

EPIDEMIOLOGY OF PELVIC FRACTURES AND CONCOMITANT INJURIES- A CROSS-SECTIONAL OBSERVATIONAL STUDY

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ABSTRACT

BACKGROUND

Pelvic fractures are rare injuries (3 - 8%) as compared with fractures in other body regions. Often the result of high-energy trauma in young individuals and low-energy injury in older people, pelvic ring fractures are associated with considerable morbidity, high mortality rates and significant cost to the society.

MATERIALS AND METHODS

This study was a retrospective descriptive study analysis of data of trauma patients with pelvic fractures admitted in the Emergency Room (ER). The diagnosis of a fracture was based on the history, signs and symptoms, visual finding, manual examination and OPG radiographs. Exact determination of site and pattern of bony injury was determined by correlating it radiographically using three dimensional CT scan.

RESULTS

We conducted this study on 130 patients who presented to the emergency department and diagnosed radiologically to have some type of pelvic fracture. Out of 130 patients, 37.7% were males and 62.3% were females. Majority of fractures were seen in the elderly age group of > 75 years (50.8%).

CONCLUSION

Pelvic fractures are often the result of high-energy trauma in young individuals and low-energy injury in older people. Often associated with injuries at other multiple sites increasing morbidity and mortality.

KEY WORDS

Pelvic Fracture, Solid Organ Injury, Road Traffic Accident, Urethral Injury.

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BACKGROUND

Pelvic fractures are rare injuries (3 - 8%) as compared with fractures in other body regions,¹ although the frequency may be as high as 25% in patients with multiple trauma.² Often the result of high-energy trauma in young individuals² and low-energy injury in older people,³ pelvic ring fractures are associated with considerable morbidity, high mortality rates and significant cost to the society.⁴ With an aging population, the burden of low-energy pelvic fractures will likely continue to affect a growing number of individuals.⁵ Most deaths in patients with pelvic fractures are not caused by the pelvic fracture itself, but are linked to associated injuries.¹ Fatal pelvic injury patients die at a median of 2 days after the trauma.⁶ A meta-analysis consisting of twelve studies with a total of 5,454 pelvic fracture patients concluded that in stable and alert trauma patients a thorough clinical examination will detect pelvic fractures with nearly 100% sensitivity, thus rendering initial radiography unnecessary in this group of patients.⁷

Due to the increase of older population worldwide,⁸ the burden of pelvic fractures will become highly relevant for society in general and in particular for our healthcare systems. Consequently, low energy fractures are assumed to affect a growing number of individuals and an increase of pelvic fracture incidences has already been reported. From the viewpoint of pre-hospital emergency medical management for injured people, identification of pelvic fractures in those with stable or unstable vital signs is critical. Furthermore, evaluation of possible associated injuries is still important, even though the greater proportion of pelvic fractures are not of a life-threatening status. Comprehensive epidemiologic surveillance of pelvic fractures with other combined injuries could provide sufficient information to pre-hospital or in-hospital medical staff to improve emergency management and enable policymakers to consider alternative resources and training programs.

The objective of this study was to determine the types, aetiological factors and associated injuries of pelvic fracture.

MATERIALS AND METHODS

This study was a retrospective descriptive study analysis of data of trauma patients admitted in the emergency room (ER) of SCB Medical College and Hospital, Cuttack and Govt. Medical College and Hospital, Balasore, Odisha, India, during the period from August 2017 to July 2018. Patients with pelvic fractures were included in the study. The diagnosis of a fracture was based on the history, signs and symptoms, visual finding, manual examination and OPG radiographs. Exact

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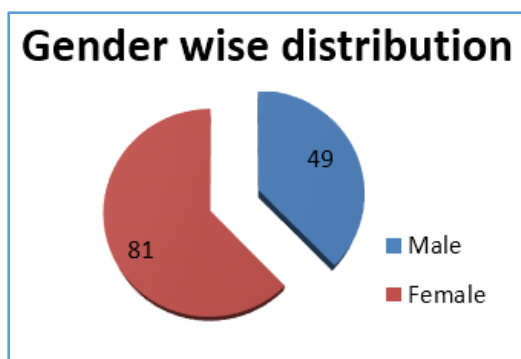
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determination of site and pattern of bony injury was determined by correlating it radiographically using three dimensional CT scan. In our study, based on the documented radiographic findings, the fracture sites were assigned to one of four anatomical subsites including pubis, ilium, ischium and sacrum. The aetiological factors were classified as Road Traffic Accidents (RTA), fall from height, pedestrian hit by car, assault and others. Age, gender, aetiology, pattern of pelvic fractures and associated injuries were recorded in clinical proforma.

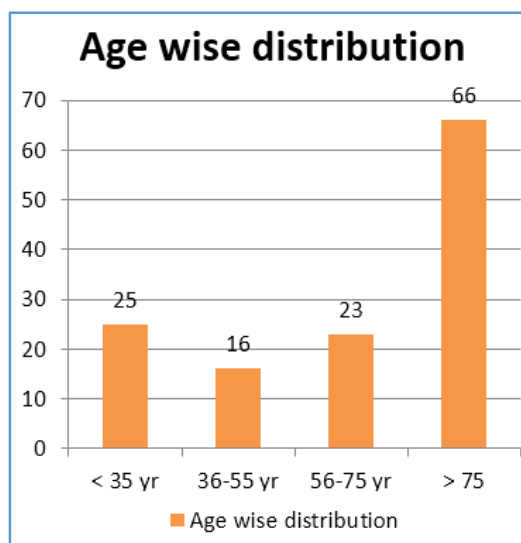
RESULTS

We conducted this study on 130 patients who presented to the emergency department and diagnosed radiologically to have some type of pelvic fracture. Out of 130 patients, 49 (37.7%) were males and 81 (62.3%) were females. Females sustained significantly more injuries as compared to males with an overall ratio of 1.7: 1 (Graph 1).



Graph 1. Gender Wise distribution of Cases

Majority of fractures are seen in the elderly age group of >75 years, 66 (50.8%) followed by < 35 years, 25 (19.2%), 56-75 years, 23 (17.7%) and 36 - 55 years, 16 (12.3%) of life. In patients aged above 55 years of age, there was more incidence of fractures that accounts for 68.5% (Graph 2).



Graph 2. Age Wise distribution of Cases

Among 130 patients with pelvic fractures pubis fracture was seen in maximum number of cases, 88 (67.7%) followed by ilium in 83 (63.8%), ischium in 61 (46.9%) and sacrum in 21 (16.2%) cases. Multiple pelvic ring fracture (more than 2 fracture sites) were seen in 23 (17.8%) cases (Table 1).

Site of Fracture		Total n= 130	Pubis n= 88 (67.7%)	Ilium n= 83 (63.8%)	Ischium n= 61 (46.9%)	Sacrum n= 21 (16.2%)	Multiple Pelvic Ring Fracture n=23 (17.8%)
Gender	Male	49 (37.7)	21 (23.9)	48 (57.8)	14 (29.5)	8 (38.1)	13 (56.5)
	Female	81 (62.3)	67 (76.1)	35 (42.2)	43 (70.5)	13 (61.9)	10 (43.5)
Age	< 35 Yrs.	25 (19.2)	17 (19.3)	23 (27.7)	9 (14.8)	7 (33.3)	7 (30.4)
	36-55 yrs.	19 (15.4)	8 (9.1)	12 (14.5)	7 (11.5)	5 (23.8)	8 (34.8)
	56-75 yrs.	20 (8.6)	14 (15.9)	17 (20.5)	10 (16.4)	3 (14.3)	3 (13.1)
	>75 Yrs.	66 (50.8)	49 (55.7)	31 (37.3)	35 (57.4)	6 (28.6)	5 (23.8)

Table 1. Distribution of Cases according to Site of Fracture

Fractures due to RTAs is most commonly seen in 73 (56.2%) cases followed by fall from height in 29 (22.3%), pedestrian hit by car in 18 (13.8%), assault injury in 6 (3.4%) and others 4 (3%) cases (Table 2).

Aetiology	n= 130	%
Road traffic accident	73	56.2
Fall from height	29	22.3
Pedestrian hit by car	18	13.8
Assault	6	3.4
Others	4	3

Table 2. Distribution of Cases according to their Aetiology

Pelvic fractures are associated with other injuries in 75 (57.7%) cases. Most commonly associated injury was urinary bladder and urethral injury in 45 (34.7%) cases followed by Solid Organ Injury (SOI) in 35 (26.9%), chest trauma with rib fractures in 24 (18.5%), haemodynamic instability in 19 (14.6%), lung contusion in 15 (11.5%) cases and other injuries observed were Acetabular fracture, Femur fracture, head injury and Facial bone fractures. Among the solid organs, most common organ involved was splenic in 16 (12.3%) followed by liver in 12 (9.2%) and kidney in 8 (6.2%) cases (Table 3).

Associated Other Injury, n= 75 (57.7%)	n= 130	%	
Urinary bladder and Urethral injury	45	34.7	
Solid Organ Injury (SOI) n= 35 (26.9%)	Splenic injury	16	12.3
	Liver injury	12	9.2
	Kidney injury	7	5.4
Chest trauma with rib fracture	24	18.5	
Haemodynamic instability	19	14.6	
Lung contusion	15	11.5	
Acetabular fracture	14	10.8	
Femur fracture	11	8.5	
Femoral neck fracture	8	6.2	
Head injury	3	2.3	
Facial bone fracture	4	3.1	

Table 3. Distribution of Cases of Pelvic Fracture and associated Other Injury

Incidence of solid organ injury was more in patients associated with rib fracture in comparison to patients with only pelvic fracture (66.7% vs. 21.7%) (Table 4).

Solid Organ Injury (SOI)	Pelvic Fracture + Rib Fracture, n= 24	Pelvic Fracture Alone, n= 106
Present (n= 35)	16 (66.7%)	23 (21.7%)
Absent (n= 95)	8 (33.3%)	83 (78.3%)

Table 4. Distribution of Cases associated with Solid Organ Injury

The most common comorbid condition associated with pelvic fractures is osteoporosis in 46 (35.4%) followed by hypertension in 33 (25.4%), diabetes mellitus in 24 (18.5%), atrial fibrillation in 21 (16.2%), congestive cardiac failure in 15 (11.5%), coronary artery disease in 14 (10.7%), old myocardial infarction in 9 (6.9%) and obesity in 7 (5.4%) cases (Table 5).

Comorbid Condition	n= 130	%
Osteoporosis	46	35.4
Hypertensive disease	33	25.4
Diabetes mellitus	24	18.5
Atrial fibrillation	21	16.2
Congestive heart failure	15	11.5
Coronary artery disease	14	10.7
Old myocardial infarction	9	6.9
Obesity	7	5.4

Table 5. Prevalence of Comorbidities in Patients with Pelvic Ring Fractures

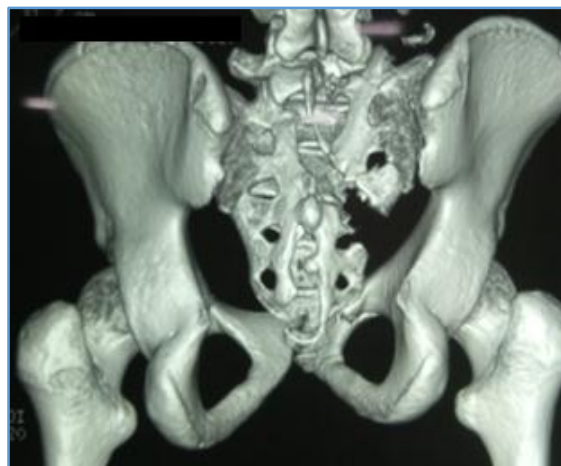


Image 3. Fracture of the Sacrum

DISCUSSION

Trauma accounts for approximately 1 in 10 deaths worldwide. The presence of a pelvic fracture increases the mortality risk.⁹ In contrast to an overall decline in trauma mortality, complex pelvic ring injuries remain associated with a significant risk of death.¹⁰ The key elements in managing patients with pelvic fractures are swift and adequate resuscitation, reversal of shock and acidosis, and rapid control of haemorrhage to facilitate survival of these patients.¹¹

From the viewpoint of pre-hospital emergency medicine, a greater proportion of pelvic fractures not of a life-threatening status, but combined with other injuries need more attention and comprehensive recognition.

In this study, we observed pelvic fracture in 6.1% of patients presented to emergency department with fracture at any site of the body. Similarly, RP Gonzalez et al¹² found pelvic fracture in 4.5% of their trauma patients. Pohlemann T et al² and Balogh Z et al¹³ also studied pelvic fractures in 2% and 8% of all fractures.

We conducted this study on 130 diagnosed cases of pelvic fracture. We studied that incidence of pelvic fracture was more in females, 81 (62.3%) compared to males 49 (37.7%). Females sustained significantly more injuries as compared to males with an overall ratio of 1.6: 1. Similarly, Leonard T Buller et al¹⁴ have also observed pelvic fracture more common in females (69.7%) than males (30.3%) in the ratio of 2.3: 1. Nan-Ping Yang et al¹⁵ have also recorded higher fracture rate in females when compared to males. Silke Andrich et al¹⁶ also observed pelvic fractures more common in women (82%) than men (18%) (4.5: 1).

We observed majority of fractures in the elderly age group of > 75 years, 66 (50.8%) followed by < 35 years, 25 (19.2%), 56 - 75 years, 23 (17.7%) and 36 - 55 years, 16 (12.3%). In both the sex we found that incidence of fracture was more in same 5th, 6th and 7th decade of life. We found that the average age of presentation was 66.5 yrs. In accordance to us, Leonard T Buller et al studied the mean age of patients with a pelvic ring fracture of 64.5 years and more patients were in 6th and 7th decades. Similar to us, Nan-Ping Yang et al found the elderly patients (aged 65 years or more) were noted to have a significantly increased incidence of pelvic fracture. Similarly, Silke Andrich et al also studied the incidence of pelvic fractures were more in age group > 75 years in comparison to < 75 years (95.2% vs. 4.8%) and the



Image 1. Fracture of Right Pubis and Right Side of Sacrum



Image 2. Fracture of Right Pubis, Superior Pubic Ramus, Ischium and Ischiopubic Ramus

mean age of affected persons was 80.3 ± 8.7 years. In contrast to us, Ramesh K Sen et al studied the mean age of the patients with pelvic fracture of (29.0 ± 2.6) years.

In our study most common site of pelvic fractures observed was in the pubis, about 88 cases (67.7%) followed by ilium 83 (63.8%), ischium 61 (46.9%), sacrum 21 (16.2%) and multiple pelvic ring fracture in 23 (17.8%) cases. Similarly, Leonard T Buller et al observed the most frequent location of pelvic fractures was at pubis. Though we observed sacrum as the least common site of fracture, they found ischium as the least common site of fracture. Nan-Ping Yang et al also observed the most common pelvic fracture pattern to be fractures of the pubis, ilium or ischium.

In this study, we observed road traffic accidents as the most common cause of pelvic fracture seen in 73 (56.2%) cases followed by pedestrian hit by car in 22% and fall from height in 13% cases. In accordance to us Nan-Ping Yang et al also studied 62% of the recorded cases resulted from transport accidents and 10% from falling accidents. Ammar Al-Hassani et al¹⁷ also found motor vehicle crash (45%) and fall from height (30%) were the most common mechanism of pelvic injury, others being pedestrian hit by motor vehicle (10%), stuck by falling object (6%) and others (9%). Laszlo Toth et al¹⁸ also studied road traffic accidents as the most common cause of pelvic fracture seen in 60% cases followed by fall from height in 29 (22.3%), pedestrian hit by car in 18 (13.8%) and assault in 6 (4.6%). In accordance to us, María Roxana et al¹⁹ found the main mechanism of trauma was traffic accidents (80% of cases) followed by falls from height (16%) and injury caused by heavy object falling into the lower limbs (4%). They also observed that among traffic accidents, the most common type was running over by car (40%) followed by accidents involving motorcycle passenger (25%), running over by a bus or truck (20%) and accidents involving car occupants (10%) and cyclists hit by bus (5%). In contrast to us, Ramesh K Sen et al²⁰ studied the most common cause of pelvic fracture being automobile pedestrian collisions (36.6%) followed by motor vehicle collisions (30.6%), fall from height > 15 feet (19.3%), fall from height ≤ 15 feet (8.3%) and other types of trauma (5.6%).

In this study, we observed that pelvic fractures are associated with other injuries in 75 (57.7%) cases. Most commonly associated injury was urinary bladder and urethral injury in 45 (34.7%) cases followed by solid organ injury (SOI) in 35 (26.9%), chest trauma with rib fractures in 24 (18.5%), haemodynamic instability in 19 (14.6%), lung contusion in 15 (11.5%) cases and other injuries observed were acetabular fracture, femur fracture, head injury and facial bone fractures. Among the solid organs, most common organ involved was splenic in 16 (12.3%) followed by liver in 12 (9.2%) and kidney in 8 (6.2%) cases. Epidemiologic studies have reported that 12% to 62% of patients with pelvic fractures had additional injuries to the thorax, brain, long bones and abdominal organs to include the genitourinary system, spine and the peripheral nervous system.^{21,22} Tomislav Pejic et al²³ studied urethral injuries in 46% of patients and urinary bladder trauma in 12% of patients. In contrast to us, Nan-Ping Yang et al¹ observed the most common injuries associated with pelvic fractures were fractures of lower limbs (21.50%) followed by fractures of

the spine/ trunk (20.97%) and fractures of upper limbs (18.18%), fracture of the skull or intracranial injury (17.59%), internal injury of the abdomen and pelvis (11.00%) and internal injury of the chest (7.20%).

In contrast to us Leonard T Buller et al observed acetabular fracture in 8.9%, femur fracture in 6.7%, femoral neck fracture in 3.8%, head trauma in 0.7%, head/ face trauma in 0.7% and chest/ trunk trauma in 0.1% of cases. In contrast to us María Roxana et al found 92% of patients had Traumatic Brain Injury (TBI) and 40% had haemodynamic instability, genitourinary in 32%, orthopaedic (other) in 32%, abdominal in 28%, neurological in 28%, thoracic in 16% and vascular in 8% of cases. In Gänsslen's multicentre review,²⁴ of the 312 pelvic fracture patients with associated injuries 63% had injury to the bladder or urethra, 35% had associated head injuries, 24% had nerve injuries and 20% had intestinal injuries. Basta and associates²⁵ found the location and displacement of anterior pelvic fractures were predictive of the presence of urethral injury in a case control study of pelvic fracture patients with and without associated urethral injury. They observed that each millimetre of pubic diastasis or inferomedial pubic bone fracture fragment displacement was associated with a 10% increased risk of urethral injury.

In this study, we observed incidence of solid organ injury was more in patients associated with rib fracture in comparison to patients with only pelvic fracture (66.7% vs. 21.7%) and the overall incidence of Solid Organ Injury (SOI) was 26.9%. Similar to our study Ammar Al-Hassani et al found SOI predominantly in patients with concurrent rib fracture and pelvic fracture compared to ribs or pelvic fractures alone (42% vs. 26% vs. 15%, respectively). They studied the most common injured organ was spleen followed by liver and kidney. The overall incidence of SOIs in their study was 22%. Early identification of patients with haemorrhage is critical in management. Although, evaluation of patients with blunt abdominal injury typically involves a Focused Assessment with Sonography for Trauma (FAST) exam in patients with pelvic fractures. A negative exam does not rule out intraperitoneal haemorrhage.²⁶

The most common comorbid condition associated with pelvic fractures is osteoporosis in 46 (35.4%) followed by hypertension in 33 (25.4%), diabetes mellitus in 24 (18.5%), atrial fibrillation in 21 (16.2%), congestive cardiac failure in 15 (11.5%), coronary artery disease in 14 (10.7%), old myocardial infarction in 9 (6.9%) and obesity in 7 (5.4%) cases.

CONCLUSION

Pelvic fractures are often the result of high-energy trauma in young individuals and low-energy injury in older people. There are a number of areas of uncertainty in the initial triage and management of patients with pelvic ring fractures. While it is clear that haemodynamically unstable patients have a higher mortality, the source of bleeding (Venous, arterial or bony) is typically not clear. A better understanding of the source would help determine if patients would be more likely to benefit from emergent arterial angiography or pelvic stabilisation. The concurrent clinical findings of fractures of the lower ribs and pelvic fracture after blunt trauma pose a high risk for intra-abdominal solid organ injury.

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