Mosby
An Affiliate of Elsevier

11830 Westline Industrial Drive
St. Louis, Missouri 63146

ATLAS OF EQUINE ENDOSCOPY ISBN 0-323-1848-3

Library of Congress Cataloging-in-Publication Data
Slovis, Nathan M.
Atlas of equine endoscopy / Nathan M. Slovis.
p. cm.
Includes bibliographical references (p.).
ISBN (invalid) 032318483
1. Horses—Diseases—Atlases. 2. Veterinary endoscopy—Atlases. I. Title.

SF951.S624 2004
636.1'089607545—dc22

2003065117

Acquisitions Editor: Liz Fathman
Developmental Editor: Teri Merchant
Publishing Services Manager: Melissa Lastarria
Book Design Manager: Gail Morey Hudson

Printed in the United States of America

Last digit is the print number: 9 8 7 6 5 4 3 2 1

Contributors

FAIRFIELD T. BAIN, DVM
Diplomate ACVIM, ACVP, ACVECC
Hagyard-Davidson-McGee, PLLC
Lexington, Kentucky

JAMES BURNS
General Manager
Endoscopy Support Services, Inc.
Brewster, New York

DOUG BYARS, DVM
Diplomate ACVIM, ACVECC
Director, Internal Medicine
Hagyard-Davidson-McGee, PLLC
Lexington, Kentucky

AURELIO MUTTINI, MED VET
Department of Veterinary Clinical Sciences
University of Teramo—Italy

LUCIO PETRIZZI, MED VET
Associate Professor of Veterinary Clinical Sciences
University of Teramo—Italy

DWAYNE RODGERSON, DVM, MS
Diplomate ACVS
Hagyard-Davidson-McGee, PLLC
Lexington, Kentucky

THOMAS SEAHORN, DVM, MS
Diplomate ACVIM, ACVECC
Hagyard-Davidson-McGee, PLLC
Lexington, Kentucky

NATHAN M. SLOVIS, DVM
Diplomate ACVIM
Hagyard-Davidson-McGee, PLLC
Lexington, Kentucky

KIM SPRAYBERRY, DVM
Diplomate ACVIM
Hagyard-Davidson-McGee, PLLC
Lexington, Kentucky

JOHN STEINER, DVM
Diplomate ACT
Hagyard-Davidson-McGee, PLLC
Lexington, Kentucky

LUCA VALBONETTI, MED VET
Department of Veterinary Sciences and Agriculture—Surgical Unit
University of Teramo—Italy

EDWARD VOSS, DVM
Diplomate ACVIM
Arizona Equine Centre
Gilbert, Arizona

To my wife

Stacey and **my family**

Norman Slovis, Carol Slovis,
Daniel Slovis, and **Margo Glickman**

Preface

Today's veterinary curriculum places more demands on both students and teachers, and consequently there is generally insufficient time and material available to teach an ever-increasing number of students the art of endoscopy. Endoscopes, videosystems, and therapeutic techniques are constantly being upgraded or redesigned, thus outdating many reports regarding their use. The purpose of this atlas is to provide both the general practitioner and student with a reference guide. The atlas's emphasis is on normal and abnormal findings of different body systems examined by the general equine practitioner. The atlas contains state-of-the-art digital images that provide a base of knowledge on which the reader may build and to describe techniques involved in endoscopy, so as to make learning an easier proposition.

Endoscopy is one of the most diagnostically useful tools available in equine practice. It allows the practitioner a minimally invasive technique in examining different organ systems. We hope that this text will help illustrate the usefulness of diagnostic endoscopy. The atlas provides photographs of endoscopic procedures that will help guide the reader through the different organ systems with an emphasis on normal and abnormal findings.

This book is divided into two major sections. The first section includes newer instrumentation and documentation for endoscopy. The second section illustrates through photographs the art of endoscopy and provides a quick reference guide in the visual form. This atlas should be regarded as a companion to other equine endoscopy texts that have educated the reader on the basics of equine endoscopy. The contributors discuss treatments and management where appropriate.

We have attempted to emphasize the diagnostic features of those conditions the general equine practitioner will be exposed to. The atlas's contributors realize that the most valuable learning resources were the photographs that we took of our patients. Through this book we have oriented many years of clinical experience in endoscopic observation and documentation by leading specialists. The atlas's photographs will provide the reader a large range of appearances from which to learn and compare, while helping the amateur endoscopist gain confidence. In order to orient the anatomy of different organ systems, distant and close-up views are provided where applicable. This is educational, particularly in identifying anatomical variations. The chapters are organized according to the area being discussed. The photographic illustrations reflect the order in which the endoscopic examination is being performed. The atlas begins with a series of photographic and, where applicable, schematic drawing of the normal anatomic conformation and variations to the specific area of the body being discussed. The abnormal findings have been grouped by type of disorder (i.e., inflammatory, neurologic, neoplastic, congenital).

We have seen significant progress being made in equine endoscopy over the last two decades. Today the public demands and insists on more specialized care for their animals. More equine practitioners have realized the importance of endoscopy for the diagnosis of various disorders.

Nathan M. Slovis

CHAPTER 1

Endoscopic Instrumentation

JAMES BURNS

FIBEROPTIC ENDOSCOPE PRINCIPLES

A fiberoptic endoscope system is based on transmission of light and images through long thin fibers of optical glass. The fiberoptic image is made up of thousands of tiny fibers that are made of coated glass. The coating acts as a mirror that reflects light through the fiber into the eyepiece. The eyepiece magnifies the group of fibers into an image that you can visualize with your eye (Figure 1-1). If you look closely, you can observe what appears to be a screen or spider web. This screen is actually all the fibers lined up next to one another. Each fiber displays part of the overall image.

When one of the fibers in the group is broken, it appears as a black dot in your overall image. If the coating on a fiber is scratched or chipped, light can escape from it, causing the fiber to appear as a light gray dot in your overall image.

Light used to visualize your image is sent into the body cavity through light guides and then travels back up through the image guide to the eyepiece for viewing.

To identify the amount of broken fibers in an instrument, you need to hold the distal tip of the insertion tube to a light (Figure 1-2) Note that fluorescent lights work

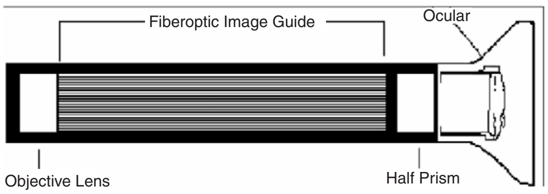

FIGURE 1-1. Optical system of fiberoptic endoscope.

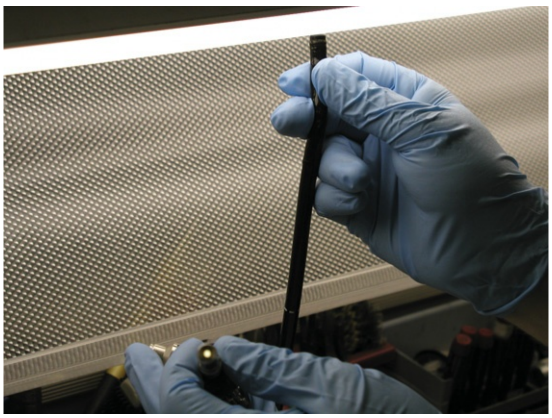

FIGURE 1-2. Identifying the amount of broken fibers in instrument.

best. While holding the tip to the light, look through the eyepiece and focus the scope so you can clearly see the outline of the fibers.

VIDEO ENDOSCOPE PRINCIPLES

Video endoscopy has been used in human medicine for several years and has just recently become widely used in equine medicine for both diagnostic and therapeutic procedures.

Endoscopic external video cameras (Figure 1-3) can be attached to the eyepiece of a fiberoptic endoscope with a coupler (Figure 1-4) and allow you to visualize what you would see through the eyepiece on screen.

There has been an increase in the demand for new and used endoscopic external video cameras. Using cameras can help enhance the visualization of a diagnostic procedure.

When you look into the eyepiece directly, a clear image is noted. However, with a camera the image may appear darker. This visualization occurs because the camera does not have the ability to sense light as well as your eye.

FIGURE 1-3. Endoscopic video camera.

FIGURE 1-4. Couplers.

The use of a fiberoptic instrument with external video cameras may produce the moiré phenomenon (Figure 1-5). This phenomenon is caused when the camera tries to generate an image from the fibers in the endoscope. The charged couple device (CCD) is made up of tiny pixels that convert the light into an electronic signal so it can be sent to the processing unit. The image from the endoscope is made up of tiny fibers that are assembled in the eyepiece as a single image. When the camera looks at the image, the pixels in the CCD will notice the individual fibers, therefore causing interference. This interference shows up as a wave of colors that flow through the image. This interference is known as moiré patterning. There are three approaches to the resolution of this problem.

The first is to fool the camera by taking it out of focus. This allows the camera to see a single image instead of all the fibers. However your image on the screen also appears to be out of focus. Some practitioners do not mind the image being slightly blurred despite the risk of missing a diagnosis when working in these conditions.

The second is to rotate the camera head until the moiré pattern clears up. A disadvantage to this is that the top of your image should appear at the 12 o'clock position on your monitor. If you rotate the camera head, the top of your image could end up in the 4 o'clock position on the monitor. Then when you angulate your scope using the "up control," it appears to move down and right. The change in orientation seems to change the angulation controls, making it difficult to determine your location when you perform a procedure. Nonetheless, some people have learned to deal with this inconvenience.

The third and best way is to use a camera system that incorporates an anti-moiré filter. This filter helps to alleviate the interference and allows you to sharpen the focus as well as position the image correctly on the screen. Only a small number of used cameras on the market incorporate anti-moiré filters in their systems. The cameras that do incorporate this filtering system have been designed for use with flexible and rigid endoscopes.

Most of the newer cameras on the market use a smaller CCD. This has allowed camera manufacturers to develop smaller, lighter camera heads. These lighter camera

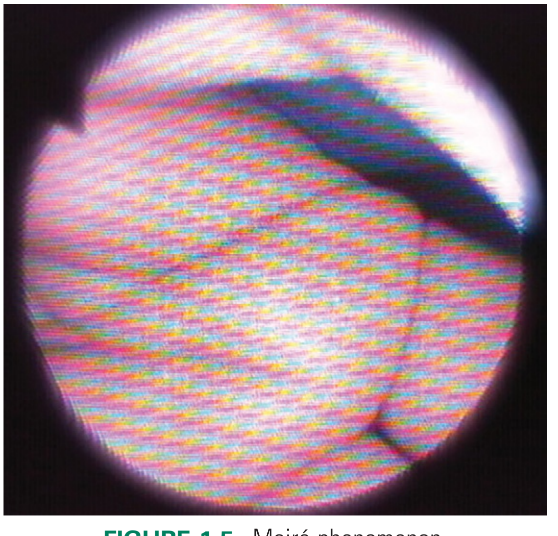

FIGURE 1-5. Moiré phenomenon.

heads prevent addition of excessive weight to the eyepiece, making it harder for the user to hold and control them.

Auto exposure cameras control the light sensitivity electronically and can be used with any light source you prefer. Some of the newer auto exposure cameras have better light sensitivity and offer more advanced manual control of the sensitivity settings. The manual control options have proven to be very useful in low-light situations. These features allow the use of a halogen light source with this type of camera system.

Non-auto exposure cameras do not control the light intensity and must be used with an auto exposure light source. Exposure control is managed by the light source in this type of system. The light source uses a robotic shutter inside the unit to control the light intensity. This prevents the camera from "whiting out" if the light on the object being visualized becomes too intense (Figure 1-6).

Another item to consider when you purchase a camera for use on a fiberoptic endoscope is the endocoupler (see Figure 1-4). The endocoupler is used to obtain mechanical and optical coupling of the fiberscope to the camera head. This device plays a very important part in the overall image. When purchasing a used camera, you do not have a choice of what size or magnification endocoupler will be provided with it. Most rigid cameras have a 32- to 35-mm coupler for use with rod lens endoscopes. Some cameras may come with a zoom coupler that allows you to change the magnification range much like that of a camcorder.

A 22- to 28-mm endocoupler normally works the best with flexible gastroscopes and colonoscopes (typical human instruments used in veterinary endoscopy). A 22- to 28-mm coupler does not overmagnify the fibers and helps reduce moiré interference. Another major advantage is that these couplers normally allow the user to see the entire image on the screen. When higher magnifications are used, the image can appear larger than the screen, causing the user to only view part of the image.

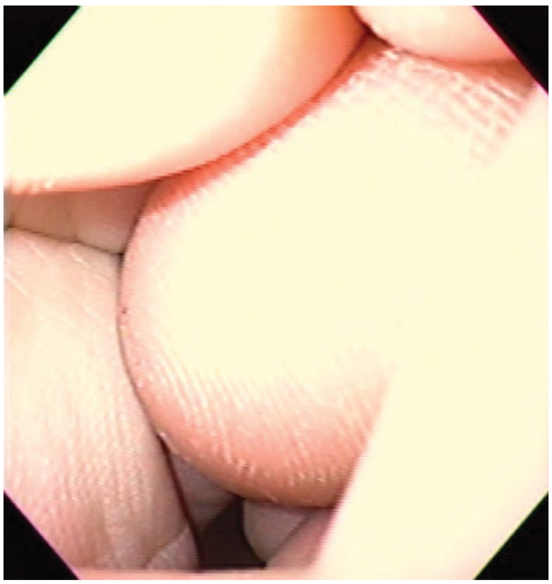

FIGURE 1-6. "White out."

VIDEO ENDOSCOPES

Video endoscopes and endoscopic video cameras gather light via a lens and a CCD. The CCD is made up of many tiny pixels that convert light into an electronic signal that is sent to the processing unit where it is converted for output as a video signal for the monitor to display.

ENDOSCOPE CONSTRUCTION

Figure 1-7 shows the construction of an endoscope.

LIGHT SOURCES

Halogen light sources are most commonly used in equine medicine. Their lightweight portable design and low cost make them the right choice for ambulatory practice. The halogen light source (Figure 1-8, *A*) typically uses a 150-watt halogen projector lamp at an average cost of about $35. When a fiberoptic scope is used optically, the light output of a halogen light source will always be suitable.

Xenon light sources (Figure 1-8, *B*) use a gas-filled lamp that burns the gas over the life of the bulb. When the gas inside the bulb has burned off, the lamp stops functioning.

Xenon light sources produce a high-intensity light as well as cleaner or "whiter" light compared with other types of light sources. When a video camera is used, this higher-intensity light is needed to visualize the subject. (See Figure 1-3.)

The cost of a xenon bulb is usually about $500. Xenon bulbs have an expected life of 600 hours. Most lamps come with a 500-hour warranty, and a lamp timer is used to gauge the lamp's life.

Most of the auto exposure light sources are 300-watt xenon light sources rather than the 150-watt halogen light sources commonly associated with flexible endoscopes. The xenon light source outputs more than twice the amount of light as a halogen unit. Xenon units produce light at a lower color temperature, making it a cleaner or whiter light.

Air and water functions of scopes are controlled by the air pump found in the light source. If you plan to use these functions, you will need a light source that has an air pump.

HUMAN ENDOSCOPES USED BY EQUINE PRACTITIONERS

Equine veterinarians generally use human gastroscopes or colonoscopes.

Human Gastroscopes

The insertion tube of a human gastroscope normally ranges in size from 7.9 to 12 mm in outer diameter with a working length of about 1 m. These scopes can be used for the following equine procedures:

- Rhinoscopy
- Pharyngoscopy and laryngoscopy
- Guttural pouch examination
- Tracheoscopy (proximal)
- Cystoscopy (young colts or geldings, ponies, and adult mares)