

Research Article

A Comparative Study of Mineral Oil and Corn Oil in Medical Management of Sand Colic Impactions in Horses

Abelardo Morales-Briceño*

Alain Stud & SHS Veterinary Center, Al Wathba, Abu Dhabi, UAE

Abstract

The aim was to a comparative study of mineral oil and corn oil in medical management of sand colic impactions in horses in Al Wathba, Abu Dhabi, UAE. This study was conducted at Al Wathba, Abu Dhabi, UAE for a 1-year period. Additionally was to a comparative review about the characteristics of mineral oil and corn oil. Clinical Examination was made and treatment with gastric lavage, straight-colon-cecum lubrication with paraffin liquid (mineral oil) or corn oil, centesis cecum and colon, medication and observation include time of recovery. A descriptive statistical analysis was performed Pearson correlation coefficient. In total 80 horses with colic was treated during the study period. The incidence of colic due to sand impaction was 15%, specifically gastric sand impaction 33%, small bowel sand impaction 18%, cecum sand impaction 27% and colon sand impaction 22%. A comparative review between the mineral oil and corn oil showed higher density for corn oil, higher viscosity and lower surface tension. The medical management of colic associated with sand impaction involving the stomach, small intestine, cecum, colon, and rectum can have a good prognosis using liquid paraffin or corn oil. In conclusion, horses with gastric sand impaction, small bowel sand impaction, cecum sand impaction, colon sand impaction, treated with corn oil, have a shorter recovery period of 8-24 hours and more than 24 hours, this means a decrease in the clinical complications associated with colic due to impaction by sand in the horse and represents a safe and effective therapeutic alternative.

Keywords: Colic; Corn oil; Equine; Horses; Mineral oil

*Corresponding author: Abelardo Morales-Briceño, Alain Stud & SHS Veterinary Center, Al Wathba, Abu Dhabi, UAE, E-mail: aamorales13@gmail.com

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Introduction

Colic is a general term that refers to abdominal pain in the horse [1]. Enteropathy associated with sand accumulation in the large colon of horses has been reported worldwide [2]. Ingestion of sand can cause colic, diarrhoea and weight loss in horses, but these signs are unspecific and can have many other causes [3]. The most common clinical signs at presentation sand colic were abdominal pain, abdominal distension and diarrhoea. Sand impaction occurs most frequently at the pelvic flexure and the terminal aspect of the right dorsal colon or it may accumulate in the ventral colon, pelvic flexure, and/or transverse colon causing impaction [4]. A recently study in Al Wathba, Abu Dhabi, United Arab Emirates, in the stable environment 94% of the boxes have sand-based beds, and most of the paddock area is sand, however it is a colic risk for some horses with mineral deficits and some behavioral disorders. Sand consumption the second cause of colic after water deficit corresponds to the ingestion of sand with the result of gastric impaction, cecal impaction and colon impaction [5]. Sand impaction can be difficult to differentiate from feed impaction, and tests for fecal sand do not correlate well with the presence of sand in the colon. History or observation of sand in the feces only indicates exposure to sand. Sand may be detected during transrectal palpation or dissolving feces in water and observing for sand in the bottom of a bucket or on a rectal sleeve may provide evidence of the possibility of sand impaction [4]. Ultrasonographic examination of the ventral abdomen and abdominal radiographs, can aid in the diagnosis of sand impaction [4]. Increased accumulation of gas on radiographs and transrectal palpation of impaction or intestinal gas distension increase the likelihood of surgery [6]. Horses with sand impactions often do not respond to medical treatment alone and require surgical intervention [4]. Liquid paraffin oil is a mineral oil and is a by-product of crude oil distillation, is transparent, colorless, odorless, and tasteless oil, which is mainly composed of high-boiling alkane derivatives. Mineral oil while this product was long considered the laxative of choice for impactions, research has shown that it's not as effective at breaking blockages down as once thought [7]. Liquid paraffin (high-boiling mineral oil) is a mixture of higher molecular weight alkane derivatives and has a number of names, including nujol, adepsine oil, alboline, glymol, medicinal paraffin, or saxol [8]. Mineral oil is commonly given in combination with water by a nasogastric tube. Liquid paraffin or mineral oil (medicinal) used to aid problems of the gastrointestinal tract and it passes through the tract without itself being taken into the body, as a laxative—this oil is not absorbed by the intestinal tract [8]. Raw linseed oil was once a commonly administered laxative for treatment of intestinal impactions, and, in some countries, it is currently marketed as a laxative for livestock but raw linseed oil and mineral oil showed all horses treated with linseed oil had signs of depression and anorexia, and these signs were not observed in horses treated with mineral oil, concentrations of serum glucose and bilirubin were significantly higher in horses treated with linseed oil when compared with horses treated with mineral oil [9]. Currently, the most commonly used medical treatments for removing sand accumulations include: *Psyllium mucilloid* (*Plantago ovata*; hereafter 'psyllium'), magnesium sulphate ($MgSO_4$) and

combinations of these products [2]. Corn oil is slightly yellowish, with a mild and characteristic odor and taste, represents an important source of minor bioactive lipids, such as phytosterols, tocopherols, tocotrienols, and carotenoids. Corn oil contains high level of linoleic acid, essential to metabolic functions. The second major fatty acid is monounsaturated oleic that, in some HOC, nearly equals the amounts of linoleic, opening the possibility of developing new high-oleic cultivars [10]. Under this important area of study, the aim was to a comparative study of mineral oil and corn oil in medical management of sand colic impactions in horses in Al Wathba, Abu Dhabi, UAE.

Materials and Methods

Data collection: This study was conducted at Al Wathba, Abu Dhabi, UAE for a 1-year period (January 2021/January 2022). Additionally was to a comparative review about the characteristics of mineral oil and corn oil.

Clinical Examination: This procedure described systematic attention to colic was performed for all cases in the field.

1. Clinical history.
2. Observation of behavior in the box and paddock.
3. Physiological parameters: capillary refill time, an evaluation of the mucous membrane color, dehydration, Cardiac auscultation (heart rate), respiratory (respiratory rate) and abdominal (intestinal motility).
4. Transrectal palpation.
5. Gastric lavage (naso-esophageal intubation).
6. Straight-colon-cecum lubrication with paraffin liquid (mineral oil) or corn oil.
7. Centesis cecum and colon.
8. Medication: Flunixin Meglumine, Dipirone and Xylazine, Physiological solution (Ringer lactate/Normal Saline).
9. Observation in hospitalization (Time of recovery: start to eating and drinking to 8 hours and 24 hours).
10. Statistical analysis: A descriptive statistical analysis was performed Pearson correlation coefficient and presentation of percentage.

Results

In total 80 horses with colic was treated during the study period. The incidence of colic due to sand impaction was 15%, specifically gastric sand impaction 33%, small bowel sand impaction 18%, cecum sand impaction 27% and colon sand impaction 22%. A comparative review between the mineral oil and corn oil showed higher density for corn oil, higher viscosity and lower surface tension. Mineral oil shows lower density, lower viscosity and higher surface tension is presented below in table 1.

The results showed the horses with gastric sand impaction and treated with mineral oil 92% start eating at 8 hours and 8% at 24 hours, with respect to water, 58% started drinking water at 8 hours and 100% at 24 hours, while 100% of the horses treated with corn oil began to eat and drink at 8 hours.

Characteristics	Mineral Oil (Paraffin Liquid)	Corn Oil
Density	0.8 g/cm ³ .	0.917 - 0.925 g/cm ³ .
Viscosity	7.0–8.5 100 °C (mm ² /s)	34.9 100 °C mm ² /s
Surface Tension	44.1 dynes/cm at 8-10°C	33.6 dynes/cm at 8-10°C

Table 1: Comparative characteristics between the mineral oil (paraffin liquid) and corn oil.

An horses with small bowel sand impaction in general for horses treated with mineral oil and corn oil required two gastric lavages, three times medication with Dipirone, xylazine 2 times, however 5L of mineral oil and 10L of normal saline and flunixin meglumine were used 3 times, while 3 liters of mineral oil, 7L of normal saline and flunixin meglumine were used twice. 56% of the horses started eating at 8 hours in the mineral oil group and 11% were not eating and drinking at 24 hours. 60% of the horses treated with corn oil began to eat at 8 hours and 40% did not eat at 24 hours and only 11% did not drink water in that period.

The horses with cecum sand impaction were generally gastric lavage and flunixin meglumine 3 times. Horses treated with mineral oil 5L, dipirone 3times, cecum-centesis 3 times and normal saline 15L, 40% began to eat at 8 hours and 10% at 24 hours. Unlike the horses treated with corn oil 3L, dipirone 2 times, cecum-centesis 1 time and normal saline 7L, at 8 hours they started eating 67% and drinking water 75% and at 24 hours 25% and 8%, respectively.

Interesting horses with colon sand impaction were treated 3 times with gastric lavage, flunixin meglumine, and dipyrone. Horses treated with mineral oil 6L, cecum-colon-centesis 3T, xylazine 3 times and normal saline 20L. At 8 hours they began to eat and drink 43% and at 24 hours 27%. The horses treated with corn oil 4.5L, cecum-colon-centesis 1time, normal saline 10L, 72% started eating and drinking water 82% at 8 hours and 27% and 18% at 24 hours.

All horses were evaluated, diagnosed and treated, 92% responded to therapeutics, 8% of the horses needed more than 24 hours to recover and the mortality was 3%. No horse was referred for abdominal surgery. On necropsy the horses showed small bowel sand impactions and endotoxic shock 48 hours after start the colic treated with mineral oil (Table 2).

Discussion

Many factors have been identified as risk factors for colic in horses in several epidemiological studies [4]. However, in Middle Eastern countries, especially colic associated with the ingestion of sand, represents an important casuistry and cause of death in horses. Management represents the most important risk factor for the development of horse colic because it includes: diet, amount of food and grass, frequency, probiotics, water availability, the environment (box, paddock, ventilation, temperature and humidity), exercise/performance and veterinary care (deworming and teeth) [5]. The identification and diagnosis of the cause of colic is decisive in medical and/or surgical therapy and the prognosis of recovery of the horse. The treatment of gastrointestinal impactions depends on the segment affected and the amount of bowel damage which has occurred from distension, many impactions respond to appropriate administration of analgesics, cathartics, and oral or intravenous fluids [11]. Intravenous fluid therapy may be necessary in horses that do not respond to initial treatment with analgesics and laxatives [4]. The laxatives mostly used in the

	Treatment	8 hours	24 hours
Gastric Sand Impaction 26 (Horses)	Gastric Lavage: 1T Flunixin meglumine: T1 Mineral oil: 2L Xylazine: T1 Total: 12	Start eating grass: 92% No eating: 8% Drinking water: 58% No drinking water: 42%	Start eating grass: 8% No eating: - Drinking water: 100% No drinking water: -
	Gastric Lavage: 1T Flunixin meglumine: T1 Corn oil: 3L Xylazine: T1 Total: 14	Start eating grass: 100% No eating: - Drinking water: 100% No drinking water: -	Start eating grass: 100% No eating: - Drinking water: 100% No drinking water: -
Small bowel sand impaction 14 (Horses)	Gastric Lavage: 2T Flunixin meglumine: T3 Mineral oil: 5L Xylazine: T1 Normal saline: 10L Total: 9	Start eating grass: 56% No eating: 44% Drinking water: 89% No drinking water: 11%	Start eating grass: 33% No eating: 11% Drinking water: 89% No drinking water: 11%
	Gastric Lavage: T2 Flunixin meglumine: T3 Dipirone: T3 Corn oil: 3L Xylazine: T2 Normal saline: 7L Total: 5	Start eating grass: 60% No eating: 40% Drinking water: 60% No drinking water: 40%	Start eating grass: 20% No eating: 40% Drinking water: 80% No drinking water: 20%
Cecum sand impaction 22 (Horses)	Gastric Lavage: T3 Flunixin meglumine: T3 Dipirone: T3 Mineral oil: 5L Cecum-centesis: 3T Xylazine: T3 Normal saline: 15L Total: 10	Start eating grass: 40% No eating: 60% Drinking water: 40% No drinking water: 60%	Start eating grass: 10% No eating: 20% Drinking water: 20% No drinking water: -
	Gastric Lavage: T3 Flunixin meglumine: T3 Dipirone: T2 Corn oil: 3L Cecum-centesis: 1T Xylazine: T1 Normal saline: 7L Total: 12	Start eating grass: 67% No eating: 33% Drinking water: 75% No drinking water: 33%	Start eating grass: 25% No eating: 8% Drinking water: 8% No drinking water: 8%
Colon sand impaction 18 (Horses)	Gastric Lavage: T3 Flunixin meglumine: T3 Dipirone: T3 Mineral oil: 6L Cecum-centesis: 3T Xylazine: T3 Normal saline: 20L Total: 7	Start eating grass: 43% No eating: 57% Drinking water: 43% No drinking water: 57%	Start eating grass: 29% No eating: 29% Drinking water: 29% No drinking water: 14%
	Gastric Lavage: T3 Flunixin meglumine: T2 Dipirone: T2 Corn oil: 4.5 Cecum-centesis: T1 Xylazine: T2 Normal saline: 10L Total: 11	Start eating grass: 72% No eating: 27% Drinking water: 82% No drinking water: 18%	Start eating grass: 27% No eating: 9% Drinking water: 91% No drinking water: 9%

Table 2: Comparative characteristics between the mineral oil (paraffin liquid) and corn oil.

management of colic associated with sand impaction involving the stomach, small intestine, cecum, colon, and rectum can have a good prognosis using liquid paraffin or corn oil, as long as the colic is identified in the first 4 hours after its onset, pharmacological management of abdominal pain, adequate hydration, application of liquid paraffin or corn oil, and constant monitoring of the patient for 48 hours. The correlation coefficient (Pearson's Correlation Coefficient) was positive between recovery at 8 ($r = 0.86 P < 0.05$), more than 24 hours and therapeutic with mineral oil ($r = 0.88 P < 0.05$). However, for recovery at 24 hours, the correlation coefficient (Pearson's Correlation Coefficient) was negative ($r = -0.5 P < 0.05$). These results seem to indicate that mineral oil-treated horses with small bowel sand impaction require more than 24 hours for recovery. The correlation coefficient (Pearson's Correlation Coefficient) was positive between recovery at 8, 24 and more than 24 hours and corn oil therapy (8 hours: $r = 0.9 P < 0.05$; 24 hours: $r = 0.720 P < 0.05$ and more 24 hours: $r = 0.643 P < 0.05$). These results seem to indicate that horses with gastric sand impaction, small bowel sand impaction, cecum sand impaction, colon sand impaction, treated with corn oil, have a shorter recovery period of 8-24 hours and more than 24 hours, this means a decrease in the clinical complications associated with colic due to impaction by sand in the horse. In the practice of the horse veterinarian, the casuistry of colic represents 80% of the cases, the availability of mineral oil by physical space may be limited, since it can be purchased in medical-veterinary supply stores, which may be a limitation, however, corn oil may be available in grocery stores, which can be an advantage. A study of comparison of medical and surgical treatment for impaction of the small colon significant differences between groups were not identified for duration of clinical signs, physical examination findings, or laboratory values. Horses treated surgically were hospitalized longer than horses treated medically, and the prognosis for horses treated surgically or medically is fair [13]. A recently study of 115 cases of colic in horses were described in Al Wathba, Abu Dhabi-UAE (Sep 2018-Nov 2019), 85% was recovered with medical treatment, 3% were referred to surgery and mortality was 11% [5]. A personal clinical observation of the author suggests that in horses treated with corn oil, greater energy while horses treated with mineral oil appear tired and exhausted may be associated with a longer recovery time. This clinical assessment seems to indicate the absorption of corn oil at the intestinal level; in a minimum amount it can provide energy for these horses with colic. The prevention of gastrointestinal impaction should be focused on management measures in the stable, a feeding (feed and pasture) adequate with the mineral requirements according to the geographical location, mineral supplementation according to the requirements, availability of water at libitum, and medical treatments with *Psyllium mucilloid* (Plantago ovata; hereafter 'psyllium') and magnesium sulphate ($MgSO_4$).

Conclusion

In conclusion, horses with gastric sand impaction, small bowel sand impaction, cecum sand impaction, colon sand impaction, treated with corn oil, have a shorter recovery period of 8-24 hours and more than 24 hours, this means a decrease in the clinical complications associated with colic due to impaction by sand in the horse and represents a safe and effective therapeutic alternative. The identification of risk factors represents an important objective for the prevention and reduction of the incidence of colic associated with gastrointestinal impaction by sand in horses. This enables horse owners/care-givers and veterinarians to make evidence-based decisions to plan their preventive care and management programs to reduce the risk of

treatment of impactions include mineral oil, dioctyl sodium sulfosuccinate, and magnesium sulfate (Epsom salt) [12]. The medical

gastrointestinal impaction sand colic in environmentally predisposed geographic locations such as the Middle East.

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