CAROTID ENDARTERECTOMY

ESSAY

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BY

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ABSTRACT

The vascular surgeon has become a key member of the health care team that treats patients with cerebrovascular disease. There are approximately 500,000 new strokes in the United States each year and the initial mortality to be between 20-30 percent. The history of carotid artery surgery began with ligation procedures early in the 16th Century. Many procedures were done but carotid endarterectomy became the standard procedure. The arterial anatomy that is important for discussion in cerebrovascular disease begins with the aortic arch and terminates with branches of the circle of Willis. The cervical portion of the carotid artery is that part which is accessible for surgical correction but the carotid siphon is inaccessible for surgical correction. The pathology of cerebral vascular disease of extracranial origin can be divided into flow restrictive lesions and lesions of embolic potential. By far the most common lesion is the atherosclerotic plaque in the carotid bifurcation. Other pathological lesions are fibromuscular dysplasia, coils, kinks, aneurysms, arteritis and migraine.

Key Words:

- Historical review
- Anatomy
- Pathophysiology of transient ischemic attacks
- Pathology of extracranial carotid occlusive disease
- Clinical syndromes of extracranial arterial occlusive disease
- Investigations
- Medical management & other non-surgical treatment of transient ischemic attacks
- Indications & selection of patients for carotid endarterectomy

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INTRODUCTION

The vascular surgeon has become a key member of the health care team involved in the treatment of patients with cerebrovascular disease.

This involvement in the care of such patients has been the direct result of successful reconstruction of the carotid and vertebral arteries for the relief of stenotic or ulcerated arterial lesions, aneurysms and vascular tumours located in the neck. (Bailes and Julian, 2002).

There are approximately 500.000 new strokes in the United States each year, the direct and indirect cost of these is about 8 billion dollars a year. Initial mortality from stroke is estimated to be between 20-30 percent. In a recent report by Roederer and associates , 167 asymptomatic patients with cervical bruits were followed with serial duplex scanning regardless of the degree of stenosis at the time of presentation. Ten patients (6 percent) become symptomatic during follow up, the development of symptoms was accompanied by disease progression in 8 of those patients. The presence of progression to 80 percent stenosis was highly correlated with either total occlusion of the internal carotid artery or the development of new symptoms (Nussbaum et al.,1996).

The clinical syndroms of cerebrovascular insufficiency vary from a few minor symptoms to catastrophic stroke with paralysis and coma. For purposes of surgical consideration we have classified our patients into four groups

1- Frank Stroke 2-Transient ischemic attacks

3- Chronic cerebral ischaemia 4-Asymptomiatic bruit

(Thompson et al., in Adams neurology 2006).

A number of diagnostic tools have been developed over the past decade that facilitate the noninvasive evaluation of cerebral ischaemia. From Doppler duplex ultrasound to Xenon computed tomography and magnetic resonance angiography. Duplex Doppler ultrasound has largely replaced angiography as the preferred noninvasive screening tool with high accuracy for identifying structural abnormalities of the carotid bifurcation despite some limitation such as restricted anatomic coverage. (Lustgarten, Jonathan et al. ,1995).

The goals of caroid endarterectomy are to relieve transient ischaemic symptoms, improve neurologic function and to prevent the occurrence of strokes in patients with extracranial cerebrovascular occlusive disease. Successful anatomic restoration of blood flow may be accomplished in more than 98% of patients with partially occluded arteries. For totally occluded arteries,

successful restoration of flow is accomplished in only about 40% of the operation (Lanzino et al., 2001).

There is still controversy regarding the advisability of performing endarterectomy on patients with asymptomatic carotid stenosis to prevent strokes. In a recent review of literature the annual stroke rates among patients who underwent surgery and had severe degrees of stenosis (70% or greater) followed up for long periods of time range from 0% to 2% with an average rate of 1.2% per year. In contrast the longterm stroke incidence per year in patients with compararable severe degrees of stenosis not treated surgically ranges from 2.6% to 9.5% with an average of 5.27% per year (Aburahma et al., 2003 & Lal et al., 2006).

Our aim from this work is to review the up date recent advances in diagnostic technology and modern trends in management of carotid artery disease.

HISTORICAL REVIEW

The development of surgery on the extracranial cerebrovascular circulation was dependent upon three principal factors:

1. Recognition of the pathology relationship between extracranial cerebrovascular disease and subsequent cerebral infarction.
2. The introduction of cerebral angiography to identify lesions prior to the patient's death.
3. The development of vascular surgical techniques that could be applied to the extracranial vessels once the anatomic patterns of disease were understood and described.

The earliest report linking cervical carotid artery disease with stroke is credited to Savory, who, in 1856 , described a young woman with left monocular symptoms in combination with a right hemiplegia and dysesthesia. Postmortem examination demonstrated an occlusion of the cervical portion of the left internal carotid artery together with bilateral subclavian artery occlusions.Gowers, in 1875, reported a similar case and subsequent reports of individual cases were made by Chiari in 1905. Guthrie and Mayon in 1908 and Cadwater in 1912. By 1914, Ramsy Hunt used the term " Cerebral

intermittent claudication" to describe the phenomenon of intermittent cerebral symptoms associated with partial occlusion of the extracranial artery.

The development of carotid angiography by Moniz in 1927 , was the next major step in the evolution of internal carotid occlusion diagnosed by angiography.

By 1937, Moniz and colleges described four cases of internal carotid occlusion diagnosed by angiography

In 1938, Chao and colleagues added two additional cases, and by 1951, Johnson and Walker had collected a total of 101 cases of occlusion of the cervical carotid artery diagnosed by angiography from the World literature.

In the 1950s and 1960s cerebral angiography came into common use for neurologic diagnosis. Only the intracranial vessels were included on films and yet the area of the carotid bifurcation was seldom looked at .

The next major steps in the evolution of understanding came from reports by Miller Fisher in 1951 and 1954 . His most important

observation however, as that the disease was often quite localized to a short segment of the carotid artery. From Buenos Aires, Carrea, Molins and Murphy (1955) managed a patient with carotid artery stenosis. They resected the diseased internal carotid artery and performed an anastomosis between the external carotid artery and the distal internal carotid artery.

In 1953, Strully, Hurwitt and Blakenberg attempted a thromboendarterectomy of a totally thrombosed internal carotid artery, but it was unsuccessful.

The first carotid endartocectomy was probably performed by Debakey and colleagues in 1953 , but was not actually published until 1959 and then reviewed again in 1975.

The report that was most important in calling the world's attention to the feasibility of carotid artery reconstruction came from Eastcott, Pickering and Rob who published their experience in 1954. Their operation was performed on a patient who had hemispherical TIAs. The operation was end to end anastomosis between the common carotid artery and the internal carotid artery distal to the atherosclerotic lesion.

In 1956 , Davis, Grove and Julian performed endarterectomy of the innominate artery. In 1957 Warren and Triedman reported the second case.

By this time, the stage was set for explosive development in the aggressive surgical approach for managing extracranial cerebral vascular disease as a mean of preventing or treating cerebral infarction (Wesly and William, 1991).

ANATOMY

ANATOMY OF CAROTID ARTERIES

Common Carotid Artery

The right common carotid artery arises from the brachiocephalic trunk behind the sternoclavicular joint, the left artery arises from the arch of the aorta and ascends to enter the neck posterior to the left sternoclavicular joint. From the joint each artery ascends to the upper border of the thyroid cartilage, at the level of the disc between the third and fourth cervical vertebrae. Here it divides into internal and external carotid arteries (Romanes, 1986) (Fig.1).

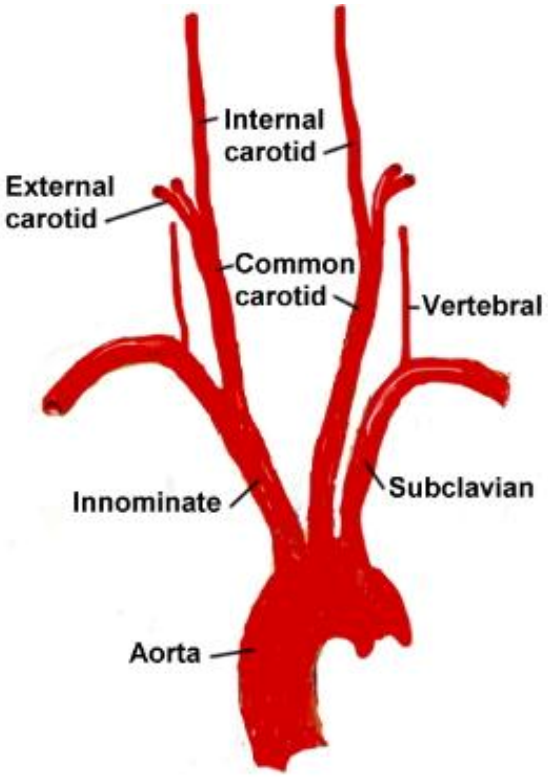

Figure 1: Origin and course of extracranial cerebral vessels. (Romanes, 1986).

The common carotid artery normally has no branches proximal to its bifurcation, although the superior thyroid or ascending pharyngeal arteries occasionally originate just before the internal and external carotids.

Variations in the level of the carotid bifurcation are frequent and are more often above the typical level than below. The carotid body is located on the medial side of the distal common or proximal internal carotid artery. The carotid bifurcation also contains the carotid sinus (Zierler, 1995).

External Carotid Artery

External carotid artery is the smaller of the two terminal branches of the common carotid. It provides main blood supply to the extracranial structures of the head and to the dura of the basal and lateral brain surfaces. These dural branches communicate with the internal carotid and vertebral systems to make collateral flow to the intracranial circulation.

Just after the common carotid bifurcation, the external carotid lies anteromedial to the internal carotid. It passes deep to the

posterior belly of digastric and the stylohyoid muscles, to enter the substance of the parotid gland, where it is crossed by the facial nerve and divides into its terminal branches (Zierler, 1995). There are eight branches of the external carotid artery:

Three anterior branches:

- Superior thyroid
- Lingual
- Facial

Two posterior branches:

- Occipital
- Posterior auricular.

One medial branch:

- Ascending pharyngeal.

Two terminal branches:

- Superficial temporal.
- Internal maxillary.

The middle meningeal artery is the most important branch of the internal maxillary artery. It enters the cranial cavity through