Causes of gastrointestinal colic at an equine referral hospital in South Africa (1998–2007)

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ABSTRACT

The most common causes of gastrointestinal colic at an equine referral hospital in South Africa were determined following retrieval of the medical records of horses admitted during a 10-year study period. The study included 935 horses of which 28 % were admitted after hours. Most horses were Thoroughbreds (54 %), male (57 %), with a mean age of 8.2 years and originated from the Gauteng Province (81 %). Heart rate (98 %), mucous membrane colour (95 %) and auscultation of the abdomen (91 %) were the clinical data commonly obtained at admission. Packed cell volume, total serum protein and white cell count were recorded in 78 %, 75 % and 44 % of horses respectively. Transrectal palpation (93 %), nasogastric intubation (84 %), intravenous catheterisation (74 %) and abdominocentesis (53 %) were the most frequently performed procedures. Medical intervention was performed in 558 horses (60 %). The common causes of medical colic were impactions (39 %), tympany (7 %) and displacement of the large colon (6 %). An exploratory laparotomy was performed in 331 horses (36 %). The common causes of surgical colic were displacement (29 %), impaction (22 %) and small intestinal strangulating lesions (18 %). Death occurred in 3 % of horses, while euthanasia before medical intervention was performed in 4 %. Overall, medical intervention was successful in 93 % of horses and 67 % in horses managed surgically. In conclusion, 55 % of all the equine admissions responded to medical intervention and the recovery rate for horses receiving both medical and surgical intervention was comparable to that reported in other studies.

Keywords: abdominal pain, horse, medical and surgical intervention, survival.

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INTRODUCTION

Equine veterinarians frequently treat horses with colic caused by visceral abdominal pain or non-gastrointestinal causes. Visceral abdominal pain is more commonly treated and may be caused by intestinal distension due to fluid, gas or ingesta, tension on the mesentery, ischaemia or infarction, ulceration of the mucosa, or peritoneal pain[36].

Studies have examined the incidence of colic events[1,38,40] in general and in specific breeds[19,33,34]. Some focused on specific causes such as caecal impaction[30], peritonitis[17,23], large colon impaction[9], small colon impaction[35], enterolithiasis[8,16], idiopathic muscular hypertrophy[6], sand colic[32] and pedunculated lipoma[11,15]. The risk factors[4,7,20,22,39] for, outcomes[2,14,24] of, prognostication[21,31,37,41] of and the economic cost[12] involving colic episodes have also been reported in countries other than South Africa. To the authors' knowledge, no previous studies have been conducted to establish the causes of gastrointestinal colic in horses in South Africa.

The purpose of this study was to determine the most common causes and the outcome of gastrointestinal colic in horses admitted to the Equine Clinic of the Onderstepoort Veterinary Academic Hospital (OVAH) over a 10-year period.

MATERIALS AND METHODS

Case selection

The medical records of 1201 horses that were admitted to the Equine Clinic of the OVAH between 1 January 1998 and 31 December 2007 for gastrointestinal colic were reviewed. For the purpose of this study, colic due to reproductive, urinary, musculoskeletal and respiratory disease were excluded. The diagnosis of colic was confirmed by physical examination, rectal palpation, transabdominal ultrasound, abdominocentesis, nasogastric intubation, exploratory laparotomy or necropsy.

Data management

Data were evaluated and divided into 8 categories: study population information, signalment and history, pre-admission data, clinical data at admission, clinicopathological data, procedures performed, treatment data and survival to discharge information. Study information recorded time of admission, the number of repeat admissions due to colic and the total number of admissions per month and year. Signalment and history included the age, breed, sex, weight and geographic location of affected horses. Pre-admission data recorded the duration of colic signs and treatment administered before referral.

Clinical data recorded at admission included cardiovascular parameters, temperature, presence of abdominal distension, mucous membrane colour, capillary refill time and borborygmi. The degree of pain on presentation was defined as no pain if the horse showed no colic signs, depressed if the horse was lethargic, mild if the horse was intermittently pawing and looking at the flank, marked if the horse was persistently pawing and rolling occasionally and severe if the horse was persistently rolling and thrashing and the pain was uncontrollable despite using analgesics.

Clinicopathological data recorded included a complete blood count, serum biochemistry, blood gas analysis, urine and faecal analysis as well as abdominal fluid cytology. Clinical procedures recorded included nasogastric intubation, rectal palpation, caecal trocharisation, intravenous catheterisation, gastroscopy, ultrasonography and radiography. Treatment data included: pre-treatment euthanasia/death at admission, medical treatment and surgical exploration.

Survival to discharge data recorded whether horses survived the medical or surgical intervention, the number of days hospitalised and the total hospitalisation cost per day per case (South African rand, ZAR).

Statistical analyses

Statistical data were stored in Microsoft Excel 2003 and analysed using Microsoft Excel 2003 and NCSS 2004 (NCSS and PASS number cruncher statistical sys-

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tems, Kaysville, Utah 2001; www.ncss.com). Descriptive statistics were calculated for each measured parameter and the data tested for normality. Parameter data that were not normally distributed were analysed as nonparametric data. Continuous data that were normally distributed are reported as mean ± standard deviation (SD) and continuous data that were not normally distributed are reported as median and range.

RESULTS

Study population

Of the 1201 medical records, 159 (13 %) were unavailable and 107 (9 %) were from horses admitted more than once. Therefore, 935 horses (78 %) were included in this study of which 72 % were admitted during normal hours and 28 % after hours. Medical and surgical intervention was performed on 411/238 horses respectively during normal hours and 147/93 horses respectively after hours. The pre-treatment euthanasia/death at admission category included 26 horses admitted during normal hours and 20 horses after hours. The total admissions for January to December during the 10 years were calculated and a steady admission rate between 6.52 % and 11.55 % was obtained. The proportion of horses admitted during the 6 hottest months of the year, October to March, represented 51 % (n = 476) and those admitted during the remainder of the year represented 49 % (n = 459) of the study population.

Signalment and history

The age of horses admitted ranged from 3 weeks to 28 years (mean ± SD, 8.2 ± 5.1 years) with the highest admission rate for horses between the ages 5–10 years (36.4 %), the majority being male (57 %) and most originating in Gauteng Province (81 %). Breeds most represented were Thoroughbreds (54 %), Warmbloods (11 %) and Arabians (9 %) with American-saddlebred horses, Friesian horses and Welsh ponies comprising <6 % each.

Pre-admission data

The median duration of pre-admission colic symptoms recorded in 53 % of horses was 11 hours (range, 0.5–168 hours). Of these horses, 61 % were admitted within 12 hours after the onset of colic symptoms. The median duration of colic signs before admission for the surgical, medical and pre-treatment euthanasia/death at admission category was 10, 12 and 14 hours, respectively. Pre-admission treatment was administered to 73 % of the horses and included anti-inflammatory and other analgesic drugs (78 %), oral and intravenous fluids (36 %), sedation (30 %) and antibiotics (9 %).

Table 1: **Clinicopathological data commonly obtained during admission of horses with gastrointestinal colic at the Equine Clinic of the OVAH (1998–2007). Data for medical, surgical and pre-treatment euthanasia/death cases which are different to the descriptive statistic are given separately.**

Parameter	Number of horses	Mean ± SD/ Median	Range
Packed cell volume (%)	729	40 ± 9	14–85
• Medical		39 ± 8	14–71
• Surgical		41 ± 10	21–85
• Pre-treatment		46 ± 13	25–75
Total serum protein (g/ℓ)	705	68 ± 9	30–110
Albumin (g/ℓ)	225	32 ± 5	15.7–46.3
Globulin (g/ℓ)	223	35 ± 8	13.3–46.3
White cell count (cells/ℓ)	407	9.6×10^9	$0.9–34.4 \times 10^9$
Mature neutrophils (cells/ℓ)	404	6.5×10^9	$0–23.4 \times 10^9$
Immature neutrophils (cells/ℓ)	296	0.32×10^9	$0–24.7 \times 10^9$
• Medical		0.20×10^9	$0–24.7 \times 10^9$
• Surgical		0.55×10^9	$0–8.95 \times 10^9$
• Pre-treatment		1.76×10^9	$0–4.5 \times 10^9$
Fibrinogen (g/ℓ)	87	4.03 ± 1.78	1–9
Abdominal fluid nucleated cell count (cells/ℓ)	138	1.7×10^9	$0.011–255.6 \times 10^9$
• Medical		1.36×10^9	$0.011–255.6 \times 10^9$
• Surgical		1.9×10^9	$0.012–164.8 \times 10^9$
• Pre-treatment		2.55×10^9	$0.5–158 \times 10^9$
Abdominal fluid total protein (g/ℓ)	306	24 ± 13	4–80
• Medical		23 ± 14	4–70
• Surgical		25 ± 13	4–80
• Pre-treatment		25 ± 12	5–50

Clinical data at admission

Heart rate was recorded in 914 horses (98 %); median heart rate was 48 beats/minute (range, 20–180 beats/min). The median heart rate of the horses in the medical, surgical and pre-treatment euthanasia/death at admission category was 44 beats/min (range, 20–150 beats/min), 52 beats/min (range, 25–180 beats/min) and 70 beats/min (range, 39–140 beats/min), respectively.

Rectal temperature, respiration rate and capillary refill time were recorded in 840 (90 %), 809 (87 %) and 729 horses (78 %). Rectal temperature ranged from 33.7 °C to 43 °C (mean ± SD, 38 °C ± 1 °C), median respiration rate was 20 breaths/minute (range, 8–110 breaths/min) and median capillary refill time was 2 seconds (range, 1–4.5 seconds). No statistical difference was detected for temperature, respiration rate and capillary refill time between the medical, surgical and pre-treatment euthanasia/death cases.

Mucous membrane colour was recorded in 885 horses (95 %), with cyanosis occurring more frequently in the pre-treatment euthanasia/death at admission category (23 %), while congestion was recorded more frequently in horses requiring surgery (24 %). Abdominal distension was recorded in 787 horses (84 %) and was present in 42 %. Borborygmi were recorded in 849 horses (91 %) of which 63 % had decreased borborygmi and 7 % had no borborygmi.

Pain character and severity were recorded in 798 horses (85 %). Twenty-two per cent of horses were alert and showed no pain, while depression, mild pain, marked pain and severe pain were recorded in 12, 44, 13 and 9 %, respectively. The pre-treatment euthanasia/death at admission category had the highest recorded percentage of marked and severe pain (48 %).

Clinicopathological data

At admission, packed cell volume, total serum protein and white cell count were recorded in 729 (78 %), 705 (75 %) and 407 horses (44 %), respectively (Table 1). The packed cell volume mean ± SD was 40 % ± 9 % (range, 14 %–85 %) and total serum protein was 68 g/ℓ ± 9 g/ℓ (range, 30–110 g/ℓ). The white cell count ranged from 0.9 to 34.4 × 10^9 cells/ℓ (median 9.6 × 10^9 cells/ℓ). A serum biochemical analysis was performed in less than 24 % of the horses. Urine analysis was recorded in 45 (5 %) and faecal analysis in 152 horses (16 %). Of all the admissions, abdominocentesis was performed in 493 cases (53 %) and most commonly in the pre-treatment euthanasia/death at admission category

(76 %). Abdominal fluid appearance (68 %), total protein (62 %) and nucleated cell count (28 %) was most frequently recorded. Table 1 contains the most commonly reported clinicopathological data.

Procedures performed

The most common procedures performed are illustrated in Fig. 1. Ninety-three per cent of horses were examined transrectally and the results were classified as unremarkable (19 %), distension (42 %), impaction (36 %), displacement (18 %) or gastrointestinal rupture (1 %).

Treatment

Pre-treatment euthanasia/death at admission category.

Of the 935 horses reviewed in the study, 46 horses (5 %) received no treatment as 40 horses were euthanased due to a poor prognosis while 6 horses died following clinical examination. A diagnosis was made at necropsy on 31 horses but was not included in the study results as no treatment was performed (Fig. 2).

Medical treatment.

The gastrointestinal lesions that were treated medically are presented in Fig. 3. Of the 558 horses (60 %) that received medical intervention, 141 (25 %) had no definitive diagnosis, while 218 horses (39 %) had impactions which affected the large colon (32 %), small colon (3 %), stomach (2 %), caecum (1 %) and small intestine (1 %). A displacement of the large colon was diagnosed in 36 horses (6 %), of which 22 horses had a left dorsal displacement of the colon.

Surgical treatment

The gastrointestinal lesions following exploratory laparotomy are presented in Figs 4 and 5. An exploratory laparotomy was performed on 331 horses (35 %). Lesions were categorised as non-strangulating lesions without mucosal damage (n = 76, 22 %), non-strangulating lesions with mucosal damage (n = 102, 31 %), non-resected strangulating lesion (n = 134, 40 %) and resected strangulating lesions (n = 11, 4 %). In 7 horses (2 %) of the 331 surgical cases no lesion was found, while no diagnosis was recorded for 1 horse. Of all the horses treated surgically, 10 horses underwent more than 1 exploratory laparotomy; 3 were euthanased during the exploratory laparotomy, 2 euthanased in the immediate post-operative period and 5 horses survived to discharge.

Impactions were reported in 75 horses (22 %) and affected the large colon (13 %), small colon (4 %), small intestine (4 %), caecum (1 %) and stomach (<1 %). Left dorsal displacement of the large intestine was recorded in 36 horses (11 %). Strangulating lipoma occurred in 2 horses but lesions were not corrected by intestinal resection. Strangulating intestinal lesions that were corrected by intestinal resection were recorded in 11 horses. Strangulation of the small intestines occurred in 8 horses and intramural obstruction in 3 horses. Of the 11 horses, 4 survived to discharge, 2 died and 5 were euthanased.

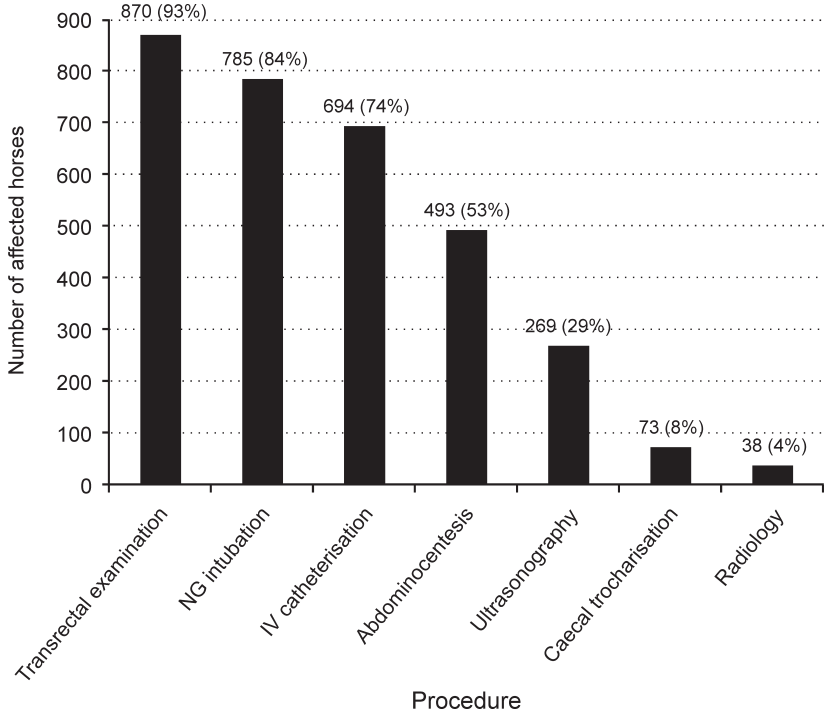

Fig. 1: **The most-common procedures performed on horses with colic admitted to the Equine Clinic of the OVAH (1998–2007).** NG = nasogastric, IV = intravenous.

Gastrointestinal causes of colic

The ten most-common gastrointestinal causes of colic in horses admitted to the OVAH are depicted in Fig. 6. Impaction of the large colon was recorded in 25 % (medical n = 180, surgical n = 44); displacement of the large colon 15 % (medical n = 36, surgical n = 97); small intestinal strangulation 7 % (medical n = 0, surgical n = 58); tympany 5 % (medical n = 41, surgical n = 2); enteritis 4 % (medical n = 31, surgical n = 8); large

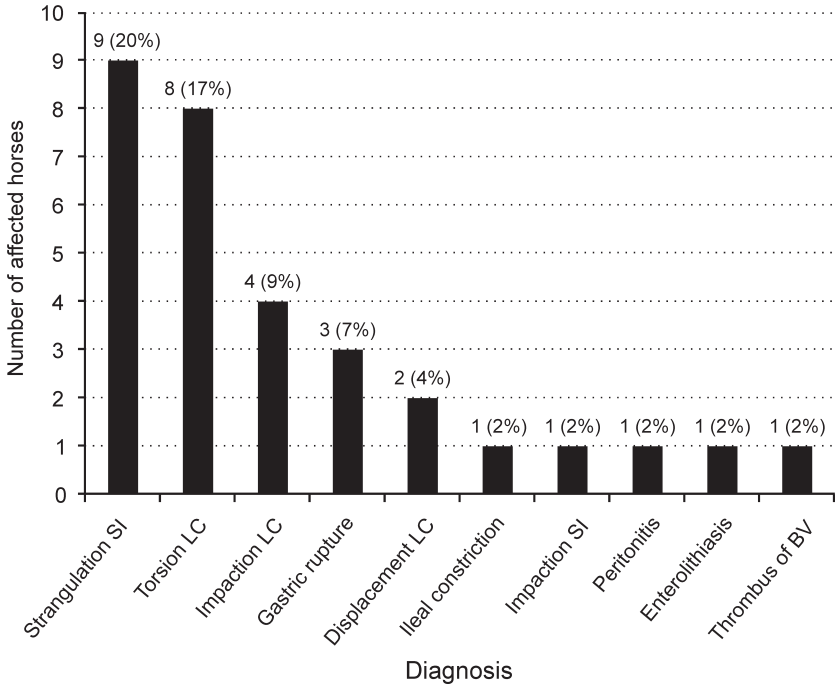

Fig. 2: **The diagnosis confirmed at necropsy on 31 of 46 horses which were euthanased or died before treatment at the Equine Clinic of the OVAH (1998–2007).** SI = small intestine, LC = large colon, BV = blood vessel.

intestinal torsion 4 % (medical n = 0, surgical n = 38); colitis 3 % (medical n = 28, surgical n = 0); small colon impaction 3 % (medical n = 13, surgical n = 11); small intestinal impaction 2 % (medical n = 8, surgical n = 14); and ileus 2 % (medical n = 15, surgical n = 4).

Survival to discharge

Of the 935 horses in this report, 737 (79 %) were discharged, 174 (18 %) euthanased and 24 (3 %) died. Forty horses (4 %) were euthanased and 6 (0.6 %) died before treatment. Of the 558 horses that received medical intervention, 37 (6.6 %) were euthanased and 3 (0.5 %) died during treatment. Of the 331 horses that received surgical intervention, 64 (19 %) were euthanased and 4 (1.2 %) died during exploratory laparotomy, while 32 (9.7 %) were euthanased and 11 (3.3 %) died following exploratory laparotomy. The overall survival rate was 93 % and 67 % for horses that received medical and surgical intervention, respectively. Nine horses were euthanased for reasons other than complications due to colic which included fractures, pneumonia, and systemic mycosis. A necropsy was performed on 138 (70 %) of the 198 cases that were euthanased or that died.

The median duration of hospitalisation for all horses was 4 days (1 to 42 days) while for horses treated medically or surgically it was 4 and 7 days, respectively. On average the median cost per day for the 935 cases included in this report was ZAR 716.41 (R0–13 026.86). The median cost per day for horses treated medically was ZAR 421.14 (R0–5597.82) and for those treated surgically was ZAR 1627.32 (R615–19 307.65).

DISCUSSION

The aim of assessing a horse with colic is to determine the severity of the colic and to select the appropriate type of medical or surgical intervention. The knowledge of common causes and plausible outcomes of colic events may aid veterinarians when considering appropriate diagnostic methods, therapeutic options and in determining the prognosis for the individual horse. Although studies conducted in other countries dealt with the causes of gastrointestinal colic, this information may not be relevant to horses with colic in South Africa due to geographical differences. To the authors' knowledge this is the 1st study in South Africa to establish causes and outcomes of horses with gastrointestinal colic at a referral hospital.

In the present study the incidence of all colic cases showed no seasonal trends which is in contrast with other stud-

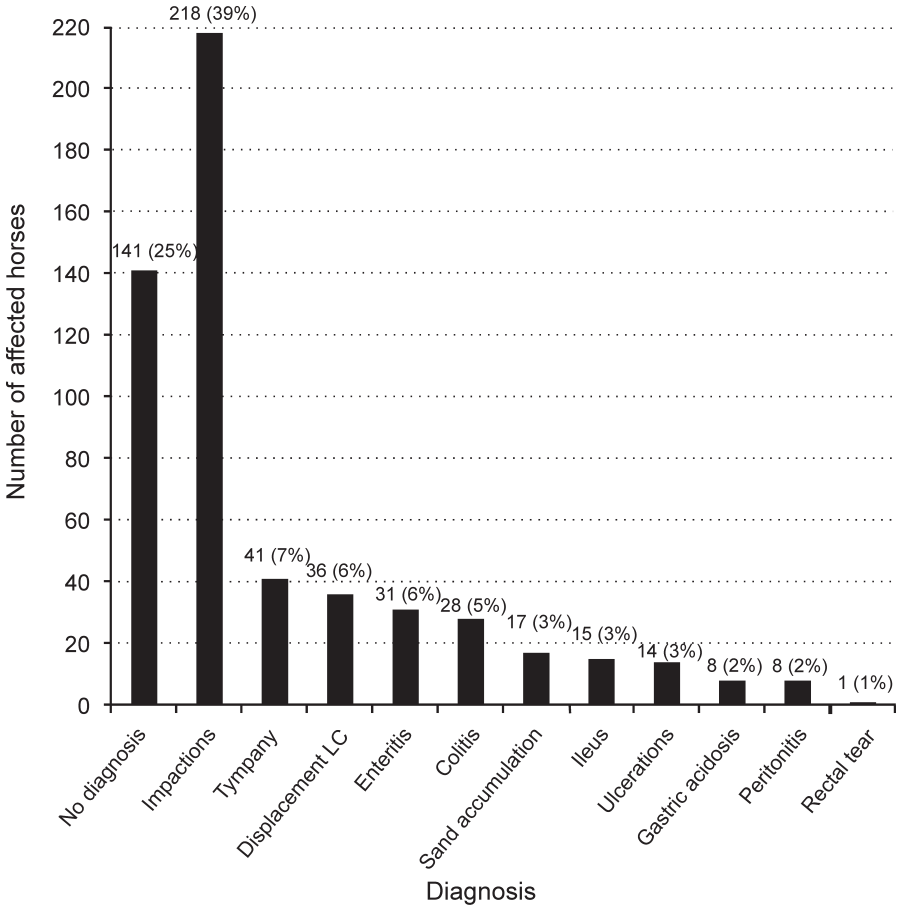

Fig. 3: **Specific causes of colic in horses that received medical intervention at the Equine Clinic of the OVAH (1998–2007)** (n = 558). LC = large colon.

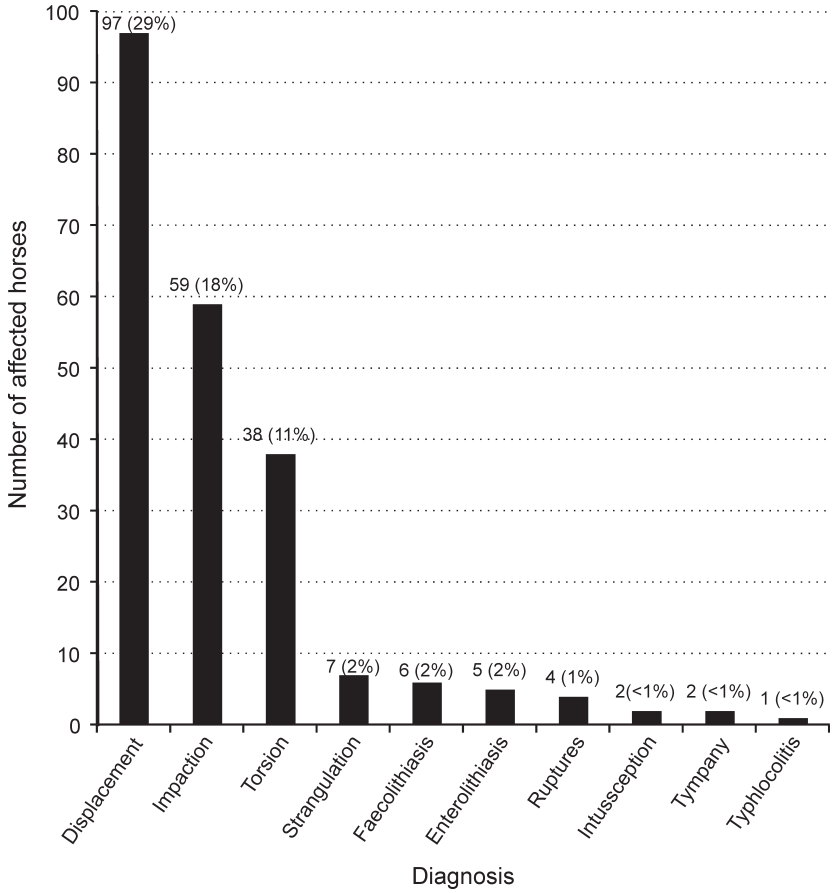

Fig. 4: **Specific causes of colic affecting the large intestine in horses that received surgical intervention at the Equine Clinic of the OVAH (1998–2007)** (percentage of n = 331).

ies[3,12,18]. In a study involving Swedish horses admitted for gastrointestinal colic, a larger proportion of all colic cases were seen in the winter months[12]. Studies performed at a United Kingdom-based referral hospital[3] and at a Thoroughbred training premises in the British Isles[18] indicated an apparent peak in horses with colic during spring and autumn. The sex distribution of horses in the present study was not evenly divided between females (43 %) and males (57 %) and agrees with similar studies[1,27], while the median age distribution was in contrast to that reported in other studies[1,12].

At the OVAH equine hospital, equine veterinarians and veterinary students are encouraged to employ the history, physical examination results and clinicopathological data when assessing a horse with colic. The usefulness of various clinical signs and clinical pathology to determine of the appropriate management of horses with colic has been previously reported [13,21,26,31,37,41]. Reports have indicated that heart rate[21,31,41], mucous membrane colour[21], capillary refill time[37], packed cell volume[21,31,37] and level of pain[31,37,41] are important predictors of outcome in horses that are hospitalised for colic. However, another study reported that white cell count, packed cell volume, blood pH and colour of the mucous membranes did not show any prognostic significance[41]. Furthermore, abdominal fluid analysis cannot be used alone to accurately predict lesion type or outcome for horses with colic[13], but it may contribute to the decision to proceed to surgery[26].

In the present study clinical examination data, packed cell volume and total serum protein concentration were recorded in > 75 % of admissions and frequently used to assess horses. Diagnostic procedures performed such as rectal examination (93 %), nasogastric intubation (84 %) and abdominocentesis (53 %) were commonly used to compliment a physical examination.

While the causes of colic in the present study were numerous and in some cases life-threatening, 55 % of all admissions responded to medical intervention and were subsequently discharged. In this study, 32 % of horses referred for medical intervention had large colon impactions while 7 % were suspected to have tympany, which was consistent with results reported in other studies[1,29]. A diagnosis could not be made in 25 % of horses that had medical intervention. It is not uncommon not to determine the cause of colic, as seen in a Canadian study where a diagnosis could not be made in 13 % of horses receiving medical intervention[1] and 10 % of horses in a

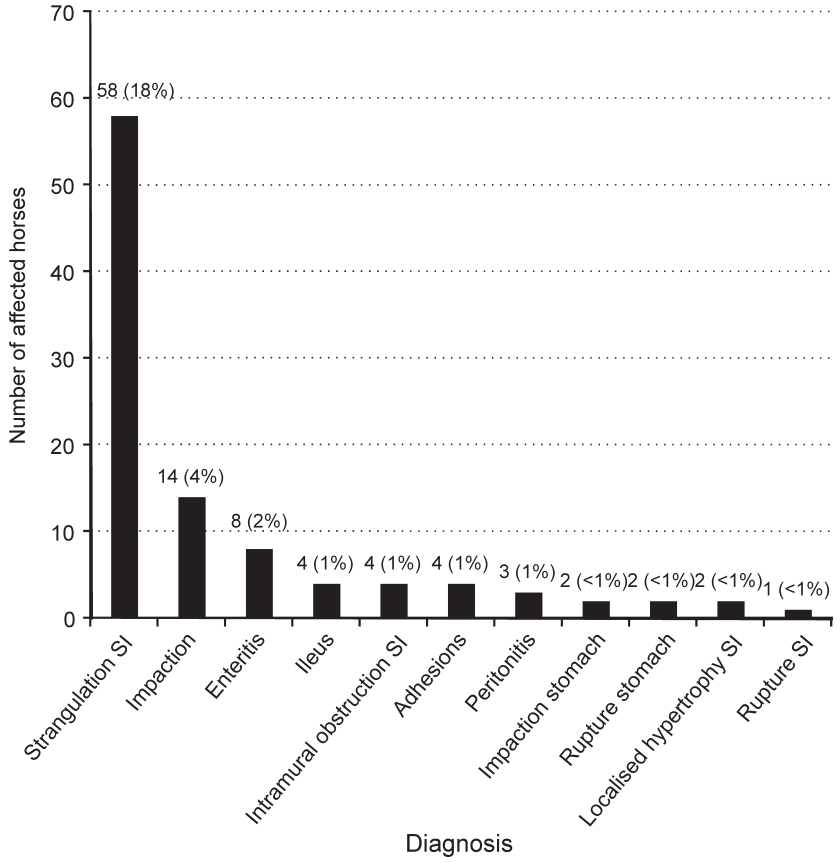

Fig. 5: **Specific causes of colic affecting the stomach, small intestine and peritoneum in horses that received surgical intervention at the Equine Clinic of the OVAH (1998–2007)** (percentage of *n* = 331)**.** SI = small intestine.

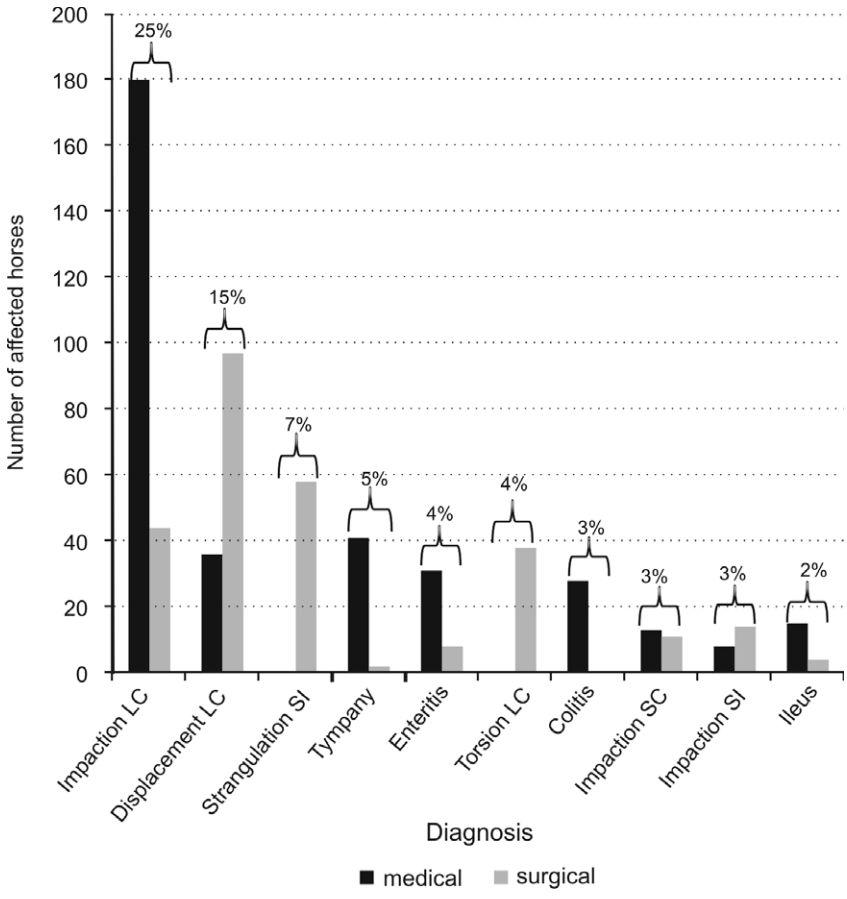

Fig. 6: **The 10 most common causes of gastrointestinal colic at the Equine Clinic of the OVAH (1998–2007)** (*n* = 889, excludes the pre-treatment euthanasia/death cases). LC = large colon, SI = small intestine, SC = small colon.

study in Georgia, USA[27].

From the results it is apparent that most horses that had surgical intervention suffered a displacement of the large colon (29 %), while intestinal impactions (22 %), small intestinal strangulation (18 %) and large intestinal torsion (11 %) occurred less often. Similar findings were reported in a Canadian study where surgical intervention was performed on horses with displacements (24.5 %) and torsion (14.3 %) of the large colon[1]. In the present study strangulating lipoma occurred in <1 % of all admissions, which is in contrast to studies reporting an incidence of 12.5 %[1] and 10 %[15]. Moreover, several studies have reported that a strangulating lipoma should be an important consideration when examining an aged horse with suspected small intestinal disease[1,5,11,15]. The finding in this study that 2 % of all the colic admissions had caecal impactions is in contrast to a reported incidence of 4.1 % in another study[30]. Horses with enterolithiasis accounted for <1 % in the present study, which is similar to a study that reported an incidence of 1.7 %[8], but is in contrast to another study that reported an incidence of 15.1 %[16]. These studies further concluded that breed and diet influence the risk of enterolithiasis, which explains the discrepancies in study results[8,16].

The common causes of gastrointestinal colic in horses in this study were consistent with results found in several studies in other countries[1,12,27,28]. A Canadian study reported that the 9 most common causes of colic were large colon impactions, large colon displacements, spasmodic colic, large colon volvulus, lipoma, strangulating small intestinal lesions, enteritis, peritonitis and verminous arteritis[1]. A study of 3100 Swedish horses with colic reported that impaction occurs most frequently, followed by torsion/volvulus, enteritis, sand impaction and incarceration of the small intestines[12]. In 2 studies at the University of Georgia, USA, involving 229 and 449 horses, the most common colic causes were large colon displacement and volvulus, large colon impaction and small intestinal obstruction[27,28].

Compared with this study, a similar pattern of short-term survival was reported in other studies[1,10,21,24,41]. In a report of the outcome of horses with colic admitted to the Liverpool University Equine Hospital, UK, over 12 months, 76 % to 88 % survived the colic surgery[10], while the survival for horses undergoing surgical intervention for colic at the Bell Equine Veterinary Clinic had a short-term survival rate to discharge of 70.3 % for all horses and 83.15 % for those recovering from anaesthesia[24]. In a Canadian report, a survival rate of 93.6 % for medically treated horses and 73.5 % for surgically treated horses was reported[1], while in a report of horses with colic in Oslo, Norway, the total survival rate was 63 % with a survival rate of 78 % and 48 % for the medically and surgically treated horses, respectively[21]. In the present study, 10 horses (3 %) needed a 2nd exploratory laparotomy of which 50 % was discharged, which is consistent with results from a similar study[25].

This study had several limitations. Although the equine hospital at the OVAH serves a wide geographical region, the results of this study may be biased towards causes of colic that occur more frequently within the OVAH region. Horses admitted may be more likely to have suffered more severe causes of gastrointestinal colic. Owing to the retrospective nature of this study, unavailable records and missing data made accurate interpretation difficult.

In conclusion, most horses in this study were Thoroughbreds (54 %), male (57 %) and with a mean age of 8.2 years. Clinical examination, transrectal palpation, nasogastric intubation, packed cell volume and total serum protein determination was most commonly performed following admission. The most common causes of horses receiving medical intervention were impactions (39 %), tympany (7 %) and displacement of the large colon (6 %) while displacement (29 %), impaction (22 %) and small intestinal strangulating lesions (18 %) occurred most often in horses receiving surgical intervention. Overall, impaction and displacement of the large colon was the leading cause of colic in the population of horses. Fifty-five per cent of all the admissions responded favourably to medical intervention, while the recovery rate for horses receiving both medical and surgical intervention was comparable with those of other studies.

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