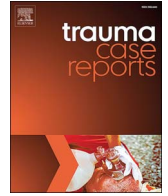


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Case Report

Atypical cardioversion in unstable arrhythmia caused by clavicle surgery

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A B S T R A C T

We report on a 54-year old male with traumatic brain injury, flail chest and floating shoulder undergoing intramedullary stabilization of a midshaft clavicle fracture in beach chair position. Intraoperatively the patient developed instable atrial fibrillation triggered by implantation of intramedullary nail. Secondary this case shows feasibility of cardioversion in latero-lateral electrode-position due to inaccessible standard positions and patient fixation between the operation table and the X-ray apparatus.

Introduction

Patients with multiple trauma are endangered by serious events in the prehospital phase and the first hours of medical management and critical care. Nevertheless these patients may be endangered in definitive surgery, several days after trauma. In this case we report on a patient with multiple injuries developing a serious cardiac event leading to cardiogenic shock during surgery with need for unconventional electric therapy.

Case report

A 54-year old male driving a quad was injured during an out-of town high-speed accident. Severe alcohol intoxication was detected on admission. Injuries consisted of traumatic brain injury with subarachnoid, subdural and intracerebral hemorrhage, flail chest with multiple rib fractures, hematom pneumothorax and right-sided floating shoulder with midshaft clavicle and scapula neck fracture. There were no clinical signs of cardiac contusion.

The patient's history revealed nicotine abuse, arterial hypertension and inguinal hernia repair years ago. Four months prior to the accident coronary heart disease had been excluded after a sole episode of angina pectoris in the same hospital. During ICU-stay the patient developed moderate ARDS, a pneumonia and a mild anemia without need for transfusion. The hematom pneumothorax was treated by chest tube insertion.

After stabilization of the intracranial injuries in the critical care department the dislocated fracture of the midshaft clavicle was scheduled for minimal invasive osteosynthesis five days after trauma. Anesthesia was conducted with continuous midazolam, sufentanil and desflurane. The patient was positioned in beach chair position. Hemodynamics was stabilized by continuous nor-epinephrine infusion (0.5 to 0.8 mg/h). A chest tube in the right pleural cavity was operating normally.

After disinfection and surgical access, nailing of the right clavicle was accomplished. By driving an x-ray guided intramedullary

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nail from medial to lateral, sinus rhythm changed to instable irregular narrow-complex tachycardia with a frequency of 180–200 beats per minute after about six hammer blows. Invasive blood pressure dropped to 55/35 mmHg and end-tidal carbon dioxide of 24 mmHg verified cardiogenic shock at risk for imminent cardiac arrest. Immediate synchronized cardioversion via Phillips Smart Biphasic Heartstart XL was prepared. Team qualifications included valid ATLS-provider and ACLS-EP-instructor status.

Standard positions (neither apical-lateral nor anterior-posterior) for defibrillator soft-pads were inaccessible for urgent electrotherapy. The apical position was clear, but right infraclavicular and sternal region were blocked by operating-cloth, surgical instruments, x-ray apparatus and the filament in situ. Posterior access point was also blocked by fixation of the patient to the operating table and the X-ray apparatus.

Thus, the team decided for bilateral pad-positioning (Buelau's position) for biphasic synchronized cardioversion with 150 J.

Atypical cardioversion changed rhythm to sinus-tachycardia (100 bpm) with prompt rise in blood pressure (110/60) and carbon dioxide levels (42 mm Hg). For stabilization 300 mg amiodarone, one gram magnesium-sulfate and low dose potassiumchloride were administered. Additionally, accidental cardiac tamponade or pneumothoraxes were excluded by intraoperative echocardiography and radiological verification of material position. Myocardial infarction was ruled out postoperatively by ECG and troponin measurements.

There were no further cardiac events during stay. Eleven days later the patient could be transferred to a rehabilitation-hospital in promising condition.

Discussion

In this case life-threatening atrial fibrillation was triggered by mechanical manipulation to the right clavicle. According to pubmed database there are no similar case reports. Causes of atrial fibrillation are manifold [1]. In this event heart contusion, myocardial infarction, paroxysmal atrial fibrillation prior to admission, septic cardiomyopathy, ARDS, electrolyte disturbances, autonomic dysregulation due to brain injury and alcoholism, norepinephrine side effects and mechanically induced shock waves may be considered.

Heart contusion was ruled out preoperatively by echocardiography and troponin measurements. Coronary heart disease was ruled out in the admission four months prior to the incident. Electrolytes were balanced during operation (potassium level of 3.9 mmol/l). Aside from multifactor-cause septic cardiomyopathy, autonomic dysregulation, norepinephrine and mechanically induced irritation (transvascular or pericardial via chest tube movement) remain as possible causes or relevant co-factors.

Although there are no comparable reports, other examples of accidental mechanically induced rhythm changes exist, e.g. for shock wave lithotripsy [2,3] and vascular guide-wires [4]. Thus, anesthesiologists should be aware for the possibility of mechanically induced malignant arrhythmias during intramedullary nailing of the clavicle, especially concerning critical ill patients.

Second implication of the case is the feasibility of atypical electrotherapy: Cardioversion in the antero-apical or sterno-apical position could not be obtained due to the open operation wound. Time-consuming extraction of the partially implanted material and remove of the operation cloth may have resulted in prolonged shock or wound contamination with considerable consequences. In addition unpositioning the patient from beach chair for anterior-posterior defibrillation would have been very time-consuming.

According to ACLS-axiom "time is brain", electrotherapy in imminent cardiac arrest is needed as soon as possible [1]. Physiologically, position of the heart has to be in line of current flow and therefore between the electrodes. Latero-lateral positioning results in higher impedance due to greater electrode distance and lung tissue. This was successfully overcome by higher chose of energy (150 instead of 120 joule) for synchronized cardioversion. General effectiveness of this approach is known but uncommon. But for surgery with limited access to the patient's chest or back it should be considered as a feasible measure to restore rhythm disturbances.

Critical ill patients are exposed to rhythm disturbances. The case shows triggering of instable atrial fibrillation by surgical manipulation with need for electrotherapy. During clavicle - operation, access to the patient may be impeded. To avoid prolonged shock with risk for organ failure or secondary brain injury after intracranial hemorrhage a time sparing and pragmatically approach was chosen. Latero-lateral cardioversion was effectively conducted with more joules than recommended to overcome greater chest impedance.

Conflict of interest

Both authors confirm no conflict of interest.

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None.

Ethical approval

All data and information were treated with regard to the Declaration of Helsinki and the German Patient Rights Act (Patientenrechtgesetz) and Data Protection Act (Datenschutzgesetz).

Consent

The patient gave his written permission for publication of his case.

Acknowledgments

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