شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

HANAA ALY

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جامعة عين شمس

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قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

HANAA ALY

INTRODUCTION

According to the World Health Organization (WHO), 15 million people suffer stroke worldwide each year. Of these, 5 million die and another 5 million are permanently disabled. WHO definition of ischemic stroke is: "rapidly developing clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 hours or longer or leading to death, with no apparent cause other than of vascular origin" ***(WHO, 1988).*** Worldwide, cerebrovascular accidents (stroke) are the second leading cause of death and the third leading cause of disability. Stroke, the sudden death of some brain cells due to lack of oxygen when the blood flow to the brain is lost by blockage or rupture of an artery to the brain, is also a leading cause of dementia and depression. Globally, 70% of strokes and 87% of both stroke-related deaths and disability-adjusted life years occur in low- and middle-income countries. Over the last four decades, the stroke incidence in low- and middle-income countries has more than doubled. During these decades stroke incidence has declined by 42% in high-income countries ***(WHO, 2012).***

Up to 2015, the only evidence-based emergency (< 4.5 h) treatment for ischemic stroke was intravenous thrombolysis (IVT) ***(Hacke et al., 2008).*** However, IVT is often ineffective for patients with a proximal occlusion. The rate of recanalization after IVT has been reported to be 30% in patients with a proximal occlusion of the middle cerebral artery (MCA) and less than 10% in those with a carotid artery occlusion ***(Christou et al., 2001).*** Moreover, intravenous alteplase appears to be less effective while opening proximal occlusions of the major intracranial arteries, which account for more than one third of cases of acute anterior-circulation stroke ***(Berkhemer et al., 2015).***

Previous trials of endovascular therapy included the intracranial administration of thrombolysis and the use of early generation mechanical thrombectomy devices as Merci [Concentric Medical, Mountain View, California] and Penumbra [Penumbra Inc., Alameda, California] devices. The initial trials did not demonstrate conclusive benefit for endovascular therapy, although there were promising signals. There seemed to be a balance between early and effective mechanical reperfusion balanced against the risk of intracranial hemorrhage (ICH) that was perhaps related to reperfusion of nonviable brain. The next step was to deliver rapid, safe, and effective reperfusion therapy in stroke patients with viable brain tissue at risk (penumbra), determined by pretreatment brain imaging ***(Papanagiotou and White, 2016).***

Between December 2014 and April 2015, Five randomized, controlled trials provided compelling evidence that intra-arterial thrombectomy (IAT) improves outcomes after acute ischemic stroke. Endovascular treatment significantly improved clinical outcome in patients with proximal intracranial occlusion of the anterior circulation compared with intravenous tissue-type plasminogen activator (IV t-PA), indicating that the preferred treatment of these patients is no longer IV t-PA, but endovascular techniques ***(Phan et al., 2016).*** The studies were Multicenter Randomized Clinical Trial of Endovascular Treatment for Acute Ischemic Stroke in the Netherlands (MR CLEAN) ***(Berkhemer et al., 2015),*** Extending the Time for Thrombolysis in Emergency Neurological Deficits-Intra-Arterial (EXTEND-IA) ***(Campbell et al., 2015),*** Endovascular Treatment for Small Core and Anterior Circula-tion Proximal Occlusion with Emphasis on Minimizing CT to Recanalization Times (ESCAPE) ***(Goyal et al., 2015),*** Solitaire with the Intention For Thrombectomy as Primary Endovascular Treatment (SWIFT PRIME) ***(Saver et al., 2015),*** and Thrombectomy within 8 Hours after Symptom Onset in Ischemic Stroke (REVASCAT) ***(Jovin et al., 2015).*** In addition to that, multiple systematic reviews and meta-analyses analyzed the results of these recent Randomized Control Trials and concluded that endovascular treatment is more likely to result in a better functional outcome for patients compared to IV thrombolysis alone for acute ischemic stroke due to large vessel occlusion, with no differences in mortality and symptomatic intracerebral hemorrhage at 90 days follow-up. Mechanical approaches have shown great potential of replacing locally applied thrombolytic agents as first-line therapy ***(Phan et al., 2016).***

In this study we assessed the role of mechanical thrombectomy for acute ischemic stroke in patients with large cerebral artery occlusion with the first six hours of symptoms onset, with or without bridging therapy (IV thrombolysis). We also compared our results to other main trials in recent years.

AIM OF THE WORK

The study aimed to assess the safety and efficacy of mechanical thrombectomy for patients with acute ischemic stroke caused by a proximal intracranial arterial occlusion of the anterior circulation, within the first six hours is effective and safe. Moreover to compare our results to other main trials in recent years in order to highlight the sustainability of results in different populations.

Chapter I

ANATOMY OF THE CEREBRAL CIRCULATION

The blood supply to the brain is provided by two arterial axes on each side of the neck, i.e. the internal carotid and vertebral arteries ***(Osborn, 1999).***

<u>Aortic Arch and Great Vessels:</u>

Aortic arch anatomy is pertinent to neuroangiography because variations of arch anatomy can affect access to the cervicocranial circulation:

1) ***Branches*** **(Figure 1a):**

   a) Innominate (aka brachiocephalic) artery.

   b) Left common carotid artery.

   c) Left subclavian artery ***(Osborn, 1999).***

2) ***Variants*** **(Figure 1):**

a) Bovine arch **(Figure 1b)**. The innominate artery and left common carotid artery (CCA) share a common origin (up to 27% of cases), or the left CCA arises from the innominate artery (7% of cases). The bovine variant is more common in blacks (10–25%) than whites (5–8%) ***(Osborn, 1999).***

b) Aberrant right subclavian artery **(Figure 1d)**. The right subclavian artery arises from the left aortic arch, distal to the origin of the left subclavian artery. It usually passes posterior to the esophagus on its way to the right upper extremity. This is the most common congenital arch anomaly; incidence: 0.4 – 2.0%.3 It is associated with Down syndrome ***(Harrigan and Deveikis, 2013).***

c) ***Origin of the*** left vertebral artery from the arch is seen in 0.5% of cases **(Figure 1c)** ***(Harrigan and Deveikis, 2013).***

d) Less common variants **(Figure 2)**. Some of these rare anomalies can lead to formation of a vascular ring in which the trachea and esophagus are encircled by connecting segments of the aortic arch and its branches ***(Harrigan and Deveikis, 2013).***

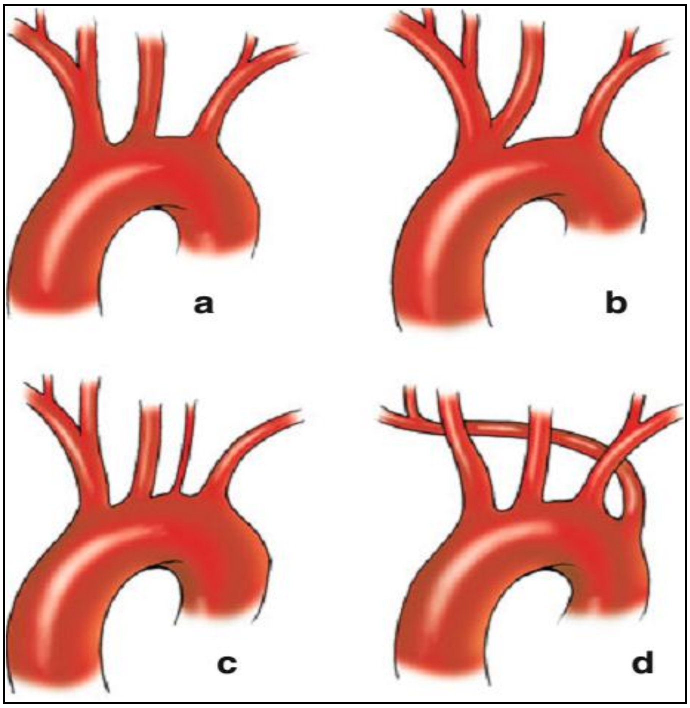

Figure 1: Common aortic arch configurations. Clockwise from upper left: (a) Normal arch; (b) bovine arch; (c) origin of the left vertebral artery from the arch, and (d) aberrant right subclavian artery ***(Harrigan and Deveikis, 2013).***

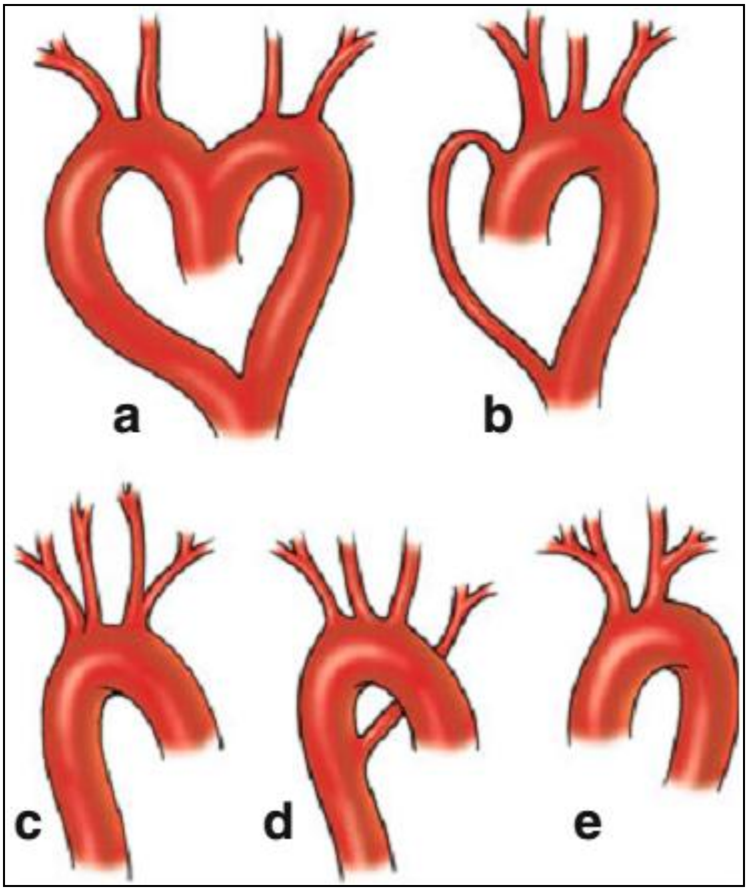

Figure 2: Selected aortic arch anomalies. (a) Double aortic arch. The arches encircle the trachea and esophagus to form the descending aorta, which is usually on the left. The right arch is larger than the left in up to 75% of cases. (b) Double aortic arch with left arch atresia. (c) Right aortic arch with a mirror configuration. The descending aorta is on the right side of the heart. This anomaly does not form a vascular ring, but is associated with other anomalies such as tetralogy of Fallot1. (d) Right aortic arch with a non-mirror configuration and an aberrant left subclavian artery. The descending aorta is on the right side of the heart, and the left subclavian artery arises from the proximal aorta. A common cause of a symptomatic vascular ring. (e) Bi innominate artery ***(Harrigan and Deveikis, 2013).***

Common Carotid Artery:

The CCAs travel within the carotid sheath, which also contains the internal jugular vein and the vagus nerve. The right CCA is usually shorter than the left. The CCAs typically bifurcate at the C3 or C4 level (upper border of the thyroid cartilage), although the bifurcation may be located anywhere between T2 and C2. The CCAs do not usually have branches, although anomalous branches can include the superior thyroid, ascending pharyngeal or occipital arteries ***(Harrigan and Deveikis, 2013).***

Internal carotid artery:

Several classification schemes exist for the segments of the ICA, including various numbering systems. The system established by Fischer in 1938 was intended to describe angiographic patterns of arterial displacement by intracranial tumors, numbered the ICA segments against the flow of blood, and excluded the extracranial ICA. Subsequent systems have included the cervical segment and have numbered the segments with the flow of blood ***(Byrne, 2012).***

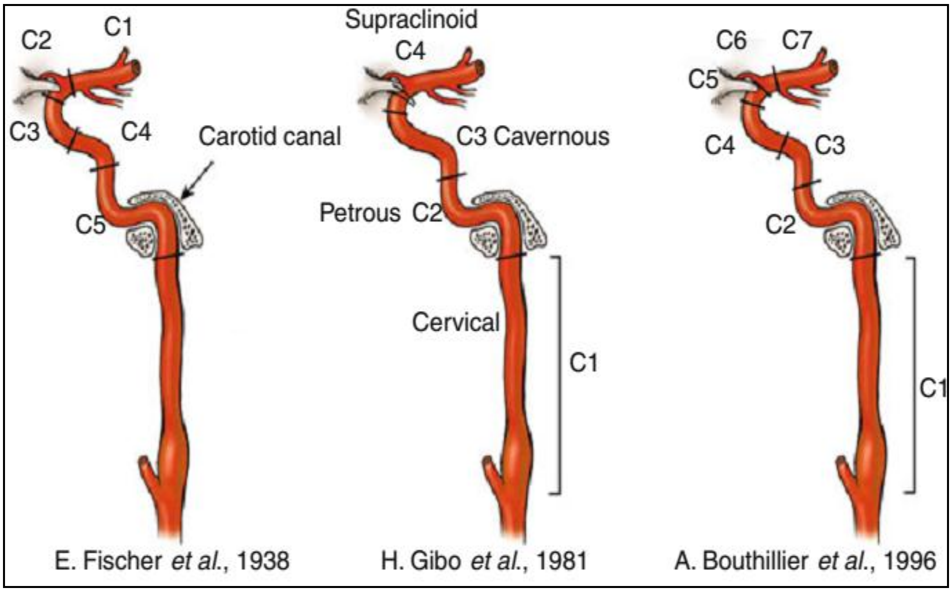

Figure 3: Selected segmental classification schemes of the internal carotid artery ***(Harrigan and Deveikis, 2013).***

Cervical Segment (C1):

This segment begins at the carotid bifurcation and ends at the skull base and usually has no branches. The carotid bifurcation is usually at the level of C3. The ICA receives approximately 80% of the flow from the CCA. The ICA is encircled by sympathetic fibers, and travels in the carotid sheath ***(Harrigan and Deveikis, 2013).***

<u>Divisions:</u>

- **Carotid bulb:**
  - Focal dilation of the ICA at the origin, measuring 7.4 mm in diameter on average, compared to 7.0 mm for the

CCA and 4.7 mm for the ICA distal to the carotid bulb ***(Harrigan and Deveikis, 2013).***

- **Ascending cervical segment:**
    - The diameter remains relatively constant throughout its course. Coiling or complete looping of the vessel is seen in up to 15% of angiograms ***(Harrigan and Deveikis, 2013).***

Variants:

- **Position of origin:**
    - The carotid bifurcation can be found as low as T2 or as high as C1. Rarely, the ICA may arise directly from the aortic arch; in these cases the non-bifurcating carotid artery gives rise to all of the branches normally supplied by the ECA and then continues as the ICA ***(Harrigan and Deveikis, 2013).***

- **Agenesis and hypoplasia:**
    - Congenital absence or hypoplasia of the ICA may occur sporadically in association with other congenital anomalies, such as anencephaly or basal telangectasia. Intracranial aneurysms are associated in 67% of cases ***(Lee et al., 2003).***
    - Agenesis of the ICA has a prevalence of 0.01% and can be distinguished from ICA occlusion by imaging of the