Letter to the Editor

Coronary endothelial damage during off-pump CABG related to coronary-clamping and gas insufflation

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We read with great interest the experimental article by Okazaki et al. about the morphological consequences on the endothelium of coronary occlusion with snares and gas insufflation during off-pump coronary artery bypass surgery (OPCAB) in dogs [1]. Indeed, various systems have been developed, such as intracoronary shunting, gas jet insufflation, and snaring sutures, to obtain a bloodless field during anastomosis, but the safest technique for the morphologic and functional preservation of the endothelial layer remains to be established.

Using the same experimental assessment of coronary lesions (scanning electron microscopy), Hangler et al. have described recently coronary artery lesions secondary to snare application in patients before removal of the recipient heart during a transplantation, under cardiopulmonary bypass and full heparinization. Examination with scanning electron microscopy showed that snares cause focal endothelial denudation, microthrombosis, and atherosclerotic plaque rupture [2]. Furthermore, more severe endothelial lesions were found with the polypropylene suture (non-elastic suture) than with the silicone loop (elastic suture). These results confirm the experimental findings in healthy canine coronary arteries reported by Okazaki et al.

Other groups, such as our own, have chosen endothelial function as a sensitive marker of surgical intimal injury, especially for assessment of coronary occlusive devices for OPCAB, which can lead to acute spasm or thrombosis and chronic intimal hyperplasia. In a prior study [3], gas jet insufflation on swine coronary arteries caused a significant decrease in endothelium-dependent relaxation to 5-hydroxytryptamine with minimal damage and preservation of endothelial continuity and architecture with silver nitrate staining. Another functional study in swine showed that snaring of the coronary artery (with thread 4/0 Gore-Tex®) to achieve hemostasis at the anastomotic site did not cause any endothelial dysfunction in healthy coronary arteries [4], despite ultrastructural lesions on the endothelial layer and blood cell adhesion demonstrated by Hangler and recently by Okazaki.

Adequate anticoagulation appears to be a very important point to improve clinical results. Indeed, patients undergoing the off-pump coronary operation show an increased procoagulant activity on the first postoperative day. As a result, these patients should be considered to be at increased risk of thrombotic graft occlusion, and this risk may be higher in cases of endothelial or arterial wall injury. It appears to be recommended to keep the intraoperative activated clotting time at more than 300 s and not to neutralize the heparin with protamine unless uncontrollable bleeding occurs [5].

Hemostatic systems remain necessary in OPCAB, but the perfect system in terms of safety on the arterial wall remains to be developed. Due to the risks described above, the use of hemostatic devices must always be guided by the concern of inducing as little trauma as possible. Better knowledge of the effects of these devices on the biology of the arterial wall, and especially on the endothelium, will provide better choices and guide the development of the optimal technique.

References
