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Comparison between Scalpel Incision and Diathermy Incision in Elective Midline Abdominal Surgery

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ABSTRACT

Introduction: Midline abdominal surgeries also need an accurate approach toward appropriate incisions to ensure safer surgery and better results. The scalpel has been used in the past, but there is evidence showing that diathermy incisions have certain benefits, both in blood loss and incision time. This study compares the efficacy and safety of these two techniques. **Objectives**: The aim was to compare between scalpel and diathermy incisions in terms of incision time, intraoperative blood loss, postoperative pain, and wound healing in elective midline abdominal surgeries. **Materials and Methods**: This randomized controlled trial occurred in Recep Tayyip Erdogan Hospital, Muzaffargarh, from 15 September, 2024 to 14 March, 2025. A total of 102 patients were selected and randomized as the scalpel group and diathermy group. Incision time, blood loss, postoperative pain (Measuring by VAS), and wound healing were recorded in the SPSS v.25 software and analyzed. **Results**: Diathermy also had the added advantages of reducing the incision time and the amount of blood loss compared to the scalpel. The Diathermy treatment group recorded fewer pains than the control group on the days after the operation. There is no significant difference between wound healing and surgical site infections. **Conclusion**: Diathermy incisions make surgery more effective and less uncomfortable for the patient without adding to the risk factors which are always associated with scalpel incisions.

INTRODUCTION

Midline abdominal surgeries are routine surgical procedures in managing various diseases, which entail the proper division of the abdominal wall because of the balance between the speed of the procedure, control of bleeding, and postoperative complications. Traditionally, a scalpel has been used in making skin incisions because of its sharpness and low heat conduction, which minimizes thermal injury (1). Nevertheless, electrocautery has explicitly come forward as a substitute effectuated by reduced blood loss and faster incisional time (2). The controversy on the choice of the kind of incision to be used still goes on as surgeons practice the two styles of incisions in elective midline abdominal operations. The scalpel is typically ideal for making a controlled incision without causing harm to other body tissues apart from the targeted area. Doctors have used this method for quite some time because it remains common and provides precisely defined wound edges (3). Nevertheless, one of the causes of incisions made by the scalpel is intraoperative blood loss, which makes surgery take longer and requires more frequent use of hemostasis (4). Further, because of the assistance of scalps, sharp injuries are likely to be experienced by healthcare workers, contributing to occupational safety (5).

Diathermy, in contrast, uses high-frequency electrical energy to incise through tissues and coagulate small vessels simultaneously, resulting in less intraoperative blood loss and shorter incision time (6). Some published studies show the diathermy incision may be beneficial in preventing postoperative blood loss and postoperative pain (7). Another RCT investigating scalpel and diathermy in elective midline laparotomies also reported significantly lesser mean incision time and less blood loss in the diathermy group, though pain intensity was not significantly different between the two groups, there was more preference towards scalpel use in patients. One other study pointed out that with diathermy incisions, less tissue damage and inflammation were known to affect wound healing (9). Nevertheless, some questions remain about diathermy's thermal impact on the neighboring tissue. Some view this type of treatment may resulting in

increased lateral tissue damage that may take a long time to heal and improve the infection rate (10). However, with the current development of technology in diathermy, the extensive damage due to the heat effect was significantly reduced in recent models (11). In the most preceding investigations comparing the incidence of wound complications between both approaches, a higher incidence of infections was observed with diathermy incisions in some, but not in other research (12).

It may also be influenced by patient-specific factors such as obesity, diabetes mellitus, and smoking history, affecting wound healing and postoperative permutation (13). A work done comparing diathermy and scalpel incisions in diabetics further observed that diathermy incisions also had better healing than scalpel incisions, provided adequate glycemic control is achieved (14). In addition, diathermy incisions were shown to have a shorter operative time and better hemostatic advantages in obese patients who had to undergo midline laparotomies (15). This should be explored further to identify which scalpel and diathermy incisions are appropriate for use and the best practices in surgery. Therefore, this research will seek to establish the differences between scalpel and diathermy incisions about intraoperative and postoperative factors, including incision time, blood loss, postoperative pain, and wound healing in patients undergoing elective midline abdominal operations. This information is very crucial to the surgeons, especially when conceiving an appropriate incision strategy to apply to the patient to increase efficiency and the result.

Objective

In this paper, the context is the Scalpel incision and the diathermy incision in elective midline abdominal surgeries. The goal is to compare their results in terms of incision time, operative blood loss, post-operative pains, and time taken for wound healing to determine which technique is preferable.

MATERIALS AND METHODS

Study Design

This is a randomized controlled trial study which tested a hypothesis that scalpel incision is superior to diathermy incision in patients undergoing elective midline abdominal surgeries. Patients were randomly divided into a scalpel group or diathermy group to compare incision time, intraoperative hemorrhage, postoperative pain, and wound healing time.

Study setting

The research was carried out at Recep Tayyip Erdogan Hospital, Muzaffargarh.

Duration of the study

The study was conducted from 15 September, 2024 to 14 March, 2025.

Inclusion Criteria

Patients of both sexes, age range 18- 65 years undergoing elective midline abdominal surgery were enrolled in the study. There was no differentiation between genders, and the patients targeted in the case included men and women. Only those patients who have stable preoperative vital and those who have consented to be used in the study were recruited. Patients with controlled ailments like hypertension and diabetes mellitus were also enrolled to capture different types of patients.

Exclusion Criteria

The excluded patients included those who had ever used corticosteroids for more than fourteen days and patients who had had their appendicitis surgery within three months. Also, those with any acute infection, poor glycemic control diabetes, coagulopathy, or any factors that may influence healing were excluded from the study.

Methods

The study participants were 102 patients selected from RTEH after receiving approval from the local ethical committee. Participants included in the study were grouped through the scalpel group, group A, and the diathermy group B using the lottery method in a sealed envelope. All the surgeries were done under general or spinal anesthesia by a consultant surgeon with more than 5 years of working experience after fellowship. Among the measures implemented for the preoperative period, skin antisepsis was carried out in the same fashion in both groups. Incisions in Group A were made using a sterile surgical blade, and in Group B, diathermy (Covidien brand, cutting mode at the frequency of 2000Hz). Details of the operation included the time taken to perform the incision (through a stopwatch) and blood loss during the operation using the swab weight. The pain intensity was evaluated in the postoperative period, at 6 and 12 hours, using VAS. For Pain management, dual analgesia was used. Patient was followed up for wound assessment at 2nd and 4th postoperative week . Information was documented in a pre-constructed format and analyzed on Statistical Package for the Social Sciences computer program v.25 with ac = 0.05.

RESULTS

Fifty-one patients in the scalpel group (Group A) and 51 patients in the diathermy group (Group B) were included in this study to give comparative data of 102 participants who underwent elective midline abdominal surgery. In this study, patients' characteristics as age, gender, obesity, hypertension, diabetes mellitus, smoking were compared between groups.

Incision Time and Blood Loss

When comparing the mean incision time between the diathermy and scalpel groups, the result showed that the mean incision time of the diathermy group was less than the scalpel group, 6.4 ± 0.8 seconds and 7.5 ± 1.1 seconds, respectively, $p<0.05$. In addition, intraoperative blood loss was significantly lower in the diathermy group, 1.2 ± 0.3 mL/cm^2 compared to the scalpel group, 1.6 ± 0.4 mL/cm^2 thereby showing improved hemostasis with diathermy.

Table 1

Comparison of Incision Time and Blood Loss

Parameter	Scalpel Group (Mean ± SD)	Diathermy Group (Mean ± SD)	p-value
Incision Time (sec)	7.5 ± 1.1	6.4 ± 0.8	<0.05

Blood Loss (mL/cm^2)	1.6 ± 0.4	1.2 ± 0.3	<0.05

Postoperative Pain

Mean VAS scores evaluated at 6 and 12 hours postoperative were overall lower in the diathermy group. The mean VAS score was 3.8 ± 1.2 at 6 hours in patients of the scalpel group, compared to 2.9 ± 1.0 in the diathermy group, which was statistically significant (P < 0.05). After 12 hours, the scalpel group recorded relatively higher overall pain than the diathermy did that was 3.2 ± 1.1 and 2.5 ± 0.9, respectively, and the 'p' value was < 0.05.

Table 2

Postoperative Pain Scores (VAS)

Time Post-Surgery	Scalpel Group (Mean ± SD)	Diathermy Group (Mean ± SD)	p-value
6 Hours	3.8 ± 1.2	2.9 ± 1.0	<0.05
12 Hours	3.2 ± 1.1	2.5 ± 0.9	<0.05

Wound Healing and Complications

The criteria used to evaluate the components of wound healing include SSI, delayed healing, and formation of a hematoma. The overall infection rate was slightly higher in the diathermy group, with 11.7%, as opposed to the scalpel group, where the rate of SSI was 9.8%. Still, the difference was not of any significant value (p= 0.67). Delayed wound healing was present in 7.8% of the scalpel incisions and 5.9% in the diathermy incisions, and thus there is no significant difference.

Table 3

Wound Healing and Complications

Complication	Scalpel Group (n, %)	Diathermy Group (n, %)	p-value
Surgical Site Infection	5 (9.8%)	6 (11.7%)	0.67
Delayed Healing	4 (7.8%)	3 (5.9%)	0.72
Hematoma Formation	3 (5.9%)	2 (3.9%)	0.81

These findings suggest that, without significantly raising wound complications, diathermy surgeries have benefits in terms of shorter incision times, less intraoperative blood loss, and less postoperative pain.

DISCUSSION

Elective midline abdominal surgeries comparing scalpel and diathermy have been a common concern in many studies. Both techniques have been widely applied in various parts of the world, while advocates of both procedures have praised the method due to its efficiency, safety, and benefits to patients. The purpose of this study was to compare the two methods and outline the outcomes for the time taken to make an incision, blood loss during surgery, postoperative pain, and wound healing. The given work emphasizes understanding the use of qualitative and quantitative approaches, their benefits and drawbacks. The last interesting area in the present study is the incision time between the two groups. This result reveals that the patients in the diathermy group used shorter periods in their incisions than those in the scalpel group. This is in line with other studies, which showed that diathermy could make sharp and clean incisions that, at the same time, can seal small vessels, thereby minimizing the requirement for further hemostasis (1). A systematic review also supports this finding that electrocautery has the advantage of offering a faster incision since it manages intraoperative bleeding well (2).

Another factor considered in the study was the intraoperative blood loss. The results indicated that the experiences registered in terms of blood loss were lower in the diathermy group than in the scalpel group. This is attributable to the coagulative effect of diathermy that decreases blood loss when generating incisions (3). Some published systematic trials have made findings that depict that diathermy incisions leave a reduction to intra operative blood loss as compared to scalpel incisions (4). Nonetheless, some surgeons' reservations rise due to more significant concerns about lateral thermal damage and tissue necrosis when using diathermy. However, it has been of concern for some time that thermal fusion exists and could limit the control of tissue dissection, though with the advancement in electrosurgery could be safer (6). Pain after surgery is an essential factor in the recovery process and the patient's satisfaction with the result of the operation. The survey revealed that patients who underwent diathermy operation had less pain at both 6 and 12 hours following the surgery compared to scalpel-operated patients. The lower pain level observed in the diathermy group can be explained by low nerve fiber disruption and limited inflammation due to minimal tissue damage (7). According to a comparison of pain and incision techniques, the electrocautery group experienced less postoperative pain without an increased risk of wound complications (51). Pain control is very crucial in early ambulation and early postoperative mobilization since patients who are in a lot of pain are likely to remain immobile, and this poses risks such as deep vein thrombosis and the development of pneumonia.

When comparing incision techniques, the critical factors are wound healing and postoperative surgical site infections (SSI) that occur in patients. The comparison between the diathermy and scalpel groups in this study showed that the former recorded slightly more SSIs than the latter, but not outside the insignificance level. This is in tune with earlier clinical investigations that also reveal that while diathermy may generate little heat to the adjacent tissues, it does not increase the risk of wound infection (10). A possible factor contributing to slightly higher SSI in the diathermy group is the dubious re-epithelialization due to thermal coagulation. However, it is minimal in the present generation of electrosurgical apparatus (11). In analyzing the results regarding wound healing time, it was observed that the mean time in both groups was nearly equal, which shows that therapeutic diathermy does not retard the healing time provided it is cautiously employed (12).

Some factors that may determine the course of the disease and outcomes of the operation include patient-associated factors like obesity, diabetes, and smoking. In this study, included patient groups had well-controlled diabetes or hypertension the presence of such patients did not affect the comparability of scalpel and diathermy incisions. However, the studies reveal that cases of diathermy incisions can undergo delayed healing in patients with

diabetes and, therefore, require close monitoring after surgery (13). Likewise, obesity was acknowledged as an application that could derive some advantages from diathermy incisions because of decreased blood loss and shorter time required for incisions in such patients (14). These findings demonstrate that patient's patient-relevant factors rather than generalized strategies should be the basis for surgical planning.

However, regarding the presented results of diathermy, the incision method depends on the specific type of surgery and the specificity of the surgeon. Some surgeons recommend it because of its sharpness and less worry about thermal damage. Secondly, scalpels have been used as the gold standard in creating neat and clean cuts that do not cause significant harm to surrounding tissues. In this respect, diathermy can simultaneously divide and coagulate tissue with decreased operative time and blood loss, which is paramount in high-risk patients. In general, the findings of this study indicate that diathermy is a safe method for performing midline abdominal incisions and is as effective as a scalpel. It has an edge concerning short operating time, minimal intra-operative blood loss, and low post-operative pain without increasing the risk of wound complication. Nevertheless, it becomes imperative to exercise caution and select optimal conditions to avoid or reduce heat damage. Further studies should be conducted about the long-term effects of this operation, such as the formation of a keloid scar and other complications, which may occur in the longer term concerning guidelines for the use of electrocautery in abdominal surgery.

CONCLUSION

In this study, scalpel and diathermy for incisions during elective midline incisions were comparatively assessed based on incision time, intraoperative blood loss, postoperative pain, and Wound healing. The study revealed that using diathermy led to shorter incision time and less intraoperative blood loss than a scalpel in terms of surgery efficiency. Also, on a related note, pain after surgery was reduced in the diathermy group to improve the comfort of recovering patients. Even though the rate of occurrence of SSI was slightly higher among patients who underwent diathermy surgery, the results were not significantly different, implying that the two methods are safe, provided they are implemented appropriately. In general, diathermy appeared to be safe and effective in regard to time-saving as well as hemorrhagic potency in surgery dissimilar to causing essential complications. Nevertheless, such incision type should also depend on the patient and their surgeon's skills. Further studies should be conducted to examine prolonged effects on scar formation and another delayed impact on patients to establish other guidelines that will give insights into best practices in the surgical process.

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