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Assessment of Electrosurgery Burns in Cardiac Surgery

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Abstract

Background: Monopolar surgery is applied mostly in major operations, while bipolar is used in delicate ones. Attention must be paid in electrosurgery application to avoid electrical burns.
Objectives: We aimed to assess factors associated with electrosurgery burns in cardiac surgery operating rooms.
Patients and Methods: This was a case-control study in which two groups of 150 patients undergoing cardiac surgery in Imam Khomeini Hospital were recruited. Several factors like gender, age, operation duration, smoking, diseases, infection, atopia, , immunosuppressive drugs use, hepatic cirrhosis, and pulmonary diseases were compared between the two groups. Patients were observed for 24 hours for development of any burn related to the operation. Data was analyzed using SPSS v.11.5, by Chi square and T-test.
Results: Patients in the two groups were similar except for two factors. DM and pulmonary diseases which showed significant differences ($P = 0.005$ and $P = 0.002$ respectively). Seventy-five patients from controls and 35 from the study group developed burns, which was significant ($P < 0.0001$).
Conclusions: None of the factors were significantly related to developing burns. The differences between the two groups highlights the importance of systems modifications to lessen the incidence of burns.

Keywords: Electrosurgery, Burn, Electrocautery

1. Background

Electrosurgery dates back to 1920 when a physician named Bovie William invented an electrical device to stop bleeding. Harvey Cushin the neurosurgeon of Harvard University used the device invented by Bovie for excision of brain tumors (1-4). Some devices are still named Bovie. Electrosurgery, which is called HF surgery or RF surgery can destroy malignant lesions, control bleeding and cut tissues (5-7). The advantage of this kind of surgery is the possibility of making accurate cuts with less bleeding. Some of the probable complications of ESU include burning at the site of the dispersive electrode, unintentional activation of the active electrode and contact with the body surface, combustion in operation room because of high concentration of oxygen, electromagnetics effects on other devices in operation room and more important on patients with pacemakers; fumes produced by evaporation of tissue liquids, can be potentially harmful for staff and patients and gas emboli in case of using Argon. Some of the advantages of electrical knife over mechanical knife in surgeries include the possibility of coagulation (8, 9).

2. Objectives

We aimed to assess factors associated with electrosurgery burns in cardiac surgery operating rooms.

3. Patients and Methods

A total of 300 patients admitted to Imam Khomeini Hospital undergoing cardiac surgery were recruited. Informed written consents were obtained before the study from all patients. Patients were allocated to two groups. One-hundred fifty patients in the control group were chosen in spring before any engineering modifications of the system and 150 patients in the case group were chosen in summer after the engineering modifications of the system. Patients were observed after 24 hours of the operation to assess any probable burns caused by electrosurgery.

3.1. Modifications

First, the earth well and its accessories were tested regarding its soil resistivity; the previous well had a resistance about 13.5 ohms, which decreased to less than 2

ohms. Second, the isolated power system was repaired and fixed. Third, the electrical resistance of the operation room antistatic and conductive rubber flooring was tested and changed if was higher than the ISO standards. Moreover, this was performed for the operating rooms bed coats. Fourth, all the equipment in the operation room such as bed, monitoring, anesthetics tools, pumps, and electrocautery were tested regarding calibration and leakage; and the leakage currents were removed as much as possible. Fifth, the circumstances under which the operation was done like body moisture and the way in which equipment was used were assessed; finally, some less important factors such as climate changes, staff training, etc., were assessed.

4. Results

Control group patients were gender-matched to the case with a P value of 0.525 (69.3% were male in case and 72.7% in controls), which did not have a significant difference between the two groups. In analysis of other factors except for two, no significant differences were detected. DM (Diabetes Mellitus) showed a significant difference between the two groups with a P value of 0.005 (12% in case and 24.2% in control). Moreover, pulmonary diseases in case group with a P value of 0.002, were significant (0.7% in control group and 12% in case). Analysis of other factors including smoking (P value = 0.075), infection, diseases, immunosuppressive drug usage, location of dispersive plate did not show any significant differences between the two groups. Analysis of burn incidence between the two groups showed significant differences. Seventy-five of 150 patients in the control group and 35 of 150 patients in case group developed burns with a P value below 0.0001. Burns were more common in controls compared to the case group. Altogether, 110 patients developed burns. The results did not show significant effects of risk factors on developing burns.

5. Discussion

Awareness of cautery burns and alarm signs to diagnosis and promptly treat them may be of great importance for surgeons. By knowing the factors involved in developing burns, they can be modified or avoided to decrease the incidence of this complication. Analysis of burns incidence showed significant differences between the two groups with a P value of 0.0001. It indicates the effectiveness of engineering modifications of systems, which was shown to decrease the incidence of burns in the case group. Moist climate can be another reason, which needs further assessment. Sheridan assessed the effectiveness of non-contact electrosurgery to reduce skin burns. He found that indirect contact of electrode by means of special gel or pads to the skin reduced the burning incidence significantly (10). Tucker in the United States found a prevalence of 17% burning following surgeries; he indicated that the reason is the use of high voltages more than 40w for coagulation in 74% (11). Incidence of burns in our study was 110 of 300, which is fairly high compared with other studies. In another study the main reason for burns was mistake in regulating temperature and voltage of used devices (13-15). Our study emphasized the effect of system modification on reducing burns incidence, which is in accord with the mentioned investigations. Tuncel et al. evaluated heat lesions because of electrosurgery and found that most burns of third degree could be avoided by proper regulation of device temperature and voltage. They suggested contriving an alarm on the device to control temperature and voltage (12). Some studies in Australia stated that an initial temperature of 45 to 47 ^{o}C could cause burning (7, 16). Main anticipatory ways to predict and prevent burns in patients undergoing operations have been discussed as follows; avoidance of applying alcohol to the skin, not to use ethyl chloride as a local anesthetics, not to use oxygen, and finally not to place electrodes on bones (17-19). It is suggested to test and control the earth well periodically to prevent high soil resistance; we showed our previous well had a resistance about 13.5 ohms, which decreased to less than 2 ohms based on standards. Moreover, isolated power system, operating bed coats and rubber flooring are important factors to be checked, fixed or changed in case of any defect. Calibration and controlling leakage of currents must be assessed. Furthermore, it is suggested to separate body parts with surgical drapes and to dry the body to lessen conductivity and current flow. According to the results, continuous surveillance of electrosurgery units by expert engineers and modifying defects has significant effects on reducing burns incidence. Risk factors in this study had no effect on burning.

Footnote

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