Case report

Cardiopulmonary bypass via common carotid artery cannulation in redo sternotomy

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Abstract

There are certain situations in redo cardiac surgery in adults where it may not be possible to use alternate arterial cannulation sites like the common femoral artery and axillary artery. We report a case where we established safe cardiopulmonary bypass with common carotid artery cannulation in an adult patient. The patient underwent aortic valve replacement for severe aortic regurgitation 8 months after repair of type A aortic dissection plus aortic valve resuspension.

Case Report

A 55 year old gentleman underwent emergency ascending aortic replacement and aortic valve repair (valve resuspension) for a type A aortic dissection. He made an excellent recovery following this procedure and postoperative transthoracic echocardiogram (TTE) showed mild aortic valve regurgitation. A TTE repeated 4 weeks later showed presence of moderate aortic valve regurgitation. Follow-up investigations at six months showed that the ascending aorta repair was intact and the dissection flap extending to the left common iliac artery with minimal flow in the false lumen. At this stage there was no change in the degree of aortic regurgitation. However, cardiac catheterisation was performed at 8 months which revealed severe aortic regurgitation, systolic pulmonary artery pressure of 51 mmHg and impaired left ventricular function. Gradual failure of the aortic valve repair to resuspend the valve was speculated to be the likely cause of significant aortic regurgitation. Aortic valve replacement was contemplated.

Various routes for cannulation for cardiopulmonary bypass (CPB) were discussed due to previous sternotomy and the X-ray finding of close proximity of the repaired ascending aorta to the sternum. During the first operation, an attempt was made to expose the right axillary artery but the artery was not accessible. CPB was established via the right common femoral artery (CFA). The left CFA was not a viable alternative in view of the dissection flap extending down to the left common iliac artery. It was therefore elected to institute CPB through the right common carotid artery (CCA). The right CCA and the left sapheno-femoral junction were exposed. A longitudinal incision was made along the medial border of the sternocleidomastoid muscle at the level of the thyroid cartilage. The internal jugular vein (IJV) and common carotid artery (CCA) were exposed. Two slings were passed behind the CCA to aid the control of the artery for the subsequent steps of the procedure. Skin incision and preparations for the sternotomy were made. Heparin was administered to maintain an activated clotting time (ACT) greater than 400 seconds. Once this was achieved a curved clamp was applied to the exposed carotid artery and a longitudinal 2 cm incision was made. A dacron graft was then sewn onto this incision in such a fashion so as to direct the inflow of the blood.
towards the aortic arch (figure 1). The arterial cannula for 
CPB was connected to the other end of the graft. The 
venous cannula was then introduced into the left femoral 
vein (figure 1) via the left sapheno-femoral junction using 
the Seldinger technique. CPB was instituted with careful 
monitoring of the head for any evidence of oedema or 
petechial haemorrhage. Patient was gradually cooled to a 
core temperature of 32°C initially and then to 28°C. Ster-
notomy was then performed followed by exposure of the 
heart and the ascending aorta. The native aortic valve was 
exposed by making an incision in the previous interposi-
tion graft to the ascending aorta. The aortic valve was 
excised and replaced by a size 25 mm mechanical valve. 
The aortotomy was then closed. Haemostasis was 
achieved and the patient was weaned successfully off the 
CPB machine. The CCA incision was closed with 4/0 pro-
lene followed by skin closure. Once the venous cannula 
was taken out the great saphenous vein was tied off. Post-
operatively, no haemodynamic support was required and 
the patient was discharged after 6 days with no evidence 
of neurologic, cardiac or renal impairment.

Discussion
A redo sternotomy is challenging procedure when the 
heart and the aorta are closely adhered to the back of the 
sternum. In order to avoid damage to the cardiac cham-
bers or the aorta during redo sternotomy, CPB can be 
established by peripheral cannulation. Femoral artery and 
vein cannulation was introduced in the 1960s to achieve 
circulatory arrest in patients undergoing intracranial oper-
ations [1]. This technique has been used successfully in 
cardiothoracic surgery to establish reliable CPB before a 
redo cardiac operation. However, femoral artery cannula-
tion in aortic dissection may lead to visceral malperfusion 
and retrograde embolisation. An option in this setting 
may be axillary artery cannulation [2,3]. Reported advan-
tages include lack of retrograde embolism, absence of 
visceral malperfusion and establishment of cerebral blood 
flow during circulatory arrest [2-5].

In the setting of surgery on the thoracic aorta requiring 
total CPB and deep hypothermic circulatory arrest 
(DHCA), extrathoracic cannulation of the left CCA has 
been reported [6]. However, CCA cannulation for total 
CPB without DHCA has not been described in adult 
patients. In our patient with previous sternotomy for 
repair of type A aortic dissection and radiographic evi-
dence of adherence of heart and aorta to the back of the 
sternum, establishment of CPB prior to the sternotomy 
was crucial. Right CFA cannulation would have been dif-

cult due to previous lymphocele following arterial can-
nulation to establish CPB. Left CFA cannulation would 
have potentially resulted in cannulating the false lumen of 
the dissection. The dissection flap was extending from the 
aortic root to left common iliac artery. Right axillary artery 
cannulation was not an option as an unsuccessful attempt 
at cannulation was made during the first operation. 
Another possible site is the innominate artery [7], but this 
would have required a sternotomy first. Thus, right CCA 
was used together with the left femoral vein to establish 
CPB prior to redo sternotomy. In order to use the CCA as 
the sole inflow during CPB, it is vital to ensure that the 
direction of the inflowing blood is towards the aortic arch 
rather than the head. This was achieved by sewing the 
dacron graft onto the CCA at an angle shown in figure 1.

Conclusion
In circumstances where it is not possible to use alternate 
arterial cannulation sites like the CFA and axillary artery in 
redo cardiac surgery in adults, CPB can be safely estab-
lished via the CCA.

Competing interests
The author(s) declare that they have no competing inter-
ests.

Authors’ contributions
SB and HV were involved in the writing of the report while 
AH and QA corrected and finalised the manuscript and 
were the first surgeons. All authors read and approved the 
final manuscript.

Figure 1
Shows a 8 mm dacron graft sewn onto the right common 
carotid artery so that the blood is directed towards the aor-
tic arch. Arrows show the direction of the blood. Key: 
RSCA- right subclavian artery, LSCA- left subclavian artery, 
RCCA- right common carotid artery, LCCA- left common 
carotid artery, RECA- right external carotid artery, LECA-
left external carotid artery.
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