Two simple techniques to mitigate against serious perfusion accidents

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The standard cardio-pulmonary bypass circuit has an arterial and venous line with integrated oxygenator and heat exchanger, driven by an occlusive roller pump.

In addition, there are usually two suckers that connect to a reservoir linked to the venous side of the bypass circuit to allow for salvage of shed blood. Most surgeons also use a vent line to drain residual blood from the left sided chambers. This vent can be used to improve vision during surgery, to prevent distension whilst the heart is contracting poorly and to allow air to be removed from the aorta during the administration of cardioplegia or de-airing.

First simple test

When the arterial line has been connected, the surgeon and the perfusionist need to check the swing on the arterial line.

Fig 1 : Monitor gauge in the cardiopulmonary bypass machine

Fig 2 : Patient Monitor

This means that the pressure gauge on the arterial return line from the pump (fig 1) should be checked to ensure that it is at a similar pressure to that of the arterial monitoring line on the patient (fig 2) . If it is damped and at a lower-than-expected pressure, a dissection of the aorta by the cannula should be suspected. Going on bypass with the cannula in a false lumen will likely cause extensive dissection. If this is suspected, an alternative arterial cannulation should be performed.

If there is no pressure, the circuit has probably been connected the wrong way round either at the pump or more commonly, at the table end. Although this may sound ridiculous, under circumstances when the arterial line and venous line are of the same diameter, as with infants (1/4", 1/4" tubing) or adolescents (3/8", 3/8" tubing) it can and does happen.

Second simple test

When massive air embolism occurs during cardiac surgery, misadventure with left ventricular vent is

often responsible [1]. The mechanism in some cases is due to the vent being connected the wrong way round in the boot of the roller pump so that it blows air rather than sucks blood. If a sucker does this, it is easily spotted and causes no harm; it just does not work. If, however, it is inside a left sided cardiac chamber or connected to the ascending aorta in a cardioplegia configuration, rapid massive air embolism is possible. If the aorta is clamped, the air will go down the coronary arteries. If the aorta is unclamped, it will go throughout the circulation. This risk can be eliminated by putting the sucker tubing into pericardial sac and briefly checking that it is sucking and not blowing before connecting it (fig 3).

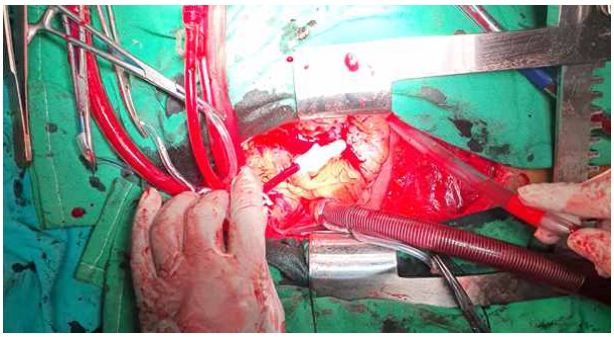

Fig 3 : Testing vent prior to connecting

The senior author has been doing this for nearly 40 years and only once has the connection been found to be faulty. The junior author has also seen it once over a period of 22 years. In both instances, the test prevented massive coronary embolism in patients undergoing CABG.

Perfusion accidents are often damaging or fatal: most are avoidable. They also carry serious medicolegal implications. Herein we have detailed two simple methods by which some can be easily avoided.

References

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