ECG DILEMMA-ANSWER

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Answer: 4

The ECG demonstrates findings of hypothermia. Such findings include: bradycardia, Osborn waves, and a prolonged QT interval. Patient's temperature was 33.6 ℃ on arrival in the emergency room.

DISCUSSION

Body's core temperature is tightly maintained between 36.5-37.5 ℃ (99.7-99.5 ℉) regardless of environmental disparities. Hypothermia is defined as a body temperature below 35 ℃. Mild hypothermia is defined as a temperature between 32.2 and 35 °C, moderate is between 28 and 32.1 °C, and severe is <28 °C[1]. ECG changes associated with hypothermia include: Osborne waves or J waves, prolonged PR, QRS and QT intervals; bradyarrhythmia, shivering artifacts, VT, VF or asystole[2]. The findings of hypothermia on this ECG are bradycardia, Osborn waves, and a prolonged QT interval.

The delay in impulse conduction through all cardiac tissue has been associated with prolongation of all the electrocardiogram intervals; PR, QRS, QT[3]. Osborne waves have been associated with hypothermia since their discovery in 1938. It's characterized as a small positive deflection (negative in aVR and V1) at the end of a QRS complex and an elevation of J point[4]. They are more prominent in anterior and lateral precordial leads and lead II[1]. Although Osborne waves are seen in 80% of patients with body temperature less than 35 ℃[1], they are apparent with body temperature <32 ℃ (90 ℉). The degree of hypothermia is inversely related to the magnitude of the QRS complex[5]. The exact mechanism of Osborne waves in hypothermia has not yet been established. An induction of increased activity of the cardiac transient outward potassium current, which is more prominent in epicardium than endocardium, has been suggested[6]. Multiple possible mechanisms have been described including acidosis, and delayed ventricular depolarization or early repolarization[3]. Similar ECG findings have been observed in patients with subarachnoid hemorrhage[7], hypercalcemia[8], early repolarization, and Brugada syndrome[9].

In the correct clinical settings, Osborne waves, prolonged QT, and bradyarrhythmias relate to hypothermia.

Notes

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References

1. Alsafwah S. Electrocardiographic changes in hypothermia. Heart Lung 2001;30:161–163.

2. Slovis C, Jenkins R. ABC of clinical electrocardiography: Conditions not primarily affecting the heart. BMJ. 2002 Jun 1;324(7349):1320-3. Review. PMID: 12039829.

3. Mattu, Amal et al.: Electrocardiographic manifestations of hypothermia. The American Journal of Emergency Medicine, Volume 20, Issue 4, 314 – 326

4. Osborn JJ. Experimental hypothermia; respiratory and blood pH changes in relation to cardiac function. Am J Physiol. 1953 Dec;175(3):389-98.

5. Okada M, Nishimura F, Yoshino H, et al: The J wave in accidental hypothermia. J Electrocardiol 1983;16:23-28

6. Yan G-X, Antzelevitch C. Cellular basis for the electrocardiographic J wave. Circulation 1996;93:372-9.

7. De Sweit J: Changes simulating hypothermia in the electrocardiogram in subarachnoid hemorrhage. J Electrocardiol 1972;5:193-195

8. Otero J, Lenihan DJ. The “normothermic” Osborn wave induced by severe hypercalcemia. Tex Heart Inst J. 2000;27(3):316-7.

9. Antzelevitch C, Yan G-X. J Wave syndromes: Brugada and Early Repolarization Syndromes. Heart rhythm : the official journal of the Heart Rhythm Society. 2015;12(8):1852-1866.