ABSTRACT

AIM: To highlight the complications of rhabdomyolysis caused by the use of tight splint for the treatment of humeral and femoral fractures by traditional bone setter in Delta State, Nigeria.

PATIENTS AND METHODS: A retrospective study of patients treated for rhabdomyolysis complicating traditional bone setter treatment of humeral and femoral fractures with tight splint in DELSUTH from August 2012 to December 2014. Inclusion criterion was those with rhabdomyolysis caused by TBS treatment of humeral and femoral fracture with tight splint. Exclusion criteria were patients with ischemic gangrene, Volkmann ischemic contracture (VIC), sickle cell and diabetic mellitus patients. Investigations done were limb x-ray, electrocardiography, chest x-ray, serum electrolyte, urea and creatinine, urinalysis with dip-stick test, creatine kinase assay and serum calcium. Treatment protocol used was fluid resuscitation with normal saline, frusemide + mannitol-alkaline diuresis.

RESULTS: A total of 6 patients were seen in the study. 4 males and 2 female with M:F ratio of 2:1. The age range of patients seen was 36-77 years (mean=54.3years). Five patients used the treatment protocol and survived while one did not use the protocol and eventually died because the diagnosis of rhabdomyolysis was not made on time.

CONCLUSION: Rhabdomyolysis is a fatal complication of reperfusion injury of muscles following release of the very tight splint used by TBS for the treatment of limb fractures. A good knowledge of the mode of presentation of the patients and necessary investigations plus the immediate commencement of treatment or amputation of the affected limb will avert the associated mortality from cardiac arrest and acute renal failure.

KEYWORDS

rhabdomyolysis, myoglobinuria, renal failure, reperfusion injury, muscle injury, tourniquet

INTRODUCTION

Rhabdomyolysis occurs when muscles are compressed or crushed causing myocyte damage1,2. Following myocyte damage, there is release of intracellular contents into systemic circulation that are toxic to the kidney and heart3. Muscle injury can also occur when pressure in a prolonged ischemic muscle is suddenly released. This is called reperfusion injury4. It results when free oxygen radicals present in the fresh oxygenated blood are released into the ischemic muscles. Other causes for rhabdomyolysis include alcohol abuse, muscular compression from coma and seizure, exertion, hyperthermia, drugs, infections and genetic disorders of muscle cell metabolism5,6,7. The injured muscle cells release myoglobin, potassium, phosphate and uric acid salts. Myoglobin and uric salts are filtered into the kidney but precipitate in the renal tubules in the presence of metabolic acidosis to cause renal failure. Hypokalemia on the other hand is cardiotoxic. Damaged muscle cells absorb calcium and water resulting in hypocalcaemia and hypovolaemic shock as up to 10litres of water can accumulate in damaged muscles8,9.

Historically, rhabdomyolysis was traced to Bible history when the Israelites were poisoned by ingestion of hemlock-poisoned quail birds10. Hemlock is now known to cause muscle damage. Seigo Minami7, a Japanese physician1 first discovered the ‘Crush syndrome’ during World War 1 in 1923. He studied the pathology of 3 dead soldiers. They had renal insufficiency from setting in. These patients are managed right from the disaster site (field management) and treatment is continued in centres designated for such cases that have intensive care unit and renal dialysis (in-hospital management)12.

In Nigeria, rhabdomyolysis has been observed in some group of patients treated by traditional bone setters (TBS) for fracture of humerus and femurs. Very tight wooden splints are applied at the middle of the arm and thigh to splint the fractures11,12. This causes very tight constriction in this region leading to gross swelling and ischemia of the forearm and leg distal to the splint. If the tourniquet-like splint is released early for those that present to orthopaedic surgeons, reperfusion injury may set. If released late, the limb may suffer ischemic gangrene or Volkmann ischemic contracture (VIC)11,12.

In this study, our preliminary experience in the management of rhabdomyolysis complicating humeral and femoral fracture by TBS in Delta State University Teaching Hospital (DELSUTH), Oghara is presented.

PATIENTS AND METHOD

This is a retrospective study of patients treated for rhabdomyolysis between August 2012 and December 2014 in DELSUTH. Inclusion criterion is patient managed for humeral and femoral fractures by traditional bone setters using very tight splint on the arm or thigh respectively. Exclusion criteria are patients with ischemic gangrene and VIC from TBS treatment of humeral and femoral fractures, sickle cell and diabetic mellitus patients. Information was obtained from case notes. The b-data include sex, age, and occupation. Others are fracture suffered, duration of treatment by TBS before presentation, symptoms and signs, clinical photograph, x-ray of the limb, outcome of treatment of rhabdomyolysis and fracture.

METHOD

Patient was admitted, clinical photograph of the patient was taken. A wide bore cannula was inserted into the vein and normal saline infusion put up. Patient was catheterized. The tourniquet-like splint was removed. Blood and urine samples of the patient was taken for test before starting infusion and subsequently everyday. The tests were dip stick test (urinalysis) for myoglobin, electrolyte, urea and creatinine, serum creatine kinase enzyme test and serum Ca²⁺ for calcium. The patient’s vital signs were monitored for evidence of hypovolemic shock. ECG was done to monitor cardiac arrhythmia.
as from the effect of hyperkalemia and hypocalcemia. Chest x-ray was done for patient above 40 years to rule out cardio-megaly.

The treatment given was; intravenous normal saline of 6-12L/day. Hyperkalemia was managed using soluble insulin 8-10i.u and bolus of 50% glucose 1-2 ampoules intravenous bolus. 20% mannitol and frusemide were used to mobilize fluid out of injured muscle and to eff-ect diuresis daily. A urine output of 200ml/hr was en-sured except in the 77 year old man that was a cardiac patient, here 150ml/hr was aimed at. Chest was aus-cultated to rule out crepitation from fluid overload. Ac-idosis was treated with sodium bicarbonate at 1meq/kg intravenous injection to keep the urine pH at ≥6.5 and prevent myoglobin and uric acid deposition in the re-nal tubules.

### Table 1: Clinical Information of Patients

<table>
<thead>
<tr>
<th>Age</th>
<th>Sex</th>
<th>Occupation</th>
<th>Duration of TBS RX</th>
<th>Fracture Injury</th>
<th>Treatment Protocol</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>36YRS</td>
<td>M</td>
<td>Policeman</td>
<td>3 months</td>
<td>Humerus</td>
<td>Used</td>
<td>Good</td>
</tr>
<tr>
<td>52YRS</td>
<td>F</td>
<td>Trader</td>
<td>10 weeks</td>
<td>Femur</td>
<td>Used</td>
<td>Good</td>
</tr>
<tr>
<td>55YRS</td>
<td>M</td>
<td>Lecturer</td>
<td>8 weeks</td>
<td>Humerus</td>
<td>Used</td>
<td>Good</td>
</tr>
<tr>
<td>77YRS</td>
<td>M</td>
<td>Retired Teacher</td>
<td>12 weeks</td>
<td>Femur</td>
<td>Used</td>
<td>Good</td>
</tr>
<tr>
<td>58YRS</td>
<td>F</td>
<td>House wife</td>
<td>8 weeks</td>
<td>Femur</td>
<td>Not used</td>
<td>Poor (Died)</td>
</tr>
<tr>
<td>48YRS</td>
<td>M</td>
<td>Trader</td>
<td>10 weeks</td>
<td>Femur</td>
<td>Used</td>
<td>Good</td>
</tr>
</tbody>
</table>

### Table 2: Symptoms and Signs Seen in Patients with Rhabdomyolysis Treated by TBS for Femoral and Humeral Fractures

Severe pains in limb part distal to tourniquet-like splint.

Gross swelling distal to tourniquet-like splint

Differential coldness in the affected limb

Peripheral pulses not easy to palpate because of marked swell-ing

Passing of concentrated or tea-colored urine before and after release of splint

Immediate relieve of pain following release of splint.

**Fig 1: Picture of right arm splinted for humeral fracture**

### Discussion

When victims of disasters trapped in wreackages are rescued, they experience relieve from their agony only to die some days after as a result of reperfusion injury suffered by the muscles of the trapped limb. This condition is nick-named “smiling death”13. Patients with humeral and femoral fractures treated by TBS and subsequently seen by an unsuspecting orthopaedic surgeon are exposed to similar scenario if efforts to treat rhabdomyolysis are not immediately commenced. This was the situation of the patient that did not receive the treatment protocol for rhabdomyolysis in our study. By the time it was realized, it was already too late as the various complications had set in viz a viz; hypovolemic shock, and cardiac arrest and acute renal failure. The key to stemming these compli-cations is to have a high index of suspicion when these pa-tients present to the surgeon. The tea-colored urine plus a positive simple dip-stick14 test for myoglobulin in urine and elevated serum creatine kinase enzyme17 will confirm ongo-ing rhabdomyolysis in the affected limb. All that is necessary to manage this type of patient must be put be in place in-cluding a renal dialysis unit and if possible an intensive care unit. This is the kind of arrangement, centres that have good outcomes in treatment of disaster victims have put in place to succeed. These centres are usually prepared and ready to care for disaster victims that are brought to them18. In 1988, Spitak earthquake in Armenia prompted the establishment of Renal Disaster Relief Task Force, a working group of the inter-national society of Nephrologists (a worldwide body of kidney expert)19. The use of renal dialysis in the treatment of rhabdo-myolysis was 1st introduced in 1950-1953 during the Korean War20. The lessons learnt from the mortality case in our study together with the experience gotten from the management of victims of disaster led to the good outcomes we had in our study.

Binnaz et al21 reiterated the possibility of missing the diagnosis of rhabdomyolysis by medical personnel that are not used to seeing the presentation of rhabdomyolysis. The patient in their
case study died due to delay in diagnosis from complication of ARF just like the patient that died in our study. He pointed out that an increase in potassium level together with metabolic acidosis and a pre-operative increase in lactic acid dehydrogenase confirms diagnosis of rhabdomyolysis.

Winburn et al.32 advised that in the event of a deteriorating physiologic state of a patient with diagnosed rhabdomyolysis, amputation of the affected limb should be done to prevent further release of the toxin into the circulation to save the life of the patient. This is similar to what is done in disaster site where the trapped limb of the victim is amputated before extricating him from the site. That way the patient is completely isolated from the toxins in the injured muscle and saved from the associated complications.

It is interesting to note that the category of patients seen in this study included a lecturer, a retired teacher and a police officer. This shows that even educated people still patronize this study. The populace needs to be enlightened to know the right to seek treatment.

CONCLUSION
Rhabdomyolysis resulting from reperfusion injury is a dangerous complication sometimes associated with TBS treatment of fractures of humerus and femur. A good knowledge of its mode of presentation and treatment by the orthopaedic surgeon cannot be over emphasized to contain the mortality associated with it. Government as a matter of urgency, need to seriously take measures that will stop the menace posed by TBS activities in Nigeria. The populace needs to be enlightened about the risk associated with TBS treatment of fracture and know the right to seek treatment.

REFERENCES

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18. Rhabdomyolysis. Wikipedia, the free encyclopedia