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Successful Cardiopulmonary Resuscitation (CPR) Lasting 187 Minutes after Aortic İnjury during Nephrectomy

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Short title: Prolonged CPR

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Abstract: ***The incidence of ''intraoperative cardiac arrest'' varies from 1,1-34,6 per 10000 cases. Cardiac arrest due to acute bleeding is the leading cause of death in non-cardiac surgery. Case Report: A 43-year-old female patient, ASA I, was taken to the operating room for laparoscopic left nephrectomy under general anaesthesia. In the 162nd minute of the operation, the surgeon stated that they had injured the aorta at the level of the renal artery and had difficulty stopping the bleeding. At the 165th minute of the operation, the patient had cardiac arrest, and cardiopulmonary resuscitation (CPR) was initiated in the supine position. The patient underwent ventricular fibrillation at the 5th minute of CPR and was defibrillated. In dialogue with the cardiovascular surgeons, surgery was allowed during the interruptions, which did not exceed 1 minute, and then CPR was continued. During the 187 minutes resuscitation, 34 units of erythrocyte suspension, 38 units of fresh frozen plasma,10 of cryoprecipate and 2 pools of platelets were given. When the postoperative neurological condition was assessed after the first 48 hours, the patient was found to be conscious and cooperative. This patient recovered without neurological sequelae after massive blood transfusion and CPR, which lasted for a total of 187 minutes with intermittent manual cardiac compression periods. The outcome of perioperative cardiac arrest depends on factors such as the patient's baseline condition, the latency to starting CPR, the quality of CPR, and good teamwork.***

Keywords: CPR, aortic injury, nephrectomy, 187minutes

1. Introduction

The incidence of "intraoperative cardiac arrest" (IOCA) varies from 1.1-34.6 per 10,000 cases (1). The wide range of incidence results from the low number of cases and the different definitions of intraoperative and perioperative concepts (2, 3, 4). This is a case report about a patient who developed IOCA as a result of acute surgical bleeding due to vascular injury. This patient recovered without neurological sequelae after massive blood transfusion and CPR, which lasted for a total of 187 minutes with intermittent manual cardiac compression periods.

2. Case report

A 43-year-old female patient was taken to the operating room for left nephrectomy under general anaesthesia. In the 162nd minute of the operation, the surgeon stated that they had injured the aorta at the level of the renal artery and had difficulty stopping the bleeding. At the 165th minute of the operation, the patient had cardiac arrest. The patient underwent ventricular fibrillation at the 5th minute of CPR and was defibrillated. A cardiovascular surgeon was called for vascular repair. In dialogue with the cardiovascular surgeons, surgery was allowed during the interruptions, which did not exceed 1 minute, and then CPR was continued. The patient returned to normal sinus rhythm (NSR) at the 76th minute of CPR, and the mean arterial pressure (MAB) was approximately 38-42 mmHg. Vascular repair was completed at the 255th minute of surgery. However, in the 285th minute of the operation, the patient had a second cardiac arrest with pulseless electrical activity (PEA) (Figure 1). Cardiac compressions were started again, and spontaneous circulation returned after 87 minutes.

Despite effective CPR, there was no increase in oxygenation in the arterial blood gases, so acute pulmonary oedema and increased intrapulmonary vascular pressure due to rapid

fluid and blood transfusion as well as CPR were considered (Figure 2).

A diuretic (80 mg) and methylprednisolone (1000 mg) were administered. This period of CPR resulted in spontaneous circulation (ROSC) after 77 minutes. Continuous end-tidal CO2 levels never decreased below 10 mmHg. When the postoperative neurological condition was assessed after the first 48 hours, the patient was found to be conscious and cooperative. The patient developed ileus on the third postoperative day, underwent colon resection with an ileostomy, and was extubated on the 18th day. On the 79th day, the patient was transferred from the intensive care unit to the surgical ward. Approximately three years after the event, her ileostomy was closed, and her intestinal absorption problems ended with no need for further parenteral support.

In this case, the cognitive evaluation was performed when she was hospitalized for the closure of the ileostomy 37 months after her intraoperative cardiac arrest. However, it is surprising for a patient with such long-term CPR to have such a good neurological picture in this state. In this case, no other findings other than mild atrophy in the left cerebellar hemisphere were observed with magnetic resonance (MR) imaging of the brain (Figure 3).

3. Discussion

In this case, IOCA developed due to an unexpected aorta injury and was rapidly diagnosed. Although there was a reversible cause, aortic repair took more time than usual because of ongoing CPR. The cardiovascular team performed surgery in intervals when the CPR team permitted the surgery. When we look at resuscitation due to aortic injuries in the literature, it is seen that mortality rates are high (5, 6, 7).

Studies have shown that pulmonary oedema is an important cause of hypoxemia and poor lung compliance during resuscitation in half of patients undergoing CPR (7). In another study, the duration of CPR and baseline pCO2 level were shown to be independent predictors for the development of severe pulmonary oedema after resuscitation (8). This was also seen in our case. However, other reasons, such as increased fluid infusion and massive transfusion, may also have played a role.

After the first dose of furosemide (80 mg), repeated doses were continued, and improvements in the oxygenation of blood gases and decreased amounts of pink foamy sputum aspirated from the trachea were observed (9). When the literature is searched for steroid use and CPR, studies support the use of various steroids to increase inotropic efficiency and improve neurological results during resuscitation or after ROSC (10,11).

Charapov et al (12) stated that especially if an irreversible cause is not clear, there should not be an upper limit for the CPR time. CPR should be maintained until any reversible causes are eliminated and until hypothermia is corrected with continuation of the shockable rhythm. No clear algorithm has yet been published for cases of intraoperative cardiac arrest. It has been emphasized that ETCO2 values can be used as real-time feedback for the quality of chest compressions and as a prognostic value for ROSC in cardiac arrest during general anaesthesia (13).

Various automatic compression devices are recommended for long-term CPR, as well as e-CPR methods (14). Many studies have shown that the use of e-CPR to save patients resistant to conventional cardiopulmonary resuscitation has also increased survival in many patient populations (15). The rates of living after cardiac arrest can be increased in centres that have prepared the team and infrastructure for rapid E-CPR application (14). In our case, e-CPR was discussed with the cardiovascular team; however, because of vascular repair, the team was against e-CPR.

Physicians should base the decision to continue CPR on several factors that affect the chances of survival after cardiac arrest (16). These factors include the patient baseline status, coexisting comorbidities, latency to CPR, latency to defibrillation, and adequacy of chest compression which should be monitored with ETCO2 and/or diastolic blood pressure. Duration of CPR is dependent on individual.

In conclusion, prolonged CPR can be performed with manpower and good teamwork. Even small pauses for reversing the cause of the arrest can be allowed if the effectiveness of cardiac compressions can be monitored with end-tidal CO2 and invasive arterial pressure measurements. The outcome of perioperative cardiac arrest depends on factors such as the patient's baseline condition, the latency to starting CPR, the quality of CPR, and good teamwork.

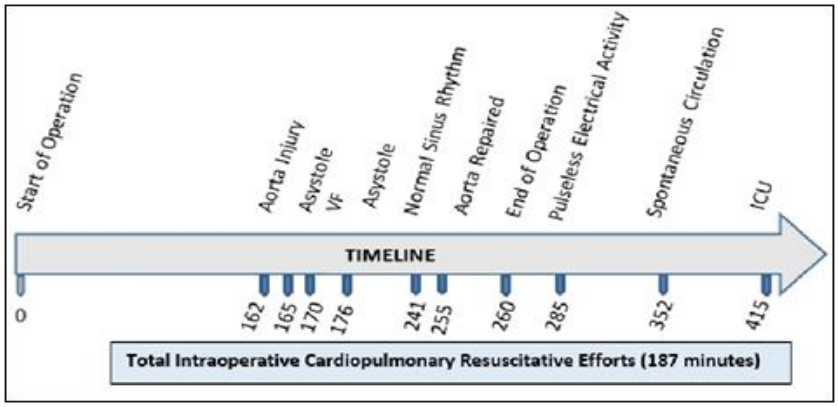

Figure 1: Timeline

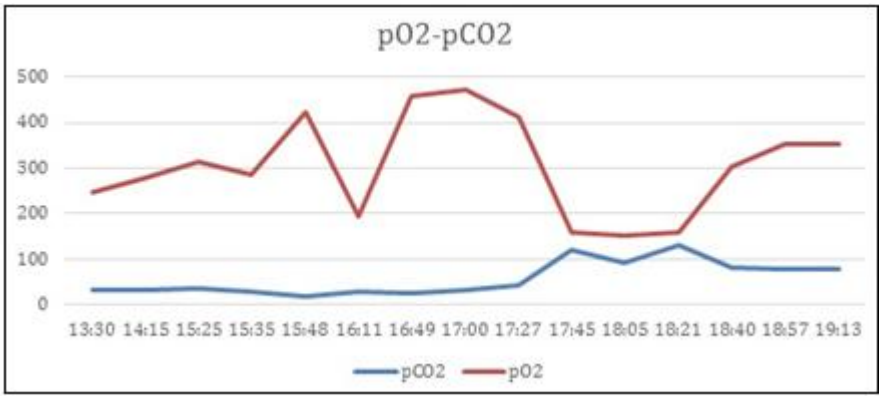

Figure 2: CPR 285. minute pulmonary edema developing

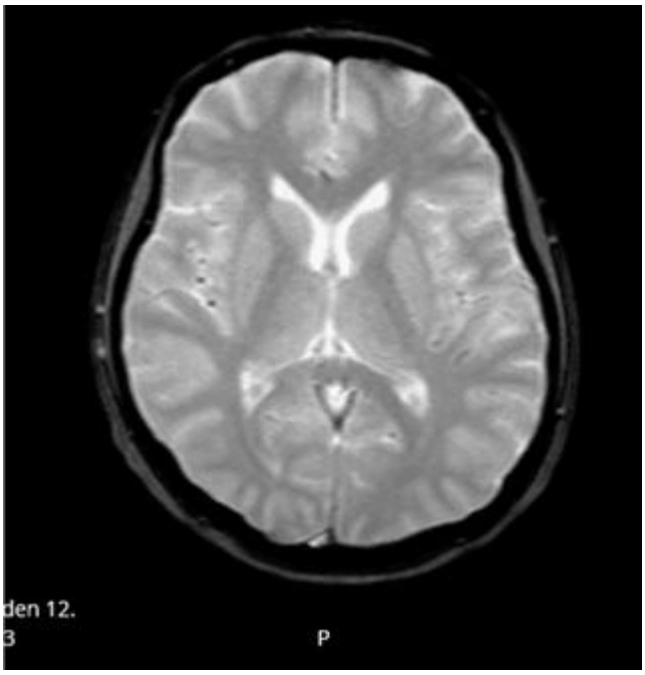

Figure 3: Brain Magnetic Resonance (MR)

4. Fund

No institutional departmental funds were received in the conduct of the study.

5. Conflict of interest

Authors have not disclosed any potential conflicts of interest.

Permission was obtained to publish a case report for the patient and her relatives

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