

Electrocution in a Pup: a case report

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Abstract

A case of German Shepherd pup with history of electrocution was presented in Medicine emergency at Multispecialty Veterinary Hospital, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab. On presentation, the pup was recumbent with severe respiratory distress and convulsions. Hemato-biochemistry and X-ray revealed macrocytic hypochromic anemia with neutrophilic leukocytosis and severe bronchointestinal pneumonia. Treatment involved oxygen therapy along with parenteral corticosteroids, fluid, antihistaminic, antibiotics, diuretics and B-complex administration. The pup succumbed 12 hours after initiation of treatment.

Electrical shock (electrocution) can occur when dogs bite electrical cords or come into contact with downed wires. Electrical shock is common in puppies, since they have a tendency to chew anything, including electrical and telephone cords but can be seen in dogs of all ages, sizes and breeds. Other possible sources of danger include faulty wiring, fallen transmission cables, broken electrical circuits and, rarely, lightning strikes during thunderstorms. A dog that gets an electric shock may be burned. At their most severe, electrical shocks can trigger seizures or cause cardiac arrest (Lehman *et al.*, 2007). The damage can be insidious because it comes on slowly, sometimes causing an irregular heartbeat with circulatory collapse - followed by cardiac arrest - or difficulty in breathing several days after the accident (Price and Cooper, 2013). Electric current also damages the capillaries of the lungs and leads to the accumulation of fluid in the air sacs, a condition called pulmonary edema. A characteristic sign of electrical shock injury is finding the unconscious dog on the floor near an electrical outlet. Electric shocks can cause involuntary muscle contractions of the dog's jaw that may prevent him from releasing his hold on a live wire. Dogs who survive electric shock may cough, have difficulty breathing, drool, have an offensive mouth odor, and have burns on the mouth.

Case History and Observations

A 40 days old male German Shepherd pup weighing 5 Kg was presented at Medicine emergency of Multispecialty Veterinary Hospital, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab. The chief complain of owner was chewing of

broken electrical cable by pup during late night hours (11:30 PM). There was froth oozing out from mouth after shock, labored breathing with involuntary muscle contraction of jaw and the pup was recumbent (Fig. 1 & 2). There was no history of any other past/ recent trauma. On clinical examination, the pup was dull, rectal temperature- 103^oF, tachycardia with heart rate- 200 bpm, respiration rate-76 breaths/minute (stertors on auscultation), Blood pressure (Doppler)- 90 mmHg, mucous membrane- mildly congested and normal lymph nodes. Oral examination revealed mild erythema in mouth and lips indicating electric burn. The examination of other body parts does not reveal any significant burn injury due to electrocution. Blood and serum samples were collected for hemato-biochemical evaluation, along with ECG and X-ray of chest in lateral and ventro-dorsal views. Results revealed Hb- 7.2 g/dl with macrocytic hypochromic anaemia, TLC- 21,320 involving neutrophilic leukocytosis (N-90%, L-10%) along with toxic changes in neutrophils, TEC- 4.13 x 10⁶/μL, PCV- 26.6 % and Platelet count- 444 x 10³/μL, with activated platelets. Biochemical profile revealed ALKP- 406 U/L, Total Protein- 4.5 g/dl, Albumin- 2.3 g/dl, BUN- 13 mg/dl, Creatinine- 0.4 mg/dl, Creatinine Kinase- 1,317 U/L and Glucose 47 mg/dl. The ECG revealed sinus tachycardia (Fig. 3) whereas, X-ray revealed severe bronchointestinal pneumonia without alteration in the cardiac silhouette (Fig. 4 & 5). The case was diagnosed as electrocution based on owners' revelation regarding chain of events and observing symptoms of electrical shock. Initially, on presentation, the pup was kept on oxygen therapy (maintaining dark and quiet setting) along with single shot of dexamethasone @ 0.5 ml I.V., followed by Normal Saline Solution @ 100 ml slow I.V., Furosemide @ 1 ml



Figure 1. Electrocuted pup in recumbency



Figure 2. Froth oozing from mouth with erythema

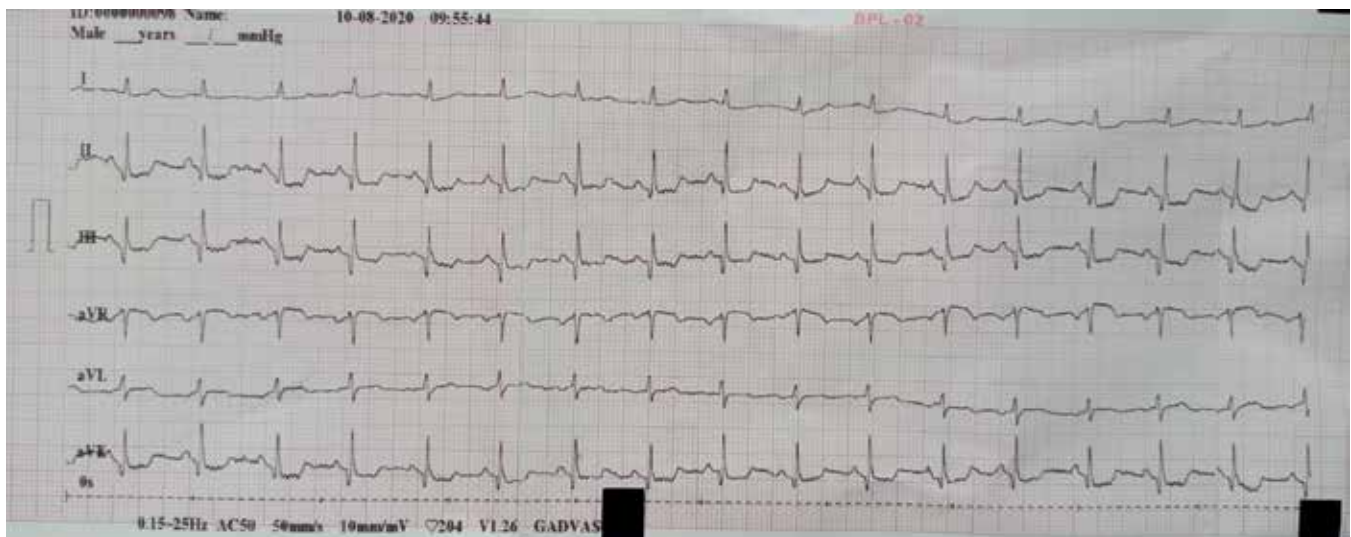


Figure 3. ECG depicting sinus tachycardia with heart rate of over 200bpm

I.V., Cefotaxim @ 62.5 mg I.V., Ranitidine @ 0.4 ml I.M., Metoclopramide @ 0.4 ml I.M., Pheniramine maleate @ 0.3 ml I.M. and B-complex liver extract with Vitamin B₁₂ @ 0.4 ml I.M. After initiation of therapy, the pup showed positive signs with improvement in respiration and heart rate but succumbed after 12 hours.

Discussion

Electricity is the flow of electrons through a conductor and is the main energy source in the 21st century. Voltage (measured in volts) is the force responsible for the flow. Current is the strength of the flow and is measured in amperes. Direct current (DC) flows in only one direction, whereas alternating current (AC) changes its direction based on the set frequency. Electricity is transported from the production site as AC at

a high voltage of 230–700 kV and is gradually reduced to 220–120 V using transformers before it reaches domestic customers (Kokatnur and Rudrappa, 2016). The severity of electrocution injuries depends on the strength of the current, path through body and duration of contact (Fig. 6). While 1 milliamp (mA) barely causes a tingling sensation, 20 mA can paralyze respiratory muscles. Electrocution with more than 2 amps of current causes significant internal organ and cardiac damage, leading to sudden death (Kisner and Casini, 1998). Most electrocution injuries which occur in domestic settings are with low-voltage current and they rarely require medical attention with majority being unreported in human patients. But in pets, such electrical injuries are often dangerous, and when it comes to dogs, are most often seen in youngsters and habitual chewers. On presentation, the pup was



Figure 4-5. Radiograph of pup in lateral & VD view depicting severe bronchointestinal pneumonia

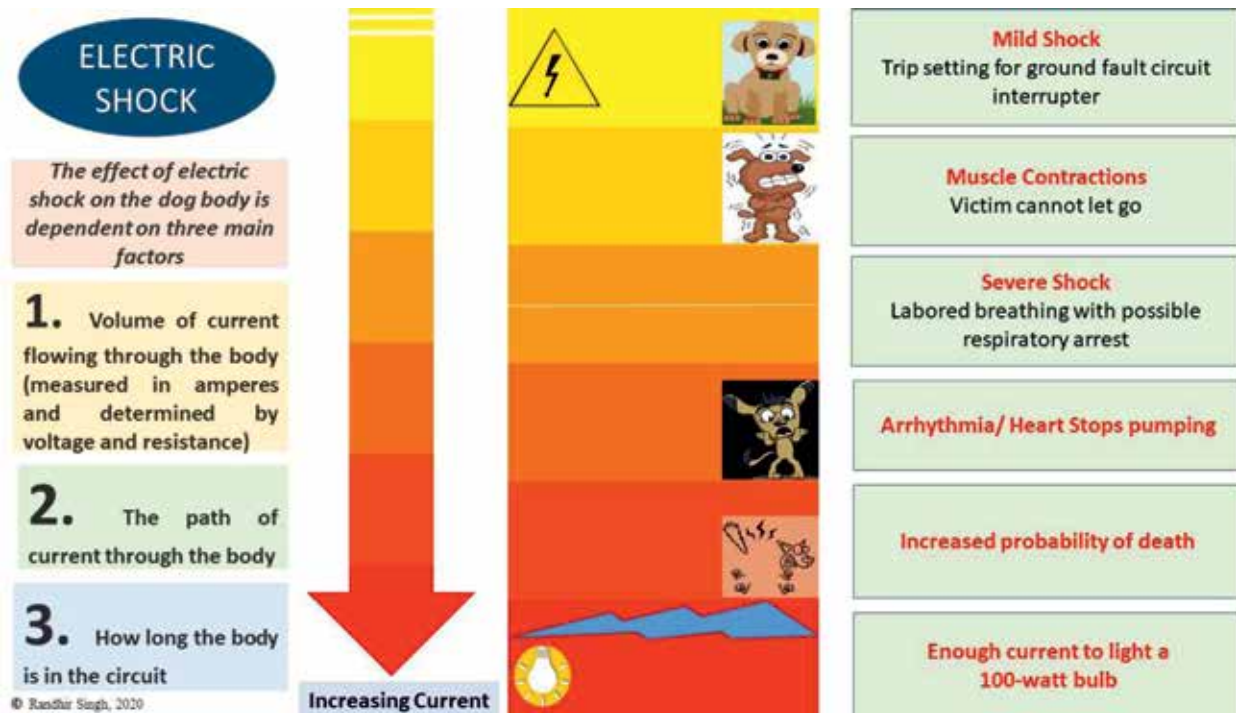


Figure 6. Determinants of electrocution severity in dog

having involuntary muscle contractions which may be attributed to electrical stimulation of cerebral vessels causing vasospasm (Echlin, 1942). To minimize these contractions, the pet was kept in dark and quiet setting by covering its face with a dark towel to avoid brain stimulation. Pup was having labored breathing which may be attributed to the fact that electricity can damage blood vessels in the body, causing a leakage of fluid that fills the lungs. This will cause coughing, difficulty breathing, and extreme anxiety. To cope up with this situation, the pup was kept on oxygen therapy. Radiograph of pup indicated severe bronchointestinal pneumonia which can be attributed to pulmonary edema due to the endothelial injuries causing an increase in the pulmonary vascular

permeability, leading to a flow out in the interstitial fluid or alveolus. As there is no specific treatment available for the injured endothelium in the pulmonary vasculature, inflammatory response cannot be blocked by a specific anti-inflammatory drug leading to the resolution of the edema. Diuretics may be given to normo-volemic animals, but they are usually ineffective because the edema is caused by alterations in the permeability and not by high hydrostatic pressure. Corticosteroids in anti-inflammatory doses can be used to minimize the tumefaction with the obstruction of the upper airways (Yamamoto *et al.*, 2009). The pup collapsed after 12 hours of initiation of treatment which can be due to the fact that since blood is a good conductor of electricity, current tends to flow along the

blood vessels, causing damage to endothelial cells and myocytes, resulting in thrombosis. These lesions may develop at any time after the accident, even after several weeks (Price and Cooper, 2013). Electricity can disrupt the normal heartbeat resulting in an arrhythmia which may cause dog to collapse, or may even cause cardiac arrest. In the worst case, brain damage, unconsciousness or even instant death can occur. Previous reports (Mills and Kersting, 1966; Lehman *et al.*, 2007) involving accidents in farm animals with low-voltage power lines also indicated only signs of acute circulatory failure.

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