ORIGINAL ARTICLE

Injuries Caused By Diathermy Plate of Electocautery Unit in Patients Undergoing Surgery

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ABSTRACT

Aim To assess the frequency of various injuries and their management caused by electocautery unit in patients undergoing surgery in Allama Iqbal Memorial Teaching Hospital, Sialkot.
Study Design: Prospective study .
Setting and time of study: Departments of Surgery, Anaesthesia and Gynaecology/ Obstetrics. Allama Iqbal Memorial Teaching Hospital, Sialkot. from March 2015 to September 2019.
Methods: All patients of both sexes presenting to the surgical OPD who have undergone surgery in the operation theatres of Allama Iqbal Memorial Hospital Sialkot and had burns/ injuries were included. The patients distributed as Group I undergoing surgery in Emergency settings while the Group II included patients operated in Elective settings. The data of all patients were collected and findings recorded. The management either as outdoorpatient or indoor carried and all variables devised.
Results: The total number of patients participated in research were 107. Those underwent emergency procedure were 45 and that of elective were 19. Regarding medical specialty general surgery patient were 28 , orthopedic were 7, gynae and obs were 19, neurosurgery were 2 , urology were 5 and peadiatric patients were 3.
The patients were divided into two groups, those who underwent burn at calf treated on emergency basis were 90% and on elective basis were 57.89%. Burns at gluteal region treated on elective basis were 42.10%. Patients having superficial burn were 68.88% on emergency basis and 47.10% on elective basis. Patients presented in emergency with deep burn were 31.11% and on elective list were 52.63%. Those patient required OPD follow up were 68.88% in emergency setup and 47.36% on elective basis.
Conclusion: There is variety of complications that occur with the use of electrocautry unit and its diathermy plate. Complications are preventable and the care totake preventative measures and taking necessary steps to minimize these plate burns is required. The staff should always keep in mind these injuries for its prevention.
Key words: Diathermy plate, Electrocautry unit, Burns, Grafting

INTRODUCTION

The Diathermy unit is a key equipment for securing hemostasis and dissection during surgical procedures. It has main components like electricity generator (Electrosurgical unit- ESU), active electrode, surgical patient and dispersive electrode or plate. The ESU has input of (AC) alternative current out of main power supply with a frequency of 110-220 Hz and modifies into electromagnetic current in excess of 200 kilohertz (KHz). Recent versions of diathermy units can generate as high current as 850 KHz. Which is exposed to the patient through wire connected to handheld device- called active electrode. Thediathermy plate which has the function of dispersion and is kept in contact with the patients' body; carries the current from the patient and return it to ESU, so an independent circuit is completed, and it does not require grounding. It is different from primitive or old versions which had ground-referenced circuits. So, the radiofrequency diathermy units are usually bipolar, it is the active electrode or delivering device that is either monopolar or bipolar[1,2].

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The diathermy lead is not the producer of heat in itself rather heat energy is generated in the cells and tissues of the patient, that is then transferred back to the device or electrode which makes it hot. The dispersion device or diathermy plate should be minimum 70cm^2. This much area will be able to take enough current back to electrosurgical unit and at the same time any harmful effect be avoided on the area of contact. The diathermy plate or dispersive unit bears two electrodes on a single plate, these separately perform as a sensor in situations of incomplete of rough contact of the pad. The transformation of electromagnetic energy to kinetic and then thermal energy in the cells and tissues is sequential. All these events are collectively termed as "diathermy." While transfer of heat from one source to other conducting source is called "Cauterization"[3,4].

There are two separate outputs or waveforms of diathermy units; consisting of lowvoltage continuous output and highvoltage interrupted output. Both these outputsproduce vaporization, and desiccation and coagulation of the cells and tissues. The low voltagemode isgenerally called "cut" mode (denoted by yellow knob or pad on ESU) and it is a misnomer. The highvoltage output is usually called "coagulation" mode (blue knob or pad) it is also a misnomer. Various other settings as needed can

also be modulated; as "cut," "blend," "desiccate and coagulate," and "fulgurate or spray"[5].

Duty cycle is the percentage of time occupied by the waveform or output. In low-voltage continuous waveform, the duty cycle is 100%. By regulating the duty cycle, voltage could be slightly increased or decreased. The higher the level (numerically, e.g., level 3 compared with level 1), shorter the duty cycle and higher the voltage. The low-voltage output irrespective of modulation is 600 to 700 V producing temperatures up to 1000°C. In contrary, high-voltage output, which has a duty cycle of approximately 6%, is 3 to 8 kV producing low temperatures[6].

The energy generated within the cells result in two types of reaction depending on the temperature. Tissue reaction varies at different frequencies. At a high frequency of more than 100 KHz, the muscles and nerves do not depolarize. Coagulation refers to protein denaturation. Desiccation and coagulation occur simultaneously at 60 to 90°C[7]. Vaporization occurs above 100°C and refers to conversion of water to gas resulting in rapid expansion of cell volume and rupture of cell membrane and wall. The difference in working of active electrodes occur depending on its manner of use. If the electrode is used in a noncontact manner, it results in vaporization due to increase in temperature[6]. The other hand, if the electrode is used in a contact manner with the tissue, the desiccation and coagulation.

Fulguration refers to superficial coagulation over a wider surface area. In practice to desiccate and coagulate tissues we use monopolar electrodes. superficial desiccation over a wider area often sufficient for nonvascular tissues or very small blood vessels[8]. To produce a uniform seal in a blood vessel, low voltage must be used, which unlike high-voltage waveform, coagulates the vessel slowly and produces deeper desiccation with higher temperatures. This effect is observed well with the use of bipolar active electrode or direct coupling technique[9,10].

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SUBJECTS AND METHODS:

All patients of both sexes presenting to the surgical outpatients department who have undergone surgery in the operation theatres of Allama Iqbal Memorial Hospital Sialkot and had burns/ injuries were included. The patients were grouped into Group I hadunderwent surgery in Emergency settings while the Group II included patients who underwent surgery in Elective settings. The data of all patients were collected and findings recorded. The management either as outdoor patient or indoor carried and all variables devised. The patients who were operated in other hospitals and got such injuries were excluded from the study. Similarly patients not completing follow up for 3 months were excluded from the study.The data collected was entered on performas and analyzed on SPSS v 22.0 programme.

RESULTS

The overall parameters of this study are presented in tabulated form as follows.

Varied details of the patients in the groups:

Treatment done is shown in Table III

Table I- General details of study

Total no of patients	107
Patients from other hospitals	43
Patients in the study	64
Age	14-56 years
Sex (m:f)	(29: 35)
Group I- Emergency	45
Group II- Elective	19
General Surgical Patients	28
Orthopedic surgery	7
Gynaecological/ Obstetric Patients	19
Neurosurgical Patients	2
Urological Patients	5
Paediatric surgery	3

Table II:Ddetails of patients group wise

	Group- I-	**Group II**
Burns at leg/ calf	40(90%)	11(57.89%)
Burns at Gluteal region	-	8(42.10%)
Superficial burns	31(68.88%)	9(47.36%)
Deep Burns	14(31.111%)	10(52.63%)
Patient treated as OPD patients	31(68.88%)	9(47.36%)
Patients required admission	14(31.11%)	10(52.63%)

Table III- Treatment

	Group- I	**Group II**
Conservative/dressings	31(68.88%)	10(57.63%)
Split thickness grafting	12(26.66%)	9(47.36%)
Full thickess grafting	2(4.44%)	1(5.26%)

DISCUSSION

The injuries caused by diathermy plate are more common in emergency settings where the hastle in the management due to time factor may lead to inadequate placement and contact with the body of patientas discussed in Partanen E et al[11], study . The staff on duty in emergency settings are usually junior and their training may be inadequate. Moreover the operation theatre staff employed in evening and night duties are not as alert as it should beas the data of Webb J B et al[12.] showed that unemployed staff causes more complications regarding use of diathermy .

Patients suffer injuries usually in legs and calf in particular, but the gluteal region is involved in children the study of Gunaruwan P et al[13],show that children are more prone to these burn.

Obstetric patient making huge bulk in emergency settings are also victims to these injuriesas the data given in Aras Aet al[14], study show that many obstetricpatient were getting these injuries in greater numbers. Neurosurgeons using bipolar diathermy is one advantage to their patients and they make up less victims as regards these injuriesas the data given in Sagawa Tet al[15],study

show that the complications were reduced by using diathermy.

CONCLUSION

There is variety of complications that occur with the use of electrocautry unit and its diathermy plate. Complications are preventable and the care to take preventative measures and taking necessary steps to minimize these plate burns is required. The staff should always keep in mind these injuries for its prevention.

REFERENCES

1. Humes D J, Ahmed I, Lobo D N. The pedicle effect and direct coupling: delayed thermal injuries to the bile duct after laparoscopic cholecystectomy. Arch Surg. 2010;145(01):96–98. [PubMed]
2. Choudhry A J, Haddad N N, Khasawneh M A, Cullinane D C, Zielinski M D. Surgical fires and operative burns: lessons learned from a 33-year review of medical litigation. Am J Surg. 2017;213(03):558–564. [PubMed]
3. McQuail P M, McCartney B S, Baker J F, Kenny P. Diathermy awareness among surgeons-an analysis in Ireland. Ann Med Surg (Lond) 2016;12:54–59. [PMC free article] [PubMed]
4. Australian 3-pin electrical mains plug. Available at:http://accesscomms.com.au/australian-mains-plug/. Accessed April 29, 2017
5. Beamer® CE600 System. Endoscopic Electrosurgical Platform.http://www.conmed.com/en/medical-specialties/gastroenterology-and-pulmonology/polypectomy/generators/beamer-ce600-system-endoscopic-electrosurgical-platform2017. Accessed April 4, 2017
6. Massarweh N N, Cosgriff N, Slakey D P. Electrosurgery: history, principles, and current and future uses. J Am Coll Surg. 2006;202(03):520–530. [PubMed]
7. Lindsey C, Hutchinson M, Mellor G. The nature and hazards of diathermy plumes: a review. AORN J. 2015;101(04):428–442. [PubMed]
8. Dobrogowski M, Wesolowski W, Kucharska M et al. Health risk to medical personnel of surgical smoke produced during laparoscopic surgery. Int J Occup Med Environ Health. 2015;28(05):831–840.[PubMed]
9. Haith L R, Jr, Santavasi W, Shapiro T K et al. Burn center management of operating room fire injuries. J Burn Care Res. 2012;33(05):649–653. [PubMed]
10. Gorphe P, Sarfati B, Janot F et al. Airway fire during tracheostomy. Eur Ann Otorhinolaryngol Head Neck Dis. 2014;131(03):197–199. [PubMed]
11. Partanen E, Koljonen V, Salonen A, Bäck L J, Vuola J. A patient with intraoral fire during tonsillectomy. J Craniofac Surg. 2014;25(05):1822–1824. [PubMed]
12. Webb J B, Balaratnam S, Park A J. Flame bums: a forgotten danger of diathermy? Surgeon. 2003;1(02):111–113. [PubMed]
13. Gunaruwan P, Barlow M. Diathermy-induced ventricular fibrillation with Riata high-voltage lead insulation failure. Europace. 2013;15(04):473. [PubMed]
14. Aras A, Oran E, Seyit H, Karabulut M, Gök İ, Aliş H. Colonoscopic perforations, what is our experience in a training hospital? Surg LaparoscEndoscPercutan Tech. 2016;26(01):44–48. [PubMed]
15. Sagawa T, Kakizaki S, Iizuka H et al. Analysis of colonoscopic perforations at a local clinic and a tertiary hospital. World J Gastroenterol. 2012;18(35):4898–4904. [PMC free article] [PubMed]