

**Diagnostic imaging and hematological and cytological analyses
play a vital role in clinical investigation and selection of
therapeutic approaches in a polo pony with
septic olecranon bursitis**

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Abstract

A 19-year-old gelding polo pony was presented with a prominent protuberance at the tip of the right elbow and five days later, developed a marked swelling on the entire right foreleg with a high fever. Ultrasonography, performed on the caudal elbow region, demonstrated heterogeneous echogenic materials encapsulated in the fibrous capsule. The initial hematological analysis revealed anemia and a normal white blood count (WBC). Hyperbilirubinemia was detected biochemically. Pale yellow/turbid fluid was aspirated from the protuberance area, which showed septic exudate characteristics and contained *Streptococcus* spp. The pony was diagnosed with septic olecranon bursitis associated with streptococcal infection. The fluid-filled capsule was drained and flushed with normal saline mixed with an antiseptic once a day. Oral sulphonamide-trimethoprim was administered according to the drug sensitivity test for ten days. The capsule was filled with granulation tissue and the surgical wound completely healed 14 days after drainage. The WBC proportions were normal and anemia and hyperbilirubinemia were resolved following therapy. Diagnostic imaging and hematological and cytological analyses benefited the clinical investigation and therapeutic approaches in a pony with septic olecranon bursitis.

Keywords: cytology, diagnostic imaging, hematology, horse, septic olecranon bursitis

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Introduction

Olecranon bursitis, also identified as elbow hygroma, is an inflammation of the bursa characterized by marked swelling near the olecranon tuberosity (Hayat *et al.*, 2009). Repetitive trauma on the caudal olecranon portion is considered the predisposing cause of olecranon bursitis (Gaul *et al.*, 2020). The injury may result from striking the shoes on the elbow while running or lying down (Gaul *et al.*, 2020; Honnas *et al.*, 1995). Complementary therapy of olecranon bursitis includes medical and surgical treatments (Gaul *et al.*, 2020). Bursitis is initially managed by removing the cause of trauma, rest and cold therapy (Arican *et al.*, 2005), and acute bursitis can be treated with medication, such as corticosteroid injection (Gaul *et al.*, 2020; Hayat *et al.*, 2009). Surgical resection of the mass has been reported to manage olecranon bursitis successfully (Hayat *et al.*, 2009; Honnas *et al.*, 1995; Shivendra *et al.*, 2010). In a recent report, negative pressure was used in conjunction with surgical resection to manage open, infected olecranon bursitis in horses (Elce *et al.*, 2020).

Although successful therapeutic approaches have been documented in horses with olecranon bursitis, selecting the appropriate treatment protocol may require specific supporting clinical evidence. This report describes the important roles of diagnostic imaging and hematological and cytological analyses for veterinary management in a polo pony with septic olecranon bursitis.

Clinical description

A 19-year-old gelding polo pony (weighed 418 kg) presented with a caudal protuberance (three inches in diameter) over the olecranon tuberosity of the right elbow (Fig. 1) and a high rectal temperature (39.2 °C) and heart rate (48 beats/min) after paddocking. Its body temperature and heart rate were returned to normal ranges (37.8 °C and 40 beats/min, respectively) 30 min after initial treatment using an electric fan and applying a sponge soaked in cool water to the skin. Unfortunately, a marked swelling sensitive to palpation on the entire right foreleg (Fig. 2A) was noticeable five days following the initial examination. The caudal portion of the right elbow was extremely warm and firm. The pony appeared to be moderately depressed with a reduced appetite. A slightly increased heart rate (44 beats/min), high rectal temperature (40.1 °C) and pale yellow mucous membranes were also observed but other parameters were normal. A blood sample was taken for hematological and biochemical analyses (VDL center,

Bangkok, Thailand) before the therapies. The leukogram revealed a normal white blood cell (WBC), lymphopenia and mild monocytosis. Anemia and hyperbilirubinemia were also detected (Table 1). Ultrasonography showed an echogenic fibrous capsule filled with heterogeneous echogenic materials in the protuberance area (Fig. 2B). The development of an abscess was suspicious concomitant with olecranon bursitis of the right elbow. A systemic corticosteroid (dexamethasone 0.1 mg/kg) (DEXAM VET, Bukalo trading, Bangkok, Thailand) was given once intravenously to reduce the swelling immediately. In addition, broad-spectrum antibiotic (oral sulfonamide-trimethoprim 20 mg/kg) (CO-TRIMOXAZOLE D/S, Utopion, Samuthprakarn, Thailand) and topical ice-cool gel (NAF, Monmouth, United Kingdom) were prescribed twice daily. Surgical drainage was carried out four days later after the swelling had been reduced and the protruded area was softened, indicating that the abscess had nearly burst. In brief, the lateral and ventral parts of the protruded area were stabbed by a No. 11 scalpel blade to produce two centimeters long surgical wounds. Pale yellow/turbid fluid (Fig. 3A) was aspirated from the encapsulated sac and was analyzed for cytology, bacterial identification and drug sensitivity. The sac was then curetted and flushed with normal saline solution (Supplemental File 1) until fresh blood was presented. Cytological analysis showed abundant red blood cells and many inflammatory cells, including neutrophils and macrophages. Many cocci-chain bacteria, present in clumps and within the cell cytoplasm, were also present (Fig. 3B). *Streptococcus* spp. was the only bacterium identified from the pus and it was sensitive to various antimicrobial medications, including sulphonamide-trimethoprim (Supplemental File 2). According to clinical information, the pony was diagnosed with septic olecranon bursitis associated with streptococcal infection.

The drained abscess was flushed daily with antiseptic-normal saline solution (1% povidone-iodine solution) (BETADINE, Meiyume manufacturing, Pathumthani, Thailand). The oral sulfonamide-trimethoprim treatment (20 mg/kg) was continued to complete 10 days of medical treatment based on drug sensitivity testing. The abscess was completely healed and the mass decreased substantially after 14 days of the surgical drainage concomitant with antimicrobial treatment (Fig. 4). Total WBC, neutrophil, lymphocyte and monocyte counts were also improved on days 11 and 14 of the treatment. In addition, no anemia or hyperbilirubinemia was detected at the end of the treatment period (14 days) (Table 1).



Figure 1 The caudal protuberance developed with superficial scratching at the right elbow.

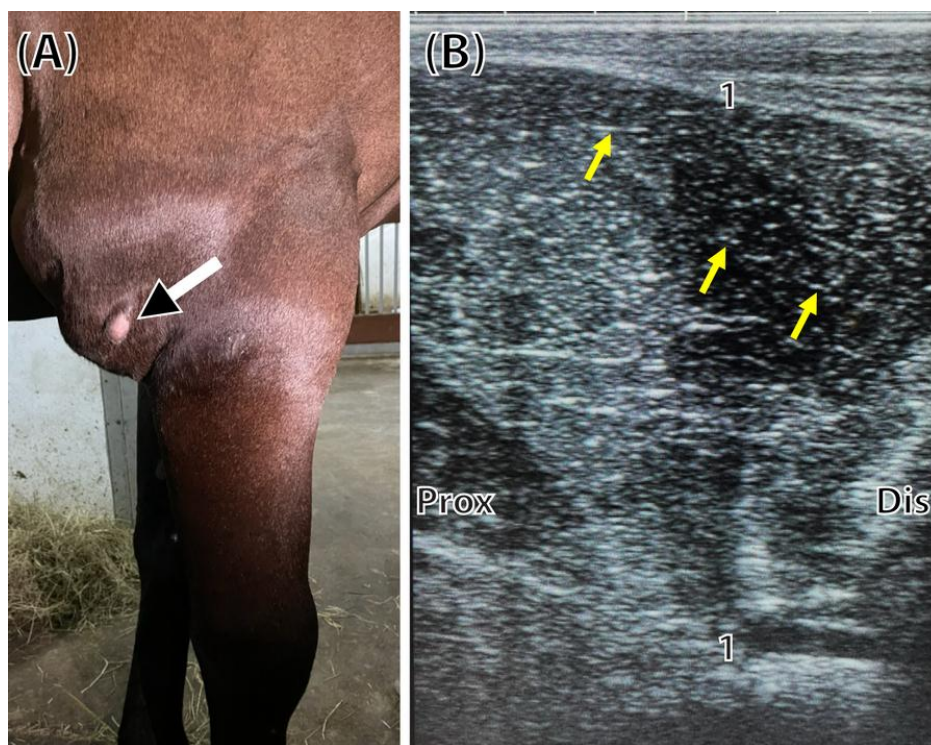
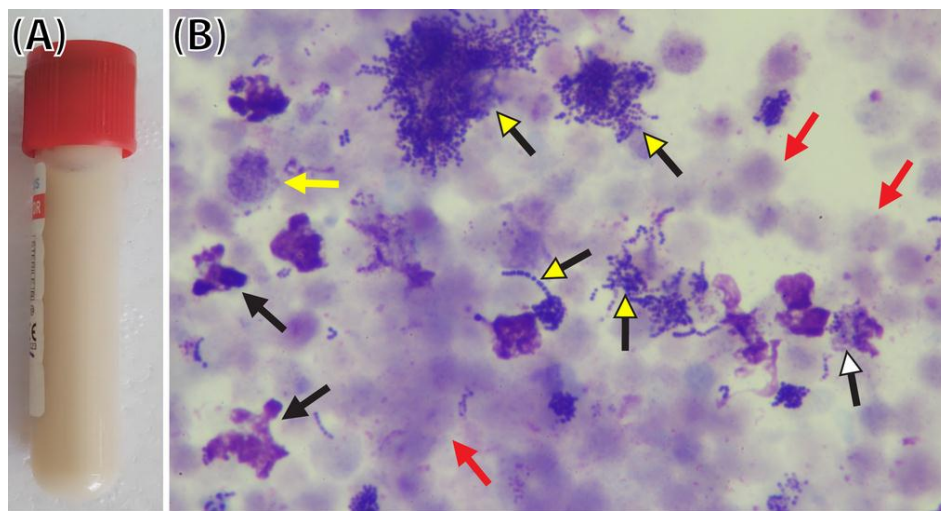
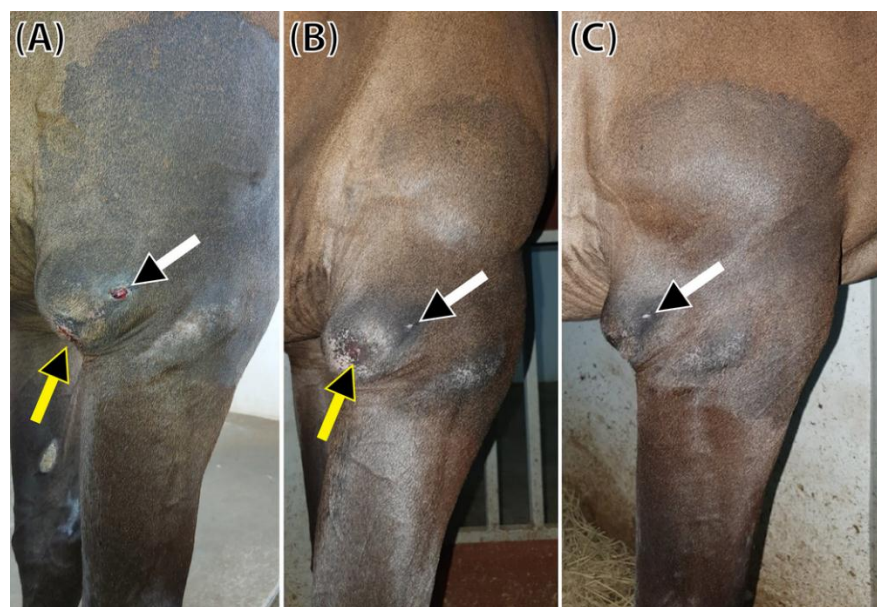


Figure 2 A marked swelling on the entire leg along with a firm caudal protuberance and a small area with a softer surface (black head of the white arrow) was observed on the right forelimb (a). The ultrasonographic image demonstrated the heterogeneous echogenic appearances with gas bubbles (yellow arrows) within the fibrous capsule (b). 1; fibrous capsule, Prox; proximal part, Dis; distal part.

Table 1 Hematological and serum biochemical parameters before treatment and at 5, 11 and 14 days of treatment

Blood parameters (normal ranges)	Before treatment	treatment		
		5 days	11 days	14 days
RBC ($6.8\text{--}12.9 \times 10^{12}/\text{L}$)	4.87	5.83	8.35	8.08
HCT (32%–53%)	23	26.9	38.7	35.7
HGB (110–190 g/L)	82	97	136	133
MCV (37–58 fL)	47.5	46.1	46.3	44.2
MCHC (31.0–38.6 g/dL)	35.4	36.2	35.1	37.3
WBC ($5.4\text{--}14.3 \times 10^9/\text{L}$)	8.2	7.1	6.9	7.62
NEU ($2.26\text{--}8.50 \times 10^9/\text{L}$)	6.97 (85%)	5.82 (82%)	5.59 (81%)	5.56 (72.9%)
LYM ($1.5\text{--}7.7 \times 10^9/\text{L}$)	0.41 (5%)	0.57 (8%)	0.96 (14%)	1.45 (19%)
MONO ($0.1\text{--}0.5 \times 10^9/\text{L}$)	0.82 (10%)	0.43 (6%)	0.27 (4%)	0.35 (4.6%)
EOS ($0.0\text{--}0.3 \times 10^9/\text{L}$)	0	0.21 (3%)	0.06 (1%)	0.21 (2.8%)
BASO ($0.0\text{--}0.1 \times 10^9/\text{L}$)	0	0.07 (1%)	0 (0)	0.05 (0.7)
PLT ($90\text{--}350 \times 10^9/\text{L}$)	168	222	185	212
TP (56–79 g/L)	59	60	58	57
AST (100–600 U/L)	205	168	199	228
Creatinine (0.4–2.2 mg/dL)	1.31	1.5	1.7	1.68
Total bilirubin (0.1–1.9 mg/dL)	3.21	N/A	2.3	1.7

N/A; not applicable

**Figure 3** Pale yellow/turbid fluid was aspirated from the abscess (a). The cytology showed abundant red blood cells (red arrows) and many nucleated cells, including neutrophils (black arrows) and macrophages (yellow arrow). Proteinaceous substances were seen in the background with many cocci-chain bacteria in clumps (yellow heads of the black arrows) and within the cytoplasm of the cells (white heads of the black arrow).**Figure 4** Representative images demonstrate a reduction in the size of the protuberance at seven (a) 11 (b) and 14 days (c) following surgical drainage and antimicrobial medication. The surgical wounds (blackheads of the white arrows and blackheads of the yellow arrows) were completely healed without complications on the 14th day of treatment.

Discussion

Typically, horses are routinely housed in individual stables with various soft bedding materials (Airaksinen *et al.*, 2001). The polo pony in this report was relocated to a new standard stall and housed with only straw bedding at night. This incident was the probable cause of the protuberance as a repetitive trauma of the olecranon process may occur from the shoes striking the elbow region or ground contact and repeated grinding of the caudal elbow region when the horse is recumbent (Gaul *et al.*, 2020). Furthermore, microorganisms might penetrate through scratching the wound at the caudal surface of the protuberance (Fig. 1), causing septic olecranon bursitis similar to that described previously (Hayat *et al.*, 2009). Marked swelling of the entire right foreleg, high rectal temperature and moderate depression are warning signs for the pony to receive urgent veterinary care.

The swelling with an extremely firm protuberance at the caudal part of the right elbow cast doubt on whether a solid mass existed in the area. Therefore, diagnostic imaging was subsequently implemented. Ultrasonography, which is frequently used complementarily to other diagnostic tools in the investigation of bursitis in humans (Blankstein *et al.*, 2006; Ruangchajituporn *et al.*, 2017) and horses (Forresu *et al.*, 2006; Lapjit *et al.*, 2021; Post *et al.*, 2003), was selected to investigate the internal architecture of the protruded mass. The heterogeneous echogenic appearance and gas bubbles encapsulated in the fibrous layer confirmed the presence of a fluid-filled abscess in the affected area. Hence, we determined that diagnostic imaging could aid the clinical investigation of olecranon bursitis with a suspected abscess in this pony.

General management of olecranon bursitis involves surgical or medical treatments depending on the bursitis's severity and physical appearance (Hayat *et al.*, 2009; Honnas *et al.*, 1995). In this case, local bacterial infection was suspected as a high rectal temperature was detected concomitant with entire right foreleg swelling. Broad-spectrum sulfonamide-trimethoprim, which has frequently been used to treat diseases caused by gram-positive and gram-negative bacteria (Duijkeren *et al.*, 1994), was initially given in advance to combat the suspected infection. However, a growing concern about antimicrobial resistance encourages the medical community to use antimicrobial medication cautiously (Brooks *et al.*, 2003; Dargatz *et al.*, 2000; Feary *et al.*, 2005). Identifying microorganisms before selecting antimicrobials could reduce the possibility of antimicrobial resistance in veterinary medicine (Morley *et al.*, 2005). To this end, the fluid aspirated from the abscess was submitted for bacterial identification, antimicrobial sensitivity and cytological analysis, previously reported to aid clinical investigation and distinguish between sepsis and non-sepsis in horses with bursitis (Forresu *et al.*, 2006; García-López *et al.*, 2010; Lapjit *et al.*, 2021). Determination of septic exudate characteristics and identification of *Streptococcus* spp. with susceptibility to sulfonamide-trimethoprim greatly benefitted the veterinary management of this affected pony. The results of ultrasonography and laboratory analyses

revealed that small-stab surgical drainage with continuous sulfonamide-trimethoprim oral medication was the ideal protocol to manage the septic olecranon bursitis.

Regarding the hematological analyses, the pony's total white blood cell count was at the high end of the normal range, accompanied by lymphopenia and mild monocytosis (Table 1). These parameters indicated that the pony suffered from chronic inflammation. The result of the leukogram, in this case, was consistent with previous reports regarding streptococcus infection, which revealed lymphopenia and monocytosis (Agina, 2017). Anemia could be present in response to chronic disease, inflammation and infection (Ganz, 2018; Weinberg, 1978). Since anemia and hyperbilirubinemia were revealed in this case, it was, at least in part, plausible that chronic infection was causing a blockage of iron release from reticuloendothelial storage (Neamat-Allah and El Damaty, 2016) and/or immune-mediated hemolytic anemia (IMHA) from streptococcal infection (Caniglia *et al.*, 2014). Although there was no improvement of hematological parameters by the fifth day of the complementary therapy, improvement was observed on the 11th and 14th days of treatment. The anemia and hyperbilirubinemia were resolved and the proportions of white blood cells were within the normal ranges following fluid drainage and medical intervention. These results stress that serial hematological measurements are also vital in the clinical investigation of horses with olecranon bursitis even though the successful treatment in this pony was achieved from medical intervention without surgical resection. The management outcomes may vary among horses due to the severity of bursitis and the individual disease progression.

In conclusion, diagnostic imaging and hematological and cytological analyses play important roles in deciding the appropriate therapeutic approaches in a polo pony with septic olecranon bursitis. The critical evaluation of clinical parameters is of paramount importance for managing septic bursitis. The provision of appropriate bedding within the stable and early detection of the clinical abnormality should be considered to prevent septic olecranon bursitis in horses.

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