Anesthesia and intensive care in cases of major burn

Essay
Submitted in partial fulfillment of Master Degree in Anesthesiology
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2016

Aim of the work

The aim of this work is to review and summarize anesthetic, pain and intensive care consideration in a case of major burn.

Content

	Page
Introduction	*1*
Chapter 1 :Classification & Pathophysiology Of Burn	*3*
Chapter 2 :Perioperative Management	*35*
Chapter 3 :Pain Management	*74*
Chapter 4: Burn Care, Fluid And Nutritional Management.	*95*
Summary	*112*
References	*115*
Arabic Summary	

التخدير والعناية المركزة فى حالات الحروق الكبرى

توطئة للحصول على درجة الماجستير بواسطة

طبيب/ عمرو محمد عاشور جبريل
بكالوريوس الطب و الجراحة –جامعة المنوفية

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List of Figures

No.	Title	Page
Figure 2	*Cross-sections of burned skin*	5
Figure 2	*burn size in adult and child body*	7
Figure 2b	*burn size in children*	7
Figure 3	*Jackson's burns zones and the effects of adequate and inadequate resuscitation*	9
Figure 4	*Systemic response to burn*	10
Figure 5	*Metabolic changes underlying insulin resistance post-burn*	15
Figure 6	*Comparison of pressure Vs time tracings for CMV and HFOV*	32
Figure 7	*Intraosseous needle placement. Insert needle at the level of tibial tubercle on the medial portion of the tibia. The needle is aimed carefully and laterally*	34
Figure 8	*Schematic drawing of event leading to the initiation, development and maintenance of pain following burn injury*	54
Figure 9	*Visual analogue scale*	56
Figure 10	*Numerical pain scale*	57
Figure 11	*Wong-Baker faces pain rating scale*	57
Figure 12	*Chemical structures of antibiotics used in topical antimicrobial therapy of burns*	83

List of Tables

No.	Title	Page
Table 1	*Classification of burn by depth*	4
Table 2	*American burn association burn injury severity grading system*	8
Table 3	*Pathophysiologic Changes During Early and Late Phases of Major Burn Injury*	12
Table 4	*Symptoms and Signs of Smoke Exposure and Inhalation Injury*	15
Table 5	*Carbon monoxide levels and toxicity*	17
Table 6	*Indications for intubation and mechanical ventilation following burns*	24
Table 7	*Indications for mechanical ventilation*	28
Table 8	*Burn resuscitation forumlas past and new*	37
Table 9	*Acute biochemical and hematologic changes during resuscitation*	38
Table 10	*Adult nonverbal scale*	58
Table 11	*Behavioral pain scale*	59
Table 12	*Critical-care pain observation*	60
Table 13	*Best predictive equations according to the burn literature*	76
Table 14	*Harris-Benedict formula*	76
Table 15	*Suggested micronutrients*	79

List of Abbreviations

2^{ry}TA	Secondary Tactile Allodynia
ABG	Arterial Blood Gas
ACS	Acute Coronary Syndrome
AIDS	Acquired Immune Deficiency Syndrome
ALI	Acute Lung Injury
APRV	Airway Pressure Release Ventilation
ARDS	Respiratory Distress Syndrome
ATP	Adenosine Triphosphate
BEE	Basal Energy Expenditure
BSA	Body Surface Area
BSA	Body Surface Area
BSA	Body Surface Area;
BSAB :	Percentage Of Total Body Surface Area Burn
CHO	Carbohydrate
CMV	Convential Mechanical Ventilation
CNS	Central Nervous System
CNS	Central Nervous System
CO	Carbon Monoxide
CO	Carbon Monoxide;
CO-Hb	Carboxyhaemoglobin
COX	Cyclo-Oxygenase
CRP	C-Reactive Protein
Cu	Copper
CVP	Central Venous Pressure
D_5W	Dextrose 5% In Water
DIC	Disseminated Intravascular Coagulopathy
DVT	Deep Venous Thrombosis
e.g.	Example
EA	Emrgence Agitation
ECG	Electrocardiogram
ECMO	Extracorporeal Membrane Oxygenation
ED	Emergency Department
EMLA	Prilocaine-Lidocaine Cream
etc.	Extra
EtCO2	End-Tidal Carbon Dioxide
ETTs	Cuffed Endotracheal Tubes
Fe	Iron
Fe_2	Ferrous Iron

FFA	Of Free Fatty Acids
FFP	Fresh Frozen Plasma
Fio_2	Fraction Of Inspired Oxygen;
FLACC	Face ,Leg ,Activity ,Cry ,Consolability Scale
g/dL	Gram Per Deciliter
H^2O^2	Hydrogen Peroxide
HDL	High Density Lipoprotien
HFOV	High-Frequency Oscillatory Ventilation
HFPV	High Frequency Percussive Ventilation
HIV	Human Immune Deficiency Virus
HNA	N-Acetylcysteine/Albuterol Nebulisation
HR	Heart Rate
HSP-70	Heat Shock Protein
HTN	Hypertension
Hx	History Of
ICU	Intensive Care Unit
IL	Interleukin
IV	Intravenous
kcal/kg/d	Kilo Calories Per Kilogram Per Day
LBM	Lean Body Mass
LBM	Lean Body Mass
LPL	Low Density Lipoprotien
LR	Lactate Ringer
LTV	Conventional Low-Tidal Volume Ventilation
M^2	Meter Square
MAOI	Monoamine Oxidase Inhibitor
mcg/kg	Microgram Per Kilogram
MCP	Monocyte Chemotactic Protein
mEq/l	Mille Equivalent Per Liter
mg/kg	Milligram Per Kilogram
MIF	Maximum Inspiratory Force;
MW	Maximum Voluntary Ventilation;
NMDA	N-Methyl-D-Aspartate Receptor
NO	Nitric Oxide
NPE:N ratio	The Nonprotein Kcalorie To Nitrogen Ratio
NSAIDs	Non-Steroidal Anti-Inflammatory Drugs
NVPS	Adult Non-Verbal Scale
O2	Oxygen
O^{2-}	Superoxide Anion

OH^-	Hydroxyl Ion
OIH	Opiate Induced Hyperalgesia
$P(A\text{-}a)O_2$	Alveolar-To-Arterial Po2 Gradient;
PA	Pulmonary Artery
$Paco_2$	Arterial Carbon Dioxide Tension;
PACU	Post Anaesthesia Care Unit
PaO_2	Partial Pressure Of Oxygen In Arterial Blood
$P_ao_2/Fi0_2$	Ratio Of Alveolar Po, To Inspired 0_2
P_aO_2/FiO_2	Ratio Of Arterial PO_2 To Inspired 0_2
Pc	Capillary Pressure
PCA	Patient-Controlled Analgesia
PE	Pulmonary Embolus
PEEP	Positive End-Expiratory Pressure
PEG	Percutaneous Endoscopic Gastrostomy
PGE2	Prostaglandin E2
PGI2	Prostacyclin
P_{high}	High Continuous Airway Pressure
P_{low}	Lowerset Continuous Airway Pressure
PRBC	Packed Red Blood Cell
PTSD	Posttraumatic Stress Disorder
PTSD	Post-Traumatic Stress Disorder
Q_s/Q_t	Intrapulmonary Right-To-Left Shunt Fraction
RDA	Recommended Dietary Allowances
REE	Resting Energy Expenditure
RR	Respiratory Rate
RWMAs	Regional Wall Motion Abnormalities
SBP	Systolic Blood Pressure
Se	Selenium
SIRS	Systemic Inflammatory Response Syndrome
SpO_2	Pulse Oximetry
SSRI	Selective Serotonin Reuptake Inhibitors
SVR	Systemic Vascular Resistance
TB	Tuberculosis
TBSA	Total Body Surface Area
Tds	Twice Daily
TNF	Tumor Necrosis Factor
TNF	Tumor Necrosis Factor
TOF	Triad Of Four
TXA2	Thromboxane A2
TXB2	Thromboxane B2

VAS	Visual Analogue Scale
VBG	Venous Blood Gas
VC	Vital Capacity
V_E	V_E Minute Ventilation .
VLDL	Very-Low-Density Lipoprotein
V_n/V_T	Dead Space Fraction;
WOB	Work Of Breathing
Zn	Zinc

ACKNOWLEDGEMENTS

First and foremost, this work owes its existence to God, the most kind and merciful. Words are too limited and will never be able to express my deep gratitude to all who helped me during the preparation of this study.

I gratefully acknowledge the sincere advice and guidance of ***Prof. Dr. Bahaa El-Din Ewis Hassan*** *Professor of Anaesthesiology & I.C.U , Faculty of Medicine, Ain-Shams University, for his kind supervision, professional suggestions, unlimited support and patience, persuit for perfection and meticulous revision of every possible detail. He has spared no effort, at any time, in helping me. Really, I was fortunate to carry out this work under her supervision . Also I must thank him for helping me in my career as he taught me how to be a real man and a dependable person .*

I am greatly honored to express my sincere appreciation to ***Dr. Walid Ahmed Abd El-Rahman Mansour****, Lecturer of Anaesthesiology & I.C.U, Faculty of Medicine, Cairo University, for his valuable advice, continuous encouragement, moral support, constructive direction and indispensable guidance.*

My acknowledgment will not be completed without expressing my respectful thanks and gratitude to ***Dr. Dina Salah El-Din Mahmoud****, Lecturer of Anaesthesiology & I.C.U, Faculty of Medicine, Cairo University, for her continuous & informative help, kind & supportive guidance, valuable facilities, unlimited time and effort offered to me during this study.*

Last but not least, I owe a particular dept of gratitude to my parents, who taught me how to walk in the path of knowledge with steady steps, and took on thier own to support these steps allthrough the way; and to whom I dedicate this work.

Introduction

The skin is the largest organ of the human body, and it plays a very important role in physiology and the maintenance of body homeostasis. A large burn can alter the ability of almost all of the body's organs and significantly increase the patient's risk for infection ***(Purdue et al, 2002).***

Burns are among the most devastating injuries encountered in medicine and are a leading cause of life-threatening trauma worldwide. The risk of death from burn injury increases with advancing age, increasing burn size, and the presence of inhalation injury. Up to 30% of burn injuries sustained each year are considered major burn injuries, characterized by burns to over 20% of total body surface area (TBSA) in adults, more than 10% TBSA in children and elderly patients, or full thickness burns to >5% TBSA . Burns involving the face, airway, or genitalia are also classified as major burn injuries regardless of the percentage of TBSA affected ***(Harbin and Norri , 2012).***

A better understanding of the pathophysiology of burn injuries, coupled with advances in burn resuscitation, critical care, and surgical practice, has resulted in improved survival in severely burned patients over the past 3 decades ***(Zhou et al ,2002)*** .Severe burn injures causes extensive physiologic changes. Changes begin when significant tissue trauma leads to widespread release of both local and systemic inflammatory mediators. Which cause an increase in systemic and pulmonary vascular resistance. The vasoconstriction increases afterload and contributes to decreased cardiac output. This vasoconstriction results in decreased flow to vascular beds that are already underperfused. Tissue ischemia and secondary organ injury can result ***(Charles et al, 2011) .***

Modern care for the severly burned patient can be divided into four overlapping phases: (1) initial evaluation and resuscitation, (2) initial excision and biological closure, (3) rehabilitation and reconstruction. The anaesthesiologist's services may be called on for airway management, intravenous access, and fluid resuscitation, in addition to providing sedation and analgesia in acute phase. Administration of analgesia and sedation for wound care and provision of anaesthesia for excision and grafting are even more challenging tasks. Reconstructive surgery poses special challenges because of the development of contractures, making airway management and positioning difficult ***(Lee Fleisher, 2012).***

Pain after burn injuries is one of the most severe forms of acute pain. Although wound and pain management have gradually improved over the last years, a sufficient pain management after severe burn trauma is still a global problem and a major challenge for the health care personnel. An adequate analgesia helps reducing complications and cause faster healing ***(Jeschke et al , 2012).***

Classification of burn

Burns are classified according to depth & drgree , according to the cause or according to burn size (***Heimbach et al, 2002).***

a) Burn classified by depth & degree :-

The old classification of burn according to depth and degree is the four-part classification which classify burn into first , second , third and fourth degree burn , for details see (table 1) (***Heimbach et al , 2002).***

The four-part classification has been replaced by the new system that classifies burns as either superficial, partial-thickness or full-thickness burn injury (fig. 1). This classification is important for patients once they are in a burn centre and less important when they are in the emergency rooms because the clinical appearance of the wounds changes over the first 3-5 days post injury. Clinical classification of burn depth in the hands of experienced burn clinicians has a poor predictive value and is only 70% accurate at best ***(Davidge and Fish, 2008).***

Newer modalities for the evaluation of depth of injury are being used in many centers with various degrees of benefit (e.g., laser flow Doppler, etc.) (***Riordan et al, 2003).*** laser Doppler imaging is the only technique that has been shown to accurately predict wound outcome with a large weight of evidence. Moreover this technique has been approved for burn depth assessment ***(Sheridan 2008).***

Table1: Classification of burn by depth

Classification	Burn depth	Appearance	Sensation	Outcome
Superficial				
First degree	Confined to epidermis	Dry and red; blanches	Painful	Heals spontaneously
Partial thickness				
Second degree				
Superficial dermal	Epidermis and upper dermis	Blisters; moist, red and weeping; blanches	Painful to air and temperature	Heals spontaneously
Deep dermal	Epidermis and deep dermis	Blisters; wet or waxy dry; patchy to cheesy white to red; does not blanch	Pressure only	Requires excision and grafting for return of function
Full thickness				
Third degree	Destructio n of epidermis and dermis	Waxy white, leathery gray or charred and black; dry and inelastic; does not blanch	Deep pressure only	Requires complete excision; limited function
Fourth degree	Muscle, fascia, bone		Deep pressure only	Requires excision and grafting; limited function.

(***Morgan et al , 2000)***