Pulmonary artery rupture by the Swan-Ganz catheter. Case report

Ruptura da artéria pulmonar pelo cateter de Swan-Ganz. Relato de caso

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Received from Clínica São Vicente – Rio de Janeiro (RJ), Brazil.

Submitted in March 24, 2009
Accepted in June 12, 2009

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ABSTRACT

Pulmonary artery catheter is frequently used to monitor patients during liver transplantation. Recently developed less invasive methods for estimating cardiac output and pulmonary capillary wedge pressure together with the failure of randomized studies to demonstrate reduced mortality in pulmonary artery catheter-monitored patients, has restricted its applicability. Pulmonary artery rupture by pulmonary artery catheter is a rare, but dangerous complication. The purpose of this report is to describe a pulmonary artery rupture caused by monitorization with a pulmonary artery catheter, reviewing the clinical approach and discussing hemodynamic monitoring with the pulmonary artery catheter during liver transplantation.

A 56 year old female patient, with cirrhosis caused by hepatitis C virus (MELD score 26) presented with acute hepatic encephalopathy. She was medicated and received a liver transplantation with invasive monitoring with a pulmonary artery catheter. In the first 24 hours after surgery, the patient presented with hemodynamic instability, low hematocrit, and cardiorespiratory arrest. After cardiopulmonary resuscitation, hemopericardium was diagnosed by transthoracic echocardiography and even after pericardiocentesis the patient developed recurrent hemopericardium. Pulmonary angiography did not disclose large vessellesions. The pulmonary artery rupture diagnosis was only made after sternotomy and direct lesion observation.

Complications from use of pulmonary artery catheter are infrequent, however, due to their clinical severity, can cause high morbidity and mortality. A decreased use of pulmonary artery catheter reduced the number of complications observed. New clinical studies comparing pulmonary artery catheter with non-invasive methods for pulmonary capillary wedge pressure measurement must be conducted in liver transplantation.

Keywords: Liver transplantation/ adverse effects; Catheterization, Swan-Ganz/adverse effects; Monitoring; Case reports

INTRODUCTION

Although rare, pulmonary artery rupture (PAR) is considered one of the worst pulmonary artery catheter (PAC)-related complications. First described in 1971[(1)], its clinical features are well known. Notwithstanding risk of severe complications with PAC, appropriate use of this hemodynamic monitoring tool may prove beneficial.

CASE REPORT

A 56 years old woman, bearing human immunodeficiency virus (HIV) infection and liver cirrhosis caused by hepatitis C virus (HCV), MELD score 26, was admitted with hepatic encephalopathy. She was hemodinamically stable, however had jaundice, paleness, legs edema and ascitis. Due to the severity of her condition and lack of liver donors, a living related liver transplantation was performed about 24 hours after admission. When preparing for the surgery, a deep vein access was placed and she was monitored by means of a peripheral arterial catheter (invasive arterial blood pressure monitoring) and a PAC. The surgery lasted 11 hours and had no intercurrence.

At postoperative she was admitted to the intensive care unit (ICU) extubated, mildly hypertensive and hypothermic (axillary temperature: 35º C) due to transplantation hypothermia. The Swan-Ganz catheter monitoring showed central venous pressure (CVP) 0 mm Hg; pulmonary capillary pulmonary wedge pressure (PCWP): 4 mmHg; mean pulmonary artery pressure (MPAP): 7 mm Hg; Cardiac Index (CI): 5.8 L/ min x m^2; venous oxygen saturation (SvO_2): 78%. Difficult to "wedge" the catheter for monitoring her clinical parameters at the ICU was reported.

Within the first postoperative 24 hours the patient had oliguria and the hemodynamic monitoring showed CVP: 5 mm Hg; MPAP: 12 mm Hg; PCWP: 7 mm Hg; CI: 4.4 L/min x m^2; SvO_2: 80%.

The PAC was removed in the second postoperative day, and the patient remained with decreased urinary output despite supportive measures, and was then placed under hemodialysis. On the same day she had several ventricular tachycardia (VT) episodes with pulse, hemodialysis was withheld and 2 vials of Amiodarone administered. About ten minutes after initiating VT, she had refractory hypotension and respiratory arrest. After cardiopulmonary resuscitation and supportive measures, a trans-thoracic echocardiogram (TTECHO) was requested, evidencing pericardial effusion. Pericardiocentesis was then performed draining 100 mL blood, with partial hemodynamic and metabolic improvement.

Twenty four hours after the pericardiocentesis, the patient had hemodynamic instability. A New TTECHO showed new pericardial effusion, which was drained by pericardiocentesis (about 100 mL). Chest X-ray suggested left hemothorax, also drained.

The patient again coursed with hemodynamic instability and a new pericardial effusion. Next, pulmonary angiography and cavography were performed, however, both failed to show any lesion and explain the clinical course.

In view of these results, surgical approach was decided. Sternotomy disclosed a small lesion at pulmonary artery left branch, which was corrected.

DISCUSSION

Use of pulmonary artery catheter is not complication free, and these include arterial puncture, pneumothorax, ventricular arrhythmias, catheter knotting and pulmonary infarction.[2]

PAC-PAR is a very rare complication, with an estimate incidence rate of 0.01% to 0.47%[3-9] In two recent studies, the incidence rate was below 0.05%.[10] This variation may be attributed to the discrepancy in the number of control cases included in the series. The mortality rate reported ranges from 50 to 75%, and is higher in anticoagulated patients. All mentioned series involved patients undergoing heart surgery, and it is disputable if these figures may be extended to other types of patient.

Risk factors for PAR, Swan-Ganz catheter-related include: female gender, age above 60 years, pulmonary hypertension, anticoagulation, improper balloon positioning and inflation, repeated catheter handling, heart manipulation during surgery and induced hypothermia.

This report case patient had, at least, three risk factors (female gender, anticoagulation and induced hypothermia), while it is difficult to evaluate inappropriate positioning or excessive manipulation of the catheter. Although, anticoagulation and hypothermia are postoperative risk factors common to all liver transplantation patients, pulmonary hypertension prevalence and age bracket may be widely different from those undergoing heart surgery.

According to a literature review by Bussières et al.[2], among the injury mechanisms responsible for PAR stand out inappropriate balloon insufflation, catheter flushing while wedged, catheter migration to small gauge arterioles, and its advance when the tip leans against a blood vessel wall.

Peculiarity of the above described case is the lesion site (pulmonary artery trunk) and clinical picture (cardiac tamponade and hemothorax). PAR generally

presents as massive pulmonary hemorrhage, hemoptysis, or the patient is asymptomatic.[11] Hemothorax is a less common condition. PAC-related cardiac tamponades reported in literature are secondary to right ventricle perforation.[2,3,6,12]

Initial management of patients with catheter-induced PAR is focused on preventing asphyxia from alveolar blood flooding (main cause of death), as hypovolemia is rarely cause of death in these patients. Bleeding control and pulmonary isolation by lateral decubitus with the non-involved side up, and double-lumen tube orotracheal intubation, maintaining appropriate gas exchange as well as hemodynamic stabilization are the therapeutic measures for this complication.

It is worthy mentioning that hemothorax patients seem to benefit from surgical repair, by thoractotomy.[12] The reported case is an example of successful surgical approach to a hemothorax complicated PAR.

Debate on PAC use continues.[13] Complications from its use and monitoring the same clinical parameters with other less invasive and affordable methods are factors ranking it as high risk/benefit by some experts. Several series evaluating critical (non surgical) patients, failed to show PAC monitoring long-term benefit, also initially admitting longer hospitalization time, higher cost, complications and mortality rates with its use.[14] Two recently published randomized clinical trials confirmed these findings, disagreeing with the increased mortality seen in the previous series.[15,16]

A number of studies evaluated the use of PAC in vascular surgery pre-operative period control in 1989 and 1990.[17,18] More recently a new retrospective evaluation also failed to find long-term benefit with PAC invasive monitoring in non-heart surgery, further showing a three-fold increase in postoperative cardiac events and two-fold increase in non-cardiac events.[19] The current recommendation is that randomized clinical trials are warranted to clarify PAC indication in anesthesia-surgery management. Regardless of the absence of long-term benefit in these series, probably, it is beneficial in the critically ill surgical patients, such as those undergoing heart and liver transplantation surgery.

There is currently a trend to avoid using PAC in several clinical conditions, however, in liver transplantation, it continues to be the best choice, trending to increase use of trans-esophageal ECHO in low MELD (<15) patients.[20,21] Additionally, it can be stated that several cirrhotic patients undergoing transplantation present hemodynamic peculiarities, such as reduced peripheral vascular resistance,[22] and that affects accuracy of less invasive methods (Vigileo/Flotrack) when compared to PAC.[23] More recent methods[20,23,24] are being launched and evaluated for replacing PAC in liver transplantation, however none has proven as reliable or able to measure so many variables in all patients.

The reported case is an example of the relevance of this discussion. PAC remains the best and most reliable method for hemodynamic monitoring of liver transplantation patients. Although it is an invasive method, it is fundamental for managing anesthesia in these patients, and its use is corroborated by the benefits when compared to the low complication rate. Additional studies comparing non-invasive cardiac output monitoring methods versus PAC are warranted. Perhaps, replacing PAC for another as, or even more effective, may additionally reduce morbidity mortality of liver transplantation patients.

RESUMO

O cateter de artéria pulmonar é frequentemente usado na monitorização de pacientes durante o transplante hepático. O advento de métodos menos invasivos para estimar o débito cardíaco e a pressão de oclusão da artéria pulmonar, aliado ao fracasso de estudos randomizados em demonstrar redução da mortalidade com o uso do cateter de artéria pulmonar, reduziu sua aplicabilidade. A ruptura de artéria pulmonar pelo uso do cateter de artéria pulmonar é complicação rara, porém grave. Objetivamos relatar a ruptura de artéria pulmonar como complicação do cateter de artéria pulmonar, revendo a abordagem clínica e discutindo a monitorização hemodinâmica com o cateter de artéria pulmonar no transplante hepático.

Paciente do sexo feminino, 56 anos, portadora de vírus da hepatite C e cirrose (escore MELD 26), apresentou quadro de encefalopatia hepática. Foi realizado transplante hepático sob monitorização invasiva com cateter de artéria pulmonar. Nas primeiras 24 horas pós-operatórias apresentou instabilidade hemodinâmica, queda do hematócrito e parada cárdio-respiratória. Após a ressuscitação cárdio-pulmonar, foi solicitado um ecocardiograma transtorácico que evidenciou hemopericárdio. Mesmo após a pericardiocentese a paciente evoluiu com hemopericárdio recidivo. A angiografia pulmonar não evidenciou lesões e o diagnóstico de ruptura de artéria pulmonar só foi feito através da esternotomia exploratória.

As complicações pelo uso do cateter de artéria pulmonar são infrequentes, entretanto associadas a grande morbimortalidade. A redução do uso do cateter de artéria pulmonar diminuiu as complicações em diversas situações clínicas, entretanto o risco-benefício do uso do cateter de artéria pulmonar para transplante de fígado não é conhecido. Novos estudos comparando o cateter de artéria pulmonar a métodos não invasivos da avaliação da pressão de oclusão da artéria pulmonar devem ser realizados no transplante hepático.

Descritores: Transplante de fígado/efeitos adversos; Cateterismo de Swan-Ganz/efeitos adversos; Monitoramento; Relatos de casos

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