

Case Report

A case of acute coronary syndrome during operation, resulting in ventricular fibrillation

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A case of 68-year-old woman. The patient was scheduled for laparoscopic transverse colectomy, due to early colorectal cancer diagnosis. Right after the surgery began, electrocardiogram showed a R-on-T phenomenon premature ventricular contraction leading to ventricular tachycardia and ventricular fibrillation. Although chest compression and electric defibrillation made the rate come back to sinus rhythm, we used emergency coronary angiography after halting the surgery since an elevation in ST segment had been confirmed in precordial leads on 12-lead electrocardiogram. As there was complete occlusion in left anterior descending coronary artery (LAD), the patient appeared to have a high-grade stenosis before surgery. Placing a stent on LAD, we carried out laparoscopic transverse colostomy once again at a later date. In this case, given that the coronary artery had had a high-grade stenosis before the surgery, it is highly likely that some kind of disruption in the myocardial oxygen balance caused myocardial ischemia, but that was difficult to predict by preoperative assessment. However, we successfully resuscitated the patient through swift and proper treatments and the case successful ended up being radical operation without any after effects thanks to a proper judgment made by cooperation between surgeons and internal cardiologists. (195 words)

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Introduction

A non-cardiac surgery hardly involves cardiac arrest during the operation, still it should be deeply concerned. Perioperative myocardial infarction, even if non-life-threatening, has a significant impact on prognosis after surgeries. We will report the case in which lethal arrhythmia occurred at the time of the laparoscopic colon resection in the patient whose coronary stenosis, which had existed before the surgery, was found.

Case report

The patient was 68-year-old-woman, an elevated lesion in transverse colon was found by endoscope for lower intestinal tract in check-up, which resulted in the diagnosis of early colorectal cancer in work-up. The patient, therefore, was scheduled for laparoscopic transverse colectomy. Her previous history showed that she was taking Valsartan 40 mg for hypertension. The pre-operative test found negative T waves without an abnormal Q wave in leads V3-V6 on 12-lead electrocardiogram (Figure 1), but an ischemic cardiac disease was not retrospectively recognized. Echocardiography

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before the surgery was not put into practice. Chest X-ray test, biochemical exam, respiratory function test didn't detect any abnormality for that matter, the patient had no alcohol and smoking history. She was reported to do usual household chores and be able to walk up more than two flights of stairs. Epidural anesthesia and general anesthesia were scheduled.

Vital signs just before induction of anesthesia were blood pressure 151/88 mmHg, heart rate 65 /min, SpO₂ 99%. An epidural tap was inserted through between the eleventh and twelfth dorsal vertebra, and a catheter was indwelled there. The epidural anesthesia was in an attempt to alleviate post-operative pain, only the test for 2% adrenaline-added lidocaine 2 mL was conducted before the surgery. The anesthesia was induced with propofol 50 mg and remifentanyl 0.5 μ g/kg/min, then intubation followed after administering rocuronium 30 mg, after the induction, a catheter was inserted into left radial artery and invasive arterial pressure was conducted. Maintaining anesthesia with sevoflurane 1.5% and remifentanyl 0.2-0.3 μ g/kg/min, rocuronium was properly added. Although etilefrine was administered when blood pressure temporarily decreased after the induction of anesthesia, the systolic blood pressure was 90-100 mmHg and the heart rate was 50-60 /min, within the sinus rate, an arrhythmia was not detected, neither was a significant change after surgery initiation. There was no abnormality in arterial blood gases and electrolyte. 5 minutes after the surgery initiation, in electrocardiogram, a R-on-T phenomenon premature ventricular contraction led to ventricular tachycardia and ventricular fibrillation. Surgeons immediately put a chest compression and used electrical cardioversion (200J \times 1) after administering lidocaine 50 mg, 3 minutes later, the

rhythm was back to the sinus rhythm. After that, systolic blood pressure recovered to 120 mmHg, but ST segment elevated in leads V1-V4 on 12-lead electrocardiogram (Figure 2b). Following intubating a central intravenous catheter, nicorandil 4 mg/h, dopamine 4 μ g/kg/min, lidocaine 40 mg/h started being continuously administered into the vein. After consulting to internal cardiologists, Wall movement decreased from front wall and septum in transthoracic echocardiogram, so the surgery had no alternative but to halt and the surgeon closed a surgical incision. And we aroused the patient and extubated the tracheal tube. The patient was lucid and didn't have any paralysis in four limbs, so we sent the patient directly to an angiography room and put emergency coronary angiography into practice. In the test, proximal LAD was completely occluded (Figure 3a). Since we found a collateral vascular flow from right coronary artery, we assumed that high-grade stenosis had existed before the surgery. After leaving a bare metal stent on LAD, a blood flow recovered up to LAD's periphery (Figure 3b). In left ventriculography, wall movement abnormality was found from front wall to ventricular apex, and the left ventricular ejection fraction (LVEF) was down to 49%, so the patient was admitted to intensive care unit with the circulation support by IABP. Blood exams showed a significant elevation in NT-proBNP by 2777 pg/mL, troponin T level by 1.09 ng/mL and elevated cardiac enzymes which suggested the patient suffered acute cardiac infarction in LAD area due to unknown reasons because the patient had had the high grade stenosis before the surgery. The condition stabilized in intensive care unit. After removing IABP on the day after the surgery, the patient was moved to a general ward on day three after the surgery, without neurological sequelae.

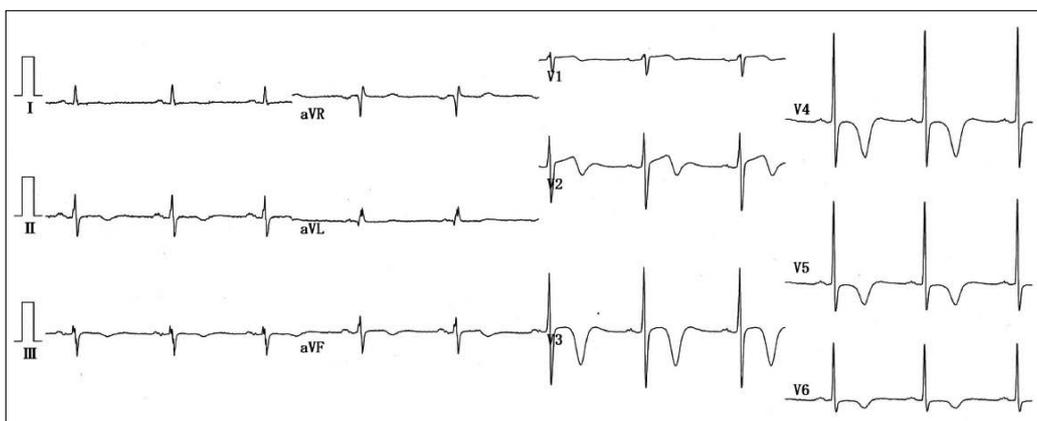


Figure 1. Pre-surgery 12-lead electrocardiogram, showing a negative T wave without an abnormal Q wave in the leads V3-V6.

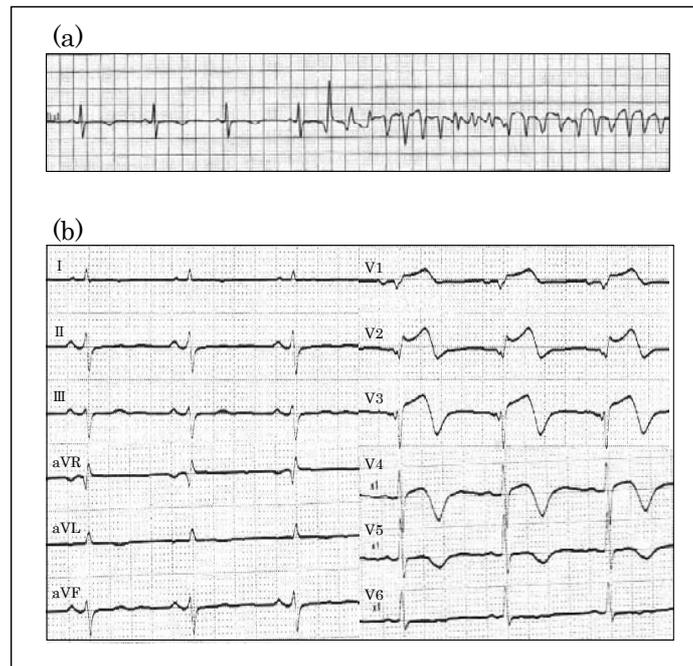


Figure 2. Electrocardiogram during the surgery. (a) R-on-T phenomenon premature ventricular contraction, leading to ventricular tachycardia, ventricular fibrillation 5 minutes after the surgery. (b) ST segment elevation in leads V1-V4, after resuscitation.

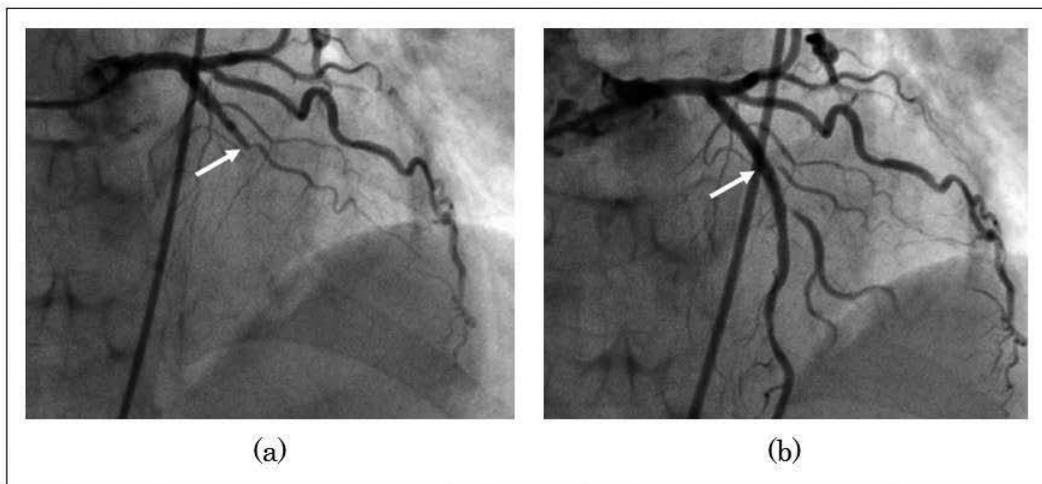


Figure 3. Coronary angiography. (a) Proximal LAD complete occlusion (the arrow showed). (b) A placed stent - bare metal stent (the arrow showed).

The patient provisionally left the hospital and another laparoscopic transverse colectomy was scheduled on day 45 after the first surgery. Before the second surgery, the wall movement improved in transthoracic echocardiogram, and LVEF showed 73%, in which hemodynamics was also stable. The post second surgery condition was on a stable recovery track, and the patient left hospital on day 27 after the surgery.

Discussion

Cardiac complications during surgeries are clinical conditions which should be deeply concerned. According to a survey of accidental cases from 2009 to 2011, released by Japanese Society of Anesthesiologist, with regard to accidentally critical cases, the number of cases, where patients developed

acute coronary syndromes during surgeries, is as few as 0.241/1000 cases¹⁾. Acute coronary syndromes can be categorized into 2 patterns: one in which myocardial ischemia was recognized in patients diagnosed as ischemic heart disease in pre-surgery check-up and the other in which myocardial ischemia was recognized in patients without diagnosis of ischemic heart disease or patients with asymptomatic ischemic heart disease. In non-cardiac surgeries, about 75% of myocardial ischemia cases showed patients didn't have angina in their medical history, which suggested that it was highly likely to be triggered by surgery or anesthesia^{1),2)}. Our case also revealed that the patient with no-ischemic-heart-disease history developed lethal arrhythmia, it was later found that coronary stenosis had existed before the surgery.

The cardiac complication is the most probable cause of death in non-cardiac surgery. And cardiac infarction reportedly accounts for 10-40% of perioperative mortality rates³⁾. The perioperative myocardial infarction, even if non-lethal, highly affects prognosis after surgery. The biggest goal in perioperative management for high-risk patients is the prevention of the perioperative myocardial infarction. As a guideline for cardiovascular evaluation in preoperative period in non cardiac surgery, including ischemic heart diseases, ACC/AHA guideline⁴⁾ is useful. The percentage of patients with ischemic heart diseases compared to the total number of surgery is significantly fewer than that in the U.S. The incidence rates of the perioperative complication for patients with ischemic heart disease in Japan, however, is not as different, which makes pre surgery evaluation based on U.S' data possible⁵⁾.

A preoperative management includes taking patient's medical history, physiological findings, evaluating the cardiac risk represented by cardiac infarction, congestive heart failure and death, by electrocardiogram findings. If needed, a non-invasive testing and pre-surgical treatment should also be added, considering patient's functional capacity, age, complication and operative procedure. ACC/AHA guideline shows algorithm based on patient's risk, functional capacity and operative procedure⁴⁾. In our case, the patient was a healthy 60-year-old woman without any disorder in medical history, except hypertension. Revised Cardiac Risk Index (RCRI)⁶⁾, used for predicting perioperative cardiovascular events, was not confirmed. Pre-surgery electrocardiogram showed a giant negative T wave, but there was no suspicion for ischemic heart diseases in the past and the level of physical activities in daily life was evaluated as better-than 4 METs. Further cardio testings, therefore, were not considered necessary. Considering the electrocardiogram prior to the surgery and the hypertension in history, in addition, that

the patient can be categorized into a medium-risk group based on risk classification in non-cardiac operation, transthoracic echocardiography could be necessary before the surgery. But it isn't necessarily useful for judging the risk of perioperative cardiac infarction in non-cardiac operation while it is non-invasive and plays a vital role in detecting abnormality in heart and valvular function and structural abnormality⁷⁾. Besides, according to the ACC/AHA guideline, exams for myocardium pressure are recommended for patients highly suspicious of myocardial ischemia or patients with exercise tolerance less than 4 METs⁴⁾. That makes it significant for pre-surgery evaluation in non-cardiac surgery to assess to what extent patients do daily activities. Even for cardiac catheter exams before surgery, which are invasive, it is recommended only when there is a possibility of halting all surgical procedures or a possibility of either prioritizing or simultaneously carrying out cardiovascular procedure⁴⁾. Therefore, in our case, it was highly likely that further heart exams would not have been necessary even if we had conducted transthoracic echocardiography before the surgery.

Generally, myocardial ischemia, decreased circulating volume, electrolyte abnormality, hypoxemia, hypothermia, effects of medicines are named as a cause for lethal arrhythmia during surgeries. Only a few studies have taken into consideration the frequency of ventricular arrhythmia in perioperative cardiac surgery and prognostic implication. The incidence rate of ventricular fibrillation and sustained ventricular tachycardia after surgery is reportedly 0.5-1% in cardiac surgery⁸⁾, in non cardiac surgery, the rate is only a few⁹⁾. In most cases a ventricular premature contraction suddenly occurs without any sign of primary illness, but it could worsen a life prognosis when organic diseases such as dilated cardiomyopathy or myocardial ischemia gets involved, which sometimes leads to ventricular tachycardia or fibrillation. Especially in the case where a coronary artery diseases were recognized before a surgery and the diseases were caused by the disturbance in myocardial oxygen balance, which is one of the unique perioperative issues, the rate of perioperative myocardial infarction accelerates. It is also reported that a ventricular premature contraction which requires perioperative treatments often involves myocardial ischemia¹⁰⁾. In our case, although electrocardiogram did not show any change in ST segment or arrhythmia until surgery initiation, a single onset of R-on-T phenomenon premature ventricular contraction led to ventricular tachycardia and ventricular fibrillation. It is doubtful that electrolyte abnormality, hypoxemia, hypothermia and effects of medicines caused them. Coronary angiography after the cardiac event predicted high-grade stenosis in coronary artery before the

surgery, even a slight change in circulatory blood volume or its decrease appears to disrupt myocardial oxygen balance and cause myocardial ischemia. It is highly likely that the lethal arrhythmia was triggered by the myocardial ischemia, but there is no solid proof to support the theory. That is because it was impossible to perfectly recognize all ischemia before arrhythmia had occurred, since 12-lead electrocardiogram after resuscitation showed an elevation in ST segment in the leads V1-V4 but it showed only the lead II during the surgery. We should have monitored precordial leads even during the surgery, considering figures in preoperative electrocardiogram.

As for ventricular premature contractions and non-sustained ventricular tachycardia, a special treatment is not reportedly necessary unless hemodynamic abnormality or myocardial ischemia gets involved, it is also reported that a single arrhythmia will not increase either the rate of perioperative myocardial infarction or death rate¹¹⁾. On the other hand, in the active cardiac condition, such as unstable coronary artery diseases or critical arrhythmia, ACC/AHA guideline recommends that it should be treated and stabilized before non-cardiac surgeries⁴⁾. Although, in our case, unpredictable cardiac events occurred, which were hard to detect based on preoperative evaluation, the swift and proper treatment resulted in resuscitation, and the cooperation between surgeons and internal cardiologists helped make a swift judgment for halting the surgery, which lead to percutaneous coronary intervention. That left no after effect and ended up the radical operation.

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