

Renal Profile in Cases Subjected to Blunt Trauma

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ABSTRACT

Objective: To study the occurrence of renal failure in cases subjected to blunt trauma.

Study design: Analytical study.

Place and Duration of Study: This study was carried out at the Medico-legal clinic, Services Hospital, Lahore from January to December, 2007.

Materials and Methods: The study was based upon 50 cases of blunt trauma reporting at Medico-legal clinic, Services Hospital, Lahore. Twenty normal healthy controls were taken for comparison purposes. The cases were clinically examined for presence of evidence of trauma. Urine and blood samples were taken for estimation of blood urea, creatinine, potassium & calcium.

Results: There were 47 males (94 %) and 3 females (6 %). The age of the subjects ranged between 18-70 years with mean of 30.9 ± 12.34 , maximum number (62 %) below the age of 30. The injuries found were abrasions / bruises in 45 cases (90 %), lacerated wounds in 5 cases (10 %). In most of the cases (40%) injuries were distributed in more than one body region. As single area involvement the head and face area was affected in one case (2 %), chest in 4 cases (8 %) and limbs in 25 cases (50 %). The most commonly involved areas were buttocks, thighs, back of chest. Twenty nine cases (58 %) reported for examination within 24 hours. Thirteen cases (26 %) reported between 24-48 hours and 8 cases (16 %) reported between 48-72 hours after being traumatized.

Urine Examination showed yellow colour in 44 cases (88%) and brownish red in 6 cases (12 %). Specific gravity ranged between 1010-1030 with mean of 1020.6 ± 6.59 . It was between 1010-1019 in 14 cases(28%), 1020-1029 in 27 cases (54%) and 1030-1039 in 9 cases(18%). pH ranged between 5 – 8 with mean of 5.8 ± 0.75 . It was between 5 – 5.9 in 7 cases(14%), between 6.0 – 6.9 in 27 cases(54%), between 7.0 – 7.9 in 14 cases(28%) and 8.0 & above in 2 case(4%). In control group it ranged between 6.0 – 7.0 with mean of 6.4 ± 0.50 . Blood was positive in 7 cases(14%), and negative in 43 cases(86%). Microscopic Examination of urinary sediment showed pus cells 0 – 5 /HPF in 35 cases (70%), and above 5/HPF in 15 cases (30%). The red blood cells were present in 15 cases (30%). Calcium oxalate crystals were found in 39 cases (78%), triple phosphate in 5 cases (10%). In 6 cases (12%) no crystals were found. The cellular casts were present in 6 cases (12%).

In blood examination blood urea ranged between 15.5 – 86.0 mg/dl with a mean of 43.54 ± 15.06 . The blood urea was above reference range in 7 cases (14 %). Blood Creatinine ranged between 0.5 – 2.6 mg/dl with mean of 0.97 ± 0.47 . The raised blood creatinine was found in 7 cases (14%). These cases are the same cases which have raised blood urea. Serum Potassium ranged between 3.2 – 5.9 mmol/dl with mean of 4.45 and S.D. 0.78. It is above reference range in 9 cases (18%). In cases with raised blood urea and creatinine it was raised in all cases. Serum Calcium ranged between 5.6 – 10.74 with mean of 8.84 ± 1.01 . The hypocalcaemia was seen in 25 cases (50%). In the cases with raised blood urea and creatinine the calcium was low in all cases. In our study 14% cases have shown the evidence of renal function derangement.

Conclusion: The cases subjected to blunt trauma are at threat to develop renal failure particularly in cases with dehydration and acidosis.

Key Words: blunt trauma, renal failure, myoglobinuria, rhabdomyolysis

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INTRODUCTION

Human beings are exposed to trauma in various situations and by various means. Sometime they meet an accident but at other times they are subjected to

intentionally caused injuries. The injuries could be caused by variety of means like blunt, sharp & firearms. The injuries caused by blunt means like bruises and lacerations are also associated with damage to underlying muscles. The traumatized muscles undergo rhabdomyolysis. The extensive muscle injury releases large quantities of myoglobin into circulation. Since its capacity to bind with serum proteins especially haptoglobins is low, it is freely filtered and appears in

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large quantities in the glomerular filtrate. Subsequently it caused extensive obstruction and necrosis of tubules resulting in acute renal failure.¹

Myo refers to muscle, *rhabdo* means striated (as in striated or skeletal muscle), and *lysis* is breakdown. Therefore, *rhabdomyolysis* (pronounced rab'-do-mi-ol'-i-sis) is a dissolution of skeletal muscles that produces a nonspecific clinical syndrome that causes extravasation of toxic intracellular contents from the myocytes into the circulatory system.²

The rhabdomyolysis is common clinical and laboratory syndrome resulting from skeletal muscle injury and acute renal failure is the most common complication.³

The rhabdomyolysis, myoglobinuria and renal failure have been known to follow massive crush injury.⁴

Crush injuries resulting in traumatic rhabdomyolysis are an important cause of acute renal failure. Intravascular volume depletion and renal hypoperfusion, combined with myoglobinuria, result in renal dysfunction.⁵

Rhabdomyolysis is a common entity that often has a multifactorial etiology. It usually affects healthy individuals, following trauma, excessive physical activity, convulsive crisis, alcohol and other drugs consumption or infections. . Myoglobinuric acute renal failure (ARF) is only possible in the presence of myoglobin, liberated by the muscle cells, and of hypovolaemia / renal hypoperfusion.⁶

The serum levels of myoglobin, creatinine, urea, beta microglobulin were measured in prolonged crush syndrome patients injured during Yervan Earth quake. A drastic increase of myoglobin level in blood was observed in all the patients by the moment of hospitalization. The level being the higher, the more severe the injury.⁷

The myoglobin has been found in serum and urine of patients after various types of muscle injury. In man and experimental animal renal damage and death have at times been the sequel to myoglobinuric states.⁸

The evidence of rhabdomyolysis included markedly elevated creatin phosphokinase (CPK), myoglobinuria and aldolase in blood.⁹

The myoglobin being nephrotoxic leads to acute renal failure which is a life threatening situation. It is important to apprehend the risk of ARF in such cases and to take appropriate measures in the treatment.

MATERIALS AND METHODS

The study was based upon 50 cases of blunt trauma reporting at Medico-legal clinic, Services Hospital, Lahore during January-December, 2007. Twenty normal healthy controls were taken for comparison purposes. The cases were clinically examined for presence of evidence of trauma. Urine and blood samples were taken at the end of clinical examination. Urine sample was collected in dry, clean wide mouth glass bottles of 250 ml capacity. Five cc blood was

taken in the disposable syringe. It was taken for estimation of Blood urea, creatinine, Potassium & Calcium.

RESULTS

Age: Frequency distribution of 50 cases with reference to age ranged between 18-70 years with mean of 30.9 ±12.34. There were 31 cases (62 %) below the age of 30 while 9 cases (18 %) were between 30-39, 5 cases (10 %) between 40-49 and 5 cases (10 %) were in age group 50-70.

The control group of 20 ranged between 24-43 years with mean of 31.2±5.81. (Table No.1)

Sex: Frequency distribution of subjects with reference to sex is 47 males (94 %) and 3 females (6 %). The control group comprised 18 male (90 %) and 2 (10 %) females. (Table No.2)

Table No. 1: Frequency distribution of subjects and control with reference to their age

Age in years	Subjects(n=50)		Control(n=20)	
	No. of cases	Percentage	No. of cases	Percentage
18-29	31	62	10	50
30-39	9	18	7	35
40-49	5	10	3	15
50-70	5	10	0	0
Mean ± SD	30.9 ±12.3		31.2 ±5.8	
Range	18-70		24-43	

Table No. 2: Frequency distribution of subjects and control with reference to their sex

Sex	Subjects(n=50)		Control(n=20)	
	No. of cases	Percentage	No. of cases	Percentage
Male	47	94	18	90
Female	3	6	2	10

Type of injuries: The abrasions / bruises were seen in 45 cases (90 %). Multiple injuries (abrasions, bruises, lacerations) were present in 5 cases (10 %). Fractures were not seen in any case.

Distribution of injuries on the body: The area subjected to trauma was categorized into 4 regions i.e. head and face, chest, abdomen and limbs. Some cases had injuries located in one area while others had involvement of multiple areas. As single area involvement the head and face area was affected in one case (2 %), chest in 4 cases (8 %) and limbs in 25 cases (50 %). The remaining 20 cases (40 %) had injuries located in multiple areas. (Table No.3)

The most commonly involved areas in these regions were buttocks, thighs, back of chest and soles. The site of injury was described according to its location in any one of four regions i.e. head and face, chest, abdomen and limbs. The regional distribution is in accordance with Qisas and Diyat Act.²²

Duration of injuries: Twenty nine cases (58 %) reported for examination within 24 hours. Thirteen cases (26 %) reported between 24 – 48 hours and 8 cases (16 %) reported between 48 – 72 hours after being traumatized.

Table No. 3: Frequency distribution of subjects with reference to body region subjected to trauma

Body region	Subjects(n=50)	Percentage
Head and face	1	2
Chest	4	8
Abdomen	0	0
Limbs	25	50
Multiple(more than one region)	20	40

Urine Examination:

Colour: The colour of urine was yellow in 44 cases (88%) and brownish red in 6 cases(12 %) and yellow in the control group.

Specific gravity: It ranged between 1010 – 1030 with mean of 1020.6 ± 6.59 . It was between 1010-1019 in 14 cases(28%), 1020-1029 in 27 cases (54%) and 1030-1039 in 9 cases(18%). In control group it ranged between 1020 – 1030 with a mean of 1022.79 ± 3.79 . (Table No. 4)

pH: It ranged between 5 – 8 with mean of 5.8 ± 0.75 . It was between 5 – 5.9 in 7 cases(14%) , between 6.0 – 6.9 in 27 cases(54%) , between 7.0 – 7.9 in 14 cases(28%) and 8.0 & above in 2 case(4%). (Table No. 8) In control group it ranged between 6.0 – 7.0 with mean of 6.4 ± 0.50 .

Blood: It was positive in 7 cases(14%), and negative in 43 cases(86%). It was negative in control group.

Microscopic Examination: After centrifugation of urine, the urinary sediment was examined for cells, crystals and casts. The pus cells were present 0 – 5 /HPF in 35 cases (70%), and above 5/PHF in 15 cases (30%). The red blood cells were present in 15 cases (30%). Calcium oxalate crystals were found in 39 cases (78%), triple phosphate in 5 cases (10%). In 6 cases (12%) no crystals were found. The cellular casts were present in 6 cases (12%). In control group 1 – 3 pus cells/PHF were present in 6 cases (30%). Calcium oxalate crystals were seen in 4 cases (20%). No cellular casts were seen.

Table No. 4: Frequency distribution of subjects with reference to Specific gravity in urine sample

Specific gravity	Subjects(n=50)		Control(n=20)	
	No. of cases	Percentage	No. of cases	Percentage
1010-1019	17	34	0	0
1020-1029	22	44	17	85
1030-1039	11	22	3	15
Mean $\pm$ SD	1020.4 $\pm$ 7.13		1022.79 $\pm$ 3.79	
Range	1010-1030		1020-1030	

p value > 0.05 (not significant)

Blood Examination

Blood Urea: The blood urea ranged between 15.5 – 86.0 mg/dl with a mean of 43.54 ± 15.06 . The blood urea was above reference range in 7 cases (14 %).

In the control group the urea ranged between 23.3 – 47.2 with a mean of 35.13 ± 6.48 . (Table No. 5)

Blood Creatinine: It ranged between 0.5 – 2.6 mg/dl with mean of 0.97 ± 0.47 . The raised blood creatinine was found in 7 cases (14%) . These cases are the same cases which have raised blood urea (Table No.6).

Table No.5: Frequency distribution of subjects and controls with reference to serum urea level.

Serum urea mg/dl	Subjects(n=50)		Control(n=20)	
	No. of cases	Percentage	No. of cases	Percentage
15-30	8	16	6	30
31-45	36	72	14	70
46-60	0	0	0	0
61-75	2	4	0	0
76-90	4	8	0	0
Mean $\pm$ SD	43.54 $\pm$ 15.06		34.88 $\pm$ 6.08	
Range	15.5-86		23.3-47.2	

p value < 0.02 (significant)

Table No.6: Frequency distribution of subjects and controls with reference to serum creatinine level.

Serum Creatinine mg/dl	Subjects(n=50)		Control(n=20)	
	No. of cases	Percentage	No. of cases	Percentage
0.0-0.5	2	4	0	0
0.6-1.1	41	82	20	100
1.2-1.7	1	2	0	0
1.8-2.3	3	6	0	0
2.4-2.9	3	6	0	0
Mean $\pm$ SD	0.97 $\pm$ 0.47		0.69 $\pm$ 0.10	
Range	0.5-2.60		0.5-0.9	

p value < 0.02 (significant)

Table No. 7: Frequency distribution of subjects and controls showing evidence of renal function derangement.

Renal status of cases		Subjects(n=50)		Control(n=20)	
		No. of cases	Percentage	No. of cases	Percentage
1	Normal renal profile	43	86	20	100
2	Deranged renal Profile	7	14	0	0

p value > 0.05 (not significant)

In control group blood urea ranged between 0.5 – 0.9 mg/dl with a mean of 0.69 ± 0.10 . (Table No. 6)

Serum Potassium: It ranged between 3.2 – 5.9 mmol/dl with mean of 4.45 and S.D. 0.78. It is above reference range in 9 cases (18%). In cases with raised blood urea and creatinine it was raised in all cases.

In control group it ranged between 3.7 – 5.0 m mol/dl and with a mean of 4.41 and S.D. 0.36.(Table No. 12)

Serum Calcium: It ranged between 5.6 – 10.74 with mean of 8.84 ± 1.01 . The hypocalcaemia was seen in 25 cases (50%). In the cases with raised blood urea and creatinine the calcium was low in all cases.

In the control group it ranged between 9.2 – 10.7 with a mean of 9.64 ± 0.39 .

DISCUSSION

The study was aimed to assess the extent and distribution of injuries in cases subjected to blunt trauma. This study revealed that persons at all ages were involved. However individuals in the 3rd decade were more prone (58% cases). This might be due to more active social involvement of the individuals in this age group. Both sexes were exposed to the situation but males were in quite higher number (94%).

When considering type of injury the majority (90%) suffered abrasions / bruises alone but some (10%) also had lacerated wounds in addition to abrasions and bruises.

Regarding the distribution of the injuries on the body, it was divided in 4 regions keeping in view the categorization of injuries under Qisas and Diyat Act 1997.¹⁰

In our study, injuries distribution on the limbs 50%, head and face 2%, chest 8% while in other cases (40%) it involved multiple regions. The most commonly involved areas were back of chest, buttocks & thighs.

The raised myoglobin in the blood is a threat to kidney. Therefore the evaluation of kidney function was made from urine examination and measurement of blood urea, creatinine, potassium and calcium.

In the urine examination the colour of urine was yellow in 44 cases, and brownish red in 6 cases. While in the cases of acute myoglobinuric renal failure reported by Naqvi it was yellow in 6, brownish red in 4 & reddish in 2 cases.¹

There was no significant change in specific gravity. It ranged between 1010 - 1030 in all subjects.

There was significant change in pH. The pH in subjects ranged between 5-8 with mean 5.67 ± 0.86 . In control group it was 5.9-7.5 with mean 6.73 ± 0.49 . This finding was comparable with finding of Ray. According to him the nephro-toxicity was unlikely to occur in absence of hypovolaemia or when the urine pH was more than 5.6 (Ray 1999).¹¹ In study of Naqvi the pH ranged between 5.0 – 6.0 in all the cases of myoglobinuric renal failure.³ Dehydration and acidosis predispose the development of ATN.¹²

Acidosis had been suggested as an important factor in myoglobinuric renal failure, and urine alkalization was routinely recommended for its prevention. Early and adequate water supply and alkalization played an essential role in prevention of impairment in renal function.⁹

Presence of acidosis and venous serum bicarbonate level below 17 mEq/L was found to be predictor of development of ATN in patients with soft tissue injury that were hospitalized for trauma (Muckhart 1992). According to Braun, at or below urine pH of 5.6 or below both myoglobin and haemoglobin dissociate into ferrihemate and globin moieties. Ferrihemate appeared to have toxic effects on renal tubules.¹³

The blood was positive in 7 cases (14%). This finding was in consensus with observations of Naqvi et al, where all the 12 cases of myoglobinuric renal failure were positive for blood. (Naqvi et al 1995).¹

The microscopic examination of urinary sediment showed numerous RBC in all the cases which were positive for blood (14%). This is comparable with Naqvi et al where 100% cases of renal failure were positive for microscopic haematuria (Naqvi et al 1995).¹ Pus cells, more than 5/PHF, were seen in 30% cases. Calcium oxalate crystals were found in 78% cases and Triple phosphate in 10% cases. Epithelial casts were present in 12% cases.

The blood urea was raised significantly as compared with control group. It ranged between 15.5 – 86.0 mg/dl with a mean of 43.54 ± 15.06 . In a study of Ali the 5 cases of traumatic rhabdomyolysis presenting with renal failure had blood urea between 50 – 105 with a mean value 73.4.¹²

There was significant rise in serum creatinine. It ranged between 0.5 to 2.6 mg/dl with mean of 0.97 ± 0.47 . In 12 cases of Naqvi the serum creatinine ranged between 6.1 to 28.7 mg % with mean of 16.5.¹

It ranged between 3.2 - 5.9 m mol/l with mean of 4.45 ± 0.78 . Although statistically the change in the serum potassium was non significant but 9 cases (18%) potassium level was above reference range. In Naqvi's study 42% of renal failure cases had blood potassium within reference range while the rest had raised potassium with mean of 6.07.¹

According to Durbow and Flamenbaum, Hyperkalemia might be severe in myoglobinuric ARF. Intracellular potassium concentration might be as high as 140 mEq/l and this potassium was released into the extracellular fluid after muscle necrosis.¹⁴

Statistically there was significant change in serum calcium. It was low in 50 % of subjects. This finding was consistent with that of Naqvi where 58.3 % cases of renal failure showed hypocalcaemia.¹

Hypocalcaemia is often seen in myoglobinuric ARF. It is partly due to deposit of calcium in damaged muscles and partly other factors like due to hyperphosphatemia following muscle damage.¹⁴

Abnormal calcium metabolism was a common complication of rhabdomyolysis-induced acute renal failure. During oliguric phase patients were frequently hypocalcaemic. Hyperphosphatemia and skeletal resistance to parathyroid hormone were believed to be possible underlying mechanisms. There was

hypercalcaemia during diuretic phase after rhabdomyolysis. It was due to mobilization of calcium deposits from soft tissues including muscles.¹⁵

In our study 14% cases have shown the evidence of renal function derangement. (Table 7). These cases had urine colour brownish red in 6 cases and yellow in one case, haematuria in all cases, specific gravity 1010, pH 5, serum myoglobin 760-1176 ng/dl, serum urea 64-86mg/dl, serum creatinine 1.8-2.6 mg/dl, serum potassium 5.6-5.9 mmol/dl, serum calcium 7.0-8.5 mg/dl. These finding were comparable with of studies at other centres. In confirmed cases of Myoglobinuria about one third of patients developed ATN. Dehydration and acidosis predispose to development of ATN.^{4,16}

CONCLUSION

The cases subjected to blunt trauma are at threat to develop renal failure particularly in cases with dehydration and acidosis.

Recommendations: In order to minimize the risk of renal failure it is recommended to institute a timely management.

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