Case report

Rhabdomyolysis: another complication after prolonged surgery

Igal Alterman MD\textsuperscript{a}, Ami Sidi MD\textsuperscript{b}, Leonard Azamferei MD\textsuperscript{c}, Sanda Copotoiu MD\textsuperscript{c}, Tiberiu Ezri MD\textsuperscript{d,e,*}

\textsuperscript{a}Department of General Intensive Care Unit, Edith Wolfson Medical Center (affiliated with the Tel Aviv University Sackler School of Medicine), Holon 58100, Israel
\textsuperscript{b}Department of Urology, Edith Wolfson Medical Center (affiliated with the Tel Aviv University Sackler School of Medicine), Holon 58100, Israel
\textsuperscript{c}Department of Anesthesiology and Intensive Care, University of Medicine and Pharmacy, Targu-Mures, Romania
\textsuperscript{d}Department of Anesthesia, Edith Wolfson Medical Center (affiliated with the Tel Aviv University Sackler School of Medicine), Holon 58100, Israel
\textsuperscript{e}Outcomes Research Group, University of Louisville, Louisville, KY, USA

Received 18 October 2005; revised 13 June 2006; accepted 15 June 2006

Abstract We present the case of a young patient who underwent a prolonged urological procedure in the lateral decubitus position. The patient’s postoperative course was complicated by rhabdomyolysis manifested by elevated levels of serum creatine phosphokinase and the presence of myoglobin in urine and blood. To prevent renal failure, we managed the patient in the intensive care unit with generous volumes of intravenous fluids, forced diuresis, and urine alkalization. Subsequently, the patient had an uneventful recovery. The linkage between surgical positioning, prolonged surgery time, and rhabdomyolysis is discussed.

Rhabdomyolysis is a dissolution of skeletal muscles that produces a nonspecific clinical syndrome causing extravasation of toxic intracellular contents from the myocytes into the circulatory system \cite{1}. This destruction leads to electrolyte disturbances, hypovolemia, metabolic acidosis, coagulopathies, and myoglobinuric renal failure. This abnormality is associated with more than 100 seemingly unrelated disorders, including direct muscle injury (crush injury syndrome), muscle ischemia, excessive physical exertion, temperature extremes, infections, drugs, toxins, venoms, and endocrine disorders, among others \cite{2}. Although initially recognized solely as a posttraumatic sequela, nontraumatic causes of rhabdomyolysis are now estimated to be more frequent than traumatic causes \cite{1}. Most patients have several risk factors \cite{3}. In this article, we report the case of a patient who underwent a prolonged urological surgery in the left lateral decubitus position, and which was complicated by rhabdomyolysis.
1. Case report

A 22-year-old, ASA physical status II, overweight (height, 180 cm; weight, 94 kg; body mass index, 29 kg/m²) man was scheduled for ureterocalicostomy. He was healthy, apart from having nephrolithiasis and ureteral stricture that was a complication of a similar (ureterocalicostomy) surgery that he had undergone as a child. Physical examination of the head, neck, heart, lungs, and other organs/systems revealed normal findings. Preoperative urinalysis and measurements of complete blood count, serum electrolytes, blood urea nitrogen, serum creatinine, blood creatine phosphokinase (CPK), and liver enzymes yielded outcomes that were within normal limits. The patient did not receive any nephrotoxic medication (eg, aminoglycosides or nonsteroidal anti-inflammatory drugs).

The procedure was a repeat ureterocalicostomy that lasted for 9 hours as a result of technical difficulties in approaching the kidney and extracting the stone. Open surgery was performed during general anesthesia with the patient placed in the left lateral decubitus position, with a wedge placed under the dependent iliac crest.

Monitoring included ASA standard monitors, direct arterial pressure monitoring via the radial artery, and central venous pressure (CVP) monitoring via the right internal jugular vein. Urinary output was measured hourly.

The patient was hemodynamically stable [heart rate (HR), 62-88 bpm; mean arterial pressure (MAP), 70-100 mmHg; CVP, 3-8 mmHg], with all the ventilation and oxygenation variables preserved within normal limits. Total fluid input was 6000 mL, and total amount of urine over the procedure was 1350 mL. Core (nasopharyngeal) temperature ranged between 36.6°C and 37°C. During surgery, the patient did not require blood transfusion.

Findings from intraoperative arterial blood gas analyses, performed every two hours, were normal.

At the end of surgery, the residual neuromuscular block was reversed with 2.5 mg of neostigmine and one mg of atropine, the patient’s trachea was extubated uneventfully, and he was transferred to the postanesthesia care unit (PACU).

In the PACU, arterial blood gas analysis, with the patient breathing oxygen through a face mask, showed the following levels: pH, between 7.35 and 7.38; PaCO₂, between 36 and 39 mmHg; base excess, between −3 and one mEq; standard bicarbonate, between 20 and 22 mEq; and PaO₂, between 120 and 145 mmHg.

Under these circumstances, a muscle injury of the left thigh as a result of pressure of the thigh against the table from the prolonged lateral position was suspected.

A diagnosis of rhabdomyolysis was made, and the patient was managed with fluid replacement using between 500 and 600 mL/h of lactated Ringer’s solution and 20 mg of IV furosemide, followed by a dose of 0.5 mg/kg per hour to maintain a urine output greater than 1.5 to 2 mL/kg per hour. In the first hour, urine output was 80 mL and its color was darker. Urine alkalinization was initiated with 25 mEq/h of sodium bicarbonate. The goal was to maintain urine pH at a level higher than 7, and this goal was attained.

The patient was subsequently transferred to the intensive care unit (ICU) for further observation and treatment. During that time, the patient continued to complain of pain in his left flank and thigh. An orthopedic surgeon ruled out the possibility of compartment syndrome after measuring normal pressures in the gluteal compartment.

In the ICU, the following measurements were noted: CPK, 12000 U/L; serum creatinine, between 1.1 and 1.3 mg/dL; and blood urea, between 30 and 40 mg/dL. The plasma myoglobin level was initially 90 ng/mL, but it was subsequently measured as 70 ng/mL (the normal myoglobin values in our laboratory range from 7 to 70 ng/mL). In addition, urinalysis revealed the presence of myoglobin. Red blood cells were not seen on microscopic examination.

Forced diuresis with volume expansion, furosemide (0.5 mg/kg per hour), and alkalinization of urine were continued, and myoglobinuria subsequently disappeared by the patient’s second day in the ICU. Twenty-four hours later, the CPK level started to decline, followed by gradual clinical improvement.

The patient was transferred to the urology ward and was discharged home one week later with normal laboratory measurements. The thigh swelling improved over the first postoperative week.

2. Discussion

Skeletal muscle ischemia can be caused by localized compression. Sources include intraoperative use of tourniquets, tight dressings, or casts, particularly in patients with hypotension [4,5].

Rhabdomyolysis can be caused by tissue compression as a result of extended periods of immobilization, including
immobilization related to intraoperative positioning [6,7]. Other cases of intraoperative rhabdomyolysis involve malignant hyperthermia, hypoperfusion, urological surgical procedures (especially nephrectomy), intense vasospasm during hypertensive crisis, and bariatric surgery, among others.

Compartment syndrome is both a cause and a complication of rhabdomyolysis. As pressure within the fascial compartment increases, blood flow decreases, tissues become necrotic, and dying muscle cells release osmotically active particles that draw additional water into the compartment, further worsening the condition [8]. Once circulation is restored (reperfusion phase), large amounts of toxic intracellular contents are released into the bloodstream [1].

Unusual patient positioning has also been associated with skeletal muscle injury [2,9]. Risk of compartment syndrome and rhabdomyolysis is especially high when other concurrent risk factors, such as obesity [10-12], peripheral vascular disease [10,13,14], and prolonged operation time [9,12,13,15-17], are present.

We believe that direct and prolonged compression of the gluteal and flank muscles against the operating table, accompanied by the patient’s overweight status and the omission of intraoperative repositioning, led to our patient’s significant rhabdomyolysis.

Fortunately, there was no obvious consequence of CPK elevation, such as overt neuromuscular weakness or acute renal failure. The latter complication was averted in our case by early diagnosis, vigorous hydration, and forced diuresis. The level of CPK (mostly of muscular origin) elevation in this case was similar to that cited in another report [17].

The cases of rhabdomyolysis from gluteal muscle injury leading to renal failure had been reported during surgery in morbidly obese patients undergoing nephrectomy (including laparoscopic procedures) [18]. The presumed risk factors in these cases were the patient’s high BMI, intraoperative flank position with flexion, a solitary kidney, and prolonged duration of surgery [19].

If compartment syndrome is suspected, fasciotomies should be facilitated and monitoring of compartment pressures in injured extremities should be performed [5].

In adult patients, the goal of isotonic crystalloid volume replacement therapy is an hourly urine output of 150 to 300 mL [5]. Maintaining an output within this range may require IV infusions of 500 to 1000 mL/h of fluid [20]. The urine is alkalized by adding sodium bicarbonate to achieve a pH level higher than 7 [1,5,21] in preventing the dissociation of myoglobin into its nephrotoxic components. Mannitol may be given to promote diuresis, keep the kidneys flushed, and prevent formation of casts in the tubules [5], and furosemide can also be added. When the kidneys do not respond to other interventions, emergency hemodialysis is necessary.

Repeat CPK determinations may be helpful in prolonged surgeries to rule out a patient’s propensity for rhabdomyolysis. If a diagnosis of rhabdomyolysis is confirmed, aggressive treatment of the disturbances produced by rhabdomyolysis should be initiated. Prevention may be aided by focusing on intraoperative padding and positioning, observing intraoperative repositioning when feasible, and limiting the duration of an operation.

References