

Comparison of tissue perfusion and electrocardiogram parameters in experimentally induced hemorrhagic shock dogs resuscitated with lactated ringer and hydroxyethyl starch solutions

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Abstract

Hemorrhagic shock remains one of the leading causes of death following multiple organ ischemic injuries in dogs. The aim of this study was to compare tissue perfusion and electrocardiographic parameters in experimentally induced acute hemorrhagic shock in dogs before and after resuscitation with the lactated ringer and hydroxyethyl starch 6% solutions. The parameters of tissue perfusion included the gingival mucosal color, CRT, peripheral pulse quality, appendage temperature, serum lactate concentration, heart rate, mean arterial blood pressure and urine output plus ECG were evaluated in ten male adult healthy mongrel dogs which instrumented, and anesthetized (control measurement). Hemorrhage was performed with removal of up to 60% of blood volume to keep MAP between 40 and 50 mm Hg (second set of measurements). After a 30- minute stabilization period in hemorrhagic shock condition, the third set of measurements was performed. The dogs were randomly assigned to two study groups which received lactated ringer or hydroxyethyl starch solutions, 20 or 5 ml/kg respectively in four consecutive 15 –min periods (fourth to seventh measurements). One hour after the last resuscitation stage, the dogs were monitored and at the end of this time, an eighth evaluation step was carried out. Time induced a significant effect on heart rate, mean arterial blood pressure, appendage temperature, urine output, serum lactate concentration, R wave amplitude and Q-T interval. While solution type had a significant effect on serum lactate concentration, urine output and P wave amplitude. The results of this study showed that each of lactated ringer and hydroxyethyl starch solutions, has no significant effect in the short term on tissue perfusion and electrocardiogram parameters in hemorrhagic shock resuscitated dogs.

Key words: Hemorrhagic shock, Hydroxyethyl starch, Tissue perfusion, Electrocardiogram, Dog

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References

- Baue, A. and Tragus, E. (1967). Hemodynamic and Metabolic Effects of Ringer's Lactate Solution in Hemorrhagic Shock. *Annals of Surgery*, 166(1): 29-38.
- Braz, J.; Nascimento, P.; Filho, O.; Braz, L.; Vane, L.A.; GalvãoVianna, P.T. and Rodrigues, G. (2004). The Early Systemic and Gastrointestinal Oxygenation Effects of Hemorrhagic Shock Resuscitation with Hypertonic Saline and Hypertonic Saline 6% Dextran-70: A Comparative Study in Dogs. *Anesthesia and Analgesia*, 99 (2): 536-546.
- Burkett, D.E. (2017). Heart rate, rhythm, and contractility. In: Kirby, R. and Linklater, A. (Eds). *Monitoring and Intervention for the Critically Ill Small Animal*. 1st ed. Wiley-Blackwell, Publication, Iowa, Pp: 177-206.
- Davis, H. (2016). Management of Patients in Shock. In: Battaglia, A.M. and Steele, A.M. (Eds). *Small animal emergency and critical care for veterinary technicians*. 3rd ed. Elsevier, Publication, Missouri, Pp: 223-233.
- Della Torre, P.K.; Zaki, S.; Govendir, M.; Church, D.B. and Malik, R. (1999). Effect of acute haemorrhage on QRS amplitude of the lead II canine electrocardiogram. *Australian Veterinary Journal*, 77(5): 298-300.
- Dyson, D. and Sinclair, M. (2006). Impact of dopamine or dobutamine infusions on cardiovascular variables after rapid blood loss and volume replacement during isoflurane-induced anesthesia in dogs. *American Journal of Veterinary Research*, 67(7): 1121-1130.
- Friedman, Z.; Berkenstadt, H.; Preisman, S. and Perel, A. (2003). A Comparison of Lactated Ringer's Solution to Hydroxyethyl Starch 6% in a Model of Severe Hemorrhagic Shock and Continuous Bleeding in Dogs. *Anesthesia and Analgesia*, 96(1): 39-45.
- Haskins, S.C. (2012). Shock. In: Macintire, DK.; Drobatz, KJ.; Haskins, SC. and Saxon, WD. (Eds). *Manual of Small Animal Emergency and Critical Care Medicine*. 2nd ed. Wiley-Blackwell, Publication, Chichester, Pp: 30-40, 85-102.
- Keefe, J. (2012). Shock and Initial Stabilization. In: Norkus, C. (Ed). *Veterinary Technician's Manual for Small Animal Emergency and Critical Care*. 1st ed. Wiley-Blackwell, Publication, Iowa, Pp: 25-43.
- Laforcade, A.D. and Silverstein, D.C. (2015). Shock. In: Silverstein, D.C. and Hopper, K. (Eds). *Small Animal Critical Care Medicine*. Second ed. Elsevier, Publication, Missouri, Pp: 26-30.
- Nakamura, Y.; Kaseno, K. and Kubo, T. (1989). Transient ST-segment elevation in subarachnoid hemorrhage. *Journal of Electrocardiology*, 22(2): 133-137.
- Nascimento, P.Jr.; De Paiva Filho, O.; de Carvalho, L.R. and Braz, J.R. (2006). Early Hemodynamic and Renal Effects of Hemorrhagic Shock Resuscitation with Lactated Ringer's Solution, Hydroxyethyl Starch, and Hypertonic Saline with or without 6% Dextran-70. *The Journal of Surgical Research*, 136(1): 98-105.
- Rozanski, E.A. and Rush, J.E. (2013). *Small Animal Emergency and Critical Care Medicine*. CRC Press, Boca Raton, Pp: 214-218.
- Rudloff, E. and Kirby, R. (2001). Colloid and Crystalloid Resuscitation. *Veterinary Clinics of North America: Small Animal Practice*, 31(6): 1207-1229.
- Safaei, M. and Mousavi Takami, H. (2011). Blood autotransfusion outcomes compared with Ringer lactate infusion in dogs with hemorrhagic shock induced by controlled bleeding. *Journal of Research in Medical Sciences*, 16(10): 1332-1339.
- Tilley, L.P. and Smith, F.W. (2016). Electrocardiography. In: Smith, F.W.K.; Tilley, L.P.; Oyama, M.A. and Sleeper, M.M. (Eds). *Manual of canine and feline cardiology*. 5th ed. Elsevier, Publication, Missouri, Pp: 287-312.
- Udelmann, A.; Bonfim, M.R.; Adalberto Silva, W. and Moraes, A.C. (2009). Hemodynamic effects of volume replacement with saline solution and hypertonic hydroxyethyl starch in dogs. *Acta Cirurgica Brasileira*, 24(2): 87-92.
- Young, B.C. (2012). Monitoring tissue perfusion: Clinicopathologic aids and advanced techniques. In: Burkitt Creedon, J.M. and Davis, H. (Eds). *Advanced Monitoring and Procedures for Small Animal Emergency and Critical Care*. 1st ed. Wiley-Blackwell, Publication, Chichester, Pp: 198-216.