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Clinical Examination and its Sensitivity in Identifying pelvic Fractures

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Abstract: Introduction: Although pelvic fracture injuries are one of rare injuries; but pelvic fractures are among the most important challenge in caring for the injured patient in emergency room. Overall Traumatic injury is the leading cause of death worldwide among persons between 5 and 44 years of age and accounts one of three leading causes of mortality along with cancer and cardiovascular disease. we conducted this study to investigate the value of a pelvic radiography has additional value compared to clinical examination alone in diagnosing pelvic fractures in alert patients after blunt trauma to see whether in the emergency department.
Methods: This was a cross- sectional study conducted at the Imam Reza hospital in Tabriz, East Azerbaijan Province that is the main and important level I trauma center in North West of Iran. During a 6-month period; from October 2012 to January 2013; total of 641 patients with blunt trauma were refereed to Emergency Medical Services (EMS) of this hospital were identified and based on inclusion criteria; 80 patients (one third) were selected. Inclusions criteria's consist of patients with blunt trauma that estimate had pelvic fracture and were hemodynamically stable and alert [Glasgow Coma Scale (GCS) ≥ 13].
Results and conclusion:
From October 2012 through January 2013 about 648 patients with blunt trauma referred to Imam Reza hospital of which 80 patients (81%) were hemodynamically stable.
Sensitivity, Specificity, Positive predictive value and Negative predictive value of pelvic physical examination in detecting the Pelvic fracture in blunt trauma were 97.36%, 80.95%, 82.22% and 97.14%, respectively.
The final result of our study aligned with most previous studies and recommended, in alert patients following blunt trauma, with negative findings on clinical examination we can omitted standard pelvic radiographs

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1. Introduction

Although pelvic fracture injuries are one of rare injuries; but pelvic fractures are among the most important challenge in caring for the injured patient in emergency room. Overall Traumatic injury is the leading cause of death worldwide among persons between 5 and 44 years of age and accounts one of three leading causes of mortality along with cancer and cardiovascular disease. Generally, incidence of pelvic fractures in blunt trauma is between 3 % and 8.2 % of skeletal injuries as that range from the benign to life threatening and specially increasing with aging population. It is most commonly reported with high-energy fracture especially high-speed motor vehicle accidents in patients surviving these accidents (Pohlemann, 1996). Iran as one of developing country in Asia that rate of road accidents is twenty times more than the world's average. Mortality and morbidity rates of road traffic crashes are 28,000 and 300,000 annually; respectively (Updated, 2012).
Reviews of large trauma registries found that the incidence of pelvic ring fractures among admitted trauma patients to be 8 and 9.3 percent. The mortality of pelvic fracture with unstable pelvic ring injuries approximately estimated 30%; of which blood loss is cause 10-12% of this percentage alone (Shlamovitz, 2009).

Due to catastrophic outcomes and hemodynamic consequences with hip and pelvic fractures; therefore, according to Advanced Trauma Life Support (ATLS) guidelines, identification of a pelvic fracture in early stage are essential to reduce high morbidity and mortality. Delay in making proper diagnosis in patient's injuries in blunt pelvic trauma is one of the main and preventable reasons for trauma-caused mortality (Ham, 1996).

At present; in the emergency room, computed tomography as the gold standard, as the first step in examining alert [Glasgow Coma Scale (GCS) ≥ 13] adult blunt trauma patients is used , however additional costs and harmful radiation are associated with radiographs. Meanwhile, need to personnel and other resources, valuable time are another limitation to early detection of pelvic fractures (Yugueros, 1995).

There are also some reports which stated that relying on clinical examination that consists of the establishment of pelvic stability, as a replacement for imaging tools result in a correct diagnosis. To assess abnormal movement and pain manual compression of the iliac crests is performed. Thus; there is a growing amount of evidence that, in the awake and alert blunt trauma patient, use of radiography in selected cases as a guide to be more confident. Several studies have shown that pelvic X-ray has not additional diagnostic value for the detection of pelvic fractures ,thus use of clinical examination alone can replace imaging evaluation and can reliably rule out significant pelvic fracture. While it is clear that in hemodynamically unstable patients will benefit from imaging such as pelvic X-ray, but it is typically not clear exactly sensitivity and specificity of the clinical examination in detecting fractures of the pelvis. There is a challenge in pelvic fracture diagnostic to rapidly diagnose unstable fractures and stabilize hemodynamically unstable patients; so we conducted this study to investigate the value of a pelvic radiography has additional value compared to clinical examination alone in diagnosing pelvic fractures in alert patients after blunt trauma to see whether in the emergency department. If pelvic X-ray not be performed in the patient with negative in clinical examination, the expenditure of time, costs, and radiation are optimized.

2. Material and Methods

This was a cross- sectional study conducted at the Imam Reza hospital in Tabriz, East Azerbaijan Province that is the main and important level I trauma center in North West of Iran. During a 6-month period; from October 2012 to January 2013; total of 641 patients with blunt trauma were refereed to Emergency Medical Services (EMS) of this hospital were identified and based on inclusion criteria; 80 patients (one third) were selected. Inclusions criteria's consist of patients with blunt trauma that estimate had pelvic fracture and were hemodynamically stable and alert [Glasgow Coma Scale (GCS) ≥ 13]. If patient were pregnant, younger than 18 years or with known skeletal disease were excluded. All the participants gave informed consent. The study protocol was approved by the Institutional Review Board of the medical university of Tabriz and local ethics committees. All patients included in the study were evaluated in terms of age; sex; chief concern on arrival in the emergency department and reported findings on plain x-film.

The physical examination commonly reveals an abducted and externally rotated hip with leg-length discrepancy in patients with severe hip pain, and was unable to walk. The patient usually has localized tenderness over the hip and limited range of motion of the affected limb during attempts at passive and active rotation and flexion.

Diagnosis of hip fracture established thorough antero posterior (AP) and a lateral view of the symptomatic hip. Plain film hip radiographs that were ordered at the discretion by the treating physician; were readings were by a board-certified radiologist. All radiographs of patients were reviewed by other radiologist who had more than25years of experience and was blinded to the results of each radiographic and clinical examination but not to the purpose of the study.

The standard trauma radiographs antero posterior (AP) view and a lateral view of the pelvis.

Sensitivity and specificity were computed for each rating threshold by use of simple proportions. The potential benefit of using pelvic X-ray compared to clinical examination in diagnosing pelvic ring fractures assessed using these measures: sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and the likelihood ratio as a measure of a test result's ability to modify pretest was used. A two-sided $p \leq 0.05$ was considered statistically significant and Ninety-five percent confidence intervals (CIs) were calculated as appropriate. Data collected from the results were analyzed and evaluations were performed using SPSS version16 and Microsoft Excel software.

3. Results

From October 2012 through January 2013 about 648 patients with blunt trauma referred to Imam Reza hospital of which 80 patients (81%) were hemodynamically stable. Patients were evaluated with respect to age, sex, signs and symptoms and diagnostic procedures. Eighty patients consisted of 61 male [76.25%] and 19 [23.75%] female. The mean

age of patients was 32.7 years (19-78). The majority patients were 22 to 28 years old(Table 1) Forty two, patients (52.5%) were involved in a high-speed car crash, ten (12.5%) were pedestrians involved in high-impact motor vehicle collisions, and 28 (35%) fell from a height of more than 4.5 m.

Table 1. Distribution of patients by age and sex

sex \ age	18-30	30-50	50-70	Up 70
Male(61)	22	15	14	10
Female(19)	8	6	3	2

The total 80 patients with pelvic blunt trauma fulfilled the criteria for inclusion for our study underwent at least one pelvic radiography and 38 had pelvic fractures identified on pelvic radiography that named fracture group and others no fracture group. In comparison both groups; majority of both groups sustained injuries after a motor vehicle crash (73% fracture group vs. 77.6% no fracture group, P>0.05). Most patients were native (52% fracture group vs. 58.7% no fracture group P>0.05) and male (77.3% fracture group vs. 73.4% no fracture group P>0.05). They were also similar in age (22.5 _ 34.6 years, fracture group vs. 19.8-36.5 years, no fracture group P>0.05).As seen in this comparison there was not any statistical different between two groups.(P value>0.05).

In clinical examination that have been done by the treating physician that were blinded to imaging results; 45 patients (56.25%) had positive variables that we were considered as predictive of pelvic fracture in Table 1 with clinical examination and thirty five (22.75%) without these predictors . In 8 patients (17.77%) with tenderness in hip, there was no pelvic fracture in imaging .Most often a fall for the elderly patients and a motor vehicle collision in those patients younger than 35 years.

Based on our study factors that were predictive of pelvic fracture are shown on Table 2 :
We evaluated 80 blunt trauma patients, 38(47.5%) of whom were diagnosed with pelvic fracture. There was 1 missed injury (false negative) on clinical examination (sensitivity 97.36% CI 92.4–100%).). The one fracture that missed by physical examination were described that whom had unilateral superior ramus and non-displaced iliac fractures.
None of the missed injuries on clinical examination required surgical. The x -ray result was positive in 38 patients, of which 37 were true positive and 1 were false positive Results of pelvic x-ray and clinical examination in our patients are shown in Table3

Table2. Factors that was predictive of pelvic fracture

Variable	OR	CI
Hip tenderness	1.025	1.011-1.039
Sever Hip pain	4.971	2.508-9.854
Internal rotation of the leg	4.880	1.980-12.027
Tenderness to palpation over the sacrum	2.297	1.144-4.612
Over the right or left hip	3.626	1.823-7.214
Diffusely throughout the pelvis	16.445	4.277-63.237

Table 3. Sensitivity of pelvic physical examination in detecting the Pelvic fracture in blunt trauma

Parameter	Data	%
Sensitivity	37 of 38	97.36
Specificity	34 of 42	80.95
Positive predictive value	37of 45	82.22
Negative predictive value	34 of 35	97.14

4. Discussion

Our aims of our study were minimizing health care costs with elimination of unnecessary resource utilization and maximize efficiency with safely evaluated clinically. Although Routine protocol for ATLS had emphasized to using pelvic radiographs as a reference test to diagnosis pelvic fracture in blunt trauma; but some recent studies have shown that; in negative clinical examination, pelvic X-ray will have no additional value thus pelvic imaging can be omitted in alert patients following blunt trauma. The value of imaging diagnosis in patients with blunt pelvic trauma has been proven, but time consuming of imaging causing that it could not be used as a screening method in all patients with blunt trauma.
The results of other studies conducted about value of clinical examination in pelvic fracture blunt are comparable with our study.

Duane et al in September 2001, prospectively compared clinical examination to plain radiographs, and both modalities to CT scanning in patients older than 16 years with blunt trauma In the cohort of patients with a GCS > 13, clinical examination was associated with a PPV of 0.18 (95% CI 0.16–0.23) and an NPV of 0.99 (95% CI 0.98–1.0). All fractures identified by pelvic X-ray were identified by clinical examination as well (sensitivity 100%). Because of the lack of a separate analysis for pelvic X-ray in patients with GCS > 13, it was not possible to calculate the added value of pelvic X-ray compared to clinical examination solely in this report. They

concluded that one could predict the absence of pelvic fractures in awake and alert blunt trauma patients with normal hemodynamic and laboratory findings (Duane, 2001).

Gonzalez et al reported a prospective study of blunt trauma patients and evaluated 2,176 consecutive patients with a GCS > 13 after a blunt trauma, their results demonstrated a PPV of 0.35 (95% CI 0.30–0.42) and an NPV of 1.0 (95% CI 0.99–1.0) for clinical examination, while the likelihood ratio for the positive and negative clinical examination were 11.7 (95% CI 10–14) and 0.08 (95% CI 0.04–0.16), respectively., evaluating sensitivity of 93%; of clinical examination as a screening tool for pelvic fractures(Gonzalez, 2002).

Koury et al in 1993, was initiated to investigate the need for routine pelvic roentgenograms for all blunt trauma victims. Over a 2-year period, they prospectively studied patients referred to the trauma service in the level I trauma center at our institution who met the inclusion criteria.
The patients were evaluated by physical examination and, if mentally alert and reliable, were included in the study.
After inclusion into the study, a routine pelvic roentgenogram was performed to substantiate the results of physical examination.
All 125 patients included in the study were found to have normal results on pelvic roentgenograms. They conclude that alert, oriented and reliable patients involved in blunt trauma do not need a routine pelvic roentgenogram if the findings on physical examination are negative. Positive physical findings included pain with palpation or compression of the pelvic girdle, sacroiliac or lower lumbar areas, or pain with hip movement(Koury, 1993).
Gillott et al at 1988conducted study to assess the utility of a routine pelvic X-ray in resuscitation of blunt trauma patients, 669 patients were studied prospectively over a 2-year period.
One hundred twelve patients (16.7%) had positive pelvic X-rays (PPX). They compared with the negative pelvic X-ray group (NPX), the PPX group had a significantly higher mean Injury Severity Score, 24-hour mean requirement for blood and component therapy, and higher incidence of associated injury of chest and abdomen. Despite the higher injury parameters, the mortality between the groups was not significantly different. When compared with five standard resuscitative assessment variables, a pelvic X-ray performed as an additional predictor of injury severity and 24-hour blood requirement.

A pelvic X-ray should be performed routinely in victims of blunt trauma as part of the early resuscitation X-ray protocol since a positive finding has immediate prognostic and therapeutic implications. They recommended pelvic X-ray should be performed routinely in blunt trauma patients as part of the early resuscitation, because a positive finding has immediate prognostic and therapeutic implications (Gillott, 1988).
We had not found any significant differences between the results obtained in this study and those of other studies; the specificity for imaging in our study, however, was lower than other studies.
This difference can be attributed to false positive cases. The sensitivity obtained in our study is similar to the sensitivity reported in most previous studies.
Our study had some limitations. First, this study was cross sectional study with all the biases and limitations of such a design. Workup bias was one of biases that have been present in our sample to mitigation this bias we had been evaluated all adults with blunt trauma suspected pelvic fractures regardless of trauma history and age.
Second, subdividing the study sample into fracture and no fracture groups might have added to the selection bias; and finally, although imaging protocols that were performed and radiographs requested varied among the patients; but imaging studies were not standardized based on protocol of these study we had been attempted to minimizing these limitation but, due to limitation the design of study and sample size of our study ; more rigorous trials comparing clinical examination and imaging evaluation with larger patient sample and from a variety of emergency departments should be performed to detection pelvic fracture in blunt trauma to express validate results that had generalizible to other context.

Conclusion:

The final result of our study aligned with most previous studies and recommended, in alert patients following blunt trauma, with negative findings on clinical examination we can omitted standard pelvic radiographs. We shown there finding as flowchart in figure 1.

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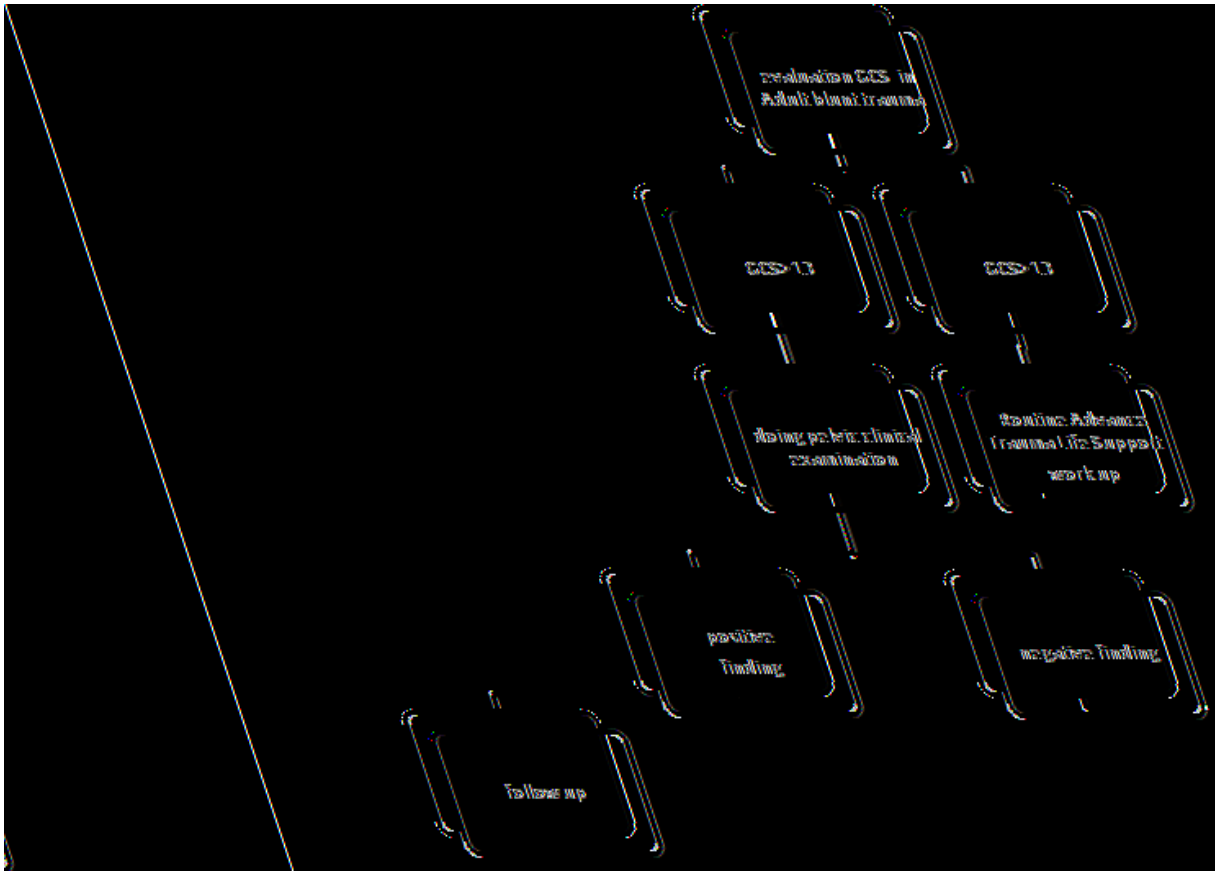

Fig. 1: Flowchart to identifying pelvic fracture in blunt alert trauma patients in emergency department

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