

We read with interest the article by Chapman *et al.* [1]. They showed that patients receiving recombinant factor VIIa (rFVIIa) for intractable bleeding after cardiac surgery are not at an increased risk of thromboembolic events. Therefore, they concluded that this effective haemostatic agent can be used with an acceptable safety profile in this patient population. We would like to ask the authors whether, among the 236 patients receiving rFVIIa, they had patients supported by extracorporeal membrane oxygenator (ECMO).

Bleeding is a major problem in postoperative ECMO implantation for post-cardiotomy cardiogenic shock [2]. Severe haemorrhage requiring re-exploration occurs in up to 58% of cases [3] and carries a dismal prognosis. Among patients who returned to the operating theatre, a surgical source of bleeding is not identified in more than half of the patients [1]. Hence, the off-label use of rFVIIa represents an attractive haemostatic agent for controlling bleeding attributed to a disseminated intravascular coagulation-like phenomenon [4].

We entirely agree with their opinion about the effectiveness of rFVIIa as a haemostatic agent, and we would like to report an exceptional thrombotic complication that we recently encountered: a native non-calcified aortic valve thrombosis in a patient on ECMO support who received rFVIIa for massive bleeding after coronary artery bypass grafting (CABG) surgery.

A 60-year old male patient was admitted on an elective basis for CABG surgery. His past medical history included hypertension and multiple sclerosis. Coronary angiogram revealed triple vessel disease. Transthoracic echocardiography disclosed a normal aortic valve and an ejection fraction at 45%. The patient had a normal hepatic and renal function and a normal coagulation profile before surgery. Cardiopulmonary bypass (CPB) was established through median sternotomy. The obtuse marginal artery was not identified during surgery due to severe adherence between the lateral aspect of the left ventricle and the pericardium while the right coronary artery and the left anterior descending artery were bypassed. Weaning from CPB was unsuccessful, and femoro-femoral ECMO was instituted. The

patient was transported to the angiography laboratory where a drug eluting stent was successfully implanted in the proximal circumflex artery. Massive bleeding from the chest tube was recorded. Therefore, a 90- μ g/kg of rFVIIa was infused, and bleeding decreased. Heparin infusion was commenced 18 h after the surgery. On postoperative day (POD) 1, a transoesophageal echocardiogram (TEE) revealed severely depressed contractility of the left ventricle and thrombus formation on the three cusps of the aortic valve on the aortic side. Despite full heparinization, a complete thrombosis of the aortic valve was disclosed on POD 3, and no clots were noted in the ECMO tubing. His family refused permission for further treatment and he died after the removal of the support.

In view of our experience with this drug, we recommend caution when rFVIIa is used in the postoperative period after cardiac surgery in the setting of ECMO support; careful patient management by routinely performing TEE and maintaining inotropic support for ventricular contractility and cusps mobility is mandatory to prevent thrombus formation on the aortic cusps.

REFERENCES

- [1] Chapman AJ, Blount AL, Davis AT, Hooker RL. Recombinant factor VIIa (NovoSeven RT) use in high risk cardiac surgery. *Eur J Cardiothorac Surg* 2011;40:1314-9.
- [2] Magovern GJ Jr, Simpson KA. Extracorporeal membrane oxygenation for adult cardiac support: the Allegheny experience. *Ann Thorac Surg* 1999; 68:655-61.
- [3] Rastan AJ, Dege A, Mohr M, Doll N, Falk V, Walther T *et al.* Early and late outcomes of 517 consecutive adult patients treated with extracorporeal membrane oxygenation for refractory postcardiotomy cardiogenic shock. *J Thorac Cardiovasc Surg* 2010;139:302-11.
- [4] Hacquard M, Durand M, Lecompte T, Boini S, Briançon S, Carteaux JP. Off-label use of recombinant activated factor VII in intractable haemorrhage after cardiovascular surgery: an observational study of practices in 23 French cardiac centres (2005-7). *Eur J Cardiothorac Surg* 2011;40: 1320-7.

The causes of re-operation in the Ross procedure

Sahin Bozok^{a,*}, Mert Kestelli^b, Gokhan Ilhan^a and Banu Lafci^b

^a Department of Cardiovascular Surgery, Rize University Faculty of Medicine, Rize Training and Research Hospital, Rize, Turkey

^b Department of Cardiovascular Surgery, Izmir Ataturk Training and Research Hospital, Izmir, Turkey

* Corresponding author. Rize Egitim ve Arastirma Hastanesi, Kalp Damar Cerrahisi Klinigi, 53020 Rize, Turkey. Tel: +90-533-2362442; fax: +90-464-2170365; e-mail: sahinboz@yahoo.com (S. Bozok).

Received 9 December 2011; accepted 3 February 2012

Keywords: Ross procedure • Re-operation • Autograft • Aortic annulus

We congratulate our colleagues who have applied the Ross operation thus far [1]. Despite the establishment of annular enlargement, the presence of preoperative aortic regurgitation and autograft re-operation in the aortic stenosis group is said to

lessen the need for aortic re-operation and a small-sized homograft leads to higher mortality rates.

In the preoperative aortic regurgitation group, what could be the reason for autograft re-operation? Is it a result of annular

stabilization or annular enlargement? We do not think the article addresses this situation.

If factors such as left ventricular diameter, the angle between the ascending aorta and interventricular septum, the size and diameter of autografts, the change of body surface area, native aortic diameter and pressure gradient after distal anastomosis had been mentioned, we believe that important criteria would have emerged.

Reference

- [1] Alsoufi B, Manlhiot C, Fadel B, Al-Ahmadi M, Tamim M, McCrindle BW *et al.* The Ross procedure in children: preoperative haemodynamic manifestation has significant effect on late autograft re-operation. *Eur J Cardiothorac Surg* 2010;38:547-55.

European Journal of Cardio-Thoracic Surgery 42 (2012) 389-390
doi:10.1093/ejcts/ezs110

LETTER TO THE EDITOR RESPONSE

Reply to Bozok *et al.*

Bahaaldin Alsoufi*

King Faisal Heart Institute, King Faisal Specialist Hospital and Research Center, Riyadh, Saudi Arabia

* Corresponding author. King Faisal Heart Institute (MBC 16), King Faisal Specialist Hospital and Research Center, PO Box 3354, Riyadh 11211 Saudi Arabia. Tel: +966-1-4647272 (ext 32049); fax: +966-1-4427791; e-mail: balsoufi@hotmail.com (B. Alsoufi).

Received 25 January 2012; accepted 3 February 2012

Keywords: Aortic valve replacement • Ross procedure • Rheumatic fever • Aortic regurgitation • Congenital heart disease

We thank Bozok and colleagues for their interest in our manuscript and appreciate their comments [1, 2]. The Ross procedure is a versatile operation that can be employed in patients with various congenital and acquired aortic valve disorders. It is considered by many to be the aortic valve substitute of choice in small children as it is associated with excellent haemodynamic and cardiac recovery; it offers potential for growth and does not require long-term anticoagulation. Therefore, early on in our, as well as in others', experience, it was widely utilized in various children with different cardiac pathologies. The early expectation was that autograft longevity would be better than that of any available prosthesis. Unfortunately, early on we were faced with a high autograft failure rate in several subgroups of patients, which led us to modify our selection criteria for the Ross procedure.

We became aware that the Ross procedure can be done safely with a low overall mortality risk of 3%. We noted that mortality was higher in younger children with congenital aortic stenosis, while we had zero mortality in our older patients with rheumatic aortic diseases, despite the frequent requirement for concomitant cardiac surgery at the time of the Ross procedure [1]. As smaller homografts are employed in smaller children, we believe that small homograft size is a surrogate for those other risk factors such as younger patients and congenital aortic stenosis. In our centre, mortality was particularly higher in neonates and young infants with congenital aortic stenosis, especially those who required simultaneous mitral or arch procedures, and was related to those associated factors rather than the homograft itself.

Annular enlargement was also frequently needed in our patients with congenital left ventricular outflow tract obstruction. When annular enlargement was needed, we used a modified Ross-Konno aorto-ventriculoplasty and we incised the aortic annulus into the septum and performed septal myectomy

without the need for a VSD patch insertion. This modified Ross-Konno technique has not been associated with an increased mortality risk. The concern was that patients who have undergone the Ross-Konno procedure may be at an especially high risk of autograft failure and re-operation due to the inherent disruption of the supporting aortic annulus, which may increase the subsequent hazard of annular and neo-aortic root dilatation and autograft regurgitation. We noted in our children who had the modified Ross-Konno procedure that the autograft continued to grow, but that enlargement was not out of proportion to somatic growth and that the risk of autograft failure and subsequent re-operation was not increased when annular enlargement was done.

The vast majority of autograft re-operations in our series were in children who had preoperative aortic regurgitation, especially in patients with a history of rheumatic fever, dilated aortic annulus and concomitant mitral valve disease [1]. In 27 children who had the autograft re-operation following the Ross procedure for rheumatic aortic valve disease, the predominant pathologies causing regurgitation were annular dilatation with cusp prolapse and failure of coaptation ($n = 16$), recurrence of inflammatory valvulopathy similar to that in rheumatic fever ($n = 8$), unknown ($n = 2$) and endocarditis ($n = 1$). There was a trend for a decreased autograft re-operation rate when annular stabilization was utilized. Of note, autograft failure in our patients with rheumatic aortic disease and preoperative regurgitation was noted mainly within the first 5 years following the Ross procedure, which is different from the more delayed failure described in patients from Europe and Northern America with predominant bicuspid aortic valve disease.

It is noted that better patient selection and the multiple technical modifications that we have adopted have mitigated the need for autograft re-operation and we believe that our results support the Ross procedure as the aortic valve replacement of