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EDUCATIONAL TECHNIQUE

Pelvic Fractures and the Application of Pelvic Binders in Athletic Training

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Context: With the rise of athletic trainers (ATs) providing care to more nontraditional sports such as skiing, motor sports, rodeo, and X Games, the potential for dealing with traumatic pelvic injuries has increased from the traditional setting. The prehospital care provided by the AT can greatly reduce the potential complications seen in these patients. Application of a pelvic binder should be integrated into the athletic training education curriculum.

Objective: To provide the presentation of traumatic pelvic fractures, various types of pelvic binders available in the prehospital setting, and integration and teaching of this skill to professional level athletic training students.

Description: Students should be able to recognize and assess traumatic pelvic injuries. Proper treatment of these injuries is presented with a step-by-step process of how to manage these injuries in the prehospital setting. Equipment needs and how to teach this within the athletic training setting are discussed.

Clinical Advantage(s): Integrating the application of the pelvic binder into current athletic training curricula helps provide ATs another tool to use in helping to prevent blood loss, shock, or death in patients with a possible traumatic pelvic fracture.

Conclusion(s): Traumatic pelvic fractures are an important critical injury that must be assessed and addressed promptly to avoid hemorrhage and other sequela.

Key Words: Traumatic fractures, prehospital emergency care, hemorrhage, pelvic sling

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Pelvic Fractures and the Application of Pelvic Binders in Athletic Training

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KEY POINTS

- Athletic trainers and athletic training educators must stay up to date on changes in prehospital emergency care and incorporate those changes into their practice as appropriate and into the classes they teach.
- Pelvic fractures are rare but life-threatening injuries, and managing them with a pelvic binder in the prehospital setting can help improve patient outcomes.
- Various cost-effective pelvic binders are available.
- The application of a pelvic binder is simple to teach with minimal equipment needs.

INTRODUCTION

Traumatic pelvic fractures are potentially life-threatening injuries, primarily because of the potential for blood loss, shock, and the possibility of other associated injuries (eg, cervical spine, head, and/or organ) because of the amount of force transmitted throughout the body.[1–3] The typical mechanisms of injury for traumatic pelvic fractures include motor vehicle accidents (MVAs), pedestrian versus vehicle collisions, motorcycle accidents, and falls and crush injuries.[2,4,5] Although they are not commonly seen in the traditional sports setting, the potential for pelvic fractures does exist in football, wrestling, ice hockey, men's lacrosse, and other collision sports.[6] with football being the most commonly reported traditional sport.[3] Athletic trainers (ATs) must also consider the potential for pelvic fractures in nontraditional settings such as motor sports, rodeo,[7] downhill skiing, snowboarding,[6,8] other X Games–type sports,[6] and industrial settings. Athletic training presence is increasing in many nontraditional settings, so ATs need to be prepared for potential injuries not commonly seen in the traditional setting.

We acknowledge that not all pelvic fractures are traumatic in nature or medical emergencies. Avulsion fractures, stress fractures, and other overuse injuries or conditions are more common than traumatic pelvic fractures in the athletic population, but the management of these conditions is vastly different from the management of traumatic pelvic fractures. Complete and accurate assessment, proper prehospital emergency care, and rapid transport of a potential traumatic pelvic fracture are critical to prevent blood loss, shock, and even death.[2] Although terminology may vary between *pelvic binder* and *pelvic sling*, these terms are synonymous, and for this article, the term *pelvic binder* will be used. The purpose of this article is to review the clinical presentation of traumatic pelvic fractures, discuss prehospital management strategies, review current literature related to the use of a pelvic binder, and present teaching strategies to help athletic training educators incorporate the pelvic binder into their curriculum.

TRAUMATIC PELVIC FRACTURES

Pelvic fractures, or pelvic ring fractures as they are also known, typically result from a high-energy, blunt-force trauma.[2] As addressed above, they are most seen in car accidents and from other high-impact collisions,[4] but they can occur in both traditional and nontraditional sports. Pelvic fractures are most common in males between the ages of 15 and 30,[1,3,6] the age of the population many ATs care for. There are various types of pelvic fractures, and they are classified using 1 of 2 systems: Tile classification and Young and Burgess classification. The Tile classification system[9] is based on the severity of the fracture, whereas the Young and Burgess classification system[10] is based on the direction of force causing the injury and the anatomical area involved. The Tile classification and the Young and Burgess classification are summarized in Tables 1 and 2, respectively. These classification systems are used by physicians and emergency department personnel to predict severity and mortality.[5]

Pelvic fractures can either result in an opening or a collapsing of the pelvic ring. Lateral compression (LC) fractures, one specific type of pelvic fracture, commonly occur from a side-impact MVA or a traumatic fall on the side. This mechanism results in a compressive fracture of the sacrum and pubic ramus, fracture of the ilium, and/or damage to many of the sacroiliac ligaments, which can cause a collapse of the pelvic ring.[1,5] Lateral compression fractures are frequently associated with other traumatic injuries, including chest trauma (21.2%), head injuries (16.9%), and liver or spleen injuries (8.0%),[5] because of the amount of force transmitted through the body. These associated injuries increase the risk of serious complications and death. Complications include hemorrhaging,[11–13] multiorgan damage,[1] and shock.[1,4,11] From these injuries and complications, internal bleeding is the leading cause of death in patients with pelvic fractures.[11,12,14] Bleeding can occur from the sacral plexus,[12,15] associated soft tissue,[12,15] and/or the fracture site.[12,15,16] The overall mortality rate among patients with pelvic fractures has been reported to be between 7% and 23%,[5] with the authors stressing the severity of the injury as the key indicator of mortality rate.

PREHOSPITAL CARE

Because of the nature of the injury and likelihood of additional major trauma, evaluation of possible pelvic injuries should occur after addressing any airway or breathing problems and controlling major bleeding, if possible.[2,5] A detailed history, including the mechanism of injury, is key in the evaluation process and predicting the likelihood of fracture.[2] The patient should be questioned about pain in the pelvis, low back, hips, and groin. Dealing with an unconscious patient adds a degree of difficulty to the evaluation, as there might not be any outward display of the injury.[11]

During the secondary survey, assessment of the pelvis via compression or rocking of iliac crests is no longer recommended, as it may cause further damage to the area, including disruption of any clot development formed[2,4,5] and additional hemorrhaging at the site.[2,5,17] Instead, gentle palpation of the area should be done, along with a thorough inspection of the patient, including observing for positioning of the legs (including possible rotation and/or shortening), bruising,

Table 1. Tile Classification System[a]

Injury Type	Grade 1	Grade 2	Grade 3
A. Stable	Avulsion fracture on innominate bone	Iliac wing fracture or isolated, stable fracture of a pubic ramus (rare)	Transverse fracture of sacrum or coccyx
B. Vertically stable, rotationally unstable	Open-book injury (disruption of pubic symphysis with intact posterior sacroiliac ligaments)	Lateral compression injury (ipsilateral anterior and posterior arch fractures)	Bilateral injuries (B1 on one side and B2 on the other)
C. Vertically and rotationally unstable	Unilateral (disruption of anterior and posterior sacroiliac ligaments and pelvic floor on one side)	Bilateral (one side type B, one side type C1)	Bilateral (both sides type C)

[a] Table adapted from Shivji et al.[5]

swelling, and hematuria.[1,2,5,18] Abdominal palpation might reveal tenderness and swelling over the public symphysis area.[5,18] As the reliability of the physical examination in an unresponsive patient can be questionable, palpation should not be performed. If the mechanism of injury warrants it, such as a high-impact collision in snowboarding or a fall on a hard surface from a pole vaulter, and the patient is conscious, a fracture should be assumed and a pelvic binder applied.[2,17]

Depending on local protocols, a cervical collar may need to be applied and other spinal motion restriction considerations taken because of the possibility of other associated injuries.[2,19] A potential pelvic fracture could be considered a "distracting injury" when assessing a patient and determining if spinal motion restriction is warranted.[20] While waiting for a pelvic stabilization device, or if one is not available, the patient's hips should be internally rotated and his or her ankles should be secured together.[5] If available, a commercial pelvic binder or another stabilization device should be applied as soon as possible, before moving and transporting the patient.[11] According to Wayne,[12] early pelvic stabilization has the following potential benefits: (1) promoting and protecting clot formation by minimizing movement, (2) decreasing pelvic volume by circumferential compression of the pelvis, and (3) increasing patient comfort and potentially decreasing the need for narcotics. The priority is to prevent and treat the lethal triad of hypothermia, acidosis, and progressive coagulopathy.[16] Once the stabilization device is placed, lifting of the patient should be done via scoop stretcher or CombiCarrier (Hartwell Medical; Figure 1), if available, to avoid compression and distraction of the pelvis during a log roll.[2] Lee and Porter[2] recommend a maximum of 15% log roll, if needed, after application of the stabilization device, to allow for positioning on the scoop stretcher. There was no mention in the literature of the viability of the 8-person lift for moving the patient; therefore, we do not recommend it currently. The patient can be transported on the scoop stretcher, a standard backboard, or a vacuum mattress device.[2] Before and during transportation, the patient should be treated for shock, including intravenous fluids, oxygen therapy, and pain medications via advanced life support protocols by paramedics.[2,19] The patient should be transferred to a trauma center capable of handling the potential polytrauma, ideally a level I or II trauma center.[2,5] The pelvic stabilization device should not be removed until radiologic exams and physician's assessment are complete.[2]

STABILIZATION METHODS IN THE PREHOSPITAL SETTING

Various devices and techniques have been used in the prehospital setting to stabilize the pelvis when a fracture is

Table 2. Young and Burgess Classification System[a]

Injury Type	Type 1	Type 2	Type 3
Lateral compression (defined by anatomy of the posterior injury: large range of severity)	Sacral fracture, may be minor of complete	Iliac wing fracture, may enter the SI joint	Type 1 or 2 with associated contralateral SI disruption. (windswept pelvis)
AP compression "open-book" injury (increasing severity with increasing grade)	<2.5 cm widening of pubic symphysis, intact anterior and posterior SI ligaments	>2.5 cm widening of pubic symphysis, disrupted anterior SI ligaments, intact posterior sacroiliac ligaments	Complete separation of pubic symphysis and SI joint, all ligaments disrupted
Vertical shear		Vertical displacement of the hemipelvis through the SI joint or a sacral fracture combined with an anterior injury	
Combined mechanism		Combination of injury patterns as a result of 2 distinct injuries	

Abbreviation: SI, sacroiliac.

[a] Table adapted from Shivji et al.[5]

Figure 1. Pelvic binder and CombiCarrier.

suspected (Table 3). Over time, these have included medical antishock trousers (MASTs, also known as pneumatic antishock garments or G-suits),[2,11,14,21] bedsheet wraps,[1,2,11,21] and improved devices.[2,21] The goal of these devices is the application of pelvic compression to reduce pubic symphysis diastasis and help control bleeding.[22] Some of these devices, especially MASTs, are more cumbersome and time-consuming in their application, which can lead to increased prehospital time and possibly increased mortality. Although the use of MASTs has been shown to decrease pelvic volume, it also does not allow prehospital providers access to the abdomen, pelvis, and lower extremity. In the event of a polytrauma, this can make comprehensive patient care difficult. Additionally, MASTs have been associated with abdominal compartment syndrome, compartment syndrome of the lower extremities, and pressure sores, with no added survival advantage.[14] Because of the reasons discussed above and the lack of practicality of use for most ATs, we do not recommend MASTs and will not address their application in detail.

An alternative to MASTs and commercial pelvic binders that is commonly used in the prehospital setting is bedsheets. The application of a bedsheet (or circumferential antishock sheet) is a simple and cost-efficient way to provide stabilization of the pelvis if other means are unavailable. Some authors have suggested use of an appropriately sized piece of clothing, such as long pants or anything large and long enough to provide adequate tension around the pelvis, as another alternative.[21] Although use of bedsheets provides the advantage of allowing access to the abdomen, perineum, and lower extremity, it is important that the bedsheet be placed and wrapped appropriately to reduce the risk of skin irritation and breakdown. To help maximize the surface area, the sheet should be flat against the skin, avoiding any wrinkles, and secured with scissor clamps.[21] If clamps are unavailable, a square knot may be used; however, this provides additional pressure to the skin and can contribute to skin breakdown if left in place long term.[1] Any binder should be placed at the level of the greater trochanter and not over the iliac crest.[1,15,23–26] Although the bedsheet can be a valuable tool in the absence of other commercial devices, there is no gauge as to how much force to apply and if adequate stabilization is provided.[27]

From these earlier options and additional research, commercial pelvic circumferential compression devices (also known as PCCDs, pelvic binders, and pelvic slings) were developed. Commercial pelvic binders were first mentioned in applied emergency medicine literature in 2003, but the authors did not address the specific devices because of lack of Federal Drug Administration approval and supporting literature.[11] Then Bottlang and Krieg[11] published "Introducing the Pelvic Sling" to provide emergency medical personnel background information on development and use of the first commercial pelvic binder.

Pelvic binders are made from a variety of materials, but their goal is the same—to circumferentially compress the pelvis. These noninvasive devices stabilize the pelvic ring, decrease pelvic volume, and reduce or control bleeding.[5,12,15] Ideally, these devices are durable, are easy to apply, and can be tightened to a known tension.[5,14,15] They can also be applied with minimal training and personnel in the prehospital setting.[15] Although pelvic binders may be used to assist placement of an external fixator device, such as a pelvic C clamp, the increased use of prehospital pelvic binders has led to the decreased need for emergent external fixation of the pelvis and better outcomes in the hospital setting.[1,5]

CLINICAL EVIDENCE

As pelvic fractures are not commonly seen in the traditional athletic training setting, research has focused primarily on pelvic fractures sustained during high-energy trauma, such as MVAs,[4,28,29] motorcycle accidents,[28] falls,[4,28–30] and from improvised explosive devices in the military.[22] Many newer studies have tried to address additional questions, such as the effectiveness of the pelvic binder's use and its adverse effects, that were not previously answered in the literature.[17,31] The main goals for the use of these devices are to reduce overall mortality, stabilize the pelvis, and provide hemorrhage control. A systematic review of the literature showed that patients with early placement of a pelvic binder had an improvement in survival.[31] These patients were also stabilized sooner and spent less time overall in both the intensive care unit and the hospital in general (5.33 ± 5.42 and 16.11 ± 12.54 days) than patients without the placement of the pelvic binder (8.36 ± 11.52 and 19.55 ± 26.14 days), although the differences did not reach statistical significance.[31] However, there was a statistical difference in the amount of transfused blood required between the 2 groups (2462 ± 2215 mL versus 4385 ± 3326 mL, $P < 0.01$).[31] Interestingly, 1 study[32] noted that the application of a bedsheet wrap resulted in significantly more days hospitalized and required an increased need for blood transfusion when compared with a commercial

Table 3. Various Types of Pelvic Binders

Binder	Manufacturer	Cost, $[a]	Comments
Pelvic Binder	PelvicBinder, Inc https://www.pelvicbinder.com/	Contact manufacturer	One size fit all, "cut-to-fit"—may take longer to apply Velcro-backed fastener with shoelace mechanism Latex-free
SAM Pelvic Sling II	SAM Medical https://www.sammedical.com/	79.00	Autostop buckle that clicks into place to limit tension Narrower belt allows for space to treat those with polytrauma to the pelvis and abdomen
SAM Junctional Tourniquet	SAM Medical https://www.sammedical.com/	349.00	Autostop buckle that clicks into place to limit tension Can be used as a tourniquet or stabilizer for pelvis Target compression device to help minimize blood loss
T-POD	Teleflex https://www.teleflex.com/usa/en/index.html	165.00	One size fits all, "cut-to-fit"—may take longer to apply Pulley system used to provide circumferential compression, but does not provide feedback on applied force Two fingers should be able to fit between binder and patient
Pelvigrip Binder	Be Safe Paramedical https://be-safe.co.za/pelvigrip-pelvic-binder/	244.00	Made of neoprene Various sizes available—can purchase single or full set
Bedsheet	NA	Approximately 3.00	Easy to apply No feedback on amount of tension applied May not provide enough stabilization as compared with other binders

Abbreviation: NA, not applicable.

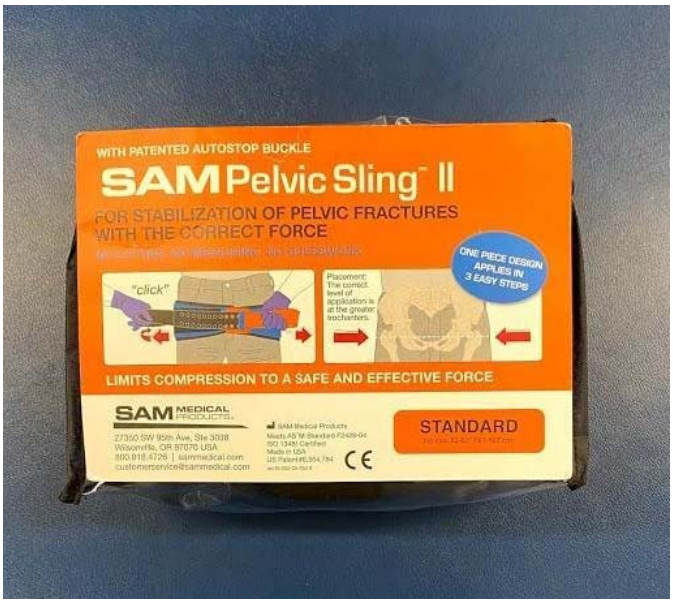
[a] Cost may vary based on supplier.

pelvic binder. Additionally, there was approximately a 20% increase in lethal bleeding from the pelvic region when using the bedsheet wrap as compared with a pelvic binder.[32] It is hypothesized that these consequences are possibly due to not sustaining enough force to control internal hemorrhage or because the bedsheet wraps were removed too early as they hindered further examination of the patient.

Accurate placement of the pelvic binder is essential in ensuring hemorrhage control.[31] In military combat, 30% of pelvic binders were placed incorrectly.[22] Placing a pelvic binder too high is frequently seen, with only 39% to 50% of applications at the correct level of the greater trochanter.[15,23] Higher compressive forces are applied to the posterior pelvis and gluteal muscles and increased movement at the pubic symphysis (2.8 times greater) occurs when the pelvic binder is placed too high, over the iliac crest.[15,23] Placing the pelvic binder below the greater trochanters occurs less frequently, in 3.8% of patients.[23] Proper hemodynamic function and approximation of the pelvis cannot be maintained when the pelvic binder is placed too low.[23] Approximation of the diastasis occurs with less force when applied to the level of the greater trochanters.[22] When comparing pelvic binders, the T-POD showed greater reduction in the diastasis (32.2 mm) and more reductions to normal (9 of 12) than the bedsheet wrap (21.9 mm, 2 of 12).[16]

Although various devices may be used for pelvic stabilization (Table 3), limited research has presented how exactly the pelvic binders can affect the fracture fragments. One study[33] compared the quality of the reduction with various commercial devices, including the Pelvic Binder (PelvicBinder, Inc), SAM Sling (SAM Medical), and T-POD (Arrow). The researchers compared the pelvic binders with regard to the various types of pelvic fractures as identified by the Tile classification system.[9] All 3 binders showed complete reduction of the pelvic ring in all 3 classifications without gross overcompression to allow displacement of fracture fragments.[33] The only meaningful difference among the 3 types of pelvic binders noted was the mean pulling force required when applying the binder, with the T-POD requiring the lowest amount of force and the SAM Sling requiring the highest. The amount of force needed to reduce pelvic volume when applying the various type of binders has also varied in the literature.[16,27] One study reported by Spanjersberg et al[16] showed that 180 N (40 pounds [18.1 kg]) of tension was needed to achieve complete reduction of the pelvis, whereas the SAM Sling autostops at 150 N of tension (33 pounds [15.0 kg]) per the manufacturer's guidelines. This is contradictory to the study by Prasarn et al,[27] in which multiple devices were assessed for tension and reduction of the pelvis. Although all trials using the SAM Sling were reported to tighten until the autostop feature was enabled, the peak force reported with use of this device was only 24 N (5 pounds [2.3 kg]). Although

Figure 2. Pelvic binder.



these forces vary greatly in the literature, the T-POD has typically shown lower force with application compared with the SAM Sling and other pelvic binders.

Adverse effects of all types of pelvic binders are reported in the literature, with only approximately 1.35% of patients experiencing any complications.[31] Although most adverse effects have usually been described in case reports, in one case[31] the authors were unable to identify if the technique caused the adverse effect or if it was due to other factors. Additionally, one adverse effect shown by Schaller et al[34] was the presence of skin breakdown and bullae at the greater trochanters in a patient with a fracture-dislocation of the left acetabulum and pelvic ring disruption. This patient had received a bedsheet pelvic binder that was left in place for 10 hours for continued resuscitation and maintenance of vital signs. Skin necrosis also occurred in another case of an adolescent female who received bilateral sacroiliac joint injuries, pubic disruption, and bilateral rami fractures. A SAM Sling was used for an unspecified amount of time, which lent to skin necrosis that required debridement and skin grafts.[16] Although not as common as skin breakdown, another reported adverse effect is nerve palsy.[24] One case presented a patient who sustained bilateral nerve palsy of the lower extremities with a 16-hour placement of a bedsheet pelvic binder.[16] Overall, pelvic binders have minimal adverse effects of less than 2% of patients having complications, primarily skin breakdown and necrosis. Pelvic binders should be placed on all patients with suspected pelvic fractures because of the high risk of hemorrhage and death if not properly managed and low risk of complications.

CONSIDERATIONS FOR USE IN THE PREHOSPITAL SETTING

Commercial pelvic binders provide many benefits and should be considered in the prehospital setting. They are simple and easy to use with little training needed to learn proper application. They are waterproof and noncorrosive, and can withstand extreme changes in temperature.[11] Their versatility can be useful in many athletic training settings, whether traditional or nontraditional. Once applied to the patient, pelvic binders can be left in place for up to 24 hours without causing the development of pressure sores.[5] Additionally, all pelvic binders can be left on during various imaging techniques until diagnosis[5,11] and proper treatment[5,11] are determined. It is important to follow the manufacturer's guidelines for application and use for the pelvic binder you have available.

INDICATIONS, CONTRAINDICATIONS, AND PRECAUTIONS

Indications

As the purpose of the pelvic binder is to temporarily stabilize the pelvis to reduce the risk of exsanguination and shock from hemorrhage, the pelvic binder should be applied if there is any suspicion of a pelvic fracture.[11] The pelvic binder should be applied before moving and transporting the patient.[2,12,25]

Contraindications

Only one absolute contraindication exists for the use of the pelvic binder, except if an impaled object prevents the application of the binder. Some relative contraindications include open pelvic fractures, perineal lacerations, morbidly obese patients, and burns to the area. It should be noted that in the presence of a pelvic and femur fracture, immobilization of the pelvis should be obtained before the femur is stabilized. A traction splint should not be applied to femur fractures in the prehospital setting when a pelvic fracture is suspected, as the bone displacement can facilitate hemorrhage.[19] The traction splint can also interfere with the use of the pelvic binder.

Precautions

It is imperative that the pelvic binder be placed in the optimal position to ensure adequate stabilization of the pelvis. Placement should occur at the greater trochanters of the femur as the anatomical landmark.[22] Research[15] has shown that placement at this site not only allows for near-anatomical reduction but also requires less tension to reduce the pubic symphysis. Those with experience using pelvic binders have noted that placing it under the lumbar spine and sliding inferiorly results in a higher placement of the binder, resulting in a suboptimal placement.[15] When applying a pelvic binder, it is important to palpate and identify the greater trochanters as the anatomical landmark.

Although it has been reported that pelvic binders can be in place for up to 24 hours, the risk of pressure sores also increases with an extended length of time in the binder.[4] When pressure is at least 9.3 kPa (1.35 pounds/in^2) for over 2 to 3 hours, tissue damage is thought to occur.[35] At the various bony prominences (greater trochanter, anterior inferior iliac spine, sacrum), the highest pressures were found to be when the individual was still on the spine board.[33] The pressures continue to increase as time on the spine board increases. Transferring the individual to a hospital bed has been shown to reduce some of the pressure. Therefore, pelvic binder placement is recommended on the greater trochanter and sacrum, varying depending on the type of pelvic binder used. However, to reduce pressure to below 9.3 kPa (the point at which tissue damage could occur) it is recommended that the

Figure 3. Sliding binder under patient's thighs.

Figure 4. Pelvic binder at location of greater trochanters.

patient be transferred to a bed and the pelvic binder removed as soon as safely possible. If the binder needs to be in place for an extended period of time (>2–3 hours), it is important to continue to monitor the areas of pressure.[31,32,35]

Lastly, compression by use of a pelvic binder with LC fractures is debatable, as little evidence shows the benefits or risks. Applying a pelvic binder in a patient with a possible LC fracture should be done with caution. Although it may help stabilize the pelvis, it should be removed as soon as LC fracture diagnosis has been determined.[5]

EDUCATIONAL CONSIDERATIONS

As athletic training continues to evolve and advance, so do the required knowledge and skills for entry-level ATs. In a recent study of ATs' knowledge of emergency care skills, 51.3% of respondents reported not having learned about the pelvic binder in their professional education program (J.S. Ostrowski, PhD, unpublished data, 2020). This reinforces that there is a need for education on pelvic binder use in professional athletic training education as the scope of practice increases. Although pelvic fractures are rare in the traditional setting, other areas of employment for ATs have evolved that assume a need for education on this skill. All ATs need to stay up to date on best practices in emergency care and be knowledgeable on skills used in the prehospital setting. Learning about the application of the pelvic binder is important, as it can improve patient outcomes if ATs are presented with this type of injury. Athletic trainers should be proactive instead of passively waiting for EMS to arrive, especially when this simple tool can greatly improve the patient's outcome.

EQUIPMENT

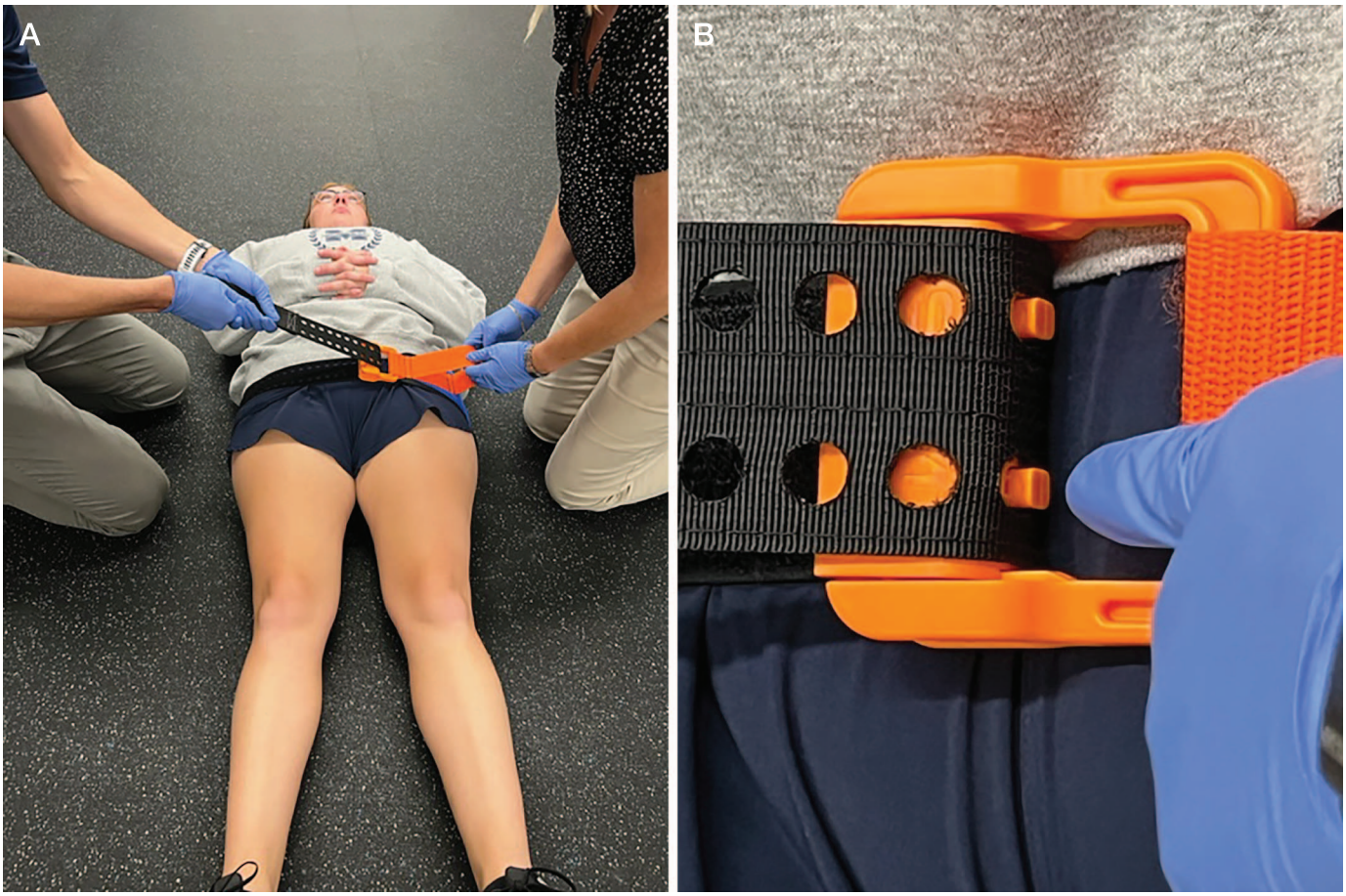
To teach and practice this skill with your students, you will need the pelvic binder currently available at your institution. Although we are not promoting a specific device, this article will discuss the use of the SAM Pelvic Sling II, as this is currently what is used at our institution for teaching students. Please note that there are 3 sizes of SAM Pelvic Sling II, and we recommend the "regular" size to fit the greatest number of patients or students (Figure 2) if you choose to purchase that brand of pelvic binder. The types of pelvic binders commercially available are listed in Table 3.

Although the skill of applying the pelvic binder can be taught without any additional equipment, we recommend having a long spine board, scoop stretcher, or CombiCarrier on hand so students can complete the "packaging" of the patient. A cervical collar, oxygen, and additional trauma equipment are warranted if teaching this skill as part of a scenario or standardized patient case. We also recommend having a skeleton on hand to help stress the anatomical landmarks needed for successful application of a pelvic binder.

PREPARING TO TEACH THE SKILL

Practicing with the pelvic binder in a controlled environment is important for students to feel comfortable and confident

Figure 5. A, Pull binder to appropriate tension. B, Apply tension until autostop click.



with the skill. We recommend allowing the students to practice on a skeleton model, other students, and/or a simulation manikin if available. Practicing on each other is safe with the SAM Pelvic Sling II because of the autostop buckle. We recommend removing all items for the patient's pockets before application of a pelvic binder in class. Anecdotally, we also recommend reminding students to void their bladders before this lab, just for patient comfort.

When preparing to teach this skill, we recommend choosing a location with various floor surfaces and heading outside to the grass if weather and location allow for it. If it is practiced on only one floor surface, students will not get an accurate representation of some of the challenges (sliding the binder under the patient, Velcro getting "stuck") when applying the pelvic binder. Currently, I (E.K.P.) teach the step-by-step skills in class on the hardwood floor, then have students practice on that flooring, indoor turf, and carpet. We head outside to the grass for scenarios that combine multiple emergency care skills, including the pelvic binder and packaging the patient for transport to the hospital.

TEACHING THE SKILLS

The steps for application of the SAM Pelvic Sling II are listed in Table 4. Other commercial pelvic binders are applied in a similar fashion, but users should consult the manufacturer's instructions before applying. When applying the binder to the patient, it may be placed directly under the pelvis by sliding it under the patient or by logrolling the patient. It also may be

Table 4. Application of SAM Pelvic Sling (2-Person)

1. Check distal CMS.
2. Remove any items from the patient's pockets.
3. Ensure the pelvic binder is unbuckled and lying flat (Figure 3).
4. Slide pelvic binder into place, level of greater trochanters. Can be placed directly under the patient's buttocks or can also be placed under legs and slid up (Figure 4).
5. Pull the black strap through the buckle and pull completely through.
6. Hold the orange strap and PULL the black strap in the opposite direction until the buckle clicks (Figure 5A and B).
7. Maintain tension and secure black strap on surface of binder (Figure 6).
8. If needed, circumferential wrapping of the ankles and/or knees can be used to help provide additional stability.
9. Recheck distal CMS.

Abbreviation: CMS, circulation, motor, sensation.

Figure 6. Secure strap to binder.

positioned by placing it under the patient's knee or thighs and sliding it superiorly to the level of the trochanters (Figure 3). We recommend having students try various methods of getting the pelvic binder in place on various surfaces (see above). No matter how the pelvic binder gets in place, the correct location is at the level of the greater trochanter (Figure 4). This is why I (E.K.P.) like showing the proper placement of the pelvic binder on the skeleton in class before students doing the skill. This helps students visualize the correct location before applying in on their classmates.

Technically, the SAM Pelvic Sling II can be applied by 1 or 2 ATs.[36] Figure 5A demonstrates 2 ATs pulling tension on the pelvic binder. If working alone, the AT should hold the orange loop while pulling tension on the black strap until the autostop pins click (Figure 5B). The black strap is then secured to the binder (Figure 6). I (E.K.P.) teach the skill as a 2-person skill because application is easier with 2 people and rarely are ATs in a situation where they do not have another person, trained or untrained, to help them. Students then check distal circulation, motor, sensation, and vital signs after placement of the binder. To complete the skill, the patient should be prepared for transport by being placed on a long spine board, Combi-Carrier, or scoop stretcher.

When teaching this in a scenario format, patient assessment should be completed including scene size-up, primary assessment, and then a thorough secondary assessment. I (E.K.P.) currently have 2 scenarios students rotate through that incorporate the pelvic binder: (1) a fall from a height at an industrial site and (2) collegiate football polytrauma. During the scenarios the cervical collar should be applied as soon as possible, as local protocols warrant. Students should consider how they plan to move the patient to minimize movement and safely and efficiently accomplish their objectives. Shock management techniques should be incorporated into scenarios, including oxygen application and monitoring of vital signs. After the pelvic binder is secured in place when doing scenarios, the patient should be fully packaged for transport. These scenarios are also a great time to practice transition of care and the patient report the athletic training students will provide to arriving EMS personnel.

CONCLUSIONS

As traumatic pelvic fractures are usually sustained because of high-velocity forces, the potential for many concurrent life-threatening injuries to the chest, abdomen, or cervical spine is high. Application of the pelvic binder is imperative for hemorrhage control and stabilization of the pelvic ring and allows the patient to recover sooner. Commercial pelvic binders are easy to apply and provide many benefits. They should be considered by ATs in the prehospital setting to provide hemodynamic and pelvic stability before transport.

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