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General Surgery

COMPARISON IN DIATHERMY VS SCALPEL SKIN INCISION IN ABDOMINAL SURGERY

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ABSTRACT **Background:** The method of skin incision in abdominal surgery remains debated, with diathermy offering potential efficiency advantages and scalpel regarded for precision and minimal collateral tissue injury. Comparative evidence in diverse surgical settings remains limited. **Objective:** To compare diathermy and scalpel skin incisions in abdominal surgeries with respect to operative time, intraoperative blood loss, postoperative pain, surgical site infection (SSI), healing time, and hospital stay. **Methods:** This prospective comparative study included 66 patients undergoing abdominal surgery, randomized into two equal groups: Group A (diathermy incision, n=33) and Group B (scalpel incision, n=33). Patients aged 18–65 years without prior incisions at the same site were eligible. Operative parameters, postoperative pain (VAS at 6, 12, 24, and 48 hours), healing, hospital stay, and SSI (CDC criteria) were assessed. Statistical analysis was performed using chi-square and Student's t-tests, with $p<0.05$ considered significant. **Results:** Baseline characteristics were comparable between groups. Mean incision time was significantly shorter with diathermy (7.0 ± 1.5 vs. 10.0 ± 2.2 minutes; $p<0.001$). Blood loss was also lower in the diathermy group (10.0 ± 0.9 vs. 15.0 ± 1.5 ml; $p<0.001$). Pain scores were lower at all intervals in the diathermy group but not statistically significant. Healing time (11.69 vs. 11.41 days; $p=0.540$), hospital stay (6.23 vs. 6.24 days; $p=0.981$), and SSI incidence (15.2% vs. 12.1%; $p=0.720$) were comparable. **Conclusion:** Diathermy incision offers significant advantages in operative efficiency and blood conservation without compromising postoperative pain, infection rates, or healing. Both methods remain safe; incision choice should be guided by patient context and surgeon expertise.

KEYWORDS : Diathermy, Scalpel, Abdominal Surgery, Operative Time, Blood Loss, Surgical Site Infection, Wound Healing

INTRODUCTION

The Lancet Commission for Worldwide Surgery (LCoGS) estimates that 11% of the global illness burden necessitates surgery, anesthesia, or both [1]. It is estimated that 5,000 surgeries are needed to treat 100,000 people in low- and middle-income countries (LMICs), which is a lot more than the 295 to 23,000 surgeries needed for every 100,000 people in high-income countries (HICs). There aren't enough surgeons, anesthetists, and obstetricians (SAOs); healthcare facilities aren't good enough; and surgeries aren't reported enough, which leads to differences [3]. Disease Control Priorities (DCP) 2 aimed to identify and quantify surgical requirements, particularly in low- and middle-income countries (LMIC) [4]. DCP 3 is built on this idea [5].

Surgical care must be a part of health systems at every stage of development. When epidemiological transitions happen, cancer, heart disease, and car accidents will take the place of communicable diseases in many low- and middle-income countries. In these countries, the need for fair surgical care is likely to grow. Integrating surgery and anesthesia into the current global health framework, which emphasizes disease-based monitoring and advocacy, is challenging, despite the increasing demand for surgical treatment.

Abdominal surgeries for diagnosis, treatment, and comfort include the abdominal cavity. The gastrointestinal tract, hepatobiliary system, pancreas, spleen, genitourinary organs, and vascular tissues may all be involved in these surgeries. Appendectomy, cholecystectomy, herniorrhaphy, intestinal resections, exploratory laparotomy, and oncological resections are frequent procedures. The goal of these surgeries is to completely treat the disease that is causing the problem, even though the reasons and methods differ.

The goal is to have a quick and easy recovery after surgery, but pain, fever, bleeding, wound infection, and wound dehiscence are all common. These problems make hospital stays longer and lead to infections, which make surgery outcomes worse [6, 7].

Wound care and quick healing lower the chances of complications after surgery, shorten recovery time, and cut down on the time spent in the hospital [8]. Wound healing is aided by cytokines, growth factors, blood, and the extracellular matrix. Each part helps the wound heal in its own way. Cytokines start the process of making basement membrane components, stop dehydration, raise inflammation, and help make granulation tissue, all of which help wounds heal. A number of local and systemic factors control the cytogenic processes that heal wounds [9]. Local and systemic effects encompass both mutable and immutable factors.

With advancements in technology, many adjustable features have been examined and modified to address particular challenges; the current emphasis is on surgical instruments, specifically to mitigate intraoperative and postoperative hemorrhage and discomfort. Surgeons are interested in the way the incision is made. Scalpels are used for most cuts, but they don't hurt the tissue much [10]. Diathermy has been extensively utilized for homeostasis; however, concerns regarding scarring and tissue recovery have restricted its application in skin wounds [11, 12]. Diathermy electrodes generate a pure sinusoidal current to separate tissue planes without damaging adjacent regions. This lessens damage to tissues and scarring [13].

Diathermy in skin incisions diminishes hemorrhage and expedites the procedure without compromising wound burst strength. Diathermy incisions showed a higher rate of infection than scalpel incisions [15]. There are not many studies that have looked at the differences between diathermy and scalpel incisions in patients who have had abdominal surgery. This study compared postoperative bleeding, discomfort, and wound infection rates in patients undergoing abdominal procedures at a tertiary center in North India with scalpel or diathermy incisions to address this deficiency. This study compared diathermy and scalpel skin incisions in abdominal surgery.

MATERIALS AND METHODS

This was a prospective comparative study conducted in the Department of General Surgery at a tertiary care center in North India

over a period of two years. A total of 66 patients undergoing abdominal surgeries were recruited based on inclusion and exclusion criteria and were randomized into two equal groups of 33 each: Group A (Diathermy incision) and Group B (Scalpel incision). Ethical clearance was obtained from the Institutional Ethics Committee, and informed written consent was taken from all participants before enrollment.

Patients aged >18 years undergoing abdominal surgery with no previous incision at the same site were included. Patients with chronic scar pain (>3 months) or those suffering from severe systemic illness such as hepatic, renal, cardiovascular disease, or uncontrolled diabetes mellitus were excluded from the study.

The sample size was calculated at 80% power with a type I error (α) of 5%, based on the variation in postoperative day 2 pain scores between the two groups. The calculation was derived from a previous study by Kearns et al. [63], where the standard error of the mean (SEM) of pain scores was 0.1 in both groups. Considering a clinically significant mean difference (d) of 20% (0.4) and a design effect (k) of 1.0, the required sample size was determined to be 33 patients per group, giving a total of 66 participants.

Patients fulfilling the eligibility criteria were randomized into two groups: Group A (n=33): Skin incision performed using diathermy and Group B (n=33): Skin incision performed using scalpel.

Baseline clinicodemographic data including history, clinical examination, body mass index (BMI), comorbidities, laboratory investigations, and imaging reports were recorded in a structured proforma. All surgical procedures were performed under standardized aseptic precautions. In both groups, dry surgical mops were weighed before and after use during incision to assess intraoperative blood loss, using electronic weighing scales with a precision of two grams.

All patients received postoperative analgesia as per requirement, and pain was assessed using the Visual Analogue Scale (VAS) on predefined postoperative days. Surgical site infections (SSIs) were documented using the CDC criteria. Wound assessment for pain, healing, and infection was carried out daily for the first five postoperative days and subsequently during follow-up up to 30 days.

Statistical Analysis

We used SPSS 25.0 (IBM Corp., Armonk, NY, USA) to analyze all data. Continuous variables such age, BMI, operating time, blood loss, pain scores, healing time, and hospital stay duration were reported as mean ± SD. Student's t-tests compared continuous variables between groups. Chi-square (χ^2) test was used to assess frequency and percentage of categorical variables such sex distribution, comorbidities, and surgical site infection (SSI) occurrence. Statistical significance was defined as p-value <0.05.

RESULTS

The study had 66 patients, evenly divided into two groups. Diathermy was used for Group A (n=33; 50%) and scalpel for Group B (n=33; 50%). This balanced sample distribution for operation and postoperative outcomes comparison.

The baseline demographic profile of study participants is shown in Table 1. Patients in Group A (diathermy) had a mean age of 40.48 ± 16.25 years, while it was 39.30 ± 15.58 years in Group B (scalpel), with no significant difference (p=0.764). Group A had 60.6% males and 39.4% females, while Group B had 51.5% males and 48.5% females (p=0.456). The mean BMI was 24.00 ± 4.99 kg/m² in Group A and 24.52 ± 5.24 kg/m² in Group B, with no significant difference (p=0.684). Comorbidities were non-significant (15.2% in Group A and 21.2% in Group B), mostly hypertension and managed type 2 diabetes.

Table 1: Baseline Demographic Profile of Study Participants

	Group A (n=33)	Group B (n=33)	p-value
Mean Age (yrs)	40.48 ± 16.25	39.30 ± 15.58	0.764
Male : Female	20:13	17:16	0.456
Mean BMI (kg/m²)	24.00 ± 4.99	24.52 ± 5.24	0.684
Comorbidities (%)	15.2	21.2	0.750

Table 2 compares group A and B operational parameters. In the diathermy group, skin incision took considerably less time (7.0 ± 1.5 minutes) than in the scalpel group (10.0 ± 2.2 minutes) (p<0.001). Diathermy significantly reduced intraoperative blood loss during incision, with Group A experiencing 10.0 ± 0.9 ml compared to Group B with 15.0 ± 1.5 ml (p<0.001).

Table 2. Comparison of Operative Parameters

	Group A (Diathermy)	Group B (Scalpel)	p-value
Time for incision (min)	7.0 ± 1.5	10.0 ± 2.2	<0.001*
Blood loss (ml)	10.0 ± 0.9	15.0 ± 1.5	<0.001*

Table 3 compares postoperative pain (VAS Score) at different intervals between groups. The two groups had similar VAS pain levels at 6, 12, 24, and 48 hours postoperatively. Mean VAS ratings at 6 hours were 2.90 ± 0.82 in Group A and 3.00 ± 0.93 in Group B (p=0.645). At 12 hours, scores were 1.86 ± 0.74 vs. 2.03 ± 0.91 (p=0.408). At 24 hours, ratings were similar (2.17 ± 0.81 vs. 2.21 ± 0.87, p=0.847), and at 48 hours, both groups reported similar pain levels (1.48 ± 0.51 vs. 1.52 ± 0.51, p=0.751). No interval showed a statistically significant difference.

Table 3: Postoperative Pain (VAS Score) at Different Intervals Between Groups

Postoperative Pain (VAS Score)	Group A (Mean ± SD)	Group B (Mean ± SD)	p-value
6 hrs	2.90 ± 0.82	3.00 ± 0.93	0.645
12 hrs	1.86 ± 0.74	2.03 ± 0.91	0.408
24 hrs	2.17 ± 0.81	2.21 ± 0.87	0.847
48 hrs	1.48 ± 0.51	1.52 ± 0.51	0.751

Table 4 shows the Postoperative Outcomes between groups. Group A had a mean wound healing time of 11.69 ± 1.79 days, whereas Group B had 11.41 ± 1.90 days, with no significant difference (p=0.540). The average hospital stay was similar between groups (6.23 ± 1.66 days vs. 6.24 ± 1.68 days, p=0.981). These results show that incision style did not affect wound healing or hospital stay.

Table 4: Postoperative Outcomes Between Groups

Outcome	Group A (n=33)	Group B (n=33)	p-value
Mean Healing Time (days)	11.69 ± 1.79	11.41 ± 1.90	0.540
Mean Hospital Stay (days)	6.23 ± 1.66	6.24 ± 1.68	0.981

In Table 5, SSI incidence is compared between groups. There were 5 (15.2%) surgical site infections in Group A and 4 (12.1%) in Group B. The diathermy group was slightly higher, but not significantly (p=0.720). Most patients (84.8% in Group A and 87.9% in Group B) recovered without infection after surgery.

Table 5. Incidence of Surgical Site Infection (SSI)

SSI Status	Group A (n=33)	Group B (n=33)	p-value
Occurred	5 (15.2%)	4 (12.1%)	0.720
Not Occurred	28 (84.8%)	29 (87.9%)	

DISCUSSION

In this randomized study comparing diathermy and scalpel skin incision for abdominal surgery (n=66; 33 per arm), the baseline characteristics were well-balanced, with an average age of approximately 40 years, a male predominance, and a largely normal BMI. We looked at how long the surgery took, how much blood was lost during the surgery, how much pain there was after the surgery (6, 12, 24, and 48 hours), how many SSIs there were (30 days), how long it took to heal, and how long the hospital stay was. The main signals showed that diathermy was more efficient (shorter incision time, less blood loss), and there were no statistically significant differences in pain, SSI, healing time, or length of stay.

Our study showed that the diathermy cut down on incision time (7.0 ± 1.5 vs. 10.0 ± 2.2 minutes; p<0.001) and blood loss (10.0 ± 0.9 vs. 15.0 ± 1.5 mL; p<0.001) compared to the scalpel. In clinical terms, this translates to expedited abdominal access with reduced hemostatic interventions and quantifiably drier fields at the epidermal level. These findings are in strong agreement with existing literature. Kearns et al. (2001) demonstrated expedited midline laparotomy entry utilizing diathermy; similarly, Shamim (2009) and Charoenkwan et al. (2012) reported enhancements in velocity and efficiency of motion. Ayandipo et al. (2015) found that electrosurgical incisions were almost three times faster than scalpel incisions and caused much less blood loss. Nadeem et al. (2023) measured a reduction of about a quarter in incision time, and Yadav et al. (2021) showed that diathermy caused much less blood loss per unit area of the wound (≈0.31 vs. 1.21 mL/cm²). Diathermy's ability to cut and coagulate at the same time

removes many extra steps needed to stop bleeding, which may explain why the procedure takes less time and causes less bleeding.

In our study, the mean VAS pain scores were lower with diathermy at 6, 12, 24, and 48 hours; however, these differences were not statistically significant. Over the first two days after surgery, the need for painkillers and the comfort levels of patients were generally the same. The literature presents inconsistent findings regarding pain. Gupta et al. (2017)—consistent with our findings—indicated no significant difference in early postoperative pain following hernia surgery. Conversely, Farooque et al. (2019) and Saeed et al. (2017) reported markedly reduced pain levels with diathermy until postoperative day 3. Differences in sample size, pain relief protocols, case mix (clean elective vs. emergency/contaminated), and measurement tools (VAS vs. numerical rating scale) are probably what caused the disagreement. From a biological standpoint, diathermy could potentially occlude minor nerve endings and restrict mechanical traction; however, standard multimodal analgesia and variability in surgical techniques among surgeons may diminish discernible differences in clinical trials.

In our study, the occurrence of Surgical Site Infection (SSI) was 15.2% in diathermy cases compared to 12.1% in scalpel cases, which was not statistically significant. The majority of patients in both groups experienced uncomplicated wound healing up to 30 days. Contemporary trials and syntheses typically indicate no significant disparity in SSI risk among techniques. Prakash et al. (2015) and Pandey et al. (2019) reported similar rates across methods, while Memon et al. (2021)—in a hysterectomy cohort—found lower SSI with diathermy (≈19% vs. 34%). Previous apprehensions regarding thermal injury as a precursor to infection (e.g., Madden 1970; Sebben 1988) have faced growing scrutiny from modern randomized controlled trials (RCTs) and meta-analyses, which demonstrate advancements in waveform control, power settings, and tip technology. Residual variability probably has to do with patient factors (like obesity or diabetes), the type of wound, the antibiotics used during surgery, and the local technique (pure cut vs. blend; contact time; tip cleanliness).

In this study, the healing time was comparable (11.69 ± 1.79 vs. 11.41 ± 1.90 days), as was the duration of hospitalization (6.23 ± 1.66 vs. 6.24 ± 1.68 days). There were no clinically significant differences in early wound trajectory between the groups. Most comparative studies indicate similar healing and aesthetic results. Stupart et al. (2016) observed no preference for scar cosmesis when comparing diathermy and scalpel halves of the same incision; similarly, Pattnaik et al. (2019) reported no long-term differences at one year. These data collectively indicate that diathermy enhances initial efficiency without compromising the final integrity of the wound or the quality of the scar in comparison to the scalpel.

Our study population was relatively young (mean age ≈40 years), predominantly male, and exhibited a largely normal BMI; the procedures encompassed general abdominal operations rather than a singular standardized surgery. The age ranges differ: Nadeem et al. (2023) encompassed individuals aged 20 to 75 years, while Memon et al. (2021) focused on postmenopausal women with a higher mean age. Talpur et al. (2015) and Huddah et al. (2024) observed a male predominance in general surgery series, whereas Memon (2021) and Pandey (2019) focused exclusively on female gynecologic cohorts. BMI varies significantly among disciplines: obstetric/gynecologic studies, including AbdElhameed (2019) and Mageed (2022), indicated overweight/obese means (approximately 28–30 kg/m²)—a known risk factor for surgical site infections (SSI) and wound complications. These differences in demographics and case mix (clean elective vs. emergency or contaminated wounds) can change both the overall event rates and how easy it is to see differences between groups, especially for SSI and pain.

For routine abdominal surgery, diathermy can be used safely for skin incisions when the main goals are to make the surgery go faster and stop bleeding. The benefits are most obvious in busy theaters and places with few resources, where less time in surgery and less blood loss have benefits for the whole system. The scalpel is still a good choice, though, especially when there are limitations on equipment, specific cosmetic goals, or the surgeon's preference.

Limitations

Our trial (n=66) was designed to assess efficiency outcomes rather than rare endpoints; therefore, it may have been inadequately powered to detect modest differences in pain or SSI. Adding different types of abdominal procedures (both elective and emergency) makes the study more valid outside of the lab, but it also makes the clinical results less consistent. Pain was assessed solely with the Visual Analog Scale (VAS); multidimensional instruments might more effectively capture qualitative variations. Finally, the follow-up focused on the first 30 days; longer-term cosmesis and chronic pain were not included.

CONCLUSION

Our randomized comparison demonstrates that diathermy provides significant intraoperative benefits—reduced incision duration and minimized blood loss—without observable detriments in postoperative pain, healing, hospital duration, or surgical site infection when contrasted with scalpel incision. Long-term wound outcomes seem to be the same, according to modern research. The choice of technique should take into account the patient's risk, the type of wound, the surgeon's experience, and the available resources. Diathermy is a safe and effective first-line option for many abdominal incisions, while the scalpel is a reliable alternative when needed.