Results

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Fifty patients suffering from spinal cord injury (either complete or incomplete injury) were included in this study. They were 30 males (60%) and 20 females (40%).

- Their ages ranged between 18 and 40 years with a mean of 26.8 ± 7.1 years.

Table (2): Age and sex distribution in studied group.

Age (year)	
Range	18 – 40
Mean ± S.D.	26.8 ± 7.1
Sex	
Male	30 (60 %)
Female	20 (40%)

- Thirty four patients (68.0%) have a complete spinal cord injury & 16 patients (32.0%). have a incomplete spinal cord injury.

Table (3): Types of spinal cord lesion in studied group.

Type of lesion	Frequency	Percent
Complete	34	68.0%
Incomplete	16	32.0%

- Thirty two patients (64.0%) have a high level of spinal cord injury (i.e. from the second cervical vertebra to the tenth thoracic vertebra) & 18 patients (36.0%) have a low level of spinal cord injury (i.e. from the eleventh thoracic vertebra to the first lumbar vertebra).

Table (4): Level of spinal cord lesion in studied group.

Level of lesion	Frequency	Percent
High	32	64.0%
Low	18	36.0%

- The duration of spinal cord injury ranged between 1 - 17 years with a mean of 9.2 ± 5.8 years.
- Twenty eight patients (56.0%) have a duration of spinal cord injury more than 3 years & 22 patients (44.0%) have a duration of spinal cord injury less than or equal 3 years.

Table (5): Duration of spinal cord lesion in studied group.

Duration of lesion	Frequency	Percent
More than 3 years	28	56.0%
Less than or equal 3 years	22	44.0%

- The T score of bone mineral density of the spine ranged between -1.0 & -2.7 S.D with a mean of -1.9 ± - 0.36 S.D
- The T score of bone mineral density of the femoral neck ranged between -1.7 & - 4.0 S.D with a mean of -2.6 ± - 0.64 S.D.

Table (6): Bone mineral density in studied group.

Bone mineral density	Range	Mean ± S.D.
Spine	-1.0 & -2.7 S.D	-1.9 ± - 0.36 S.D
Femoral neck	-1.7 & - 4.0 S.D	-2.6± - 0.64S.D

- The biochemical markers of bone formation (bone specific alkaline phosphatase) ranged between 65.0 &102.0 unit / L with a mean of 89.8 ±11.1 unit / L.
- The biochemical markers of bone resorpition (C-telopeptid) ranged between 50.0 & 122.0 mg / L with a mean of 92.1 ±17.2 mg / L.
- The serum calcium ranged between 8.3 & 11.5 mg / d L with a mean of 10.0 ±0.8 mg /d L.
- The serum phosphorus ranged between 2.5 & 5.1mg /d L with a mean of 3.9 ± 0.6 mg /d L. • The serum albumin

ranged between 3.8 & 5.1 g / d L with a mean of 4.4 ± 0.4 g /d L.

- The 24 hours urinary calcium ranged between 300 & 450 mg / d L with a mean of 389 ±29.3 mg /d L.
- The blood urea ranged between 28.0 & 52.0 mg / d L with a mean of 30.7 ±7.2 mg /d L.
- The serum creatinine ranged between 0.6 & 3.1 mg / d L with a mean of 0.8±0.5 mg /d L.
- The AST of liver ranged between 4.0 & 41.0 unit / L with a mean of 15.6±11.1 unit/ L.
- The ALT of liver ranged between 3.0 & 91.0 unit / L with a mean of 14.6±17.6 unit / L.
- The hemoglobin (Hb) percentage ranged between 10.7 and 13.6 gm% with a mean of 11.9 ± 0.7 gm%.
- The red blood cells (RBCs) count ranged between 3.3 and 5.3/ c.mm with a mean of 4.1 ± 0.5/c. mm.
- The total leucocytic count (TLC) ranged between 4.0 ± 10.9/c.mm with a mean of 6.2 ± 1.6/c. mm.
- The platelets count ranged between 177.000 and 504.00/c.mm with a mean of 353.6 ± 84.2 /c.mm.

Table(7): Laboratory results among patients group.

Variables	Range	Mean ± S.D.
Bone specific alkaline phosphatase unit / L.	65.0- 102.0	89.0 ± 11.1
C-telopeptid mg / L.	50.0 -122.0	92.1 ± 17.2
Serum calcium mg /dL.	8.3 - 11.5	10.0 ± 0.8
Serum albumin g / d L.	3.8 - 5.1	4.4 ± 0.4
Serum phosphorus mg.	2.5 - 5.1	3.9 ± 0.6
24 hours urinary calcium mg /d L.	300 - 450	389 ± 29.3
Blood urea mg /d L.	28.0 - 52.0	30.7 ± 7.2
Serum creatinine mg /DL.	0.6 - 3.1	0.8 ± 0.5
AST unit/ L.	4.0 - 41.0	15.6 ± 11.1
ALT unit/ L.	3.0 - 91.0	14.6 ± 17.6
The hemoglobin (Hb) percentage gm%.	10.7 -13.6	11.9 ± 0.7
Red blood cells/c. mm.	3.3 - 5.3	4.1 ± 0.5
Total leucocytic count/c.mm.	4.0 - 10.9	6.2 ± 1.6
Platelets count/c.mm	177.00 - 504.00	353.6 ± 84.2

- In our study a group of ten patients have renal impairment, there serum creatinine ranged between 1.5 & 3.1 mg / d L with a mean of 1.9 ±0.76 mg /d L.
- The serum calcium ranged between 8.3 & 8.5 mg / d L with a mean of 8.1 ±0.9 mg /d L.
- The serum phosphorus ranged between 5.3 & 5.6 mg /d L with a mean of 5.1 ± 0.8 mg /d L.
- The 24 hours urinary calcium ranged between 380 & 450 mg / d L with a mean of 395 ± 84.1 mg /d L.
- The bone specific alkaline phosphatase ranged between 90.0 & 102.0 unit / L with a mean of 95.0 ± 8.1 unit / L.
- The C - telopeptid ranged between 110.0 & 122.0 mg / L with a mean of 113.0 ± 7.9 mg / L.
- The T score of bone mineral density of the spine ranged between -1.5 & -2.7 S.D with a mean of – 2.0 ± - 0. 5 S.D .
- The T score of bone mineral density of the femoral neck ranged between -1.9 & - 4.0 S.D with a mean of -2.7 ± - 0.8 S.D.

Table(8): Results among renal impairment group.

Variables	Range	Mean ± S.D.
Serum creatinine mg /DL.	1.5 - 3.1	1.9 ±0.76
Serum calcium mg /d L.	8.3 - 8.5	8.1 ±0.9
Serum phosphorus mg /d L.	5.3 - 5.6	5.1 ± 0.8
24 hours urinary calcium mg /d L	380 - 450	395.0± 84.1
Bone specific alkaline phosphatase unit /L	90.0 - `102.0	95.0 ± 5.0
C-telopeptid mg / L.	110 - 122	115 ± 4.9
BMD of Spine	-1.5&-2.7S.D	2.0 ± - 0. 5 S.D
BMD OF femoral neck	-1.9&-4.0S.D	-2.7± - 0.8 S.D

- The control group was represented by 10 normal individual not suffering detectable clinical or laboratory abnormalities.

- They were 5 males (50%) and 5 females (50%).

- Their ages ranged between 18 and 42 years with a mean of 29.8 ± 8.1 years.

Table (9): Age and sex distribution in control group.

Age (year)	
Range	18 - 42
Mean ± S.D.	29.8 ± 8.1
Sex	
Male	5 (50%)
Female	5 (50%)

- The T score of bone mineral density of the spine ranged between +1.0 & +2.0 S.D with a mean of +1.4 ± 0.61 S.D.
- The T score of bone mineral density of the femoral neck ranged between +1.5 & + 2.0 S.D with a mean of +1.7 ± 0.3 S.D.

Table (10): Bone mineral density in control group.

Bone mineral density	**Range**	**Mean ± S.D.**
Spine	+1.0 - + 2.0 S.D	+ 1.4 ± 0.61 S.D
Femoral neck	+1.5 - + 2.0 S.D	+ 1.7 ± 0.3 S.D

- The biochemical markers of bone formation (bone specific alkaline phosphatase) ranged between 12.0 &68.0 unit / L with a mean of 28.2 ±11.0unit / L.

- The biochemical markers of bone resorpition (C-telopeptid) ranged between 1.0 & 3.0 mg / L with a mean of 1.8 ±0.76 mg / L.
- The serum calcium ranged between 8.3 & 11.5 mg / d L with a mean of 10.0 ±0.8 mg /d L.
- The serum albumin ranged between 3.4 & 5.1 g / d L with amen of 4.3 ± 0.3 g /d L.
- The serum phosphorus ranged between 3.1&5.1mg /d L with a mean of 3.9 ± 0.5 mg /d L.
- The 24 hours urinary calcium ranged between 86.0 & 408 mg / d L with a mean of 187.1 ± 93.2 mg /d L.
- The blood urea ranged between 20.0 & 45.0 mg / d L with a mean of 29.5±10.2 mg /d L.
- The serum creatinine ranged between 5.0 & 1.0 mg / d L with a mean of 0.7 ±0.2 mg /d L.
- The AST of liver ranged between 6.0 & 38.0 unit / L with a mean of 23.2 ± 12.2 unit/ L.
- The ALT of liver ranged between 5.0 & 46.0 unit / L with a mean of 24.8 ± 15.3 unit / L.

- The hemoglobin (Hb) percentage ranged between 10.2 and 13.5 gm% with a mean of 11.7 ± 0.7 gm%.
- The red blood cells (RBCs) count ranged between 3.4 and 5.1/ c.mm with a mean of 4.3 ± 0.3/c. mm.
- The total leucocytic count (TLC) ranged between 4.5 and 10.4 /c.mm with a mean of 4.9 ± 1.9/c. mm.
- The platelets count ranged between 167.00and 441.00/c.mm with a mean of 274.6 ± 70.9/c.mm.

Table (11): Laboratory results among control group.

Variables	Range	Mean ± S.D.
Bone specific alkaline phosphatase unit /L	120.0 - 68.0	28.2 ± 11
C-telopeptid mg / L.	1.0 - 3.0	1.8 ± 0.76
Serum calcium mg /d L.	8.3 - 11.5	10.0 ±0.8
Serum albumin g /d L.	3.4 - 5.1	4.3 ± 0.3
Serum phosphorus mg /d L.	3.1 - 5.1	3.9 ± 0.5
24 hours urinary calcium mg /d L	86.0 - 408	187.1 ± 93.2
Blood urea mg / d L.	20.0 - 45.0	29.5 ± 10.2
Serum creatinine mg / d L.	5.0 - 1.0	0.7 ± 0.2
AST unit/ L.	6.0 - 38.0	23.2 ± 12.2
ALT unit/ L.	5.0 - 46.0	24.8 ± 15.3
The hemoglobin (Hb) percentage gm%.	10.2 - 13.5	11.7 ± 0.7
Red blood cells/c. mm.	3.4 - 5.1	0.3± 0.3
Total leucocytic count/c. mm.	4.5 - 10.4	4.9 ± 1.9
Platelets count/c.mm.	167.00 - 41.00	274.6±70.9

Correlative study

Correlation between age & bone mineral density (BMD)

- Age was insignificantly correlated with T score of BMD of the spine and femoral neck (P>0.05) (Table .12).

Correlation between age & biochemical markers of bone

- Age was insignificantly correlated with the biochemical markers of bone formation (bone specific alkaline phosphates) (P>0.05).But significantly correlated with the biochemical markers of bone resorpition (C-telopeptid) (P<0.05) (Table .12).

Correlation between sex & bone mineral density (BMD)

- Sex was insignificantly correlated with T score of BMD of the spine and femoral neck (P>0.05) (Table 12).

Correlation between sex & biochemical markers of bone

- Sex was insignificantly correlated with the biochemical markers of bone formation (bone specific alkaline phosphates) & biochemical markers of bone resorpition (C-telopeptid) (P>0.05) (Table 12) .

Table (12): Correlation between age, sex & bone mineral density (BMD) & biochemical markers of bone.

Item	BMD of spine			BMD of femoral neck			BSAP			C-telopeptid		
	r	*P*	*s*	*r*	*p*	*s*	*r*	*P*	*s*	*r*	*p*	*s*
Age	-.359	>0.05	I.S	-.373	>0.05	I.S	.358	>0.05	I.S	0.034	<0.05	S
Sex	. 200	>0.05	I.S	. 182	>005	I. S	. 241	>0.05	I.S	.126	>0.05	I.S

Comparison between types (severity)of spinal cord lesion& bone mineral density (BMD).

- Complete lesion was highly significantly correlated with T score of BMD of the spine (P<0.001), while incomplete lesion was significantly correlated with T score of BMD of the spine (P<0.05), but complete and incomplete lesions was insignificantly correlated with T score of BMD of the femoral neck (P>0.05) (Table 13).

Table (13): Comparison between types (severity) of spinal cord lesion & bone mineral density (BMD).

Types of lesion	BMD of spine				BMD of femoral neck			
	Mean	*SD*	*P*		*Mean*	*SD*	*P*	
Complete lesion	-2.08	.31	0.00	H.S	-2.84	.68	.054	I.S
Incomplete lesion	-1.6	.33	0.12	S	-2.30	.35	.182	I.S

H.S:Highly Significant . P< 0.001. S: Significant.P<0.05 . I.S: Insignificant. P>0.05

Comparison between the types (severity) of spinal cord lesion & biochemical markers of bone turnovers .

- The types of lesion either complete or incomplete was insignificantly correlated with the biochemical markers of bone formation (bone specific alkaline phosphatase) & biochemical markers of bone resorpition (C-telopeptid) (P>0.05) (Table 14).

Table (14): Comparison between types (severity) of spinal cord lesion & biochemical markers of bone turnovers.

Types of lesion	BSAP				C. .telopeptid			
	Mean	*SD*	*P*		*Mean*	*SD*	*P*	
Complete lesion	92.3	10.5	.126	I.S	93.1	18.6	.241	I.S
Incomplete lesion	84.6	11.0	.125	I.S	90.0	15.5	.539	I.S

Comparison between the level of spinal cord lesion & bone mineral density (BMD)

- The level of lesion either high or low was significantly correlated with the T score of BMD of the spine and femoral neck (P<0.05) (Table 15).

Table (15): Comparison between level of spinal cord lesion& bone mineral density.

Level of lesion	BMD of spine				BMD of femoral neck			
	Mean	*SD*	*P*		*Mean*	*SD*	*P*	
High-level of lesion	-2.0	.31	.010	S	-2.8	.69	.031	S
Low-level of lesion	-1,7	,32	0,03	S	-2.3	.31	.026	S

Comparison between the level of spinal cord lesion & the biochemical markers of bone turnover.

- The level of lesion either high or low was insignificantly correlated with the biochemical markers of bone formation (bone specific alkaline phosphatase) (BSAP) & biochemical markers of bone resorpition (C-telopeptid) (P>0.05) (Table 16).

Table (16) Comparison between level of spinal cord lesion & biochemical markers of bone turnover.

Level of lesion	BSAP				C-telopeptid			
	Mean	*SD*	*P*		*Mean*	*SD*	*P*	
High-level of lesion	92.7	10.6	.124	I.S	96.2	17.6	.065	I.S
Low-level of lesion	84.7	10.4	0.47	I.S	84.9	14.8	.579	I.S

Comparison between the duration of spinal cord lesion & the bone mineral density (BMD) .

- The duration of the lesion either more or less than three years was insignificantly correlated with the T score of BMD of the spine and femoral neck (P>0.05) (Table 17).

Table (17) : Comparison between duration of spinal cord lesion & bone mineral density (BMD).

Duration of Lesion	BMD of spine				BMD of femoral neck			
	Mean	*SD*	*P*		*Mean*	*SD*	*P*	
More than 3 years	-2.06	.38	.130	I.S	-2.8	.74	.153	I.S
Less than or equal 3 years	-2.47	.31	.157	I.S	-2.4	.44	.215	I.S

Comparison between duration of the spinal cord lesion& the biochemical markers of bone turnover.

- The duration of the lesion either more or less than three years was significantly correlated with the both biochemical markers of bone formation (bone specific alkaline phosphatase) (BSAP) & biochemical markers of bone resorpition (C-telopeptid) (P<0.05) (Table 18).

Table (18) Comparison between duration of the spinal cord lesion & the biochemical markers of bone.

Duration of lesion	BSAP				C. telopeptid			
	Mean	*SD*	*P*		*Mean*	*SD*	*P*	
More than 3 years	93.6	10.8	.017	S	98.7	13.1	.030	S
Less than or equal 3 years	85.0	9.9	.003	S	83.8	18.8	.026	S

Correlation between bone mineral density (BMD) & biochemical markers of bone turnover.

- The T score of bone mineral density of the spine and femoral neck was highly significant correlation with both the biochemical markers of bone formation (bone specific alkaline phosphatase) (BSAP) & biochemical markers of bone resorpition (C-telopeptid) (P<0.001) (Table 19).

Correlation between biochemical markers of bone formation & resorption.

- Both the biochemical markers of bone formation (bone specific alkaline phosphatase) (BSAP) & the biochemical markers of bone resorpition (C-telopeptid) are highly significant correlation with each other (P<0.001) (Table 19).

Correlation between the T score of bone mineral density (BMD) spine & femoral neck

- The T score of BMD of the spine was highly significantly correlated with the T score of BMD of the femoral neck (P<0.001) (Table 19).

Table (19). Correlation between bone mineral density (BMD) & biochemical markers of bone turnover

Item	BSAP			C. telopeptid			BMD of spine		
	r	*P*	*S*	*r*	*P*	*S*	*r*	*P*	*S*
BSAP				.704	<0.001	H.S	- . 763	<0.001	H.S
C.telopeptid	.704	<0.001	H.S				-. 605	<0.001	H.S
BMD of spine	- .763	<0.001	H.S	- .605	<0.001	H.S			
BMDof femoral neck	- .840	<0.001	HS	- .757	<0.001	H.S	-.882	<0.001	H.S

Comparison between the T score of bone mineral density (BMD) of the spine in patients and control group.

The T score of bone mineral density (BMD) of the spine in patients and control group was significant correlation with each other (table 20).

Table (20). Comparison between the T score of bone mineral density (BMD) of the spine in patients and control group.

Group	Mean	SD	p	
patients	-1.9	-0.36	0.017	S
control	+1.4	0.61		

S: Significant **P <0.05**

Comparison between the T score of bone mineral density (BMD) of the femoral neck in patients and control group.

The T score of bone mineral density (BMD) of the femoral neck in patients and control group was highly significantly correlated with each other (table 21).

Table (21). Comparison between the T score of bone mineral density (BMD) of the femoral neck in patients and control group.

Group	Mean	SD	P	
patients	-2.6	0.64	0.00	H.S
control	+1.7	0.3		

H.S: Highly Significant **P <0.01**

Comparison between the biochemical markers of bone formation (bone specific alkaline phosphatase) in patients and control group.

The biochemical markers of bone formation (bone specific alkaline phosphatase) in patients and control group was highly significantly correlated with each other (table 22).

Table (22). Comparison between the biochemical markers of bone formation (bone specific alkaline phosphatase) in patients and control group.

Group	Mean	SD	P	
patients	89.0	11.1	0.00	H.S
Control	28.2	11.0		

H.S: Highly Significant **P <0.01**

Comparison between the biochemical markers of bone of bone resorpition (C-telopeptid) in patients and control group.

The biochemical markers of bone of bone resorpition (C-telopeptid) in patients and control group were highly significantly correlated with each other (table 23).

Table (23). Comparison between the biochemical markers of bone of bone resorpition (C-telopeptid) in patients and control group.

Group	Mean	SD	P	
patients	92.1	17.2	0.00	H.S
Control	1.8	0.76		

H.S: Highly Significant **P <0.01**

Comparison between the serum calcium in patients and control group.

The serum calcium in patients and control group was insignificantly correlated with each other (table 24).

Table (24). Comparison between the serum calcium in patients and control group.

Group	Mean	SD	T	P
patients	10.0	0.8	0.148	N.S
Control	10.0	0.8		

N.S: Not Significant **P > 0.05**

Comparison between the serum albumen in patients and control group.

The serum albumen in patients and control group was insignificantly correlated with each other (table 25).

Table (25). Comparison between the serum albumen in patients and control group.

Group	Mean	SD	P	
patients	4,4	0.4	0.28	N.S
Control	4.3	0.3		

N.S: Not Significant **P > 0.05**

Comparison between the serum phosphorus in patients and control group.

The serum phosphorus in patients and control group was insignificantly correlated with each other (table 26).

Table (26). Comparison between the serum phosphorus in patients and control group.

Group	Mean	SD	P	
patients	3.9	0.6	0.28	N.S
Control	3.9	0.5		

N.S: Not Significant **P > 0.05**

Comparison between The 24 hours urinary calcium in patients and control group.

The 24 hours urinary calcium in patients and control group was insignificantly correlated with each other (table 27).

Table (27). Comparison between The 24 hours urinary calcium in patients and control group.

Group	Mean	SD	P	
patients	389	29.3	0.00	N.S
Control	187.1	93.2		

N.S: Not Significant **P > 0.05**