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Original Research Article

Diathermy versus scalpel incisions in elective abdominal surgery: a comparative study

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ABSTRACT

Background: Scalpel incisions produce little damage to surrounding tissues. There has been a widespread use of diathermy for hemostasis but fear of production of large scars and improper tissue healing has restricted their usage in making skin incisions. Use of diathermy in skin incisions reduces bleeding and makes the incision quicker, but there are no differences in wound burst strength. Objective of the study was to compare the use of diathermy and scalpel incisions in elective abdominal surgery's to see the variations in incisional time, blood loss during incision, postoperative pain and wound complications

Methods: This was a prospective randomized study, which included patients above 18 years who underwent elective abdominal surgery. The patients were randomly included into Group A or Group B. In Group A incision was made with a scalpel and in group B with diathermy. Data was analyzed for incisional time, blood loss during incision, postoperative pain and wound complications.

Results: There was a significant increase in mean time taken for incision in Group A when compared to Group B. Mean incision blood loss was found to be significantly higher in group A compared to group B patients. Postoperative pain was significantly higher in group A (p value <0.05) on postoperative day 1. Among wound complications, no statistically significant differences were seen between the two groups.

Conclusions: Electrocautery incisions were safe, less time consuming, reduced blood loss and had less postoperative pain. We conclude that diathermy could be accepted as an alternative method for surgical skin incisions.

Keywords: Diathermy, Electrocautery, Scalpel, Skin incisions, Wound complications

INTRODUCTION

Traditionally skin incisions have routinely been performed with scalpels. Now-a-days there is a shift in trend from this method to electrosurgical skin incisions. Currently most surgeons still make skin incisions with scalpel and use coagulation diathermy to dissect deeper tissues.[1]

Diathermy skin incisions are less popular among the surgeons, as it has been hypothesized that application of extreme heat may result in significant post-operative pain and poor wound healing.[2] There has been a widespread use of diathermy for hemostasis, but fear of production of large scars and improper tissue healing has restricted their use in making skin incisions.[3] Now-a-days electrodes used in making diathermy incision generate a pure sinusoidal current which produces cleavage in tissue planes without creating damage to the surrounding tissues, thus reducing damage inflicted to tissues leading to minimal scar formation.[4]

This study was performed to compare both methods of skin incisions to determine differences in incisional time, blood loss during incision, postoperative pain and wound complications.

METHODS

Study design

This was a prospective observational comparative study conducted in R. L. Jalapa Hospital and Research Center, Kolar, a tertiary teaching hospital in southern Karnataka, India over a period of 12 months (May 2017 to April 2018). Candidates enrolled in this study were of either sex above 18 years of age, who scheduled for elective abdominal surgeries and willing to participate in the study.

Inclusion criteria

All patients scheduled for elective abdominal surgeries for benign general surgical diseases, of either sex above 18 years of age and willing to participate in the study.

Exclusion criteria

Malignancy and chronic medical illness like diabetes mellitus, anaemia, asthma or tuberculosis.

Method

These candidates were randomly divided into two groups. In Group A, abdominal incision was made with a scalpel and in Group B, abdominal incision was made with diathermy (at setting of 70 watt with monopolar current). The incisions included vertical, horizontal, inguinal hernia repair and appendicectomy incisions.

Figure 1: Intraoperative images showing skin incision by scalpel (a) and electrocautery (b).

A medical history, a complete physical examination and routine laboratory tests were performed. They were given a prophylactic dose of one gram of ceftriaxone one hour prior to the incision.

The abdominal skin was prepared with povidone iodine in the operating room after giving anesthesia. Incision time was calculated from the start of skin incision until deep fascia or aponeurosis was reached with complete hemostasis. Incision length was measured using sterilized calibrated scales and blood loss during incision making was calculated by weighing the swabs pre and postoperatively (1 mg = 1 ml). Subcutaneous tissue was not approximated with suture in either group to maintain uniformity.

Figure 2: Intraoperative images showing amount of blood loss in scalpel incision (a) and electrocautery incision (b).

These patients were evaluated clinically for pain daily during postoperative period on day 0, day 1 and day 2 using Verbal Rating Score (VRS). VRS grading, 0: No pain, 1: mild pain, 2: moderate pain, 3: severe pain and 4: worst pain. Data was analyzed for indications, incisional blood loss, incision time, postoperative pain and wound complications like seroma, hematoma, fever, infection, dehiscence (separation of the subcutaneous tissues with skin).

A wound culture was performed if incision separation or purulent discharge occurred. The presence of a healing ridge with adequate tensile strength was used as an index of a healing wound while the Southampton grading system was used to denote the presence or absence of an infection. G0: normal wound healing, G1: normal healing with mild bruising or erythema, G2: erythema plus other signs of inflammation, G3: clear or serosanguinous discharge, and G4: purulent discharge.

All patients were followed up in 2nd, 4th, 6th week and 6 months after the discharge and any readmission after discharge from the hospital was evaluated to detect the occurrence of late wound complications.

Analysis and statistical methods

All the data was recorded and analyzed for categorical and continuous variables such as age, sex, indications, incisional time, blood loss during incision making, postoperative pain and wound complications for both methods of skin incision. Data was entered into Microsoft excel data sheet and analyzed using SPSS 22 version software. Categorical data was represented in the form of frequencies and proportions. Chi square test was used as test of significance for qualitative data.

Continuous data was represented as mean and standard deviation. Independent t test was used as test of significance to identify the mean difference between two quantitative variables.

Figure 3: Postoperative scar in a patient with scalpel incision (A) and electrocautery incision (B). Note there is no significant difference in terms of postoperative scar.

P value (probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests. Statistical software: MS Excel, SPSS version 22 (IBM SPSS Statistics, Somers NY, USA) was used to analyze data.

RESULTS

Total 84 patients were enrolled in this study, 42 were included in Group A and other 42 in Group B. They underwent various elective general surgical procedures. Indications of surgeries are as shown in Table 1.

Table 1: Indications of surgery.

Indications	Numbers	Percentage
Inguinal hernia	52	61.9
Acute appendicitis	16	19.04
Incisional hernia	10	11.9
Epigastric hernia	3	3.57
Umbilical hernia	2	2.38
Pseudocyst of pancreas	1	1.19
Total patients	84	

In the present study majority of the patients underwent mesh repair for inguinal hernia (n = 52; 61.9%), followed by open appendicectomy for acute appendicitis (n = 16; 19.04%), repair of incisional hernia (n = 10; 11.9%), epigastric hernia (n = 3; 3.57%) and umbilical hernia (n = 2; 2.38%). One patient underwent cystogastrostomy for pseudocyst of pancreas (n=1; 1.19%).

In the study mean age of subjects in Group A was 46.7±18.3 years (mean±SD) and in Group B was 50.4±16.0 years (mean ± SD). Majority of subjects in Group A and Group B were in the age group 51 to 60 years i.e. 31% and 23.8% respectively. There was no significant difference in age distribution between two groups (p = 0.372).

Table 2: Age distribution of subjects in both the groups.

		Group			
		Group A		Group B	
		Count	%	Count	%
Age	<20 years	4	9.5	0	0.0
	21 to 30 years	7	16.7	7	16.7
	31 to 40 years	4	9.5	5	11.9
	41 to 50 years	5	11.9	8	19.0
	51 to 60 years	13	31.0	10	23.8
	61 to 70 years	5	11.9	9	21.4
	>70 years	4	9.5	3	7.1
	Total	42	100.0	42	100.0
	Mean ± SD	46.7±18.3		50.4±16.0	

$\chi^2 = 6.48$; df = 6; p = 0.372; SD = Standard Deviation

Table 3: gender distribution of subjects in both the groups.

		Group A		Group B	
		Count	%	Count	%
Sex	Female	8	19.0	10	23.8
	Male	34	81.0	32	76.2
	Total	42	100.0	42	100.0

$\chi^2 = 0.283$; df = 1; p = 0.595

Table 4: Outcome parameters comparison between two groups.

	Group				p value
	Group A		Group B		
	Mean	SD	Mean	SD	
Time taken for incision (s)	36.8	8.8	27.0	10.1	<0.001*
Length of incision (cm)	7.0	2.0	6.9	2.9	0.811
Blood loss (ml)	3.4	1.5	2.6	1.5	0.021*

SD: standard deviation; p <.05 considered statistically significant

As seen in Table 3, majority of patients in both the groups were males (81% and 76.2% in Group A and Group B respectively). There was no significant difference in terms of gender distribution in both the groups

There was statistically significant increase in the mean time taken for incision in Group A when compared with Group B (36.8±8.8 and 27.0±10.1 respectively; p<.001).

Similarly, mean blood loss was statistically higher in Group A when compared with Group B (3.4±1.5 ml and 2.6±1.5 ml respectively; p = .021).

There was however no statistically significant difference between mean length of incision in Group A and Group B (7±2 cm and 6.9±2.9 cm respectively; p = .811).

Table 5: Pain score comparison between two groups at different postoperative period.

		Group				*p* value
		Group A		Group B		
		Count	%	Count	%	
Day 0	2	42	100.0	42	100.0	-
Day 1	0	0	0.0	5	11.9	0.021*
	1	42	100.0	37	88.1	
Day 2	0	42	100.0	42	100.0	-

P<.05 considered statistically significant

At Day 0, 100% of subjects in both the groups had grade 2 pain. On Day 1, in Group A, 100% of them had Grade 1 pain score, were as in Group B, 88.1% had Grade 1 and 11.9% had grade 0 pain score. This difference in pain score between two groups on day 1 was statistically significant. On Day 2, 100% of them had pain score of 0.

Table 6: Wound characteristics comparison between two groups at different postoperative period.

		Group				*p* value
		Group A		Group B		
		Count	%	Count	%	
G0	Absent	2	4.8	3	7.1	0.645
	Present	40	95.2	39	92.9	
G1	Absent	41	97.6	41	97.6	1.000
	Present	1	2.4	1	2.4	
G2	Absent	42	100.0	41	97.6	0.314
	Present	0	0.0	1	2.4	
G3	Absent	41	97.6	42	100.0	0.314
	Present	1	2.4	0	0.0	

P<.05 considered statistically significant

Table7: Complications comparison between two groups at different postoperative period.

		Group				p value
		Group A		Group B		
		Count	%	Count	%	
Primary intension	Absent	1	2.4	2	4.8	0.557
	Present	41	97.6	40	95.2	
Delayed healing	Absent	41	97.6	41	97.6	1.000
	Present	1	2.4	1	2.4	

In the study there was no significant difference in wound characteristics between two groups at G0, G1, G2 and G3. In Group A, primary intension was absent in 2.4% and delayed healing was present in 2.4%. In Group B, primary intension was absent in 4.8% and delayed healing was present in 2.4%.

There was no significant difference in complications between two groups in primary intension and delayed healing.

DISCUSSION

Several studies have shown that diathermy is increasingly being used for making skin incisions, and dissecting tissue planes. It facilitates hemostasis, reduces overall intra-operative time and shows similar wound healing as scalpel incision.[4,5]

In recent years after introduction of advanced electrocautery units (pure sinusoidal current), there is an increasing trend in the use of cautery for making skin incision. Studies have shown that when compared with scalpels, use of electrocautery results in reduced operating time, minimum blood loss and early pain reduction and fewer analgesics in postoperative period.

In our study, use of electrocautery resulted in significantly reduced mean incision time (27±10.1 s vs 38.8±8.8 s; p<.001) and significantly lower blood loss (2.6 ml versus 3.4 ml; p = .021) when compared with scalpel.

Present findings are comparable to findings reported by Talpur et al, who in their study reported statistically significant reduction in mean incision time and mean blood loss with electrocautery when compared with scalpel (7.3057sec/cm^2 versus 8.9025 sec/cm^2 and 1.1346 ml/cm^2 versus 1.8262ml/cm^2 respectively).[6]

Similarly, Ly et al in their systemic review and meta-analysis of fourteen randomized trials comprising of 2541 patients (1267 undergoing abdominal wall incision by cutting diathermy and 1274 by scalpel), found that diathermy may offer significant advantages in many variables including, operative blood loss, incision time and postoperative pain.[7] They noticed significantly reduced amounts of blood loss (mean difference of 0.72 ml/cm2 (P<0.001) and shorter incision time (mean difference of 36 seconds; P<0.001) with diathermy incisions as compared to scalpel incisions.

In present study, it was concluded that postoperative pain is significantly less (p value 0.021) in the electrocautery group on day 1 and it is comparable with other study conducted by Ombolaji et al.[8] Kearns also found that postoperative pain was significantly lower in the diathermy group for first 48 hours after operation which is consistent with present study.[9] There was no significant difference in pain of both groups on post-operative day 0 and day 2 onwards. Aird et al noted that electrocautery significantly reduced postoperative wound pain.[10] Results of present study are consistent with other studies by Siraj

et al, Gilmore et al and Shivagouda et al, which showed that elective laparotomy incisions made with electrocautery had significant benefits compared to scalpel incisions in terms of reduced early postoperative pain.[11,12,13] There was no statistically significant differences in terms of wound complications with use of electrocautery and scalpel in our study. Talpur et al have also shown no statistically significant difference in wound healing with electrocautery and scalpel.[6]

Eren et al compared wound complications associated with scalpel and electrocautery in patients operated for gastrointestinal malignancies with different incision methods and showed no significant statistical difference in wound infection.[14] Not a single patient in both groups developed wound infection or dehiscence as reported by Gilmore and their colleagues, but wound discharge was noticed in the scalpel group in four patients that were treated conservatively with daily dressing for few days.[12]

CONCLUSION

The use of diathermy for abdominal skin incision was associated with reduced incisional blood loss, shorter incisional time and less post-operative pain as compared to scalpel incision. There was no difference in the wound complications rate between the scalpel and diathermy incision. We conclude that diathermy could be accepted as an alternative method for surgical skin incisions.

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