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Unstable pelvic trauma patient: Emergency department presentations, physical examination, and imaging: Systematic review

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ABSTRACT

Background: Patients with forceful trauma frequently have pelvic fractures, prompt and precise diagnosis can enhance patient outcomes. Whether physical examination are enough in this situation is still up for debate. The purpose of this study is to conduct a comprehensive evaluation of research on the diagnostic efficacy of physical examinations for pelvic fractures in individuals who have suffered severe trauma. **Method:** we followed Preferred Reporting Items for a Systematic Review and Meta-analysis (PRISMA), in this study. We searched MEDLINE, Cochrane, and PubMed for pertinent studies published between 2009 and 2023. We included 6 studies in our systematic review. **Results:** Data from 40667 people were included in the research. Four articles were prospective, and two were retrospective. The majority of the study was carried out at the trauma centre or emergency department of a university hospital. Emergency physicians performed physical exams at an emergency department or trauma unit. CT or x-ray were used as reference standards. Results from the CT scan, X-ray, and symptoms criteria showed no significant difference in the absence of a distracting injury. To reduce the danger of significant pelvic bleeding, it is helpful to apply a pelvic binder as soon as feasible, depending on the trauma cause or clinical outcomes. **Conclusion:** Regardless of the results of a physical examination or the patient's state of consciousness, imaging tests have to be conducted on all trauma patients.

Keywords: Emergency department, pelvic trauma, physical examination

1. INTRODUCTION

The early diagnosis and treatment of pelvic fractures is crucial for individuals with multiple trauma injuries. All of the information currently available points to the fact that a comprehensive clinical examination can effectively identify a significant and unstable pelvic fracture and that undetected fractures are typically small or stable and don't need to be treated urgently (Den-Boer et al., 2011). The iliac crest is manually compressed to determine the stability of the pelvic ring (Yong et al., 2016). Manual distraction of the pelvis involves pressing the iliac crest outward with both hands if instability is not detected (Den-Boer et al., 2011). When a patient complains of discomfort upon compression or there is movement of the pelvic ring, instability is suspected. It has been demonstrated that evaluating pelvic stability in polytraumatized patients can be challenging, particularly when the patient is unconscious. One potentially hazardous consequence of pelvic manipulation is the possibility of dislodging formed clots, which might lead to more bleeding (Van-Stigt et al., 2009).

A dependable external fixation of the pelvic ring in unstable fractures was made possible by the invention of pelvic binders and their simple application (Bonner et al., 2011). Clinical research revealed that pelvic binders greatly enhance cardiovascular health, lower the incidence of pulmonary problems, and minimize the need for blood transfusions (Spanjersberg et al., 2009). For the first assessment and treatment of pelvic ring fractures, the clinical examination of pelvic stability and pelvic palpation are recommended, although their validity is questioned because of their sensitivity, which ranges from 26.5 to 59%, and their specificity, which ranges from 71 to 99.9% (Shlamovitz et al., 2009). According to a poll conducted among trauma surgeons, 91% of them concur with this suggestion (Wohlrath et al., 2016). According to current standards, screening techniques for individuals with severe blunt trauma injuries include regular pelvic X-rays (ATLS, 2013). Additionally, a pelvic radiograph is not necessary for conscious, awake individuals who do not have pelvic discomfort or tenderness.

However, pelvic X-rays are often performed as part of a protocol-driven assessment in all patients who have had blunt trauma, with little regard to the severity of the injuries. As a result, there may be an overuse of radiographic exams, particularly in patients who do not appear to be injured or who have experienced a single trauma, such as conscious, hemodynamically and respiratory stable patients who do not exhibit symptoms of a pelvic fracture (Van-Trigt et al., 2018). It is vital to take into account the clinical utility and diagnostic potential of physical examination in order to comprehend its clinical significance in this situation. To estimate these parameters while following methodological criteria, however, only a few systematic reviews have been carried out (McInnes et al., 2018). In order to evaluate the clinical value and diagnostic accuracy of physical examination for pelvic fracture in patients with blunt trauma, this study was conducted.

2. METHOD

Comprehensive review and meta-analysis of research on the reliability of physical examinations in diagnosing pelvic injuries. We reported our findings using the Preferred Reporting Items for a Systematic Review and Meta-analysis (PRISMA). Patients with blunt trauma who may have suffered a pelvic injury were the intended participants. Physical examination for pelvic fractures was the relevant index concern Van-Leent et al., (2019) and it is defined as follows: When applying manual internal and external rotational stress, as well as anteroposterior and superior-inferior stress, palpation may reveal pelvic bone discomfort or hip dislocation, soreness, ecchymosis, hematoma and laceration, over the pelvic ring. Along with the parameters established by the lead study authors, the goal condition was regarded as a pelvic fracture resulting from blunt trauma that was identified by emergency physician based on CT scan or x-ray.

All research on the diagnostic yield of physical exams in the treatment of patients with blunt trauma in emergency rooms or trauma centres for the detection of pelvic fractures was included. Retrospective, prospective, and observational studies were among the research designs that qualified. Diagnostic case-control studies and case studies with incomplete physical examination accuracy data were omitted. Each study was individually examined by all authors to ensure eligibility before data extraction. Conflicts amongst reviewers were settled through dialogue. Figure 1 indicated the reasons full text publications were excluded. We looked through MEDLINE, Cochrane, and PubMed to find all relevant studies published in the period from 2009 to 2023.

We yielded 540 articles from the selected databases and after duplication removal 428 articles remained which undergone screening for title and abstract, and 355 were removed, leaving 73 full text articles which read by all authors to exclude ineligible studies. Finally, 6

studies were included in our review. Search was conducted without any limitations on language. We manually scanned the references of all qualified research to find further papers that could be relevant. The features of the study (year of publication, author, design, nation, clinical settings, sample size), the patient, and the factors pertaining to diagnostic accuracy were retrieved. All contributors gathered and organized data into Google Sheets and Google Documents.

3. RESULTS

The analysis comprised data from 40667 individuals. Two articles Lustenberger et al., (2016), Shlamovitz et al., (2009) were retrospective, while four Moosa et al., (2019), Van-Leent et al., (2019), Schweigkofler et al., (2018), Majidinejad et al., (2018) were prospective (Table 1). The majority of research were conducted at a university hospital's emergency room or trauma center. Patients with Glasgow Coma Scale (GCS) scores of ≥ 13 or lower were included in one study Moosa et al., (2019); patients with GCS scores of ≤ 13 were included in other studies. Inquiries regarding pelvic discomfort, pelvic inspection and palpation, pelvic stability evaluation, and other procedures were part of the physical examination. In an emergency department or trauma centre, physical examinations were conducted by emergency physicians. The reference standards were CT or x-ray Shlamovitz et al., (2009), Majidinejad et al., (2018), Schweigkofler et al., (2018), uncertain Lustenberger et al., (2016) x-ray (Moosa et al., 2019).

A radiologist Shlamovitz et al., (2009), Moosa et al., (2019) or an undisclosed expert Van-Leent et al., (2019), Lustenberger et al., (2016), Majidinejad et al., (2018), Schweigkofler et al., (2018) interpreted the results. Research on unstable pelvic fractures was conducted (Schweigkofler et al., 2018). According to Majidinejad et al., (2018), the absence of a pelvic fracture was detected with a 39.7% sensitivity and a 100% specificity in the clinical signs and symptoms. There was a significant difference in the other criteria, but there was no significant difference in the lack of a distracting injury, according to the results of the CT scan, X-ray, and symptoms criterion. The ability to activate Straight Leg Raise and the lack of pelvic soreness or tenderness had a substantial influence on the prediction of not having pelvic pain. Any distracting illness can be eliminated from the criteria without compromising specificity or raising sensitivity (Table 2).

Table 1 Characteristics of included studies

Citation	Country	Study setting	Year of publication	Number of participants	Men percentage	Study design
Moosa et al., 2019	Pakistan	Emergency	2019	133	68%	Prospective
Van-Leent et al., 2019	Netherlands	Trauma center	2019	54	-	Prospective
Schweigkofler et al., 2018	Germany	Trauma center	2017	147	66%	Prospective
Majidinejad et al., 2018	Iran	Emergency department	2018	3527	76%	Prospective
Lustenberger et al., 2016	Germany	Trauma registry	2016	35490	69%	Retrospective
Shlamovitz et al., 2009	USA	Trauma center	2009	1316	92%	Retrospective

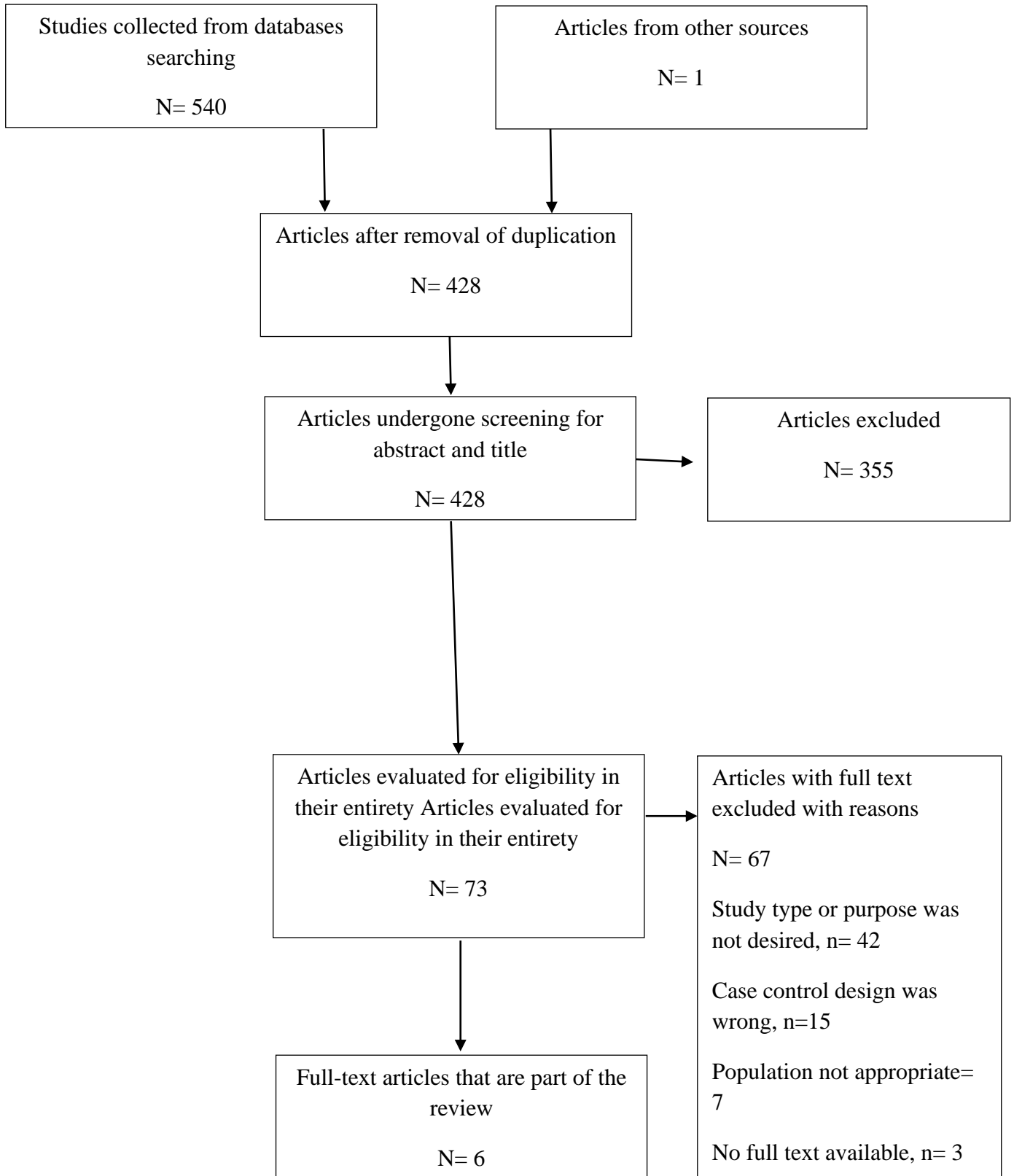


Figure 1 Selection of studies PRISMA consort chart

Table 2 Main results and conclusion of studies selected

Citation	Main results	Conclusion
Moosa et al., 2019	Fifty-two of the 133 patients were men. The average age of the group was 37. Ten percent of the patients had a pelvic X-ray and clinical examination result in a true positive for a pelvic fracture, whereas the other ten percent had a false negative. Two patients who had X-ray evidence of a fracture were overlooked by the clinical assessment and were deemed false positives. Furthermore, no fracture was seen on the X-ray or clinical examination, making 77.4% of the patient's genuine negatives.	Reducing undesired radiation exposure and avoiding needless financial strain are two benefits of skipping the pelvic X-ray in the suggested strategy.
Van-Leent et al., 2019	Of the 56 patients in the research, 11 had a pelvic ring fracture. Just five of the 13 patients who received pelvic compression devices suffered a pelvic ring fracture. doctors who conducted clinical examinations had a 0.45 overall sensitivity and a 0.93 specificity.	Based on the manual compression test, pelvic ring instability cannot be reliably detected in the prehospital context. Regardless of the manual compression test or trauma etiology, patients with high impact blunt trauma should always utilize a pelvic binder.
Schweigkofler et al., 2018	This research comprised 254 individuals from 12 different trauma centres who had suspected pelvic injuries. It was determined that 95 out of 254 cases—46 type B and 49 type C fractures—had unstable pelvic fractures. After 61% of the cases underwent mechanical stability testing, the results showed a sensitivity of 31.6% and a specificity of 92.2%. In fact, 11.5% of patients exhibited mechanical instability. Nevertheless, due to clinical judgment, noninvasive external stabilization was administered to 65.4% of patients before diagnostic imaging. In the ensuing CT scans, 72% had evidence of severe bleeding. 33 pelvic ring fractures were not stabilized before to hospitalization.	Testing the pelvic ring's mechanical stability was done less often than anticipated, and the results had less of an impact on real management. Based on the trauma mechanism or clinical results, it is beneficial to use a pelvic binder as soon as possible in order to lower the risk of major pelvic bleeding.
Majidinejad et al., 2018	Clinical signs and symptoms had a 100% specificity and a 39.7% sensitivity to the absence of a pelvic fracture. The findings of the X-ray and CT scan, as well as the clinical signs and symptoms criterion, did not show a significant difference in the absence of a distracting injury; on the other hand, there was a significant difference in the other criteria. The prediction of not experiencing pelvic pain was significantly impacted by the absence of pelvic discomfort or tenderness as well as the capacity to activate SLR. It is possible to exclude any distracting ailment from the criteria while maintaining specificity and increasing sensitivity.	Author's suggestive criteria strong predictive value suggests that it may be useful in distinguishing between individuals who may have pelvic fracture and those who do not. This method can lessen the need for imaging in these patients, which lowers health care costs, the risks associated with X-rays used for imaging, and the wear and tear on medical equipment.
Lustenberger et al., 2016	65.1% of the patients were diagnosed with a pelvic fracture at the time of hospital admission. Preclinical suspicion of a pelvic injury was absent in 44.1% of the patients with a	In the pre-hospital context, a sizable fraction of pelvic fractures types B and C were not detected.

	pelvic fracture. Type B and C pelvic fractures were not suspected in the pre-hospital setting in 40.5% and 32.3% of cases, respectively. GCS < 8 and age more than 60 were independent risk factors for failing to detect a pelvic injury in the pre-hospital context. The likelihood of overlooking a pelvic injury was reduced in the cases of hypotension and a high injury severity.	Consequently, regardless of the results of the physical assessment, a mechanical pelvic stabilization in the pre-hospital setting should be taken into consideration for patients with severe blunt trauma injuries.
Shlamovitz et al., 2009	Unstable pelvic ring physical examination findings showed a sensitivity and specificity of 8% and 99%, respectively, for identifying any pelvic fracture and 26% and 99.9%, respectively, for identifying pelvic fractures that were mechanically unstable. For pelvic fractures diagnosis in patients with a GCS >13, the sensitivity and specificity of pelvic pain or tenderness were 74% and 97%, respectively, and 100% and 93%, respectively, for unstable pelvic fractures diagnosis. For any pelvic fracture diagnosis, the sensitivity and specificity of pelvic deformity existence were 30% and 98%, respectively, but for the detection of pelvic fractures that were mechanically unstable, they were 55% and 97%, respectively.	In patients with blunt trauma, the appearance of unstable pelvic ring or a pelvic deformity during physical examination has a low sensitivity for identifying unstable pelvic fractures. According to this research, individuals who have had severe trauma and have a GCS of >13, as well as no pelvic pain or tenderness, are less likely to experience unstable pelvic fracture.

4. DISCUSSION

According to this comprehensive research, the range of pelvic fractures for which a physical examination is sensitive is 0.761–0.952. Additionally, compared to patients with decreased consciousness, trauma patients with GCS ≥ 13 had a sensitivity range of 0.847 to 0.998. The evidence quality was low overall, but increased when studies including individuals with reduced consciousness were eliminated. Regardless of the physical examination results, all trauma patients should have imaging tests done. Meanwhile, physical examination is a valuable screening tool, according to our review study. In general, the frequency of pelvic fractures and the patients' level of consciousness determine the clinical value of physical examinations. Whether a patient is conscious or not, imaging tests should always be ordered for trauma patients receiving care at a trauma centre or tertiary care centre. The clinical utility of a test is typically determined by its prevalence of the target condition, diagnostic accuracy, physician policy regarding associated risks, and patient and physician preference.

According to the findings of Van-Leent et al., (2019) study, patients who have had high-impact blunt trauma and have a strong suspicion of a pelvic ring fracture may find it challenging to rule out a pelvic fracture at the accident scene based solely on physical examination. Unlike the meta-analysis carried out by Sauerland et al., (2004) this investigation was carried out on the spot with patients who had hemodynamic or neurologic impairments. Surprisingly, study by Van-Leent et al., (2019) revealed that patients with neurologic impairment (GCS ≤ 13) had a higher manual compression test (MCT) sensitivity. Due to concurrent brain injuries or distracting injuries, collecting a patient's history might be challenging in polytraumatized individuals. Van-Leent et al., (2019) findings suggest that patients with neurologic deficits have more clouded pelvic ring clinical examinations, whereas patients with hemodynamic deficits had less obscured pelvic ring examinations.

Van-Leent et al., (2019) came to the conclusion that a pelvic fracture is not ruled out by a negative MCT. This supports the conclusion, which is consistent with the work of Yong et al., (2016) that pelvic binders ought to be the standard of therapy following high-energy blunt trauma regardless of MCT. The pelvic binder should be utilized with a low threshold, as verified by the MCT's limited accuracy and possible hazards (Van-Stigt et al., 2009). Most trials had an overall sensitivity of nearly 100% for identifying a pelvic fracture that was clinically significant and needed special care. Only 7 out of 97 pelvic fractures were missed on clinical examination in the study by Gonzalez et al., (2002) which evaluated a total of 2176 consecutive blunt trauma patients presenting with a GCS C 14; none of the missed fractures required surgical intervention (sensitivity, 0.93).

The overall sensitivity and specificity of a meta-analysis that evaluated the clinical examination's dependability in identifying pelvic fractures, pooling data from 12 trials with more than 5 thousand patients, were found to be 0.9, translating to a 10% false positive and false negative rate, respectively (Sauerland et al., 2004). In contrast to these results, a small number of other studies Grant, (1990), Shlamovitz et al., (2009) found lower sensitivities, ranging from 27 to 59%, for clinically identifying pelvic instability. Regarding the validity of the pre-hospital physical evaluation of the pelvis, our results support these findings.

5. CONCLUSION

The results of this review showed that, irrespective of the results of physical examinations or the patients' states of consciousness, imaging studies should be carried out for all patients with trauma. Clinicians should, however, take the prevalence of the target ailment into account when evaluating the value of a physical examination.

Ethical approval

Not applicable

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This study has not received any external funding.

Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

REFERENCES

1. ATLS Subcommittee; American College of Surgeons' Committee on Trauma; International ATLS working group. Advanced trauma life support (ATLS®): the ninth edition. *J Trauma Acute Care Surg* 2013; 74(5):1363-6. doi: 10.1097/TA.0b013e31828b82f5
2. Bonner TJ, Eardley WG, Newell N, Masouros S, Matthews JJ, Gibb I, Clasper JC. Accurate placement of a pelvic binder improves reduction of unstable fractures of the pelvic ring. *J Bone Joint Surg Br* 2011; 93(11):1524-8. doi: 10.1302/0301-620X.93B11.27023
3. Den-Boer TA, Geurts M, Van-Hulsteijn LT, Mubarak A, Slingerland J, Zwart B, Van-der-Heijden GJ, Blokhuis TJ. The value of clinical examination in diagnosing pelvic fractures in blunt trauma patients: a brief review. *Eur J Trauma Emerg Surg* 2011; 37(4):373-7. doi: 10.1007/s00068-011-0076-7
4. Gonzalez RP, Fried PQ, Bukhalo M. The utility of clinical examination in screening for pelvic fractures in blunt trauma. *J Am Coll Surg* 2002; 194(2):121-5. doi: 10.1016/s1072-7515(01)01153-x
5. Grant PT. The diagnosis of pelvic fractures by 'springing'. *Arch Emerg Med* 1990; 7(3):178-82. doi: 10.1136/emj.7.3.178
6. Lustenberger T, Walcher F, Lefering R, Schweigkofler U, Wyen H, Marzi I, Wutzler S; TraumaRegister DGU. The Reliability of the Pre-hospital Physical Examination of the Pelvis: A Retrospective, Multicenter Study. *World J Surg* 2016; 40(12):3073-3079. doi: 10.1007/s00268-016-3647-2
7. Majidinejad S, Heidari F, Kafi Kang H, Golshani K. Determination of Clinical Signs and Symptoms Predicting No Pelvic Fracture in Patients with Multiple Trauma. *Adv Biomed Res* 2018; 7:112. doi: 10.4103/abr.abr_127_17
8. McInnes MDF, Moher D, Thoms BD, McGrath TA, Bossuyt PM; and the PRISMA-DTA Group; Clifford T, Cohen JF, Deeks JJ, Gatsonis C, Hooft L, Hunt HA, Hyde CJ, Korevaar DA, Leeflang MMG, Macaskill P, Reitsma JB, Rodin R, Rutjes AWS, Salameh JP, Stevens A, Takwoingi Y, Tonelli M, Weeks L, Whiting P, Willis BH. Preferred Reporting Items for a Systematic Review and Meta-analysis of Diagnostic Test Accuracy Studies: The PRISMA-DTA Statement. *JAMA* 2018; 319(4):388-396. doi: 10.1001/jama.2017.19163
9. Moosa MA, Gill RC, Jangda I, Sayyed RH, Zafar H. Is pelvis x-ray essential in stable trauma patients? Step towards lowering the treatment cost. *J Pak Med Assoc* 2019; 69 (Suppl 1) (1):S33-S36.

10. Sauerland S, Bouillon B, Rixen D, Raum MR, Koy T, Neugebauer EA. The reliability of clinical examination in detecting pelvic fractures in blunt trauma patients: a meta-analysis. *Arch Orthop Trauma Surg* 2004; 124(2):123-8. doi: 10.1007/s00402-003-0631-8
11. Schweigkofler U, Wohlrath B, Trentsch H, Greipel J, Tamimi N, Hoffmann R, Wincheringer D. Diagnostics and early treatment in prehospital and emergency-room phase in suspicious pelvic ring fractures. *Eur J Trauma Emerg Surg* 2018; 44(5):747-752. doi: 10.1007/s00068-017-0860-0
12. Shlamovitz GZ, Mower WR, Bergman J, Chuang KR, Crisp J, Hardy D, Sargent M, Shroff SD, Snyder E, Morgan MT. How (un) useful is the pelvic ring stability examination in diagnosing mechanically unstable pelvic fractures in blunt trauma patients? *J Trauma* 2009; 66(3):815-20. doi: 10.1097/TA.0b013e31817c96e1
13. Spanjersberg WR, Knops SP, Schep NW, Van-Lieshout EM, Patka P, Schipper IB. Effectiveness and complications of pelvic circumferential compression devices in patients with unstable pelvic fractures: a systematic review of literature. *Injury* 2009; 40(10):1031-5. doi: 10.1016/j.injury.2009.06.164
14. Van-Leent EAP, Van-Wageningen B, Sir Ö, Hermans E, Biert J. Clinical Examination of the Pelvic Ring in the Prehospital Phase. *Air Med J* 2019; 38(4):294-297. doi: 10.1016/j.amj.2019.04.004
15. Van-Stigt SF, Tan EC, Van-Vugt AB. Acute behandeling van bekkenfracturen. *Ned Tijdschr Geneesk* 2009; 153:A500.
16. Van-Trigt J, Schep NWL, Peters RW, Goslings JC, Schepers T, Halm JA. Routine pelvic X-rays in asymptomatic hemodynamically stable blunt trauma patients: A meta-analysis. *Injury* 2018; 49(11):2024-2031. doi: 10.1016/j.injury.2018.09.009
17. Wohlrath B, Trentsch H, Hoffmann R, Kremer M, Schmidt-Horlohè K, Schweigkofler U. Präklinische und klinische Versorgung der instabilen Beckenverletzung: Ergebnisse einer Online-Umfrage [Preclinical and clinical treatment of instable pelvic injuries: Results of an online survey]. *Unfallchirurg* 2016; 119(9):755-62. German. doi: 10.1007/s00113-014-2679-z
18. Yong E, Vasireddy A, Pavitt A, Davies GE, Lockey DJ. Prehospital pelvic girdle injury: Improving diagnostic accuracy in a physician-led trauma service. *Injury* 2016; 47(2):383-8. doi: 10.1016/j.injury.2015.08.023