ELSEVIER

Does Routine Completion Angiogram During Embolectomy for Acute Upper-Limb Ischemia Improve Outcomes?

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Background: Since 1963, Fogarty balloon catheter thromboembolectomy is usually adopted as the gold standard treatment for acute limb ischemia. As the success of the procedure depends on complete removal of all thromboembolic material, intraoperative arteriography can be used after arterial thromboembolectomy as a guide for extension of the procedure. It is still a matter of debate whether intraoperative angiography should be routinely performed in all cases or only in selected cases, depending on intraoperative findings, when the surgeon suspects an incomplete disobstruction. Most published evidence derives from analysis of lower-limb thromboembolectomies. The aim of our retrospective study was to elucidate the value of routine completion angiogram in acute arterial embolism of the upper limb.

Methods: Clinical and demographic data of 100 patients with acute embolic upper-limb ischemia were prospectively recorded during an 18-year period in a central hospital vascular unit setting. The relevance of intraoperative angiography was retrospectively analyzed. The procedures were divided into two groups: group A, when intraoperative angiography was performed in selected cases (selective angiography); and group B, when angiography was performed as a routine procedure in all cases (routine angiography). All factors associated with reocclusion and mortality were investigated to produce meaningful information that could assist the surgeon to predict outcomes.

Results: Cumulative reocclusion and mortality rates at 24 months were 14.0% and 70.0%, respectively. After upper-limb arterial embolectomy, the rate of extension of the procedure was significantly higher in group B than in group A (26.0% vs. 4.0%, $P = 0.002$). At 24 months after embolectomy, group B resulted in a lower incidence of reocclusion compared with group A (12.0% vs. 2.0%, $P = 0.05$), whereas there was no statistical difference between the two groups in terms of mortality ($P > 0.05$). On univariate analysis, the factor associated with increased 2-year reocclusion rate was only the avoidance of completion angiography, although it lost some of its predictive value on multivariate analysis. Factors associated with increased 2-year mortality rate on univariate analysis included age >80 years, diabetes mellitus [DM], and antiplatelet drug use. Only DM was significantly associated on multivariate analysis.

Conclusion: Routine use of intraoperative angiography influences outcome after embolectomy for upper-limb acute arterial occlusion. Routine use of intraoperative angiography, compared with selective use, results in a higher rate of extension of the procedure for residual lesion and in a lower rate of reocclusion at 24 months. In prevention of reocclusion, completion angiogram has a hazard ratio of 5.44 on multivariate analysis. Postoperative late mortality is mainly affected by old age and DM.

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INTRODUCTION

The success of thromboembolectomy surgery for acute limb ischemia is due to the complete removal of all thromboembolic material accessible to the Fogarty catheter. It is important to ensure that complete clearance of the whole arterial tree has been achieved because failure to recognize residual thromboembolic material after completion of the procedure is related to higher reocclusion rates. Intraoperative angiogram is the most reliable method,[1,2] as clinical evaluation alone with back bleeding is considered an unreliable guide to distal patency.[2]

Nevertheless, routine use of completion angiogram before the patient leaves the operating theater is not commonly advocated.[3] The Trans-Atlantic Inter-Society Consensus II recommendation number 32[4] states that ''unless there is good evidence that adequate circulation has been restored, intraoperative angiography should be performed to identify any residual occlusion or critical arterial lesions requiring further treatment.''

We showed in a previous study that routine use of completion angiography improves outcomes in nontraumatic acute arterial occlusions of lower limbs, where it results in higher rates of extension of the procedure for residual lesion and in lower rates of reocclusion.[5]

Most studies concentrated on acute limb ischemia of lower extremities because upper-limb acute ischemia is seen less frequently. According to different authors, the upper limb is affected in 6.5% to 24% of all cases of embolism and 1.5% to 3% of all cases of thrombosis.[6–8]

In the light of our results on lower-limb occlusion, we tried to evaluate whether the same results could be achieved using routine intraoperative angiography also in upper-limb acute ischemia.

The aims of the present retrospective study were to elucidate the value of routine completion angiogram in acute arterial embolism of the upper limb and to investigate other factors associated with reocclusion and mortality to produce meaningful information that could assist the surgeon to predict outcomes.

METHODS

Study Group

All patients undergoing arterial embolectomy for native vessel occlusion of the upper limb in the Department of Vascular and Thoracic Surgery of the Regional Hospital of Bozen from September 1991 to August 2009 were prospectively recorded, and the case notes were retrospectively reviewed.

From September 1991 to December 1997, intraoperative arteriography was performed in selected cases, when the surgeon was not satisfied with back bleeding or with the clinical appearance of the hand or when the Fogarty catheter could not be passed far enough distally, indicating a severe stenosis (group A). From January 1998 to August 2009, intraoperative angiography was performed as a routine procedure by all but two surgeons (group B). These two expert surgeons continued to perform selective completion angiogram (group A).

We did not include patients treated with thrombectomies of the upper limb.

Definition of Arterial Embolism

The differentiation between embolism and acute thrombosis was based on history, physical examination, and appearance of the clot. Significant factors for differentiation between acute arterial embolism and acute arterial thrombosis were status of peripheral pulse on the contralateral limb, clinical risk factors of the two diseases, previous arterial embolism, and clinical presentation.

The study included exclusively those patients who had a history of acute embolic arterial occlusion with critical ischemia of the upper extremity. Patients referred and treated during the period of the study for the diagnosis of acute arterial occlusion of the upper limb were approached by categorizing the level of the patient's limb ischemia using clinical assessment of motor and sensory function and interrogating wrist arterial flow velocity signals using a hand-held Doppler detector.

According to the reporting standards published in the literature (based on SVS/ISCVS classification), we categorized the patient's level of limb ischemia as follows: category I (viable), category IIA (marginally threatened), category IIB (immediately threatened), and category III (irreversible).[9]

Surgical Technique

All embolectomies of the upper extremities were performed through a transverse brachial arteriotomy; however, in two cases, a distal artery was also explored. All but seven procedures were performed under regional anesthesia through an axillary brachial plexus block.

Intraoperative angiographies were performed by manual contrast injection through a cannula inserted into the brachial artery, after closure of the arteriotomy and restoring the forearm vessel patency. All the arteriotomies were closed using a 6-0 polypropylene suture in a continuous manner.