

Use of the Madigan Squeeze System for calming neonatal foals during routine plasma administration and minor procedures.

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Introduction

Restraint of neonatal foals is a routine practice to facilitate their husbandry and management. Because the horse, including the neonatal foal, is a flight animal, physical restraint has often been used after ‘capturing’ a foal in a stall and holding it with an arm in the front of the foal’s chest under the neck and the other arm around the rear of the foal in attempts to prevent flight. Slightly invasive procedures such as plasma administration, often results in the need for prolonged physical restraint in the standing position. Some farm veterinarians use chemical restraint including benzodiazepines (diazepam, midazolam), opioids (butorphanol tartrate), and alpha-2 agonists (xylazine hydrochloride) for plasma administration in large neonatal foals. Neonatal thoroughbred foals weigh between 34 and 72kg (75 and 159 lbs) at birth. Physical restraint for plasma or IV injection in neonates has been reported to have complications including the foal attempting to leap, flipping over, having the airway compromised by the arm holding the front of the foal and interference with jugular dispensability. While older healthy foals tolerate sedatives and anesthetics well, the avoidance of routine use of these drugs in neonates is desirable due to their immature cardiorespiratory and hepatic physiology (1).

Neonatal foals display an intriguing phenomenon of predictable collapse when physically restrained in a particular manner often described as the flopping reaction (2). Upon a handler placing firm, constant pressure around the front of the foal's chest with one arm, around the buttocks with the other arm and then gently turning the head and tail inwards towards each other, the foal quickly becomes recumbent and immobile until release of restraint (2-5). This response was previously termed a 'flopping reaction' (1,4) or 'reflex relaxation' (4), however recent clinical, biochemical and electroencephalographic study of this reaction has suggested 'squeeze induced somnolence' (SIS) to be a more accurate term (6). SIS can be reliably induced by application of a soft rope around the thorax in healthy neonatal foals. Studies of this specific rope calming method has revealed the foal becomes recumbent and goes into slow wave sleep during the squeeze (6). Additionally, while in the rope squeeze system significant increased tolerance to noxious stimuli was observed (6). Because positive early human exposure, and lack of fear generated responses are considered beneficial for the foal's welfare; further methods of restraint have been pursued. The ease of inducing this calming and somnolence with the squeeze procedure and the lack of any adverse effects associated with its use in earlier studies suggested it might be a practical alternative to prolonged standing physical restraint in neonatal foals.

Foal Squeeze Procedure

The Madigan foal squeeze method is performed using a soft cotton rope as previously described http://vetmed.ucdavis.edu/compneuro/local_resources/pdfs/mfsm_instructions.pdf Briefly, a soft linen rope (6.1 m in length and 1.27 cm in diameter) was used to construct the restraint device. All foals used in the study had a normal foaling, normal post birth standing and nurse times and were palpated for evidence of rib trauma or possible fracture. A bowline knot was used

to secure the rope around the neck and under the shoulder of the foal and then two half-hitch knots were used to loop the rope around the thorax and abdomen, perpendicular to the vertebral column, twice, 5 to 25 cm apart. A designated person stands behind the foal and pulled on the rope, which results in a generalized squeezing of the foal, as a second person assisted the foal as it lay down. Tension that induced the foal to become recumbent was maintained on the rope until the procedure is complete.

Plasma Administration

A farm with 60-80 foals births per year has been performing plasma administration in 12-24 hr old foals using the Madigan Squeeze System since 2012. A few precautions are given here. First, the foal is in slow wave sleep and is not anesthetized and might arouse during the procedure and can kick. Stay to the back side (withers side of the foal) when placing the catheter. The mare is kept close to the foal in the center of the stall. The foal is squeezed and laid down in front of the mare. A towel is placed over the foal's head and eyes. Immediately following recumbency an area over the right or left jugular vein is aseptically prepared and a small bleb of local anesthetic injected subcutaneously using an insulin syringe and 25 ga needle while keeping a hand on the foal's neck with some pressure. Some foals respond to the injection and then quickly return to a sleep-like state. A 16G, 3 inch intravenous catheter is sterilely inserted and 1 L of plasma (Plasvac USA Inc, Templeton, CA, USA) administered slowly over approximately 20 minutes. The foals should be constantly monitored for any reaction to the plasma, any signs of distress caused by the restraint and any arousal from somnolence. Following completion of plasma administration, the catheter is removed and the rope restraint released. This farm also uses very low dose xylazine intravenously if the foal is large is not responding to the squeeze

procedure. No adverse effects have been reported using this system by this particular farm. Sick neonatal foals should not be sedated with alpha 2 drugs.

Due to their inherent physiological response to this technique, SIS is most appropriate for use in neonates. The age at which foals no longer respond to SIS is not conclusively known but it is suggested to use this method in foals 1-4 days of age.

In conclusion, the Madigan Squeeze System might provide a useful method of non-chemical restraint for minor procedures in neonatal foals. Recently the use of the method has been reported in foals with maladjustment syndrome revealing a significant number of foals nursed within one hour of the procedure compared to foals treated with conventional therapy <https://www.mdpi.com/2076-2615/7/9/69> (7).

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Figure 1: Application of squeeze induced somnolence to provide non-chemical restraint in a healthy neonatal foal.

Objectives: To investigate a novel squeeze procedure for providing calming of healthy neonatal foals for the purpose of plasma administration.

Study Design: Prospective clinical study

Methods: A novel squeeze system was performed on 14 Thoroughbred healthy neonatal foals by application of a soft rope around the thorax to induce calming and recumbency to facilitate intravenous catheterization and plasma administration. Behavioral, physiological and clinical parameters were monitored pre-, during and post- squeeze application.

Results: Use of the squeeze procedure produced recumbency and calming which allowed plasma administration on 14 foals within the first day of life without any adverse effects. Mean time to achieve recumbency following application of the squeeze system was 53 s, mean time to stand and mean time to nurse from dam following release of the squeeze were 46 s and 163 s respectively. Over 50% of foals gave mild reaction to subcutaneous injection of local anesthetic at the site of catheterization and one foal reacted strongly. The squeeze technique was performed without adverse behavioral manifestations in 8/14 foals, 5/14 foals became less somnolent at around 17-18 min) and 1 foal never became fully somnolent.

Conclusions: This novel squeeze calming method produced minimal behavioral objections from the foals in this study and allowed plasma administration without the need for excessive physical restraint or sedation in 13/14 neonatal foals. These results suggest this procedure may improve neonatal foal welfare for similar procedures that previously required prolonged standing physical restraint or injectable sedation by veterinarians.