A new cannula for antegrade selective cerebral perfusion

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ABSTRACT

Objective: Our aim was to perform antegrade selective cerebral perfusion with a different surgical technique using a new type of cannula.

Methods: This cannula has been designed to be introduced in the supra-aortic vessels directly using a standard guidewire technique (Seldinger technique). The cannula can also be inserted from the ostia of a vessel if preferred. Furthermore, this device can be introduced before the institution of hypothermic circulatory arrest and opening the aortic arch.

Results: We have performed operations on 5 patients so far using this cannula. No stroke or spinal cord injuries were detected. At the moment, both intraoperatively and at computed tomography scan follow-up, no significant stenosis of the cannulation sites were noted. Follow-up at 2 years found that patients are alive and free from new major neurological events.

Conclusions: Transarterial introduction using the Seldinger technique of our cannula (AV Flow; MedEurope Srl, Bologna, Italy) represents an alternative to the current well-established techniques. The major advantages we describe are complete cerebral protection throughout the hypothermic circulatory arrest and easier arch vessels reimplantation or hemiarch operations. (JTCVS Techniques 2020;4:10-3)

CENTRAL MESSAGE

AV Flow (MedEurope Srl, Bologna, Italy) is a cannula to perform antegrade selective cerebral perfusion. It has been designed to be introduced in the supra-aortic vessels wall directly using a standard guidewire technique.

PERSPECTIVE

The novelty of this device is the possibility of a guidewire introduction using the Seldinger technique. The major advantages of the AV Flow cannula (MedEurope Srl, Bologna, Italy) are complete cerebral protection throughout the hypothermic circulatory arrest time and easier arch vessel reimplantation or hemiarch operation because the cannula is out of the anastomotic site.

See Commentaries on pages 14 and 16.

Video clip is available online.

Antegrade selective cerebral perfusion (ASCP) has become the preferred choice for brain protection during aortic arch surgery. In the past, many different technical variants of how to perform ASCP have been described.1,2 This technique was standardized during 1989-1991.3-5

We describe an innovative surgical technique with a new type of cannula for ASCP. The AV Flow cannula...
(MedEurope Srl, Bologna, Italy) has been designed to be introduced directly into the supra-aortic vessels (SAV) wall using the Seldinger technique. The AV Flow can also be inserted from the ostia of the vessels if preferred.

**SURGICAL TECHNIQUE**

AV Flow is a silicone cannula with a malleable steel shaft. This cannula is similar to existing cannulas with an inflatable balloon at the tip to seal the vessel proximally while perfusing distally. The are 2 different sizes of the AV Flow cannula at the moment: 14 Fr and 17 Fr. The 14 Fr cannula has an optimal flow up to 400 mL/min, whereas the 17 Fr is adequate up to 700 mL/min. Therefore, the size of the cannula is chosen according to the desired cerebral flow and to the SAV diameter.

We briefly describe our surgical technique for the introduction and removal of the cannula. Usually, we start by isolating and encircling with an umbilical tape the innominate and the left carotid artery. Secondly a 5-0 polypropylene pledget reinforced purse-string suture is placed on both arteries wall ~2 cm from their origin. The vessel is then punctured with a specific needle to introduce a guidewire.
insertion site is determined by the arch vessel length and anatomy.

The vessel is then punctured with a specific needle (Figure 1) and a guidewire is introduced a few centimeters. If required, before introducing the cannula a small incision with a No. 11 blade can also be done on the vessel wall; moreover, if necessary, standard available dilators can be used. The AV Flow is then inserted into the innominate artery and in the left common carotid artery (Figure 2) and a purse-string suture is tied and secured. The left subclavian artery can also be cannulated with the same devices and technique. We inflate the balloon at the tip of the cannula to seal the vessel proximally; therefore, we can start ASCP just before the removal of the aortic crossclamp and the beginning of circulatory arrest. This is among the major advantages of this technique. As systemic cardiopulmonary bypass is discontinued, ASCP is started with a flow of 10 to 15 mL/kg/min as described in the literature. Blood pressure from the cannula itself can also be monitored.

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The arch operation is then carried out (Figures 3 and 4) and only after restarting full flow cardiopulmonary bypass the AV Flow cannulas will be removed only by tying the previously prepared 5-0 polypropylene purse-string suture (Figure 5). This is another advantage of the AV Flow compared with the existing cannulas that have to be removed before the completion of the anastomosis, exposing the brain to further unprotected ischemic time (Video 1).

DISCUSSION
We have used the AV Flow cannula in 5 patients so far. No stroke or spinal cord injuries were detected postoperatively; moreover, no major or minor neurological deficits were observed at 2 years follow-up. No significant stenosis of cannulation sites was noted intraoperatively and at computed tomography scan follow-up (Figure 6).

The major advantages of the technique are complete bilateral cerebral protection throughout the hypothermic circulatory arrest time and easier arch vessels reimplantation or hemiarch operations because the AV Flow is out of the anastomotic site. The only contraindication is the presence of dissection of the SAV vessel itself. In this situation, the traditional technique remains the preferred strategy.

CONCLUSIONS
The AV Flow is a safe option for instituting ASCP in selected patients; in many situations, it is a faster and easier alternative to the currently used surgical technique.

Conflict of Interest Statement
The authors reported no conflicts of interest.

The Journal policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

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Key Words: antegrade selective cerebral perfusion, aortic arch replacement, frozen elephant trunk, hemiarch operation