Negative results - Coronary

Carbon dioxide embolism during endoscopic vein harvesting

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Abstract

Endoscopic vein harvesting (EVH) is becoming common for the patients undergoing coronary artery bypass grafting. Using carbon dioxide insufflations during the vein harvest can produce rare but catastrophic CO₂ embolism. We report a case of massive right atrial CO₂ embolism due to femoral vein injury which occurred during the performance of a routine EVH procedure.

Keywords: CO₂ embolism; Endoscopic vein harvest

1. Introduction

Endoscopic vein harvesting (EVH) has gained increasing acceptance as an alternative to traditional open vein harvesting. This procedure offers, besides improved cosmesis, reduced wound morbidity and faster postoperative mobilization [1–3], while at the same time providing good quality conduits for coronary bypass grafting. The VasoView-6 vessel harvesting system (Boston Scientific, Indianapolis, IN, USA) uses CO₂ insufflations in variant pressure (range 10–15 mmHg) for creating a closed working tunnel for the preparation and harvesting of the great saphenous vein (GSV). As with most new techniques, unusual and unpredictable side effects and complications can occur. Carbon dioxide embolism during the EVH procedure has been reported [4, 5].

2. Case report

A 75-year-old male who presented with unstable angina, diabetes mellitus and ischemic heart disease, his preoperative echocardiogram showed moderate mitral regurgitation, reduced wound morbidity and faster postoperative mobilization [1–3], while at the same time providing good quality conduits for coronary bypass grafting (CABG) and mitral valve repair. Routine transesophageal echocardiography (TEE) at the beginning of the surgery demonstrated mild mitral valve regurgitation, mild anular dilatation and small size left atrium with no evidence of PFO, therefore, the decision was made to perform CABG without mitral repair. As a routine in our center, EVH for left GVS was performed simultaneously with sternotomy and takedown of the left mammary artery. After the left GSV was identified through a 2-cm skin incision above the knee, the EVH port was inserted and with a 7-mm endoscope the vein dissection was started. The vein was prepared while the CO₂ insufflations maintained pressure in the tunnel of 12 mmHg. The dissection was continued until the common femoral vein aiming to prepare the full length of the vein; while we were doing the dissection around the GSV junction with the femoral vein, a small bleeding was noticed in the tunnel, however, we continued the posterior dissection of the vein together with increasing the CO₂ pressure to 15 mmHg due to poor visibility inside the tunnel. At this stage the anesthesiologist reported deterioration of the patient’s hemodynamics which was shown by systemic hypotension (from 130 mmHg to 70 mmHg) together with an increase in central venous pressure (CVP) (from 10 to 23 mmHg). There were no signs of acute ischemia reported on the monitor. TEE revealed good bi-ventricular functions but there were large amounts of gas bubbles occupying the entire right atrium. Immediately the CO₂ insufflation was stopped, the patient was put in the Trendelenburg position and pharmacological resuscitation of the systemic blood pressure with an alpha-adrenergic agonist was started. The patient hemodynamically became more stable and there was no need for emergency cardiopulmonary bypass (CPB). There was no gas exchange impairment during the event. The EVH was converted to open technique at the groin region which was opened to explore the femoral vein. It was found to have been injured with the endoscope. After systemic heparinization, two vascular clamps were applied proximally and distally of the injury which was repaired using a 6/0 continuous running Proline suture. The patient was placed on CPB and then underwent CABG procedure using the left internal mammary artery to left anterior descending artery and reversed GSV to first diagonal, first obtuse marginalis and posterior descending arteries. The patient was transferred to the intensive care unit with minimal inotropic support. Post-operatively, the patient had an uneventful course. He was
extubated 14 h after surgery and he was fully awake with no focal or diffuse neurological deficits noted at postoperative computer tomography examination. Femoral vein Doppler ultrasound showed excellent flow. He was discharged home on the 6th postoperative day.

3. Discussion

EVH offers several advantages over the open traditional technique in decreasing the overall postoperative morbidity [1–3]. However, using CO₂ insufflations during the procedure was reported to be associated with gas embolism during saphenous vein harvesting as well as during some other surgical intervention [6, 7]. Lin and colleagues reported the incidence of moderate and massive CO₂ embolism occurring during EVH to be between 3.5% and 0.5%, respectively [5]. Chiu et al. showed that working in a CO₂ pressure of 15 mmHg will increase the CO₂ bubbles detected by TEE in the inferior caval vein [8]. Large femoral vein laceration in our case was the reason for CO₂ embolism, and by increasing the CO₂ pressure to achieve better visualization we increased the CO₂ leaks to the venous system. This was manifested by increasing the patient CVP and hemodynamic instability. Presence of the TEE helped us to identify early the presence of CO₂ bubbles inside the right atrium and early management of this complication. There are some technical tips that can minimize the occurrence of this complication like, lowest possible CO₂ insufflations pressure, careful dissection of the sapheno-femoral junction as well as the use of TEE.

In conclusion, increasing the interest with the EVH technique will uncover previously unanticipated technical complications such as CO₂ embolism. Cardiac surgeons should be aware about this complication for early detection and management when it occurs. Continuous TEE monitoring of the CO₂ bubbles in the IVC is an essential tool for early detection of CO₂ embolism.

References