Trauma in Geriatrics

Essay

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Abbreviations List

ADLs	: Activities of daily living
AE	: Angiographic embolization
AF	: Atrial fibrillation
AP	: Anteroposterior
BD	: Base deficit
BSA	: Body surface area
CAD	: Coronary artery disease
CCHR	: Canadian CT Head Rule
CHF	: Congestive heart failure
CO	: Cardiac output
COPD	: Chronic obstructive pulmonary disease
CV	: Closing volume
DHT	: Dihydrotestosterone
DO_2	: Oxygen delivery
DPL	: Diagnostic peritoneal lavage
ED	: Emergency department
ERPF	: Effective Renal Plasma Flow
FAST	: Focused Assessment with Sonography for Trauma
FEV1	: Forced expiratory volume in first second
FF	: Filtration fraction
FFP	: Fresh frozen plasma
FRC	: Functional Residual Capacity
FVC	: forced vital capacity

GCS : Glasgow coma scale

GFR : Glomerular filtration rate

ICH : Intracranial hemorrhage

INR : International normalized ratio

ISS : Injury severity score

LC : Lateral compression

LOS : length of stay

LR : Lactated ringers

MDCT : Multidetector CT

MEP : Maximal Expiratory Pressures

MIP : Maximal Inspiratory Pressures

MOF : Multiorgan failure

MVC : Motor vehicle crash

NO : Nitric oxide

NOC : New Orleans Criteria

NOM : Non Operative Management

NS : Normal saline

OH : Occult hypoperfusion

PA-aO2 : The alveolar-arterial pressure difference for oxygen

PAC : Pulmonary artery catheters

PCC : Prothrombin complex concentrates

PHI : Prehospital Index

PNS : Parasympathetic nervous system

rfVIIa : Recombinant activated factor VIIa

RTS :Revised Trauma Score

RV : Residual volume

RVR : RenoVascular Resistance

SNF : Skilled nursing facility

SVR : Systemic vascular resistance

TBI : Traumatic brain injury

TLC : Total lung capacity

TLCO : Transfer capacity of the lungs for carbon monoxide

V 'A/Q' : Ventilation-perfusion ratio

VC : Vital capacity

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INTRODUCTION

Trauma in the elderly poses special challenges. Physiologic changes impact morbidity and mortality. Geriatric patients have different injury patterns that impact care ***(Siracuse, 2012).***

Trauma is the fifth leading cause of death in patients over the age of 65.The elderly sustain a disproportionate share of fractures and serious injury, accounting for approximately 28 % of deaths due to trauma while representing only 12% of the overall trauma population ***(Keller, 2012).***

In Egypt the average life span has increased to 71 years in 2011. The number of people over 65 years is 2.424 millions which represents 3.3 % of the total population which is now 85 millions ***(Egyptian census, 2011).***

The United States' population is living longer than ever before. The average American life span has increased by almost 30 years in the past century, from 47 years in the early 1900s to 76 years in 2000. It is predicted that the number of people over the age of 85 will likely double by the year 2020 and that by 2050 people over age 64 will make up over 20 % of the US population compared with 12 % today *(**Bonne & Schuerer, 2013).***

Older victims of trauma may have significant comorbid medical conditions and may be taking medications that can complicate injury and resuscitation. Until the early 1980s, trauma research traditionally focused on the pediatric and young adult population and few studies focused specifically on the elderly.Since that time, a plethora of studies have been performed on geriatric trauma. Unfortunately, most have been retrospective trauma registry reviews. Few prospective and even fewer randomized controlled trials have been performed. Much of the literature on geriatric trauma remains to be written ***(Goodmanson & Rosengart, 2012).***

Although it is clear that morbidity and mortality from major trauma in the geriatric population is high, the vast majority of patients survive to hospital discharge and a significant percentage return to their previous levels of function and activities of daily living ***(Freeland &Thompson, 2012).***

Aim of the Essay

The aim of this study is to know that age is a well-known risk factor in trauma patients. The aim of the present study was to define the age-dependent cut-off for increasing mortality in multiple injured patients. Pre-existing medical conditions in older age and impaired age-dependent physiologic reserve contributing to a worse outcome in multiple injured elderly patients. Aggressive management of trauma for elderly is justified by the favorable long-term outcome.

PHYSIOLOGICAL CHANGES IN GERIATRICS

Two important principles must be kept in mind when discussing the physiology of aging. First, aging is associated with a progressive loss of functional reserve in all organ system. Second, the extent and the onset of these changes are highly variable from one person to another. In the vast majority of older persons, physiological compensation are adequate, but the resultant limitations in the physiological reserve may become evident only during times of physiological stress, including exercise, illness and surgery ***(Peterson & Gordon, 2011).***

A) Changes in the cardiovascular system:

Physiology of Cardiovascular Aging

Major developments in aging include progressive replacement of supple, functional cardiac and vascular tissue by stiff fibrotic connective tissue, a decline in the responsiveness of β-receptors and diminution in tonic influence of the parasympathetic nervous system (PNS) ***(Smith et al., 2011).***

1. Connective tissue stiffening:

Connective tissue stiffening depends primarily on its constituent’s collagen and elastin. Both proteins are damaged over time, mostly from free radical production and glycosylation and replaced by fibrotic tissue. Free radicals are generated by production of oxidative metabolism and ionizing radiation. Glycosylation is a chemical reaction between sugars and amines, which produces reactive intermediates that attack other organism molecules. Control of sugar levels in diabetes mellitus slows down the damage caused by glycosylation ***(Cappelli et al., 2012).***

2. Arterial stiffening:

Arterial stiffening tends to elevate the systemic vascular resistance (SVR). Much of the stroke volume is stored in the thoracic aorta. A stiffened aorta results in a higher pressure during systole to accommodate the same stroke volume, leading to systolic hypertension. As a consequence, the left ventricle (LV) must work harder to eject blood into a rigid aorta and arterial tree. This chronic strain leads to hypertrophy of the LV ***(Verwoert et al., 2011).***

An increase in the duration of contraction accompanies hypertrophy. The calcium uptake and removal from the sarcoplasmic reticulum slows as a result of hypertrophy. Failure of rapid removal of calcium from the cytoplasm slows the process of muscle relaxation during diastole. Normally prompt relaxation of the ventricle leads to rapid early diastolic filling of the ventricles. In elderly hearts with delayed relaxation, early filling is impaired since the muscle remains contracted in early diastole leading to increased end-diastolic LV pressures ***(Cappelli et al., 2012).***

In less affected individuals, ventricular filling may occur adequately without excessive increase in atrial pressures via the atrial kick to preserve late diastolic filling. When the ventricle becomes stiffer, atrial pressures increase to overcome raised LV filling pressures which are reflected in the left atrium and pulmonary vasculature, leading to pulmonary congestion and diastolic heart failure ***(Kato et al., 2011).***

This phenomenon in the elderly contributes to heart failure not caused by systolic dysfunction. In this setting loss of sinus rhythm may depress cardiac output and arterial pressure more markedly in elderly patients ***(Franklin et al., 2009).***

3. Venous Stiffening:

The veins contain almost 80% of blood volume, which maintains preload to the heart. This reservoir is responsible for maintaining venous pressures and flow to the central circulation when fluid shifts or changes in blood volume occur such as during sympathetic nervous system activity or blood loss. However the veins stiffen with age, the decreased compliance of which impairs ability of the venous system to maintain a constant preload to the heart in situation of stress ***(Obermayer & Garzon, 2010).***

Venous stiffening may be responsible for exaggerated hypotension of blood loss and also peripheral pooling of blood with general or neuraxial anaesthesia ***(Ghauri & Nyamekye, 2010).***

4. Changes in Response to β- Receptor Stimulation:

The response to β- receptor stimulation is reduced in the elderly. The number of β receptors on the heart does not decline but coupling of the receptor to the intracellular transmitter appears to diminish with age ***(Fang et al., 2013).***

This change alters the response to exogenously administered catecholamines and to any stress including exercise and the baroreflex. The end result is a diminished chronotropic and inotropic response by the heart to β receptor stimulation. Although resting heart rates do not change much with age, the maximal attainable heart rate, stroke volume, ejection fraction, cardiac output (CO) and oxygen delivery (DO_2) are all reduced. B-adrenergic drugs elicit lesser chronotropic and inotropic response. The elderly person seems to have a β-blocked heart. However, the vascular response to exogenous α-adrenergic agonists does not change with age ***(Hefke et al., 2012).***

Perioperative stress, increased metabolic demands imposed by sepsis or shivering may predictably not be met with by older patients as increase in CO and DO_2 are limited by