ANESTHETIC MODALITIES FOR INTERVENTIONAL NEURO-RADIOLOGY

Essay

Submitted for partial fulfillment Of Master

Degree in Anesthesiology and Intensive care

By

Tarek Abd El-Fattah Zanata

MBBCH

Under supervision of

Prof.Dr.Mohammed Taher Matar

Professor of Anesthesiology &Intensive care

Faculty of medicine –Al Azhar University

Prof.Dr.Emad Abd El-Hamid Shaban

Professor of Anesthesiology &Intensive care

Faculty of medicine –Al Azhar University

Dr.Alaa El-Deen Mahmoud Said

Assistant Professor of Anesthesiology &Intensive care

Faculty of medicine –Al Azhar University

Dr.Hatem Mahmoud Nasr El-Kenany

Lecturer of Anesthesiology &Intensive care

Faculty of medicine –Al Azhar University

Faculty of medicine

Al Azhar University

2013 - 2014

سورة طة الأية(١١٤)

Acknowledgment

First and foremost I thank **ALLAH** for every thing and especially for my steady steps I have been taking in my career.

I would like to express my most sincere thanks and deepest gratitude to ***Prof.Dr.*** **Mohammed Taher Matar.** Professor of Anesthesia and Intensive Care, Faculty of Medicine, Al-azhar University, for his gracious supervision, valuable guidance, generous help, support and continuous encouragement through the whole research.

I would like to express my most sincere thanks and deepest gratitude to ***Prof.Dr.*****Emad Abd El-Hamid Shaban.**, Professor of Anesthesia and Intensive Care, Faculty of Medicine, Al-azhar University. I am deeply affected by his noble character, perfection, care and consideration. I am very much privileged and honored to have him as my supervisor. To him I owe much more than I can express.

I would like also to express my most sincere thanks and deepest gratitude to **Dr. Alaa El-Deen Mahmoud Said**, Assistant Professor of Anesthesia and Intensive Care, Faculty of Medicine, Al-Azhar University, for his remarkable effort, valuable comments and sincere advices.

Special thanks for **Dr. Hatem Mahmoud Nasr El-Kenany**, Lecturer of Anesthesia and Intensive Care, Faculty of Medicine, Al-Azhar University, without whom this work couldn't have been completed. He gave me more time and more help to gather the information, reading and correcting it with great care.

Finally no words can express the warmth of my feeling to my family for their patience and help.

Tarek Abd El-Fattah Zanata

2013

LIST OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Table. No. **Title** **Page. No.**

LISTE OF ABBREVIATIONS

- **ACT:** **(**activated clotting time)
- **ADP:** **(**adenosine di phosphate)
- **ATP:** **(**adenosine tri phosphate)
- **AVF:** **(**arterio venous fistula)
- **AVM:** **(**arterio venous malformation)
- **BB:** **(**beta blockers)
- **CBC:** **(**complete blood count)
- **CBF:** (cerebral blood flow)
- **CBV: (** cerebral blood volum)
- **CEA:** **(**carotid end arterectomy)
- **CFA:** **(c**ommon femoral artery)
- **CGD:** **(**coherence gated Doppler)
- **CMR:** (cerebral metabolic rate)
- **CMRO$_2$:** **(**cerebral metabolic rate O_2 consumption)
- **CNS:** **(**central nervous system)
- **CPP:** (cerebral perfusion pressure)
- **CSF:** (cerbro spinal fluid)
- **CVP:** **(**centeral venous pressure)
- **D5W:** **(**dextrose 5% in water)
- **DSA:** **(**digital subtraction angiography)
- **EEG:** **(**electro enchephalo gram)
- **GABA:** **(**gamma amino butyric acid)
- **ICH:** **(**intra cerebral hemorrhage)
- **ICP:** **(**intra cerebral pressure)
- **ISAT:** **(**international subarachinoid aneurysm trial)
- **LMA:** **(**larngyal mask airway)
- **MAC:** **(**minimal alveolar concentration)
- **MAP:(**mean arterial pressure)
- **MRI:** **(**magnetic resonans image)

- **N_2O:** (nitrous oxide)
- **NBCA:** (n acetyl cyano acrylate)
- **NGF:** (nerve growth factor)
- **NIBP:** (non invasive blood pressure)
- **NMDA:** (n methyl de aspartate)
- **NT3:** (neuro tropin 3)
- **$PaCO_2$:** (arterial CO_2 pressure)
- **PaO_2:** (arterial O_2 pressure)
- **$PetCO_2$:** (end tidal CO_2)
- **PT:** (prothrombine time)
- **PTT:** (partial thrombo plastine time)
- **PVA:** (poly vinyl alchol)
- **SAFE:** (super selective anesthesia functional examination)
- **SPECT:** (single photon emission computerized tomography)
- **SSEP:**(somato sensory evoked potential)
- **TCD:** (trans cranial Doppler)

INTRODUCTION

INTRODUCTION

The medical world has seen rapid advances in diagnostic and interventional radiology, including interventional neuroradiology. Many intracranial vascular pathologies can now be successfully managed by interventional neuroradilogy techniques by the endovascular approach, thus either avoiding surgical intervention or making it safer for the patient. These techniques include embolization of vascular tumors and arterio-venous malformations (AVM), coiling of cerebral aneurysms, and balloon occlusion of some vascular lesions. **(Miller et al., 2011).**

The last decades have seen the development of the basic applications of the interventional neuroradiological methods regarding the development of improved fluoroscopic equipments, angiographic techniques, magnetic resonance angiography as well as a better understanding of the neurovascular anatomy. **(Young et al., 2007).**

Interventional neuroradiolgy is a hybrid of traditional neurosurgery and neuroradiology, with certain overlaps with aspects of head-and-neck surgery. It can be broadly defined as treatment of central nervous system disease by endovascular access for the purpose of delivering therapeutic agents, including both drugs and devices. Because of recent advancement in this field , more anesthesiologists are involved in care of patients undergoing procedures. Anesthesiologists have several important concerns when providing care to patients who undergo procedures, including: Maintenance of patient immobility and physiologic stability; manipulating systemic or regional blood flow; managing anticoagulation; treating and managing sudden unexpected complications during the procedures; guiding the medical management of critical care patients during transport to and from the radiology suites; and, rapid recovery from anesthesia and sedation during or immediately after the procedure to facilitate neurologic examination and monitoring. To achieve these goals, anesthesiologists should be familiar with specific radiological procedures and their potential complications.

(Casasa et al.,2009).

The procedures performed in interventional radiology practice are usually life-threatening, even in experienced hands. A primary goal of anesthesia coverage is immediate intervention in the event of catastrophe, such as intracranial hemorrhage. **(Budohoski et al.,2013)**.

As the use of endovascular neurosurgery expand, care of these patients will demand more of anesthetist's participation. Historically, the pioneers of endovascular neurosurgery provided light intravenous sedation with traditional monitoring for their adult patients, although many prefer to have an anesthetist in attendance. Some centers have employed anesthetists on an on-call fashion. As the complexity of the procedures and breadth of patient populations expand, the distinction between the endovascular therapists' angiography suite and the operating room will blur and need for sophisticated sedation techniques and monitoring will increase.

(Varma et al., 2007)

Chapter 1

ANATOMICAL AND PHYSIOLOGICAL CONSIDERATIONS OF CEREBRAL CIRCULATION

ANATOMICAL AND PHYSIOLOGICAL CONSIDERATIONS OF CEREBRAL CIRCULATION

BLOOD SUPPLY OF THE BRAIN

- ### Arteries Of The Brain

The brain is supplied by the two internal carotid and two vertebral arteries. These four arteries anastomose on the inferior surface of the brain and form the circulus arteriosus or the Circle of Willis **(Fig. 1) (De Silva et al., 2011).**

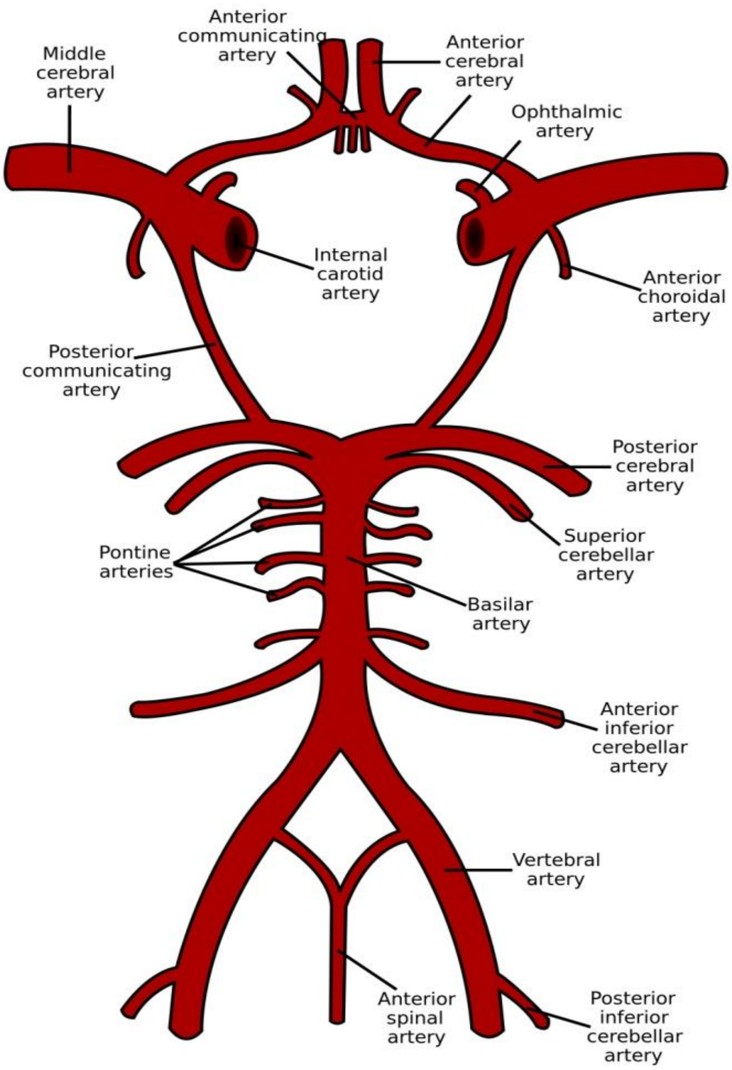

Figure-1: THE ARTERIAL CIRCLE OF WILLIS (Smith et al.,2010).

1. Internal Carotid Artery

The internal carotid artery arises from the bifurcation of the common carotid artery, ascends in the neck and enters the carotid canal of the temporal bone. Its subsequent course is said to have petrous, cavernous and cerebral parts **(Standring, 2004).** The cerebral portion emerges from the cavernous sinus on the medial side of the anterior clinoid process by perforating the dura matter. Branches of the cerebral portion of the internal carotid arteries are:

a) **The ophthalmic artery** which enters the orbit through the optic canal below and lateral to the optic nerve.
b) **The posterior communicating artery** which runs backwards to join the posterior cerebral artery.
c) **The choroidal artery** which ends in the choroid plexus.
d) **The anterior cerebral artery** which is the smaller and one of the two terminal branches of the internal carotid. It is joined to the artery of the opposite side by the anterior communicating artery. It supplies the tip of the cortex on the lateral surface and the entire medial surface of the cortex. It also supplies the "leg area" of the precentral gyrus and a number of its central branches pierce the brain substance and supply the deep mass of the gray matter within the cerebral hemispheres.
e) **The middle cerebral artery** which is the largest branch of the internal carotid artery. Its cortical branches supply the entire lateral surface of the hemisphere. It supplies all the motor area except the "Leg area". The central branches also supply the deep mass of the gray matter within the cerebral hemispheres **(Devault et al., 2008).**

2. Vertebral Artery

The vertebral artery, a branch of the first part of the subclavian artery, enters the skull through the foramen magnum. At the lower border of pons, it joins the vessel of the opposite side to form the basilar artery. It gives meningeal arteries, the anterior and the posterior spinal arteries, the posterior inferior cerebellar artery and medullary arteries **(De Silva et al., 2011).**

3. Basilar artery

At the upper border of pons, it divides into two posterior cerebral arteries. It gives branches to pons, the cerebellum and to the internal ear. ***The posterior cerebral arteries*** supply the visual cortex, the midbrain and the deep masses of the gray matter within the cerebral hemispheres**.**

- ### Circulus Arteriosus

It lies at the interpeduncular fossa at the base of the brain. It allows blood that enters by either the internal carotid or vertebral arteries to be distributed to any part of both cerebral hemispheres. Cortical and central branches arise from the circle and supply the brain substance **(Fig. 2)**.

- ### Veins Of The Brain

They emerge from the brain and lie in the subarachnoid space. The veins pierce the arachnoid matter and the meningeal layer of the dura to drain into the cranial venous sinuses. There are cerebral and cerebellar veins of the brain stem. The great cerebral vein is formed of the union of the two internal cerebral veins and drains into the straight sinus **(De Silva et al., 2011)**.

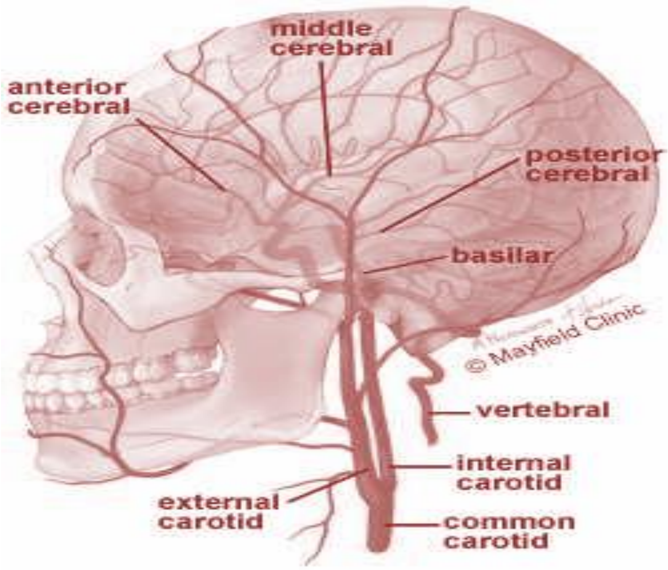

Figure 2: contribution of internal carotid and vertebral arteries in arterial supply of brain (smith et al., 2010).