



بسم الله الرحمن الرحيم

∞∞∞∞

تم رفع هذه الرسالة بواسطة / مني مغربي أحمد

بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى

مسئولية عن محتوى هذه الرسالة.

ملاحظات: لا يوجد





The Versatility of Usage of Hydrosurgical Debridement in Major Burns

Thesis

*Submitted For Partial Fulfillment of Master Degree in
Plastic, Burn and Maxillofacial Surgery*

By

Mohamed Reda Elsayed

M.B.B.Ch. Mansoura University

Under supervision of

Prof. Amr Abd Elwahab Reda Mabrouk

*Professor of Plastic, Burn and Maxillofacial Surgery
Faculty of Medicine, Ain Shams University*

Dr. Tarek Salem Elmenoufy

*Consultant of Plastic, Reconstructive and Burn Surgery
Military Medical Academy*

Dr. Riham Zakaria Lashin

*Assistant Professor of Plastic, Burn and Maxillofacial Surgery
Faculty of Medicine, Ain Shams University*

Dr. Mohamed Samir Badawy

*Lecturer of Plastic, Burn and Maxillofacial Surgery
Faculty of Medicine, Ain Shams University*

*Faculty of Medicine
Ain Shams University*

2022

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قَالَ

سَبَّحَانَكَ لَا إِلَهَ إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ
الْعَلِيمُ الْعَظِيمُ

صدق الله العظيم

سورة البقرة الآية: ٣٢

Acknowledgment

*First and foremost, I feel always indebted to **ALLAH**, the Most Kind and Most Merciful.*

*I'd like to express my respectful thanks and profound gratitude to **Prof. Amr Abd Elwahab Reda Mabrouk**, Professor of Plastic, Burn and Maxillofacial Surgery, Faculty of Medicine, Ain Shams University for his keen guidance, kind supervision, valuable advice and continuous encouragement, which made possible the completion of this work.*

*I am also delighted to express my deepest gratitude and thanks to **Dr. Tarek Salem Elmenoufy**, Consultant of Plastic, Reconstructive and Burn Surgery, Military Medical Academy, for his kind care, continuous supervision, valuable instructions, constant help and great assistance throughout this work.*

*I am deeply thankful to **Dr. Riham Zakaria Lashin**, Assistant Professor of Plastic, Burn and Maxillofacial Surgery, Faculty of Medicine, Ain Shams University, for her great help, active participation and guidance.*

*I wish to introduce my deep respect and thanks to **Dr. Mohamed Samir Badawy**, Lecturer of Plastic, Burn and Maxillofacial Surgery, Faculty of Medicine, Ain Shams University, for his kindness, supervision and cooperation in this work.*

Mohamed Reda

The Versatility of Usage of Hydrosurgical Debridement in Major Burns

ABSTRACT

Background: Burn wound debridement is an important step in management of major burns. There are several techniques of burn wound debridement include surgical, enzymatic, mechanical and autolytic. Hydrosurgical system is an additional type of debridement that preserve viable tissues, create smooth wound bed and decrease bacterial load.

Objective: This study compared the hydrosurgical debridement and traditional surgical methods of debridement of major burns.

Patients and Methods: This study is a prospective and comparative that compared traditional surgical debridement versus hydrosurgical debridement of major burns. This study was conducted between December 2020 to December 2021 at 2 major burn centers in Egypt (Burn unit of Ain Shams University hospital and Armed Forces Burn Center at El Helmia Armed Forces Hospital).

Twenty patients with mixed depth of major burns were divided into two groups. In group I (n=10) debridement done surgically by Watson knife. In group II (n=10) debridement done by hydrosurgical system. Both groups were compared regarding intraoperative blood loss, blood component transfusion, mean number of sessions, mean duration of each session, healing time, risk of infection and Vancouver scar scale.

Results: The current study showed that, the estimated blood loss, healing time, blood component transfusion and risk of infection were lower in group II than group I.

Keywords: VERSAJET®, burn debridement, burn excision, wound bed.

List of Contents

Title	Page No.
List of Abbreviations.....	i
List of Tables	iii
List of Figures	v
Introduction	1
Aim of the Work.....	2
Review of Literature	
Pathophysiology Of Burns.....	3
Management of Burns	23
Hydrosurgery Debridement	33
Patients and Methods.....	41
Results	63
Discussion	88
Summary	94
Conclusion	96
References	97
Arabic Summary	—

List of Abbreviations

Abb.	Full term
ACS.....	Abdominal compartment syndrome
AKI	Acute kidney injury
ALT.....	Alanine aminotransferase
AST	Aspartate aminotransferase
ATLS.....	Advanced Trauma Life Support
BSA.....	Body surface area
CBC	Complete blood count
CNS	Central nervous system
CT	Computed tomography
ECG	Electrocardiography
GIT.....	Gastrointestinal tract
Hb	Hemoglobin
IAH	Intraabdominal hypertension
IL-6	Interleukin-6
IQR	Inter-quartile range
IV	Intravenous
MC	Mast cells
MDA	Malondialdehyde
MIF	Migration inhibitor factor
MRI.....	Magnetic resonance imaging
NF-κB	Nuclear factor κB
NO	Nitric oxide
ROS.....	Reactive oxygen species
SBI.....	Severe burn injury

List of Abbreviations Cont...

Abb.	Full term
SIRS.....	Systemic inflammatory response syndrome
STSG	Split-thickness skin graft
TBSA	Total body surface area
TGF.....	Transforming growth factor
Th-2	T helper 2
TNF- α	Tumor necrosis factor- α
VAT.....	Value-added tax
WBC	White Blood Cells
WHO	World Health Organization

List of Tables

Table No.	Title	Page No.
Table (1):	American Burn Association severity classification.....	6
Table (2):	Vancouver scar scale	61
Table (3):	Patient satisfaction scale.....	61
Table (4):	Demographic data for studied patients including age, sex, smoking, and residence.	63
Table (5):	Clinical data on admission for studied patients including mode of burn, suspected inhalational injury, extent, depth of burned area and mean HB.....	65
Table (6):	Surgical intervention for studied patients including session 1, session 2, session 3 and session 4	67
Table (7):	Immediately post-operative data for studied patients including Mean Hb post-operative (gm/dl), need for Blood component transfusion, incidence of Infection.	69
Table (8):	Late postoperative data for studied patients including Remaining Percentage that required Grafting, Healing time (days), Texture (regular or irregular), Vancover scar score component and its total score.....	70
Table (9):	Comparison between knife based surgical debridement group (group I) and hydrosurgical debridement group (group II) regarding demographic data.....	72

List of Tables Cont...

Table No.	Title	Page No.
Table (10):	Comparison between knife based surgical debridement group (group I) and hydrosurgical debridement group (group II) regarding clinical data on admission.....	73
Table (11):	Comparison between knife based surgical debridement group (group I) and hydrosurgical debridement group (group II) regarding surgical intervention data.....	74
Table (12):	Comparison between group I and group II regarding number of patients in each session and mean number of sessions	78
Table (13):	Comparison between knife based surgical debridement group (group I) and hydrosurgical debridement group (group II) regarding immediate postoperative data.....	79
Table (14):	Comparison between knife based surgical debridement group (group I) and hydrosurgical debridement group (group II) regarding late postoperative data	82

List of Figures

Fig. No.	Title	Page No.
Figure (1):	The Rule of Nines used in burn size	5
Figure (2):	Jackson's burns zones and the effects of adequate and inadequate resuscitation	7
Figure (3):	Superficial partial-thickness burn	24
Figure (4):	Mixed partial-thickness burn	24
Figure (5):	Full-thickness burn a small burn caused by contact with a hot motorcycle exhaust pipe	25
Figure (6):	Hydrosurgery system and debridement design.....	35
Figure (7):	VERSAJET II Hydrosurgery	37
Figure (8):	Escharotomy of left forearm after circumferential burn in emergency room.	45
Figure (9):	Watson knife and its blade.	49
Figure (10):	(A) Mixed pattern burn in back. (B) Late follow up, grafts were taken completely and show hypopigmentation after debridement by Versajet®. (C) Mixed pattern burn in both lower limbs preoperatively. (D) Late follow up after complete healing show hyperpigmentation of the burned area after debridement by Watson knife.	50
Figure (11):	VERSAJET® hydrosurgery device.....	51
Figure (12):	Debridement of the burn wound in the chest with the VERSAJET® hydrosurgery system. Hand piece of the device was arrowed.....	53
Figure (13):	Meshed grafts(1.5: 1).....	54

List of Figures Cont...

Fig. No.	Title	Page No.
Figure (14):	Mesher (1.5: 1)	54
Figure (15):	Grafts applied to the bed after debridement and fixed by staplers.....	55
Figure (16):	Partial thickness burn over the anterior trunk during debridement by Versajet® intraoperatively hand piece of the device was arrowed.	55
Figure (17):	Debridement of burn in the neck and chest by Versajet® device, A) Hand piece of the device, B) adrenaline soaked gauze over the debrided area for heamostasis.	56
Figure (18):	Mixed pattern burn in left upper limb before and after hydrosurgical debridement by Versajet®.	56
Figure (19):	Mixed pattern burn in left lower limb before and after hydrosurgical debridement by Versajet®.	57
Figure (20):	Mixed pattern burn in abdomen and left breast before and after hydrosurgical debridement by Versajet®.	57
Figure (21):	A case of hydrosurgical debridement by versajet® of mixed pattern burn in both feet, A) Intraoperatively before starting hydrosurgical debridement, B) First dressing after debridement, C) During follow up, complete healing occurred without grafting.....	58
Figure (22):	Sex distribution among the studied patients.....	63

List of Figures Cont...

Fig. No.	Title	Page No.
Figure (23):	Residence of the studied patients.....	64
Figure (24):	Mode of burn among studied patients.....	66
Figure (25):	Suspected inhalational injury among studied patients.....	66
Figure (26):	Incidence of infection among studied patients.....	69
Figure (27):	Texture among studied patients.....	71
Figure (28):	Comparison between group I and group II regarding mean duration of sessions (min).....	76
Figure (29):	Comparison between group I and group II regarding mean estimated blood loss (ml) in each session.....	76
Figure (30):	Comparison between group I and group II regarding percentage of patients needing blood component transfusion in each session.	77
Figure (31):	Comparison between group I and group II regarding number of patients in each session and mean number of sessions.	78
Figure (32):	Comparison between group I and group II regarding mean hemoglobin postoperatively (gm/dl)	80
Figure (33):	Comparison between group I and group II regarding percentage of patients receiving blood component transfusion postoperatively.....	80
Figure (34):	Comparison between group I and group II regarding percentage of patients with infection postoperatively.	81

List of Figures Cont...

Fig. No.	Title	Page No.
Figure (35):	Comparison between group I and group II regarding remaining percentage grafted	83
Figure (36):	Comparison between group I and group II regarding healing time (days)	84
Figure (37):	Comparison between group I and group II regarding texture	84
Figure (38):	Comparison between group I and group II regarding patient satisfaction	85
Figure (39):	Comparison between group I and group II regarding scar vascularity	85
Figure (40):	Comparison between group I and group II regarding scar pigmentation	86
Figure (41):	Comparison between group I and group II regarding scar pliability	86
Figure (42):	Comparison between group I and group II regarding scar height (mm)	87
Figure (43):	Comparison between group I and group II regarding total Vancouver scar score	87

INTRODUCTION

Burn injuries are the fourth most common traumatic injury and cause an estimated 265000 deaths worldwide (*Bailey et al., 2019*).

Management of burn patients includes several steps starting from the incidence of injury and may be lasting for years. Wound debridement is an initial step in burn management (*Ziegler et al., 2020*).

It can be made by different methods like enzymatic, autolytic, mechanical, biological and osmotic debridement (*Legemate et al., 2018*). It aims to remove the necrotic tissue, reduce the bacterial load, and convert the burn to acute wound that can accept skin graft (*Edmondson et al., 2018*).

However, this procedure can be painful and nonselective because it may remove healthy tissue. So, hydrosurgical debridement is an innovative tool based on jet of water and on the Venturi effect resulting from it, which is capable of removing the necrotic tissue by suction (*Barret, 2006*). Moreover, it is a more selective and less painful procedure with shorter healing time, better tissue contouring and less intraoperative bleeding (*Legemate et al., 2018*).