Case Report

A Water Slide Accident Resulting in an Open Book Pelvic Injury and Subsequent Pulmonary Embolus: A Case Report

Cary Fletcher^a Kaye Lambert Fletcher^b

^aDepartment of Orthopaedics, Saint Ann's Bay Regional Hospital, Saint Ann, Jamaica;

^bCommunity Mental Health, Trelawny Health Services, Western Regional Health Authority, Trelawny, Jamaica

Keywords

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Abstract

Obesity and pelvic injuries are well-known independent risk factors for developing a pulmonary embolus; however, there is minimal literature with regard to obesity being a risk factor for suffering a pelvic injury from descending a water slide. We believe that obese patients are potentially at increased risk of receiving open book pelvic injuries on modern-day high-velocity water slides. To our knowledge, there are no other reports of a patient suffering an open book pelvic injury and a subsequent pulmonary embolus due to a water slide accident. We also propose a mechanism of injury for an obese person developing an open book pelvic injury from a water slide. An obese 46-year-old female descended on a thrill ride at a popular water park and sustained an open book pelvic injury. She subsequently developed a pulmonary embolus while awaiting open reduction and internal fixation of the anterior pelvic ring. One month post-injury, she had uneventful open reduction and internal fixation and went on to have an uneventful postoperative course. Patrons and amusement park owners should be aware of the increased risk an obese person is at when using a high-velocity water slide. There should be appropriate emergency personnel and equipment on site in anticipation of a possible high-energy injury.

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Introduction

It has been accepted that modern water slides will expose patrons to more frequent and severe injuries [1]. Despite attempting to obey the rules of the water park, in terms of the recommended starting position, our index case lacked the ability to maintain this position when she hit the thrill point of the slide. It could be argued that she lacked the requisite balance and co-ordination necessary to prevent losing control of her limbs. Obesity should be considered a risk factor for developing a pelvic injury on these high-velocity slides. Of note, obesity especially in combination with a pelvic injury predisposes the victim to developing a pulmonary embolus [2].

Case Presentation

A 46-year-old female with no known chronic illnesses presented to our regional hospital, complaining of severe anterior pelvic pain and an inability to weight bear. One hour prior to presentation, she had descended a thrill ride at a water park. The slide is 35 feet high and 120 feet long. The patient described the sensation of hitting a bump where the slide had a significant vertical slope. Her legs which were initially crossed as per the park's instructions, were uncontrollably abducted. She was assisted out of the water by fellow patrons and carried to a waiting area. She was then taken to the hospital in a fellow patron's motor car.

On examination, she was an obese patient in moderate painful distress, and her vital signs were normal. Significant positive findings included marked pubic tenderness and a mobile pelvis on springing. X-rays demonstrated a 4-cm diastasis of the pubic symphysis (Fig. 1). There was widening of the right sacroiliac joint. No fractures were seen. No further imaging was performed.

Her initial management included strict bed rest and prophylactic doses of enoxaparin at 40 mg subcutaneously once daily. Despite this, she developed a pulmonary embolus confirmed on computed tomography pulmonary angiogram, shortly after admission. The report noted a small filling defect related to the right distal pulmonary artery. The patient was then treated with therapeutic doses of enoxaparin at 80 mg subcutaneously twice daily. Once she was medically optimised, she was taken to the operating theatre at 4 weeks post-injury. In this window period, her anticoagulation was temporarily stopped.

Via the Pfannenstiel approach, the dissection was carried down to the diastasis of the symphysis pubis. Subperiosteal dissection was used to expose the superior and anterior surfaces of the pubic bones. The pubic diastasis was completely reduced using a tenaculum clamp (Fig. 2). Using the implants that were available, the reduction was maintained with a 6-hole reconstruction plate and screw construct (Fig. 3, 4). The blood loss was 150 mL. Therapeutic enoxaparin was recommenced 6 h after surgery. The postoperative period was uneventful (Fig. 5). One year postoperatively, the patient was fully weight bearing with no difficulty ambulating.

Discussion

Open book injuries are by far most commonly due to high velocity motor vehicle accidents and are less commonly due to high energy falls from a height. These injuries have been found to have a 20% mortality rate [3]. An open book injury may be caused by forced external

rotation of the legs or less commonly, direct trauma to the posterior iliac spines [4]. Once the pelvic ring is broken in one area, there is a fracture or dislocation in another area [4]. In this injury, there is disruption of the anterior sacroiliac ligaments, sacrotuberous ligaments, and sacrospinous ligaments [5].

We theorise that it is technically difficult for a patient with large thighs to maintain an adducted position at high speeds and that the lower limbs likely were also externally rotated in addition to being abducted while hitting the pool with significant force. The patient's mass in combination with the high velocity generated while travelling down the slide, would account for this significant energy imparted on her by the water.

Paulozzi et al. [6] had reported on a cluster of injuries which were seen at a Washington State water park and found that being overweight was a risk factor for injury on a water slide when age and gender were controlled, using a multiple regression logistics model. He found that patrons who were 10% greater than the ideal body weight had a 1.6 odds ratio of getting an injury. The index case has a body mass index of >30 and is considered to be obese.

The combination of being obese, having a pelvic injury, and lying in bed for a few days, put her at very high risk of developing deep vein thrombosis with subsequent pulmonary embolism. The embolus was confirmed by a computed tomography pulmonary angiogram. Of note, the increased risk of significant intraoperative bleeding due to the recent administration of therapeutic anticoagulation therapy was mentioned as part of the informed consent for surgery.

Liu et al. [7] retrospectively reviewed 466 obese and 2,701 non-obese accident victims and compared their patterns of injury. Obese patients had a longer stay in hospital, especially patients with pelvic injuries. There was a 1.9-fold increase in the incidence of pelvic injuries in obese patients compared to non-obese patients.

Buerger et al. [8] retrospectively analysed 198 pelvic patients at a regional trauma centre over a 3-year period and compared them to other victims without pelvic injury. There was a statistically significant difference in pulmonary embolism rates in patients with a pelvic injury versus patients without pelvic injury (2 vs. 0.2%). Godzik et al. [2] reviewed 61,474 patients with pelvic trauma. They were found to be at increased risk of developing pulmonary embolism (odds ratio 1.5). Obesity was also a predictive factor in acquiring a pulmonary embolism [2] (3.38 odds ratio).

Although it is well known that there is an increased risk of venous thromboembolism in obese patients, there is no universal agreement on an appropriate prophylactic dose. Furthermore, compression stockings and bandages are ineffective in obese patients. Also, no study has identified a consistent safe prophylactic dose which would reliably reduce the risk of developing deep venous thrombosis as well as minimise bleeding risk during surgery [9].

Reports of other similar injuries sustained at the park resulted in the park being temporarily closed. Several changes suggested by the treating orthopaedic team through the regional health authority were proposed. This included: (1) having a lifeguard in the vicinity of the base of the slide who will amongst other things evacuate injured patrons from the water; (2) ensure the presence of an emergency trained nurse in a well-equipped first aid area; (3) ensure that there is an emergency vehicle on standby to transport injured patients to the hospital in a timely manner – this is particularly critical in cases of life-threatening injuries including a major pelvic injury; and (4) a body mass index limit was also expected to be proposed.

Conclusion

Obese patrons who are unable to cross their legs on rides and who lack the coordination to somewhat control their momentum during descent, should avoid high-velocity thrill rides. The water park should play an active role in warning patrons especially when there is not a universally agreed weight limit. Amusement parks in conjunction with specialist engineers ought to determine an appropriate body mass index which is considered safe.

Statement of Ethics

The case report was conducted ethically in accordance with the World Medical Association Declaration of Helsinki. Written informed consent was obtained from the subject to conduct and publish the case review (including publication of images). Authorization was obtained from the hospital to conduct the study.

Conflict of Interest Statement

The authors declare no conflict of interest relevant to this article.

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Author Contributions

Cary Fletcher: visualization, conceptualization, and writing – review and editing, approval of final manuscript. Kaye Lambert Fletcher: writing – review and editing, approval of final manuscript.

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Fig. 1. AP pelvic X-ray.

Fig. 2. Tenaculum clamp holding reduction.

Fig. 3. Postoperative AP X-ray.

Fig. 4. Intraoperative picture: plate and screw construct.

Fig. 5. Healed wound at 2 weeks post-surgery.