Perioperative Stroke

An assay
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in anesthesiology

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133-XE	133-xenon
ABP	Arterial blood pressure
AF	Atrial fibrillation.
AMPA	α-amino-3-hydroxyl-5-methyl-4-isoxazole-propionate
ASA	Acetyl salicylic acid
ASA	Acetyl salysalic acid
ATP	Adenosine Tri Phosphate
BMS	Base metal stent
Ca^{++}	Calcium ions
CABG	Coronary artery bypass grafting
CABG	Coronary artery bypass graft
CBF	Cerebral blood flow
CBV	Cerebral blood volume
CEA	Carotid edarterectomy
CFAM	Cerebral function analyzing monitor
CMR	Cerebral metabolic rate
CMRO2	cerebral metabolic oxygen requirement
CNS	Central nervous system
CO2	Carbon dioxide
CPB	Cadiopulmonary bypass
CPP	Cerebral perfusion pressure .
CPSS	Cincinnatic prehospital stroke scale
CSF	Cerebro spinal fluid
CT	Computerized Tomography
CVR	Cerebrovascular resistance

D.M	Diabetus mellitus.
DES	Drug eluting stent
ECG	Electrocardiograph
EEG	Electroencephalogram
FAST	Face, arm and speech test
FDA	Food and drug administration.
GABA	Gama amino butyric acid
GRE	Gradiant recalled echo
ICH	Intracranial hemorrhage.
ICP	Intracranial pressure
IA	Intraarterial
JVP	Jugular venous pressure
LACI	Lacunar infarct
LAPSS	Los Angeles prehospital stroke screen
MAC	Minimum alveolar concentration
MAP	Mean arterial preesure
MCA	Middle cerebral artery
MERCI	Mechanical embolus removal in cerebral embolism
MRI	Magnetic resonance imaging
N2O	Nitrous oxide
NMDA	*N*-methyl *D*-aspartate
NPCS	Neural progenitor cells
NXY-059	Free radical trapping agent .
PACI	Partial anterior circulation infarct
PACO2	Partial arterial pressure of carbon dioxid

PACU	Post anesthesia care unite.
PAO2	Partail arterial pressure of oxygen
PFO	Patent foramen ovale
PO2	Oxygen saturation pressure
POCI	Posterior circulation infarct
PP	Perfusion pressure
PROACT	Prolyse in acute cerebral thromboembolism
PTT	Partial thromboplastin time
ROS	Reactive oxygen species
ROSIER	Recognition of stroke in the emergency room
SCADS	Small arteriolar capillary dilation
SPECT	Single photon emission computerized tomography
SSEPS	Somatosensory evoked potentials
SVZ	Subventricular zone
TACI	Total anterior circulation infarct
TCD	Transcranial Doppler sonography
TIAS	Transient ischemic attacks
T-PA	Tissue plasminogen activator
VTE	Venous thrombo embolism

Introduction

Stroke is a neurological deficit of cerebrovascular cause that persists beyond 24 hours or interrupted by death within 24hours **(Donnan et al.,2008).**

Stroke is one of the most feared complications of surgery. The incidence of perioperative stroke depends on the type and complexity of the surgical procedure. The risk of stroke after general, noncardiac procedures is very low (0.08-0.7%)**(Selim, 2007)**. Cardiac and vascular surgeries — in particular, combined cardiac procedures — are associated with higher risk(7.4%)**(Selim, 2007)**. The timing of surgery is also important, more strokes occur after urgent surgeries than after elective ones **(Bucerius et al.,2003).**

Radiological and postmortem studies indicate that perioperative strokes are predominantly ischemic and embolic. In a study of stroke after coronary bypass grafting(CABG), hemorrhage was reported in only 1% of patients ; and 62% had embolic infarcts;1% thrombotic;9% hypoperfusion and 27% other causes **(Likosky et al.,2004).**

Approximately 45% of perioperative strokes are identified within the first day after surgery. The remaining 55% occur after uneventful recovery from anesthesia, from the second postoperative day onward **(Hogue et al.,1999)**.

Stroke is diagnosed mainly by clinical neurological examination ,with assistance from imaging techniques as CT scans, MRI. scans, Doppler ultrasound, and arteriography **(Hill, et al.,2005).**

The prevention of stroke is an important public health concern and this occurs through modification of perioperative risk factors as high blood pressure, atrial fibrillation, high cholesterol levels, diabetes, cigarette smoking, heavy alcohol consumption, drug abuse, lack of physical activity, obesity, and unhealthy diet. Perioperative administration of statins or beta blockers appears to reduce the incidence of stroke and cognitive decline after CABG **(Crystal et al.,2004).**

In patients with both cardiac and carotid disease who are undergoing urgent cardiac surgery — a population in which the risks of complications and death from cardiac causes exceed the risk of stroke — a reversed-stage

approach (carotid revascularization after CABG) or a combined approach (simultaneous carotid revascularization and CABG) may be undertaken. However, the combined approach may be associated with higher morbidity **(Das et al.,2000)**.

Therefore, the extent of the preoperative evaluation of patients with asymptomatic carotid disease should be individualized. At a minimum, the evaluation should include a history taking designed to elicit unreported symptoms of transient ischemic attack , a detailed neurologic examination, and brain computed tomographic (CT) or magnetic resonance imaging (MRI) studies to rule out "silent" ipsilateral infarcts **(Soinne et al.,2003)**.

The importance of antiplatelet therapy in stroke prevention is without doubt. Aspirin ,acetyl salysalic acid , (ASA) and clopidogrel are the most studied agents in the perioperative period **(Horlocker et al.,1995).**

Although patients with atrial fibrillation and mechanical valves are dependent on anticoagulation to lower their thromboembolic risk in the perioperative

period, this benefit may be outweighed by the risk of bleeding **(Blacker et al.,2003).**

Ideally; people who had stroke are admitted to a stroke unit so that history and physical examination must be carefully done to determine the cause. Treatment of stroke varies according to the cause , whether thromboembolic or hemorrhagic **(Fisher, et al.,2008).**

The use of intra arterial thrombolysis within 6 hours after the onset of perioperative stroke is relatively safe. There are few data on the use of mechanical thrombectomy or embolectomy in patients with perioperative stroke **(Selim, 2007).**

Aim of the work

The aim of this assay is to highlight the physiology of cerebral blood flow, cerebral autoregulation, pathophysiology, and management of perioperative stroke ,with future directions on its prophylaxis.

Chapter I

Cerebral blood supply

1) **Gross anatomy of the brain.**
2) **Cerebral blood supply.**
3) **Physiology of cerebral blood flow.**
4) **Autoregulation of cerebral blood flow:**

    1. Myogenic regulation.
    2. Neurogenic regulation.
    3. Respiratory gases tension.
    4. Temperature.
    5. Viscosity.
    6. Endothelial derived factors.

1) Gross anatomy of the brain:

The human brain is the center of the human nervous system and is a highly complex organ. The mass of an adult human brain is approximately 1300 to 1400 grams and the newborn human brain is about 350 to 400 grams. The average Male's brain weighs 1360 grams and the average Female's brain weighs 1250 grams. The mammalian brain has three primary subdivisions: the cerebrum (including the outer, wrinkled cortex), cerebellum, and brainstem. The brain-stem is further divided into the diencephalon, midbrain, pons, and medulla. The human brain

is about 85 percent cerebrum, 11 percent cerebellum, and 4 percent brainstem **(fig.1.1).**

The human brain has more than 100 billion **neurons** , with 14 to 16 billion neurons in the **cerebral cortex** and nearly 100 billion neurons in the cerebellum alone. In addition, there are perhaps nine times as many glial cells, whose exact roles are unclear, but which help to support and maintain neurons. Most neurons are present shortly after birth, and as the brain continues to grow, the number and complexity of neuronal connections increase. These neurons are arranged into gray matter and white matter. Gray matter composes areas rich in neurons, their dendrites, and synapses. White matter is tissue rich in **axons** (nerve fibers), but with a few cell bodies or dendrites. It gets its color from an insulating wrap called myelin around the nerve fibers. The high lipid content of white matter makes it light and easily distinguished from gray matter in fresh tissue ***(Campbell et al.,2005)*** **.**