

RESULTS

20 patients with suspected or proven pelvic fractures were examined by CT and results illustrated high diagnostic capability of CT in assessment of pelvic fractures. The site of injury, degree of comminution, displaced fragments, intraarticular foreign bodies, and associated soft tissue injuries were used as diagnostic parameters.

The patients were classified into 3 groups according to the type of injury.

- **Group I (cases with pelvic ring injuries):** including 19 cases of pelvic ring injury associated or not associated with acetabular fractures.
 - 11 cases were diagnosed as pelvic ring injuries associated with acetabular fractures.
 - 8 cases were diagnosed as pelvic ring injuries not associated with acetabular fractures.
- **Group II (cases with acetabular fractures):** Including 12 cases of acetabular fractures with or without overlap of pelvic ring injuries (group I).
 - 11 cases were diagnosed as acetabular fracture associated with pelvic ring injury.
 - One case was diagnosed as acetabular fracture not associated with pelvic ring injury.
- **Group III (cases with sacral fractures):** All cases of these group were cases from group I with sacral fractures which were separated from pelvic ring injury to deal with, in more detail. These were 13 cases diagnosed as sacral fractures, they were classified into zone I, II, III.

Table (I): Groups of injuries.

Groups	Type of fracture	Male	Female	Age range	No. of patients
I	- Pelvic ring injuries				
	▪ Type A: Stable pelvic ring injury.	3	2	(15-38)	5
	▪ Type B: Partially stable pelvic ring injury.	6	3	(8-46)	9
	▪ Type C: Unstable pelvic ring injury	2	3	(11-45)	5
II	Acetabular fractures:				
	▪ Type A: Partial articular fractures (one column involved).	3	4	(15-46)	7
	▪ Type B: Partial articular fractures (transverse or T-type fractures, both columns involved).	2	3	(11-38)	5
	Sacral fractures:				
III	▪ Zone I (lateral extraforaminal)	5	2	(10-43)	7
	▪ Zone II (foraminal)	-	4	(8-45)	4
	▪ Zone III (medial to foramen)	1	-	(8-15)	1
	▪ Zone II, III	1	-	(8)	1

Table (2): Type A pelvic ring injury (stable pelvic ring injury).

Case	Age/ sex	Causative trauma	Presentation	CT characteristics of pelvic ring fractures							Extra- pelvic injuries	Class.
				Pubic rami	S.P	Iliac bone Fr.	Sacrum and coccyx	S.I.J	L5 T.P avulsion Fr.	A. F.	Pelvic soft tissue injuries	
1	23/F	Car accident (occupant)	- Tender left iliac wing - Abduction, external rotation of Lt. lower limb	-	-	Lt. iliac bone	-	-	-	+	- Minimal free intraperitoneal fluid. - Multiple hematomas of Lt. iliacus, obturator internus muscles - Displaced urinary bladder to the Rt. side	A2-1
2	21/M	Car accident (Pedestrian)	- Tenderness over Rt. iliac bone	-	-	Rt. iliac bone	-	-	-	-	- Hematoma of Rt. gluteus medius muscle	A2-1
3	15/F	Fall from height	- Limited painful Rt. lower limb movement	Fissure of Rt. Superior pubic ramus	-	-	Small fissure of Lt. ala zone I	-	-	-	- Atrophy of Rt. glutii, obturator internus, iliacus muscles (Chance findings)	A2-2
4	38/M	Car accident (occupant)	- Inability to walk. - Tender symphysis pubis. - Adduction, internal rotation deformity of Rt. Lower limb	Fracture of Rt. pubic rami	Disruption	-	-	-	-	+	- Hematoma of Lt. obturator internus muscle. - 2 bone fragment impacted in Rt. obturator internus muscle.	A2-2
5	27/M	Fall from height	- inability to walk - tenderness over symphysis pubis	Rt. pubic rami fracture	-	-	-	-	-	-	- Small bone fragments impacted in Rt. obturator internus and adductor magnus muscles	A2-2

S.P. = Symphysis pubis

T.P. = Transverse process

Class = Classification

S.I.J. = Sacroiliac joint

A.F. = Acetabular fractures

Fr = Fractures

Table (3): Type B pelvic ring injury (partially stable pelvic ring injury).

Case	Age/ sex	Causative trauma	Presentation	CT characteristics of pelvic ring fractures							Extra- pelvic injuries	Class.
				Pubic rami	S.P	Iliac bone Fr.	Sacrum and coccyx	S.L.J	L5 T.P avulsion Fr.	A. F.	Pelvic soft tissue injuries	
2	38 M	Car accident (pedestrian)	Inability to walk after 2 S.L.J	Both Rt. pubic rami	-	Comminuted fracture of Rt. ilac	Both ilia	Rt. Distal tibia bone fracture	L1 one + L2 L4-5	-	hematoma of Rt. iliacus muscle	B1 + bilateral sacral fractures
3	39 M	Car accident (pedestrian)	Partial limited Rt. lower limb movement + external compression of Rt. iliac wing.	Both Rt. Pubic rami	-	Oblique fracture of Rt. one	-	-	-	-	Multiple hematomas of Rt. obturator internus, adductor magnus, iliopectus Rt. subcutaneous hematoma	B2-1
4	39 M	Car accident (occupant)	Inability to walk + Adduction, internal rotation of Rt. lower limb	Four rami	-	Lt. iliac blade fracture	Lt. hip and ala	-	-	-	Hematomas of Rt. obturator internus, externus muscles	B2-1
5	43 M	Car accident (occupant)	Inability to walk + Abduction, external rotation of Lt. lower limb	Four rami	-	-	Lt. ala	-	-	-	Moderate amount of free intrapertitoneal fluid	B2-1 Spleenic tear + fractures lower, upper limbs
6	46 M	Car accident (occupant)	Crepitus over pubic bones, Abduction, external rotation deformity of Rt. lower limb	Four rami + pubic bodies	-	-	Lt. ala	-	-	+	-	B2-2
7	45 F	Car accident (pedestrian)	Tender groin, limited flexion of both hips, Crepitus on pubic compression	Rt. superior + Both inferior	-	Oblique fracture one	Lt. hip	-	-	-	Hematomas of Rt. iliacus, obturator internus, adductor magnus and longus muscles	B2-2 + iliac wing fracture

Table (3): Cont'd

Case	Age/ sex	Causative trauma	Presentation	CT characteristics of pelvic ring fractures							Extra-pelvic injuries	Class.
				Pubic rami	S.P	Iliac bone	Sacrum and coccyx	S.I.,J	L5 T.P avulsion Fr.	A. F.	Pelvic soft tissue injuries	
7	42/F	Crushed by falling wall	- Inability to walk - Abduction internal rotation deformity of Lt. lower limb	Rt. both pubic rami	-	Lt. iliac bone	Lt. iliac ala	-	-	-	- Hematomas of obturator internus. piriformis muscles. - Free intraperitoneal fluid	B2-2
8	10/ M	Car accident (pedestrian)	- Hematuria - Limited painful lower limb movement - Wound over pubic region	- Rt. superior. Separate Lt. superior - Both inferior	Disruption	-	Both ala	-	-	-	- Hematomas of posterior urethral tear - Subcutaneous emphysema in pelvis and thigh	B3- (Bilateral B2)
9	30/ M	Car accident (pedestrian)	- Inability to walk - Abduction, external rotation of Lt. lower limb.	Lt. both pubic Rami	-	- Fissure of Rt. - Fracture of Lt.	Promon- tory, Rt. ala, coccyx	-	-	-	- Hematoma of piriformis, gluteus medius, Lt. Gemellus muscles	B3 (B2- 2+ B2-1)

Table (4): Type C pelvic ring injury (unstable pelvic ring injury).

Case	Age/ Sex	Causative trauma	Presentation	CT characteristics of pelvic ring fractures									
				Pubic rami	S.P	Iliac bone Fr.	Sacrum and coccyx	S.I.J	L5 T.P avulsion Fr.	A. F.	Pelvic soft tissue injuries	Extra- pelvic injuries	Class.
1	34 F	Car accident (occupant)	- Locomotion of Lt Femur - Abduction, extension, activity of Lt lower limb	Four rami pubic rings	-	Lt. Iliac	Coccyx	Lt. one is wider (less than 4mm). upward displaced	Both	-	- Minimal free intraperitoneal fluid + hematoma Lt. obturator internus, iliacus, Lt. piriformis, iliacus muscles	Intra- cranial Hx.	(C1-1)
2	17 M	Car accident (pedestrian)	- Inability to walk + compressed Lt. coccyx - Crepitus of pubic rami	Lt. pubic rami + superior displaced	Disruption	Both	Lip of Lt. ala	Lt. diastasis	-	-	- Hematoma Lt. obturator internus, piriformis Rt. lateral wall of urinary bladder is indented by displaced Rt. iliopsoas muscle.	-	(C1-1)
3	16 M	Car accident (occupant)	- Painful lower movement	Four rami	-	Both	Lip of Rt. ala	Rt. diastasis + upward displaced	-	-	- Hematomas of back muscles of pelvis. - Subcutaneous emphysema, gas bubbles in Rt. gluti, iliacus. - Moderate free intraperitoneal fluid.	-	(C1-2)
4	11 F	Car accident (occupant)	- Limited painful Lt. lower limb movement. - External rotation deformity of Lt lower limb	-	Diastasis, upward displaced Lt. pubic bone	-	Lt. ala with superior displaced	-	Lt.	-	- Perisacral and pericoccygeal hematoma, bone fragments in Lt. iliacus, hematoma Lt. obturator internus, Lt. pectineus - Lower limb fracture	-	(C1-3)
5	45 F	Car accident (occupant)	- Limited painful lower limb movement. - Abduction, internal rotation Rt Lower limb	Four rami	-	-	Lt. ala + Lt. lip superior displaced	Lt. diastasis + bone fragments	Lt. one + body, Lt. pedicle + bilateral pars + L5-S1 spondylo- lithesis	-	- Back muscles hematomas - Bone fragment impacted in Lt. iliacus muscle	-	(C1-3)

Table (5): Type A acetabular fractures (one column involved).

Case	Age/ Sex	Causative trauma	Presentation	CT characteristics of acetabular fractures								Class.	
				Anterior column, lip	Posterior column, lip	Roof	Q.P.	Hip joint	(F.H) dislocation	Pelvic ring injury	Pelvic soft tissue injuries		Extra- pelvic injuries
1	17/M	Car accident (occupant)	- Inability to walk - Compressed Lt. iliac wing	-	Lt. lip	-	-	-	-	+	- Hematoma of Lt. obturator internus, externus, piriformis	-	A1
2	43/M	Car accident (occupant)	- Inability to walk - Abduction, external Lt. Rotation - lower limb	Lt. lip	-	-	-	-	(Lt) anterior dislocation	+	- Moderate amounts of free intrapertitoneal fluid	Splenic tear Fracture limbs	A3-1
3	46/M	Car accident (occupant)	- Abduction, external rotation of Rt. lower limb - Creptus of pubic bone	Rt. column	-	-	-	-	-	+	-	-	A3-3
4	15/F	Car accident (pedestrian)	- Limited lower limb flexion. - Rt. abduction, external rotation deformity	Rt. column	-	Rt. roof	-	-	-	+	- Hematoma of Rt. iliacus, obturator in ternus, adductor magnus muscles	Fracture ribs	A3-3
5	23/F	Car accident (occupant)	- Abduction external rotation Lt. lower limb - Tender Lt. iliac bone	Lt. lip, column	-	+ Lt. roof	-	Lt. subcaps- ular hematoma + bone fragment	-	+	- Minimal free intraperitoneal fluid. - Hematoma of Lt. iliacus, obturator internus	-	A3-3
6	19/F	Car accident (occupant)	- Inability to walk	Rt. lip, column	-	-	-	- Rt. hemoarth- rosis	-	+	- Hematoma of Rt. obturator internus, externus muscles - Lower limb fracture	Lower limb fracture	A3-3
7	45/F	Car accident (occupant)	- Limited painful Rt. Lower limb movement. - Abduction/intern al rotation Rt. lower limb	Rt. column	-	-	-	Single free bone fragment	-	+	- Hematoma of back muscles of pelvis	-	A3-3

Q.P. = Quadrilateral plate

F.H. = Femoral head

Class. = Classification

Table (6): Type B acetabular fractures (transverse or T-type fracture, both columns involved).

Case	Age/ Sex	Causative trauma	Presentation	CT characteristics of acetabular fractures							Extra- pelvic injuries	Class.
				Anterior column, lip	Posterior column, lip	Roof	Q.P.	Hip joint	(F.H) dislocation	Pelvic ring injury	Pelvic soft tissue injuries	
1	11/F	Car accident (pedestrian)	- Lt. lower limb external Rotation - Severe limited movement	-	-	Trans- verse of Lt.	-	Bilateral hemiarth- rosis, multiple free fragments (Lt.)	Central superior of Lt.	+	- Hematoma of Lt. iliacus, obturator internus, pectineus muscles - Pericardial and coccygeal hematomas	B1-2
2	38/M	Car accident (occupant)	- Inability to walk - Adduction, internal rotation of Lt. lower limb	-	-	Trans- verse of Lt.	-	-	-	-	- Hematoma of Lt. obturator internus muscle	B2-3
3	15/F	Car accident (pedestrian)	- Limited painful Rt. lower limb movement. - Abduction, external rotation of Rt. lower limb	-	-	Trans- verse of (Rt.)	Verti- cal or (Rt.)	Rt. Sub- capsular hematoma	Central	-	Rt. Obturator internus muscle hematoma	B2-3
4	34/F	Car accident (occupant)	- Abduction, external rotation of Lt. lower limb - Ecchymosis of Lt. hip joint	Lt. Lip, column	-	Trans- verse of (Lt.)	(Lt) verti- cal	Multiple bone fragments	Anterior, superior of (Lt.)	+	- Minimal free intraperitoneal fluid hematoma of Lt. obturator internus, piriformis, iliopsoas	B2-3
5	29/M	Car accident (occupant)	- Limited painful Rt. Lower limb movement. - Shortening of Rt. Lower limb	Rt. column	Rt. in antero- posterior direction	Compl- ex of (Rt.)	(Rt) verti- cal	Bone fragments impacted in capsule in capsule (Rt.)	(Rt) anterior	+	- Hematoma of Rt. obturator internus, adductor magnus iliopsoas. - Subcutaneous hematoma of Rt hip	B3-2

Table (7): Sacral fractures.

Case	Age /sex	Traumatic force	CT characteristics of sacral fractures						
			Rt. ala and neural foramen	Lt ala and neural foramen	Sacroiliac joint affection	Neurologic insult	Pelvic ring injury	Acetabular injury	Fracture pattern
1	15/F	Fall from height	-	Lt. Lip not reaching neural foramen	-	-	+	+	Zone I (Lt)
2	10/M	Car accident (pedestrian)	Comminuted of Rt. ala not reaching foramen	Comminuted reaching foramen	Fracture reaching both S.I.J.	-	+	-	Zone I bilateral
3	15/F	Car accident (occupant)	-	Subtle fracture of Lt. ala	-	-	+	-	Zone I (Lt)
4	16/M	Car accident (occupant)	Lip. Rt. neural foramen affection	-	Fracture reaching Rt. S.I.J. with diastasis, upward displacement	-	+	-	Zone I (Rt)
5	30/M	Car accident (pedestrian)	Vertical fracture of Rt. ala, promontory	-	-	-	+	-	Zone I (Rt)
6	43/M	Car accident (occupant)	-	Lt. ala	Fracture reaching Lt. S.I.J.	-	+	+	Zone I (Lt)
7	17/M	Car accident (occupant)	-	Lt. lip	-	-	+	+	Zone I (Lt)
8	11/F	Car accident (occupant)	-	- Lt. ala passing through neural foramen - Superior displacement of Lt. ala	-	-	+	+	Zone II (Lt)
9	45/F	Car accident occupant	-	- Lt. ala, reaching promontory, Lt. foramen. - Superior displacement. - Single fragment in Lt. ventral neural foramen. - Lt. lip	- Associated Lt. S.I.J. diastasis. - With multiple bone fragments impacted in it.	-	+	+	Zone II (Lt)

Table (7): Cont'd

Case	Age /sex	Traumatic force	CT characteristics of sacral fractures					
			Rt. ala and neural foramen	Lt ala and neural foramen	Sacroiliac joint affection	Neurologic insult	Pelvic ring injury	Acetabular injury
10	19/F	Car accident (occupant)	-	-	-	-	+	+
11	42/F	Wald fall on patient	-	-	-	-	-	-
12	46/M	Car accident (occupant)	-	-	-	-	-	-
13	8/M	Car accident (pedestrian)	Comminuted fracture of ala passing through foramen	Comminuted fracture of both ala passing through foramen. Another fracture line lateral to neural foramen	Fractures reaching both joints, diastasis of R1 eye with multiple fragments and hemarthrosis	-	-	-

Table (8): Causative trauma.

Causative trauma	No. of cases	Percentage
Car accidents	17	85%
- Occupants	9	45%
- Pedestrians	8	40%
Falling from height	2	10%
Falling wall	1	5%

Table (9): Age distribution of pelvic fractures.

Age range	No. of cases	Percentage
8-15 years	6	30%
16-30 years	8	40%
31-46 years	6	30%

Table (10): Sex distribution of pelvic fractures

Sex	No. of cases	Percentage
Males	11	55%
Females	9	45%

Table (11): Associated pelvic soft tissue injuries.

Pelvic soft tissue injuries	No. of cases	Percentage
Vascular injury:	15	75%
- Free intraperitoneal hemorrhage	1	5%
- Intramuscular hematomas only	10	50%
- Combined free intraperitoneal hemorrhage and intramuscular hematomas	4	20%
Urethral tears	1	5%

Table (12): Associated extrapelvic injuries:

Extrapelvic injuries	No. of cases	Percentage
- Upper and lower limbs fractures	3	15%
- Splenic tears	2	10%
- Chest injuries	2	10%
- Dorsal and lumbar spine injuries rather than L5 transverse process	2	10%
- Intracranial hemorrhage	1	5%