To my mother and father, Lorna and Zaman, for their unfailing support and encouragement
The use of endoscopy in veterinary practice has become commonplace over the last decade, such that almost every practice dealing with horses now owns a fibreoptic or videoendoscope. The equine upper and lower respiratory tract suffers a huge array of disorders and therefore not surprisingly, the vast majority of endoscopy in equine clinical practice concerns examination of the respiratory tract. This handbook concentrates on the more common abnormalities found in the respiratory system.

This handbook aims to educate general equine practitioners and veterinary students to become familiar with the normal endoscopic appearance and normal variations of the equine upper and lower respiratory tract, and from there, to recognise and interpret abnormalities of these areas. The highly visual nature of the book allows the reader to compare what they see endoscopically in their own cases with the disorders illustrated in this text and it would be a useful book for the practitioner to keep in the car as a quick reference and for client education.

A concise outline of aetiology, diagnosis, treatment and prognosis is given for each disorder, thus giving key information which can help the practitioner make a diagnosis and also provide information that can be easily relayed to the client. This handbook is not aimed to provide exhaustive information on all disorders of the equine respiratory tract, and further reading lists are provided at the end of each chapter which will enable the reader to research individual disorders in more detail. This book will make a valuable addition to all equine practitioners’ collections.

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1: Endoscopic equipment

Selecting an endoscope for equine respiratory endoscopy

Length and diameter of endoscope

A wide variety of endoscopes are available for examination of the equine respiratory tract. For general equine practice, an endoscope should have a wide range of applications in order to make it both a useful diagnostic instrument and a sound economic investment.

The external diameter of the endoscope is important; an endoscope with a small diameter (7–9 mm) will allow examination of the nasal meatuses, the guttural pouches and the airways of foals or small ponies. An endoscope of sufficient length to reach the ‘sump’ of the trachea for collection of respiratory secretions in adult horses (approximately 100–110 cm) is ideal. Longer endoscopes (>160 cm) are required for bronchoscopy or for collection of broncho-alveolar lavage fluid from adult horses. Equine gastroscopy requires an endoscope with a 250–300 cm working length.

Fiberoptic (Fig. 1-1) vs. videoendoscopes (Fig. 1-2)

These two systems differ in the way that images are collected and transmitted to the eyepiece or monitor. Fiberoptic images are transmitted from the subject, through long thin fibers of optical glass, into a magnifying eyepiece. The optical fibers are quite sensitive to damage which may be caused by excessive bending or general wear and tear, and broken fibers are represented by black dots on the image. Using a ‘coupler’, an external video camera can be attached to the eyepiece of a fiberoptic endoscope to enable transmission of the image to a monitor screen. However, the quality of image is not as good as that seen directly through the eyepiece. The main advantage of fiberoptic endoscope systems is that they are easily portable and inexpensive, and therefore, they are often chosen by clinicians who work in ambulatory practice.

Videoendoscopes provide a higher quality image than do fiberoptic endoscopes but are more expensive. Videoendoscopes produce an image at the objective lens at the distal tip of the insertion tube (the portion of the scope that is inserted into the patient) (Fig. 1-3) which is sensed by a charged couple device (CCD) chip. This image is transmitted electronically via wires along the length of the endoscope to a processor, which converts the signal back into a standard video signal. This video signal can then be displayed on a
**Fig. 1-2:** Videoendoscope.

**Fig. 1-3:** Tip of the insertion tube of a videoendoscope:  
A = instrument channel,  
B = light guide bundles,  
C = CCD bundle,  
D = air/water feed channel.

**Fig. 1-4:** Videoendoscope set-up: the endoscope uses a halogen light source and output from the endoscope is connected to a monitor, printer and DVD/video recorder.
monitor and recorded on a videotape or DVD, or printed (Fig. 1-4). Videoendoscopes are often connected to large monitors and recording devices, and therefore most systems are not readily portable. They should be considered an essential addition to any equine practice with a clinic facility. Smaller, more portable videoendoscope units with built-in digital recording systems are now becoming available for use in equine practice.

**Light sources**

Halogen ‘cold’ light sources are the most commonly used for equine respiratory endoscopy and are available as compact and light units (Fig. 1-5). A light source with an integral air feed/pump allows the tip of the endoscope to be flushed with water and air to clear it of debris. Xenon light sources produce a higher-intensity, cleaner light than do halogen light sources, but are considerably more expensive to buy and maintain.

**Maintenance of endoscopes**

**Cleaning and disinfection**

The endoscope should be cleaned thoroughly after every endoscopic examination to minimize cross-contamination of pathogenic microbes between horses. After endoscopically examining a horse with potentially infectious respiratory disease (e.g. strangles or influenza), the endoscope should be fully sterilized.

Manufacturers of endoscopes provide cleaning instructions in their manufacturer’s manual that should be strictly adhered to. Both the external surface of the endoscope and the air/water and biopsy channels should be cleaned and flushed after every procedure; first with an enzymatic cleaning solution, then with water, and finally with air to dry the channels. Some endoscopes are fully submersible, but the eyepiece end of older fiberoptic endoscopes may not be waterproof and immersion in water can result in serious damage. When the endoscope has been used, a channel cleaning brush should be inserted in all the channels at least once daily. Cleaning brushes come in various sizes and in reusable and disposable versions.

**Sterilization**

Flexible endoscopes can be sterilized by immersion in 2% gluteraldehyde solution for several hours (see guidelines provided by manufacturers of the endoscope and the disinfectant),
followed by thorough rinsing of the exterior and all the channels in sterile water, because gluteraldehyde is very irritant to tissues. Full sterilization is not routinely carried out after every use because repeated sterilization may predispose to leakages. Ethylene oxide sterilization is a good alternative to wet sterilization, but the ethylene oxide sterilization procedure may take up to 72 hours, rendering the endoscope out of use for this time.

**Testing**

All endoscopes should be tested regularly for leakages in the channels using the manufacturer’s leakage testing equipment. This enables small leaks to be identified before irreparable damage occurs. Regular maintenance programs are also essential to ensure that the optical systems, the sheath and the channels are in good working order.

**Storage**

Endoscopes, and particularly fiberoptic endoscopes, should be stored in a hanging position with the insertion tube straight. This prevents damage to optical fibers, stops liquid from settling in the channels and prevents the insertion tube from becoming deformed. They should not be stored coiled inside their cases.

**Accessories**

**Biopsy and grasping forceps**

A variety of biopsy and grasping forceps are available for endoscopic use. For general practice, the most useful all-round instrument is either standard or serrated fenestrated cup biopsy forceps (Fig. 1-6a, b). These forceps have a rounded, atraumatic end, which, when shut, can be also be used to facilitate endoscopy of the guttural pouches (see Chapter 5). ‘Basket’ forceps (Fig. 1-6b) can be useful for retrieving larger masses, such as chondroids or foreign bodies from the respiratory tract.

**Fig. 1-6**: Transendoscopic biopsy and grasping forceps.

a) Whole instrument with plastic handle to open/close jaws.

b) Close-up of jaws. Left to right: basket grasping forceps, standard fenestrated cup biopsy forceps with needle and standard fenestrated cup biopsy forceps.
Simple and guarded aspiration/delivery catheters (Fig. 1-7)

Simple aspiration/delivery catheters are commonly used for delivery of fluid or medication and aspiration of samples (e.g. tracheal washes) for cytological examination. One end has a ‘female’ luer lock to which a syringe can be attached. Simple Teflon™, polypropylene, polyethylene or polyurethane catheters are available in lengths of up to 240 cm and external diameters of 1.8 mm or 2.4 mm. Some companies manufacture aspiration catheters that contain a glycol plug in the tip, which reduces contamination of the catheter’s lumen by microbes as the catheter is advanced through the biopsy channel of the endoscope. This glycol plug is pushed out of the catheter after the endoscope is positioned in the required area and allows an uncontaminated sample to be collected for bacteriological culture.

‘Double-guarded’ aspiration catheters are also available (e.g. Mila International endoscopic microbiological aspiration catheter). These catheters contain a glycol plug in the outer catheter which is pushed out after the endoscope is in place, allowing extrusion of an inner catheter which is used to retrieve an uncontaminated sample.

Lance catheters (Fig. 1-8)

These are catheters with needles attached to one end, designed for aspiration and injection of fluids. They are useful for a variety of endoscopic applications, including injecting ethmoidal hematomas with formalin, injecting sites with local anesthetic prior to surgery.
(e.g. for biopsy of masses and laser surgery of the upper respiratory tract), and taking fine-needle aspirates from lesions. If the tissue to be injected/aspirated is quite soft (e.g. an ethmoidal hematoma), a simple aspiration/delivery catheter, cut obliquely with a scalpel blade to a form a sharp point, may provide an inexpensive alternative. Lance catheters made in this way are safe to pass unguarded through the biopsy channel of the endoscope, because they are not sharp enough to damage the inner sleeve. Homemade lance catheters can also be constructed by fixing a short hypodermic needle into the end of an aspiration catheter that has been passed through the biopsy channel of the endoscope. However, there is a risk that the needle may become detached from the tubing when it is inside the horse or inside the biopsy channel of the endoscope, causing significant damage.

**FURTHER READING**