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Induced Hypothermia & Fever Control in Neurologically Ill Patients

Essay

Submitted for partial fulfillment For master degree in Intensive care

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ATP: Adenosine Tri Phosphate

AHA: American heart association

AMPK: Adenosine mono Phosphate activated protein kinase

AF: Atrial fibrillation

AVDO٢: arterio venous difference of oxygen

ADH: anti diuretic hormone

ANP: atrial naturetic peptide

BBB: blood brain barrier

Bcl: beta cell lymphocyte

Bax: BCL associated X protein

CBF: cerebral blood flow

CPP: cerebral perfusion pressure

CVR: cerebro vascular resistance

CMRO٢: cerebral metabolic rate of o٢

CPR: cardio pulmonary resussitation

CNS: central nervous system

CCR: chemokine receptor

CIRP: cold inducible RNA binding protein

DNA: deoxy ribonucleic acid

ECG: Electro cardio graphy

FaS: fatty acid synthase

GluT: glucose transporter

H+: hydrogen

HIF: hypoxia-inducible factor.

HSPs: heat shock protiens

ICP: intra cranial pressure

IV: Intera venous

IL: interleukin

LPs: lipopoly sacharides

MABP: mean arterial blood pressure

MCP: methyl accepting chemotaxis protein

MCAO: middle cerebral artery occlusion

MIP: monocyte chemotactic protein

mRNA: messenger ribonucleic acid

NF: necrotic factor

NO: nitric oxide

OGD: oxygen glucose deprevation

PaO_2: partial o_2 pressure

$PaCO_2$: partial co_2 pressure

PARP: poly ADP ribose polymerase

PKc: protein kinase c

RINSE: rapied infusion of cold normal saline

RBM: RNA binding motif protein

SVR: systemic vascular resistance

TH: therapeutic hypothermia

TBI: traumatic brain injuery

TNF: tumor necrosis factor

VF: ventricular fibrillation

VEGF: vascular endothelial growth factor

Introduction

The issue of temperature management in neurologically ill patients has gained increasing attention from the critical care community. Evidence show that fever in patients with various types of neurological injury is associated with an increased risk of adverse outcome. This is clear in patients with ischemic stroke. The absolute risk of adverse outcome (death or permanent neurological impairment) increases by ٢,٢٪ for every degree of temperature increase as well as post-cardiac arrest patients **(Poldeman, ٢٠٠٨).**

Severe environmental hypothermia will cause a systole and patients might not be revived. Milder degrees of hypothermia might protect the brain and other vital organs from injury. The use of hypothermia in intensive care units is not new. It has been used in the past and has recently seen resurgence **(Eelco, ٢٠٠٤).**

There has long been a search for a simple method of neuroprotection. Clinical data have emerged to

suggest that induced hypothermia could be effective **(Berger et al., ٢٠٠٢).**

Neurologists have also been interested in using the technique in the treatment of large hemispheric stroke predominantly when swelling occurs. However the benefits of therapeutic hypothermia remain unclear. Mild hypothermia for brain injury would prevent unfavorable neurological outcome **(Michael, ٢٠٠٢).**

Hypothermia has been shown to reduce the cerebral metabolism by decreasing oxygen consumption, glucose utilization and lactate concentration. It is estimated that for each ١°C decrease in temperature the cerebral metabolic rate decreases by ٦ to ٧٪. Mild-to-moderate hypothermia (٣٤ to ٣٢°C) has been shown to decrease CBF due to cerebral vasoconstriction particularly in patients with traumatic brain injury. This mechanism decreases the intracranial pressure and may act as an anticonvulsant. Therapeutic hypothermia also affects the pH value. Every ١°C decrease in body temperature there is an increase of ٠,٠١٦ points in the pH value. **(Yenari et al., ٢٠٠٥).**

Aim of work

The aim of this work is to express the importance of Induced hypothermia and Fever control in neurologically ill patient.

Anatomy of central nervous system And its blood supply

The brain lies in the cranial cavity and is continuous with the spinal cord through the foramen magnum. It is surrounded by three meninges, the dura mater, the arachnoid mater and the pia mater. These are continuous with the corresponding meninges of the spinal cord. The CSF surrounds the brain in the subarachnoid space **(Goetz, ٢٠٠٣)**.

The brain is conventionally divided into three major divisions arranged in ascending order from the spinal cord. It is **hindbrain** (divided into medulla oblongata, pons and cerebellum)**, midbrain and forebrain** (divided into the diencephalon which is the central part of the forebrain, and the cerebrum) **(Guyton et al., ٢٠٠٦).**

The brainstem (a collective term for the medulla oblongata, pons, and midbrain) is that part of the brain that remains after the cerebral hemispheres and cerebellums are removed **(Guyton et al., ٢٠٠٦).**

Blood supply of CNS

Blood Supply of the Brain

- Arterial supply of the Brain

The brain is supplied by the two internal carotid and the two vertebral arteries. The four arteries lie within the subarachnoid space and their branches anastomose on the inferior surface of the brain to form the circle of Willis. **(Snell, ٢٠٠٧).**

(A) Internal Carotid artery **fig (١.١)**

It begins at the bifurcation of the common carotid artery. It usually possesses a localized dilatation called the carotid sinus. It ascends the neck and perforates the base of the skull by passing through the carotid canal of the temporal bone. It divided into five branches **(**ophthalmic artery, posterior communicating artery, choroidal artery, anterior cerebral, middle cerebral artery**) (Snell, ٢٠٠٧).**

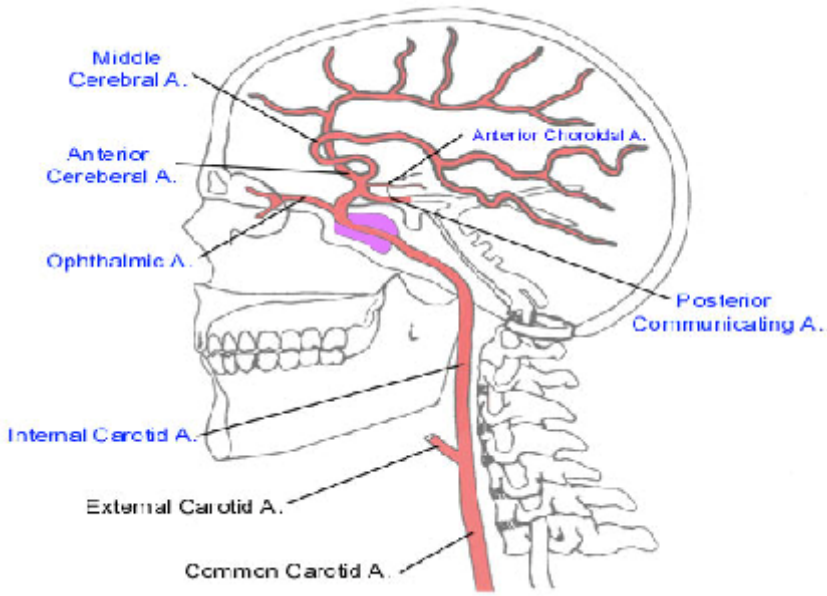

Fig (١.١) Internal carotid a. & its branches **(Snell, ٢٠٠٧).**

(B) Vertebral artery **fig (١.٢)**

It is a branch of the first part of the subclavian artery. It ascends the neck by passing through the foramina in the transverse processes of the upper six cervical vertebrae. It enters the skull through the foramen magnum. At the lower border of the pons it joins the vertebral artery of the opposite side to form the basilar artery. It divided into four branches **(**meningeal branches, posterior spinal artery, anterior spinal artery, posterior inferior cerebellar artery**) (Snell, ٢٠٠٧).**

(C) Basilar artery **fig (١.٢)**

The basilar artery is formed by the union of the two vertebral arteries. It ascends in a groove on the anterior surface of the pons. At the upper border of the pons it divides into the two posterior cerebral arteries. Basilar artery give branches **(**pontine arteries, anterior inferior cerebellar artery, superior cerebellar artery, posterior cerebral artery**) (David et al., ٢٠٠٢).**

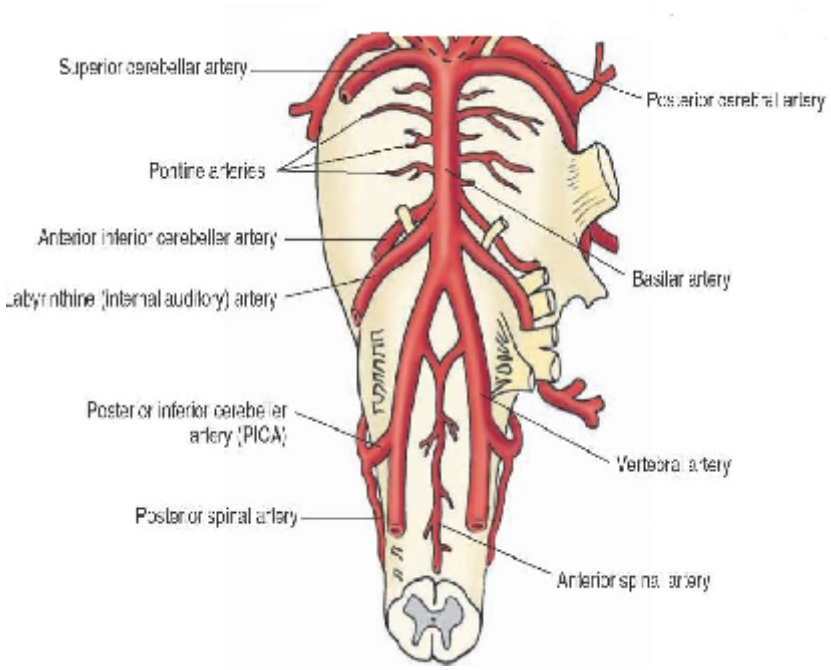

Fig (١.٢) Basilar A. and its branches **(Patrick, ٢٠٠٩).**