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How to manage recovery from anaesthesia in the horse - to assist or not to assist?

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Summary

Thirty percent of all equine perioperative deaths are related to severe injury of the musculoskeletal system including fractures during the recovery phase, making recovery a critical part of equine anaesthesia. The opinion on the utility of the routine use of assistance for the horse is very variable and seems to depend largely on personal experience. The aim of this survey was to collect information on type and frequency of assisted recoveries and other measures to improve the recovery phase in horses as they are used and taught by Diplomates of the ACVA or ECVAA. Questionnaires from 34 institutions from 15 countries could be evaluated. In 50% of the equine hospitals assisted recovery was the standard method, whereas in 41.2% the standard was free recovery without assistance. Assisted recovery as the standard method of recovery prevails in North America (North America 11 of 12 clinics versus Europe 5 of 17). Head and tail ropes are used in the majority of equine hospitals (94.1%) as one method to assist the horse. Specialized equipment for high risk recoveries with lifting or weight neutralizing properties is available in 15 of 34 (44.1%) hospitals. Criteria given by ACVA/ECVAA Diplomates for changing from an unassisted to an assisted recovery method were related to type and site of surgery as well as the presence of a cast. Horse and anaesthesia related factors as well as available manpower and familiarity with the recovery system also play a role.

Keywords: horse, recovery, rope, anaesthetic risk, survey

Management der Aufwachphase- mit oder ohne Hilfe?

Die Aufwachphase stellt ein besonderes Risiko bei der Allgemeinanästhesie des Pferdes dar. Ein Drittel aller perioperativen Todesfälle stehen im Zusammenhang mit Verletzungen und Frakturen während der Aufstehphase Die Lehrmeinungen aufgrund persönlicher Erfahrungen zum Management der Aufwachphase und der Notwendigkeit der Aufstehhilfe sind sehr variabel. Das Ziel der vorliegenden Umfrage war es Informationen zur Art und Häufigkeit der Anwendung einer Aufstehhilfe und anderer Maßnahmen zur Unterstützung der Aufwachphase des Pferdes durch Anästhesiespezialisten im internationalen Vergleich gegenüber zu stellen. Ein elektronischer Fragebogen wurde über das Internetforum des American College of Veterinary Anesthesia (L-ACVA) an Diplomates des European College of Veterinary Anaesthesia and Analgesia (ECVAA) und des American College of Veterinary Anesthesia (ACVA) verschickt. Die Fragenbögen von 34 Institutionen (Universitäts- und Privatkliniken) aus 14 Ländern auf 4 Kontinenten [Europa (18), Amerika (14), Afrika (1), Australien (1)] konnten ausgewertet werden. In 17/34 (50%) Kliniken wird als Standard immer eine Aufstehhilfe verwendet, in 14/34 (41,2%) Kliniken wird als Standard keine Aufstehhilfe verwendet und in 3/34 (8,8%) Kliniken werden beide Methoden in etwa gleich häufig angewendet. Dabei wird in Nordamerika (11 von 12 Kliniken) signifikant häufiger als in Europa (5 von 17 Kliniken) eine Aufstehhilfe als Standardverfahren verwendet. Die am häufigsten verwendete Methode der Aufstehhilfe ist die Kopf- und/oder Schweifstrickanbindung (32/34 (94,1%)). Als besondere Aufstehhilfen kommen in 15/34 (44,1%) der Kliniken verschiedene Hebeschlingen- und Transportnetzsysteme zur Anwendung. Ein Pool System (3/34 (8,8%)) oder ein Kipptisch (2/34 (5,9%)) ist nur wenigen Einrichtungen vorbehalten. Die häufigsten Gründe für die Verwendung einer Aufstehhilfe, abweichend von einem Standard ohne Aufstehhilfe waren Art des Eingriffes, Vorhandensein eines Gipsverbandes und propriozeptive Defizite des Pferdes. Eine Nachsedierung mit Xylazin oder Romifidin, eine analgetische Therapie und Sauerstoffverabreichung in der Aufwachphase können als Standardmaßnahmen gelten.

Schlüsselwörter: Pferd, Aufwachphase, Strick, Anästhesierisiko, Umfrage

Introduction

General anaesthesia of horses is associated with considerable risk of morbidity and mortality. A large-scale, multicenter study - CEPEF (Confidential enquiry of perioperative equine fatalities) reported a death rate from non-colic-related anaesthetics of 0.9% (*Johnston* et al. 1995), while the perianaesthetic mortality rate at a single, equine surgical practice seemed to be more favourable with 0.12%, because of preponderance of short procedures (*Bidwell* et al. 2007). Thirty percent of all equine perioperative deaths are related to severe injury of the musculoskeletal system including fractures during the recovery phase, making recovery a critical part of equine anaesthesia (*Johnston* et al. 1995, *Johnston* et al. 2002, *Johnston* et al. 2004, *Bidwell* et al. 2007).

Mortality figures alone do not reflect the overall morbidity of equine anaesthesia in terms of non terminal events or injuries related to recovery. Injuries during the recovery phase range from superficial skin abrasions, bruises and lacerations to luxations and fractures (*Portier* and *Walsh* 2006, *Wagner* 2008). The quality of the recovery phase depends on factors like lengths and type of anaesthesia, concurrent medications, duration of surgery, positioning during surgery, adverse events like hypotension and hypoxaemia and weight and temperament of the individual horse (*Johnston* et al. 2002, *Wagner* 2008, *Hubbell* and *Muir* 2009, *Larenza* et al. 2009). The development of the neuropathy/myopathy syndrome might predispose horses to injuries as a consequence of uncoordinated and/or unsuccessful attempts to rise (*Grandy* et al. 1987, *Lindsay* et al. 1989, *Franci* et al. 2006). However,

numbers on overall morbidity related to recovery from anaesthesia in horses and if they can be reduced by assisted recovery techniques are currently not available.

A simple way to assist horses during recovery is the application of head and tail ropes. Head and tail ropes are able to stabilize a horse during its attempts to rise, however, it is evident that they cannot prevent fractures during standing up (*Johnston* et al. 2002, *Bidwell* et al. 2007) as they do not have a weight neutralizing function. For this reason several systems with lifting or weight neutralizing function mainly for recovery after fracture repair have been developed. These include sling systems in combination with hoists (*Liechti* et al. 2003, *Driessen* 2005, *Taylor* et al. 2005, *Fürst* et al. 2008), tilt tables (*Elmas* et al. 2007) and pool systems exploiting buoyancy of water (*Sullivan* et al. 2002, *Tidwell* et al. 2002).

What is your routine recovery method?
assisted
unassisted
In case your usual method is unassisted –
how often do you change to an assisted recovery?

What system do you use for assisted recoveries?
Hand recovery
Head rope
Head and tail rope
Sling system – (please specify what type)
Pool Recovery
Tilt table
Other method, please specify

What are your criteria for using assisted recovery?
Type or design of recovery stall available
Familiarity with the system
Manpower
Type of surgery
Site of surgery
Extent of surgery
Presence of a cast
Proprioceptive deficits, ataxia
Temperament of the horse
Size of the horse
Lengths of anaesthesia
Type of anaesthesia
Quality of anaesthesia
-like difficulties to maintain blood pressure
-frequent top ups needed
Other, please specify

How do you prepare a horse for recovery?
Empty bladder
Leather helmet
Protective leg wraps
Alpha$_2$ agonist, please specify which
Morphine
Butorphanol
Other pain medications, please specify
Other measures, please specify

Fig. 1 Electronic questionnaire sent to Diplomates of the ECVAA and the ACVA via the internet forum of the American College of Veterinary Anesthesia (L-ACVA).

The opinion on the utility of the routine use of head and tail ropes for every horse and management of the recovery phase in horses is very variable and seems to depend largely on personal experience. The aim of this survey was to collect information on type and frequency of assisted recoveries and other measures to improve the recovery phase in horses as they are used and taught by specialists in veterinary anaesthesia on an international level.

Material and Methods

An electronic questionnaire was sent to Diplomates of the European College of Veterinary Anaesthesia and Analgesia (ECVAA) and the American College of Veterinary Anesthesia (ACVA) via the internet forum of the American College of Veterinary Anesthesia (L-ACVA). Questions were related to routine recovery methods used in the institution, availability of specialized equipment and other measures undertaken in preparation of equine recovery (Figure 1). Data were analysed by descriptive statistics including frequency distributions, Chi-square and Fisher s Exact Test. Alpha was set at 5%. Sample size estimations were performed with Win Episcope 2.0. Answers from several Diplomates from the same institution were contracted as one answer.

Results

Completed questionnaires from 34 institutions (university and private equine hospitals) with a board certified ACVA/ECVAA Diplomate) from 15 countries (Table 1) on 4 continents [Europe (18), America (14), Africa (1), Australia (1)] could be evaluated.

Table 1 Alphabetical list of workplace of participating Diplomates

Location of Hospital	Number
Australia	1
Austria	1
Belgium	2
Canada	1
France	2
Germany	2
Ireland	1
Italy	1
Netherlands	1
Norway	1
South Africa	1
Sweden	1
Switzerland	2
UK	4
US	13

Table 2 Criteria given by ACVA/ECVAA Diplomates for changing to an assisted recovery method - answers from anaesthetists using unassisted recovery or both as their main method (n = 17)

	Absolute number	Relative Frequency (%)
Type of recovery stall footing, size	6	35.3
Familiarity with the system	8	47.1
Manpower available	10	58.5
Type of surgery	15	88.2
Site of surgery	10	58.8
Extent of surgery	6	35.3
Presence of a cast	11	64.7
Proprioceptive deficit	11	64.7
Character of the horse	8	47.1
Size of the horse	8	47.1
Lengths of anaesthesia	8	47.1
Type of anaesthesia	3	17.6
Quality of anaesthesia	3	17.6
Blood pressure	3	17.6
Frequent top ups	2	11.8

In 17 of 34 (50%) clinics assisted recovery was the standard method used in all horses, in 14 of 34 hospitals (41.2%) the standard was free recovery without assistance and in 3 of 34 clinics (8.8%) both methods were used with similar frequency. Assisted recovery as the standard method of recovery prevails in North America. (North America 11 of 12 clinics versus Europe 5 of 17 clinics) ($p = 0.0018$)).

Head and tail ropes are used in the majority of equine hospitals (32 of 34 (94.1%)). A single head rope is applied in 10 locations and the use of a single tail rope was reported by one hospital. A thick foam mattress mainly in conjunction with head and tail ropes is employed in 10 (29.4%) hospitals. Direct hand recovery is mainly used in foals and ponies [22/34 (64.7%)].

Specialized equipment for high risk recoveries with lifting or weight neutralizing properties is available in 15 of 34 (44.1%) hospitals. This includes various sling and transport net systems, a tilt table and pool systems. The pool systems include the swimming pool-raft technique and two water tank systems.

In hospitals using unassisted recoveries as the standard method a deviation from this routine to some sort of assisted procedure was reported to be necessary with an estimated frequency of 0.5 to 10% of cases. Criteria given by ACVA/ECVAA Diplomates for changing to an assisted recovery method were related to the surgical procedure, the horse, the course and type of anaesthesia and the premises (Table 2).

Measures taken to prepare the horse for the recovery phase comprise mainly sedative and analgesic drugs, the use of protective devices and provision of adequate oxygenation and breathing (Table 3).

Table 3 Measures taken by ACVA/ECVAA Diplomates to prepare a horse for the recovery phase (n=34)

	Absolute number	Relative Frequency (%)
Protective measures:		
Helmet/hood	11	32.4
Leg wraps	7	20.6
Drugs:		
$Alpha_2$ Agonist (xylazine >>>> romifidine)	33	97.1
Acepromazine	6	17.6
Morphine (systemic, intraarticular, epidural)	17	50.0
Butorphanol	17	50.0
Methadone	7/	20.6
NSAIDS mostly as premedication	25	73.5
Ketamine	5	14.7
Local blocks	5	14.7
Oxygenation/Breathing:		
Oxygen insufflation	34	100.0
Nasal drops/nasal tube	10	29.4
Comfort:		
Dim light, reduce noise; ear plugs, eyes covered	10	29.4
Empty bladder after long procedures	25	73.5

Discussion

Sedation with an $\alpha 2$ agonist mainly xylazine followed by romifidine, analgesic treatment with NSAIDS and/or an opioid and oxygen insufflation as well as emptying the bladder after long anaesthetics can be considered international standard procedures for the recovery phase in equine anaesthesia. The main aim of such measures is to prevent premature attempts to stand up, before the horse is fully awake and can coordinate its movements. Pain, hypoxia, excitement and noise lead to sympathetic stimulation and can contribute to early uncoordinated rising. Ideally, horses should roll into sternal recumbency early in the recovery phase because of improved lung function in this position, remain in this position until drugs have waned allowing regain of full control of leg and body movements. Sedation with an $\alpha 2$ agonist has been shown to keep horses down for a longer period associated with significant improvement of the recovery quality in horses (*Glitz* et al. 2001, *Bienert* et al. 2003, *Santos* et al. 2003, *Ringer* et al. 2007), whereas morphine treatment improved the quality of recovery with better coordination without further prolongation of the recovery time (*Clark* et al. 2008).

Injuries during the recovery phase range from superficial skin abrasions to fractures. Abrasions, lacerations and bruises mainly on the head and legs can be minimized by protection with a leather helmet/hood or leg wraps. However, the use of such devices seems not to be included into a standard protocol used and taught by anaesthesia specialists. Application of protective devices was independent of the type of recovery employed (data not shown).

In the current survey a major difference in standard practice of the employment of assistance by head and/or tail ropes or hand recovery between North America and Europe became very obvious. The reason for this observation remains unclear, as assisted and unassisted recovery seem to be equally accepted methods for routine equine anaesthesia according to various textbooks (*Doherty* and *Valverde* 2006, *Taylor* and *Clarke* 2007, *Muir* and *Hubbell* 2009). Within the extensive CEPEF studies no differentiation between assisted and unassisted recoveries or location of the participating equine practices and hospitals was made (*Johnston* et al. 1995, *Johnston* et al. 2002, *Johnston* et al. 2004). The use of head and tail ropes cannot prevent the occurrence of fractures when the horse pushes itself up (*Young* and *Taylor* 1993, *Bidwell* et al. 2007, personal observation), but it might help to reduce uncontrolled falls. There is no evidence based information available on possible reduction of morbidity and mortality by the use of a head and tail rope recovery system in equine anaesthesia. It would be of interest to obtain information on what type of injuries can be prevented or if the presence of the ropes might even lead to unwanted early attempts to get up if used by personnel unfamiliar with the system. Because morbidity data are scarce (*Senior* et al. 2007), sample size estimations could be based on published mortality data. Mortality rate of healthy horses (ASA 1-2) undergoing general anaesthesia is 0.9 %, fractures being the cause in 23% of deaths (*Johnston* et al. 2004), this leads to a frequency of 2 fractures per 1000 equine anaesthetics. To show if recovery with a head and tail rope is able to reduce the risk of a fracture from 2 per 1000 to 1 per 1000 anaesthetics, data of 47000 equine anaesthesia cases would be necessary (power

80%; confidence interval 95%) (Win Episcope 2.0), requiring a multicentre study.

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