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MANAGEMENT AND PREVENTION OF IMPACTION COLIC IN A 56-YEAR OLD ASIAN ELEPHANT (*ELEPHAS MAXIMUS*)

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ABSTRACT

A 56-year-old female Asian elephant (*Elephas maximus*), with known dental issues, presented with lethargy and inappetence. Clinical examination and a history of dental abnormalities and mild impaction colic led to a diagnosis of moderate to severe obstructive intestinal impaction colic. Treatment with oral meloxicam, DSS (Dioctyl Sodium Sulfosuccinate), mineral oil, epsom salt and electrolytes as well as rectal enemas were combined with rest and periods of exercise. Treatment resulted in successful passing of an enlarged fecal ball consisting of dried out long fiber feed material. A prevention plan was created for this elephant which has been successful in reducing frequency and severity of colic events for this patient.

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Asian elephants (*Elephas maximus*) are monogastric, hindgut fermenters and their abdominal contents and digestive processes are most comparable to the domestic horse. Elephants have a relatively short gastrointestinal tract compared to other species, but their gastrointestinal organs can hold large volumes of fluids and ingesta (Greene, 2019a; Wiedner, 2012). Their simple stomach is very similar to other monogastric animals like horses and pigs. Fermentation of gastrointestinal contents occurs in the ceco-colon, as in horses, however elephants have a proportionally larger colon to cecum ratio (Greene, 2019a; Sahu, 2021; Teodoro, 2023). Elephants eat large amounts of variable quality forage, consuming approximately 2% of their body weight and regularly drink 150-250 liters of water per day (Greene, 2019a, 2019b; Wiedner, 2012). Due to the variety and large volume of plant material they consume, dentition in elephants is vital to mechanical breakdown of plant stems, branches and fibers. Elephant dental formula is 1/0 C 0/0 PM 3/3 M 3/3 and they grow six sets of molars over the course of their life, the final set erupting at

around 40 years of age (Greene, 2019a). Geriatric elephants can wear down and lose their teeth from the last set of molars, which may result in diastemas and subsequent abnormal dental wear as seen in domestic herbivores (Greene, 2019a). When these dentition changes occur, the mechanical breakdown of feed material is reduced which decreases feed digestibility and can increase the likelihood of choke, intestinal obstruction, weight loss and other gastrointestinal issues. As in horses, elephants are also prone to multiple forms of colic, including obstructive colic which can result from sand/dirt ingestion, poor dentition as previously mentioned, eating large volumes of high fiber feed, etc (Sahu, 2021).

CASE REPORT

"Jenny", a 56-year-old female Asian elephant presented on May 31, 2022 acting quiet, with mild lethargy and anorexia. On the morning of May 31, Jenny drank a normal amount of water, ate a normal amount of grain, had a bath given by keepers and then began to act

abnormally. Jenny was quiet, standing around more than normal, not performing normal behaviors and did not pass any feces. By late afternoon, Jenny had progressed to inappetence. Keepers did not detect any signs of bloat and gave a warm water (~40 °C) rectal enema with a hose allowing 5 minutes of full flow intrarectally (~180L). Keepers performed a rectal palpation just prior to giving rectal fluids and did not feel any obvious obstruction or abnormal structures. Keepers monitored her periodically overnight. Jenny laid down at 6:30pm and was still recumbent when keepers checked on the patient at 10pm which was abnormal for this elephant. Overnight, Jenny was still uncomfortable, getting up and down repeatedly and did not produce any feces.

The following morning, veterinarians arrived to assess the elephant. Jenny was quiet, alert, and responsive. Mucous membranes were pink and moist, capillary refill time was less than two seconds and eyes were not sunken indicating good cardiovascular perfusion and normal hydration. Rectal palpation and ultrasound were performed. No abnormalities were felt on rectal palpation. On rectal ultrasound, the colon was mildly dilated and filled with homogeneous churning fluid with no other abnormalities seen. With these findings and a history of mild colonic impactions, the veterinary team's top differential was a more severe colonic impaction colic. The veterinary team and elephant care staff developed a treatment plan (Table 1).

Table 1. Treatment schedule created for described elephant patient.

Time	Time in Treatment	Treatments given
11:30am	0h	Administer rectal fluids (~180L) as part of the rectal exam and ultrasound, 1200 ml mineral oil PO in syringe, 25ml Meloxicam PO (15mg/ml, Solvet, Calgary, AB T2C5N6, Canada).
12:30pm	1h	Give 350g Epsom salt and 1 packet of v-lyte (Vetoquinol, Lavaltrie, QC J5T3S5, Canada) electrolyte supplement with 2.25L of warm water PO.
2:30pm	3h	One container of DSS (Anti Gaz Emulsion, Vetoquinol) given PO in syringe
3:00pm	3.5h	Walk patient for 30 mins
4:30pm	5h	350g epsom salt and 1 packet of v-lyte (Vetoquinol) with 2.25L of warm water PO
6:30pm	7h	1200 ml mineral oil PO in syringe and rectal enema with warm water (~180L)



Figure 1. Patient's abnormally large and compacted fecal ball.

At 3:30pm, Jenny passed a large fecal ball made of very compact dry fecal material mostly consisting of long plant stems. This abnormal fecal ball was approximately 24"x 9"x 9" (Figure 1) while normal fecal balls for this elephant are roughly 5"x 5"x 5".

The treatment plan was altered to 350g Epsom salt and 1 packet of v-lyte (Vetoquinol) with 2.25L of warm water PO at 4:30pm and an enema at 6:30pm. Additionally, the elephant's hay was to be chopped up to reduce particle size, increased amounts of bran and oats were to be given each day.

During the 6:30pm enema, Jenny passed a large amount of normal fecal balls, and several smaller fecal balls after the enema. Jenny began regaining her appetite and normal behavior, therefore the veterinarians and keepers decided to reduce the number of treatments and formulate a preventative plan to reduce this issue from reoccurring.

DISCUSSION

Colic is a broad term for a number of disease processes that affect the gastrointestinal tract and is a frequent condition seen in horses as well as elephants. Elephants have been reported to have suffered from colic due to strangulating intestinal obstructions (Wiedner, 2012), infectious organisms (Molenaar, 2022), sand impactions (Teodoro, 2023) and feed impactions (Firyal, 2007; Sahu, 2021), as well as other etiologies. This elephant had an intestinal obstruction colic due to high fiber feed as well as poor dentition. Unresolved large intestinal obstruction can cause dilation of the intestinal lumen by gas and fluid leading to ischemia of the mucosa resulting in intestinal necrosis, sepsis, or even intestinal rupture (Mair, 2013). Therefore, keen animal observation, knowledge of normal and abnormal animal behavior and a prompt treatment plan are all vital to the success of colic intervention and survival of the patient.

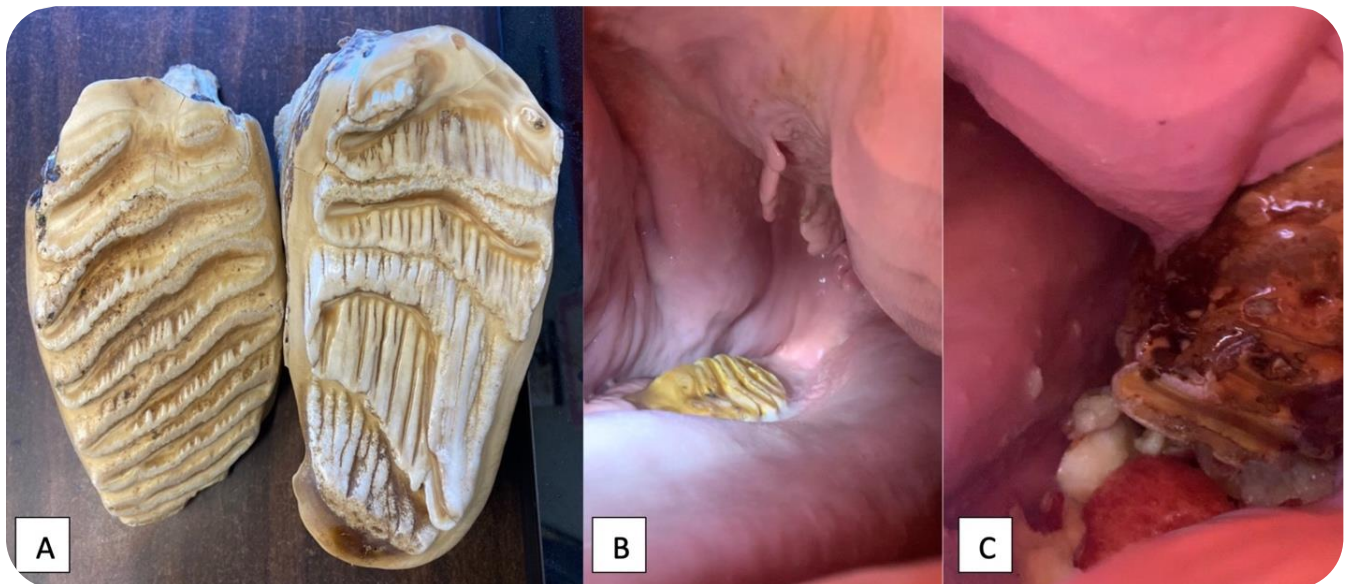


Figure 2. A) Normal elephant molar on left. Patient's abnormal left lower molar lost in Dec 2021. B) Patient's right sided dental arcades. Note the absent upper molar and normal lower molar. C) Patient's left sided dental arcades. Note the absent lower molar which is seen in figure 1A (gum is covered with apple) and abnormally worn upper molar.

Jenny had a previous episode of mild impaction colic a couple months prior to the previously discussed episode. At that time, Jenny was mildly lethargic and ended up passing an abnormally large fecal ball made of long pieces of poorly digested forage/roughage. Dentition was considered the likely etiology of the colic as Jenny had lost a molar set with abnormal wear in Dec of 2021 (Figure 2A). It was later confirmed that Jenny has complete loss of her upper right and lower left dental arcades as well as

severely worn upper left and mildly worn lower right dental arcades which is a common concern in geriatric elephants (Greene, 2019a; Sahu, 2021) (Figure 2B, 2C). These dental issues reduce the patient's ability to properly grind food which increases the particle size of feed material of the ingesta and causes a higher chance of intestinal impactions.

Due to the historically increasing number and severity of colic events, the elephant keepers and veterinary team

made further changes to Jenny's routine and nutritional enhancements to help prevent further colic episodes from occurring.

Firstly, the regular grass hay and timothy hay given to the elephant would now be chopped in a hay grinder to reduce the particle size and break up plant stems to compensate for the patient's worn/missing dentition. Oat hay is also used to replace the regular grass hay as it has more leaves as well as smaller stems. Regularly supplemented oat and bran feed is maintained, as they provide good fiber and calories, but have small particle size and high digestibility. Peanut oil has been integrated as a regular supplement given by syringe (400ml, q12h) to improve the lubrication of the gastrointestinal contents, as well as providing Omega fatty acids and increased calories to help maintain the elephant's weight. It is also important to monitor the elephant's hydration by ensuring it follows a normal drinking schedule with access to water twice daily. If hydration declines, rectal fluids will be administered. Another aspect of Jenny's prevention plan is exercise. This is facilitated by multiple walks daily, by having access to the woods to forage and swim in ponds, and by walking to the hay barn to retrieve bales of hay and bring them to the elephant barn. Finally, fecal output is monitored each day to ensure bowel movements occur with regular frequency and size.

Since the described colic episode, Jenny has been doing very well with the changes to the patient's management and nutrition. On a couple of occasions when the hay has had more stems and less leaves, Jenny has exhibited some mild colic episodes which present as lethargy and reduced feed intake. Within 12-24h, Jenny had passed mildly enlarged fecal balls that are made of long dried out fiber materials, but these enlarged fecal balls have all passed with thick coatings of mucous and oil on the outside. The elephant's weight slightly decreased approximately 6 months after the described impaction colic episode and a new equine pelleted feed (Podium Cool Energy, Masterfeeds, London, Ontario N6E1P5, Canada) was added into the patient's diet to help maintain body condition. Jenny's weight has returned to normal and clinically is doing excellent, for a now 57-year-old Asian elephant. Cooked white rice has also recently been added to the patient's nutritional program for the extra calories and enrichment. The weight gain and the ability for Jenny to pass these infrequently enlarged fecal balls without human intervention, suggests Jenny's prevention plan is working well. The keepers and veterinary team often

make small changes to the prevention plan in order to optimize it for Jenny's condition.

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