Surgical management of the left superior vena cava draining into the left atrium: a novel off-pump technique using the left atrial appendage

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Abstract

The left superior vena cava is the most common congenital venous anomaly in the chest; however, its drainage into the left atrium is exceptional. The aim of the paper is to describe our novel technique to connect the left superior vena cava to the right cavities using the left atrial appendage, without cardiopulmonary bypass.

Keywords: Left superior vena cava • Left atrial appendage • Left atrium • Off-pump

INTRODUCTION

The left superior vena cava (LSVC) is the most common congenital venous anomaly in the chest; however, its drainage into the left atrium is exceptional. Although this variation in drainage is usually asymptomatic, it can lead to cyanosis or some neurological complications. Such cases must be treated.

Many surgical options were reported with variable results. We aim to describe our novel technique to connect the LSVC to the right cavities using the left atrial appendage, without cardiopulmonary bypass (CPB).

CASE REPORT

We report the case of a 7-year old child who received a right systemic-pulmonary shunt in the first year of life and who was referred for a complete repair of a tetralogy of Fallot (TOF). Preoperative investigations showed a regular form of TOF with a permeable shunt.

After sternotomy and resection of the thymus, no innominate vein was found. The presence of the LSVC was suspected and confirmed after opening the pericardium.

The complete repair of the TOF was performed under CPB and mild hypothermia. The CPB was instituted between an aortic cannula and three venous cannulae in the inferior vena cava as well as both the superior vena cavae.

In the intensive care unit, a severe but paradoxically well-tolerated hypoxia was observed (PaO₂: 45% under 100% FiO₂). This hypoxia contrasted with the normality of clinical and radiological investigations. Transthoracic echocardiography (TTE) confirmed good operative results with no residual shunt or residual pulmonary stenosis.

For technical reasons, we were unable to perform further investigations. Thus, we decided to re-explore the child with a particular focus on the drainage site of the LSVC. Effectively, the operative findings showed that the LSVC drained into the left atrium.

With the aim of redirecting the LSVC to the right cavities, we harvested the left atrial appendage (Fig. 1) and we anastomosed it end-to-end to the right atrial appendage and to the LSVC (Fig. 2). Both anastomoses were performed using polypropylene 6/0. The intervention was achieved using the beating heart technique without CPB. The side-clamping of vascular structures was well tolerated. The subsequent course was uneventful.

DISCUSSION

The LSVC is the most common congenital venous anomaly in the chest. This anatomic variation occurs when the left anterior cardinal vein fails to obliterate during normal foetal development; this is seen in ~0.5 and 4.4%, respectively, in normal patients and patients with congenital heart disease [1]. In only 8% of patients, the LSVC drains into the left atrium [2]. In almost all cases, this variation is asymptomatic; however, it can lead, in some patients in whom the shunt is important, to cyanosis and eventually to some life-threatening complications such as cerebral abscess [3].

In our case, the drainage site of the LSVC was missed for many reasons. First of all, the preoperative cyanosis was related to the TOF. TTE determined a regular form of TOF and prevented further investigations (catheterization, computed...
tomography scan, transoesophageal echocardiography). Also, because the LSVC was draining into the left atrium, no dilation of the coronary sinus was noted.

In addition, on postoperative radiography we were unable to observe the aberrant trajectory of the central venous catheter since it was put on the right side. Finally, we usually repair the TOF through a right infundibulotomy, and thus only a small right atriotomy is made to aspirate cardioplegia. The LSVC was cannulated electively and unfortunately no particular attention was given to its drainage site.

Several surgical procedures to correct this anomaly have been reported [3–5]. Certainly, intra-atrial rerouting techniques have been the most common approaches to correcting this variation. Nevertheless, these techniques present some limitations. The first and principal disadvantage in our case was the need for CPB and aortic cross-clamping, which might be deleterious regarding the context of redo surgery. Also, the proximity of pulmonary veins to the orifice of the LSVC often makes the placement of intra-atrial baffles cumbersome. Furthermore, many cases of baffle detachment or late deterioration were reported with a serious compromise of pulmonary venous return [3–5].

In contrast to the previous techniques, ligation of the LSVC seems to be the simplest one. However, it can lead to serious neurological complications by obstructing the venous return of the head and the neck if the collateral links are not well developed. Owing to the important shunt, it was impossible to choose this option.

The redirection of the LSVC to the right cavities can be carried out directly or indirectly and in different sites. In our case, direct implantation was impossible except in the left pulmonary artery. Despite this advantageous proximity, the cavo-pulmonary connection seems to be less physiological. Thus, we decided to redirect the LSVC to the RSVC or the right atrium. In contrast to synthetic grafts, the left atrial appendage presents many advantages. On the one hand, this is an autologous and well-endothelized material. These properties allow better thrombo-resistance, particularly with low pressure venous flow. On the other hand, it is also probable that this graft may grow and prevent distension. Of note, the left atrial appendage was already used to redirect the LSVC to the right atrium [2], but in contrast to our technique, the reported one consists of intra-atrial rerouting using the inverted left appendage.

CONCLUSIONS

In conclusion, the drainage site of the LSVC must be systematically checked. The extra-cardiac redirection of the LSVC to the right cavities can be achieved without CPB and aortic cross-clamping and independently of anatomical presentations. The left atrial appendage seems to be a good material with excellent mid-term outcomes.

Conflict of interest: none declared.

REFERENCES