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Research Paper

Surgical site infection rates in scalp incisions for cranial surgeries; a comparison of scalpel and cutting electrocautery

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Abstract: *Background: Traditionally, the scalpel, has been the device used to make incisions on the skin. It is readily available, cheap and makes precise cuts on the skin. However, there may be increased operation time with its use because of the time spent in trying to secure haemostasis. The cutting electrocautery has the advantages of being faster with securing haemostasis and reducing blood loss. One of the concerns with the use of cutting electrocautery is that it may increase the risk of surgical site infection. This study compares the surgical site infection rates between the use of electrocautery and the scalpel in patients undergoing cranial surgeries.*
Methods: This prospective randomized study reviewed 64 patients undergoing cranial surgeries (craniotomy and craniectomy) for various indications. The patients were randomized into 2 groups: the diathermy and scalpel groups. The diathermy group had their incisions made with cutting electrocautery set at 30-40W, blend. The scalpel group had their incisions made with size 20 scalpel after standard skin preparation. The wounds were subsequently assessed for surgical site infection using the CDC criteria, at 3,14 and 30 days after surgery. The difference in infection rate was assessed using fisher's exact test
Results: At least some biodata of the patients showed that both groups were matched. Two patients in each of the groups developed surgical site infection giving rise to an incidence of 6.3%. There was no statistical difference between the two groups in terms of surgical site infection rate.
Conclusion. This study did not find any difference in the surgical site infection rate in cranial surgeries when scalp incision was made with either scalpel or cutting electrocautery.

Keywords*: Cutting electrocautery, scalpel, surgical site infection, scalp*

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I. INTRODUCTION

The scalp as the soft tissue covering over the cranium is first traversed before getting to the cranium and the intracranial cavity in order to perform most intracranial surgeries. The scalp has a very rich blood supply and incisions on it can result in significant bleeding. Wounds on the scalp generally heal fast and the wounds heal well. The scalpel has been the conventional instrument for making incisions on the scalp. The cutting electrocautery has been in use as an alternative to the scalpel in making incisions on the skin including that of the scalp[1]. The scalpel has the advantages of being readily available and easy to use, cheap, with minimal tissue damage along the incision site [1]. There are however some disadvantages with the use of the scalpel. The use of the scalpel is associated with several exchanges between making the incisions and then switching over to the use of coagulation diathermy to stop bleeding. These switching actions between incision and coagulation add to the operation time and additional blood loss. Again, these several switching actions between instruments are associated with increased risk of injury to the surgeon, the assistant and the peri operative nurse. The cutting diathermy was introduced as an alternative to overcome some of the problems associated with the use of the

scalpel. The cutting electrocautery is associated with shorter incision time and reduced blood loss [2]. Despite these advantages with the use of electrocautery, there have been concerns about possible complications with its usage. One of these fears is that it increases the risk of surgical site infections [2]. This is because the diathermy is associated with charring and collateral tissue damage with some degree of necrosis at the wound edges [3]. This can result in an increased risk for surgical site infections (SSI) [1]. This is because the devascularized tissue encourages the growth of microorganisms, especially skin flora that may be directly inoculated into the wound [4]. These concerns largely emanated from animal studies [5]. This fear has not been proven in clinical studies [2]. Very few of such studies have been done for cranial surgeries; thus, this study compared the SSI rate when scalp incisions were done with scalpel and when it was done with cutting electrocautery in cranial surgery.

II. METHODS

This was a prospective randomized, double blind comparative cohort study. The study was conducted at a tertiary health facility. An approval for this study was obtained from the Health Research and Ethical Committee of the Jos University Teaching Hospital. All consecutive patients 18 years and above who were scheduled for craniotomy and craniectomies for various indications and gave consent were recruited. Those with increased risk for developing surgical site infection like uncontrolled diabetes mellitus, morbid obesity and immunosuppression were excluded from the study.

A sample size for finite population was determined prior to commencement of the study. A total of 69 patients were enrolled into the study A computer-generated table of random numbers was used to consecutively allocate the patents into the two study groups. Group 1 was the diathermy group and group 2 was the scalpel group. Prophylactic antibiotics was given at induction of anaesthesia, the scalp was shaved with a clipper and the skin was prepared in the standard fashion for both groups and infiltrated with adrenaline. The incision was made with cutting monopolar diathermy set at 30W from skin to the pericranium for group 1 while group 2 had their incisions with size 20 scalpel. Surgical procedure after scalp incision were based on the indication for the cranial surgery. After the surgical procedure, a subgaleal drain was left in both groups and the scalp closed in 2 layers. The scalp wounds were subsequently inspected for wound infection at days 3,14 and 30 from date of surgery using the CDC criteria.

The data obtained from the study was inputted into excel spreadsheet and then subsequently transferred to IBM SPSS version 27 for analysis. The patients' demographics were compared between the two groups as shown in table 1 using fisher's exact test, likewise the inferential statistic comparing SSI rate, and mortality between the two groups was performed using fisher' exact test. A p- value for significance was set at $p < 0.05$ and 95% Confidence Interval (CI)

III. RESULTS

Sixty-four (64) patients completed the study, with 32 in each group. Most of the patients were males (83%in group 1and 94%in group 2) with no statistical difference between the 2 groups.

There was no statistically significant difference between the mean ages of the 2 groups

There was a statistically significant difference between the mean body mass indices of the 2 groups with diathermy group having a higher BMI.

There were more emergency surgeries done in the scalpel group than in the diathermy group and this was statistically significant.

The duration of surgery was significantly higher in the diathermy group than in the scalpel group. [Table 1]

The surgical site infection rate in both groups was 6.3%, with no statistical difference between the 2 groups.

The overall mortality rate was 7.2%. [Table 2]

Table 1. Summary of the characteristics of the two samples

Variable		Diathermy group N (%)	Scalpel group N (%)	P Value
1.	Sex			
	Male	29(82.9)	32(94.1)	0.14
	Female	6(17.1)	2(5.9)	
2.	Mean age(years)	37.2	32.7	0.12
3.	Mean BMI (kg/m^2)	26.27	24.64	0.031
4.	Nature of surgery			
	Emergency	23(65.7)	32(94.1)	0.003
	Elective	12(34.3)	2(5.9)	
5.	Indications for surgery			
	Trauma	23(65.7)	31(91.2)	0.001
	Tumours/others	12(34.3)	3(8.8)	

6.	Mean duration of surgery	193.22	149.82	0.026

Table 2. Outcome of surgery

Variable		Diathermy group N (%)	Scalpel group N (%)	P-Value
1.	Survival			
	alive	32(91.4)	32(94.1)	
	dead	3(8.6)	2 (5.9)	0.667
	Total	35(100%)	34(100%)	
2.	Surgical site infection			
	present	2(6.3)	2(6.3)	1.000
	absent	30(93.7)	30(93.7)	
	Total	32(100)	32(100)	

IV. DISCUSSION

The following are the findings from this study. Sixty-four (64) patients completed the study with 32 persons in each group. There was a male preponderance in both groups, 83% and 94% with no significant difference between the two groups. There was no significant difference in age between the 2 groups. The diathermy group had significantly higher BMI and longer duration of surgery than the scalpel group. There were significantly higher proportion of trauma and emergency cases in the scalpel group when compared to the diathermy group. Thus, the 2 groups were not equally matched in terms of their body mass indices, duration of surgeries, urgency of surgery and whether or not the indication for surgery was for trauma or not. Four (6.3%) patients developed SSI, and each study group had two patients each, and the overall mortality rate was 7.2% in this study.

Published data in the literature in the field of general surgery comparing diathermy and scalpel have shown a clear superiority of the cutting electrocautery over the scalpel in terms of the reduced incision time, reduced blood loss and post-operative pain and then no significant difference in the infection rates between the two groups[6,7,8,9] In fact, three other systematic reviews and meta-analyses not only showed the reduced incision time, reduced blood loss and post-operative pain, no difference in surgical site infection rates, but also provided strong support for the use of electrocautery as their recommendations [5,10,2].

There are many factors that increase the risk of developing a surgical site infection. They include advanced age, BMI>30kg/m^2, emergency surgeries, complexity of the surgery, duration of the surgery, comorbidities among others [11,12]. In this study, there was no significant difference between the age and sex distribution of the two groups. However, the mean weights and the duration of surgery were significantly higher in the diathermy group than in the scalpel group. This would expectedly increase the risk of surgical site infection in the diathermy group. In this study however, there was no significant difference in the surgical site infection rates in the two groups. On the other hand, there was a significantly higher proportion of emergency and trauma cases in the scalpel group when compared to the diathermy group. There is a higher risk of surgical site infection in emergency cases when compared to elective cases [11]. This may account for the very high surgical site infection rate of 6.4% seen in our study as there were more emergency cases in both groups (see table 1). Perhaps, the risks existing in both groups cancelled each other and thus in the long run, there was no difference in the infection rates between these two groups. This is an assumption that would need to be explored further.

Xu W et al in their protocol for comparing these two methods and their review of literature revealed a paucity of literature on this subject in neurosurgery and showed that the few available studies confirm the advantages of the cutting electrocautery as noted in the studies done in general surgery and that there is no significant difference in the infection rates between the two groups[3].These findings were also reproduced in two other separate studies done on neurosurgical patients[13,14].

V. CONCLUSION

This study did not find any difference in the surgical site infection rate in cranial surgeries when scalp incision was done with either scalpel or cutting electrocautery.

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