A 50-year-old man was diagnosed with Stanford type A acute aortic dissection with cerebral malperfusion and unconsciousness. This clinical presentation was investigated by computed tomography which revealed a severe type A dissection involving all limb arteries. Successful operative treatment based on the direct arterial cannulation of the real lumen of dissected aorta at the level of Botallo’s ligament by Seldinger technique achieves an appropriate perfusion and rapid cooling of the instable patient. To our knowledge this is the first reported case in the literature.

Keywords: Aortic dissection; Type A; Direct cannulation; Seldinger; Botallo’s ligament

1. Introduction

Acute Stanford type A dissection, with or without involvement of the aortic arch, represents an emergency situation that requires immediate surgical intervention. Surgical therapy consists mainly in replacing the ascending aorta, and as extended procedure also removing the arch up to the proximal descending region as well, regardless of the extent of the pathological process. Acute aortic insufficiency, when present, is generally treated by valve resuspension or replacement. Mortality rates from these operations have dramatically improved as the result of recent advances in preoperative recognition, intraoperative techniques, and postoperative care [1]. Nevertheless, operations for acute type A dissections is still associated with high mortality rates [2]. Cannulation of an extended lesion presents often an enormous challenge either through subclavian or lower limb arteries [3–5]. We prefer an innovative cannulation method through the dissection membrane at the level of Botallo’s ligament by Seldinger manner.

2. Case

A 50-year-old man complained of sudden chest pain, was admitted unconscious with anisochoria to our hospital. A computed tomography scan showed a Stanford type A aortic dissection. The dissection began directly over the aortic valve; the maximal aortic diameter of $6.0 \times 5.5$ cm was detected on the ascending part. A connection of real lumen with the adjacent wall elements could be observed at the level of the Botallo’s ligament (Fig. 1). The dissection involved both brachiocephalic trunk, left carotid and subclavian artery. The visceral arteries originated from the real lumen except the left renal artery. Wall destruction showed in the iliac arteries too.

Because of rapid worsening of general status and cardiovascular instability, the ascending aorta and aortic arch were exposed through a median sternotomy. The function of the aorta adjacent to the pulmonary trunk at the level of Botallo’s ligament was followed by a minimal invasive cannulation with dilation steps by Seldinger technique (Fem-Flex Femoral Arterial Cannula®, 24 Fr TFA 02425H Edwards Lifesciences LLC, Irvine, USA; Joline Special Dilatorset®, Hechingen, Germany) (Fig. 2). Correct position of the guidewire and cannula was confirmed by TEE in the descending aorta. Cardiopulmonary bypass was instituted between the arterial cannulation site and right atrium.

The patient was cooled down to a tympanic temperature of 23.5 °C (Mon-a-therm® Thermistor YSI 400 Series tympanic temperature probe, Mallinckrodt Inc, St Louis, USA), rectal temperature measured 25.3 °C, bladder temperature reached 20.7 °C. After cross-clamping an ascending aortic incision was made, antegrade crystalloid cardioplegic solution (2000 ml Custodiol HTK-Solution by Brettschneider, Dr F. Köhler Chemie, Hännlein, Germany) was administered through both coronary orifices. Hypothermic cerebral perfusion was maintained through selective cannulation of both carotids (DLP Retrograde Coronary Sinus Perfusion Cannula with manual Inflating Cuff®, Medtronic Inc, Minneapolis, USA) at a flow rate of 190–200 ml/min each side.
and a perfusion pressure of 25–30 mmHg. Cerebral monitoring was performed with near infrared spectroscopy (INVOS® cerebral oxymeter, Somanetics Inc, Troy, USA), brain tissue oxygen saturation measured 60–65% continuously during perfusion.

Under systemic circulatory arrest, a complete reconstruction of the aorta up to proximal descending section was performed by a 30-mm vascular prosthesis (Hemashield Platinum Woven Double Velour Vascular Graft®, Boston Scientific Inc, Wayne, USA) including the island type reinsertion of all supraaortic vessels. The false lumen was eradicated with 45% bovine serum albumin-10% glutaraldehyde glue (BioGlue®, CryoLife International Inc, Kentwood, USA); aortic valve commissures were refixed with the resuspension suture technique. Systemic reperfusion and rewarming were started through a graft side-branch. ECC time measured 156 min, circulatory arrest 63 min, antegrade selective cerebral perfusion time 50 min.

Pathological study of the aortic wall showed a degenerative atherosclerosis in combination with adventitial hemorrhage. A computed tomographic scan undertaken 12 days after the operation showed consolidation of the complete vascular situation and proper perfusion of both supraaortic and visceral branches. The postoperative course was uneventful except for a reversible left upper limb palsy. The patient was discharged after 22 days, and event free at six-month outpatient visit with consolidated vascular status.

3. Discussion

A Stanford type A dissection should always be treated surgically consisting of at least an ascending aortic grafting, although ascending aorta and total aortic arch grafting is appropriate for some of the complicated cases. The cannulation is a crucial point in dissection patients, if medial tear involves all great limb arteries. Establishing an access point at the level of the Botallo’s ligament by Seldinger technique could provide a useful alternative to achieve a quick arterial entry. At this portion of aorta the pulmonary trunk is firmly bound by a massive connective tissue, which usually prevents complete dissection in this area. Through the rapid and atraumatic cannulation method ECC is introduced, thereby reducing the likelihood of peroperative shock leading to an increased mortality [6]. With increasing experience in arch reconstructions and improvement in outcome, the indications of minimal invasive direct cannulation could be expanded to include all type A aortic dissections with or without limb artery involvement. Concomitant replacement of aortic arch in ascending aorta surgery recently has been recommended for event-free long-term survival [7, 8]. It is mandatory to protect the central nervous system; a successful cerebral protection contributes to lower hospital mortality rate to 28% [9]. Reversible unilateral limb palsy is a rare complication of the procedure, in 3.8% observed according to some studies [10]. To our knowledge this is the first reported case of direct Seldinger cannulation of a Stanford A aortic dissection in the literature.

References

eComment: Perfusion of the true lumen during surgery for aortic dissection

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doi:10.1510/icvts.2008.189878A

We read with interest the paper of Gobolos and co-workers [1], and we congratulate the authors for this precise technique. Retrograde perfusion via the femoral artery has been the perfusion mode of choice in aortic dissection surgery. However, many groups have moved to routine axillary artery cannulation to avoid potential malperfusion and atheroembolic complications associated with retrograde perfusion. However, in cases of hemodynamic instability, the auxiliary approach is time-consuming. We also have to consider that sometimes the dissection may extend to the innominate artery, with difficulties in the cannulation. Furthermore, even with axillary cannulation and antegrade perfusion, due to the presence of internal flap, there may be a malperfusion syndrome during cardiopulmonary bypass (CPB). This is usually due to the presence of multiple flaps inside the dissected aorta. Alternately, Wada and colleagues [2] reported good results with transapical left ventricular cannulation across the aortic valve into the true lumen guided by transesophageal echocardiography. Jakob and coworkers [3] reported the use of an open direct cannulation of the ascending aorta after exanguination of the patient through the venous line.

All those techniques share together an important point: the importance of true lumen perfusion. We should consider that aortic dissection is an acute disease with often rapid progression. Areas of intact aorta during the diagnosis by CT scan may result dissected at the time of surgery. The dissection may progress, and new intimal tears with new flaps may be present. Cannulation sites thought to be appropriate at the moment of diagnosis may later result insufficient to give an appropriate perfusion for the presence of new flaps. Malperfusion with low flow during CPB will prolong the time to reach the temperature chosen for the circulatory arrest and will predispose to malperfusion of vital organs and incidence of acidosis. The cannulation and perfusion of the true lumen appear then of vital importance.

We had a case where we used a technique similar to the one used by Gobolo. We would add that really, in our case, there was no need to cannulate near the Botallo's ligament, and that the ascending aorta or the arch, even if dissected, may be cannulated using the Seldinger technique and ultrasound control.

In conclusion, we congratulate again the authors and we look forward to using this technique in particular clinical settings to further improve it.

References