AIM OF THE WORK

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The aim of this work will be directed to study the role of Multi-Detector Computed Tomography (MDCT) over Conventional Radiography in evaluation and clearing the diagnosis of osseous injuries of the pelvis.

PATIENTS

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The present prospective study included 30 patients known or clinically suspected pelvic fracture referred to the radio-diagnosis department at Alexandria University Hospital.

METHODS

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All the studied patients were subjected to the following:

I. Full history taking about type of trauma.
II. Thorough clinical examination.
III. Plain X-ray of the pelvis:
   1. AP view.
   2. Inlet / Outlet views whenever possible.

IV. Non enhanced MDCT of the pelvis:
   1. Multi-Planar volume Reformation (MPR).
   2. Three-dimensional Volume Rendering (VR).

V. The medical ethics were considered: the patient should be aware of the exami-nation, patient agreement is obtained, the economic status of the patient is consi-dered and the patient has to get benefit from the examination.

HRCT technique on MDCT scanner

Thin axial section images (1 mm slice thickness) with a sharp reconstruction algorithm. On multi-detector CT (MDCT) scanner (Philips MX16, Philips Healthcare), high-resolution CT data sets were acquired lying supine, arms comfortably on the chest or above the head and lower legs supported. The scan started above the iliac crests to include all of fifth lumber vertebra. The inferior landmarks were to entirely include the ischial tuberosities and inferior pubic rami, and through the lesser trochanters of the femurs.

Scan parameters

Scanning parameters were:
- Volumetric sharp kernel algorithm.
- Increments on both sharp kernel (B70) and very smooth (B10)
- Slice thickness: 1 mm.
- Rotation time: 0.5 second.
- Detector Collimation: 1 mm.
- KVp and mA per slice: 140 kVp and approximately 145 mA.

Reconstruction methods

The acquired images were sent to highly specialized workstations. The highly influential tools available at these workstations were mandatory in evaluating and diagnosing the encountered diseases. Volume Rendering and Multi-Planar Reconstruction of the acquired thin sliced axial images facilitated not only coronal and sagittal viewing but also 360 degrees.

RESULTS

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This study included 30 patients with pelvic fractures. They were 21 males (70%) and 9 females (30%) with male to female ratio of 2.3:1. Their ages ranged between 13 and 85 years with a mean age of 36 years (Table 1).

Table 1: Distribution of patients according to age and sex (n=30).

Age in years	Males (%)		Females (%)		Total	
	n	%	n	%	n	%
10 > 20	3	10	--	--	3	10
20 > 30	11	36.67	2	6.66	13	43.34
30 > 40	3	10	1	3.33	4	13.33
40 > 50	--	--	2	6.66	2	6.66
50 > 60	3	10	1	3.34	4	13.33
60 > 70	--	--	1	3.34	1	3.34
70 > 80	1	3.33	1	3.34	2	6.66
80 > 90	--	--	1	3.34	1	3.34
Total	**21**	**70**	**9**	**30**	**30**	**100**

The most common cause was RTA (road traffic accidents) in 20 patients (66.66%), Blunt trauma in 7 patients (23.34%) and fall from height in 3 patients (10%). (Table 2)

Table 2: Distribution of patients according to cause of trauma (n=30).

Couse of trauma	Number of patients	%
RTA	20	66.66
Blunt Trauma	7	23.34
Fall from Height	3	10

The fractures were stable fracture in18 patients (60%) is more common than unstable in 12 patients (40%). (Table 3)

Table 3: Distribution of all patients according to final diagnosis by CT (n=30).

Stability	Number of patients	%
Stable	18	60
Unstable	12	40

The fractured innominate bones and side of fracture where pubic bone is the most bone fractured in 22 patients 73.34% (23, 34% in Right side, 20% in the Left and 20% bilateral), The Ilium where fractured in 18 patients 60% (36.66% in right side and 23.34% in the Left side), followed by the ischium in 3 patients 10% (6.66% in Left side and 3.34% in Bilateral) (Table 4).

Table 4: Distribution of patients according to side of fracture (n=30).

Side of fracture	Pubis (%)		Ilium (%)		Ischium %	
	n	%	n	%	n	%
Right	7	23.34	11	36.66	--	--
Left	6	20	7	23.34	2	6.66
Bilateral	9	30	--	--	1	3.34
Total	**22**	**73.34**	**18**	**60**	**03**	**10**

The suspected fractured in plain radiography and confirmed by MDCT was in 10 patients 33.3% (2 in Ilium, 3 in Ischium, 1 in pubis, 4 in sacrum), and the missed fractured in plain radiography and diagnosed in MDCT was in 6 patients 10% (2 in Ischium, 1 in Pubis, 3 in Sacrum). (Table 5)

Table 5: Distribution of patients with suspected and missed fracture in plain radiography and diagnosed by MDCT (n=30).

Bone	Suspected fracture	Missed fracture
Ilium	2	-
Ischium	3	2
Pubis	1	1
Sacrum	4	3
Total	**10**	**6**

The Type of pelvic fractures in our study according to Young-Burgess Classification which is a mechanistic classification system that classified the fracture according to direction of force : lateral compression (LC), anteroposterior compression (APC), vertical shear (VS) and combined mechanical injury(CMI) , and the statistics were as following: Lateral compression (LC) in 19 patients 63.34% (LC1 13,34% , LC2 30% , LC3 20%) , anteroposterior (APC) in 7 patients 23.34% (APC1 13.34% ,APC2 6.67%, APC3 3.34%) ,vertical shear (VS) in 2 patients (6.66%) and combined mechanical(CMI) in 2 patients (6.66%). (Table 6)

Table 6: Distribution of patients according to young-burgess classification (n=30).

Type	Subtype	n	%	n	%
Anteroposterior Compression	I	4	13.34	7	23.34
	II	2	6.67		
	III	1	3.34		
Lateral Compression	I	4	13.34	19	63.34
	II	9	30		
	III	6	20		
Vertical shear				2	6.66
Combined Mechanical Injury				2	6.66

Type of pelvic fractures in our study according to Tile Classification where the pelvis is divided into the posterior arch (posterior to the acetabulum) and the anterior arch (anterior to the acetabulum), Fracture type is dictated by the stability of the posterior arch (sacroiliac complex), with a spectrum ranging from stable type A injuries to unstable type C fractures, , the statistics were as following: Type A2 in 12 patients (40%), Type B1 in 5 patients (16.66%), Type B2 in 9 patients (30%), Type B3 in 2 patients (6.67%) and Type C1 in 2 patients (6.67%). (Table 7)

Table 7: Distribution of the patients according to tile classification (n=30).

Type of Fracture	Number of patients	%
A1	--	--
A2	12	40
B1	5	16.66
B2	9	30
B3	2	6.67
C1	2	6.67
C2	--	--
C3	--	--

The percentage of comminuted fracture in the patients where comminuted fractured in 24 patients (80%) and non-comminuted fractures in 6 patients (20%). (Table 8)

Table 8: Distribution of the patients according to commination existence (n=30).

Comminuted OR Not	Number of patients	%
Comminuted	24	80
Non Comminuted	6	20

Case (1)
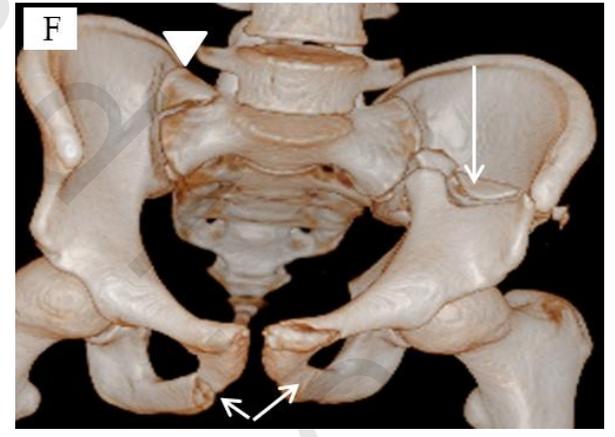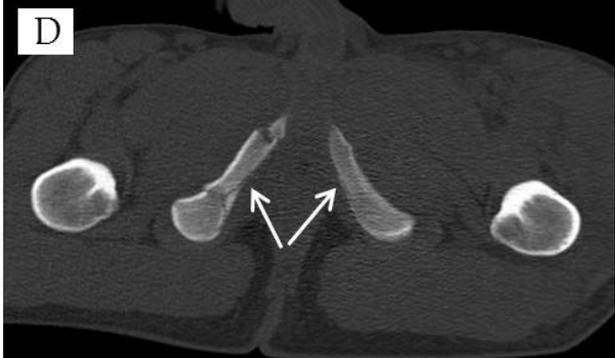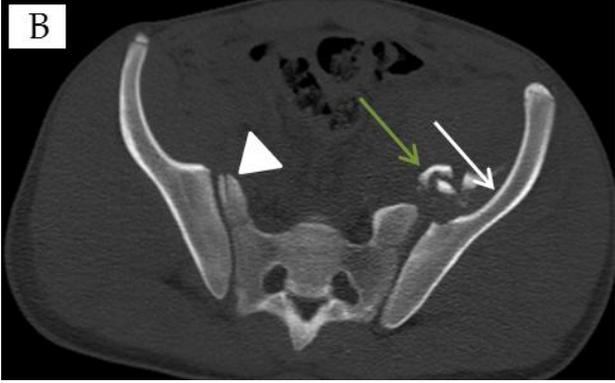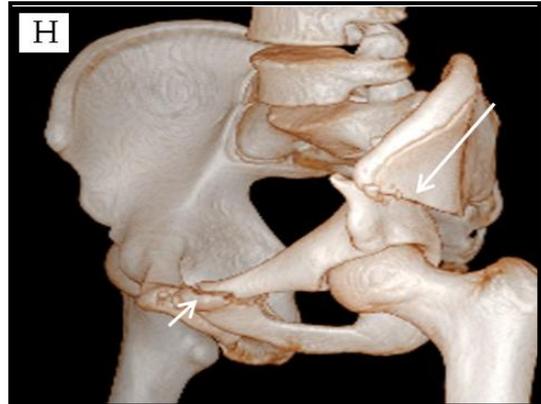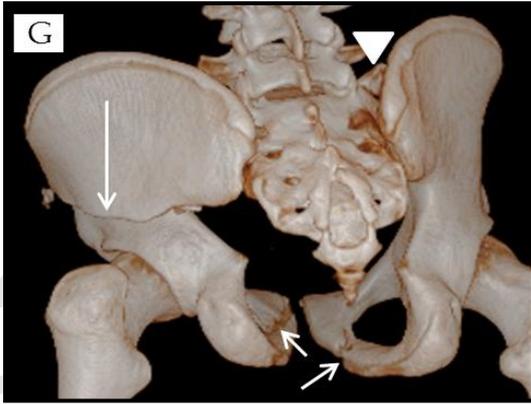
Fig. (30): 16 years old male with history of Falling from height, **(A)** plain x ray anteriorposterio view**, (B, C, D)** axial, **(E)** coronal CT bone windows and **(F,G,H)** VR images they are showing left iliac wing bone fracture reach the SI joint (long arrows in **B,F,G,H**) with diastasis anterior of the left SI joint, and sacral fracture (arrow head in **B,E,F**). Fragment is noted in **B** and **E** (Green arrow). There is fracture in both right and left inferior pubic rami (short arrows in **C,D,F,G,H**).
Conclusion: Lateral compression pelvic fracture (Young classification), Type B2 (Tile classification).

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Case (2)
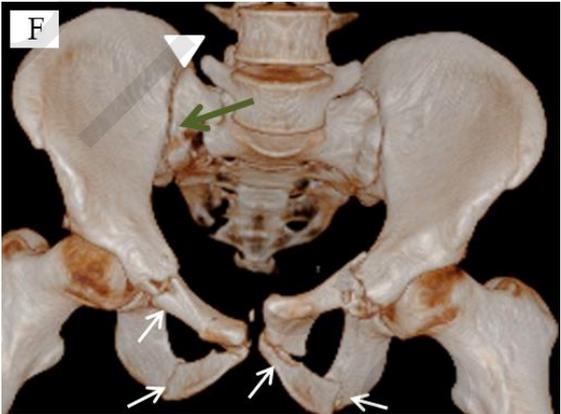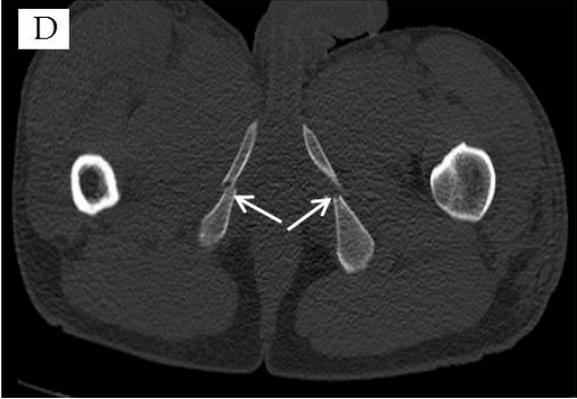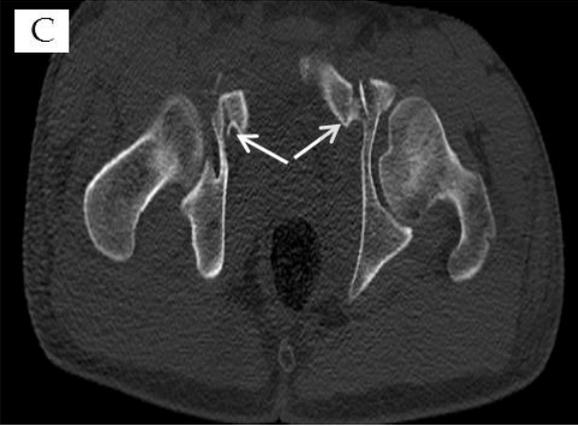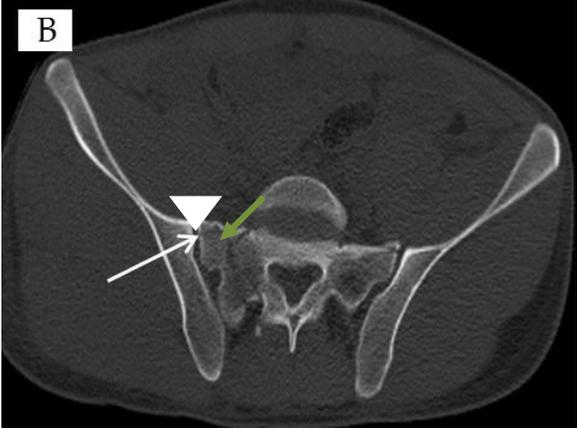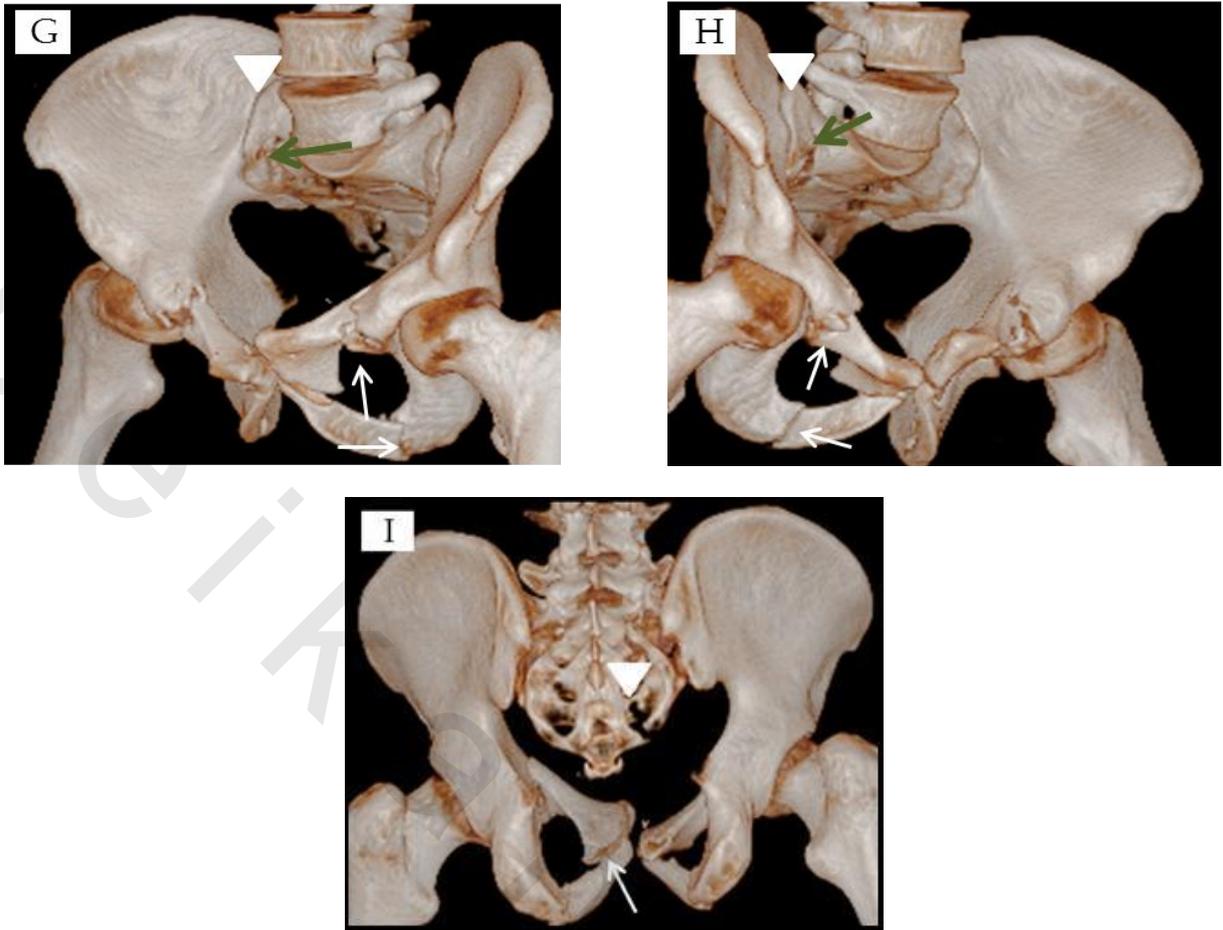
Fig. (31): 23 years old male with history of road traffic accident,**(A)** plain x ray anteriorposterio view, **(B, C, D)** axial CT, **(E)** coronal CT bone windows and **(F,G,H, I)** VR images they are showing right anterior SI joint diastasis (long arrow in **B**) with sacral fracture (arrow heads in **A,B,E,F,G,H,I**) .Both right and left superior and inferior pubic rami are fractured (short arrows in **A,C,D,F,G,H,I**) , with fragment (Green arrow in **B,E,F,G,H**). **Conclusion:** lateral compression pelvic fracture (Young classification), Type C1 (Tile classification).

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Case (3)
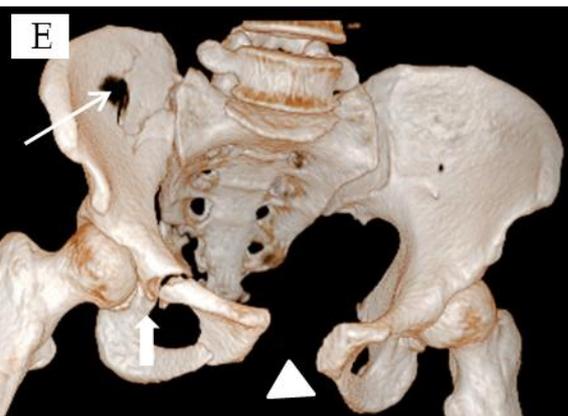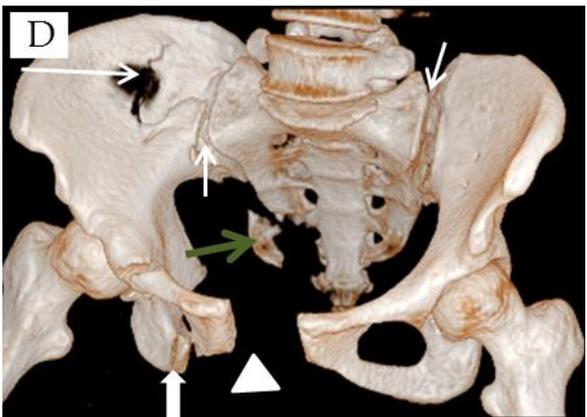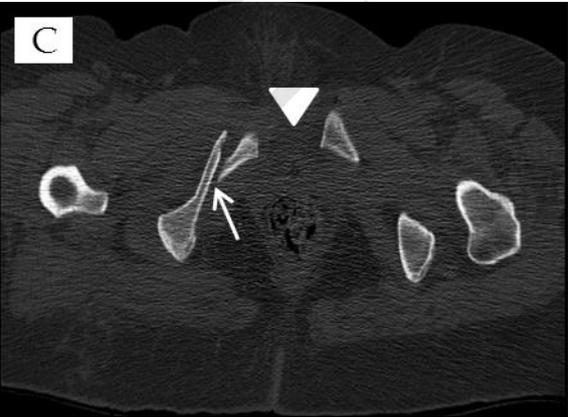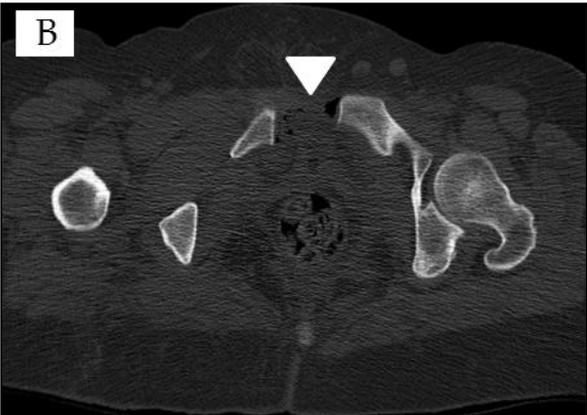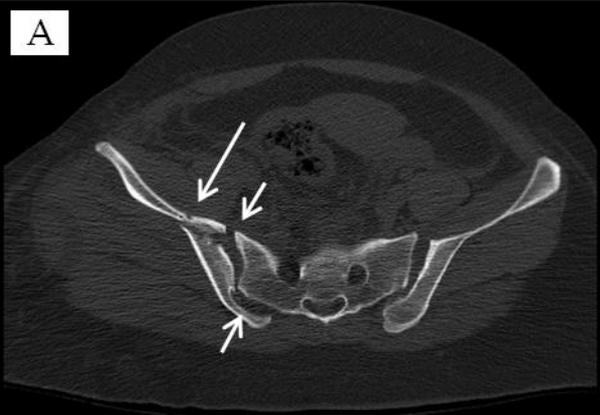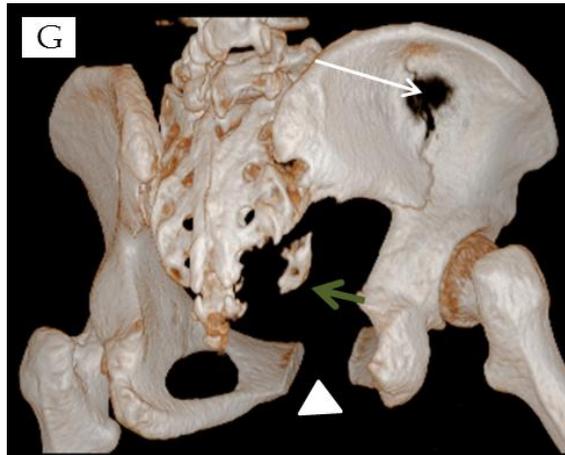
Fig. (32): 35 years old female with history of road traffic accident, axial bone window CT in **(A,B,C)** and VR in **(D,E,F,G)** show widening of the symphysis pubis (arrow head in **B,C,D**) , right iliac wing fracture (long arrow in **A,**) reach to right SI joint that showed diastasis (small arrow in **A,D**). There is fracture in both inferior and superior right pubic rami (arrow in **C** and thick arrow in **D,E,F**). Fragment is seen in **D** (Green arrow).
Conclusion: anteroposterior compression pelvic fracture (Young classification), Type B3 (Tile classification).
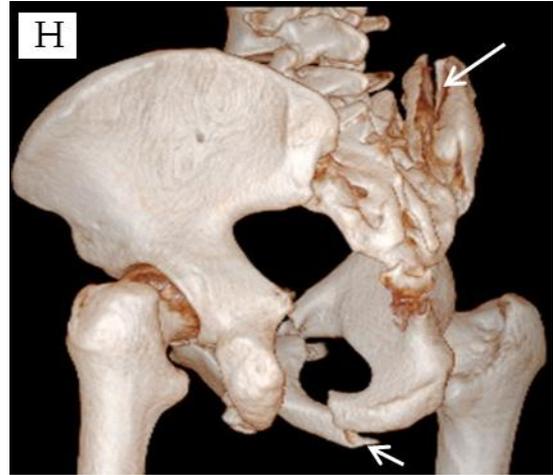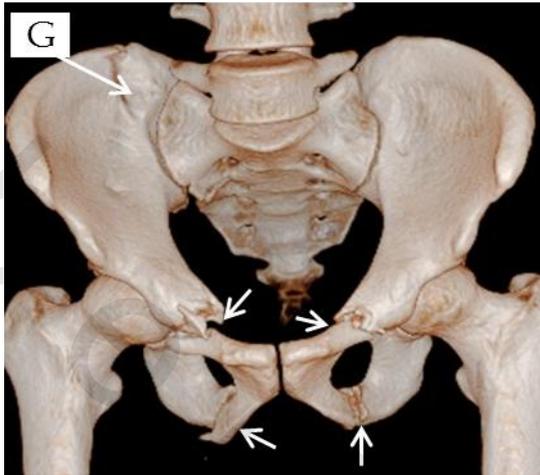
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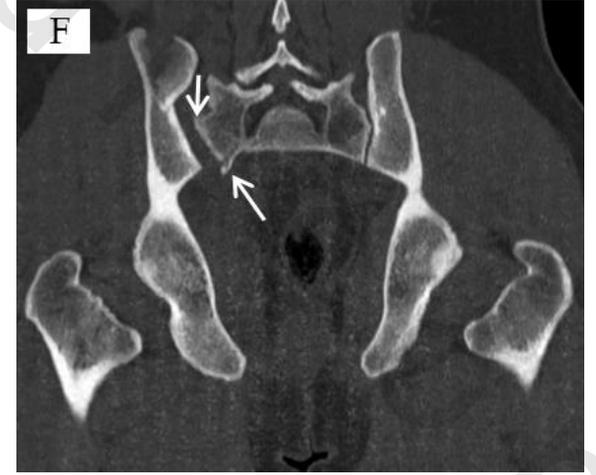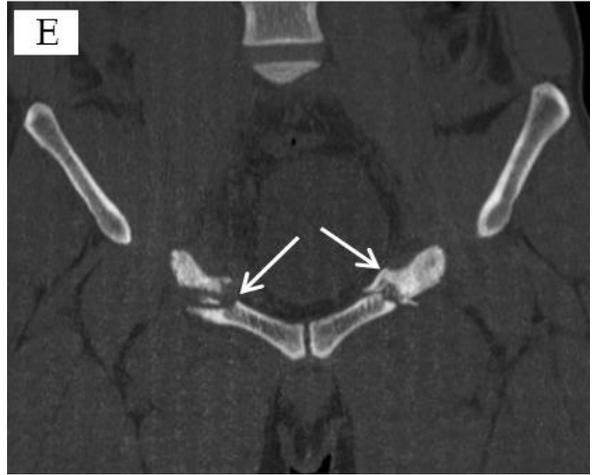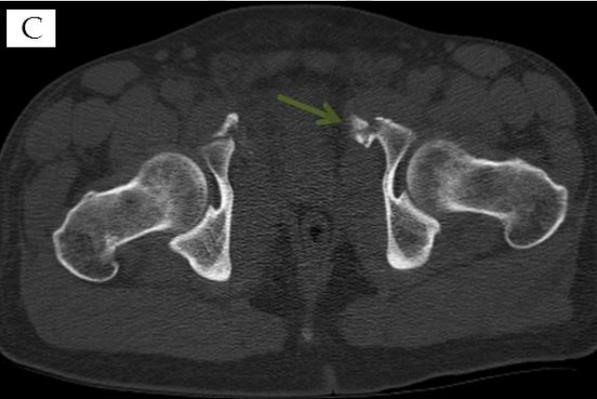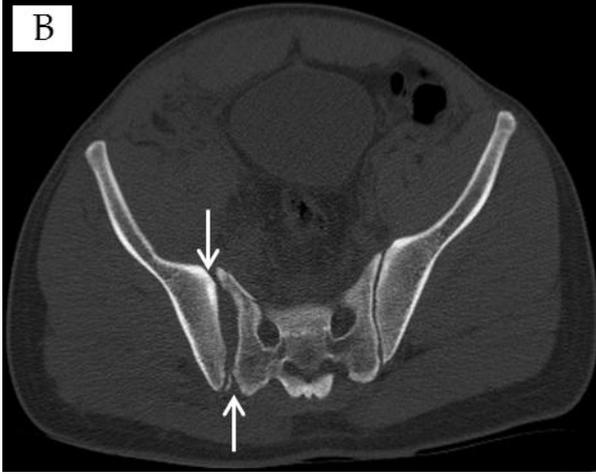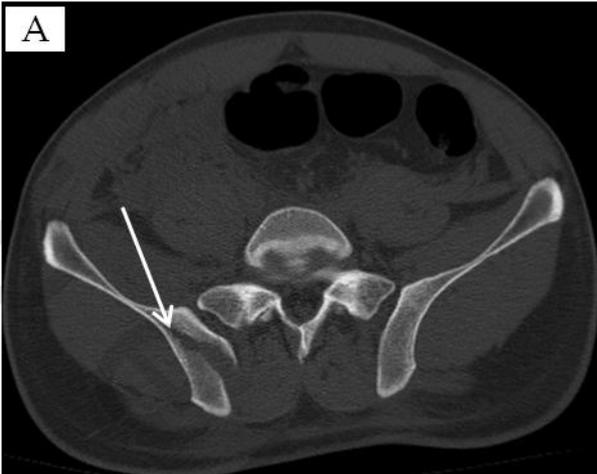
Fig. (33): 23 years old male with history of road traffic accident, **(A, B, C, D)** axial CT, **(E, F)** coronal CT bone windows and **(G,H)** VR images (anterior view in **H** and posterior oblique view in **H**) they are showing right iliac bone fracture reachs to the right SI joint (long arrow in **A,G,H**) ,the right SI joint diastasis in both anterior and posterior with (short arrows in **B**). Both right and left superior and inferior pubic rami are fractured (short arrows in **D, E,G,H**) , with fragment (Green arrow in **C**).
Conclusion: lateral compression pelvic fracture (Young classification), Type C1 (Tile classification).
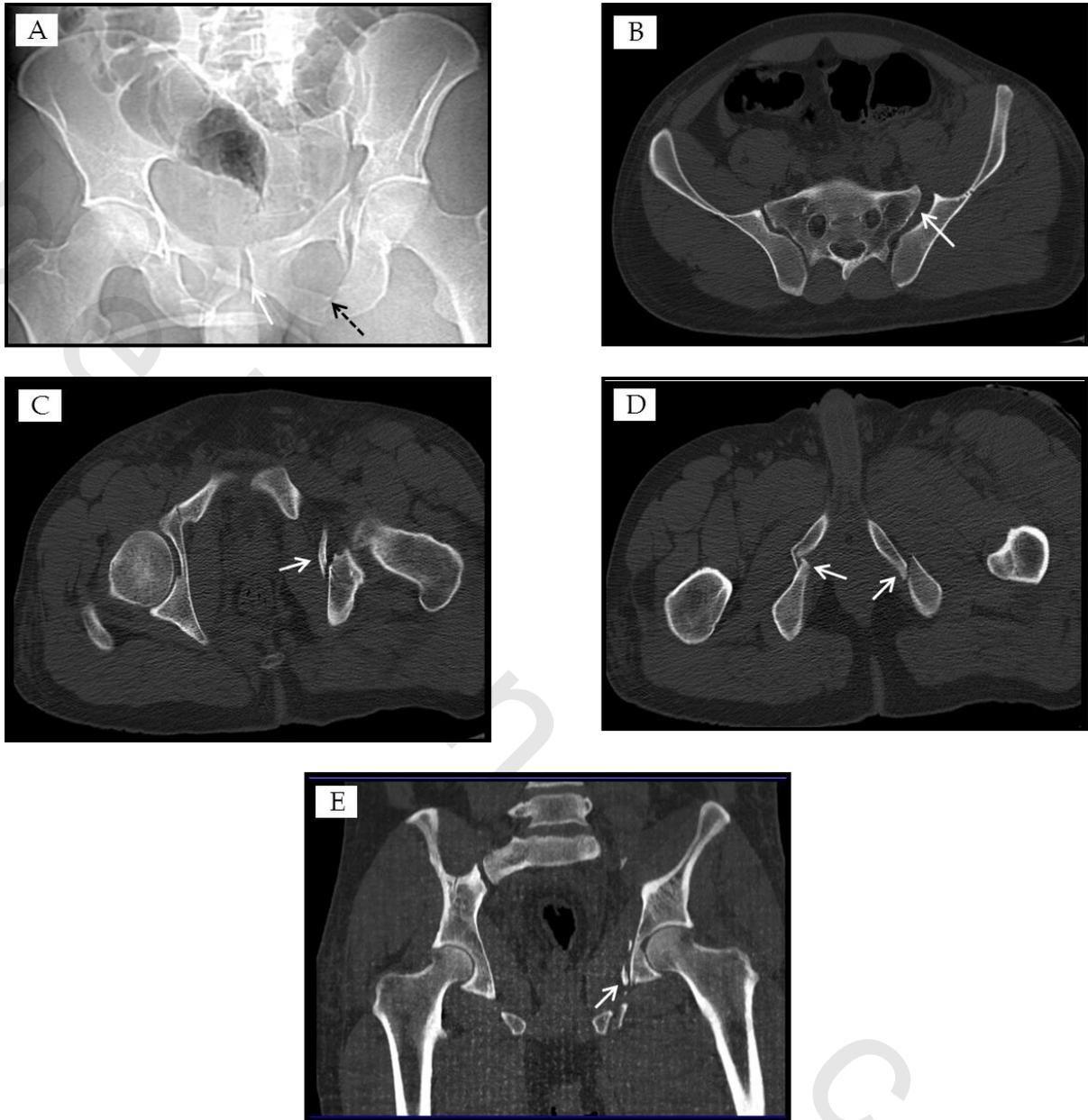
Case (5)

Fig. (34): 30 years old male with history of falling from height, plain x-ray anteriorposterior view in **(A)** show pubic symphysis diastasis (short white arrow), and a fracture of the left inferior pubic rami (black arrow), **(B,C,D)** Axial bone window CT of the pelvis showing left sacroiliac diastasis which didn't seen in plain radiography in **(B)** and both inferior pubic rami in **(C,D)** , **(E)** Coronal CT of the pelvis show the fragments.
Conclusion: Vertical shear pelvic fracture (Young classification), Type B2 (Tile classification)