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Free-Floating Thrombus in the Internal Carotid Artery: Diagnosis and Treatment of 16 Cases in a Single Center

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Background: Free-floating thrombus in the internal carotid artery (FFT-ICA) is a rare condition and its real incidence is unknown. The most common etiology is a complication of an atherosclerotic plaque, but several medical conditions can be responsible. The purpose of this study was to retrospectively analyze our experience with carotid endarterectomy in the management of FFT-ICA and also to analyze the patient outcome.

Methods: A retrospective review was performed of all patients admitted during the past 9 years with a diagnosis of FFT-ICA. Patient demographics, clinical manifestations, diagnostic modalities, surgical indications, operative details, postoperative courses, and follow-up information were recorded from the hospital database.

Results: Between January 2000 and December 2008, in our Unit, 2,572 carotid endarterectomies were performed for carotid artery disease. A total of 16 patients (16 of 2,572; 0.62%) were treated for an FFT-ICA. In all, 87.5% (14 of 16) of patients had neurological symptoms. All patients underwent a duplex scan. In 75% (12 of 16) of cases, additional diagnostic tests were performed: digital subtraction angiography (DSA), magnetic resonance angiography, or computed tomographic scan. Duplex scan and DSA detected the FFT-ICA in 62.5% and 100% of cases, respectively. Computed tomographic scan and magnetic resonance angiography failed to provide a diagnosis in majority of the patients (33.4% and 66.7%, respectively). The presence of FFT-ICA was confirmed intraoperatively in all cases. The cumulative stroke rate after surgery was 6.3% (one of 16). Of the total number of patients discharged, 68.75% showed an improvement of neurological symptoms, 12.5% were asymptomatic, 12.5% had no changes in symptoms, and 6.25% of cases worsened. At 30-day follow-up, the survival rate was 93.7% and 75% of patients showed an improvement of neurological symptoms, 12.5% were asymptomatic, and 6.25% died. In all, 6.25% of patients were lost to follow-up.

Conclusion: Patients with FFT-ICA are usually symptomatic and present with an acute emergency. DSA remains the gold standard diagnostic test in FFT-ICA detection. We cannot assert that early surgery is superior to temporary anticoagulation and/or delayed intervention because of the absence of a comparison group. However, our retrospective results suggest that prompt intervention seems to be a safe alternative in FFT-ICA treatment.

INTRODUCTION

Free-floating thrombus of the internal carotid artery (FFT-ICA) is a rare condition and its real incidence is unknown. The most common etiology is a complication of an atherosclerotic or ulcerated plaque,[1-4] but several medical and multifactorial conditions can be responsible (hypercoagulable states,[2,3,5-8] hyperfibrinogenemia,[9-11] iron deficiency anemia and thrombocytosis,[12,13] or use of stimulant drugs[3,14]).

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The diagnostic methods used to reveal FFT-ICA are duplex scan (DS), digital subtraction angiography (DSA), magnetic resonance angiography (MRA), or computed tomographic (CT) scan. In the literature published in English, the management of FFT-ICA is guided by case reports and few series and is still debated. This retrospective study was designed to analyze the efficacy of carotid endarterectomy (CEA) in symptomatic and asymptomatic patients with FFT-ICA who were under treatment during the past 9 years. We also wanted to evaluate the role of different imaging modalities for FFT diagnosis.

METHODS

Between January 1, 2000 and December 31, 2008, a database of 2,572 consecutive CEAs performed at our vascular surgery unit was created retrospectively using data entry into Microsoft Excel (Microsoft, Redmond, WA). Only CEAs used to treat FFT-ICA were included in the study, and carotid surgeries performed in conjunction with other vascular reconstructive surgeries were excluded. These data were reviewed to determine cumulative major cardiovascular events (myocardial event, stroke, death) rate within 30 days. Patient demographics (Table I), risk factors, surgical indications, operative details, and postoperative courses were recorded from hospital records and previous clinic assessments.

Inclusion Criteria

To determine the presence of FTT-ICA, inclusion/exclusion criteria, as described by Bhatti et al.,[15] were used. The inclusion criteria required that the thrombus originated or was anchored within the ICA and it was partially occluding or had an elongated or protrusive morphology, with circumferential flow around the distal portion and cyclical motion synchronized with the cardiac cycles. The exclusion criteria included emboli, arch thrombi with extensions into the carotid artery, occlusions, ''string-sign,'' and microscopic thrombus. The exclusion criteria for the performance of the CEA were disabling neurological deficit (modified Rankin scale: 5) at the time of admittance, cerebral lesions measuring >3 cm at MRA/CT scan, presence of or suspected parenchymal hemorrhage associated with ischemic damage, condition considered unfit for surgery (American Society of Anesthesiology classification grade V), and occlusion of the cerebral middle artery (these exclusion criteria are usually adopted by us for the treatment of symptomatic carotid artery disease).[16]

Diagnostic Examinations and Preoperative Assessment

All patients underwent preoperative clinical examinations and carotid DS on admission to the Hospital (Fig. 1). Symptomatic patients underwent CT scan or MRA to study cerebral tissue (presence of focal lesions). The severity of ischemia-related symptoms was evaluated on the basis of the modified Rankin scale (Table II) by a consultant neurologist. All patients underwent electrocardiogram, echocardiograms, and hypercoagulability state evaluation. In some cases, patients also underwent DSA, MRA, or CT angiography scan to confirm or confute the presence of FFT-ICA. We calculated the degree of carotid stenosis according to the North American Symptomatic Carotid Endarterectomy Trial criteria. All patients underwent early CEA or thromboendarterectomy (TEA) within 48 hours of FFT-ICA detection.

Surgical Strategy

The surgical technique was chosen based on the anatomical features of the carotid vessels. In all, 68.7% of procedures were performed under general anesthesia using systemic anticoagulation with unfractionated intravenous heparin during the endarterectomy phase of the operation. At admission, 25% of patients did not receive medical therapy. Medical antiplatelet therapy was administered in 68.75% of cases and 6.25% were placed on anticoagulation therapy (Table II). During the clamp interval, normotension (maximum systolic pressure: 140-150 mm Hg) was allowed or induced pharmacologically. The Pruitt-Inahara shunt (LeMaitre Vascular, Burlington, MA) was used on demand when the carotid stump pressure was ≤ 50 mm Hg or when the patient presented a neurological deficit at cross-clamping. CEA was performed by means of a skin incision; systemic heparinization; isolation of the common carotid artery and the origin of the external carotid artery; isolation of the ICA in the distal segment without touching the bulbar and the ICA proximal segment; simultaneous clamping of common carotid artery and external carotid artery; stump pressure measurement; or neurological evaluation. After the arteriotomy, a visual check of the thrombus and the back flow was performed. The thrombus was generally retrieved through the back bleeding control. When this maneuver was not possible or a residual thrombus was not completely removed, we teased out the thrombus either manually or by using