

Case Study

Management of Humeral Fracture in a Dog at Klinik Bersama Dokter Hewan Jungle Bekasi

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Abstract: A humeral fracture is a discontinuity of the humeral bone due to an injury or illness. A three-year-old black mongrel female dog weighing 12.5 kg was brought to the Jungle Veterinary Clinic in Bekasi City, Indonesia, due to lameness and swelling in the left front limb. The radiological examination indicated an oblique fracture of the distal diaphysis of the left humerus. Haematological and biochemistry tests indicated neutrophilia, leukocytosis, and decreased erythrocyte, haemoglobin, hematocrit, MCV and MCH levels, while the levels of globulin and ALP were elevated. An orthopaedic surgery was performed using cerclage wires in conjunction with the intramedullary pin approach to immobilize the fracture. Post-surgery medical treatments were oral Amoxicillin 20 mg/kg, tramadol 5 mg/kg, meloxicam 0.1 mg/kg, Curcuma™ ½ tablet, Sangobion™ ½ tablet, and Kalmicetin™ ointment for topical wound dressing twice a day. The surgical wound healed and front leg function improved seven days after surgery

Keywords: cerclage wire, dog, humeral fracture, intramedullary pinning

INTRODUCTION

Fracture is a discontinuity of bone tissue due to a trauma or disease. Fractures in animals generally occur due to trauma from hitting hard objects, being hit by motorized vehicles or falling from high places. Most fractures in animals occur in long bones such as the humerus, femur, tibia and fibula (Dada, 2016). The humerus of a dog is the most common site of long bone fracture in the animal. The incidence ranges between 5 and 13%, with the majority of fractures involving the middle (diaphysis) and distal third of the humerus (Yardimci et al., 2018). In a study of 130 humeral fractures, Piermattei et al. (2017) found that 4% occurred on the proximal physis, 47% on the diaphysis, 13% on the supracondylar region, and 37% on the distal articular surface. The principle of the treatment of fractures is to reposition the fractured bone to its original position and hold it there while waiting for the bone to heal until it is appropriately and properly attached (Dada, 2016). Intramedullary pinning, intramedullary interlock nailing, bone plating, and screws are common surgical treatments for humeral diaphysis fractures. Intramedullary pinning is the most straightforward and effective method for treating humeral diaphyseal fractures (Singh et al., 2022). The present study described the application of the intramedullary pinning for the treatment of humeral fracture in a large breed Mongrel dog in a tropical region.

THE CASE STUDY

Signalment and Anamnesis

A three-year-old mongrel dog was sent to the Klinik Hewan Bersama Jungle Veterinary Clinic in Bekasi City, Indonesia with a complaint from the owner including observed swelling and pain

reflex following palpation, around the distal part of the left humerus. The patient was barking, defensive when it was approached and unable to raise her left front leg when walking (**Figure 1 (A)**). This case study has received client approval with informed consent and publication permission from Klinik Bersama Dokter Hewan Jungle Bekasi.

Physical Examination

Physical examination of the patient showed body weight of 12.5 kg, temperature of 38°C, respiration 60 breaths/minute, heart rate 140 beats/minute, turgor < 2 seconds, capillary refill time < 2 seconds, pale pink mucosa color, and moist nostrils. Examination of the affected area revealed crepitation and swelling. The patient showed signs of pain when the affected area is palpated.

Radiographic Examination

Radiographic examination of the affected limb was carried out to help confirm the diagnosis. X-ray imaging revealed a distal one-third oblique fracture of the left humeral diaphysis (**Figure 1 (B)**).

Hematological and Blood Chemistry Examination

Hematological examination results showed leukocytosis followed by neutrophilia, decreased erythrocytes, hemoglobin and hematocrit/PCV as well as MCV and MCH, indicating normochromic microcytic anemia (**Table 1**). Blood chemistry results showed an increase in ALP and Globulin (**Table 2**).

Table 1. Hematological examination result.

Parameter	Result	Reference Interval	Unit	Description
WBC	34.18	6.0 - 17.0	10 ³ /μL	High
Lymphocytes	3.59	1.0 - 4.8	10 ³ /μL	Normal
Monocytes	0.58	0.2 - 1.5	10 ³ /μL	Normal
Neutrophil	29.21	3.0 - 12.0	10 ³ /μL	High
Eosinophil	0.56	0.04 - 0.8	10 ³ /μL	Normal
Basophil	0.24	0.0 - 0.4	10 ³ /μL	Normal
Lymphocytes (%)	10.5	12.0 - 30.0	%	Low
Monocytes (%)	1.7	2.0 - 4.0	%	Low
Neutrophil (%)	85.5	62.0 - 87.0	%	Normal
Eosinophil (%)	1.6	0.0 - 8.0	%	Normal
Basophil (%)	0.7	0.0 - 2	%	Normal
RBC	5.46	5.5 - 8.5	10 ⁶ /μL	Low
Hb	9.7	12.0 - 18.0	g/dL	Low
HCT	29.58	37.0 - 55.0	%	Low
MCV	54	60.0 - 77.0	fL	Low
MCH	17.7	19.5 - 24.5	Pg	Low
MCHC	32.6	31.0 - 24.0	g/dL	Normal
RDWc	20.2	-	%	Normal
PLT	366	200.0 - 500.0	10 ³ /μL	Normal
PCT	0.29	-	%	-
MPV	7.8	3.9 - 11.1	fL	Normal
PDWc	39.0	-	%	-

Diagnosis

The dog was diagnosed with an oblique fracture of the distal diaphysis of the left humerus.

Table 2. Blood chemistry examination result.

Parameter	Result	Reference Interval	Unit	Description
Albumin	2.5	2.5 - 4.4	10 ³ /μL	Normal
Alkaline Phosphatase	170	20 – 150	10 ³ /μL	High
Alanine Transaminase	48	10 - 118	10 ³ /μL	Normal
Amylase	758	200 – 1.200	10 ³ /μL	Normal
Total Bilirubin	0.3	0.1 - 0.6	10 ³ /μL	Normal
Blood Urea Nitrogen	8	7 - 25	10 ³ /μL	Normal
Calcium	9.7	8.6 – 11.8	%	Normal
Phosphate	2.9	2.9 – 6.6	%	Normal
Creatinine	0.7	0.3 - 1.2	%	Normal
Glucose	82	60 - 110	%	Normal
Natrium ion ⁺	147	138 – 160	%	Normal
Kalium ion ⁻	5.5	3.7 - 5.8	10 ⁶ /μL	Normal
Total Protein	8.1	5.4 – 8.2	g/dL	Normal
Globulin	5.5	2.3 - 5.2	%	High

Surgery

The dog fasted for 12 hours prior to surgery to allow the stomach contents to empty in order to avoid the vomiting reflex after an anaesthesia induction. For premedication 0.02 mg/kg atropin sulfate was administered subcutaneously. Anaesthesia was induced 10 - 15 minutes after the premedication, with an intravenous injection of a combination of five mg/kg Ketamine and one mg/kg Xylazine. An endotracheal tube (ETT) was placed to provide the isoflurane 2 - 4% inhalation to maintain the anaesthetic state. The intramedullary pinning technique (IMP) in conjunction with a cerclage wire was used as the humeral fracture surgery technique (**Figure 1 (C)**).



Figure 1. (A) Patient on presentation; (B) Pre-operative radiograph showing the oblique humeral fracture (red circle); (C) Post-surgery radiograph showing complete reduction of the fracture

Post-surgery

Amoxicillin 20 mg/kg, tramadol 5 mg/kg twice in 12 hours apart (first day post-surgery), meloxicam 0.1 mg/kg daily for five days (second day post-surgery), Curcuma® ½ tablet, Sangobion® ½ tablet, and Kalmicetin® ointment were used as post-surgery treatments. During a seven days observation post-surgery, the surgical wound healed and front leg function improved.

Discussion

The presence of normochromic microcytic anaemia was indicated by a decrease in erythrocyte counts, haemoglobin, haematocrit, MCV and MCH. Anaemia, in this case, can be caused by tissue bleeding due to fractures or nutritional deficiency. Haemoglobin concentration could be lower in various conditions including iron deficiency, chronic infection, inflammation and malnutrition (Robbie, 2020). Anaemia with haemoglobinemia and thrombocytopenia indicates that a patient is at risk of excessive bleeding during surgery, as well as morbidity and mortality after surgery, and iron infusion or blood transfusion during surgery could help prevent hypovolemic shock (Muñoz et al., 2016).

Leukocytosis with neutrophilia observed in this study was the indication of infection, inflammation, or an allergic reaction (Salasia & Hariono, 2014). In the current case, it was clinically indicated by inflamed tissue in affected limb characteristics by apparent redness, swelling, elevated temperature, and pain reflex during palpation (Ciaccia, 2011).

In dogs, alkaline phosphatase (ALP) is a biomarker enzyme for hepatic disorders but also increases when extrahepatic disorders occur such as bone disorder. Serum or plasma ALP levels are derived from the liver (L-ALP), bone (B-ALP), and corticosteroid (C-ALP) (Alvarez & Whittemore, 2009). The ALP enzyme is normally responsible for protein degradation in the body (Sharma et al., 2014). However, if an animal has bone disorders, B-ALP activity will increase (Alvarez & Whittemore, 2009).

An oblique fracture of the distal diaphysis left humerus was revealed in the radiographic examination of the affected area. The haematologic and biochemical analyses indicated that surgery to correct the fracture was indicated.

Atropine sulphate 0.025 mg/kg was used to sedate the patient. This medication acts as an anticholinergic agent that inhibits acetylcholinergic effect on muscarinic receptors (antimuscarinic agents), causing decreased salivary gland secretion and preventing bradycardia prior to anaesthesia agent administration (Papich, 2016; Sardjana & Kusumawati, 2011). The anaesthetic drug used was an intravenous combination of Ketamine 5 mg/kgbw and Xylazine one mg/kgbw. In general, intravenous administration was administered at a lower dose than intramuscular administration (Papich, 2016). Further, administering xylazine can reduce salivary secretion and provide good muscle relaxation when combined with Ketamine (Yudaniayanti et al., 2010).

In the current study, the intramedullary pinning (IMP) technique was combined with cerclage wire. Previously, an IMP combined with cerclage wires was used to reconstruct a humeral fracture (Dewi & Pelayun, 2020). The IMP used must be selected based on the diameter of the medulla of a bone, and the humerus must be at 60-70% of the diameter of the medulla of a long bone for effective and rigid fixation of the fractured bone (Fossum, 2018). The intramedullary pin is a fixator used to treat diaphyseal fractures of the tibia, ulna, metacarpal, humerus, femur, and metatarsal bones, and is the simplest, low cost and the most practical internal fixation method for small animal fractures (Erwin et al., 2019). The advantage of the IMP technique lies in its resistance level to bone, its flexibility and its circular shape similar to a tube that allows IMP to maintain bone stability. Its disadvantage lies in its weak fixative properties that cannot lock on the bone to the IMP due to the lack of friction between the IMP and the bone, so the IMP cannot prevent the fracture from rotating (Fossum, 2018). Due to its flaws, the IMP is usually used in combination with additional fixation

reinforcement techniques, for example, with a cerclage wire, an external skeletal fixation (ESF), a bone plate, and a screw (Gemmil & Clements, 2016).

Apart from the fixative technique used, a few other factors influence bone healing, including the age of the animal, the shape of the fracture, the type of fracture line, and the location of the fracture (Dewi & Pemayun, 2020).

Post-surgery treatment in this case included antibiotic, analgesic, as well as supportive medications. Antibiotic Amoxicillin is a beta-lactam antimicrobial with broad-spectrum bactericidal activity including gram-positive and gram-negative bacteria. Amoxicillin works by inhibiting the synthesis of bacterial cell walls. The dose of Amoxicillin for dog ranges from 6.6 – 20 mg/bw q8-12h IM or PO (Plumb & Pharm, 2011; Papich, 2016). Tramadol was administered on the first post-surgery day. This medication can be used as an alternative or as an adjunct in the treatment of postoperative or chronic pain. Tramadol can be administered to a dog at a dose 2 - 5 mg/kg 2 to 3 times per day as an analgesic (Plumb & Pharm, 2011). Meloxicam was administered on the second postoperative day. Meloxicam has anti-inflammatory, analgesic and antipyretic effects by inhibiting the COX 2 (cyclooxygenase) enzyme, preventing the formation of inflammatory mediators such as prostaglandins. Meloxicam was given for five days as long-term use may result in gastric ulcers (Plumb & Pharm, 2011; Papich, 2016).

Ferrazone (iron) and vitamin B12 are both present in Sangobion®. Iron and vitamin B12 are required for the formation of red blood cells and haemoglobin, thus indicated in anaemic animals. Curcuma® is a ginger extract (*Xanthorrhiza rhizoma*) supplement that could help to maintain liver function and increase appetite. The curcuma may have anti-inflammatory, anticarcinogenic, antibacterial, antifungal, and neuroprotective properties (Silalahi, 2018). Kalmicetin® is an ointment containing the antibiotic chloramphenicol which is bacteriostatic by inhibiting protein synthesis by inhibiting peptidyl transferase activity in the protein synthesis pathway in bacterial ribosomes (Papich, 2016; Ramsey, 2017). The antibiotic seemed to work well in this case and would healed after seven days. However, the function of the limb did not come to normal. The fracture healing could need a longer time before the bone fully recovers and the organ obtains its full functionality.

CONCLUSION

The dog was diagnosed with an oblique fracture of the diaphysis left humerus. The humerus bone was realigned using a cerclage wire and a retrograde intramedullary pinning technique as the treatment method. The surgical wound healed and front leg function improved seven days after surgery.

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