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Case Report

Cardiac arrest after tourniquet deflation in tibial plateau fracture surgery in a healthy man

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ABSTRACT

Surgical tourniquets are commonly used in orthopedic and trauma surgery. Although the pneumatic tourniquet has been classified by the US Food and Drug Administration as a class I medical device, there are still reports of hazards related to its use. Here, we describe an unusual complication experienced by a healthy man after he underwent surgery for trauma to the lower extremity. The patient experienced cardiac arrest 5 minutes after tourniquet release and was resuscitated immediately. He regained consciousness without any symptoms, and the electrocardiographic signs of arrhythmia completely resolved within 30 minutes of leaving the operating room. The patient recovered completely and was discharged 5 days later. The mechanism underlying the incidence of cardiac arrest after tourniquet deflation is still not clear. By ruling out other common intraoperative triggers as possibilities and upon reviewing the literature, we conclude that reperfusion injury is a plausible and the most likely explanation. Injuries resulting from tourniquet use are commonly pressure-related, and can also be caused by excessive tourniquet time. To reduce these injuries, an adequate pressure set-up (a cuff pressure not exceeding 300 mmHg) and tourniquet ischemia time less than 2 hours should always be the preferred option. Even then, it may be impossible to eliminate all associated complications.
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1. Introduction

Surgical tourniquets are commonly used in orthopedic and trauma surgery, but their complications and contraindications are well recognized. Tourniquets are required to facilitate good exposure of the surgical field, in which case it is often necessary to prolong the duration of the procedure. Surgeons and anesthetists always pay attention to the duration of tourniquet use, which is associated with an increased risk of complications. Here we describe an unusual complication of trauma surgery performed on the lower extremity of a healthy man.

2. Case report

In November 2008, a 54-year-old man, a heavy worker and smoker (12 cigarettes per day) but with no past history of ischemic heart disease, presented to our emergency department after a motor vehicle crash. He reported pain in his swollen right knee. Physical examination of the right knee revealed diffuse tenderness and swelling compatible with hemarthrosis. The distal peripheral pulses were palpable, and no neurological deficits were noted in the right lower limb.

Radiography of the right knee showed a Schatzker type V fracture of the tibial plateau (Fig. 1). The results of the preoperative laboratory evaluations, including a complete blood count, blood coagulation profile, and blood chemical parameters, were all within normal limits. The results of evaluations using electrocardiographic (ECG) and roentgenographic imagings of the chest were also normal.

Under general anesthesia, open reduction and internal fixation (Fig. 2) were performed after a pressure of 300 mmHg had been applied to the right thigh using a tourniquet. The patient's blood pressure during the tourniquet inflation was 146/88 mmHg. The tourniquet was used for 2 hours 12 minutes. The patient experienced arrhythmia 5 minutes after the tourniquet was released, which was clearly noted on the ECG tracing (ST segment depression, and then widening of the QRS complex) in leads II and III (Fig. 3). Cardiac arrest then occurred, and the patient was resuscitated immediately.

After 30 minutes of resuscitation, the patient's vital signs became stable. Blood samples were then sent for a complete blood cell count and analyses to determine the levels of urea, arterial blood gas, cardiac enzymes (creatine kinase 116 U/L, creatine

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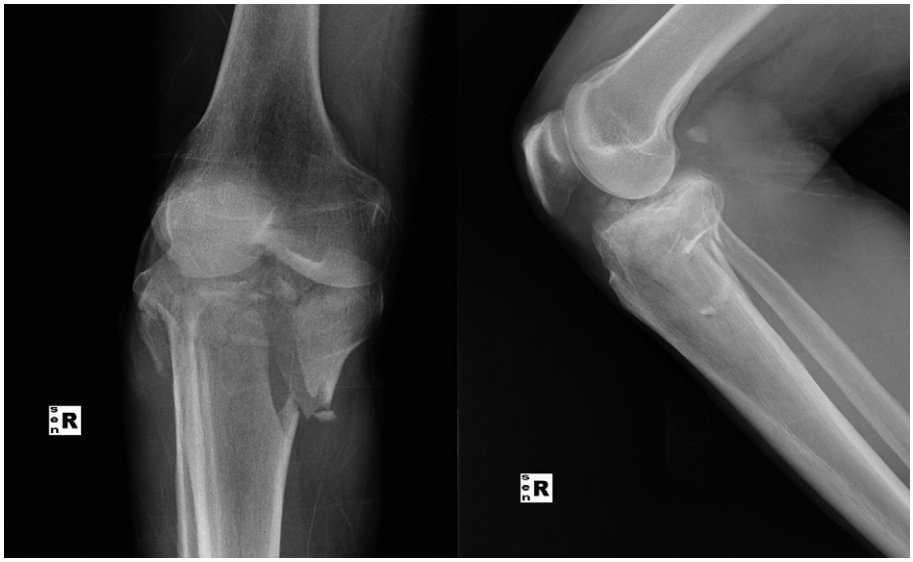

Fig. 1. Anteroposterior and lateral radiographs demonstrate a Schatzker type V tibial plateau fracture.

kinase-MB 36.1 U/L, troponin I: 0.02 μg/L), D-dimer (2.28 μg/L), and electrolytes (potassium 5.7 mmol/L) during resuscitation. The patient was taken to the recovery room for 12-lead ECG and further management.

During recovery, a cardiological opinion was sought. An echocardiogram was obtained, which showed hypokinesis of the anterior wall and of the apical, middle, and basal septa of the left ventricle, with mild-to-moderate impairment of left ventricular systolic function. The patient regained consciousness without any symptoms, and the arrhythmia recorded on the ECG (Fig. 4) completely resolved within 30 minutes of his leaving the operating room.

In the recovery room, an arterial blood gas sample was immediately taken for analysis and showed metabolic acidosis (pH 7.23, base deficit 2). The electrolytes revealed a serum potassium level of 5.7 mmol/L. The patient left the recovery room 3 hours after the operation with a completely normal ECG and normal repeat blood sample results, indicating resolution of the previous discrepancies.

The patient made a full recovery and was discharged 5 days later. An intensive cardiovascular follow-up examination was conducted in the outpatient department after the patient had been discharged, and no cardiovascular disorders, such as coronary heart disease, were found. The implants were removed after 1 year because of bony union.

3. Discussion

The use of a tourniquet in the treatment of fractures is somewhat controversial. In the early years of the Association for Osteosynthesis/Association for the Study of Internal Fixation, it was suggested that internal fixation should be performed using a tourniquet because it would maintain a relatively bloodless surgical field during extremity surgery, reduce operating time,[1] minimize blood loss,[2,3] aid in the identification of vital structures, and expedite the procedure.[4] Moreover, animal studies have shown no delay in bone healing with the use of a tourniquet.[5] Nevertheless,

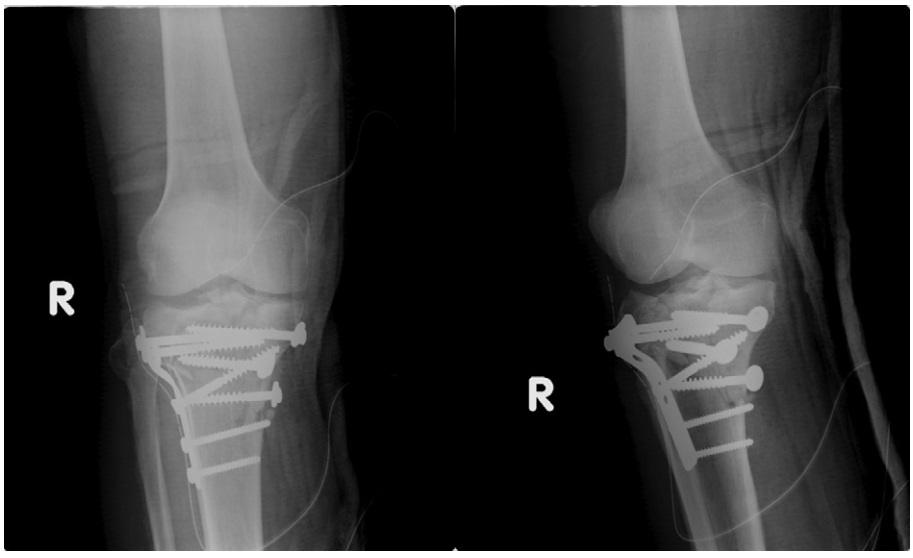

Fig. 2. The patient underwent open reduction and internal fixation via a lateral approach with buttress plate fixation and bone grafting.

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