



Literature Review

Articles That May Change Your Practice: Pelvic Binders Revisited

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According to the World Health Organization, road traffic accidents are one of the leading causes of morbidity and mortality, making it a major global public health issue. Pelvic ring fractures, which predominantly have a high potential risk as a source of significant bleeding in trauma, are big contributors to such poor outcomes. The prevalence of pelvic fractures in blunt trauma is as high as 16%, prompting some trauma centers and transport services to advocate for the use of a pelvic binder in all polytrauma victims. The application of a pelvic circumferential device, such as sheets, wraps, or commercial pelvic binders, is a common method to bind the pelvis, helping maintain its mechanical stability, reducing bleeding from the fracture site, and promoting hemodynamic stability.

Any intervention, such as a pelvic binder, should be easy to use, provide some benefit, and be without harm. Although some advocate that the application of a pelvic binder is contraindicated in patients in whom there is a lateral compression injury to the pelvis, most guidelines now support the early use of a pelvic binder when suspecting pelvic injury. The physical examination is not a reliable way to rule out a potentially unstable pelvic injury, particularly in the prehospital and transport setting, or with a trauma patient with an altered level of consciousness or other distracting injuries. The following is a brief summary of recently published literature regarding pelvic binders.

Jarvis S, Salottolo K, Meinig R, et al. Utilization of pre-hospital pelvic circumferential compression devices for pelvic fractures: survey of U.S. level I trauma centers. *Patient Saf Surg.* 2020;14:12.

The Eastern Association for the Surgery of Trauma, Western Trauma Association, Advanced Trauma Life Support, and Trauma Quality Improvement Project all recommend pelvic binder use and have developed guidelines regarding their use. The authors of this study surveyed the medical directors of all American College of Surgeons–verified level 1 trauma centers and their associated emergency medical service agencies to determine their current practice in the use of pelvic binders and which guideline these agencies use.

Of the 158 medical directors to whom the survey was sent, only 25% responded. Of the respondents, all indicated they apply a pelvic binder in hospital to all patients with multisystem trauma patients, typically as one of the first procedures upon receiving a trauma patient. While all their affiliated emergency medical service agencies surveyed had pelvic binders available, only 71% required training for the application of a pelvic binder. In comparing the guidelines used, the Eastern Association for the Surgery of Trauma's guidelines were the most commonly used.

The study was limited by the relatively low response rate from those surveyed, making interpretation of the findings difficult. However, the study highlighted the variability in guideline use, the lack of recommendations regarding field application of pelvic binders, and the fact that some prehospital and transport agencies do not receive specific training regarding their use. The study highlights the need for uniform guidelines, practices, and education regarding the practice of pelvic binder use in patients with multisystem traumatic injuries.

Pap R, McKeown R, Lockwood C, Stephenson M, Simpson P. Pelvic circumferential compression devices for prehospital

management of suspected pelvic fractures: a rapid review and evidence summary for quality indicator evaluation. *Scand J Trauma Resusc Emerg Med.* 2020;28:65.

The authors conducted a systematic review of the literature available regarding pelvic binders in the prehospital and transport setting that was published up to June 2020. Studies were included if the cohort was composed of trauma patients with suspected or confirmed pelvic fracture, the intervention was the application of a pelvic binder, there was a comparison group to which no intervention or a simple sheet wrapping of the pelvis was applied, and data on clinical end points and adverse effects were documented. A total of 13 articles were included, 3 of which were systematic reviews, 1 randomized clinical trial, 2 before-and-after studies, and 7 retrospective cohort studies.

The heterogeneity of the study designs and challenges in extracting the relevant data made it difficult to arrive at firm conclusions or recommendations. Overall, the data supporting the application of a pelvic binder in a patient with suspected or confirmed pelvic fracture are poor. However, there were a few findings that are relevant to practice in the prehospital and transport setting. A high index of suspicion based on the mechanism and patient condition should alert to the presence of a pelvic injury. Physical examination of the pelvis is an unreliable method to identify or rule out a pelvic fracture, and undue manipulation may dislodge any clots that have formed, thus worsening blood loss. Three studies included the use of a sheet as a method to stabilize the pelvic ring. This was found to

be less effective in reducing pelvic volume and stabilizing a pelvic fracture compared with a commercial pelvic binder. Data on clinical outcomes, such as mortality length of hospital or intensive care unit stay, are conflicting and inconclusive. There is no strong evidence that the application of a pelvic binder lowers hemorrhage or mortality in suspected or known pelvic fractures. The pelvic binder should only be used as an adjunct to early hemorrhage control along with other established methods to address hemorrhage and shock.

The authors identified complications of pelvic binder use, often because of improper application or excessive forces used. These iatrogenic injuries include damage to the skin, myonecrosis, peroneal nerve palsy, and worsening of injuries. These risks increase the longer the binder is left in place.

Overall, the authors concluded that the potential clinical benefits of a pelvic binder seem to outweigh the risk. However, high-quality evidence is needed to make strong recommendations and guide experts in identifying optimal training and the use of these devices.

Tiziani S, Janett A-S, Alkadhi H, Osterhoff G, Sprengel K, Pape H-C. Does the accuracy of prehospital pelvic binder placement affect cardiovascular physiological parameters during rescue? A clinical study in patients with pelvic ring injuries. *OTA Int.* 2022;5(suppl):e186.

Hypovolemia caused by blood loss is a common presentation in patients with multi-system traumatic injuries. Pelvic bleeding usually originates from the sacral venous plexus or fracture site itself but can also be arterial. The latter is usually observed when a pelvic ring is unstable rotationally, as seen with open-book fractures. Pelvic binder placement may help to stabilize the fracture assuming the binder has been placed correctly over the greater trochanters. Correct placement is the key factor in decreasing pelvic volume and mitigating further blood loss.

The authors of this retrospective study determined the incidence and magnitude of binder misplacement and assessed whether binder position affects measurable resuscitation parameters in patients with unstable pelvic ring fractures. A total of 76 patients with pelvic ring fractures and pelvic binders applied were assessed. Their mean Injury Severity Score (ISS) was 22.3, indicating significant multisystem injuries. The pelvic fractures were classified by computed tomographic imaging (lateral compression, anterior-posterior compression, or vertical shear), the degree of hemorrhagic shock determined, and the placement of binders via the initial scans.

Nearly half the pelvic binders applied were incorrectly placed, with 1 in 5 placed > 10 cm above the greater trochanters. There was no difference in physiologic parameter changes (ie, heart rate, systolic blood pressure, hemoglobin, hematocrit, lactate, base excess, and shock index) when comparing correctly and incorrectly placed pelvic binders.

The authors compared patients with pelvic binders with a control group of those in whom a pelvic binder was not applied. The comparison did not reveal any statistically significant differences in physiologic parameters or response to resuscitation between the 2 groups. The authors also assessed for complications due to pelvic binder application and did not identify any differences between the binder group and the control group.

This study was retrospective in nature with a small sample size of severely injured patients with other injuries that would confound the authors' findings. It would also be difficult to generalize the findings to larger, more diverse populations of trauma patients. Although the authors did not identify any specific benefit of the pelvic binder itself, they did identify that incorrect placement of pelvic binders was quite common, typically being misplaced proximal to the greater trochanters. This highlights the need for proper provider education to ensure correct placement.

Savary D, Morin F, Douillet D, et al. Impact of specific emergency measures on survival in out-of-hospital traumatic cardiac arrest. *Prehosp Disaster Med.* 2022;37:51–56.

The outcome of traumatic cardiac arrest in the out-of-hospital or transport setting is typically poor due to a variety of factors. The focus of immediate resuscitation is to identify any potentially correctable causes and correct them immediately. These include hypovolemia, hypoxemia, tension pneumothorax, and cardiac tamponade. Measures to minimize further blood loss and restore circulating volume may be beneficial in select cases.

The authors of this retrospective study assessed the impact of specific rescue measures on short-term outcomes in patients suffering from traumatic cardiac arrest managed by 2 emergency medical and rescue units in the French Alps. The outcomes of interest were the patients' hospital disposition (dead or alive) and the neurologic outcome of survivors. Provider scope and practice for these patients included the administration of crystalloid, application of a tourniquet, bilateral thoracostomies, field thoracotomy, and application of a pelvic binder. The authors also determined the impact on outcomes attributed to each specific prehospital intervention.

There were 287 patients with a mean age of 46.8 years; 22 (7.6%) had penetrating injuries, all but 2 of whom were in cardiac arrest on responder arrival. Fifty-seven (19.9%) arrived at the hospital alive, but only 8 (2.8%) had a 30-day survival with good neurologic status (cerebral performance category of 1 or 2).

When assessing prehospital interventions, 281 were successfully intubated, 262 received crystalloid resuscitation, 175 had bilateral thoracostomies (including 44 with a pneumothorax), 41 had their pelvis bound, and 5 had a tourniquet applied. No patient underwent field thoracotomy nor received any prehospital blood products.

Among the standard resuscitation measures used to treat reversible causes of traumatic cardiac arrest, the authors were able to show that 2 interventions, namely bilateral thoracostomies in the setting of a pneumothorax and tourniquet application for the control of limb hemorrhage, led to significantly improved survival. Thoracostomy performed without a pneumothorax showed no association with improved outcomes. The use of pelvic binders was not associated with improved survival, but the authors attributed this finding to an insufficient sample size.

The study was limited by its retrospective nature, small proportion of those with penetrating injuries, and some missing data. It was also conducted in a mountainous region of France where the majority of injuries were mountain related, making it difficult to translate to other populations and other settings. However, the findings show some potential outcome benefit of relatively simple procedures in the management of patients with traumatic cardiac arrest. The results regarding pelvic binders are inconclusive and will require a larger cohort.

Bangura A, Burke CE, Enobun B, et al. Are pelvic binders an effective prehospital intervention? *Prehosp Emerg Care.* 2023;27:24–30.

Binding the pelvis of a trauma patient may be a lifesaving nonsurgical approach for suspected pelvic ring injuries. The adoption of pelvic binders in the prehospital and transport setting is not universal because of the cost of training, devices, and uncertainty regarding benefit versus risk in patients without radiography-proven pelvic fractures, especially those with fractures resulting in internal rotation of fractured elements.

This single-center, retrospective cohort study focused on those with unstable pelvic ring fractures. A total of 1,527 pelvic fracture patients were screened for study inclusion. The application of a pelvic binder was defined as the use of any commercial pelvic

binders or modified circumferential splint. Prehospital records and data on initial vital signs, injury characteristics, prehospital team composition, and documented suspicion of pelvic ring injury were reviewed. These were matched with the hospital records, with data obtained on patient characteristics, first hospital vital signs, and mortality. The presence of a pelvic binder was noted by documentation by either prehospital or emergency department personnel. Each patient's ISS and age-adjusted shock index summarized the severity of multiple injured patients and enabled the adjustment for potential confounding. The primary outcomes were the identification of patients who had a pelvic binder applied by the prehospital team before hospital arrival and the fraction of patients for whom there was prehospital record documentation of a suspected pelvic injury. The secondary outcomes included changes in vital sign between the initial prehospital measurement and the first hospital measurement, the volume of red blood cell transfusion within 24 hours of admission, and in-hospital mortality.

Of the 1,527 patients screened, the authors identified 162 patients with unstable pelvic fractures. The mean age was 42 years, and 75% of patients were male. The mechanism of injury involved motor vehicle collisions (83%), with motorcycle accidents causing 40% of the injuries. Prehospital care providers documented suspicion of an unstable pelvic ring fracture in 52.8% of patients; however, only 32.2% of all patients had a pelvic binder applied. The remainder of patients received a pelvic binder on hospital arrival.

There were no differences detected in the data between the first prehospital vital signs and Glasgow Coma Scale score compared with the first hospital vital signs and Glasgow Coma Scale score. Patients transported by helicopter had a binder applied in 46% of cases compared with only 5% for those transported by land.

Prehospital providers documented suspicion of a pelvic injury in half of the patients yet applied a pelvic binder in only two thirds of these suspected cases. This variation in practice was noted despite the same statewide prehospital trauma protocol that included the application of pelvic binders. The application of a pelvic binder was related to the prehospital provider level, with those having higher certification being more likely to apply a binder.

The presence of a pelvic binder in place on hospital arrival was also a predictor of a higher ISS. There was an association between those with a pelvic binder applied before arrival at the hospital and a shorter hospital stay. However, there were no other clinical findings or outcomes, such as vital signs, blood cell transfusion within 24 hours, or inpatient mortality, when comparing those in whom a pelvic binder was applied before hospital arrival. There was also no difference in physiological changes and no significant differences in other outcomes between patients who received a pelvic binder in the prehospital setting compared with those in the emergency department.

This study demonstrates a wide variation of the application of pelvic binders in the prehospital and transport setting. Except for

hospital length of stay, there were no differences in the outcomes between groups. However, the presence of a pelvic binder on hospital arrival was found to be a predictor of a higher ISS. This may trigger hospital staff and the trauma team to have a higher index of suspicion for occult injuries, and this may in turn positively impact the timeliness of care.

In summary, there is considerable variation in recommendations regarding pelvic binder application and actual use. It is clear that provider education leads to increased use and correct application of the binder. Thus far, the evidence does not clearly show a significant impact on patient outcome. Further studies are needed to better assess the utility of pelvic binding in the prehospital and transport setting. However, what is known is that the presence of a binder applied before hospital arrival is a marker for increased severity of injury. Uniform guidelines and provider education are needed to enhance the use of a low-cost, low-risk intervention that may have a positive impact of a segment of those with traumatic injuries.

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