

Video-assisted lung lobectomy in cardiac transplant recipient: Dynamic monitoring of cardiac output and fluid responsiveness

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Marianna Esposito, Antonio Corcione, Salvatore Buono**

ABSTRACT

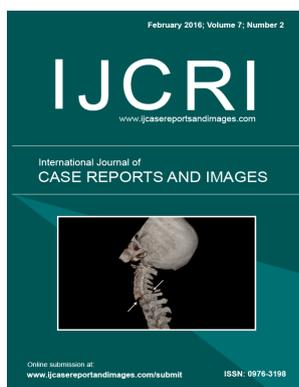
Introduction: Heart transplant recipients have a significantly higher risk of any “de novo” cancer due to immunosuppressive therapy and also they have an increasing risk of infections. Carcinoma of lung represents one of the five most common malignancies in these transplant populations. Patients’ comorbidities may request high invasive intraoperative monitoring, as well as neuraxial analgesia to avoid acute pain stress response, exposing patients to iatrogenic nosocomial infection.

Case Report: Our patient was admitted to thoracic surgery ward for lung adenocarcinoma and video assisted lung lobectomy was planned. She received heart transplantation 15 years before due to idiopathic dilatative cardiomyopathy and she had chronic rejection six years after transplant treated with corticosteroid therapy.

Conclusion: Anesthesia management can be difficult in cardiac transplant recipients due to a potentially impaired heart function and hypotension should be avoided due to preload dependence of denervated cardiac graft. We used a minimally invasive, monitoring of hemodynamic and fluid responsiveness for intraoperative management of the patient.



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Keywords: Continuous cardiac output, Fluid responsiveness, Heart transplant recipient, Uncalibrated pulse contour-derived monitoring

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INTRODUCTION

In population-based study heart transplant recipients have a significantly higher risk of any “de novo” cancer due to immunosuppressive therapy [1]. The incidence of post transplant malignancy ranged from 4.1–16.3%, and a 2-fold to 4-fold overall increased risk of cancer over the general population was observed. Carcinoma of lung represents one of the five most common malignancies in these transplant populations [2]. Therefore, is not uncommon for these patients undergoing oncologic surgery after transplant. The main worries are risks of infection and impairment of other organs, particularly those that may be compromised due to either immunosuppressive therapy or dysfunction of the transplanted organ itself [3]: diabetes, hypertension, coronary disease, osteoporosis, neurological impairment. Patients’ comorbidities may request high invasive intraoperative monitoring, as well as neuraxial analgesia to avoid acute pain stress response, exposing patients to iatrogenic nosocomial infection.

Marco Rispoli¹, Giuseppe Rossi¹, Moana Nespoli¹, Dario Mattiacci¹, Marianna Esposito¹, Antonio Corcione¹, Salvatore Buono¹

Affiliations: ¹Department of Anaesthesia and Surgical Intensive Care Unit, “Azienda Ospedaliera dei Colli - Monaldi” Medical Hospital, Naples, Italy.

Corresponding Author: Giuseppe Rossi, Department of Anaesthesia and Surgical Intensive Care Unit, “Azienda Ospedaliera dei Colli - Monaldi” Medical Hospital, Naples, Italy; Email: giuseppe.rossi@live.com

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The traditional invasive hemodynamic monitoring like pulmonary artery catheter (PAC) has the same risk associated with central venous catheterization. These risks include arrhythmias, pulmonary infarction, infection, pulmonary embolus, and rupture of the pulmonary artery to name just a few [4]. The minimally invasive monitoring devices are enable to measure pressures in the central circulation but their use in the assessment of global tissue perfusion is necessary to the goal directed therapy [5].

CASE REPORT

A 41-year-old female, 67 kg of body weight, 1.68 m tall, was admitted to thoracic surgery ward for lung adenocarcinoma diagnosis and a video assisted upper left lobectomy was planned. She received heart transplantation 15 years before due to idiopathic dilatative cardiomyopathy and she had chronic rejection six years after transplant treated with corticosteroid therapy. Echocardiogram showed adequate systolic function with mild tricuspid regurgitation. No evidence of graft rejection was documented by regular myocardial biopsies. She had an impaired glycemic tolerance and fasting hyperglycemia at 8.9 mmol/L. No kidney pathologies and mild anemia was referred. She was in treatment with cyclosporine, mycophenolate mofetil, corticosteroids, B-blocker, diuretics and antiplatelet drug. Preoperative respiratory values were forced expiratory volume in the 1st second (FEV₁) 104%, diffusion lung carbon monoxide (DLCO) 79% and maximal oxygen consumption (VO₂ max) 17 ml/kg/min with physiological arterial blood pressure (AP) and heart rate (HR) rising pattern during cardiopulmonary exercise test; metabolic equivalents of task (METs) >> 4. Predicted postoperative values (ppo) were: ppoFEV₁ 77%, ppoDLCO 58%, and ppoVO₂max 12.5 ml/kg/min.

Vascular access included a 16-G and a 14-G intravenous catheters. Monitoring consisted of American Society of Anesthesiologist standard monitors, train of four (TOF-Watch®, Organon Ltd., Dublin, Ireland) and Bispectral Index Spectroscopy (BIS Covidien, Mansfield, Massachusetts, USA). After light intravenous sedation with midazolam 0.03 mg/kg and sufentanil 10 µg, achieving observer's assessment of alertness/sedation (OAA/S) Scale score 4, right radial artery incannulation was performed to assess cardiovascular status (Figure 1 and Figure 2): heart rate 99 bpm; AP 136/81 mmHg; C.I. 4.7 l/min/m²; SVV 4%. The hemodynamics parameters were assessed with a self-calibrating arterial pulse contour cardiac output monitoring system (FloTrac/Vigileo™, Edwards Lifesciences, Irvine, California, U.S.A.). Induction of general anesthesia was performed with intravenous propofol 1 mg/kg and remifentanil 0.15 µg/kg/min until BIS < 60 and intravenous rocuronium 0.6 mg/kg was administered to perform tracheal intubation (TOF < 2).

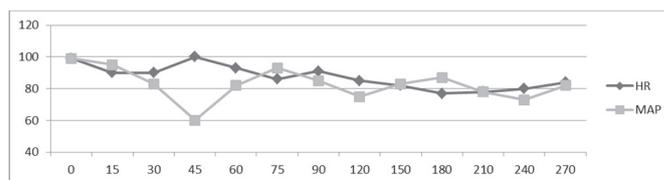


Figure 1: Time trend (in minutes), from induction of anesthesia (0 min) to awakening (270 min), of HR (bpm), rhombi, and mean arterial pressure MAP (mmHg), squares.

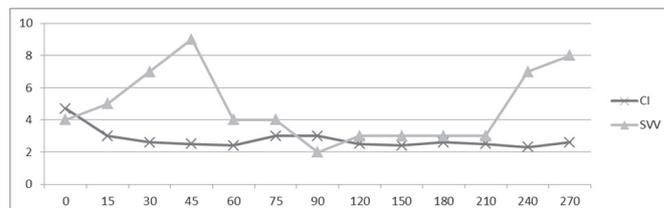


Figure 2: Time trend (in minutes), from induction of anesthesia (0 min) to awakening (270 min), of CI (l/min/m²), crosses, and SVV (%), triangles.

One lung ventilation (OLV) was obtained using a left side double-lumen bronchial PVC tube 37 F (RÜSCH, Wien, Austria) and bronchoscopic control. Mechanical ventilation settings were: tidal volume 4 ml/kg; respiratory rate 16; minute ventilation 4 l; fraction of inspired oxygen 65%; positive end expiratory pressure 4 cmH₂O. Hemodynamics values just after induction were: heart rate 90 bpm; AP 129/79 mmHg; C.I. 3 l/min/m² and SVV 5%. Anesthesia depth was guaranteed by BIS value of 47; Pulse oximetry (SpO₂) 98% was firm even in OLV.

Forty-five minutes after anesthesia induction, an hypotension episode occurred: HR 100 bpm, AP 80/50 mmHg, SpO₂ 98%, C.I. 2.5 l/min/m², SVV 9% and BIS 60. Crystalloids bolus (300 ml) was administered obtaining a fast recovery from hypotension until getting HR 93 bpm; AP 113/75 mmHg; C.I. 2.5 l/min/m² and SVV 4%. After 75 minutes of OLV the arterial blood gas (ABG) showed: pH 7.33, PaCO₂ 49 mmol/L, PaO₂ 93 mmol/L, Lactate 0.7 mmol/l and Base Excess, 0.1 mmol/l. An analgic elastomeric pump was prepared with morphine 0.2 mg/kg. Analgic transition was obtained with intravenous sufentanil 20 µg and acetaminophen 1 g, 20 minute before ending surgery. After chest drainage positioning, surgeons made an internal video assisted intercostal blockade using 20 ml of ropivacaine 0.5% at 4th and 6th intercostal space, covering the thoracic trocar access and mini-thoracotomy. Programmed upper left lobectomy was performed in 210 minutes without complications.

Propofol infusion was stopped and remifentanil infusion decreased at 0.05 µg/kg/min, patient awake after few minutes, returning to BIS value > 80. The reversal of neuromuscular block, according to TOF, was obtained with sugammadex 2 mg/kg. The tracheal tube was removed after patient spontaneous breathe recovery. Heart rate 89 bpm; AP 115/66; SpO₂ 98%; C.I.

3.2 l/min/m²; SVV 13%. Pain control was adequate with visual analogue scale < 3. The patient was transferred to intensive care unit (ICU) to perform postoperative surveillance. Before leaving operating room one of the venous access (16 G) and arterial catheter were removed. After 18 hours in ICU, spent in isolation room to prevent any infection, without any complications, patient came back to thoracic surgery ward and five days later she was discharged from the hospital.

DISCUSSION

The patient had no clinical markers of heart impairment or functional capacity decrease, the only risk factors were anemia and specific surgery risk, ECG and echocardiogram revealed no cardiac impairment and cardiopulmonary exercise test revealed a physiological response to maximal physical stress without ischemic signs [6]. We did not need further investigation according to 2014 ACC/AHA guidelines for perioperative cardiovascular evaluation for noncardiac surgery-executive summary [7].

To prevent any kind of iatrogenic infection a central venous catheter was not inserted, preferring peripheral approach to arterial and venous catheterizations. Dynamic arterial pulse monitoring was enough to check heart activity, and patient respiratory status did not require strict central venous oxygen saturation (ScvO₂) monitoring. Massive blood loss could be managed with two large bore (14–16 G) intravenous catheters using blood warmer and rapid infusion device. Patient heart status was good and there was no need for inotropic support, unless unpredictable eventualities. The only hypotension episode was reverted, reading the raise in SVV, with fast crystalloids administration. Goal-directed fluid therapy guided by functional parameters of preload, such as SVV, is believed to be rather fluid aggressive since in clinical studies the goal-directed groups received more fluids than the control group [8] and a volume restrictive regime is usually recommended for lung surgery [9] but SVV-guided fluid management, in specific thoracic surgery study, does not result in pulmonary fluid overload [10]. Furthermore, after thoracotomy with open chest conditions, SVV is not without controversy regarding prediction of volume responsiveness [11] but the VATS-approach is “close chest” procedure, so no major confounding factors but side position could interfere with our parameters.

Even not admitting the absolute precision of arterial pulse contour CO monitoring in thoracic surgery, due to side position and OLV, its relative modifications are still a measure of hemodynamic pattern; also anesthesia induction is one of the more critical moment in a cardiac patient and position and mechanical ventilation is quite the same in every surgery specialties, so we can obtain significant information during induction and early phases of anesthesia.

Video assisted surgery granted patient less intense postoperative pain [12,13] so thoracic epidural analgesia could be considered overtreatment and too invasive exposing patient to dangerous hypotension, compared to intravenous morphine and remifentanyl infusion during ICU staying. Hypotension in heart transplant patients is worrying due to their “preload dependence” [14], so, to prevent acute vasodilatation, hypotension and hypovolemia, central neuraxial blockade was avoided. Internal intercostal blockade and sufentanil bolus granted adequate analgesia during the critical first hours after surgery. Every invasive device was placed under strictly aseptic conditions and removed before entering ICU, to minimize infective risk. The theory behind using the arterial pulse wave form to measure CO is based on the model that describes the loads faced by the heart when pumping against the pulmonary or systemic circulation and the relationship between the arterial blood pressure and flow in the systemic and pulmonary arteries. Particular algorithms can be used to define an area under the systemic arterial pulse waveform, available to establish CO and SV [15]. Changes in the systolic pressure between the inspiratory and expiratory phase during mechanical ventilation can be used to ascertain intravascular volume status and, by calculating the systolic pressure variation and the SV variation (SVV), the pulse contour systems can also function as volume status monitors [16]. Pulse contour devices have some advantages over other devices used to measure CO. They require little training, are simple to calibrate and provide an estimation of intravascular volume status [5]. Several studies show a good correlation between pulse contour devices and traditional invasive hemodynamic monitoring both during cardiac surgery and no cardiac surgery [17–19].

CONCLUSION

Pulse contour devices have some advantages over other devices used to measure CO. They require little training, are simple to calibrate and provide an estimation of intravascular volume status. Several studies show a good correlation between pulse contour devices and traditional invasive hemodynamic monitoring both during cardiac surgery and no cardiac surgery.

Author Contributions

Marco Rispoli – Substantial contributions to conception and design, Acquisition of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Giuseppe Rossi – Substantial contributions to conception and design, Acquisition of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Moana Nespoli – Substantial contributions to conception and design, Acquisition of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Dario Mattiacci – Substantial contributions to conception and design, Acquisition of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Marianna Esposito – Substantial contributions to conception and design, Acquisition of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Antonio Corcione – Substantial contributions to conception and design, Acquisition of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Salvatore Buono – Substantial contributions to conception and design, Acquisition of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Guarantor

The corresponding author is the guarantor of submission.

Conflict of Interest

Authors declare no conflict of interest.

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REFERENCES

1. Na R, Grulich AE, Meagher NS, McCaughan GW, Keogh AM, Vajdic CM. Comparison of de novo cancer incidence in Australian liver, heart and lung transplant recipients. *Am J Transplant* 2013 Jan;13(1):174–83.
2. Chiu B, Sergi C. Malignancy after Heart Transplantation: A Systematic Review of the Incidence and Risk Factors Compared with Other Solid Organ Transplants. *Clin Exp Cardiol* 2013;9:005.
3. Swami AC, Kumar A, Rupal S, Lata S. Anaesthesia for non-cardiac surgery in a cardiac transplant recipient. *Indian J Anaesth* 2011 Jul;55(4):405–7.
4. Domino KB, Bowdle TA, Posner KL, Spitellie PH, Lee LA, Cheney FW. Injuries and liability related to central vascular catheters: a closed claims analysis. *Anesthesiology* 2004 Jun;100(6):1411–8.
5. Funk DJ, Moretti EW, Gan TJ. Minimally invasive cardiac output monitoring in the perioperative setting. *Anesth Analg* 2009 Mar;108(3):887–97.
6. Eagle KA, Brundage BH, Chaitman BR, et al. Guidelines for perioperative cardiovascular evaluation for noncardiac surgery. Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Committee on Perioperative Cardiovascular Evaluation for Noncardiac Surgery. *Circulation* 1996 Mar 15;93(6):1278–317.
7. Fleisher LA, Fleischmann KE, Auerbach AD, et al. 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *Circulation* 2014 Dec 9;130(24):e278–333.
8. Buettner M, Schummer W, Huettemann E, Schenke S, van Hout N, Sakka SG. Influence of systolic-pressure-variation-guided intraoperative fluid management on organ function and oxygen transport. *Br J Anaesth* 2008 Aug;101(2):194–9.
9. Licker M, de Perrot M, Spiliopoulos A, et al. Risk factors for acute lung injury after thoracic surgery for lung cancer. *Anesth Analg* 2003 Dec;97(6):1558–65.
10. Haas S, Eichhorn V, Hasbach T, et al. Goal-directed fluid therapy using stroke volume variation does not result in pulmonary fluid overload in thoracic surgery requiring one-lung ventilation. *Crit Care Res Pract* 2012;2012:687018.
11. Reuter DA, Goepfert MS, Goresch T, Schmoeckel M, Kilger E, Goetz AE. Assessing fluid responsiveness during open chest conditions. *Br J Anaesth* 2005 Mar;94(3):318–23.
12. Karmakar MK, Ho AM. Postthoracotomy pain syndrome. *Thorac Surg Clin* 2004 Aug;14(3):345–52.
13. Nagahiro I, Andou A, Aoe M, Sano Y, Date H, Shimizu N. Pulmonary function, postoperative pain, and serum cytokine level after lobectomy: a comparison of VATS and conventional procedure. *Ann Thorac Surg* 2001 Aug;72(2):362–5.
14. Cheng DC, Ong DD. Anaesthesia for non-cardiac surgery in heart-transplanted patients. *Can J Anaesth* 1993 Oct;40(10):981–6.
15. Wesseling KH, de Wit B, Weber JAP, Smith NT. A simple device for the continuous measurement of cardiac output. *Adv Cardiovasc Phys* 1983;5:16–52.
16. Michard F. Changes in arterial pressure during mechanical ventilation. *Anesthesiology* 2005 Aug;103(2):419–28.
17. Sauder KA, Pokorney PE, McCrear CE, Ulbrecht JS, Kris-Etherton PM, West SG. Noninvasive assessment of hemodynamics: a comparative analysis of fingertip pulse contour analysis and impedance cardiography. *Blood Press Monit* 2015 Aug;20(4):209–14.
18. Smetkin AA, Hussain A, Kuzkov VV, Bjertnæs LJ, Kirov MY. Validation of cardiac output monitoring based on uncalibrated pulse contour analysis vs transpulmonary thermodilution during off-pump coronary artery bypass grafting. *Br J Anaesth* 2014 Jun;112(6):1024–31.
19. Sander M, von Heymann C, Foer A, et al. Pulse contour analysis after normothermic cardiopulmonary bypass in cardiac surgery patients. *Crit Care* 2005;9(6):R729–34.

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