoperineal resection (APR) will likely be necessary but can be delayed. The need for fecal diversion, preferably with a diverting loop colostomy, will largely be dictated by the presence of concomitant colorectal injury, but should be considered for loss of rectal tone with incontinence. In the UK Military, Mossadegh et al³ found that fecal diversion was performed in 17% of patients, of which 45% had isolated perineal injuries. Lastly, early wound coverage simplifies wound care, decreases the metabolic losses of a large open wound, and helps with early mobility of the patient.³

The focus on urogenital trauma is outside the scope of this article; however, a few key points should be kept in mind. Urinalysis for microscopic hematuria has only a moderate discriminatory power of identifying urethral and/or bladder injury.⁶ In pelvic trauma, a high riding prostate or blood at the urethral meatus should raise the suspicion of urethral injury and prompt consideration for placement of a suprapubic cystostomy.⁷ Lastly, all viable gonadal tissue should be preserved, although placement of the testicles into a thigh pocket is not recommended, as this may potentially damage viable sperm.⁷

Fig. 2 Comparison of low-energy versus high-energy anal and perineal trauma. In general, isolated injuries favor primary repair, while complex polytrauma favors delayed repair.

Low-Energy (Civilian) Injuries

Although we will place a limited focus on perineal tears from vaginal childbirth, only 5 to 15% of anal sphincter repairs are performed for nonobstetric trauma.⁸ In fact, in primiparous women, 35% had an anal sphincter defect on routine endosonography at 6 weeks.⁹ Furthermore, in women with persistent or late-onset fecal incontinence after vaginal delivery, as many as 90% of women have a defect in the external anal sphincter (EAS) and 65% in the internal anal sphincter (IAS).¹⁰ For sphincter tears recognized at the time of delivery, immediate primary repair should be performed, while women presenting with delayed fecal incontinence are generally managed conservatively and elective repair deferred for at least 3 months.¹¹

Anal and perineal trauma in the civilian population can be stratified into blunt and penetrating mechanisms.¹² Examples of the more common blunt mechanisms include, in the adult population, falls and motor vehicle accidents and, in the pediatric population, sports and straddle injuries. Penetrating injuries can be very diverse in nature, including iatrogenic injury, anal penetration from consensual sexual intercourse or rape, gunshot or stab wounds, and impalement by picket fences, tree branches, or broomsticks. In the setting of minor disruptions, such as can result from sexual practices or cases of abuse, early primary repair can be considered—an approach adopted from management of obstetrical injury.¹³ When complex repairs are required, consideration should be given to fecal diversion, but it is not mandated.

Initial Evaluation of Anal Trauma

History and Physical

After the patient recovers and regains the ability to toilet, definitive management of the anal injury can be considered. The degree of sphincter injury can be more accurately assessed once the perineum has been allowed to fully heal, as substantial scarring can alter function.¹⁴ Early in the evaluation, an assessment of the patient's previous bowel function and continence is helpful in identifying additional pathology unrelated to the index trauma. The physical exam must include a digital rectal examination (DRE) to assess for resting and squeeze tones. Lastly, rigid proctoscopy and flexible sigmoidoscopy are imperative to identify location of injuries within the rectum and anal canal.

Anorectal Manometry

Anorectal manometry is one of the most effective tools available to functionally evaluate various parameters of defecation, including rectoanal coordinated activity.¹⁵ Manometry is best utilized once the acute injury has resolved. The primary component contributing to anal resting tone is IAS activity, and, in general, symptoms of passive fecal incontinence correlate with low resting anal tone.¹⁶ However, patients with very low basal pressures may be fully continent and, conversely, those with high resting tone may have significant incontinence. On the other hand, the squeeze pressure is attributed primarily to the function of

the EAS, as well as the puborectalis sling.¹⁵ Squeeze is generally measured in terms of maximal value, as well as duration of sustained squeeze. Of all standard measures of anorectal function, anal squeeze pressure has been shown to have the greatest sensitivity and specificity for discriminating patients with fecal incontinence from continent controls; nevertheless, the correlation is far from perfect.¹⁵ Since anal manometry offers limited anticipatory guidance with regard to type of repair, it is often best employed to objectively compare postrepair function.

Pudendal Nerve Latency

The pudendal nerve is composed of afferent and efferent pathways, most notably innervating the EAS. Functionally, pudendal nerve terminal motor latency (PNTML) is a measurement of the conduction time from stimulation of the pudendal nerve at the level of the ischial spines to contraction of the EAS.¹⁵ Prolonged latencies are used as a surrogate marker of pudendal nerve injury. Before the advent of endoanal ultrasound (EAUS), most cases of neurogenic fecal incontinence were attributed to pudendal nerve injury. It is now recognized that, in actuality, structural damage to the sphincters rather than pudendal neuropathy is the underlying cause in most patients.¹⁷

Anorectal Imaging

As it pertains to the sphincter complex, EAUS (with either 2D or 3D probes) is the preferred modality to evaluate anal sphincter anatomy.¹⁸ The probe is inserted into the anal canal to the level of the puborectalis muscle, and then scanned distally, until the internal sphincter band disappears and the distal external sphincter is imaged to its terminus.¹⁹ Injury to either the IAS or the EAS results in replacement of ruptured muscle fibers with granulation tissue and subsequent fibrosis. Defining the areas of sphincter defect provides invaluable information to guide surgical repair. EAUS is superior to other modalities, namely, manometry, electromyography, and clinical assessment, and is reported to have a sensitivity of nearly 100% for evaluation of sphincter defects.²⁰ While more expensive and time-consuming, endoanal coil magnetic resonance imaging (MRI) is an alternative modality to obtain anatomic information regarding the sphincter complex. However, in a prospective study of the accuracy of endoanal MRI as compared with endosonography, Malouf et al²¹ found that while they may be equivalent with regard to diagnosing EAS injury, MRI is inferior in diagnosing IAS injury. EAUS in the setting of trauma is best utilized in planning repair. Isolated sphincter injury can inform sphincteroplasty, while demonstration of a widely disrupted sphincter indicates the need for more advanced forms of anorectal reconstruction.

Initial Management of Anal Trauma

Fecal incontinence, while not life-threatening, is a source of tremendous morbidity for patients after anorectal trauma. First-line therapy is often conservative and generally consists of bulking agents and anti-diarrheal medication. A

recent Cochrane review identified 16 trials studying the effects of antidiarrheals, as well as drugs to enhance anal sphincter function, including phenylephrine gel and sodium valproate.²² The authors concluded that there was limited evidence that either class of medications reduced fecal incontinence in patients with liquid stools. Agents, such as loperamide, codeine, diphenoxylate plus atropine, are effective in slowing gut transit time and firming stool consistency when compared with placebo; however, they are associated with adverse effects including abdominal pain and nausea.

Often in conjunction with anti-diarrheal and bulking agents, biofeedback can be utilized in the management of fecal incontinence. Therapy involves education regarding sphincter exercises, rectal sensory retraining, and learning to coordinate voluntary EAS contraction with onset of rectal distension.¹¹ Using a manometric probe in the anal canal, the exercises are designed to give visual and/or verbal feedback to the pressure delivered during squeeze.²³ In a series of 100 patients treated with biofeedback for fecal continence, when compared with patients with no identifiable defect on EAUS, an isolated EAS defect did not appear to alter the efficacy of treatment with 47% reporting cure and 32% reporting improvement.²⁴ Those with IAS involvement were less likely to respond to biofeedback with 50% failing to respond to treatment.²⁴

Operative Approach for Anal Trauma

Sphincteroplasty

In the setting of isolated sphincter defects of the EAS, overlapping sphincteroplasty appears to be the preferred modality of repair. The technique was initially described, primarily for anterior defects, by Parks and McPartlin in 1971.²⁵ In the current adaptation, most surgeons dissect out the sphincter complex to the level of the anorectal ring, taking care not to injure the pudendal nerves posterolaterally, although in the setting of lateral sphincter injury, this may not be possible. The sphincters are divided through the scar and then overlapped and approximated with absorbable suture. It is advised not to excise the scar tissue nor separate the IAS and EAS.²⁵ An alternative method involves maintenance of the bridging scar with imbrication of the functional muscle around it. At a mean follow-up of 84 months, Lamblin et al²⁶ reported that 48% of patients maintained good fecal continence with a satisfaction rate of 85% using these techniques. Failure of sphincteroplasty can be attributed to mechanical dehiscence of the repair, progressive muscular atrophy, or occult neuropathy. In a randomized trial to assess need for fecal diversion at the time of sphincteroplasty, Hasegawa et al²⁷ concluded there was increased morbidity from the stoma with no difference in functional outcome or wound healing.

Graciloplasty and Gluteoplasty

Occasionally, due to devastating trauma to the anosphincteric complex, sphincteroplasty is not a viable option for repair of anal trauma. In such cases, anorectal reconstruction

may be indicated. One such repair is graciloplasty, in which one of the gracilis muscles can be mobilized as a pedicled flap and tunneled around the damaged sphincter complex with attachment of the end to the contralateral ischial tuberosity. Since this muscle does not act as a dynamic sphincter, training is required for continence with varying degrees of success in the literature.²⁸ In response to poor outcomes, Baeten et al²⁹ first reported the use of dynamic graciloplasty in 1988, in which a stimulator with intramuscular leads was implanted to provide more sustained tonic contraction. In assessing the outcomes of dynamic graciloplasty, neo-anal manometry was performed in 163 patients after repair, yielding relatively low mean sphincter pressures (basal 25 mm Hg and squeeze 102 mm Hg) but a consistently high perception of continence.³⁰

Gluteal muscle transposition has also been reported by detaching the muscle at the sacrococcygeal ligament and mobilizing around the anal canal.³¹ It is innervated by the L5–S1 nerve roots and generally reserved for neurogenic fecal incontinence, multiple failed sphincteroplasties, and severe sphincter defects.²⁸ In a multicenter trial of 128 patients, 66% achieved a successful outcome, as defined by a 70% reduction in solid stool incontinence.³²

Artificial Sphincter

First described in 1987 for the treatment of fecal incontinence, the artificial bowel sphincter (ABS) was developed to mimic the function of the anosphincteric complex by modification of an artificial urinary sphincter.³³ The device consisted of an inflatable occlusive cuff placed around the anal canal with a pump placed in the scrotum or labia.³¹ In a retrospective single-center review, ABS had a high failure rate with 28% achieving continence and many devices requiring explantation for infection or erosion and malfunction.³⁴ Currently, due to unacceptably high complication rates, the ABS is no longer available in the United States.

Sacral Nerve Stimulation

In the treatment of fecal incontinence, sacral nerve stimulation (SNS) is rapidly growing in popularity. Adapted from the treatment of urinary incontinence, SNS is predicated on neuromodulation of the S3 nerve root.³⁵ Due to uncertainty regarding the exact mechanism of action, its application is still based on trial-and-error philosophy.³⁶ However, if at least a 50% reduction in fecal incontinent episodes is achieved, the first phase is considered a success and the device is permanently implanted.

Excellent long-term outcomes for the use of SNS in the treatment of fecal incontinence are being published. In a multicenter prospective study of 120 patients, Hull et al³⁶ reported a dramatic decrease in the number of fecal incontinence episodes with 89% having $\geq 50\%$ improvement and 36% having complete continence at over 5 years. Additionally, in a large European cohort of patients, similarly with a minimum of 5 years of follow-up, Altomare et al³⁷ found SNS was responsible for a significant reduction in episodes of fecal incontinence, as well as improvement in

symptomatology based on Cleveland Clinic and St. Mark's incontinence scores. Long-term success was maintained in 71% of patients and full continence in 50% of patients. Only a marginal improvement in symptom score during the temporary test phase correlated well with the risk of long-term failure.³⁷ However, one flaw in the data on the use of SNS for fecal incontinence is that the implantation for traumatic indications is almost universally due to obstetric injury, limiting the generalizability to trauma.

Magnetic Sphincter Augmentation

The magnetic anal sphincter (MAS) (FENIX, Torax Medical, Shoreview, MN) is a novel continence device consisting of a flexible band with a magnetic core that is placed around the anal canal to augment anal sphincter tone.³⁸ To defecate, the patients strains in a normal way and the force generated separates the beads to open the anal canal. Continence is restored by a means of passive attraction of the beads. A small feasibility study suggests a more than 50% improvement in continence in 70% of patients in the short term.³⁹ To gain a better appreciation for the potential benefit of the MAS device, the National Institute for Health Research Horizon Scanning Centre has funded a multicenter, randomized study and is currently recruiting for the SaFaRI trial—SNS versus the FENIX magnetic sphincter augmentation for adult fecal incontinence.³⁸

Conclusion

Traumatic injuries to the anus and perineum encompass a broad array of anatomic and physiologic problems, but the major morbidity remains fecal incontinence. In general, bulking agents and antidiarrheals, in conjunction with biofeedback, offer very little downside and should be considered as first-line therapy. In the setting of failed nonoperative techniques, surgical repairs, such as sphincteroplasty, tend to be fairly effective and simple to perform. More complex sphincter reconstructive techniques exist but have only slightly better outcomes in very small studies. The excellent response of fecal incontinence to neuromodulation, with minimal morbidity from the therapy, will likely result in increased use of SNS. However, for all therapies, health care providers should note that satisfaction scores often exceed the objective measures of fecal incontinence.

Lastly, for disabling fecal incontinence refractory to medical management and sphincter repair, a diverting colostomy can provide substantial improvement in the quality of life. In a survey of 69 patients, Norton et al⁴⁰ found that 84% would “probably” or “definitely” choose to have fecal diversion again. The results highlight the severe morbidity of fecal incontinence and the need for exploring burgeoning therapies that offer patients a significant chance at bowel continence.

Conflict of Interest
None.

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