

Rhabdomyolysis associated AKI: Case series from Iraq.

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Summary:

Background: Rhabdomyolysis is a clinical and biochemical syndrome that occurs when skeletal muscle cells disrupt and release creatine phosphokinase and myoglobin into the interstitial space and plasma. The causes of rhabdomyolysis are legion, but the most important and the classical form is the crush syndrome. Acute kidney injury occurs in 33-50% of patients with rhabdomyolysis. Here we report nine cases with acute kidney injury due to crush injury with rhabdomyolysis after the Al-Aema bridge catastrophe in Baghdad, in September 2005.

Methods: Nine patients presented to the nephrology department of the Baghdad Teaching Hospital with a suggestive history of crush and laboratory evidence of rhabdomyolysis and acute kidney injury within the first three weeks of this tragic event. All patients were treated initially with aggressive fluid resuscitation with isotonic normal saline and bicarbonate. However, eight patients required acute peritoneal dialysis that was followed by intermittent hemodialysis, while only one received watchful conservative treatment with intravenous fluid support.

Results: All patients achieved complete recovery of their clinical status and renal function and discharged within a period of 8 to 30 days.

Conclusion: Crush syndrome is common. Early detection, aggressive fluid support still the main aspect of management. Correction of electrolytes abnormalities beside the judicious decision of dialysis initiation are also important in the management of this potentially life threatening situation.

Key words: Acute Kidney Injury , Crush syndrome, Rhabdomyolysis.

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Introduction:

Rhabdomyolysis is the rapid breakdown (lysis) of skeletal muscle (rhabdomyo) due to injury to muscle tissue with subsequent leakage of potentially toxic cellular contents like creatine phosphokinase (CK), lactate dehydrogenase (LDH), and myoglobin into the interstitial space and plasma causing derangements in multiple body organs including hypovolemia, acidosis, acute kidney injury, and disseminated intravascular coagulation (1). Under the title of "Crush injuries with impairment of renal function", the first documented paper on rhabdomyolysis with acute kidney injury (AKI) was published in the British Medical Journal in March 1941 by By waters and Beall during the 2nd World War after London Bombings (2). Acute kidney injury (AKI) occurs in 33-50% of patients with rhabdomyolysis. Together with sepsis it is the main cause of mortality in them (3). The causes of rhabdomyolysis are many, but the most classical form of rhabdomyolysis is the Crush syndrome which is the usual synonymous in clinical practice and medical literature. While this form of injury is now seen most often as a sporadic event, it can still occur in "epidemic" proportions, as tragically demonstrated by the Armenian earthquake of 1988 in which 600 patients developed myoglobinuric ARF (4). Macroscopically the kidneys look enlarged and rather dark and firm with tense capsule due to

swelling of the cortices. On microscopic examination, the main change is found in the tubules with evidence of necrosis and commencement of

reactive changes (2). Treatment should be instituted immediately in the field prior to extrication in order to modify the factors that cause AKI, such as volume depletion, tubular obstruction, aciduria, and release of free radicals (5). Better et al advocate very early aggressive volume replacement followed by alkaline diuresis with bicarbonate may protect against AKI. This can be achieved by the administration of saline solution (1.5 L/h) as soon as possible. If resuscitation failed and AKI cascade started hemodialysis has the role to replace the failing kidney especially with CPK > 5000 U/l but may be of limited capacity and the institution of a super-high-flux membrane in continuous hemofiltration may be of more benefit in removal of myoglobin as proved by Naka and colleagues with combination of continuous hemofiltration with the use of hyperpermeable membranes (6,7).

In this series we report nine cases with acute kidney injury due to crush injury with rhabdomyolysis after Al-Aema bridge catastrophe in Baghdad, September 2005. The way of management and local practice reviewed in the view of the new management guidelines.

Patients and Methods:

Nine male patients with the mean age of 36.7+ 3 years presented to the Nephrology Department, Baghdad Teaching

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Hospital following a crush injury in the Al-Aema Bridge catastrophe. The diagnosis of rhabdomyolysis related AKI was made upon history, clinical examination and laboratory data that revealed elevated CPK, hyperkalemia, hypocalcemia, hyperuricemia and hyperphosphatemia with a muddy brown urine on general urine examination. On presentation, patients received intravenous isotonic normal saline in a bolus of one liter per hour and sodium bicarbonate. Neither mannitol nor diuretics used in the management strategy. Intravenous calcium gluconate 10% started for the initial treatment of hyperkalemia plus four hourly ECG monitoring. Eight patients were treated with acute intermittent peritoneal dialysis for 72 hours, followed by intermittent hemodialysis. One patient with the least value of CPK continued on conservative treatment with adequate hydration and correction of electrolytes abnormalities. This patient was clinically stable, normotensive

with no signs of fluid overload nor hyperkalemia so continued on conservative treatment with the same fluid strategy and daily follow up. The frequency of HD was determined by the clinical status, daily monitoring of serum electrolytes and CPK values. Antibiotic cover with intravenous ceftriaxone 1gm bid was initiated. There was no clinical evidence of increased intracompartmental pressure and fasciotomy was not necessary. Because of difficulty in placing vascular access, peritoneal dialysis was the initial choice of renal replacement therapy. In 2005 dual lumen catheter insertion was the job of vascular surgeon plus the limited resources to have catheters at time to immediately initiate hemodialysis, so our unit did its usual practice of PD initiation. Fortunately all patients went on to have complete recovery of their clinical status and renal function and were discharged within a period range of 8 – 30 days.

Results:

Table 1 shows the biochemical data of the series before and after treatment

Table 1: The biochemical profile of the study group on presentation and after treatment

	Biochemical data on presentation mg/dl and U/l							Biochemical data after treatment mg/dl and U/l						
	B.Urea	S.Cr	K	Ca	Po4	UA	CPK	B.Urea	S.Cr	K	Ca	Po4	UA	CPK
Patient 1	164	7.3	6.4	6	7.2	18	20000	75	2.2	5	9.1	5	6.5	550
Patient 2	107	9.3	6	6.1	7	14	11000	72	2.1	5	9.3	4.9	6	400
Patient 3	210	14	5.7	6.1	7.7	11.9	10100	53	1.3	4.5	10.2	4	5.7	175
Patient 4	136	5.9	5.1	8.1	6	8	850	48	1.5	4	9.8	2	5.3	130
Patient 5	148	14	5.5	7	6.2	11	2200	55	1.3	4.2	9.6	3	5.9	165
Patient 6	263	10.2	5.9	6.5	8.9	9	1120	50	1.3	4.3	10.3	5	6.1	170
Patient 7	320	15	6	6.2	9	13.3	4000	45	1.3	4	9.5	4	5.5	160
Patient 8	152	7.1	5	8	6.7	10	1225	48	1.4	4.2	9.7	3.5	5.8	147
Patient 9	200	9	6.1	6.3	7.4	10	25000	65	2.1	5.1	9.2	5	6.1	432

Figure 1 describes the change in CPK values after treatment.

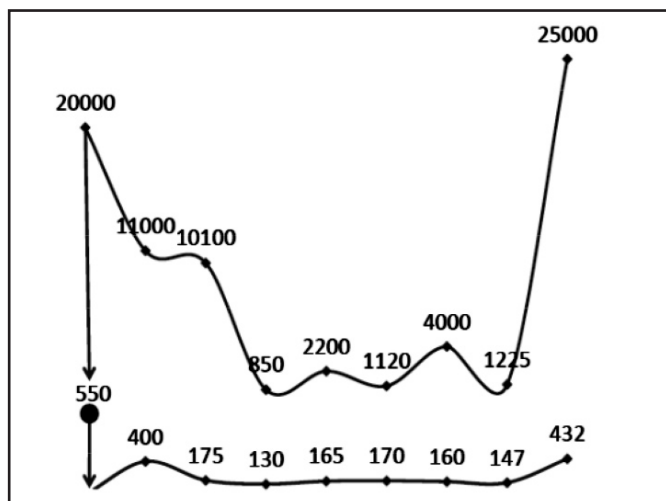


Figure 1: CPK values at presentation and after treatment

Discussion:

Rhabdomyolysis is a clinical and biochemical syndrome characterized by skeletal muscle necrosis with the release of intracellular muscle contents into the circulatory system. The severity of the illness ranges from asymptomatic elevations of muscle enzyme levels in the serum to life-threatening cases associated with extreme enzyme elevations, electrolyte imbalances, compartment syndrome, and acute renal failure (8). The environment in which crush injuries and catastrophe occur provides favorable condition to the development of rhabdomyolysis and to be complicated by AKI with delayed management, especially in the underdeveloped countries; in addition to dehydration (9). Although posttraumatic rhabdomyolysis has been written about extensively for decades, multiple issues remain unresolved, including the following: How common is posttraumatic rhabdomyolysis? What CK value places patients at risk for AKI and at what

level more aggressive treatment is needed? What modality of dialysis is the best for management? Our case series attempts to highlight these issues in the view of our local practice and logistics. Crush syndrome and rhabdomyolysis is still common, especially in underdeveloped countries; particularly if analysis based on measurement of CPK in critically traumatized patient (10). The exact level of CK above which the risk of AKI becomes significant is unknown. Although often arbitrary, CK levels ranging from 500 to 75,000 U/L have been suggested and 20% of the trauma patients have values > 5000 IU and with these values regarded as a high risk category. Independent risk factors for developing significant rhabdomyolysis are extremity injury, blunt mechanism, male gender, tachycardia, and BMI > 30 kg/m² (11). Those in such high risk CPK levels are mostly in need for dialysis treatment, while other may have other indications for dialysis beside the elevated level of CPK. It's important to admit that the requirement for dialysis indicates delayed or inadequate fluid support and this can explain why patients presented lately after the event treated with dialysis. The main stay of management is prevention with intravenous fluid support immediately after the event before extrication and during transport. Here fluid management is part of life support measures. Thus there is a consensus for intravenous volume expansion with saline and for sodium bicarbonate, but there is controversy about mannitol which may improve urine output and decrease compartmental pressure but on the expense of inducing osmotic kidney injury adding more to the existing AKI (12). Dialytic treatment is sometimes necessary once AKI has occurred to correct fluid and electrolytes imbalance (13). The usual practice is to achieve extracorporeal therapy with hemodialysis or recently by the use of high-flux hemofiltration (14). In this series eight patient started dialysis with acute intermittent peritoneal dialysis (AIPD) and then converted to intermittent HD. Although AIPD is not the preferred treatment for myoglobin removal but its early initiation and seventy two hours continuity might be of value at least in decreasing the daily generation of myoglobin to keep it in low levels until recovery of renal function. Probably there is no convincing evidence that myoglobin is particularly toxic yet dialysis will correct the organic acids, urea, and potassium. In patients with massive myoglobinaemia, the blood myoglobin rapidly falls independent of renal function or any therapeutic manipulation. The results indicate that extra renal factors play a major role in disposing circulating myoglobin in such patients (1, 13, and 14). However, there is little evidence that more versus less removal of myoglobin changes the outcome and is better than conventional hemodialysis with standard membranes once the kidneys have failed and the use of hyperpermeable membranes seems to be the best way (7). The use of peritoneal dialysis in the management of acute kidney injury secondary to rhabdomyolysis had been described with the use of equilibrium peritoneal dialysis in the management

of crushed patients in Mexico City earthquake in September 1985 with the initial use of peritoneal dialysis and full renal recovery of five patients described in the study (15). A unique management issue in rhabdomyolysis-induced AKI is the development of hypercalcemia during the recovery phase in 20–30% of patients (1) as in two out of nine patients in our series. In 2005 there was no consensus about management of crush syndrome and most of plans depend on local expertise and the available resources but now it seems to be imperative to refer to the recommendations for the management of crush victims in mass disasters by the European Renal Best Practice (ERBP) and Renal Disaster Relief Task Force (RDRTF) of the International Society of Nephrology. Such work will add considerably to international efforts to manage these victims in a more planned medical and logistic approach (16). In conclusion Crush syndrome is still common, can occur in any society at any time and AKI with its complication is the main cause of fatality and this case series demonstrates how early management with hydration and correction of electrolytes abnormalities beside the judicious decision of dialysis initiation are important in the management of this potentially life threatening situation. More prospective studies are needed to define the most appropriate fluid composition for resuscitation, if there is a CPK or myoglobin threshold above which extracorporeal therapy is inevitably required and the most appropriate modality. An increased awareness about such serious condition is certainly mandatory. Health authorities should expect and prepare actions for disasters which should include logistic plans for transferring the victims to the most appropriate health care facilities, effectively managing limited medical personnel and resources, and making realistic requests to obtain additional medical supplies and personnel.

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