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Ivan has recently graduated from Hong Kong Polytechnic University with the first cohort of BSc(Hons) veterinary nursing students. During the four years of study, he had placements in a number of different environments, including private veterinary hospitals, charity organizations, rescue shelters, laboratories, a theme park, a riding school and a government department. Since graduation, Ivan has started working at the Hong Kong Jockey Club, in the Equine Hospital, as a Veterinary Clinical Technician.

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# Clinical review: Anaesthesia of a racing Thoroughbred undergoing orthopaedic surgery in Hong Kong

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ABSTRACT After graduation and gaining experience in small animal hospitals, I moved to work in an equine hospital in Hong Kong. I found that some fundamental, small-animal surgical nursing techniques learnt at university could be applied to large-animal practice. This article is a clinical case review and aims to act as an introduction to equine surgery and anaesthesia in Hong Kong.

## Introduction

Hong Kong is a focal point on the international racing stage, with world-class horses, trainers, jockeys and veterinary surgeons, as well as state of the art technology and facilities. Despite a small population of 1,200 Thoroughbreds, the ratio of elite horses means that Hong Kong is ranked fifth in the Longine's World's Best Racehorse Rankings. To achieve this standard, veterinary services have played a crucial role in maintaining the horses' health and condition. This article reviews the anaesthetic protocol used in a case of a common orthopaedic surgical procedure.

## Case history

A five-year-old Thoroughbred gelding was brought into the hospital for further investigation of poor performance associated with lameness in the left forelimb. A series of investigations were performed including nerve blocks, radiography, scintigraphy and MRI. These revealed bone fragments between the condyles of the third metacarpal bone and the proximal phalanx (fetlock joint) as the cause of lameness.

Arthroscopic surgery to remove loose bone chips and trim damaged cartilage, was recommended to prevent recurrent joint damage causing lameness and, ultimately, osteoarthritis. Arthroscopy is a minimally invasive surgical technique for visualising and operating inside a joint. It generally causes less surgical morbidity than arthrotomy, and results in a lower risk of complications, such as infection, fibrosis of the joint capsule and joint stiffness. Recovery time is consequently shortened and this is important in racehorses as time is a significant factor when treating young Thoroughbreds, as the costs of maintaining a horse in training are high and opportunities to race are restricted due to the age constraints placed upon entry for races.

## Pre-operative preparation

Food was withdrawn for 12 hours before surgery to minimise the risk of gastrointestinal complications under anaesthesia. The horse was weighed and its shoes were removed.

When the horse arrived at the hospital, a full clinical examination was performed which focused on the respiratory and cardiovascular systems in order to evaluate anaesthetic risk. If considered necessary, blood can be collected for haematology, biochemistry and electrolyte analysis.

Racehorses are usually a lower anaesthetic risk than others, due to their young age and high levels of health and fitness – although lack of body fat can make it difficult to maintain a stable plane of anaesthesia. The most common anaesthetic problem is reduced respiratory rate due to this high level of fitness. This was managed in this case by using a mechanical ventilator during anaesthesia. Anaesthesia in horses carries a much higher risk in cases of colic and emergency trauma, where the horse may be suffering from metabolic or circulatory complications.

## Premedication

Intramuscular acepromazine (ACP) was given 30 minutes before surgery in order to calm the horse and facilitate a smooth anaesthetic induction and recovery. However, it should be noted that it does reduce blood pressure.

A non-steroidal anti-inflammatory drug (NSAID) and antimicrobials were also administered pre-operatively. The use of a NSAID is important for pain relief and analgesia. Benzylpenicillin and gentamicin were given intravenously and norocilliin was given intramuscularly. Prophylactic antibiotics are used to minimise the risk of incidental contamination of the joint developing into infection. Although this risk is low, the consequences could be life-threatening (Taylor & Clarke, 2007).

After the hair over the surgical field was clipped and skin preparation performed with chlorhexidine and ethyl alcohol, the horse was walked into the induction box. The induction box is constructed with soft, padded walls and floor to minimize the risk of injury when horses lie down.

A combination of xylazine and butorphanol was then administered intravenously in order to achieve profound sedation. Xylazine and butorphanol have sedative and muscle relaxant properties, and their administration reduces the amount of anaesthetic needed.

## Induction

Five minutes after sedation, diazepam was administered intravenously followed immediately with a bolus of ketamine. Ketamine will induce anaesthesia rapidly in the horse but the induction can be relatively violent if used on its own. Diazepam ensures a smoother induction and subsequent anaesthesia (Taylor & Clarke 2007).

A controlled induction technique was used. This involved four handlers to steady the horse safely as it sank to the ground when the anaesthetic took effect. One veterinary technician controlled the head while three colleagues pushed against the horse's shoulder and hindquarters to the keep it supported against the padded wall. Particular care was taken to support the head to avoid the chance of injury to the horse's neck as it lost consciousness. The horse slid down into sternal recumbency and was then manipulated into lateral recumbency. The surgical site then received a final skin preparation prior to moving the patient into the theatre (**Figure 1**) to minimize potential contamination of the operation theatre.

The anaesthetist put a cone-shaped mouth gag in place between the incisor teeth and then intubated the horse with a size 26 cuffed, endotracheal tube. The endotracheal tube was then connected to a mechanical ventilator and isoflurane was used to maintain anaesthesia. Isoflurane has a low blood gas solubility that allows quick recovery even after prolonged anaesthesia.

Once the anaesthetist had confirmed that the horse was in a stable plane of anaesthesia, it was moved by an overhead winch and rail system (**Figure 2**) through to the surgery theatre and then lowered onto an inflatable support mattress on a Haico equine surgical table (Ray-Miller, Hodgson, McMurphy & Chapman 2006).

## Maintenance of anaesthesia

A pneumatically driven ventilator with a tidal volume of around 5 litres was set for 5–6 breaths per minute, and a semi-closed circle rebreathing circuit was used. In theory, when a stable plane of anaesthesia has been reached a rebreathing circuit can be run as a closed system. However, in practice, the expiratory valve is kept partially open to prevent a build-up of gas. The main advantages of the system are that it keeps inspired air warm and moist and reduces the volume of inhalation agent required. A balanced anaesthetic technique was adopted using a combination of isoflurane and medetomidine to maintain anaesthesia when the patient was on the operating the table. The circuit system was connected to a filter and waste gasses were scavenged and discharged safely out of the building.

Isotonic fluids were administered by IV infusion at a rate of 10 ml/kg/h to replace fluid loss and counter the risk of hypotension. Medetomidine, acepromazine, xylazine and isoflurane all contribute to hypotension and so blood pressure was measured directly via an arterial catheter placed in the transverse facial artery. A continual infusion of the β-adrenergic agonist dobutamine was used, to maintain arterial blood pressure above 70mmHg. In addition, ECG, end-tidal carbon dioxide, inspired oxygen concentration; blood oxygen-haemoglobin concentration and arterial blood-gas analysis were recorded.

A urinary catheter was inserted to collect urine, production of which was increased as a side-effect of the medication used and intravenous fluids administered. In addition, catheterisation ensured that the horse's bladder was empty when it was being recovered from the anaesthetic. This is important, as horses with a full bladder might attempt to move and stand in order to urinate before they are ready to do so safely.

In addition to the parameters mentioned above, it was also important to monitor the horse manually by checking the pupillary reflex, palpebral reflex, mucous membrane colour, respiratory pattern, capillary refill time and pulse rate and quality. A deep plane of anaesthesia is recognisable by a central eye position, low blood pressure and reduced response to surgical stimulus

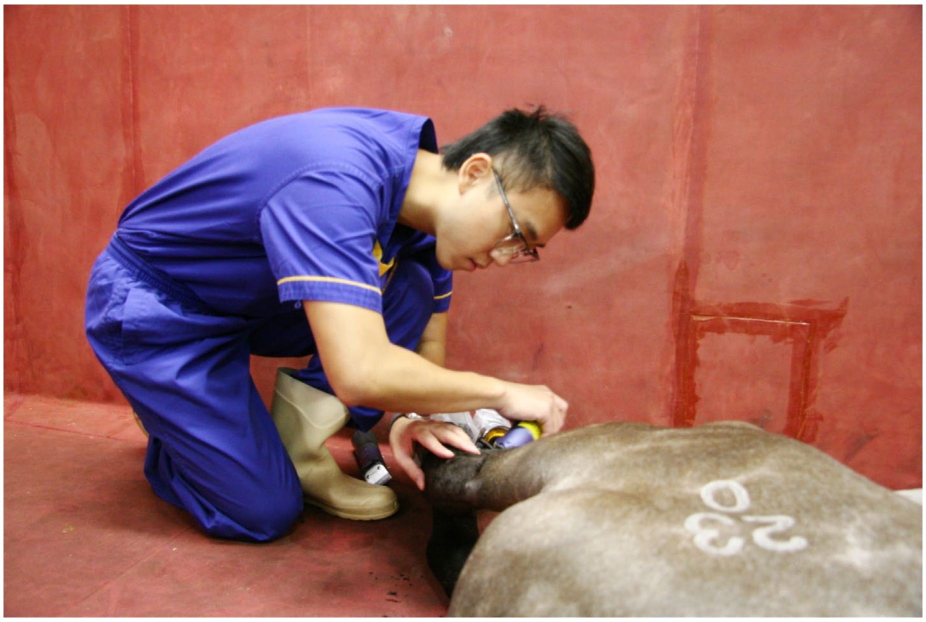

**Figure 1.** A veterinary clinical technician preparing the surgical site

Figure 2. The horse was anesthetised and connected to the electrical hoist system in the induction box

(Neges, Bettschart-Wolfensberger, Muller, Furst & Kastner 2003).

If the horse had started to make unexpected movements, indicating a lighter plane of anaesthesia, a small bolus of ketamine (100mg) would have been administered intravenously to deepen the level of anaesthesia.

Recovery from isoflurane can be rapid, resulting in the horse trying to stand before it has regained adequate coordination. Therefore, medetomidine and butorphanol were administered by intramuscular injection shortly before the end of surgery to keep the horse calm until it was ready to stand safely in a coordinated manner (Neges, et al 2003).

## Recovery

Recovering a horse from general anaesthesia can be dangerous, especially for orthopaedic patients, where the strength of limbs may already be compromised. When regaining consciousness, horses often exhibit fright or flight behaviour. Excitement and ataxia may drive the horse to struggle to its feet prematurely and subsequent falls may lead to injuries such as fractures, luxations, muscles sprains or implant failure. To reduce the risk of such falls, a rope-assisted recovery system was used, with ropes to a head collar and the horse's tail being used to stabilise it (**Figure 3**).

The head and tail ropes were guided through metal rings secured high up the wall in opposite corners of the room. A climbing pulley was attached to facilitate smooth traction on the ropes. Both head rope and tail rope exit the recovery room through small openings in the recovery room door. A friction-brake climbing device (Petzl Grigri), was used on the tail rope to help the staff assisting the horse to gather slack rope rapidly as the horse attempted to stand and then lock immediately (Clarke-Price, Psoner & Gleed, 2008).

The horse was assisted when it tried to stand by maintaining the tail rope in full tension to fully support its hindquarters. The horse moved forward when standing up and in doing this full tension was maintained on the tail rope. The head was steadied but not pulled up. When the horse was standing, both head and tail ropes were used to stabilise and support it until it regained sufficient muscle strength to stand safely on its own (Elmas, Cruz & Kerr, 2007).

Figure 3. Recovery room with rope-assisted recovery system: the red rope connects to and supports the head while the green rope with friction-brake climbing device (PetzlGrigri) supports the tail; note the padded walls and floor

## Conclusion

Equine patients should be provided with a quiet, stress-free and controlled recovery environment. After the horse has been transferred to the recovery room, continuous observation, periodic monitoring and the ability to rapidly respond to complications are essential components of recovery from anaesthesia.

Furthermore, there are some recommendations to minimise recovery complications in equine patients. Adequate analgesia should be provided, the veterinary surgeon may opt to sedate and calm the patient with an agent such as xylazine. Oxygen should be supplemented if necessary, and it is essential to ensure patency of the airway post extubation. Finally constant observation of the patient should be maintained until it is ambulatory.

**Disclosure Statement**

No potential conflict of interest was reported by the author.

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