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Hydrostatic Pelvic Injury Due to Personal Watercraft Accident: Surgical Planning

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Abstract

A multidisciplinary approach, including imaging, to evaluate and manage hydrostatic pelvic floor injuries is recommended.

Keywords

pelvic watercraft injury; hydrostatic injury surgical planning

Introduction

Risk of injury associated with participation in boating activities is well known, with 651 deaths and 3000 injuries reported in 2012. Of these, 58 deaths and 721 injuries were associated with personal watercraft.¹ One of the more unusual injuries that may occur is secondary to hydrostatic assault on the perineum when a passenger falls from the rear and exposes the perineal orifices to the water jet. While this type of injury has been described previously, the majority of these described events have been of severe magnitude requiring extensive surgical interventions including laparotomy and/or colostomy.^{2–4} It is probable that publication bias has over-estimated the severity of the typical case.

A literature search performed to aid in the care of a patient with this type of injury might lead a provider to perform a more invasive surgery than necessary (e.g. laparotomy).^{2–4} Also, as the technology associated with radiologic imaging has improved, optimization of surgical planning can be affected, making the exact procedures needed more accurately predicted by the operative team.

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Case

A 36-year-old Caucasian G2P2002 was the rear passenger on a personal watercraft when she was ejected and experienced the force of the jet applied to her perineum. Brisk vaginal bleeding and a syncopal episode subsequently occurred, and the patient was transported by ambulance to a local hospital. Extensive vaginal lacerations were noted, and pelvic imaging by non-contrasted computed tomography was performed. No explanation for omitting contrast was identified in the patient transfer records. After vaginal packing, the patient was deemed stable and was transferred to a tertiary care facility. The patient was evaluated after transfer with vaginal packing still in place and appeared clinically stable. The decision was made to delay removal of the vaginal packing until the patient was in the operating room where intervention could be performed if needed. After review of the outside radiologist's interpretation, the images were reviewed with the on call radiologist to allow for more directed assessment and planning. Initial survey showed the vagina as the entry point with gas distention noted (Figure 1). Hemorrhagic change was also noted in the distal uterine, cervical, and paracervical fascia (Figure 2). As the computer-assisted tomography scan (CT) was not undertaken with contrast, active extravasation of blood could not be confirmed or excluded. Specific findings included an $8.4 \times 4.5 \times 8.4$ cm area of interstitial hemorrhagic change and emphysema in the left lateral pelvis, including periadnexal and perirectal spaces (Figures 3 and 4). While there was extraperitoneal stranding and gas, there was no evidence of intraperitoneal fluid or free air. In light of the radiologic assessment and the patient's clinical status as hemodynamically stable with a hematocrit of 29, the decision was made to proceed conservatively and to defer laparotomy but to discuss all possible outcomes with the patient. The patient was consented for exam under anesthesia, vaginal laceration repair, laparoscopy, cystoscopy, possible laparotomy, possible total abdominal hysterectomy, and possible bilateral salpingo-oophorectomy, and other indicated repairs.

Examination under anesthesia, after the vaginal packing was removed, revealed vaginal defect extending 10 centimeters (cm) from the left to right vaginal wall along the posterior fornix, with dissection of the underlying spaces. Absence of a peritoneal defect could not be definitively assessed. Laparoscopy was undertaken and revealed intact peritoneum throughout the pelvis and no evidence of active retroperitoneal bleeding or hematoma formation. After initial assessment of the injury, urogynecology consultation was requested. The vagina was copiously irrigated. After hemostasis sutures were placed, the vaginal defect was closed in interrupted fashion to allow for drainage. Cystoscopy confirmed no bladder injury and intact ureters following the repair. Air was passed into the rectum after filling the vagina with water to confirm no rectal injury, and digital rectal examination confirmed no suture material present. The postoperative hematocrit was 25%, and the patient received 1 unit of packed red blood cells after reporting symptoms of lightheadedness and shortness of breath. The patient was discharged home on postoperative day 2 in good condition. A telephone interview was conducted with the patient 8 weeks postoperatively during which she reported receiving clearance from her local gynecologist to resume sexual activity and had done so without complication.

Comment

The case presented represents a hydrostatic injury that, despite appearing severe at the onset, was able to be managed with conservative surgical intervention after consultation with radiology and evaluation under anesthesia. In cases where the patient is hemodynamically stable, predicting the extent of traumatic vaginal and/or rectal injuries on clinical examination alone is difficult, as the signs and symptoms are similar for genitourinary and gastrointestinal injuries, with abdominal pain and bleeding being the most common. Failure to recognize the extent of the injuries and the organ systems involved can result in poor surgical planning. However, by utilizing radiologic assessment and understanding the mechanism of injury, recruitment of the appropriate specialists and directed surgical planning can occur.

The optimal study for assessment is an intravenous contrasted CT scan although this was not available to the team on this case as the imaging was performed prior to her transfer. This imaging modality allows for assessment of active bleeding and provides a means for identification of whether fluid or free air is present in the intraperitoneal cavity or restricted to the retroperitoneal space. If needed, further evaluation can be performed with water soluble enema, vaginogram, and cystogram. Decisions regarding the most beneficial mode of imaging and use of contrast can be greatly aided by consultation with radiology. When the affected systems have been delineated, the appropriate specialists can be enlisted for the repair. In vaginally focused injuries, the most likely result is laceration with dissection into the retroperitoneal space, and, unless there is arterial bleeding, the patient may be managed with minimally invasive techniques. In rectally focused injuries, the likelihood of entry into the peritoneal cavity with need for more extensive surgical management is high. Fortunately, rectal injuries seem to be less likely than vaginal injuries, thought to be due to the lack of sphincter at the vaginal opening.⁵

Despite being a very small subset of injuries resulting from personal watercraft accidents, the prompt recognition and understanding of the mechanism of injury is essential to caring for a patient with a hydrostatic vaginal and/or rectal injury in an appropriate manner. Since 1995, there have been 11 such injuries reported in the literature, with the severity of injury and incidence of rectal injury being variable. As horsepower and maximum speeds of personal watercraft have significantly increased, there is concern for increasing severity of injury. Watercraft manufacturers do recommend the use of wetsuits for all passengers. Another solution involving addition of an automated engine shut-off switch responsive to the passenger in addition to the operator was suggested as early as the late nineties but has not been implemented.³ Without these protective measures in place, the resulting injuries are believed to occur due to over distention of the lumen of the affected organ.²⁻⁵ Vaginal rupture has previously been shown to occur at 10 pounds per square inch, and a mere 20% thrust level in current personal watercraft can exceed 80 pounds per square inch, dependent upon proximity to the exposed orifice.⁵ There are currently no cases in the literature describing injury from direct force of the water jet alone or detailing urethral injuries which would suggest that the supposed mechanism of injury is likely.

The last time such an injury was addressed in the American gynecology literature was 1991.² A steady increase in the popularity of personal watercraft has occurred in the last 10–15 years, with over 1.3 million personal watercraft currently registered for use, up from 750,000 in 1998.^{1,3} As these devices become more prevalent and powerful, the pelvic injuries that they can cause need to be readily known to physicians who may encounter them including general surgery, trauma surgery, and gynecology as well as radiologists who may be enlisted to assist in assessing the extent of the injury prior to surgery. These injuries do not always occur concurrently, but the possibility of needing a multidisciplinary team should be appreciated.

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Figure 1.
Sagittal view of pelvis with gas-filled vagina (arrow).

Figure 2.
Area of hemorrhage shown. No evidence of intraperitoneal free air/fluid.

Figure 3.
Interstitial emphysema (arrow) indicating disruption of vaginal wall.

Figure 4.
Coronal view of interstitial hemorrhagic change and emphysema (arrow) in the perianal and perirectal space.