

## Role of pelvic X-ray in blunt trauma patients — A university hospital experience in Oman

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### Abstract

**Objective:** To confirm the safety of the advanced trauma life support algorithm by comparing the incidence of pelvic fractures diagnosed by pelvic X-ray and computed tomography and to evaluate the need of pelvic X-ray in the management of haemodynamically stable polytrauma patients in whom computed tomography is deemed necessary.

**Methods:** The prospective study was conducted at Sultan Qaboos University, Muscat, Oman, from January to December 2012, and comprised stable blunt trauma patients treated according to advanced trauma life support guidelines. All the patients underwent pelvic X-ray on presentation and later had computed tomography scan of abdomen and pelvis. Radiology reports were filed by the on-call radiologist prospectively. The reports were reviewed retrospectively. Data was analysed using SPSS 19.

**Results:** Of the 67 patients, 59(88%) were male and 8(12%) were females. The overall mean age was 32.09±12.28 years (range: 14-77 years) Pelvic X-rays showed no fracture in 62(92.5%) cases compared to 55(82.1%) scans. All cases that were positive on pelvic X-ray were detected by scan. Pelvic X-ray revealed only 4(6%) patients as having only pelvic fracture and 1(1.5%) as femoral head fracture. Computed tomography scan was able to detect 6(9%) pelvic fractures, 2(3%) femoral fractures and 4(6%) lumbar fractures.

**Conclusion:** Computed tomography scan was found to be superior in detecting pelvic, femoral and lumbar fractures.

**Keywords:** Pelvic x-ray, Computed tomography, CT, Stable, blunt trauma, ATLS, Advanced Trauma Life Support. (JPMA 65: 910; 2015)

### Introduction

Fracture of pelvis can be severe and life-threatening.<sup>1</sup> Most fractures are caused by blunt abdominal trauma secondary to motor vehicle collision (MVC)<sup>1,2</sup> and falls.<sup>2</sup> Identification of pelvic pathology is challenging.<sup>2</sup> One of the causes of morbidity and mortality in all age groups is blunt abdominal trauma<sup>2,3</sup> and fractures of pelvis and femur.<sup>4,5</sup> The pelvic trauma is usually accompanied by significant intra-abdominal, bladder or urethral injuries<sup>6</sup> with associated risk of bleeding, shock and death.<sup>2</sup> In a study, 13 out of 24 deaths had resulted from pelvic trauma, 10 from intractable bleeding and 3 due to sepsis.<sup>7</sup>

According to Advanced Trauma Life Support (ATLS) guidelines, pelvic X-ray (PXR) is mandatory in the initial survey of poly-trauma patients<sup>2</sup> though it contains some degree of false negativity.<sup>2,8-10</sup> According to the 9th edition of ATLS guidelines,<sup>11</sup> cervical spine, thoracic and

PXRs are recommended as part of the primary survey. Even though the guidelines leave some room for interpretation, Multi-detector Computed Tomography (MDCT) scanning of the cervical spine often replaces the plain X-ray, but PXR is mandatory and should be routinely performed following completion of the primary survey.

MDCT technology plays an important role in the evaluation of poly-trauma patients.<sup>2,8,9,12</sup> It was shown that it is more specific and sensitive.<sup>9,13</sup> Omitting PXR from the modified ATLS algorithm in haemodynamically stable poly-trauma patients with clinically stable pelvis was in favour for a later pelvic CT.<sup>2</sup>

The current study was planned to confirm the safety of the ATLS algorithm by comparing the incidence of pelvic fractures diagnosed by PXR and CT and to evaluate if routine PXR has any impact on the management of haemodynamically stable poly-trauma patients in whom CT was deemed necessary.

### Patients and Methods

The prospective study was conducted at Sultan Qaboos University, Muscat, Oman, from January to December

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2012, and comprised stable blunt trauma patients treated according to ATLS guidelines.

All patients underwent PXR on presentation and later had CT scan of abdomen and pelvis. Patients who did not undergo both procedures were excluded. Pelvic, femoral, L4/5 lumbar vertebral fractures were considered positive result. Soft tissue injuries and haematomas were not considered positive results due to limited ability of X-rays to detect them. SPSS 19 was used to analyse data, and Fisher exact test was applied.

Radiology reports were filed by the on-call radiologist prospectively, while the reports were reviewed retrospectively.

### Results

Of the 67 patients, 59(88%) were male and 8(12%) were females. The overall mean age was 32.09±12.28 years (range: 14-77 years). The mean age of male patients was 32.12±12.42 years (range: 16-77 years). The mean age of female patients was 31.88±12.05 years (range: 14-49 years).

PXR showed no fracture in 62(92.5%) cases of which 55(89%) were males and 7(11%) were females. Furthermore, 4(6.0%) of the X-rays only showed a pelvic fracture of which 3(75%) were males and 1(25%) was a female. Fractures detected included superior and inferior pubic rami fracture, fracture of superior pubic ramus, fracture of ischial spine and acetabular fracture. Besides, 1(1.5%) femoral head fracture was detected on PXR of a male patient.

CT scan showed no fracture in 55(82.1%) patients of whom 48(82.3%) were males and 7(12.7%) were females. It was able to detect 6(9.0%) pelvic fractures of which 5(83.3%) were males and 1(16.6%) was female. The fractures included fracture of superior, inferior pubic rami, fracture of ala of sacrum, small chip fracture of iliac crest, fracture of the pubic bone and comminuted acetabular fracture.

In addition, it detected 2 (3%) femoral fractures of which both were male patients. Proximal femoral fracture and bony fragment from the greater trochanter were detected.

**Table:** X-ray CT Crosstabulation.

		CT		Total	
		Positive <sup>a</sup>	Negative		
X-Ray	+ ve	Count	5	0	5
		% of Total	7.5%	0.0%	7.5%
- ve	Count	7	55	62	
		% of Total	10.4%	82.1%	92.5%
Total	Count	12	55	67	
		% of Total	17.9%	82.1%	100.0%

CT: Computed tomography.

Moreover, 4(6.0%) lumbar fractures were detected by CT scan and all of them were male patients. It included fracture of body of L4, fracture of L5 transverse process, fracture of L3 transverse process and compression fracture of L4.

There were 7(10.4%) fractures which were detected on CT, but not on PXR. Two (29%) of them were in the pelvic bone. They were described in the radiology reports as fracture of ala of the sacrum and small fracture of the iliac crest. One (14.5%) was in the greater trochanter and 4(57%) were in the vertebrae. The vertebral fractures were reported as fracture of L3, L4, compression fracture of L4 and L5 transverse process fracture.

All cases that were positive on pelvic X-ray were detected by CT scan (Table).

Sensitivity of PXR when compared to CT as the gold standard test was found to be 41.67%. In contrast, the specificity was 100%. Positive predictive value (PPV) of PXR was found to be 7.46%. Negative Predictive Value (NPV) was 92.54%.

### Discussion

The study was done to explore the possibility of excluding PXR as an unnecessary test in stable blunt trauma patients who set to undergo CT. This would reduce the cost, time and unnecessary radiation. Most of blunt trauma patients who present to our hospital would undergo PXR as part of the primary survey and later have CT as part of the second survey in line with the ALTS recommendations.<sup>2</sup>

In this study, CT scan was superior in detecting pelvic, femoral and lumbar fractures. A study done in Switzerland between 2004 and 2006 found that in 4% patients PXR failed to detect pelvic fractures but it was detected on pelvic CT.<sup>2</sup> Another study was conducted in Israel, between 2001 and 2004 showed 35.6% more pelvic fractures diagnosed by CT angiography (CTA) than PXR and there was no change in the treatment policy following PXR results compared to CTA which led to pelvic angiography in 14.7% patients.<sup>12</sup> In USA, a study was done between 2008 and 2009 and found that 8% patients had pelvic fractures, 59% of them were identified by PXR while all pelvic fractures were identified by MDCT.<sup>9</sup> A study in Columbia included 608 patients where 9.7% had pelvic fractures and 57% of them were detected by physical examination alone. It concluded that negative physical examination had a predictive value of 99% in excluding pelvic fractures.<sup>14</sup> A prospective study in US included 50 patients and found that 16 out of 20 cases of intra-articular fragments in the hip joint were not recognised on PXR. It suggested that PXR was not effective in

identifying fracture fragments in the hip joint.<sup>15</sup>

Some studies recommend replacing PXR with history, and physical examination with CT in highly suspicious patients.<sup>16</sup> Others recommend omitting it in haemodynamically stable patients in favour of CT to identify small fractures that cannot be seen in PXR.<sup>2,12,17,18</sup> In addition, patients with severe trauma will undergo CT regardless of the result of PXR.<sup>19,20</sup> Omitting PXR would result in reduction in the time to CT from the time of admission<sup>21</sup> as well as reduction of radiation exposure and cost.<sup>2</sup> Furthermore, it will lead to reduction of radiation dose as PXR has 20% of the radiation of spiral pelvic CT.<sup>22</sup> Decreased mortality was also observed in some studies.<sup>23</sup> Other studies showed no difference in mortality.<sup>24</sup> Moreover, it would improve the diagnostic accuracy.<sup>25</sup>

In our study, PXR yielded 7.46% positive results compared to pelvic CT scan which yielded 17.91% positive results. We recommend eliminating PXR from the primary survey if the patient would have a CT as second survey in view of the severity of trauma.

The small sample size in our study was its limitation. We recommend increasing the sample size to explore the accuracy of our results.

## Conclusion

PXR can be eliminated in haemodynamically stable patients who are going to have pelvic CT regardless of the results of PXR. This will result in decreased costs, decreased radiation dose, and increased efficiency.

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