



PRESSURE SORES IN INTENSIVE CARE UNIT

An Essay Submitted for partial fulfillment of master degree in Intensive care
medicine

By

Soad Gomaa Ahmed

M.B.B.CH (2006)

Faculty of Medicine
Elmansora University

Under supervision of

Prof. Dr. Amr Essam El-deen Abdel-Hamed

Professor of anesthesiology and intensive care
Faculty of Medicine
Ain Shams University

Dr. Ahmed Mohamed Khamis

Lecturer of anesthesiology and intensive care
Faculty of Medicine
Ain Shams University

Faculty of Medicine
Ain Shams University

Faculty of Medicine
Ain Shams University

2011



قرح الفراش في وحدة العناية المركزة

مقال مقدم

كتوطئة جزئية لمتطلبات الحصول على درجة الماجستير في تخصص العناية المركزة

مقدمة من الطبية

سعاد جمعة احمد

بكالوريوس الطب و الجراحة (2006)

كلية الطب- جامعة المنصورة

المشرفون

الاستاذ الدكتور/ عمرو عصام الدين عبد الحميد

أستاذ التخدير و العناية المركزة

كلية الطب- جامعة عين شمس

الدكتور/ احمد محمد خميس

مدرس التخدير و العناية المركزة

كلية الطب- جامعة عين شمس

كلية الطب- جامعة عين شمس

كلية الطب- جامعة عين شمس

٢٠١١

It is concluded that the pressure ulcer is an area of localized damage to the skin and under lying tissue. Pressure ulcers are a serious medical problem that can affect a patient in any health care setting. Pressure ulcers typically occur among patients who can't move or have lost sensation and result from prolonged periods of immobility. Pressure ulcers constitute an important cause of morbidity particularly amongst frail elderly and physically disabled patients. The presence of pressure ulcers often makes the patient's medical care more complicated and reduces the patient's quality of life.

Pressure ulcers are caused by sustained mechanical loading; without a mechanical loading no pressure ulcer will develop. External loading of the tissues leads to a non uniform internal stress and strain state. This internal mechanical state depends on the magnitude of the applied loading, type of external loading (pressure, shear, friction), and the mechanical and geometrical properties of the tissues. In addition, the time of exposure to mechanical loading also plays an important role in the development of tissue damage. On the other hand, the ability of the tissue to withstand mechanical loading determines whether a certain loading will lead to the development of an ulcer or not. Both the mechanical loading and patient susceptibility are influenced by intrinsic and extrinsic factors. Intrinsic factors are related to the individual, e.g. with age, mobility, weight, posture, incontinence and nutritional state. Extrinsic factors are related to the environment, e.g. with nursing, the contact surface, nutrition, and the temperature and humidity of the environment. In clinical practice, these risk factors are used in risk assessment scales to identify patients at risk of developing pressure ulcers.

ACKNOWLEDGEMENT

First and foremost I am deeply indebted to **Allah**, the most gracious and the most merciful whose help I will always seek.

I will try humbly to lead on his path, and without his willing I will achieve nothing.

I would like to express my deepest appreciation and gratitude to **Professor Dr. Amr Essam El-deen Abdel-Hamed**, Professor of Anesthesia and Intensive Care, Faculty of Medicine, Ain Shams University for his great support, close supervision and continuous encouragement throughout the whole work; it is a great honor to work under his supervision.

I stand in great debt to **Dr. Ahmed Mohamed Khamis** Lecturer of Anesthesia and Intensive Care, Faculty of Medicine, Ain Shams University for her continuous care, guidance, supervision, and meticulous care throughout the whole study.

The co-operation and assistance of all the staff of Anesthesia and Intensive Care Department, Faculty of Medicine, Ain Shams University are deeply appreciated.

Finally special thanks to my family.

Soad gomaah ahmed

بسم الله الرحمن الرحيم

"رب قد آتيتني من الملك وعلمتني من تأويل الأحاديث"

صدق الله العظيم

Table of Contents	Pages
List of Figures	I
List of Abbreviations	III
List of Tables	IV
Introduction	ث
Chapter-1 : Definition and pathophysiology	3
Chapter-2 : Incidence and staging of pressure sores	25
Chapter-3 : Risk factors of pressure sores in critical care units	٣٣
Chapter-4 : Prevention of pressure sores	٤٩
Chapter-5 : Management of pressure sores	72
English Summary	102
References	104
Arabic Summary	

List of Figures

Figure No.	Title	Page
1	Anatomy of the skin	4
2	Pressure ulcer stage II	6
3	Foot ulcer in a diabetic patient	7
4	Toe ulcer in a diabetic patient with neuropathy	8
5	Necrotic leg ulcer (arterial) located at the shin area	8
6	Typical venous ulcer	9
7	Effect of compressive force over bony prominence	11
8	Pathology of pressure sores	20
9	vulnerable areas to pressure ulcer development	23
10	Stage I of pressure sores	27
11	Stage II of pressure sores	28
12	Stage III of pressure sores	29
13	Stage IV of pressure sores	30
14	Unstageable of pressure sores	31
15	Suspected Deep Tissue Injury	32
16	Shear is extrinsic factor of pressure sores	37
17	Friction is extrinsic factor of pressure sores	38

Figure No.	Title	Page
18	Moisture is extrinsic factor of pressure sores	39
19	30-degree tilt	54
20	The mechanism of action of Static Support Surfaces	58
21	The mechanism of support of Dynamic Mattress support	58
22	Mattresses	59
23	Foam	60
24	Sheepskins	61
25	Air mattresses	62
26	Examples of various protective surfaces designed for prevention and treatment of pressure ulcers.	63
27	Stages of wound healing	73
28	Pressure ulcer before therapy	88
29	Pressure ulcer after therapy	88
30	Pressure ulcer after 2 weeks therapy	88
31	Small sacral pressure sores can be reconstructed with the inferior based skin rotation flap, with or without the superior gluteus maximus myocutaneous flap	95
32	Sacral pressure ulcer before and after flap closure	96

List of Abbreviations

PU	pressure ulcer
RH	Reactive Hyperemia
TPP	tissue perfusion pressure
APACHE	Acute Physiology and Chronic health Evaluation
USA	United states of America
NPUAP	National Pressure Ulcer Advisory Panel
Tc	Technetium
PUR	pressure ulcer risk
SURE	Skin Ulcer Risk Evaluation
CURS	The Cornell Ulcer Risk Score
ICU	Intensive care unit
EPUAP	The European Pressure Ulcer Advisory Panel
BMI	Body Mass Index
AHCPR	The Agency for Health Care Policy and Research
pH	Potenz Hydrogen
SCI	Spinal cord injury
HVMS	high voltage monophasic stimulation
DNA	Deoxyribonucleic acid
ATP	Adenosine tri phosphate
RNA	Ribnucleic Acid

List of Tables

No.	Tables	Page
1	Schematic representation of changes and damage involved in pressure sore development	19
2	Schema which accounts for the relative contributions of the duration and intensity of pressure and the tolerance for pressure	33
3	Norton scale for pressure ulcer risk assessment	45
4	Waterlow pressure ulcer risk assessment tool	47
5	Simplified representation of the Braden Scale	48
6	Selected mechanical methods used for relieving chronic pressure as well as for pressure ulcer treatment and prevention.	66
7	Selected mechanical methods used for relieving chronic pressure and for pressure ulcer treatment and prevention	67
8	Decision flowchart for individualized planning of decubitus ulcer prevention.	71
9	Methods of Pressure Ulcer Debridement	80
10	Characteristics of Some Major Dressing	82

Introduction

The pressure sores are also known as bedsores and decubitus ulcers and defined as an area of localized damage to the skin, muscle and underlying tissue, caused by shear, friction or unrelieved pressure, usually over bony prominences (*TAN, 2001*).

Pressure sores represent a common but preventable condition seen most often in high-risk populations' such as elderly persons and those with physical impairments. The epidemiology of pressure sore varies considerably by clinical settings, with the incidence rates ranging from 0.4% to 38% in acute care, 2.2% to 23.9% in long term care, 0% to 17% in home care the development of pressure sores can interfere with recovery, may be complicated by pain and infection, and can contribute to excesses in hospital length of stay. The presence of pressure sores is a marker of poor overall prognosis and may contribute to premature mortality in some patients (*Madhuri, 2006*).

Pressure sores first appear as reddened areas that don't blanch when you touch them. Most sores then continue to open and become deeper wounds. Nurses and doctors will describe pressure sores by their depth. Stage I is just some redness. Stage II is some skin loss that looks like a blister or abrasion. Stage III is when the sore has extended through the skin down to the muscle. In stage IV the wounds extend through the muscle to bone (*Santa, 2006*).

The pressure sores are more likely to occur in those who are seriously ill, are neurologically compromised (i.e. individuals with spinal cord injuries), have impaired mobility who are immobile suffer from impaired nutrition, obesity, poor posture or use equipment such as seating or beds which don't provide appropriate pressure relief (*NHS, 2008*).

The pressure sores result from impairment of blood flow and mechanical stress to the skin and tissue over a bony area that has under pressure for long a prolonged period .Other important cause are horizontal forces working in parallel to the skin surface, which make upper layers of tissue move over the lower layers. Excessive exposure to the moisture such as sweat, blood, urine or faeces, skin maceration, accumulation of anaerobic products stimulated by emotional stress (*Katarzyna, 2005*).

The pressure sores can be prevented by careful and frequent skin assessments; frequent repositioning, managing moisture and maximizing nutritional support are common interventions for prevention of pressure sores. Progressive mobility techniques and repositioning techniques used to prevent pressure sores (*Irene, 2010*).

Nutritional supplementations, including carbohydrates, fats and protein, may decrease the incidence of pressure sores in high risk patients. Arginine and vitamin A are also important in the wound healing process .the modulation of nitric oxide, together with growth factors, may serve as a key therapy (*Pierre ,2002*).

Chapter 1

Definition and Pathophysiology

- **Anatomy and function of the skin:**

The skin structure composed of the 3 layers of skin: the epidermis, dermis, and subcutaneous tissue. Shown in figure (1)

- **Epidermis:**

The epidermis is the outer layer of skin. The thickness of the epidermis varies in palms and soles at 1.5 mm. It is the thinnest on the eyelids at .05 mm and the thickest on the palms and soles at 1.5 mm. The weight of the human's skin about 11 kg. The skin is the largest human organ. The epidermis is contiguous with the mucous membranes and the lining of the ear canal, consists of live, continuous dividing cells covered on the surface by dead cells that were originally deeper in the dermis but were pushed upward by the newly developing. This external layer is replaced every 3-4 weeks .The dead cells contain keratin an insoluble fibrous protein that forms the outer barrier of the skin and the capacity to repel pathogens and prevent excessive fluid loss from the body. The melanocytes are the special cells of the epidermis that are involved in producing the pigment melanin which colors the skin and hair (*Smeltzer et al, 2000*).