Comparison of C-reactive protein concentrations in dogs with *Bordetella bronchiseptica* infection and aspiration bronchopneumonia

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Abstract

Background: C-reactive protein (CRP) is a well-known acute-phase protein in dogs that may discriminate bacterial bronchopneumonia from other pulmonary conditions. Bronchopneumonia caused by *Bordetella bronchiseptica* (Bb) is common but the associated increase in CRP concentration in naturally infected dogs has not been fully explored.

Objective: To compare CRP concentrations of dogs with Bb infection, with or without radiographic pulmonary lesions, to dogs with aspiration bronchopneumonia (ABP).

Animals: Sixteen dogs with Bb infection and 36 dogs with ABP.

Methods: Retrospective study. C-reactive protein concentrations and thoracic radiographs were available for each dog.

Results: Eleven dogs with Bb infection had alveolar lesions. In all dogs, CRP concentration was mildly increased (14-38 mg/L). In the 5 dogs without alveolar lesions, CRP concentration was within the reference range in all but 1 dog, in which it was slightly increased. Median CRP concentration was significantly higher in dogs with alveolar lesions (20 mg/L) compared with dogs without alveolar lesions (5 mg/L; $p < .002$). In dogs with Bb infection, median duration of clinical signs was not different between dogs with normal CRP concentration and dogs with increased concentration. In dogs with Bb infection either with or without alveolar lessions, median CRP concentration was significantly lower (20 mg/L) than in dogs with ABP (118 mg/L; $p < .001$).

Conclusions and Clinical Importance: In contrast to dogs with APB, CRP was not a good marker for the diagnosis of dogs suspected to have bordetellosis. Confirmation of Bb infection still requires lower airway sampling.

- CRP is an inflammatory biomarker, highly sensitive +ve APP, major APP in dogs (incr rapidly and rapidly normalizes w/ recovery).
- CPR has been useful in ddx b/w bacterial bronchopneumonia vs other pulmonary diseases and CRP levels decr quickly after starting ABX and may help dictate duration of ABX.
- Goals:
    - Report CRP concentration in odgs w/ confirmed subacute or chronic bordetella bronchiseptica (Bb) infection +/- pulmonary lesions on TXR
    - Compare magnitude of CRP incr in dogs with aspiration pneumonia vs bordetella infection
- Retrospective evaluation dogs presenting to their hospital b/w Sept 2016-April 2019
    - Bb infection confirmed via +ve culture or qPCR on BALF
    - AP group -- compatible hx, recent v+ or r+, PE findings of 3 of the following (fever, lethargy, tachypnea, dyspnea, cough), TXR showed cranioventral alveolar consolidation, and clinical + radiographic resolution w/ ABX
- CRP is not consistently elevated in Bb infection with or without alveolar lesions and was not associated w/ incr duration of Cx
- CRP levels lower in dogs w/ Bb than ABP
- CRP is not a reliable marker for Bb diagnosis

Effects of leukoreduction on storage lesions in whole blood and blood components of dogs

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Abstract

Background: Leukoreduction is a routine procedure in human transfusion medicine but is uncommon in veterinary.

Objectives: To evaluate the effect of leukoreduction on the quality of canine whole blood (WB) and blood products during storage.

Animals: Ten canine blood donors.

Methods: This is a case series study. An amount of 450 mL of blood was collected from each dog. Five WB and 5 packed red blood cells (pRBC) bags were divided into 2 units each: leukoreduced (LR) and non-leukoreduced (nLR). RBC count, erythrocytes' mean osmotic fragility (MOF), 2,3-diphosphoglycerate (2,3-DPG), adenosine triphosphate (ATP), percentage of hemolysis, potassium (K), lactate, glucose, and cytokines were measured weekly from day of donation (T0) to day 35 (T35); pH, coagulation times, and clotting factors were evaluated at T0 and T35 from WB and in fresh frozen plasma after 1 year of storage.

Results: Leukoreduction showed positive effects on lactate (T35: LR WB 14.42 mmol/L SD 2.71, nLR WB 22.42 mmol/L SD 1.86, LR pRBC 20.88 mmol/L SD 2.65, nLR pRBC 36.81 mmol/L SD 2.34; $P < .0001$), pH (T35: LR WB 6.88 SD 0.16, nLR WB 6.69 SD 0.20, $P = .02$; LR pRBC 6.57 SD 0.23, nLR pRBC 6.22 SD 0.11; $P < .001$), and K (LR pRBC 4.08 mmol/L SD 0.88, nLR pRBC 5.48 mmol/L SD 0.90; $P < .001$). Increasing values of IL8 were observed in nLR units during storage (T0: 4167 ± 11 888 pg/mL; T35: 6367 ± 11 612 pg/mL).

Conclusion and Clinical Importance: LR blood units are recommended to critically ill dogs with marked inflammatory conditions.

- In human transfusion medicine, quality of blood stored is one of the most critical issues → esp. metabolites of WBC (cytokines, histamine, elastase, acid phosphatase) are fundamental to storage lesion development and post-transfusion rx
- Leukoreduction of human blood units reduce of # of WBC and may reduce RBC lesions during storage
- Goals for study:
    - Investigate effect of prestorage leukoreduction on in vitro biochem changes (canine WBC stored in CPDA-1 and pRBC stored in SAGM for 35d)
    - Investigate the coagulative profile (PT/PTT/fibrinogen) and [clotting factors] in WBC soon after donation, at the end of storage (35d) and in FFP after 1y
- Results:
    - LR WB and pRBC units had lower leukocyte counts (<1x10^6WBC/unit)
    - Almost all plt depleted after LR
    - MCV increased during storage (suspect d/t impairment of Na/K ATPase pump on RBC and prolonged contact w/ anticoagulant)
    - Echinocytes was the main RBC morphological change during storage → decrease RBC elasticity
    - LR had no effect on % hemolysis during storage
    - Plasma lactate incr during storage and glucose decr during storage
    - [K] incr during storage (inactivation of Na/KATPase pump)
    - IL-8 levels increased during storage in NON-LR units
- Bottom line: Recommend LR blood units in pets w/ marked inflammatory conditions

Coagulation status, fibrinolysis, and platelet dynamics in dogs with chronic inflammatory enteropathy

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Abstract

Background: Coagulation status is poorly understood in dogs with chronic inflammatory enteropathy (CIE). Fibrinolytic activity and platelet dynamics have not been evaluated in CIE dogs.

Objectives: To assess coagulation status and fibrinolysis in normoalbuminemic CIE dogs (CIE-N) and CIE dogs with protein-losing enteropathy (CIE-PLE) compared to healthy controls (HC). To evaluate thromboelastography (TEG) variable differences between groups and for correlations with clinicopathologic data. To report platelet dynamics in CIE dogs.

Animals: Twenty-five client-owned dogs with CIE (n = 16 CIE-N; n = 9 CIE-PLE); 14 HC beagle dogs.

Methods: All dogs had tissue factor + tissue plasminogen activator TEG. Nine of 25 CIE dogs had whole blood impedance platelet aggregometry. The TEG variables and coagulation data were compared between all CIE vs HC dogs, CIE-N dogs vs HC, and CIE-PLE dogs vs HC. Clinicopathologic and coagulation data were available for CIE dogs and assessed for correlation to TEG variables.

Results: Dogs with CIE had higher maximum amplitude (MA; $P < .001$), longer clot lysis times (CLTs; $P < .001$), lower % lysis after 30 minutes (LY30; $P < .001$), and % lysis after 60 minutes (LY60; $P < .001$) compared to HC, suggesting hypercoagulability and hypofibrinolysis. When separated out, both CIE-N and CIE-PLE dogs had higher MA, longer CLT, and lower LY30 and LY60 compared to HC. Serum albumin and 25-hydroxyvitamin D (25[OH]D) concentrations, and plasma antithrombin and fibrinogen concentrations moderately correlated with MA.

Conclusions and Clinical Importance: Normoalbuminemic and hypoalbuminemic CIE dogs were considered hypercoagulable based on TEG compared to HC. Some CIE dogs displayed hypofibrinolytic phenotypes on TEG.

- PLEs patients at risk of developing TE - usually hypercoagulable on TEG
- In people, having IBD carries 3x risk of developing TE and both normo- and hypoalbuminemic people are at risk
- Exact pathogenesis of hypercoagulability with IBD is not well understood even in people
    - Acquired factors: Immobilization, steroid, active dz, cobalamin + folate deficiencies, hypoalbuminemia and hyperhomocysteinemia reported
    - Role of vit D deficiency in people and decreased serum 25[OH]D in dogs have been reported as risk factors for TE
    - In people, altered coag parameters include decreased anticoagulant factors, incr coagulation factors, incr plt aggregation, hyperfibrinolysis, and changes on TEG
    - In dogs, thought to be related to decreased AT and incr fibrinogen
- Study goals
    - Assess coagulation status + fibrinolysis in normoalbuminemimc and hypoalbumminemic dogs w/ CIE compared to healthy dogs

    - Asses for correlation b/w TEG data and variety of clinpath + hemostatic data for LF markers of hypercoagulability
    - Report platelet aggregometry findings in dogs w/ CIE
- Results
    - CIE group: All dogs had GI endoscopic biopsy of duodenum and ileum, had CBC/chem, fecal testing
        - Hypoalbuminemia group: Albumin <2.5g/dL, had no evidence of PLN, normal liver function, not been on drugs
    - Healthy controls were beagles - normal CBC/Chem/UA, not scoped
    - Both CIE-N and CIE-PLE dogs had higher MA, lower LY30, lower LY60, and longer CLT = i.e. hypercoagulable and hypofibrinolytic
        - Based on MA>60 mm to define hypercoagulability, 76% of CIE dogs were hypercoagulable (all of the hypoalbuminemic ones and 63% of normoalbuminemic ones)
    - Fibrinogen higher in dogs w/ CIE compared to controls, positively correlated to MA in CIE dogs
    - Plt aggregometry showed incr spontaneous aggregation in 3/9 CIE dogs
    - Plasma AT decor in 40% w/ CIE and 90% of CIE dogs w/ decr AT were hypoalbuminemic
    - Low serum 25[OH]D was moderately correlated w/ increased MA but clinical relevance is unknown
- Bottom line: CIE dogs who are normoalbuminemic can also be hypercoagulable