

Case Report Rapport de cas

Successful medical management of intra-abdominal abscesses in 4 adult horses

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Abstract — Four adult horses with large intra-abdominal abscesses, suspected to be complications of strangles, were treated with systemic antibiotics alone and made a full recovery. The 100% survival rate is significantly better than other reported survival rates. The median duration of treatment (35 days) was shorter than in most previous reports. This study suggests that penicillin G can be used for successful treatment of strangles associated intra-abdominal abscesses in horses.

Résumé — **Gestion médicale réussie d'abcès intra-abdominaux chez 4 chevaux adultes.** Quatre chevaux adultes avec des abcès intra-abdominaux de grande taille, suspectés d'être des complications de la gourme, ont été traités seulement à l'aide d'antibiotiques systémiques et se sont rétablis complètement. Le taux de survie de 100 % est significativement meilleur que les autres taux de survie signalés. La durée médiane du traitement (35 jours) a été plus courte que celle indiquée dans la plupart des rapports antérieurs. Cette étude suggère que la pénicilline G peut être utilisée avec succès pour le traitement des abcès intra-abdominaux associés à la gourme chez les chevaux.

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Intra-abdominal abscesses in adult horses are potentially life-threatening. Abscesses may develop insidiously but can eventually rupture and cause fatal septic peritonitis. Known etiologies of abdominal abscessation in adult horses include hematogenous or lymphatic bacterial spread, gastrointestinal perforation, previous intestinal surgery, and ulceration (1). Abdominal abscesses have been described in the liver, mesenteric lymph nodes, kidney, spleen, uterus, bladder, intestine, and abdominal wall (2). Adhesions involving the abscess within the abdominal cavity may further complicate the condition. Several species of bacteria have been associated with abdominal abscesses in adult horses including *Streptococcus* spp., *Corynebacterium* spp., *Bacteroides* spp., *Clostridium* spp., and *Escherichia coli* (1,3). One of the most common causes of abdominal abscessation in adult horses is the hematogenous spread of *Streptococcus equi* subsp. *equi* from the respiratory tract to the mesenteric lymph nodes as a complication of strangles known as “bastard strangles” (2).

The diagnosis of abdominal abscesses in the horse may be challenging due to their anatomical location and the non-specific clinical signs. Diagnosis is usually based on rectal palpation, ultrasound (trans-abdominally or trans-rectally)

images, abdominal fluid analysis, hematology, and surgery (1). Treatment options include systemic antimicrobial treatment alone or combined with surgical intervention (1). In both options, several weeks of systemic antimicrobial treatment are usually required. The survival rate reported in the literature varies between 24.6% to 80% and is apparently related to the presence of complications such as adhesions and the severity of the inflammatory response, determined by fibrinogen levels (4–7).

The purpose of this study is to describe the successful medical management of 4 adult horses with large intra-abdominal abscesses.

Case descriptions

Case 1

A 2.5-year-old Quarter horse mare weighing approximately 350 kg was presented at the Koret School of Veterinary Medicine Veterinary Teaching hospital (KSVM-VTH) due to colic, peritonitis, and a suspected intra-abdominal mass. A month earlier the mare had exhibited clinical signs which were attributed to strangles and included purulent nasal discharge, fever, lymphadenopathy, and retropharyngeal lymph node abscessation. The mare was treated symptomatically by the owner with flunixin meglumine and apparently recovered. Two days before presentation, the mare was depressed, anorexic, and showed mild signs of colic. The next day, the colic signs worsened and the mare was recumbent. On physical examination by the referring veterinarian, the mare was hyperthermic (39.2°C), tachycardic (80 beats/min), and had hyperemic mucous membranes. Gastrointestinal sounds were absent on auscultation, there was no gastric reflux, and on rectal examination a firm, painful mass was palpated in the

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Table 1. Selected clinical and laboratory findings, and treatments during hospitalization of 4 horses with abdominal abscesses

	Case 1	Case 2	Case 3	Case 4
On presentation				
Physical examination	T-38.1, P-56, R-8 Pink MM, reduces GIT sounds	T-38.2, P-48, R-40 Pink MM, normal GIT sounds	T-36.6, P-36, R-16 Pink MM, reduced GIT sounds, pain on external abdominal palpation	T-37.6, P-36, R-12 Slightly dehydrated, mild icterus and prolonged CRT
Findings on rectal palpation	A firm mass in the mid-cranial aspect, 15 to 20 cm in diameter	A firm, rough mass in the mid-cranial aspect, 20 cm in diameter	A firm mass in the mid-cranial aspect, 20 cm in diameter	A firm mass in the right-cranial aspect, 25 cm in diameter
Abdominal fluid analysis	WBC-190 TS-60 Negative culture	TS-40 Abundant neutrophils, reactive macrophages, no bacteria	TS-65 Abundant mature neutrophils, reactive macrophages, no bacteria	TS-28 Abundant pyknotic neutrophils, no bacteria
Hematology	^a WBC-16 PLT-315 PCV-28, TS-92	^b WBC-20.1 PLT-357 PCV-27, TS-82	^b WBC-16.7 PLT-294 PCV-36, TS-89	^a WBC-15.4 PLT-152 PCV-26, TS-63
Treatment and Outcome				
Antibiotic regimen: dosages and duration	SPG 15 × 10 ⁶ IU for 27 d PPG 6 × 10 ⁶ IU for 5 d Total: 32 d	SPG 15 × 10 ⁶ IU for 44 d SPG 10 × 10 ⁶ IU for 6 d Total: 50 d	SPG 20 × 10 ⁶ IU for 27 d SPG 10 × 10 ⁶ IU for 9 d Total: 36 d	SPG 15 × 10 ⁶ IU for 30 d SPG 10 × 10 ⁶ IU for 4 d Total: 34 d
Other medications	Flunixin meglumine 1 mg/kg BW, IV, q12h for 2 d	None	Flunixin meglumine 0.5 mg/kg BW, IV, q12h for 3 d	IV fluids, water, and mineral oil through NGT. Flunixin meglumine 0.5 mg/kg BW, IV, q12h for 3 d
Duration of hospitalization (days)	3	66	37	34
Time until the mass was no longer palpable rectally (days)	27	35	27	30
Final hematology	WBC: 10.4, PLT: n/a PCV: 34, TS: 84	WBC: 7.6, PLT: 182 PCV: 30, TS: 60	WBC: 10.0, PLT: 315 PCV: 30, TS: 80	n/a

^a On presentation.^b On the day prior to referral.

T — Temperature (°C), P — Heart rate (beats/min), R — Respiratory rate (respirations/min), MM — Mucous membranes, GIT — Gastrointestinal, CRT — Capillary refill time, SPG — Sodium penicillin G, PPG — Procaine penicillin G, BW — Body weight, NGT — Nasogastric tube, WBC — White blood cell count (× 10³/μL), PCV — Packed cell volume (%), TS — Total solids (g/L), PLT — Platelet count (× 10³/μL), IU — International units, q12h — Twice daily, n/a — not available.

mid-cranial aspect of the abdominal cavity. Blood tests revealed leukocytosis [17.6 × 10³/μL; reference interval (RI): 5.4 to 14.3 × 10³/μL], mild anemia [packed cell volume, PCV: 22%; RI: 32% to 53%], and elevated total solids (TS; 86 g/L; RI: 55 to 75 g/L). Abdominocentesis revealed turbid fluid (TS: 62 g/L, reference value: < 2.5 g/L) with abundant neutrophils with no visible bacteria on cytology. The mare was treated with intravenous fluids, water, and mineral oil via nasogastric tube, and flunixin meglumine (Flunixin Injection: Norbrook, Lenexa, USA), 0.5 mg/kg body weight (BW), IV, and was referred to the hospital for further diagnosis and treatment.

Case 2

A 3-year-old Quarter horse gelding weighing 377 kg was presented at the KSVM-VTH due to colic and suspected intra-abdominal mass. Two months prior to referral the horse suffered from strangles, was treated with procaine penicillin G (unknown dosage and duration), and apparently recovered. Three weeks prior to referral the horse exhibited several episodes of fever that were treated symptomatically with flunixin meglumine. A week later, the fever continued and the horse became depressed, lost weight, and suffered from intermittent colics and bruxism that did not improve with H₂-receptor blocker (ranitidine)

treatment. Prior to referral, blood tests revealed leukocytosis (20.1 × 10³/μL), mild anemia (PCV: 27%), thrombocytosis (357 × 10³/μL; RI: 70 to 250 × 10³/μL), hyperproteinemia (87 g/L; RI: 57 to 79 g/L), hyperglobulinemia (58 g/L; RI: 26 to 40 g/L), with elevated lactate dehydrogenase (1956 U/L; RI: 14 to 570 U/L), and alkaline phosphatase (900 U/L; RI: 90 to 400 U/L) concentrations. Other parameters (albumin, aspartate aminotransferase, gamma-glutamyltransferase, urea, creatinine, chloride, potassium, sodium, and calcium) were within the normal ranges. Three days prior to referral, a mass in the mid-cranial abdomen was palpated rectally. Procaine penicillin G (Norocillin, Norbrook), 25 000 IU/kg BW, IM, q12h, was administered for 3 d before a severe episode of colic developed at which time the horse was referred to the hospital.

Case 3

An 8-year-old Quarter horse mare, 4 months pregnant, weighing 470 kg was presented at the KSVM-VTH due to peritonitis. One of the other 5 horses residing on the same farm suffered from a sub-mandibular abscess 6 wk prior to referral that was suspected to have been caused by a foreign body, but this had resolved spontaneously without any other clinical signs. Three weeks prior to referral the mare became depressed, quiet, and

had reduced appetite which did not improve with teeth floating. Blood tests prior to referral revealed mild leukocytosis ($14.75 \times 10^3/\mu\text{L}$), mild anemia (PCV 29%), hypoalbuminemia (18 g/L; RI: 26 to 41 g/L), and hyperglobulinemia (55 g/L). The mare was treated for several days with an oral iron supplement and trimethoprim-sulfadiazine, which was subsequently replaced with procaine penicillin G and enrofloxacin (unknown doses). No improvement was observed and on the day prior to referral the referring veterinarian noticed pain on external palpation of the abdomen with no abnormal findings on rectal palpation. Abdominocentesis revealed turbid fluid with elevated total solids (TS: 65 g/L) and marked leukocytosis ($97.5 \times 10^3/\mu\text{L}$; reference value: $< 10 \times 10^3/\mu\text{L}$). Microscopic examination of the abdominal fluid revealed mainly mature neutrophils, occasional lymphocytes, and reactive monocytes, with no visible bacteria. The mare was referred to the hospital on the following day.

Case 4

A 4-year-old Thoroughbred-cross gelding, weighing 370 kg, was referred to the KSVM-VTH due to colic and a suspected intra-abdominal mass. The horse had suffered from strangles as a yearling and had recovered. Two months before presentation, the horse was moved to a new farm where an outbreak of strangles was ongoing; however, he did not seem to develop any of the characteristic clinical signs of strangles. Two weeks prior to referral, the horse exhibited signs of intermittent colic and episodes of mild fever that responded favorably to treatment with flunixin meglumine. Two days prior to referral the colic signs worsened. On the day of referral the attending veterinarian treated the horse with water and mineral oil via a nasogastric tube and with intravenous fluids. On rectal palpation, a firm mass was palpated on the cranial right side of the abdomen and the horse was referred to the hospital.

Table 1 summarizes the findings of the physical examination, rectal palpation, abdominal fluid analysis, and selected blood parameters on presentation at the hospital.

Rectal ultrasound imaging of the abdominal mass revealed a hyperechoic outer layer (capsule) in all cases and either a hypoechoic single distinct interior cavity (Cases 1, 2, and 4) or several cavities (Case 3). These findings combined with the evidence of peritonitis were consistent with the diagnosis of intra-abdominal abscesses. In all cases, the etiology of the abscesses was considered to be a complication of strangles (metastatic abscessation or bastard strangles) based on the history of typical clinical signs of strangles in the horse itself (Cases 1 and 2) or in other horses on the same farm (Cases 3 and 4).

In all cases, the location of the abscess, at the cranial aspect of the abdominal cavity was suspected as being in the mesenteric root thus surgical drainage was not considered a safe option. Medical treatment with long-term intravenous antibiotic was chosen as an alternative option. Due to the presumptive diagnosis of *S. equi* subsp. *equi* infection, all horses were hospitalized in the isolation unit, and the antibiotic treatment of choice was penicillin. Sodium penicillin G (Sodium penicillin G; Sandoz, Kundl, Austria) was initially given intravenously at a high dose (40 to 44 000 U/kg, 4 times a day). The dose was then reduced to 20 to 25 000 U/kg (Cases 2–4) or replaced by procaine peni-

cillin G (Norocillin, Norbrook) intramuscularly (17 000 U/kg, twice daily, Case 1) after marked reduction in the size of the abscess combined with normal abdominal fluid were observed (see below). The horse in Case 1 was discharged after 3 d and was treated at home by the owner and the referring veterinarian (D. Berlin).

All horses were monitored once a week by rectal examination and abdominocentesis. Hematology was repeated during the course of treatment in Cases 1, 2, and 3 but not in Case 4, due to financial considerations. The antibiotic treatment was discontinued when the abscess was no longer palpated rectally and the abdominal fluid seemed normal on cytology in 2 consecutive weekly samplings. The results of white blood cell counts were not used as indicators of recovery since they returned to within the normal range while the abscesses were still present on rectal palpations. Furthermore, indicators of inflammation such as fibrinogen and serum amyloid A were not routinely measured at the hospital at the time, thus, they could not be used as indicators of the resolution of the infectious process. The duration of the antibiotic treatment was 32 to 50 d (median 35 d). An accurate white blood cell count of the abdominal fluid was only available for Case 1. In the other cases (2–4), the abdominal fluid was evaluated by measurement of TS and cytology (microscopic evaluation of Giemsa-stained smears prepared before and after centrifugation of the fluid) and was considered normal when TS was < 25 g/L and the nucleated cell count seemed low, there were more mononuclear cells than neutrophils, and the macrophages were not reactive (all the smears were examined by the same person, D. Berlin). An indwelling intravenous catheter was placed in the jugular vein in all horses for the sodium penicillin G treatment. The catheter was replaced every 3 d or 3 wk depending on the type used (BD Angiocath — fluorinated ethylene propylene, Becton Dickinson, USA and Milacath Extended Use — polyurethane, Mila International, USA, respectively). The duration of antibiotic treatment and other treatments, duration of hospitalization, time until the abscess was no longer palpated rectally, time until the abdominal fluid was considered normal and findings of the last CBC are presented for each case in Table 1.

All 4 horses improved within days of initiation of treatment. None of them showed signs of colic, fever, or inappetence during hospitalization. In Case 1, ventral edema developed 5 d after presentation and resolved spontaneously after 10 d. In Case 2, thrombophlebitis developed in both jugular veins. Since the signs of inflammation (skin edema, pain, and thrombosis of the vein) developed twice within 2 d of placement of a new catheter in both veins, an allergic reaction to the catheter was suspected rather than an infectious process. The reaction resolved and did not recur following a change in the type of catheter.

The horse in Case 1 was used for competition riding (reining) for several years after recovery and then for pleasure riding. Four years after discharge the mare was presented again at the KSVM-VTH due to West Nile Virus myeloencephalitis that was treated symptomatically. The horse made a full recovery, but no further follow-up was available.

The horse in Case 2 returned to the previous level of riding and seemed to do well; however, 6.5 mo after discharge the horse

was referred to the KSVM-VTH due to acute colitis and colic. The presumptive cause for the colitis was a change in the type of hay that was fed on the farm (several other horses had concurrent, self-limiting, mild diarrhea). The horse was euthanized after 2 d due to severe, unresponsive colic. On postmortem examination there was no evidence of the abdominal abscess or intra-abdominal adhesions. The diagnosis was of acute necrotizing colitis. Bacteriologic culture was not available.

The mare in Case 3 went on to deliver a normal foal, returned to the former level of pleasure riding and was still doing well 4 y after discharge. The horse in Case 4 returned to the former level of pleasure riding and was reported to be doing well 1.5 y after discharge.

The presented study reports a 100% [95% confidence interval (CI): 40 to 100] survival rate in 4 horses treated for an intra-abdominal abscess with systemic antibiotic alone. Since no other cases in which abdominal abscesses were suspected were admitted to the hospital during the time period of the current study, this survival rate is accurate for this time period. Therefore, although the study sample is small and only 4 cases were reviewed, the prognosis is significantly more favorable than previously reported (Fisher's exact test, $P < 0.05$). A recent study of 6 horses treated by surgical drainage of abdominal abscesses reported a survival rate of 67% (95% CI: 22 to 96) (4), which is similar to the rate of 68% (17/25, 95% CI: 47 to 85) reported by Rumbaugh et al (7). A brief report of 61 cases, which does not specify the mode of treatment used, reported the extremely low survival rate of 24.6% (95% CI: 14 to 37) (5). Pusterla et al (6) reported survival of 60% (6/10, 95% CI: 26 to 88) of horses treated with systemic antibiotics for an extended period of time. A possible reason for the difference in the survival rate between this study and the cases presented here could be the severity of the presenting clinical signs. Three of the horses in the report by Pusterla et al (6) were euthanized within 3 days of presentation due to severe colic or financial considerations.

The diagnosis of abdominal abscesses was based on rectal palpation, rectal ultrasound, and abdominocentesis. Since none of the horses had exploratory celiotomy and no postmortem examinations were initially available, there was no definitive diagnosis. However, the ultrasonographic appearance of a soft tissue mass with a fluid-filled cavity, in all horses, was highly suggestive of an abscess. Furthermore, the history of a recent respiratory tract infection suspected as strangles in 2 of the horses (Cases 1 and 2) and the exposure to suspected strangles infected horses in the other 2 horses (Cases 3 and 4) were highly suggestive of *S. equi* subsp. *equi* metastatic abscessation. The main differential diagnosis is abdominal neoplasia and although the differentiation between abdominal abscesses and neoplasia can be challenging (8), the positive response to the antimicrobial treatment and the full recovery of all the horses further support the diagnosis.

The treatment choices for abdominal abscesses in adult horses include surgical excision, surgical drainage followed by long-term systemic antibiotics, and systemic antibiotic treatment alone (1). In the cases presented here, the location of the abscesses was considered difficult to approach surgically and the potential for severe complications such as spillage of the

abscess content into the abdominal cavity led to the decision to avoid surgical intervention. Existing adhesions may be a reason for surgical treatment in cases of abdominal abscessation, but clinically significant adhesions were not suspected in the horses in this study at the time of presentation.

The antimicrobial drug of choice in all cases was sodium penicillin G. The choice was based on the working diagnosis of bastard strangles in all 4 cases. Penicillin is not routinely used to treat abscesses due to suggested impaired tissue penetration (9). In previous reports, ceftiofur, rifampin, potentiated sulfonamides, chloramphenicol, gentamicin, and metronidazole were used (1,3,6,10,11). However, Ensink et al (12) demonstrated good penetration of procaine penicillin G (20 000 IU/kg, every 24 h, for 21 d) into subcutaneous chambers in ponies and elimination of *S. equi* subsp. *zooepidemicus* that was introduced into the chambers. Based on that study, penicillin G may have better tissue penetration than previously perceived. Furthermore, its efficacy in the presence of purulent material was also proven (12). Even though the study by Ensink et al (12) demonstrated the good penetrating ability of a standard dose of penicillin G, in the cases presented here, a high dose of intravenous sodium penicillin G was administered initially (44 000 IU/kg), to ensure enhanced tissue penetration and inhibit the maturation of the abscess and thus avoiding rupture and spillage into the abdominal cavity. The gradual reduction in the size of the abscesses and the full recovery achieved in all the described cases further demonstrate the ability of penicillin G to penetrate abscesses in clinical cases. It is possible that a regular dose of penicillin G could have been sufficient. The postmortem examination of the horse in Case 2, which died of an unrelated cause several months after discharge, revealed complete resolution of the abscess.

The median duration of antimicrobial treatment (35 d) in this study was considerably shorter than in most previous studies. A median of 47 d with a range of 42 to 52 d was described by Mair and Sherlock (4), a mean of 72 d (30 to 131 d) was recorded by Pusterla et al (6), and a single case reported by Aleman et al (3) was treated for 3 mo. A shorter duration (29 d) was described in a single case reported by Mogg and Rutherford (11). The shorter duration of treatment in our study may have resulted from the beneficial properties of the penicillin itself or from the use of the high dose during most of the treatment period.

Recently, Mair and Sherlock (4) described the surgical drainage of abdominal abscesses in 6 horses. Their choice of treatment was based partially on their experience that large abscesses do not respond favorably to antibiotic treatment alone. The current study showed that large abscesses, 15 to 25 cm in diameter, could in fact be resolved with medical treatment alone thus rendering this treatment a reasonable option to consider even with large abscesses. It is possible that the favorable outcome in the described cases was related partly to the absence of other complications such as significant adhesions which warrant an unfavorable prognosis and the confinement of the abscesses to the root of the mesentery with no involvement of other organs.

In conclusion, based on the experience described here, we believe that medical management of suspected cases of bastard strangles is a viable option regardless of the size of

the intra-abdominal abscess, especially in cases where significant abdominal adhesions are not suspected or diagnosed. Furthermore, the favorable outcome and the relatively short duration of treatment support the use of intravenous sodium penicillin G.

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Book Review

Compte rendu de livre

Breed Predispositions to Disease in Dogs and Cats – 2nd edition

Gough A, Thomas A. 2010. Wiley Blackwell, Chichester, United Kingdom, 327 pp. ISBN: 9781-4051-8078-8. \$62.78 USD.

Purebred dogs can present various dilemmas to practicing veterinarians. One area in which we can look incompetent is with regard to inherited diseases in certain breeds, especially rare ones. It isn't uncommon to have an owner come in with rare (and of course oh-so valuable) breed "x" with a rare condition "y" (which of course everyone who deals with this exciting breed knows about). In many cases the first problem is that we don't recognize the dog as being breed "x," to us it merely looks like a not very pretty mutt, but then beauty is in the eye of the beholder. The other issue is keeping abreast of all these breed-specific problems, which is where this book can be an invaluable resource. It won't help in breed identification (that is what Wikipedia is for), but it will give you a rundown of diseases the breed can have (ever heard of trapped neutrophil syndrome in border collies, ocular melanosis in Cairn terriers, or Burmese head defect?). The list of diseases is quite exhaustive and is divided into groups or conditions such as neurological, ocular, neoplastic, physiological, GI, musculoskeletal, reproductive, respiratory, cardiovascular, endocrine, and hematological/immunological. The list for each breed varies in length but can be very extensive, for instance in the West Highland white terrier the list of 31 conditions is almost 3 pages long. Each condition

has some short bullet points to go along with it, in most cases with a reference provided. The list of dog and cat breeds is also quite long, some breeds I haven't seen and some I have never even heard of (Alaskan Klee Kai, Boerboel, McNab shepherd to mention just a few).

Given the information provided, this book is also ideal for owner education, especially those owners looking to obtaining a new pet. This text will allow you to provide objective information to clients with regard to what potential problems are seen in a particular breed; thereby enabling strategies to be developed that will minimize the impact of genetic disease in the patient or allow early identification.

The final section of the book is devoted to the more common diseases. These write-ups are very short, usually only a short paragraph so they will not suffice to gain a clear understanding of the condition but are a good starting point. The reference list is extensive and provides a current list of articles regarding various breed-related disorders.

I certainly think this book is a great reference to have in practice; it probably is a good idea to have it close to the examination room so that you can quickly sneak out and take a peek to see what diseases breed "x" can be predisposed to and what disease "y" actually is, thereby making you look like a really smart vet.

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