

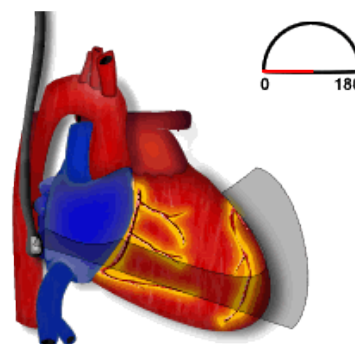
An Introduction to Invasive Monitoring during Cardiac Surgery

Perioperative Transesophageal Echocardiography (TEE)

TEE is a useful diagnostic and monitoring tool. A probe is inserted into your food pipe (oesophagus), after anaesthesia has been induced. It allows us to get images of the heart for assessing its structure and function. It also assists us to seek further confirmation of a previous diagnosis, monitor how the heart performs during anaesthesia, and evaluate the effects of surgical repair and correction.

There are only a few conditions prohibiting us from performing TEE, such as oesophageal stenosis / stricture, presence of a web / varices. The anaesthesiologist will enquire about your symptoms and medical record which may suggest that you have any of these conditions.

All diagnostic and therapeutic modalities carry risks of causing certain complications. The common and serious ones for TEE are listed below. We would exercise every care to avoid such complications. In general, this tool is safe and the risk-to-benefit ratio is very favourable.



Invasive Arterial Blood Pressure and Central Venous Pressure Monitoring

To ensure your safety, it is necessary for us to closely monitor your cardiac and circulatory status. We will monitor your arterial blood pressure and / or central venous pressure every instant throughout anaesthesia, surgery and post-operative period.

Arterial blood pressure monitoring

We will insert a small plastic catheter into one of your arteries (at the wrist / foot / groin) before / after putting you to sleep. If the catheter is inserted before you are asleep, we will first inject some local anaesthetic in the area to minimize the discomfort. This catheter enables us to monitor your blood pressure, take blood for investigations and tests that you may need to undergo during the operation and in the early post-operative period. This will spare you the discomfort of repeated venous punctures. The catheter will be removed once the need for intensive monitoring is no longer required.

Venous pressure monitoring

We will insert a special catheter into one of your central veins, most likely in the neck, upper part of your chest, or the groin for monitoring the pressure in your central veins. This pressure can reflect the amount of blood circulating in your heart and circulatory system which enables us to assess your condition to decide whether medications or corrective measures are required. This catheter can also be used to administer certain drugs which are too painful to give through the smaller peripheral veins. Usually, we will insert the catheter after inducing anaesthesia, but occasionally, we may need to perform the procedure before putting you to sleep. In that case, we will inject some local anaesthetic to minimize the discomfort. This invasive monitoring technique does carry risks of causing certain complications, most of which are listed below. However, its benefits greatly outweigh the risks and most complications can be dealt with quite effectively and easily. Only very few may need major intervention and such cases are rare.

Pulmonary artery pressure monitoring

Based on your current cardiac and / or circulatory status, as well as the complexity of your surgery, it may be necessary to perform an even closer monitoring on the pressure inside your heart chambers and pulmonary artery (the artery that carries blood to the lungs from the right side of the heart). The pressure measured from your pulmonary artery allows us to gain some insight of the function of the left side of your heart and assess the need of giving you more intravenous fluids, or aid the function of your heart with some specific cardiovascular drugs. As this is quite an invasive procedure, we will exercise every possible care, but we would like you to go over the complications listed below. Most complications can be avoided or dealt with quite effectively and easily. Serious complications may still occur but they are rare.



Complications associated with various invasive monitoring

Perioperative Transesophageal Echocardiography (TEE)

- | | |
|--------------------------|---|
| - lip injuries (13%) | - esophageal/gastric injury or bleeding |
| - hoarseness (12%) | - vocal cord paralysis |
| - dysphagia (1.8%) | - dysrhythmias |
| - bradycardia (0.2%) | - hypotension |
| - dental injuries (0.1%) | |

Central Venous Catheter

1. During insertion	<ul style="list-style-type: none"> - pneumothorax <ul style="list-style-type: none"> • subclavian ~ 2% • internal jugular vein ~ 1-2% - arterial puncture <ul style="list-style-type: none"> • subclavian ~ 5% • internal jugular vein ~ 1-2% - haematoma - structural damage <ul style="list-style-type: none"> • nerves: vagus, recurrent laryngeal, stellate ganglion, cervical plexus • trachea • thoracic duct
2. During use	<ul style="list-style-type: none"> - colonization, infection, bacteraemia - venous thrombosis - embolism: thrombus, septic thrombus, air, catheter tip - venous perforation - arteriovenous fistula - accidental removal - migration: fluid administration to pleural cavity
3. During removal	<ul style="list-style-type: none"> - haemorrhage / haematoma - air embolism

Arterial-line

- | | |
|--------------------------|-----------------------------------|
| - thrombosis | - ischaemia of the limbs |
| - haematoma | - proximal forearm ischaemia |
| - accidental haemorrhage | - aneurysm |
| - sepsis | - arteriovenous fistula |
| - distal emboli | - inadvertant drug administration |

Pulmonary Artery Catheter

1. Early complications

- Arrhythmias
- Misplaced catheter tip
- Air embolism

2. Late complications

- | | |
|-------------------------------|-----------------------------------|
| - Mechanical problems | - Thrombosis / pulmonary embolism |
| - Catheter entrapment | - Thrombocytopenia |
| - Catheter coiling / knotting | - Pulmonary infarction |

- Catheter tip migration
- Introducer sheath problems
- Balloon rupture
- Infection
- Endocarditis

3. Structural damage

- Endocardium, tricuspid valve, pulmonic valve
- Pulmonary artery rupture, pseudoaneurysm

