A simple method to pass a pulmonary artery flotation catheter rapidly into the pulmonary artery in anaesthetized patients

Z. Szabó*

Department of Cardiothoracic Anaesthesia Linköping Heart Centre, University Hospital, Linköping, Sweden

*E-mail: zoltan.szabo@lio.se

Background. In some patients passage of a pulmonary artery flotation catheter (PAFC) into the pulmonary artery may be difficult and time consuming and the prolonged manipulation can cause ventricular arrhythmias. A simple clinical method used during general anaesthesia is presented to allow rapid passage of a PAFC into the pulmonary artery.

Methods. The operating table is positioned head up and slightly right side down to position the pulmonary valve at the highest level possible. When the balloon catheter is in the right ventricular outflow tract (indicated by premature ventricular contractions) the ventilator is paused in inspiration and the balloon catheter simultaneously passed into the pulmonary artery.

Results. The manoeuvre shortens the time necessary to pass the catheter into the pulmonary artery and may reduce ventricular arrhythmias. Over 5 yr, 105 PAFCs were inserted with this method without major complications.

Conclusion. This method may reduce the risk of ventricular arrhythmias, and could be particularly useful in high-risk critically ill patients.

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The PAFC has been used for monitoring the circulation in surgery and intensive care since 1970.1 Occasionally the insertion of the pulmonary catheter may take a long time.2 In some patients (for example those with a low cardiac output) it may be difficult to pass a PAFC into the pulmonary artery. A simple way to rapidly pass the PAFC into the pulmonary artery is presented. The method can be used with or without the help of transoesophageal echocardiography (TOE).

Methods and results

The method depends on positioning the opening of the pulmonary artery at the highest point possible and applying an inspiratory pause at the moment the pulmonary balloon catheter is passed through the pulmonary outflow tract and pulmonary valve.

The method was applied using a standardized anaesthetic and catheterization procedure.3 The catheter currently used is the Abbott Opticath (Chicago, IL) or the Edwards Lifesciences Swan-Ganz CCOmbob CCO/SvO2 (Irvine, CA). During 1990–96, Arrow catheters were also used.

1. After the induction of general anaesthesia and intubation of the trachea an 8Fr introducer is inserted in the right internal jugular vein with a standard Seldinger technique. The side-hole of the introducer sheath and all the infusion ports, except the tip of the catheter, which is used to measure the pressure for guidance, are closed during the entire procedure.

2. The PAFC is placed into the introducer before placing the patient head up.

3. The balloon (previously tested) is fully inflated after insertion to 20 cm.

4. The patient’s thorax is raised by positioning the operating-table head up 15–20° (Fig. 1A) and the table is rotated towards the right 15–20° (seen from the head of the patient) (Fig. 1B).
5. The PAFC is then advanced with the balloon inflated as far as the right ventricle while the pressure display is observed.

6. Premature ventricular contractions indicate when the balloon is in the right ventricle particularly in the right ventricular outflow tract. At this moment the ventilator is stopped at end-inspiration: the Servo Ventilator 900D (Siemens Elema Sweden) has an inspiratory pause button. During the inspiratory pause (Fig. 1C) the catheter is advanced from the right ventricle into the pulmonary artery, guided by the pressure curve. The magnitude of the applied intra-thoracic pressure can be adjusted by changing the tidal volume. The inspiratory pause rarely exceeds 10–30 s.

7. As the pulmonary catheter passes the pulmonary valve the inspiratory pause is stopped and the PAFC further advanced to the wedge position.

Between 1995 and 2000, I anaesthetized 810 patients for open-heart operations and inserted a PAFC with this method in 105 patients (13%). Descriptive data for these patients are shown in the Table 1. No major complications related to the insertion or presence of the PAFC were recorded in our institutional database (Summit Vista for Windows; Summit Medical Systems Inc. Version 1.98.1). The PAFC catheter was used for standard indications.

Comment

In this paper a practical and useful technique is presented: by positioning the patient head up and rotated to the right, and applying an inspiratory pause, it is easy to pass the balloon flotation pulmonary catheter rapidly into the pulmonary artery.

The most common and potentially dangerous complication during the insertion of PAFC is ventricular arrhythmia when the catheter is being passed through the right ventricle. By passing the catheter rapidly into the pulmonary artery this complication can be reduced. The insertion of the PAFC especially before induction of the anaesthesia may be time consuming in routine coronary surgery.

I used two types, Abbott Opticath and Edwards Lifesciences Swan-Ganz CCOMbo CCO/SvO₂, with no obvious differences in the difficulty in passing through the pulmonary valve. However, the softer Arrow catheters appeared to be easier to pass through the pulmonary valve.

In a few patients, transoesophageal echocardiography was used to guide the PAFC, in patients for tricuspid annuloplasty, and we did not see any air embolism during the introduction of the PAFC.

This position of the patient places the pulmonary valve at the highest point of the right ventricle. Because the air filled balloon floats upwards it is thus directed more easily by the blood flow to pass directly into the pulmonary artery. The tendency of the balloon to float is more important than the effect of flow direction during insertion of a balloon flotation catheter.

Probable, our end-inspiratory hold manoeuvre causes congestion of the pulmonary vessels, which may dilate the pulmonary artery opening. This may help to pass the balloon into the pulmonary artery. If a reflex increase in heart rate and contractility is caused, then this would augment forward flow even if venous return were reduced. However the exact mechanism of the method is not clear at the moment.

This simple clinical technique can be a used in routine practice to facilitate insertion of a PAFC during anaesthesia. This method may reduce the risk of ventricular arrhythmias, and could be particularly useful in high-risk critically ill patients. The underlying physiological mechanism remains to be clarified.

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References


