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## Case report

# Fatal Takotsubo cardiomyopathy due to epinephrine in shoulder arthroscopy



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## ABSTRACT

The authors report a case of a shoulder arthroscopy in which epinephrine saline irrigation was held responsible for acute hypertension followed by fatal Takotsubo cardiomyopathy.

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## 1. Introduction

Addition of epinephrine to irrigation fluid for shoulder arthroscopy improves operative field visualization by reducing bleeding is routine practice in France [1] and throughout the world [2–6]. We report the first case of fatal cardiogenic shock due to Takotsubo cardiomyopathy attributed to this practice during a shoulder arthroscopy.

## 2. Observation

A 48-year-old female patient was scheduled for acromioclavicular resection and partial supraspinatus tear and labrum tear debridement via arthroscopy. The patient's history included hypertension treated with a beta-blocker (acebutolol 400 mg/day), a BMI of 33 kg·m<sup>-2</sup>, and the patient was a smoker. A cardiology workup 19 months before was normal, as was the clinical examination during the presurgical anesthesiology consultation.

The patient was premedicated orally with acebutolol 200 mg, alprazolam 0.5 mg, and cimetidine 400 mg. When she arrived in the operating room, her blood pressure was 130/85 mmHg and her heart rate was 50 bpm. An interscalene plexus block with 30 mL of a blend of local anesthetics (ropivacaine HCl at 3.75 mg/mL and lidocaine 1% with adrenaline) and 60 µg of clonidine was performed.

One hour later, a general anesthesia with intubation using sufentanil, propofol, and cisatracurium was induced followed by the onset of acute hypertension at 180/110 mmHg without tachycardia, which resolved rapidly. While installing the patient in the beach chair position, her blood pressure dropped to 80/40 mmHg, and then rapidly rose to 100/50 mmHg.

The arthroscopy was conducted with a pressure-controlled pump system (pressure at 50 mmHg), with saline solution 1 mg/L of epinephrine, as per the usual protocol. The surgery began with the glenohumeral procedure, followed by the subacromial procedure. At the time of the bursectomy using a radiofrequency ablation probe, 20 min after the beginning of the arthroscopy, a new hypertensive episode occurred, with blood pressure at 220/130 mmHg with tachycardia at 140 bpm. Irrigation was interrupted. After injection of 10 µg of sufentanil and 100 mg of propofol, the hemodynamic status progressively normalized. The intervention was continued and 20 min later the blood pressure decreased to 80/20 mmHg, treated with two injections of 6 mg of ephedrine, and then the patient was positioned to the supine position. During awakening from anesthesia, the patient underwent cardiac collapse with acute pulmonary edema, then major bradycardia requiring cardiac resuscitation. A cardiac ultrasound showed apical akinesia and severe hypokinesia of the left ventricle walls with reduction of the ejection fraction at 20%. After three other cardiac arrests and then thrombolysis for suspected myocardial infarction, the patient was transferred, with 3 mg/h epinephrine, for a coronary angiography, which showed normal coronary arteries, an ejection fraction at 25%, and apical ballooning of the left ventricle, suggesting Takotsubo syndrome. The cardiac collapse was complicated by

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disseminated intravascular coagulation and multiorgan failure and then death the following day. The autopsy was interpreted as catecholamine cardiomyopathy. The expertise concluded that the use of irrigation fluid with epinephrine was directly responsible for the high blood pressure and the fatal cardiogenic shock because of the Takotsubo heart condition. This complication was deemed a medical accident with no malpractice.

### 3. Discussion

Takotsubo cardiomyopathy mimics myocardial ischemia with reversible myocardial dysfunction in patients with healthy coronary arteries [7]. The incidence in Île-de-France is 30/1,000,000 and mortality is 3%. [7]. The physiopathological hypothesis favored is catecholaminergic discharge following acute stress, an injection of catecholamines, or surgery [7]. To our knowledge, there have been no cases published during arthroscopy using saline solution with epinephrine.

Adding epinephrine to the saline irrigation fluid in arthroscopy has been routinely practiced for more than 15 years, for the most part at doses of 0.33 or 1 mg/L [1–6]. However, this use of epinephrine is today an off-label use and there are no guidelines from the learned societies in France on this subject. Nevertheless, this technique has been the subject of six prospective, randomized, double-blind studies, five of which showed an improvement in visualization [1–6]. No hemodynamic repercussions have been observed, beyond one case of discomfort. One of the studies found a significant increase in adrenaline blood levels in the group with epinephrine as well as the control group and concluded in a systemic reaction to the surgical intervention [2]. The number of cases included was, however, limited (maximum 105) and rare complications could not be ruled out.

In the literature, six isolated cases of arthroscopy complications related to the addition of epinephrine have been described: tachycardia, hypertensive crises, pulmonary edema, and ventricular hypokinesia, symptoms that were found in our observation [8–12]. There were no deaths and no sequelae. In three cases, the complication occurred following a bone procedure with drilling or reaming, suggesting rapid absorption of the irrigation fluid via the bone [8,10,12]. Two cases were related to a mistake in the drug mixture and another in an epinephrine dosage error [9,11]. In the present observation, the hypertensive crisis was not preceded by a bone procedure and no error in the irrigation fluid preparation was detected.

Hypersensitivity to alpha-adrenergic agonists has been reported by Mazzocca et al. in the ENT literature as a hypertensive crisis, tachycardia, pulmonary edema, and death after local application of epinephrine dilutions [8]. Activation of alpha-adrenergic receptors increases peripheral vascular resistance and consequently left ventricle filling pressure with a shift in blood volume toward pulmonary vasculature, which is less sensitive to the effect

of epinephrine. The physiological compensatory mechanism of increasing the heart rate and cardiac contractility is inhibited by beta-blockers, which are not advised in this situation [8]. In our observation, the hypothesis of a hypersensitivity reaction to epinephrine could be raised, whose consequences may have been aggravated by the beta-blocker treatment.

### 4. Conclusion

Onset of serious cardiac complications related to the addition of epinephrine to the arthroscopic irrigation fluid, although exceptional, should raise questions on this practice. Its benefit to the surgical intervention, by providing better visualization, should be balanced with the risks of epinephrine related to its preparation (dosing error or incorrect drug mixture), its rapid intraosseous passage, and an unadapted cardiocirculatory response on the part of the patient because of prior treatments or hypersensitivity reaction.

### Disclosure of interest

The authors declare that they have no conflicts of interest related to this article.

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