do, and you can go very far on the isthmic ridge and the isthmic part of the aorta to do your suture line. So the clamp is taking a lot of space.

**Dr Dion:** And in case of chronic dissection, don’t you have a problem with some retrograde perfusion of the false lumen?

**Dr Touati:** No. The only problem we had in one patient of chronic dissection was when I was inflating the balloon and put the Djumbodis system, thrombi of the false lumen was like toothpaste in the aorta, and we saw that on the MRI, and anticoagulation permits the complete eliminating of that.

**Dr S. Kucuker (Ankara, Turkey):** You haven’t cooled down your patients. You have worked on 37 degrees. But you have to stop your femoral perfusion while putting the stents in. You said it takes only 5 min. But if in case it gets longer, you may have problem with the spinal cord protection. And again, at 37 degrees, your cardiopulmonary bypass times are quite long. So how did you protect the myocardium?

**Dr Touati:** Concerning the perfusion in the femoral artery, it was not completely interrupted, but the flow was around 1 l or 1.5 l, just to obtain the direct vision of the aorta when you are inflating the balloon and the Djumbodis system. So it takes, really, 2 to 5 min. And the perfusion of the heart was obtained like standard myocardial protection on the sinus, retrograde sinus, every 8 min. So we don’t have a problem with that.

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**Editorial comment**

**Normothermic selective cerebral perfusion – how safe is it?**

I read the article by Touati and colleagues with great interest [1]. In this study, the authors analyze the surgical outcome of 29 patients who underwent total aortic arch replacement under normothermic conditions without circulatory arrest. There was one in-hospital death (3.4%). Transient neurological deficit was apparently seen in one patient. The authors compare their technique and results with those of arch replacements under profound hypothermic circulatory arrest and propose that their strategy ensures a more physiological autoregulation of cerebral blood flow and maintains body perfusion without high vascular resistance. Before we go on to discuss this work, I think it is important to remember that the authors are reporting on their experiences with the above technique in a very small series of patients – a fact that almost automatically precludes any definitive conclusions to be drawn from here.

Antegrade selective cerebral perfusion (SCP) has now established itself as the most reliable method of brain protection during aortic arch repair operations. While the technique is basically performed under profound or at least moderate hypothermic conditions, there have been attempts to raise the temperature to somewhere around 30 °C. Some surgeons have even attempted normothermic SCP as in the present study. This takes us back to Dr DeBakey, who, as early as in 1957, had performed aortic arch operations using high-flow, high-pressure perfusion under normothermic conditions [2]. However, discouraged by the high incidence of in-hospital mortality and neurological complications with this strategy, it was subsequently abandoned. Since then, there have been numerous attempts to make SCP a safer and more efficient brain protection method. The authors have correctly pointed out the role of Dr Jean Bachet in popularizing the technique. However, the important contributions by the numerous Japanese aortic surgery groups in this regard failed to get a mention, which is rather regrettable.

In the early nineties of the last century, we conducted a series of experimental studies to resolve the temperature, flow, pressure, and other related issues concerning SCP. On the basis of the results of those studies, we have settled into our present SCP strategy, which is bilateral two-vessel perfusion (innominate or right axillary artery and the left common carotid artery) with a flow rate of 10 ml/kg/min and flow pressure of 40 mmHg under moderately hypothermic condition (at a rectal temperature of 25 °C). Alpha-stat strategy is used for blood pH management. However, three-arch vessel perfusion that is additional left subclavian artery perfusion is performed in selected patients, who have occlusion of right vertebral artery, dominant left vertebral artery, and lack of efficient intracranial arterial communication to avoid the risk of vertebro-basilar artery insufficiency. With this strategy, we have been able to achieve results of total arch replacement operations that rank among the best in this specialty [3,4]. While the results achieved by the authors in the present study are commendable, there are a few issues that merit further evaluation. First of all, is there any specific rationale for setting the perfusion pressure at 70 mmHg? I do understand that the authors were trying to maintain the cerebral autoregulation and that this pressure would be adequate for most patients without a history of cerebral vascular accidents. However, as we know that in hypertensive elderly patients with a history of apoplectic, the cerebral autoregulation tends to shift to the right and that such a perfusion pressure might cause watershed infarction in these patients. Secondly, the two-vessel perfusion under a normothermic condition, as employed by the authors, theoretically leaves the vertebro-basilar region of the brain vulnerable to ischemic insult. Thirdly, the authors employ three separate pumps and a descending aortic occlusion balloon placed in an antegrade fashion. Such a technique has the potential of cluttering the operative field and may also be considered cumbersome. Placing an occlusion balloon in the true lumen of the descending aorta in patients with aortic dissection may also be technically difficult and risky. Moreover, the retrograde systemic perfusion through the femoral artery can be considered a suboptimal strategy in the sense that it may result in underperfusion of the abdominal viscera, particularly in patients with dissection. The cannulation technique employed by the authors can be called a blind cannulation technique as they do not transect the neck vessels and cannulate under direct vision – a technique that is practiced by many aortic surgeons nowadays. There was one patient who apparently suffered some form of neurological deficit but recovered in the postoperative period. The nature of this
deficit and possible factors responsible for it should have been discussed. The authors do not discuss their aortic arch replacement technique. The detail of descending aortic stent grafting is also lacking. Finally, the authors have compared their results with those of profound hypothermic circulatory arrest. A comparison with moderately hypothermic selective cerebral perfusion is, however, non-existent. Many prominent aortic surgeons have achieved excellent results with this latter strategy.

Despite these limitations, the present study can be termed an important addition to the ongoing efforts to standardize cerebral protection during aortic arch surgery. However, the true merit of totally normothermic aortic arch replacement, as proposed by the authors of this study, will be fully understood only when it is critically judged against the other prevailing strategies, of which moderate hypothermic SCP has fared the best.

References


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