Stroke-Related Pulmonary Complications and Abnormal Respiratory Patterns

An Essay

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List of Abbreviations

Abb.	Full term

AHI *.....Apnea- hypopnea index*
ARDS *.....Acute respiratory distress syndrome*
CNH *.....Central neurogenic hyperventilation*
CPAP *.....Continuous positive airway pressure*
CSA *.....Central sleep apnea*
CT *.....Computed Tomography*
DRG *.....Dorsal respiratory group*
DVT *.....Deep venous thrombosis*
DWI *.....Diffusion – weighted imaging*
EMTs *.....Emergency medical technicians*
HAP *.....Hospital acquired pneumonia*
ICH *.....Intracerebral hemorrhage*
ICP *.....Intracranial pressure*
IPC *.....Intermittent pneumatic compressions*
IVC *.....Inferior vena cava*
IVF *.....Intravenous fluid*
LMWH *.....Low molecular weight heparin*
MI *.....Myocardial infarction*
MRI *.....Magnetic resonance imaging*
MRSA *.....Methecilin resistant staphylococcus aureus*
NCCT *.....Noncontrast computed tomography*
NIHSS *.....National Institutes of Health Stroke scale*
NPE *.....Neurogenic pulmonary edema*
NPO *.....Non per os*
OSA *.....Obstructive sleep apnea*
PaCO2 *.....Partial pressure of carbon dioxide in arterial blood*
PaO2 *.....Partial pressure of oxygen in arterial blood*
PE *.....Pulmonary embolism*

List of Abbreviations (Cont…)

Abb.	Full term

PEEP *.....Positive end expiratory pressure*
RV *.....Right ventricle*
SAH *.....Subarachinoid hemorrhage*
SDD *.....Selective decontamination of the digestive tract*
SOD *.....Selective decontamination of the oropharengeal tract*
UFH *.....Unfractionated heparin*
VAP *.....Ventilator associated pneumonia*
VKAs *.....Vitamin K antagonists*
VRG *.....Ventral respiratory group*
VTE *.....Venous thromboembolism*

ABSTRACT

Venous thromboembolism (VTE) is a serious complication of stroke because it may lead to life-threatening pulmonary embolism. Patients with hemiparesis, immobility, severe stroke, and advanced age are predisposed to the development of deep vein thrombosis.Prophylaxis against VTE include intermittent pneumatic compression (IPC), low-dose anticoagulant therapy, using either low molecular weight heparin or unfractionated heparin, after confirming that benefit of VTE prophylaxis is thought to outweigh the risk of bleeding.The treatment of proximal deep vein thrombosis and/or pulmonary embolism in patients with acute ischemic stroke may require anticoagulation or placement of an inferior vena cava filter.

Abnormal breathing patterns are a common consequence of stroke. Intubation and mechanical ventilation of patients with ischemic stroke is usually performedfor inability to protect the airway or to treat pulmonary edema. The morbidity and mortality in patients intubated after acute stroke is high.

Keywords: Selective decontamination of the digestive tract- Selective decontamination of the oropharengeal tract - Ventilator associated pneumonia

INTRODUCTION

Stroke is an acute brain disorder of vascular origin accompanied by neurological dysfunction that persists for longer than 24 hours, dysfunction is usually localized or focal. however, global dysfunction can occur ***(Easton et al., 2009).***

Stroke is classified according to the responsible mechanism into ischemic stroke accounts for 87% of all strokes and hemorrhagic stroke accounts for 13% of all strokes ***(Go et al., 2013)***.

The evaluation of a patient with suspected acute stroke must proceed quickly. Each minute of cerebral infarction results in the destruction of 1.9 million neurons and 7.5 miles of myelinated nerves ***(Saver, 2006)***.

The rates of reported medical complications of stroke are high, at least one medical complication occurred in 95 % of patients, and at least one serious medical complication occurred in 24 %, including pneumonia, gastrointestinal bleeding, congestive heart failure, and cardiac arrest. Approximately 50 % of deaths after stroke are attributed to medical complications ***(Langhorne et al., 2000)***.

The most common serious medical complications are respiratory complications, particularypneumonia occurring in about 5 to 9 % of patients. The incidence of stroke-related pneumonia appears to be higher in patients with acute ischemic

stroke admitted to a neurologic intensive care unit and in those who require nasogastric tube feeding ***(Finlayson et al., 2011)***.

Prevention, early diagnosis and management of stroke related pulmonary complications must get a good attention to reduce morbidity and mortality ***(Govan et al., 2007).***

Stroke may be associated with abnormal breathing patterns including Cheyne-Stokes respiration, periodic breathing, ataxic breathing, apneustic breathing, gasping, apnea and sleep apnea ***(Rowat et al, 2006).***

AIM OF THE WORK

This work aimed at highlighting stroke related pulmonary complications, its effect on prognosis, prevention, and management, and to highlight abnormal respiratory patterns associated with stroke.

Chapter 1

STROKE DEFINITION, CLASSIFICATION AND INITIAL EVALUATION

Definition:

Stroke

WHO defines stroke as clinical syndrome of rapid onset of focal or global cerebral deficit, lasting more than 24 hours (unless interrupted by surgery or death), with no apparent cause other than a vascular one ***(Easton et al., 2009).***

Classification:

Stroke is classified according to the responsible mechanism.

1. Ischemic stroke accounts for 87% of all strokes: 80% of ischemic strokes are thrombotic strokes, and 20% are embolic strokes. Most emboli originate from thrombi in the left atrium (from atrial fibrillation) or left ventricle (from acute MI), but some originate from venous thrombi in the legs that reach the brain through a patent foramen ovale.
2. Hemorrhagic stroke accounts for 13% of all strokes: 97% of hemorrhagic strokes involve intracerebral hemorrhage, and 3% are the result of subarachnoid hemorrhage.

(Members et al., 2014)

1. Brain Ischemia

There are three main subtypes of brain ischemia:

- Thrombosis generally refers to local in situ obstruction of an artery. The obstruction may be due to disease of the arterial wall, such as arteriosclerosis, dissection, or fibromuscular dysplasia; there may or may not be superimposed thrombosis ***(Caplan., 2009).***

- Embolism refers to particles of debris originating elsewhere that block arterial access to a particular brain region. Since the process is not local (as with thrombosis), local therapy only temporarily solves the problem; further events may occur if the source of embolism is not identified and treated ***(Caplan and Manning., 2006).***

- Systemic hypoperfusion is a more general circulatory problem, manifesting itself in the brain and perhaps other organs ***(Louis et al., 2017)***.

Blood disorders are an uncommon primary cause of stroke. However, increased blood coagulability can result in thrombus formation and subsequent cerebral embolism in the presence of an endothelial lesion located in the heart, aorta, or large arteries that supply the brain ***(Flemming et al., 2004).***

2. Brain Hemorrhage

There are two main subtypes of brain hemorrhage:

- Intracerebral hemorrhage (ICH) refers to bleeding directly into the brain parenchyma.
- Subarachnoid hemorrhage (SAH) refers to bleeding into the cerebrospinal fluid within the subarachnoid space that surrounds the brain.

o **Intracerebral hemorrhage** Bleeding in ICH is usually derived from arterioles or small arteries. The bleeding is directly into the brain, forming a localized hematoma that spreads along white matter pathways. Accumulation of blood occurs over minutes or hours; the hematoma gradually enlarges by adding blood at its periphery like a snowball rolling downhill.

The neurologic symptoms usually increase gradually over minutes or a few hours. In contrast to brain embolism and SAH, the neurologic symptoms related to ICH may not begin abruptly and are not maximal at onset.

o **Subarachnoid hemorrhage** The two major causes of SAH are rupture of arterial aneurysms that lie at the base of the brain and bleeding from vascular malformations that lie near the pial surface. Bleeding diatheses, trauma, amyloid angiopathy, and illicit drug use are less common.

(Louis et al., 2017)

Symptoms of SAH begin abruptly in contrast to the more gradual onset of ICH. The sudden increase in pressure causes a cessation of activity (eg, loss of memory or focus or knees buckling). Headache is an invariable symptom and is typically instantly severe and widespread; the pain may radiate into the neck or even down the back into the legs. Approximately 30 percent of patients have a minor hemorrhage manifested only by sudden and severe headache (the so-called sentinel headache) that precedes a major SAH. The complaint of the sudden onset of severe headache is sufficiently characteristic that a minor SAH should always be considered ***(Louis et al., 2017)***.

Table (1): Characteristics of stroke subtypes ***(Louis et al., 2017)***

Stroke type	Clinical course
Intracerebral hemorrhage	Gradual progression during minutes or hours
Subarachnoid hemorrhage	Abrupt onset of sudden, severe headache. Focal brain dysfunction less common than with other types.
Ischemic (thrombotic)	Stuttering progression with periods of improvement. Lacunes develop over hours or at most a few days; large artery ischemia may evolve over longer periods.
Ischemic (embolic)	Sudden onset with deficit maximal at onset. Clinical findings may improve quickly.

A. Initial Evaluation

The evaluation of a patient with suspected acute stroke must proceed quickly. Each minute of cerebral infarction results in the destruction of 1.9 million neurons and 7.5miles of myelinated nerves, and continued tissue destruction eventually leads to a point where reperfusion of occluded arteries with thrombolytic therapy will not promote neurological recovery. This point occurs 4–5 hours after stroke onset, where the benefit from thrombolytic therapy is lost ***(Saver., 2006)***.

Initial Assessment Sudden loss of focal brain function is the core feature of the onset of ischemic stroke. However, patients with conditions other than brain ischemia may present in a similar fashion.

The goals in the initial phase include:

- Ensuring medical stability, with particular attention to airway, breathing, and circulation.
- Quickly reversing any conditions that are contributing to the patient's problem.
- Determining if patients with acute ischemic stroke are candidates for thrombolytic therapy or endovascular thrombectomy.
- Moving toward uncovering the pathophysiologic basis of the patient's neurologic symptoms.

(Jauch et al., 2013)