

# WOUND CARE MANAGEMENT

for the Equine  
Practitioner



Dean A.  
Hendrickson  
DVM, MS



**Made Easy Series**  
T e t o n   N e w M e d i a



# Wound Care



## for the Equine Practitioner

Dean A. Hendrickson, DVM, MS  
Diplomate American College of  
Veterinary Surgeons



**Teton NewMedia**

*Innovative Publishing*  
Jackson, Wyoming 83001

Teton NewMedia  
Teton NewMedia  
90 East Simpson, Suite 110  
Jackson, WY 83001

© 2004 by Teton NewMedia

Exclusive worldwide distribution by CRC Press an imprint of Taylor & Francis Group, an Informa business

Version Date: 20140128

International Standard Book Number-13: 978-1-4822-4143-3 (eBook - PDF)

This book contains information obtained from authentic and highly regarded sources. While all reasonable efforts have been made to publish reliable data and information, neither the author[s] nor the publisher can accept any legal responsibility or liability for any errors or omissions that may be made. The publishers wish to make clear that any views or opinions expressed in this book by individual editors, authors or contributors are personal to them and do not necessarily reflect the views/opinions of the publishers. The information or guidance contained in this book is intended for use by medical, scientific or health-care professionals and is provided strictly as a supplement to the medical or other professional's own judgement, their knowledge of the patient's medical history, relevant manufacturer's instructions and the appropriate best practice guidelines. Because of the rapid advances in medical science, any information or advice on dosages, procedures or diagnoses should be independently verified. The reader is strongly urged to consult the drug companies' printed instructions, and their websites, before administering any of the drugs recommended in this book. This book does not indicate whether a particular treatment is appropriate or suitable for a particular individual. Ultimately it is the sole responsibility of the medical professional to make his or her own professional judgements, so as to advise and treat patients appropriately. The authors and publishers have also attempted to trace the copyright holders of all material reproduced in this publication and apologize to copyright holders if permission to publish in this form has not been obtained. If any copyright material has not been acknowledged please write and let us know so we may rectify in any future reprint.

Except as permitted under U.S. Copyright Law, no part of this book may be reprinted, reproduced, transmitted, or utilized in any form by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying, microfilming, and recording, or in any information storage or retrieval system, without written permission from the publishers.

For permission to photocopy or use material electronically from this work, please access [www.copyright.com](http://www.copyright.com) (<http://www.copyright.com/>) or contact the Copyright Clearance Center, Inc. (CCC), 222 Rosewood Drive, Danvers, MA 01923, 978-750-8400. CCC is a not-for-profit organization that provides licenses and registration for a variety of users. For organizations that have been granted a photocopy license by the CCC, a separate system of payment has been arranged.

**Trademark Notice:** Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe.

**Visit the Taylor & Francis Web site at**  
<http://www.taylorandfrancis.com>

**and the CRC Press Web site at**  
<http://www.crcpress.com>

**and the Teton NewMedia Web site at**  
[www.tetonnewmedia.com](http://www.tetonnewmedia.com)



# Dedication

This book is dedicated first and foremost to my wife and children who put up with me working on the book when I should have been playing ball, going swimming, or just hanging around. You are my favorite people in the world, and you have made me a better person with your love and care for me.

It is also dedicated to all of the students and horse owners that have challenged me to be a better veterinarian. I hope that you will enjoy the book as much as I have enjoyed learning about wound care.

Dean A. Hendrickson

September, 2003



# Acknowledgements

This book would not have been possible without a few key people. Thanks to Meredith Anderson for the prodding and encouragement to try some new techniques. Thanks to Judy Papen for the education on figuring out how to use some of the advanced wound care products. And finally the encouragement of Dr. George Rodeheaver in helping me to know that I could actually get this information down in print.

Drs. Luis Silva, Gayle Trotter, and Troy Trumble have supplied various figures. Thank you for helping out where I needed the help.

The CD layout was the idea of Lauren Javernick; thanks for all of your hard work.

And a special thanks to the people at Teton NewMedia, especially Carroll Cann, for all of your hard work and guidance.

# Table of Contents

## Section 1 Wound Care Dressings

Introduction.....	3
Some Helpful Hints.....	3
Dressings used for Cleaning and Prepping.....	4
Dressings Used for Debridement.....	6
Dressings Used for Packing.....	7
Dressings Used for Absorption.....	9
Dressings Used for Compression.....	11
Dressings Used for Support.....	12
Dressings Used for Protection.....	13
Dressings Used for Moisture.....	14
Methods of Dressing Application.....	14
Splint Application.....	16
Emergency Transport.....	19

## Section 2 Wound Preparation, Cleaning, and Debridement

Wound Preparation.....	26
Wound Infection.....	28
Wound Cleaning Agents.....	29
Scrubbing.....	30
Lavage.....	31
Saline.....	32
Antiseptic Agents.....	32
Povidone Iodine.....	34
Chlorhexidine.....	35
Hydrogen Peroxide.....	36
Acetic Acid (Vinegar).....	36
Dakin's Solution.....	37



Topical Antibiotics . . . . .	38
Silver . . . . .	38
Nitrofurazone . . . . .	39
Triple Antibiotic . . . . .	39
Surfactant Based Agents . . . . .	40
Wound Debridement . . . . .	41
Mechanical Methods . . . . .	41
Sharp Debridement . . . . .	42
Physical Debridement . . . . .	43
Chemical Debridement . . . . .	44
Chemicals . . . . .	44
Hypertonic Saline Dressings . . . . .	44
Natural Methods . . . . .	45
Autolytic Debridement . . . . .	45
Enzymatic Debridement . . . . .	46

## Section 3 Wound Exploration

Head Wounds . . . . .	52
Neck and Back Wounds. . . . .	54
Chest Wounds. . . . .	55
Abdominal Wounds . . . . .	57
Leg Wounds. . . . .	58
Important Anatomical Considerations . . . . .	60
Foreign Body Detection . . . . .	64
Exploration . . . . .	64
Ultrasound . . . . .	65
Plain Radiology . . . . .	66
Contrast Radiography . . . . .	67
Computed Tomography and Magnetic Resonance Imaging . . . . .	67

## Section 4 Primary Wound Closure

Appropriate Wounds for Primary Closure . . . . .	70
Closure Techniques for Primary Wound Closure . . .	73
Suture Closure . . . . .	74
Needle Type . . . . .	74
Absorbable versus Non-Absorbable . . . . .	75
Monofilament versus Multifilament . . . . .	76
Suture Patterns . . . . .	77
Appositional . . . . .	77
Simple Interrupted . . . . .	77
Simple Continuous . . . . .	78
Interlocking . . . . .	79
Intradermal . . . . .	80
Tension Relieving . . . . .	80
Cruciate . . . . .	81
Near-Far-Far-Near . . . . .	81
Vertical Mattress . . . . .	82
Horizontal Mattress . . . . .	82
Knot Types . . . . .	83
Staple Closure . . . . .	83
Suture/Staple Removal . . . . .	84
Tissue Adhesive Closure . . . . .	85
Other Tension Relieving Techniques . . . . .	85
Wound Protection and Immobilization. . . . .	87

## Section 5 Delayed Primary Wound Closure

Appropriate Wounds. . . . .	92
Intermediate Wound Care . . . . .	92
Preparation for Closure . . . . .	93

## Section 6 Second Intention Wound Healing

Moist Wound Healing Concepts.....	100
Dressing Choices .....	103
Hypertonic Saline Dressings .....	105
Antimicrobial Dressings .....	111
Hydrogel Dressings .....	115
Calcium Alginate Dressings .....	117
Topical Dressings: Collagens, Maltodextrans .....	122
Replacement Tissue Dressings .....	124
Growth Factors .....	125
Semi-Occlusive Dressings .....	126
Steroids .....	131
Summary .....	132
Caustic Agents .....	134
Excess Granulation Tissue.....	134
Non-Healing Wounds.....	136

## Section 7 Skin Grafting

Immediate Wound Care.....	140
Bed Preparation .....	141
Types of Grafts .....	142
Healing Stages of Grafts .....	142
Skin Graft Types.....	143
Grafting Techniques .....	144
Skin Graft Donor Sites.....	145
Animal Positioning, Anesthesia, and Sedation....	146
Pinch Grafting .....	147
Punch Grafting.....	151
Tunnel Grafting .....	154
Mesh Grafting.....	155
Pedicle Grafting .....	158

Grafting Aftercare ..... 158

    Dressing Choices .....158

    Frequency of Dressing Changes .....159

    Wound Immobilization .....159

Reasons for Graft Failure .....161

    Inappropriate Type of Graft .....161

    Inadequate Graft Preparation .....161

    Inadequate Recipient Bed Preparation .....162

    Infection .....162

    Separation of Graft from Wound Bed .....162

    Graft Movement .....163

**Section 8      Specific Wound  
                         Considerations**

Heel Bulb Lacerations/Hoof Wall Avulsions..... 166

Lacerations of Synovial Structures..... 173

Tendon and/or Ligament Lacerations ..... 178

Chest Lacerations ..... 181

Abdominal Wall Lacerations ..... 183

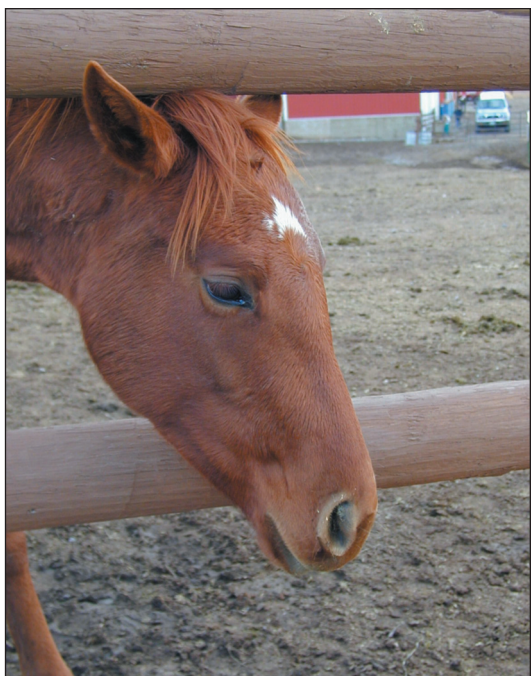
Head Lacerations ..... 185

Lacerations to the Axillary Region ..... 190

**Index ..... 193**

**Recommended Readings..... 208**







# Section 1

## Wound Care Dressings







# Introduction

Wound care is part of everyday practice for the equine practitioner. It can be either very frustrating or rewarding, and sometimes both, to try and provide the best functional and cosmetic outcome for our clients and patients. The goal of this book is to help veterinarians work with one of the most common ailments of the horse-wounds. This book will cover basic and some advanced wound care principles as general topics, along with specific wound considerations. There are many tried and true principles that will be discussed as well as some new and exciting principles.

## Some Helpful Hints

Scattered throughout the text, you will find the following symbols to help you focus on what is routine and what may be really important:

- ✓ This is a routine feature or basic point for understanding the subject discussed.
- ♥ This is an important feature. You should remember this.
- 🔑 The key symbol will be used selectively to indicate a very important point to assist your understanding of the topic area.
- 👉 Stop. This does not look important, but it can really make a difference when trying to sort out unusual or difficult situations. It can be my opinion based on personal experience.
- 💣 Something serious will happen if you do not remember this, possibly resulting in injury or loss to the patient, and upset to the client.
- 📀 A companion CD is available for purchase by calling 877-306-9793. The CD contains the full text, figures, and tables of this book formatted for easy search and retrieval. The CD symbol indicates that additional images of a topic are available on the CD.

This section will help the practitioner to identify the different types of wound dressings that are available.

✓ Wound care dressings include any therapy that can be used to treat a wound.

♥ Often these dressings are used in multiple layers providing distinct benefits for the desired outcome. Dressings can include anything from a simple non-adherent pad to a complex synthetic semi-occlusive pad and everything in-between.

♥ For many veterinarians, the number of dressings available can be overwhelming. It is important to recognize that most dressings have been designed for specific purposes.

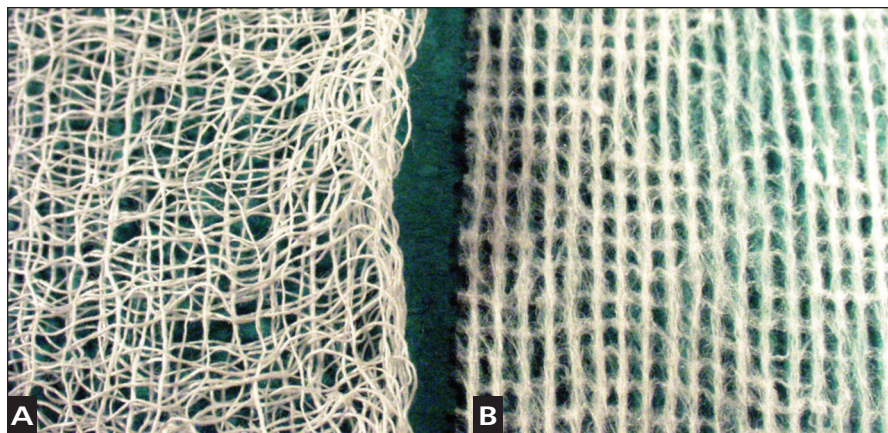
🔑 In many cases, equine practitioners have traditionally used dressings for tasks they weren't designed for, in order to minimize the number of different materials needed. While this technique may work, it is likely that appropriate use of specific materials will provide a more satisfactory outcome. While the list could be very long, there are eight general dressing categories that will be discussed. In some instances, the same dressing could be included in more than one category.

## Dressings Used for Cleaning and Prepping

✓ Many dressings have been used for cleaning and prepping. The purpose is often twofold: one to reduce the amount of debris, and the other to minimize risk of infection.

✋ The most commonly used dressings for cleaning and prepping are gauze dressings; however, not all gauze dressings are created equal (Figure 1-1). Gauze is available in both woven and non-woven forms. Each of the forms has positive and negative characteristics (Table 1-1). In general, woven gauze is better for cleaning and prepping than is non-woven gauze because of the loose weave and the inherent strength they provide.

💡 The superior prepping and debriding characteristics, while beneficial in some cases, are detrimental in others. One example is a wound that is clean and free of bacterial infection. When woven gauze is used to clean the wound, the superficial fibroblasts and epithelial cells are removed, retarding the healing process. In some cases, enough mechanical trauma ensues to increase the likelihood of infection. In summary, woven gauze is



**Figure 1-1 A. Woven and B. non-woven gauze.**

**Table 1-1 Woven -vs- Non-woven Gauze**

WOVEN GAUZE	NON-WOVEN GAUZE
Made of 100% Cotton	Primarily Synthetic Blends
Moderate Lint Levels	Low Lint Levels
High Strength	Low Strength
Moderately Absorbent	Highly Absorbent
Vertical Wicking Ability	Horizontal Wicking Ability
Conformable	Resilient
Relatively Adherent	Less adherent
Moderate to High Loft or Bulk	Little Loft or Bulk
Superior Debridement Characteristics	Poor Debridement Characteristics
Superior Prepping Characteristics	Poor Prepping Characteristics

best used on normal skin when aggressive cleaning properties are needed. Non-woven gauze is best used for cleaning wounds and surgical sites where less mechanical trauma will occur with use.

✓ Cotton and foam applicators impregnated with some type of antiseptic are often used in human medicine to clean and prep an area. They are rarely used in horses due to the expense and the surface area involved in the preparation.

# Dressings Used for Debridement

♥ Debridement can be achieved through various methods including sharp debridement, physical debridement, chemical debridement, autolytic debridement, and enzymatic debridement. Dressings are generally used to achieve physical and autolytic debridement. The methods of debridement will be more completely discussed in Section 2.

✓ Physical debridement employs the concept of removing contamination and devitalized tissue with a dressing using physical force (Figure 1-2). In most cases, woven gauze is used to perform this task (see Table 1-1). Woven gauze is more aggressive than non-woven gauze in removing both contamination and tissue. Large amounts of contamination or devitalized tissue will impede healing.

✋ It is important to remember that in some cases, physical debridement is more traumatic than beneficial to the wound bed. Consequently the use of physical debridement should be carefully considered and used only when removal of tissue and contamination by physical force will ultimately lead to the best possible outcome.



**Figure 1-2** Drawing showing gauze debridement.

✂ In most cases, sharp debridement should be used to begin the debridement phase, and less aggressive physical debridement used to finish the process.

♥ Autolytic debridement occurs when an appropriate dressing is chosen to maintain the proper moisture balance at the wound surface (Figure 1-3). The wound exudate is then left in contact with the wound, allowing better access of white blood cells and autologous enzymes to remove the devitalized tissue. Autolytic debridement requires a moist wound, and will only remove devitalized or diseased tissue, whereas physical debridement is non-selective. Calcium alginate and semi-occlusive foam dressings are examples of dressing types that are used for autolytic debridement.

🖐 Autolytic debridement is more completely described in Section 2. Specific dressing types will be described in more detail in Section 6.



**Figure 1-3** Wound over dorsal spinous processes undergoing autolytic debridement.

## Dressings Used for Packing

✓ Dead space occurs when enough tissue is lost from a wound to leave a cavity where tissue should remain. The presence of dead space in a wound or surgical site provides the potential of seroma or hematoma formation.

♥ In either case, infection is a more common sequela than when the entire wound or surgical area can be closed. In some cases this is simply not possible and dead space remains.

✓ Gauze is the most commonly used dressing to fill dead space.

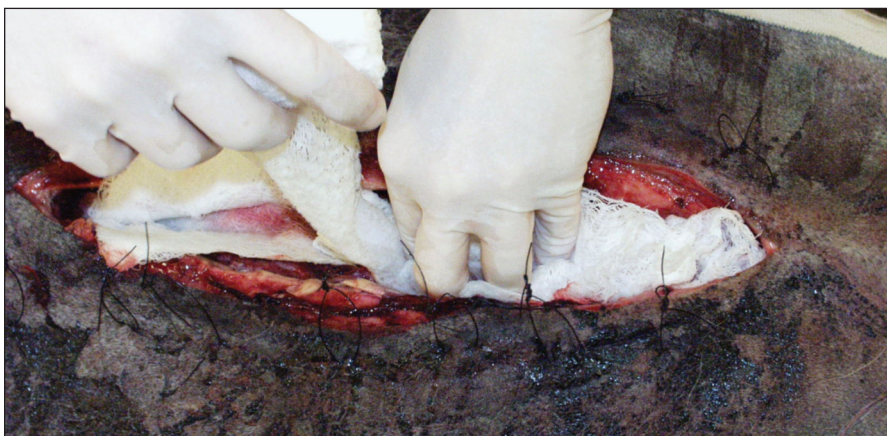
✎ Roll gauze is preferred in order to have a contiguous dressing thereby minimizing the chance of leaving foreign material in the depths of the dead space. The gauze is unrolled and pushed into the defect until the defect is filled (Figure 1-4). If the defect is large and requires more than one roll, the end of the first roll is tied to the beginning of the next roll and so on. In this fashion, only one end of the gauze needs to be pulled until all of the gauze is removed.

✓ Woven gauze is preferred because it is stronger than non-woven gauze and is less likely to tear.

💧 The gauze should be moistened prior to application and kept moist to minimize drying of the wound and reduce the pain associated with removing the packing.

♥ Antimicrobial gauze such as Kerlix A.M.D. provides the benefit of reducing bacterial load while also filling the dead space.

♥ Any type of woven gauze will provide physical debridement and as long as it is pre-moistened will minimize trauma to the surrounding tissue. Specific dressing types will be described in more detail in Section 6.



**Figure 1-4** Dorsal spinous process wound being packed with saline moistened antimicrobial roll gauze (Kerlix A.M.D.™ Tyco Healthcare/Kendall).