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Case Report

A Case report - On-pump Coronary Artery Bypass in a Paraplegic Patient

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Abstract

Here, we report a 71-year-old Caucasian male with a chronic spinal cord injury at the level of T4, who underwent a coronary artery bypass grafting for a 3-vessel disease. During surgery an almost fatal hypotension took place in the presence of an autonomic dysregulation, requiring to go back on cardiopulmonary bypass. A few other episodes of hyper- and hypotension occurred perioperatively. We discuss the issues with the anesthesia and surgical cardiac procedures in the light of this acute blood pressure variability called autonomic dysreflexia.

Keywords: Spinal Cord Injury; Cardiac Surgery; Autonomic Dysreflexia

Citation

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Introduction

For patients with prolonged spinal cord injury (SCI) and associated paraplegia or tetraplegia, perioperative management presents several challenges due to orthostatic hypotension, autonomic dysreflexia, sarcopenia, higher risks associated with the use of depolarizing muscle and diminished mobility [1]. Among patients with damaged cord above T6, this autonomic dysregulation leads to an acute syndrome known as autonomic dysreflexia (AD) [2].

Anesthetic and surgical plan must also take into consideration the special needs of SCI patients during the perioperative period. Although in recent years, treatment of patients with SCI is getting more attention, the literature on perioperative management of this population remains to this day scarce and cardiovascular and pulmonary complications remains the main causes of morbidity and mortality in this population [2].

Case Report

A 71-year-old Caucasian male started complaining of chest pain with a non-ST elevation myocardial infarction (NSTEMI) during hospitalisation for macroscopic hematuria. Clopidogrel treatment was started one week before for a left femoral artery stent. Cardiac echography identified an anteroseptal and anteroapical wall hypokinesis with conserved global left ventricular function. Cardiac catheterisation revealed a severe three vessel coronary artery disease. To be mentioned in the history is a spinal cord injury during public road accident at the level of T4, 13 years earlier with subsequent paraplegia. In addition an amputation of the 5th radius of the left foot had been performed on the context of chronic obliterative arterial disease.

The patient underwent a double coronary artery bypass grafting surgery using bilateral internal mammary arteries in the absence of venous grafts and bridgeable periphery on the right coronary. Anesthesia was induced according to our standard protocol with midazolam, linisol, sufentanil, propofol and rocuronium and maintained with sevoflurane and sufentanil. Neuro-Sense (NeuroWave Systems, Inc, Cleveland, OH), which was used for bilateral frontal EEG, as depth anesthesia monitor. A 3D transoesophageal probe (X7-2t, IE33, Philips Healthcare,Inc,Andover,MA), was also inserted to help at hemodynamic monitoring. During surgery there was a need for norepinephrine with a maximum of 3.5 mcg/kg/h prior to the event of suspected autonomic dysreflexia. After weaning of cardiopulmonary bypass (CPB) and right before closure, the surgical team checked for hemostasis of the graft anastomosis on the lateral wall as usual by gentle heart luxation. This procedure caused a marked decrease in blood pressure that was followed by a major hypotension (minimal reached mean arterial blood pressure (MAP) 35 mmHg). Dobutamine (maximum of 1.1 mcg/kg/h) was added to norepinephrine (max 14.11 mg/kg/h) unsuccessfully leading to an urgent return on CPB. In order to stabilize the patient's hemodynamic and clear the lactates (peak at 9.1 mmol/L) accumulated during the hypotensive episode, we run the CPB for 45 minutes. Second weaning of CPB was held without any complications. Lactates normalized completely within 12 hours. As often the case the other extreme of the AD, a transient blood pressure elevation (increase of > 80mmHg [3]), systolic blood pressure >210mmHg occurred also 30 min after the second weaning of the CPB without any other confounding factors, responding among others at a head up position.

On the intensive care unit, several episodes of unexplained tensional instability occurred. After 48 hours of observation the patient was transferred on the ward and then discharged home without any further complication.

Discussion

These SCI patients are at higher cardiovascular risk than non-SCI patients, explained partially by having multiple cardiovascular risk comorbidities as in our case. There is a 3-fold increase in the risk of heart disease and a 4-fold increase in risk of stroke after correction for the main cardiovascular risk factors [2, 4, 5]. Otherwise, Aronson, et *al*, demonstrated that intraoperative blood pressure variability (magnitude of the excursion above and below a threshold intraoperative systolic pressure) in patients undergoing aortocoronary bypass surgery is associated with 30-day postoperative mortality [6]. Manipulation of blood pressure during cardiac surgery is however pervasive in cardiac surgery in order to response a numerous safety concerns: clamping, unclamping, maintaining adequate perfusion conditions during CPB, and juggle with surgical bleeding concerns [6].

The loss of supraspinal control, and especially sympathetic control, reduces cardiac contractility and heart rate variability (HRV); attenuates cardiovascular adaptation to activity; as well as some microcirculation changes of the skin [2]. The consequences are as follows: low resting blood pressure and unstable blood pressure with orthostatic hypotension when moving to the upright position and/or autonomic dysreflexia. On the other hand, parasympathetic nervous system is preserved in most cases of SCI as compensatory bradycardia is frequent [7]. Arrhythmia other than bradycardia was not seen in any abnormal way or amount during surgery, as suggested for most of the chronic SCI by the team of Biering-Sørensen [8].

Autonomic dysreflexia is a known condition that ails frequently patients with SCI above T6, marked by life-threatening sustained elevations in blood pressure [9]. This abrupt increase of blood pressure is followed by headaches, flushing and sweating above the level of the SCI.

In experimental settings paraplegic mice with T5 spinal cord transection had an impaired ability to maintain arterial blood pressure during coronary artery occlusion as arterial blood pressure fell to near lethal levels within the first 2 min of occlusion. This lower arterial pressure was due to lower cardiac output which were mediated only by a reduced heart rate and stroke volume as peripheral resistance was elevated in this paraplegic mice model [10]. Accordingly in our clinical case the peripheral resistance was fixed due to the autonomic dysregulation in chronic paraplegic patients and therefore cardiac output directly correlated to heart rate and stroke volume. Furthermore, the same effect of a short coronary occlusion and/or reduced stroke volume for hemostasis check on the lateral wall had almost fatal consequences.

Conclusion

Patients with spinal cord injury is a group with increased cardiovascular risk with special needs to tailored anesthetic and surgical plans. Herewith, we underline the cautiousness in regards to peroperative management due to dysautonomic dysreflexia leading to potentially harmful blood pressure variation in cardiac surgical patient. Cardiac surgery itself requiring blood pressure manipulation in order to encounter safety concerns.

Learning Objective

Autonomic dysreflexia in patients with chronic spinal cord injury is an under recognised but clinically relevant phenomenon, especially in anesthetic conditions. In this case, we demonstrated the extreme variability of the blood pressure without functional peripheral resistance mechanisms. Both cardiac anesthesiologists and

surgeons should pay special attention to this clinical entity to avoid potentially fatal issues.

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