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Case Report

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Should computer-based medical education be a solution for treatment of rarely seen diseases? A forensic death case due to malignant hyperthermia

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ABSTRACT

We presented a case of a 33-year-old female who was admitted to hospital because of secondary infertility and underwent anesthesia for hysteroscopy. She was suspected to die from malignant hyperthermia during hysteroscopy process and accepted as forensic death. There were no data about postoperative biochemical findings and body temperature measurements. Histopathologic examinations showed pulmonary edema, intraalveolar edema and hemorrhage, chronic inflammation in the epiglottis and acute and chronic cervicitis. Creatinine kinase level was 11522 IU/L in postmortem analysis of serum (normal range 29 to 200 IU/L), creatine phosphokinase (CKMB) level was >500 ng/mL (Normal range 3.9 ng/mL) and myoglobin level was >800 ng/mL (normal range 0 to 70 ng/mL). In present study, limitations of postmortem investigations in the diagnosis of malignant hyperthermia have been emphasized and importance of the records kept before and during surgery has been discussed in terms of medicolegal aspects. Computer-based simulation technology is shown to be an effective method in anesthesiology education and becoming an essential part of the curriculum of anesthesia residency programs. We reckon that malignant hyperthermia should be presented before graduation by simulation programs in medical faculty and also similar postgraduate medical education activities should be settled.

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1. Introduction

Malignant hyperthermia is a syndrome characterized by a paroxysmal fulminating hyper metabolic crisis in the skeleton and heart muscle (Bina et al., 2008). A genetic problem was detected in calcium homeostasis in skeletal muscle (Christiansen and Coolins, 2005). In fact, malignant hyperthermia frequently appears following induction of anesthesia and may also occur during and after the procedure. Depolarizing muscle relaxants and halogenated anesthetics can trigger this disorder (Christiansen and Coolins, 2005). It is stated that the incidence of malignant hyperthermia episodes during anesthesia was between 1:5.000 and 1:50.000-100.000 anesthesia. (Rosenberg et al., 2007). A mutation within the ryanodine receptor gene (RYR1) was identified and DNA testing was suggested in 1990 but malignant hyperthermia was shown as a heterogeneous genetic disorder (McCarthy et al., 1990; Robinson et al., 2006). In this case report, medicolegal aspects of a case of preoperative death are presented. Importance of medical records kept before and during surgery in terms of medicolegal view and possible benefits of computer-based medical education in approaching malignant hyperthermia cases are discussed.

2. Case

We presented a case of a 33-year-old female who was admitted to hospital because of secondary infertility and underwent anesthesia for hysteroscopy. She was suspected to die from malignant hyperthermia during hysteroscopy and accepted as forensic death. By reviewing hospital records and death report; we saw that the decedent had a history of secondary infertility and applied to a state hospital. The obstetricians performed an infertile diagnose program and an

invasive intervention (hysteroscopy) was planned. She had only tonsillopharangitis before the operation and antibiotics were used for treatment. After completing the treatment process for tonsillopharangitis, premedication was performed and no obstacle was found for anesthesia procedure by physical examination and electrocardiogram. Patient had undergone anesthesia for hysteroscopy with administration of 100 mg succinylcholine and 400 mg thiopental administered by oxygen mask. During the operation process she had difficulty in respiration due to thoracic muscle rigidity. 20 mg succinylcholine was administrated again for muscle relaxation. The SpO_2 was begun to decrease. Bradycardia was noted. Due to temporomandibular and neck muscles rigidity, intubation process couldn't be done. Dopamine, epinephrine, dexamethazone, atropine were administrated. Tracheotomy was performed because of increasing central cyanosis. But the patient went into cardiac arrest. Cardiopulmonary resuscitation was performed. Results of arterial blood gas drawn after anesthetic induction showed respiratory acidosis due to hypercarbia. Patient was hyperventilated and bicarbonate was given. Also for preventing brain edema, mannitol, frosemid and corticosteroid were given. The patient was sent to another state hospital for further diagnose and treatment, however, resuscitative attempts did not succeed there. According to hospital records, we found that administration of intravenous dantrolene for possible malignant hyperthermia diagnose was not performed.

3. Autopsy findings

Autopsy was performed in Morgue Department of Izmir Group Chairman, Council of Forensic Medicine. The body was well-developed, adult white female, black hair, measured 150 cm in length. The upper and lower limbs were symmetrical. External examination revealed livor mortis (contact pallor) over the shoulder blades, buttocks. Rigor mortis was generalized and fixed on knee and elbow not blanching on fingertip pressure. Injection puncture marks were found on upper extremity. Resuscitative instruments were patent and properly placed and burn injuries consistent with electroshock (defibrillator) were observed. Lesion on anterior part of neck due to tracheotomy was found. No sign of assault or pathologic change on external genital was found. Internal examination; at autopsy, macroscopic examination showed hemorrhagic spots in the lungs and tissue sections revealed congestion and edema. We didn't see any abnormal finding in the internal organs in gross examination. The heart was 265 gr, intact coroner vessels. Cranium and nervous system; Cranial vessels; have a normal anatomical distribution with no aneurismal dilatation and no significant atherosclerosis. Brain: 1050 gr, cerebral edema was found. Serial coronal sections of the cerebrum at 1 cm intervals revealed no pathological changes. Respiratory system; trachea and main bronchi; unobstructed and free from disease except tracheotomy incision. Lungs; macroscopic examination showed hemorrhagic spots in the lungs and tissue sections revealed congestion and edema. The left lung was 585 gr, right lung was 635 gr. Pleural cavities; no adhesions or free fluid. Digestive and genitourinary system; liver, 1250 gr, revealed macro vesicular steatosis and congestion. The kidneys, 155 and 135 g, showed vascular congestion. Endocrine system; thyroid, adrenals were unremarkable. Musculoskeletal system; No visible fractures were found of spinal column, limb griddles, sternum, ribs and no fractures evident on palpation of long limb bones, hands and feet. Histopathological remarkable findings were: Microscopic examination of the lungs showed hyperemia, intraalveolar hemorrhage and vascular congestion. Mild pulmonary edema was in several sections. Toxicological analyses revealed negative results in blood and urine. Any anesthetic drug or its metabolite could not be determined from blood or urine by systematic techniques. Histopathologic examinations showed pulmonary edema, intraalveolar edema and hemorrhage, chronic inflammation in the epiglottis and acute and chronic cervicitis. Toxicological analyses revealed negative results. Creatinine kinase level was 11522 IU/L in postmortem analysis of serum (normal range 29 to 200 IU/L) two hours after death, and creatine phosphokinase (CKMB) level was >500 ng/mL (Normal range 3.9 ng/mL), and myoglobin levels was >800 ng/mL (normal range 0 to 70 ng/mL). As a result; autopsy findings revealed a very likely malignant hyperthermia diagnose but not certain by the help of limited antemortem medical records.

4. Discussion

In literature, in the studies about malignant hyperthermia it is emphasized that detecting respiratory and metabolic acidosis, cardiac monitorization findings (arrhythmias), muscle rigidity, increase in body temperature, muscle breakdown, family history, good respond to dantrolene treatment are used as diagnostic criteria for malignant hyperthermia (Rosenberg et al., 2007; Dong-Chan, 2012). In our case, according to hospital records we didn't find any information about detected body temperature and dantrolene treatment during the surgical operation. But the other clinical findings were matched the criteria. In the present study, limitations of postmortem investigations in the diagnosis of malignant hyperthermia have been emphasized and importance of the records kept before and during surgery is emphasized in terms of medicolegal aspects.

Modern medical treatment, dantrolene is used in malignant hyperthermia for reducing the mortality (Rosenberg et al., 2007). The genetic identification of susceptibility to malignant hyperthermia in patients can possibly further reduce the risk of death during and after anesthesia. But the most important thing is to have adequate information about disease by physicians. When an anesthesiologist is faced with a malignant hyperthermia case, the adequate medical approach must be done. By simulated this kind of rarely seen cases in computer-based education activities can give a chance to doctors to do adequate medical approach. Computer-based simulation technology is shown to be an effective method in anesthesiology education and becoming an essential part of the curriculum of anesthesia residency programs (Morgan et al., 2002; Berkenstadt et al., 2003).

We reckon that malignant hyperthermia should be presented before graduation by simulation systems in medical faculty and also similar postgraduate medical education programs should be settled.

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