



Lightning Strike

Ayça Calbay, Atıf Bayramoğlu, Kenan Ataç, Şahin Aslan

Department of Emergency Medicine, Ataturk University, Erzurum, Turkey

Cite this article as: Calbay A, Bayramoğlu A, Ataç K, Aslan Ş. Lightning Strike. J Emerg Med Case Rep 2017; DOI: 10.5152/jemcr.2017.1827

ABSTRACT

Introduction: Lightning strike is a rare, deadly natural phenomenon, affecting multiple organ systems with serious complications. Known complications include but are not limited to myocardial infarction, arrhythmias, cardiac contusion, stroke, cutaneous burns, pulmonary disorders, neurological disorders, acute renal failure, and death. Electrophysiological effects of a strike on the heart may result in ventricular fibrillation, asystole, QT prolongation, supraventricular tachycardia, and nonspecific ST-T changes.

Case report: Here we report the case of a patient whose medical history revealed syncope due to being struck by lightning, and electrocardiography changes were identified together with positive troponin I value during follow-up.

Conclusion: Patients who manifest cardiac and neurological symptoms and signs should be monitored and followed-up for at least 24-48 h with cardiac investigation, neuromuscular evaluation, and supportive treatment (especially rhabdomyolysis).

Keywords: Lightning strike, electrocardiography

Received: 09.10.2016 **Accepted:** 20.12.2016 **Available Online Date:** 25.08.2017

Introduction

Lightning strike is an environmental disaster that can cause death. It is estimated that the result of the brief contact with direct current results in temperature of approximately 3000°C and an intensity of 20-100 million volts (1). The annual mortality rate due to lightning strike is 0.2-0.7 per million people. Cardiovascular causes are the main causes of mortality due to lightning strike (2). Here we present a case with diffuse negative T wave in V1 to V6 in electrocardiography (ECG) due to lightning strike.

Case Report

A 37-year-old man was brought to Ağrı State Hospital with the chief complaint of syncope due to lightning strike. On admission, T wave in V1 to V6 (Figure 1) and troponin were determined to be negative and positive, respectively. The patient, whose ECG findings had reverted to normal physiological limits during follow-up (Figure 2), was transferred to our clinic in this state.

On admission to our clinic, his blood pressure was 103/60 mmHg, pulse was 65 per min, and oxygen saturation was 87%. No significant pathological finding was present on neurological examination. Systemic examination revealed no pathological finding other than first-degree burn marks found bilaterally between his toes (Figure 3). His laboratory test results were as follows: CK: 659u/L, CK MB: 31U/L, creatinine: 1mg/dL, K: 4.9mmol/L, Troponin: 1.84ng/dL, Na: 136mmol/L, BUN: 13.08mg/dL, WBC: 14800/μL, Hgb: 13.9g/dL, Plt: 226000/μL, MCV: 82.7fL, urine protein negative, blood gas pH: 7.35, HCO₃: 22.4 mmol/L, pO₂: 54.5, and pCO₂: 41.7. ECG showed normal sinus rhythm (Figure 4). Cranial CT findings of the patient, who had a history of syncope, were within normal limits. Because of the suspicion for the Gastrointestinal system bleeding we did rectal examination to the patient and was not showed any sign about melena, just seen a little amount of stool over the physician finger. Chest X-ray findings were normal. Although the patient did not complaint of chest pain, due to the dynamic changes in ECG, the Cardiology Clinic was consulted and the patient was later hospitalized in that clinic. His ECG results were as follows: EF: 35%, apex-apicoseptum was dyskinetic, and anterior was hypokinetic. Coronary angiography was performed; proximal and mid portions

Address for Correspondence:

Ayça Calbay, Department of Emergency, Ataturk University, Erzurum, Turkey

E-mail: drycshn@gmail.com

©Copyright 2017 by Emergency Physicians Association of Turkey - Available online at www.jemcr.org

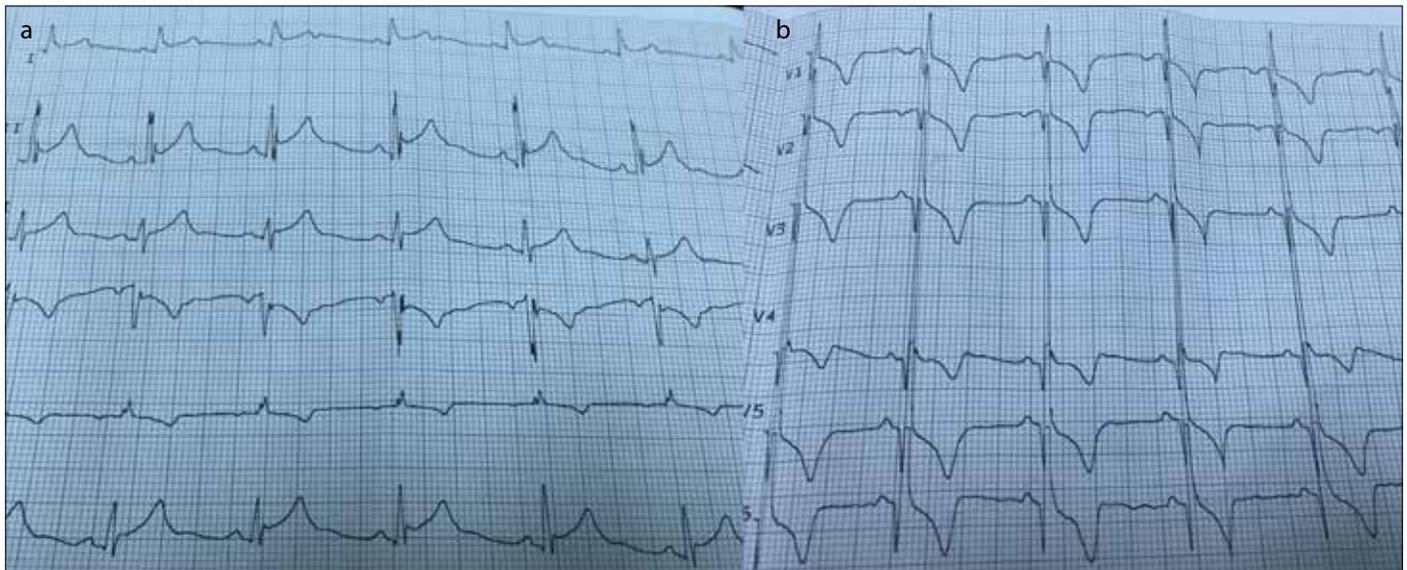


FIGURE 1. a, b. T wave negativity from V1 to V6

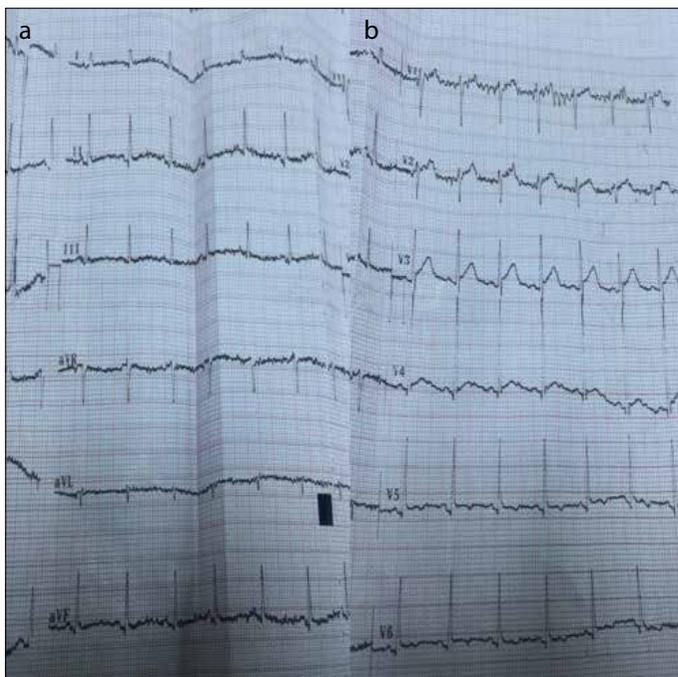


FIGURE 2. a, b. Follow up ECG findings reverted to normal physiological limits



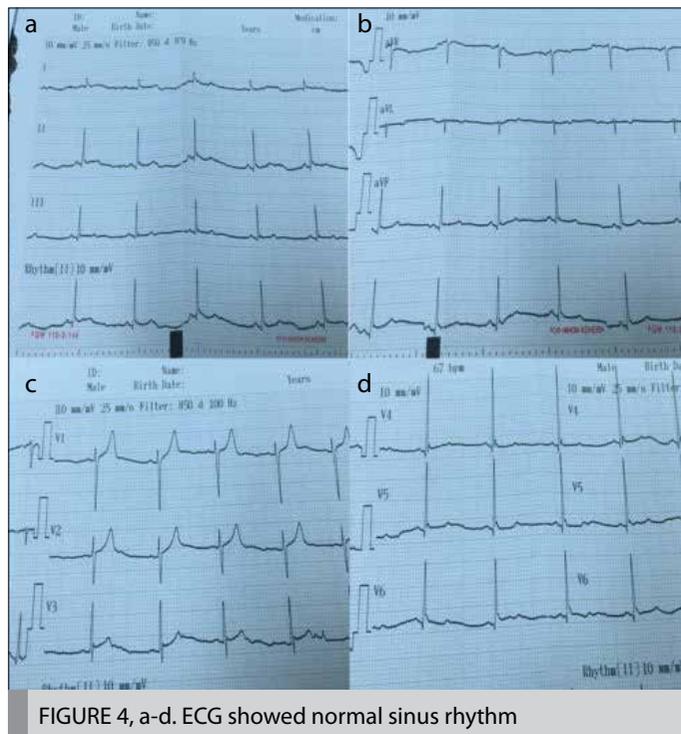
FIGURE 3. The first-degree burn marks found bilaterally between his toes

of LAD had plaques, mid and distal portions of the circumflex artery had plaques, distal circumflex artery was 30% lesion-obstructed, and proximal RCA was 30%-40% lesion-obstructed. The patient fully recovered and was discharged after observation for 5 days and occurrence of no additional pathological conditions after planning his outpatient medical treatment.

Discussion

Lightning strike is a rare natural phenomenon and leads to serious body damages that are not often encountered in our daily life (3). Its

effects occur in five ways: 1) Direct effect: The individual is directly exposed to the lightning and mortality rate is high; 2) Ground current: The lightning hits the ground, uses a tree or a pole and they distribute the energy; 3) Side splash: This is the most common type, wherein the lightning proceeds by jumping over individuals or objects; 4) Contact: The effect occurs through a pole or object, held by the individual; and 5) Blunt trauma: It occurs due to the blast effect of the lightning (4). We believe our patient had been affected by the side splash effect.



The most common initial cause of death is cardiac involvement. In the literature, there have been reports that lightning may cause myocardial injury and arrhythmias such as conductive disorders, atrial fibrillation, ventricular tachycardia, and asystole (5-7). Myocardial damage may occur due to direct myocardial injury, spasm of coronary artery, or blunt cardiac injury. Due to acute ischemic changes, ST-T changes may be detected with ECG. In our patient, negative T waves were seen on chest derivation from V1 to V6. Frequently reversible findings such as life-threatening left ventricular dysfunction and pericardial tamponade are limited to patients who are directly struck by the lightning. Since 25%-32% of patients who are exposed to lightning strike die due to cardiopulmonary arrest, acute medical intervention has utmost importance in reducing mortality (4, 8, 9).

Conclusion

Patients who manifest cardiac and neurological symptoms and signs should be monitored and followed-up for at least 24-48 h with cardiac investigation, neuromuscular evaluation, and supportive treatment (especially rhabdomyolysis).

Through this case, we wanted to draw attention to the importance of close follow-up with ECG monitoring and dynamic ECG changes.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - A.C.; Design - A.B.; Supervision - S.A.; Materials - K.A.; Data Collection and/or Processing - A.C.; Analysis and/or Interpretation - A.B.; Literature Search - A.C.; Writing - A.C.; Critical Reviews - A.B.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study has received no financial support.

References

1. Cooray V, Cooray C, Andrews CJ. Lightning caused injuries in humans. *J Electrostat* 2007; 65: 386-94. [\[CrossRef\]](#)
2. Pfortmueller CA, Yikun Y, Haberkern M, Wuest E, Zimmermann H, Exadaktylos AK. Injuries, sequelae, and treatment of lightning-induced injuries: 10 years of experience at a Swiss Trauma Center. *Emerg Med Int* 2012; 2012: 167698. [\[CrossRef\]](#)
3. Slesinger TL, Bank M, Drumheller BC, Peress DA, Ward MF, Sama AE, et al. Immediate cardiac arrest and subsequent development of cardiogenic shock caused by lightning strike. *J Trauma* 2010; 68: E5-7. [\[CrossRef\]](#)
4. Cooper MA. A fifth mechanism of lightning injury. *Acad Emerg Med* 2002; 9: 172-4. [\[CrossRef\]](#)
5. Saglam H, Yavuz Y, Yurumez Y, Ozkececi G, Kilit C. A case of acute myocardial infarction due to indirect lightning strike. *J Electrocardiol* 2007; 40: 527-30. [\[CrossRef\]](#)
6. Dronacharya L, Poudel R. Lightning induced atrial fibrillation. *Kathmandu Univ Med J* 2008; 6: 514-5.
7. Emet M, Aksakal E, Aslan S, Karacan M, Ersunan G. Lightning-induced lethal myocardial infarction and ventricular tachycardia in a boy. *Anadolu Kardiyol Derg* 2010; 10: 378-9. [\[CrossRef\]](#)
8. Fontanarosa PB. Electrical shock and lightning strike. *Ann Emerg Med* 1993; 22: 378-87. [\[CrossRef\]](#)
9. Aslar AK, Soran A, Yildiz Y, Isik Y. Epidemiology, morbidity, mortality and treatment of lightning injuries in a Turkish burns units. *Int J Clin Pract* 2001; 55: 502-4.