PERIOPERATIVE CARE OF THE BURN-INJURED PATIENT

Essay

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in Anesthesia

By

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بسم الله الرحمن الرحيم

قالوا

سبحانك لا علم لنا

إلا ما علمتنا إنك أنت

العليم الحكيم

صدق الله العظيم

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List of Abbreviations

Abbr.	Title
AAG	**:** Albumin and α1acid glycoprotein
ARDS	**:** Acute respiratory distress syndrome
BRI	**:** Burn Resuscitation Index
CNS	**:** Central nervous system
COHb	**:** Carbon Monoxide Toxicity Based on Blood Carboxyhemoglobin
ECG	**:** Echocardiogram
ETT	**:** Endotracheal tube
ICU	**:** Intensive care unit
IV	**:** Intravenous
NASIDs	**:** Nonsteroidal antiinflammatory drugs
NDMRs	**:** Nondepolarizing muscle relaxants
PCO2	**:** Blood carbon dioxide partial pressure
PT	**:** Prothrombin
PTT	**:** Partial thromboplastin
RBC	**:** Red blood cells
RL	**:** Ringer's Lactate
TBSA	**:** Total Body Surface Area
UV	**:** Ultraviolet
WBC	**:** White blood cell count

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Abstract

Background: Burn injuries are challenge both to patients and members of the burn team. Anesthesiologists are involved throughout the resuscitation and recovery phases of the burn patient in the emergency department, burn intensive care unit and operating room. **Aim of the Work.** The aim of this essay is to provide an updated review of the pathophysiology of burn injury and the proper anesthetic management of burn- injured patients. **Conclusion:** During anesthesia there is a continual requirement to monitor the patient's physiological state, to confirm correct equipment function, and to avoid patient awareness. Accepted recommendations state that the following monitoring devices are essential to the safe conduct of anesthesia: pulse oximetry, non-invasive blood pressure monitor, ECG and capnography. Securing central venous access before generalized tissue oedema obscures landmarks is preferable.

Keywords: burn, fluid resuscitation, pain management, anesthetic management

Introduction

Burn injury is a leading cause of life-threatening trauma worldwide, and is associated with an average mortality rate of 0.8%. Patients with an increased risk of death from burn injuries include elderly patients and patients with large burns or inhalation injury **(Harbin *et al.*, 2012).**

The American Burn Association estimates that more than 450,000 burn-injured patients seek medical treatment in the United States each year, resulting in 45,000 hospitalizations and 4,000 deaths **(American Burn Association, 2010).**

Burns can be classified by depth, mechanism of injury, extent, and associated injuries. The most commonly used classification is based on the depth of injury. The depth of a burn is usually determined via examination, although a biopsy may also be used. The size of a burn is measured as a percentage of total body surface area (TBSA) affected by partial thickness or full thickness burns **(Tintinalli, 2010).**

Dramatic improvement in patient outcomes over the past 3 decades has been attributed to advancements in the understanding of major burn injury pathophysiology, improved burn shock management, early aggressive surgical intervention, and the development of specialized burn treatment centers. Yet providing optimal care to patients with major burn injuries remains challenging **(Woodson, 2013).**

Providing optimal care for patients with major burn injuries requires the coordinated effort of multidisciplinary teams in which anesthesia providers play a critical role. Anesthetic management for burn surgery can be technically challenging because of difficult airway management and vascular access, as well as cognitively demanding because of dramatic pathophysiologic changes that compromise hemodynamic stability and alter patient response to many anesthetic agents **(Norris *et al.*, 2012).**

Airway and ventilatory management of patients with burn injury is of utmost importance Whether or not intubation occurs immediately after injury, frequent re-evaluation of the airway and respiratory status is critical because of the dynamic evolution of maximal airway edema and complications that may develop as a result of superimposed smoke inhalation. Both of these situations may impair ventilation and oxygenation **(Marko *et al.*, 2003).**

Important cardiovascular changes occur in the presence of major burn injury. Patients with major burn injury are initially hypovolemic, owing to extensive plasma loss into burned tissues and increased systemic vascular permeability; thus, fluid resuscitation is one of the pillars of treatment of this patient Population **(Latenser, 2009).**

Aim of the Essay

The aim of this essay is to provide an updated review of the pathophysiology of burn injury and the proper anesthetic management of burn- injured patients.

Chapter (1):
Anatomy of the Skin

I. Anatomy of the Skin

The skin is the largest organ of the body, accounting for about 15% of the total adult body weight. It performs many vital functions, including protection against external physical, chemical, and biologic assailants, as well as prevention of excess water loss from the body and a role in thermoregulation. The skin is continuous, with the mucous membranes lining the body's surface. The integumentary system is formed by the skin and its derivative structures (Figure 1). The skin is composed of three layers: the epidermis, the dermis, and subcutaneous tissue **(Kanitakis, 2002).**

The outermost level, the epidermis, consists of a specific constellation of cells known as keratinocytes, which function to synthesize keratin, a long, threadlike protein with a protective role. The middle layer, the dermis, is fundamentally made up of the fibrillar structural protein known as collagen. The dermis lies on the subcutaneous tissue, or panniculus, which contains small lobes of fat cells known as lipocytes. The thickness of these layers varies considerably, depending on the geographic location on the anatomy of the body. The eyelid, for example, has the thinnest layer of the epidermis, measuring less than 0.1 mm, whereas the palms and soles of the feet have the thickest epidermal layer, measuring approximately 1.5 mm. The dermis is thickest on the back, where it is 30–40 times as thick as the overlying epidermis **(James *et al.*, 2006).**

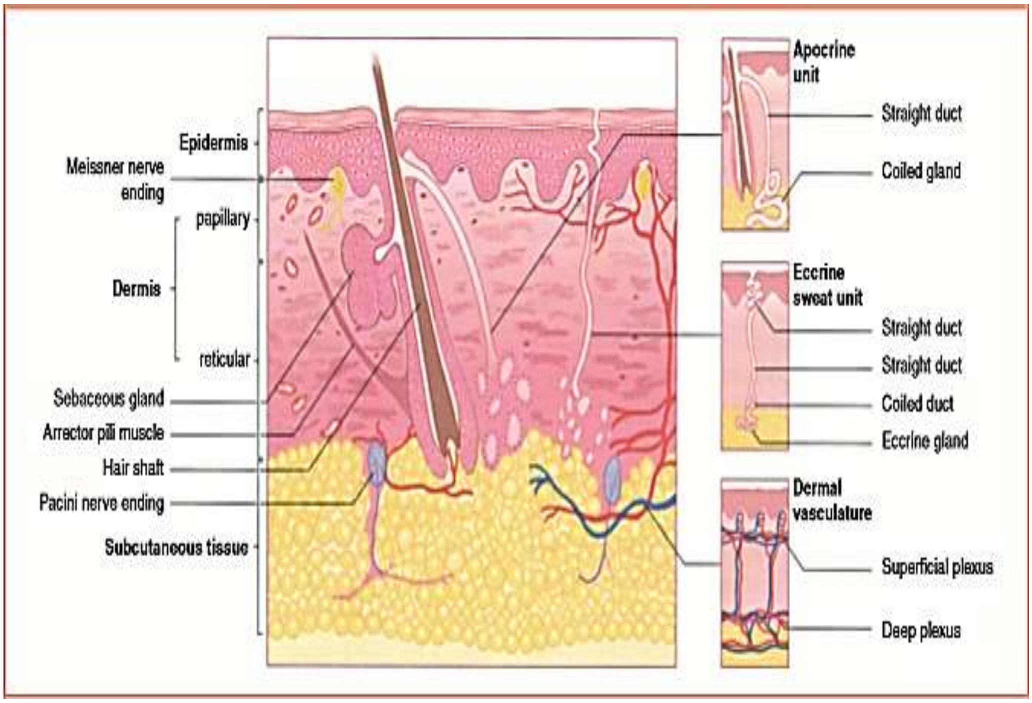

Figure (1): Cross Section of the Skin **(James *et al.*, 2006).**

A. Epidermis

The epidermis is a stratified, squamous epithelium layer that is composed primarily of two types of cells: keratinocytes and dendritic cells. The keratinocytes differ from the "clear" dendritic cells by possessing intercellular bridges and ample amounts of stainable cytoplasm. The epidermis harbors a number of other cell populations, such as melanocytes, Langerhans cells, and Merkel cells, but the keratinocyte cell type comprises the majority of the cells by far. The epidermis commonly is divided into four layers according to keratinocyte morphology and position as they differentiate into horny cells, including the basal cell layer (stratum germinativum), the squamous cell layer (stratum spinosum), the granular cell layer (stratum granulosum), and the cornified or horny cell layer (stratum corneum) (Figure 2) **(James *et al.*, 2006).**

The lower three layers that constitute the living, nucleated cells of the epidermis are sometimes referred to as the stratum malpighii and rete malpighii (Murphy). The epidermis is a continually renewing layer and gives rise to derivative structures, such as pilosebaceous apparatuses, nails, and sweat glands. The basal cells of the epidermis undergo proliferation cycles that provide for the renewal of the outer epidermis. The epidermis is a dynamic tissue in which cells are constantly in unsynchronized motion, as differing individual cell populations pass not only one another but also melanocytes and Langerhans cells as they move toward the surface of the skin **(Chu, 2008).**

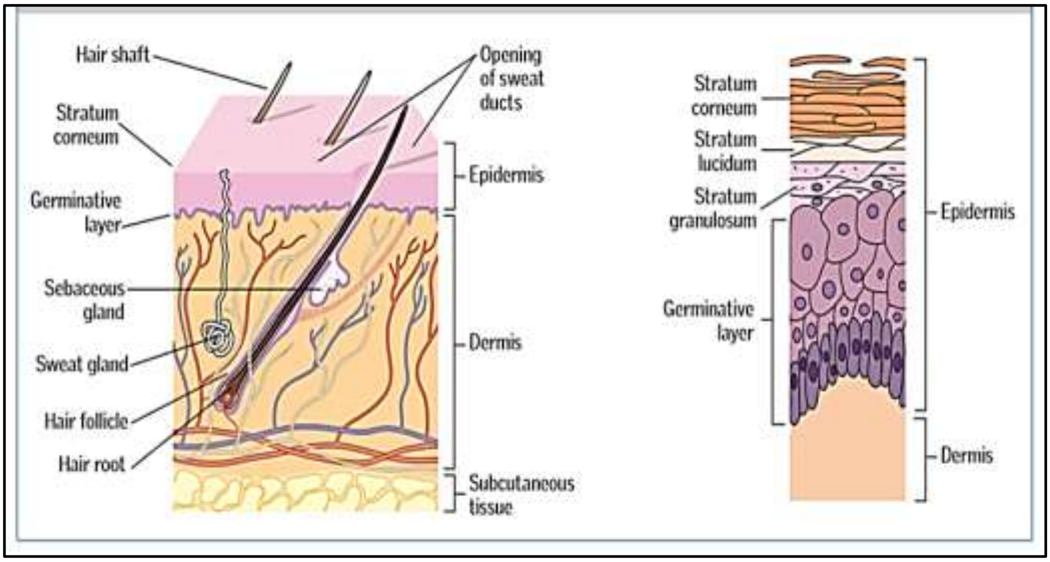

Figure (2): Layers of the Epidermis and Main Structures of the Dermis **(McLafferty *et al.*, 2012).**

B. Dermis

The dermis provides a flexible but tough support structure. It is between 1-4 mm thick (depending on age and body location), making it much thicker than the epidermis. It contains the blood and lymphatic vessels and nerves which supply the skin, as well as sweat glands and hair follicles **(Berger *et al.*, 2007).**

Elastin is the other protein that is code posited with collagen by fibroblasts into the dermis and is responsible for elastic recoil. Elastin is the protein that returns skin continuity when it is pinched or stretched. This protein also prevents excessive injury with the daily use of the skin when sitting, bending, stretching, and grasping **(Wolfe, 2002).**