

## Assessing the Pelvic X-ray Findings of High-energy Multiple Trauma Patients in Emergency Department of Rajae Trauma Hospital, Shiraz-October 2013 to May 2014

Mahsa Akhavan<sup>1</sup>, Amir Reza Mesbahi<sup>2</sup>, Mahsa Mohammadian<sup>1</sup>, Alireza Shakibafard<sup>3</sup>, Mahnaz Yadollahi<sup>4</sup>, Zahra Ghahramani<sup>4\*</sup>, Shahram Paydar<sup>4</sup>

<sup>1</sup>General Practitioner, Shiraz University of Medical Sciences, Shiraz, Iran

<sup>2</sup>Department of Orthopedics, Shiraz University of Medical Sciences, Shiraz, Iran

<sup>3</sup>Department of Radiology, Shiraz University of Medical Sciences, Shiraz, Iran

<sup>4</sup>Trauma Research Center, Shahid Rajae (Emtiaz) Trauma Hospital, Shiraz University of Medical Sciences, Shiraz, Iran

\*Corresponding author: Zahra Ghahramani, Trauma Research Center, Shahid Rajae Trauma Hospital, Shiraz University of Medical Sciences, Shiraz, Iran. Tel: +987136360697; Fax: +987136254206; Email: ghahreman2@yahoo.co.nz

**Citation:** Akhavan M, Mesbahi AR, Mohammadian M, Shakibafard A, Yadollahi M, et al. (2017) Assessing the Pelvic X-ray Findings of High-energy Multiple Trauma Patients in Emergency Department of Rajae Trauma Hospital, Shiraz-October 2013 to May 2014. Emerg Med Inves: EMIG-156. DOI: 10.29011/2475-5605.000056

**Received Date:** 5 August, 2017; **Accepted Date:** 2 October, 2017; **Published Date:** 9 October, 2017

### Abstract

**Background:** Because of the significance of pelvic fracture, anteroposterior pelvic X-ray (PXR) is routinely performed for all patients referring to the emergency department with multiple trauma. But routine performance of PXR may have several complications and might not be necessary in all cases. Thus, we performed PXR selectively for patients.

**Objectives:** We aimed to assess the PXR findings in traumatized patients referring to emergency department of Rajae Trauma Hospital, a level 1 triage center, by reviewing PXR findings of multiple trauma patients.

**Methods:** This prospective study was conducted in Rajae Trauma hospital of Shiraz, the level one Trauma center in south of Iran during October 2013 to May 2014. Shiraz is the center of Fars Province with the population of 2 million and 5 million for the province. Four-hundred traumatic patients were recruited for the study. PXR was performed for selected patients according to the criteria of Rajae Trauma Hospital. Demographic data, including age, sex, type of accident, and type of hip fracture was recorded.

**Results:** Most patients (80%) were men with a mean±SD age of 36.1(17.5) years. The most frequent pelvic fractures were left superior and inferior pubic ramus (12.8 and 12.5%) followed by right inferior pubic ramus fracture (10.5%). The most frequent causes of injury included car turnover and car to pedestrian accident. Chi-square test revealed significant difference between men and women in motor to car accident, car to pedestrian accident, and car to car accident groups ( $P=0.02$ , 0.001 and 0.004, respectively).

**Conclusion:** PXR is an appropriate diagnostic tool for pelvic fractures and is most proper to be selectively performed in patients with the criteria mentioned in the current study and more attention should be paid to superior and inferior pubic ramus fractures, as it was found to be the most frequent fractures observed in the present study.

**Keywords:** Emergency; Hospital; Multiple Trauma; Patients; Pelvic X-Ray; Radiography

## Introduction

Trauma is a leading cause of mortality and morbidity, especially in developing countries, such as Iran. The pelvis is commonly injured due to the high impact of blunt trauma such as motor vehicle accident or a pedestrian being hit by a car. Pelvic fracture present approximately 3% of selected injuries [1], overall mortality ranges from 5-16% with the rate for unstable pelvic fracture of 8% [2]. Hemorrhage is the leading cause of death in patients with pelvic fracture [3]. Thus, early and proper diagnosis and management are necessary for patients' survival.

Several radiographies, like cervical spine and thoracolumbar radiography [4,5] have been suggested for blunt high-energy traumatic patients. Pelvic fracture, on the other hand, is a life-threatening issue in patients with multiple trauma, because of masked massive hemorrhage [6]. The predictive value of pelvic physical examination has been reported to be different in various studies [7-9]. Thus, Advanced Trauma Life Support (ATLS) has suggested anteroposterior Pelvic X-Ray (PXR) for all patients referring to the emergency department with multiple trauma [10]. This importance is emphasized by ATLS as adjuvant to primary survey. The reason for ATLS's emphasis on pelvic x-ray is the knowledge of pelvic fracture and is not often based solely on clinical findings, it is possible by pelvic X-ray. Knowing the pelvic fracture makes a lot of change in patient's management. Since then, all physicians follow this algorithm as a routine, as it is also an additional predictor of injury severity and 24-hour blood requirement [11] and has been strongly suggested for hemodynamically unstable or unconscious patients [12-14].

Yet, radiography has a high radiation rate [15] and avoiding routine PXR, especially in awake patients with no pain and normal physical examination reduces its costs and complications [9,16,17]. Conversely, studies have reported low sensitivity of PXR as low as 60% [3,7,17-19], although its low diagnostic value might be improved by training emergency department physicians [20], some have suggested other imaging methods, such as CT scan and MRI [21], in severely injured multiple trauma patients [22], but it also have a high radiation dose, higher cost, and complications, especially as most traumatic patients are young individuals [23] and they need special devices that may not be available in all centers, especially in developing countries, like Iran. Regarding several controversies about PXR in traumatic patients, this study aimed to assess the PXR findings in traumatic patients referring to emer-

gency department of Rajaei Trauma hospital, a level 1 crowded emergency department in Shiraz, Iran.

## Materials and Methods

In this prospective study, Four-hundred traumatic patients were recruited for the study referring to level 1 triage center of Rajaei Trauma Hospital, Shiraz, Iran, with the population of 2 million from October 2013 to May 2013 were recruited. The research protocol was approved by the Ethics Committee of the center. Recruiting patients into the study was based on convenient sampling. Informed written consent for participation in research was obtained from all patients. Demographic data, including age, gender, type of accident, and type of hip fracture was recorded in a checklist. A detailed history was taken from all patients and meticulous physical examination was performed for all of them by the emergency medicine specialist. PXR was performed for selected patients according to Rajaei Hospital's guideline, including decreased level of consciousness (GCS<13); hip pain; tenderness on compression of the iliac wings, on bilateral inversion and eversion of the anterior superior iliac spine, or in hip flexion, internal or external rotation of the hip; pubic symphysis tenderness; confounding pain in the posterior midline of the lumbar spine (indicator of the possibility of fracture); presence of limb length inequalities; unrevealing or unreliable pelvic physical examination for any reason [24]. All images were reported accurately by a unique radiologist.

## Statistical Analysis

Categorical variables were described by numbers and percentages, whereas mean  $\pm$  standard deviation was used to describe continuous variables. Data were analyzed using Chi-square or Fisher's exact test to assess the relationships between categorical variables and statistical analysis was performed using SPSS 18.0 software. P-value less than 0.05 was considered significant.

## Results

During the study period, considering the inclusion/exclusion criteria, 402 patients referred to the level 1 triage center of Rajaei trauma hospital with high-energy blunt trauma and the data of 400 cases were analyzed, as two patients did not give consent to participate in the study. Data showed that the mean age of patients was  $36.1 \pm 17.5$  (range: 14-90), with 81.5% under 50 years. The majority of patients, 320 (80%), were also male. The most frequent causes of injury included 55.6% motor vehicle accidents with the highest frequency in car turnover and car-to-pedestrian accidents (both 17%) (Table 1).

Injury cause	Total N (%)	sex	N (%)	P-value
Gun Shot	7 (1.8%)	Male	6 (1.9%)	>0.99
		Female	1 (1.3%)	
Car-to-Car Accident	44 (11%)	Male	29 (9.1%)	0.02
		Female	15 (18.8%)	
Car-to-Pedestrian Accident	68 (17%)	Male	44 (13.8%)	0.001
		Female	24 (30%)	
Motor-to-Car Accident	65 (16.3%)	Male	61 (19.3%)	0.004
		Female	4 (5%)	
Motor-to-Motor Accident	16 (4%)	Male	15 (4.7%)	0.28
		Female	1 (1.3%)	
Motor-to-Pedestrian Accident	14 (3.5%)	Male	9 (2.8%)	0.27
		Female	5 (6.8%)	
Car Turnover	68 (17%)	Male	53 (16.6%)	0.76
		Female	15 (18.8%)	
Motor Turnover	29 (7.3%)	Male	26 (8.1%)	0.27
		Female	3 (3.8%)	
Falling	51 (12.8%)	Male	40 (12.5%)	0.91
		Female	11 (13.8%)	
Stab Wound	16 (4%)	Male	16 (5%)	0.08
		Female	0 (0%)	
Assault Trauma	12 (3%)	Male	11 (3.4%)	0.47
		Female	1 (1.3%)	
Blunt Trauma	10 (3.1%)	Male	10 (3.1%)	0.22
		Female	0 (0%)	

**Table 1:** Injury Cause of the Studied Patients According to Gender.

Chi-square test also revealed a significant association between patients' gender and some types of accidents: Motor-to-car and car-to-pedestrian accidents were significantly higher in female patients ( $P=0.02$  and  $0.001$ ) and car-to-car accidents were significantly higher in male patients ( $P=0.004$ ) (Table 1).

The most frequent pelvic fractures were left superior and inferior pubic ramus (12.8 and 12.5%) followed by right inferior pubic ramus fracture (10.5%) (Table 2).

Fracture type	N (%)
RIGHT iliac Bone Fx	21 (5.3%)
LEFT iliac Bone Fx	23 (5.8%)
RIGHT Sup Pubic Ramus Fx	34 (8.5%)
LEFT Sup Pubic Ramus Fx	51 (12.8%)
RIGHT Inf Pubic Ramus Fx	42 (10.5%)
LEFT Inf Pubic Ramus Fx	50 (12.5%)
RIGHT Sacral Bone Fx	11 (2.8%)
LEFT Sacral Bone Fx	24 (6%)

RIGHT Ischial Bone Fx	5 (1.3%)
LEFT Ischial Bone Fx	12 (3%)
RIGHT Acetabulum Fx	15 (3.8%)
LEFT Acetabulum Fx	21 (5.3%)
RIGHT Hip Joint Abnormality Fx	3 (0.8%)
LEFT Hip Joint Abnormality Fx	5 (1.3%)
RIGHT Femoral Neck Fx	1 (0.3%)
LEFT Femoral Neck Fx	5 (1.3%)
RIGHT Greater Trochanter Fx	4 (1%)
LEFT Greater Trochanter Fx	3 (0.8%)
RIGHT Lesser Trochanter Fx	3 (0.8%)
LEFT Lesser Trochanter Fx	2 (0.5%)
RIGHT Diastasis of Sacroiliac Joint	13 (3.3%)
LEFT Diastasis of Sacroiliac Joint	11 (2.8%)
Diastasis of Symphysis Pubis	25 (6.3%)

**Table 2:** Frequency of Different Fracture Types in the Studied Patients.

## Discussion

Trauma is a major cause of morbidity and mortality and paying attention to different aspects of trauma care is an important health matter, as pelvic fracture causes fatal internal bleeding and the majority of affected patients are male young patients. Therefore, the choice of imaging method is very important for early diagnosis with minor adverse effects and complications.

Al Balushi et al., [25] compared the incidence of pelvic fracture diagnosed by pelvic X-ray and computed tomography to evaluate the need of pelvic X-ray in the management of haemodynamically stable polytrauma patients and found that computed tomography is a superior in detecting pelvic femoral and lumbar fractures. Study of Gordic et al., [26] determined the number of imaging examinations in multiple trauma patients and showed that CT examinations are needed.

In our study, we performed PXR selectively for the traumatic patients with the indicated inclusion criteria according to Rajaee Hospital's guideline and have concluded that precise history taking and physical examination is very important to select patients who require PXR in emergency room. Although some studies suggest performing PXR routinely for all traumatic patients [11], it will expose them to unnecessary radiation and as far as the patients usually suffer from multiple trauma, they mostly require a series of radiographies for neck, chest, and other imaging. Besides, the traumatic patients are mostly young and it is thus unethical to expose a young patient to unnecessary radiation that disposes them to cancer and other important complications of over-radiation. Moreover, it is not cost effective to perform PXR for all traumatic patients entering the emergency. Therefore, it is optimal to perform PXR in selective patients.

The results of the present study showed that the mentioned criteria for selecting patients for PXR, which was similar to other studies. A recent study conducted by Paydar et al. [25] prospectively evaluated 1002 blunt trauma Iranian patients and have concluded sufficiency of radiographic imaging in stable patients with normal physical examination that will reduce the excessive cost and radiation. Duane and colleagues have compared the radiologic findings of 520 traumatic patients with positive physical examination with 1441 controls and have reported that all pelvic fractures were identified by history and physical examination and suggested that elimination of PXR in awake and alert patients saves a large amount of costs and have proposed the protocol that PXR should only be performed in severely injured patients [17]. Yugueros and colleagues have also assessed 608 hemodynamic stable patients and found that 9.7% of patients had pelvic fractures and have proposed cost-effectiveness of the selective use of PXR [16]. Gonzales et al., [27] have reported 4.5% pelvic fractures in blunt trauma patients and have reported 87% sensitivity for PXR. They have

clearly concluded that routine PXR will not increase its diagnostic sensitivity and have suggested PXR in patients with positive physical examination as a reliable diagnostic tool to rule out pelvic fractures. The protocol for selective PXR in the above-mentioned studies were all similar to the protocol of the current study (pelvic pain, pelvic girdletenderness, pelvic deformities, limb inequalities and signs of bleeding in rectal examination) and the results obtained were also similar to ours. Besides, the higher rate presented in the current study reflects the fact that we have only performed PXR selectively for patients with the above-mentioned criteria.

Other studies have reported necessity and indication of PXR in comparison to CT imaging. Paydar study [28] retrospectively investigated routine performance of PXR in 1679 high-energy blunt trauma Iranian patients with negative pelvic physical examination and have concluded that elimination of PXR in awake and hemodynamically stable patients would not change the therapeutic approach and will save healthcare resources. They have also questioned the necessity of CT scan in such patients, especially due to its high cost and radiation, its unavailability in all centers, and long duration of imaging time. Hilty et al., [18] also suggested that routine PXR can safely be removed in hemodynamically stable patients, although they have reported low predictive value of PXR, compared to CT scan. Guillaumondegui et al., [29] have suggested limitation of PXR to unstable patients. The above-mentioned studies also confirms that PXR can be safely performed for selective patients, as performed in the protocol of our study.

Some other studies have compared the false negative rates for PXR compared to other imaging methods, such as CT scan and MRI [12,18,29,30]. Also they have reported that around 10-30% of fractures are not defined by plain radiography, some other researchers have declared that CT scan would not change the management [31] and have thus reported PXR sufficient. Moreover, using CT scan and MRI is not practical in emergency cases, especially in developing countries, where the devices are not available everywhere and imposes a higher cost to the patients and health system.

The strengthening point of our study was assessing all causes of injury and fractures in patients, which has been scarcely studied in Iran. We also tried to exclude confounding factors in our assessment, to be able to evaluate the PXR findings in multiple trauma patients. Yet, the study would have been more thorough, when we considered other socio-economic, psychologic, and other demographic details of the patients and compare the results of radiographies with CT scans. We also did not have the choice to follow the patients, to observe if they required repeating the imaging or what further interventions they needed. Future studies are needed to give the emergency medicine specialists a better view in diagnosis and management of multiple traumatic patients.



## Conclusion

The results of the current study, in accordance to previous studies, suggest that PXR is an appropriate diagnostic tool for pelvic fractures and is most proper to be selectively performed in patients with the criteria mentioned in the current study and more attention should be paid to superior and inferior pubic ramus fractures, as it was found to be the most frequent fractures observed in the present study.

**Conflict of Interest:** None declared.

## References

- Grotz MR, Allami MK, Harwood P, Pape HC, Krettek C, et al. (2005) Open pelvic fractures: epidemiology, current concepts of management and outcome. *Injury* 36: 1-13.
- Yoshihara H, Yoneoka D (2014) Demographic epidemiology of unstable pelvic fracture in the United States from 2000 to 2009: trends and in-hospital mortality. *J Trauma Acute Care Surg* 76: 380-385.
- Their ME, Bensch FV, Koskinen SK, Handolin L, Kiuru MJ (2005) Diagnostic value of pelvic radiography in the initial trauma series in blunt trauma. *Eur Radiol* 15: 1533-1537.
- Ghaffarpasand F, Paydar S, Foroughi M, Saberi A, Abbasi H, et al. (2011) Role of cervical spine radiography in the initial evaluation of stable high-energy blunt trauma patients. *Journal of Orthopaedic Science* 16: 498-502.
- Hsu JM, Joseph T, Ellis AM (2003) Thoracolumbar fracture in blunt trauma patients: guidelines for diagnosis and imaging. *Injury* 34: 426-433.
- Moreno C, Moore EE, Rosenberger A, Cleveland HC (1986) Hemorrhage associated with major pelvic fracture: a multispecialty challenge. *Journal of Trauma and Acute Care Surgery* 26: 987-994.
- Kessel B, Sevi R, Jeroukhimov I, Kalganov A, Khashan T, et al. (2007) Is routine portable pelvic X-ray in stable multiple trauma patients always justified in a high technology era? *Injury* 38: 559-563.
- Pehle B, Nast-Kolb D, Oberbeck R, Waydhas C, Ruchholtz S (2003) Significance of physical examination and radiography of the pelvis during treatment in the shock emergency room]. *Der Unfallchirurg* 106: 642-648.
- Salvino CK, Esposito TJ, Smith D, Dries D, Marshall W, et al. (1992) Routine Pelvic X-Ray Studies In Awake Blunt Trauma Patients: A Sensible Policy? *Journal of Trauma and Acute Care Surgery* 33: 413-416.
- Surgeons ACo (1993) Committee on Trauma, Abdominal Trauma, Advanced Trauma Life Support Program. Chicago, IL: American College of Surgeons: 141-155.
- Gillott A, Rhodes M, Lucke J (1988) Utility of routine pelvic X-ray during blunt trauma resuscitation. *Journal of Trauma and Acute Care Surgery* 28: 1570-1574.
- Obaid AK, Barleben A, Porral D, Lush S, Cinat M (2006) Utility of plain film pelvic radiographs in blunt trauma patients in the emergency department. *The American Surgeon* 72: 951-954.
- Civil ID, Ross SE, Botehlo G, Schwab CW (1988) Routine pelvic radiography in severe blunt trauma: is it necessary? *Annals of emergency medicine* 17: 488-490.
- Ersoy G, KARCIOGLU Ö, Enginbas Y, User N (1995) Should all patients with blunt trauma undergo routine pelvic X-ray? *European Journal of Emergency Medicine* 2: 65-68.
- Jurik AG, Jensen L, Hansen J (1996) Total effective radiation dose from spiral CT and conventional radiography of the pelvis with regard to fracture classification. *Acta Radiologica* 37: 651-654.
- Yugueros P, Sarmiento JM, Garcia AF, Ferrada R (1995) Unnecessary use of pelvic x-ray in blunt trauma. *Journal of Trauma and Acute Care Surgery* 39: 722-725.
- Duane TM, Tan BB, Golay D, Cole Jr FJ, Weireter Jr LJ, et al. (2002) Blunt trauma and the role of routine pelvic radiographs: a prospective analysis. *Journal of Trauma and Acute Care Surgery* 53: 463-468.
- Hilty MP, Behrendt I, Benneker LM, Martinoli L, Stoupis C, et al. (2008) Pelvic radiography in ATLS algorithms: A diminishing role? *World Journal of Emergency Surgery* 3: 11.
- Kirby MW, Spritzer C (2010) Radiographic detection of hip and pelvic fractures in the emergency department. *American Journal of Roentgenology* 194: 1054-1060.
- Wei C-J, Tsai W-C, Tiu C-M, Wu H-T, Chiou H-J, et al. (2006) Systematic analysis of missed extremity fractures in emergency radiology. *Acta Radiologica* 47: 710-717.
- Sauser DD, Billimoria PE, Rouse GA, Mudge K (1980) CT evaluation of hip trauma. *American Journal of Roentgenology* 135: 269-274.
- Herzog C, Ahle H, Mack M, Maier B, Schwarz W, et al. (2004) Traumatic injuries of the pelvis and thoracic and lumbar spine: does thin-slice multidetector-row CT increase diagnostic accuracy? *European radiology* 14: 1751-1760.
- Kalra MK, Rizzo SM, Novelline RA (2005) Reducing radiation dose in emergency computed tomography with automatic exposure control techniques. *Emergency radiology* 11: 267-274.
- Paydar S, Ahmadi A, Dalfardi B, Shakibafard A, Abbasi H, et al. (2014) Clinical and economic effects of selective radiological evaluation of high-energy trauma patients: a prospective experience of a level 1 busy trauma centre. *Emergency Medicine Journal*. emmed 204083.
- Al Balushi AA, Malik KA (2015) Role of pelvic X-ray in blunt trauma patients -- A university hospital experience in Oman. *J Pak Med Assoc* 65: 910-912.
- Gordic S, Alkadhi H, Hodel S, Simmen HP, Brueesch M, et al. (2015) Whole-body CT-based imaging algorithm for multiple trauma patients: radiation dose and time to diagnosis. *Br J Radiol* 88: 20140616.
- Gonzalez RP, Fried PQ, Bukhalo M (2002) The utility of clinical examination in screening for pelvic fractures in blunt trauma. *Journal of the American College of Surgeons* 194: 121-125.
- Paydar S, Ghaffarpasand F, Foroughi M, Saberi A, Dehghankhalili M, et al. (2013) Role of routine pelvic radiography in initial evaluation of stable, high-energy, blunt trauma patients. *Emergency Medicine Journal* 30: 724-727.

**Citation:** Akhavan M, Mesbahi AR, Mohammadian M, Shakibafard A, Yadollahi M, et al. (2017) Assessing the Pelvic X-ray Findings of High-energy Multiple Trauma Patients in Emergency Department of Rajae Trauma Hospital, Shiraz-October 2013 to May 2014. *Emerg Med Inves*: EMIG-156.

---

29. Guillaumondegui OD, Pryor JP, Gracias VH, Gupta R, Reilly PM, et al. (2002) Pelvic radiography in blunt trauma resuscitation: a diminishing role. *Journal of Trauma and Acute Care Surgery* 53: 1043-1047.
30. Dominguez S, Liu P, Roberts C, Mandell M, Richman PB (2005) Prevalence of traumatic hip and pelvic fractures in patients with suspected hip fracture and negative initial standard radiographs--a study of emergency department patients. *Academic emergency medicine* 12: 366-369.
31. Resnik CS, Stackhouse DJ, Shanmuganathan K, Young J (1992) Diagnosis of pelvic fractures in patients with acute pelvic trauma: efficacy of plain radiographs. *AJR American journal of roentgenology* 158: 109-112.