"A COMPARATIVE CLINICAL STUDY ON THE OUTCOMES FOLLOWING USAGE OF DIATHERMY VERSUS SCALPEL DURING SKIN INCISION FOR LICHTENSTEIN TENSION FREE INGUINAL HERNIA REPAIR"

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ABSTRACT

Background: We performed this study to compare diathermy and steel scalpel skin incisions in inguinal hernia repair with regards to incision time, incisional blood loss, early post-operative pain and post-operative wound complications. **Material and Methods:** The study was conducted between August 2015 to April 2017 including all patients with inguinal hernia who undergo elective Lichtenstein tension free inguinal hernia repair. **Results:** 250 patients with steel scalpel and 250 patients with diathermy inguinal skin incision were evaluated. The mean incision time was significantly shorter with diathermy (7.04 ± 0.88 sec/cm^2) as compared to scalpel (8.41 ± 1.39 sec/cm^2; $p<0.01$). The mean blood loss was less with the diathermy as compared to the scalpel (1.17 ± 0.67 vs. 1.84 ± 0.89 ml/cm^2; $p<0.01$). Mean VAS score was seen to be significantly less in diathermy group as compared to scalpel group at 6, 12 and 24 hours ($p<0.01$). Seroma formation was seen in 45 (18.2%) subjects of scalpel group as compared to 53 (21.2%) subjects in diathermy group (p- 1.0). Hematoma formation was seen in 23 (9.1%) subjects of scalpel group as compared to 15 (6.1%) subjects in diathermy group (p- 1.0). Purulent collection was seen in 23 (9.1%) subjects of scalpel group as compared to 38 (15.2%) subjects in diathermy group (p-0.078). **Conclusion:** Time required for incision was significantly less with diathermy and it was also associated with lower intra-op blood loss and less post-op pain. Post-operative wound complication rate was comparable between the two methods. We thus concluded that diathermy should be preferred for making abdominal skin incisions for hernia repair.

INTRODUCTION

Surgeons have been in search for ideal methods of skin incisions which would provide quick and adequate exposure with minimal blood loss. Electrocautery which is available in all surgical theatres is less frequently used for skin incisions for the fear of tissue damage, post-operative pain, increase in infection rate and scarring. Nevertheless, electrocautery (diathermy) is frequently used by some surgeons for skin incisions. Various studies [1-6] have been undertaken to evaluate the efficacy of electrocautery over scalpel in making skin incision and the results are varying; some showing better results with electrocautery while some showing similar results.

Skin incisions with electrocautery are not frequent because of the hypothesis that (a) the application of extreme heat may result in significant postoperative pain and poor wound healing because of excessive tissue damage and scarring respectively and (b) skin incision with the use of electrocautery entails increases the risk of wound infection in the presence of an underlying prosthetic material.[7] These presumptions stem from experimental and clinical studies that yielded varied reports.[8-10]

Modern electrosurgical units capable of delivering pure sinusoidal currents have evolved a change in this concept. The advantages are rapid hemostasis, faster dissection, and a reduced overall operative blood loss.[6-11] Various studies reporting the overall safety and efficacy of diathermy has mixed results.[9],[12-25]

We thus planned our study to compare diathermy and steel scalpel skin incisions in inguinal hernia repair with regards to: Incision time, incisional blood loss, early post-operative pain and post-operative wound complications.

AIMS AND OBJECTIVES: To compare diathermy and steel scalpel skin incisions in inguinal hernia repair with regards to the following parameters:

1. Incision time.
2. Incisional blood loss.
3. Early post-operative pain.
4. Post-operative wound complications.

MATERIAL AND METHODS

Study Design

A Hospital Based Randomized Control Study was performed between August 2015 and April 2017 including all patients admitted in surgical ward of Ispat General Hospital, Rourkela with inguinal hernia and has to undergo elective Lichtenstein tension free inguinal hernia repair. Ethical clearance was obtained from the Institutional Review Board.

Sampling Technique & Sample Size

We followed consecutive sampling in present study. A total of 500 subjects undergoing elective inguinal hernioplasty (Lichtenstein tension free mesh repair) were selected for the study. These patients were divided into two groups based on computer generated random numbers:

GROUP A: 250 patients receiving skin incision with scalpel.

GROUP B: 250 patients receiving skin incision with diathermy.

Inclusion Criteria

All patients admitted to Ispat General Hospital, Rourkela for elective Lichtenstein tension free inguinal hernia repair.

Exclusion Criteria

1. All complicated inguinal hernias such as obstructed, strangulated and bilateral hernias.
2. Pediatrics (<16 years) and geriatric (>65 years).
3. Patients with chronic pain of any organ for more than 3 months.
4. History of alcohol abuse, drug abuse and diabetes mellitus.

Material Required:

1. Scalpel with disposable blade.
2. Electrosurgical unit (ESU), of ERBE VIO 300 D.
3. Stop watch.
4. Sterile flexible ruler.

Study Methodology

A total of 500 uncomplicated inguinal hernia patients who met the inclusion criteria, after taking informed written consent, were enrolled in the study. The patients included in the study were randomised into two groups based on computer generated random numbers according to whether scalpel or diathermy was used in making skin incision (as mentioned above).

All the patients were operated under spinal anesthesia and were given intravenous antibiotic prophylactically in the form of Ceftriaxone 1 gram intravenous at the time of induction of anesthesia and its dose was repeated 12 hourly for a period of 3 days. Post-operatively all patients were given diclofenac 75 mg intramuscular injection 12 hourly for 24 hours, followed by diclofenac oral tablet 50 mg 8 hourly for next 24 hours.

The surgeon was informed of the type of skin incision to be used just before the start of the skin incision. Skin incision was given with scalpel in Group A (scalpel group) and with diathermy in Group B (diathermy group). Tissue dissection was done with diathermy in both the groups and Lichtenstein tension free hernia repair was performed as per standard guidelines of our institute. In diathermy group (group B) skin incision was taken with electrocautery needle using pulse sine wave current and power setting of 70 watts. Haemostasis achieved with forceps coagulation. In scalpel group (group A) skin incision was taken with scalpel, bleeding controlled by forceps coagulation using pulse sine wave on power supply of 30 watts.

Subcutaneous tissue were sutured using vicryl (polyglactin 910 suture) and skin closure was done using ethilon 2/0 (monofilament polyamide), mattress suture in both the groups of patients. Skin suture removal was done on 7^{th} post-operative day, after checking the tensile strength of wound (by gradual lateral traction) in all patients and then patients were discharged.

Time was recorded using a second's stop watch. The surgical incision in each case was made through skin, subcutaneous tissue, deep fascia and aponeurosis. The length and depth of each incision were measured in centimeters using a sterile flexible ruler and the incision time was defined as the start of the skin incision till the intended operation site was reached with complete hemostasis. Incision area was calculated as the product of the length and width of skin incision. The incision time was compared among the groups as sec/cm^2.

Blood loss during skin incision was calculated by weighing the swabs used exclusively in making the incision and during hemostasis, with each gram taken as equal to one millilitre of blood (i.e. 1g = 1 ml). No suction evacuation of blood was done while making the skin incision. The amount of blood loss was calculated in ml/cm^2.

Early post-operative pain was assessed using visual analog scale (VAS) at 6, 12, and 24 hours. Visual analog scale was represented by a straight line measuring 10 cm, the extremes of which corresponds to no pain at one end and worst pain at the other.

During post-operative period up to 7 days, patients were followed up regularly for wound complications viz. seroma, haematoma and purulent collection if any.

Statistical Analysis

Statistical analysis was performed using unpaired "t" test, Man Whitney U test and Chi square test. A '*p*' value of <0.05 was considered as statically significant. All statistical calculations were done using computer programs Microsoft Excel version 7 (Microsoft Corporation, NY,USA) and SPSS software version 21.0.

OBSERVATIONS AND RESULTS

Mean age of the study subjects was 50.1 and 45.9 years in scalpel and cautery group respectively (*p*-0.134).

Mean BMI of the study subjects was 25.8 and 25.3 Kg/m^2 in scalpel and cautery group respectively (*p*- 0.313).

The mean incisional time was significantly shorter with cautery (7.04 ± 0.88 sec/cm^2) as compared to scalpel (8.41 ± 1.39 sec/cm^2; $p<0.01$).

The mean blood loss was less with the electrocautery as compared to the scalpel (1.17 ± 0.67 vs. 1.84 ± 0.89 ml/cm^2; $p<0.01$).

Seroma formation was seen in 45 (18.2%) subjects of scalpel group as compared to 53 (21.2%) subjects in cautery group (*p*- 1.0).

Hematoma formation was seen in 23 (9.1%) subjects of scalpel group as compared to 15 (6.1%) subjects in cautery group (*p*- 1.0).

Purulent collection was seen in 23 (9.1%) subjects of scalpel group as compared to 38 (15.2%) subjects in cautery group (*p*- 0.078).

DISCUSSION

Electrosurgical unit (ESU) is the most common electrical equipment in the modern operating rooms. Several studies have shown that electrocautery is increasingly being used for making skin incisions, securing hemostasis, dissecting tissue planes and cutting. It facilitates hemostasis, reduces overall intraoperative time and lastly produce a wound that heals similarly as one created by the scalpel. Despite these advantages; its use by surgeons for skin incisions in centers in developing countries including ours is still suboptimal.

We can allude to the paucity of studies involving this group of patients in this region as the cause along with the old belief that electrocautery causes electric burns when used to make skin incisions, thus increasing the amount of devitalized tissue within the wound. Surgeons, generally avoid diathermy for making skin incisions due to suspected delayed wound healing, infections and excessive scarring.[7] The present hospital based randomized control trial was thus conducted to compare diathermy and steel scalpel skin incisions in inguinal hernia repair with regards to: Incision time, incisional blood loss, post-operative pain and post-operative wound complications.

Demography

Mean age of the study subjects undergoing hernia repair was 48.0 years with mean age of 50.1 and 45.9 years in scalpel and cautery group respectively. Mean BMI was 25.8 and 25.3 Kg/m^2 in scalpel and cautery group respectively. Both groups were comparable on the basis of baseline demographic variables.

Incision time & Intra-operative Blood Loss

The mean incisional time was significantly shorter with cautery (7.04 ± 0.88 sec/cm^2) as compared to scalpel (8.41 ± 1.39 sec/cm^2; $p<0.01$). The mean blood loss was also less with the electrocautery as compared to the scalpel (1.17 ± 0.67ml/cm^2 vs. 1.84 ± 0.89 ml/cm^2; $p<0.01$).

Post-op Pain

Mean VAS score was seen to be significantly less in cautery group as compared to scalpel group at 6, 12 and 24 hour follow up (p<0.01).

This is in accordance with previous studies our results suggested a significantly reduced postoperative pain in the diathermy group.[1],[7],[16],[18-21],[25] This is due to the thermal effect of diathermy on the sensory nerve fibers with the subsequent disruption of transmission of nerve impulses. Cell vaporization caused by the application of a pure sinusoidal current leads to immediate tissue and nerve necrosis without significantly affecting adjoining structures. Consequently, there is total or partial injury to the cutaneous nerves in the area of the surgical wound with a reduced postoperative pain profile in patients who had diathermy skin incisions.[15]

Complication Rate

Seroma and Hematoma formation was seen in 45 (18.2%) and 23 (9.1%) subjects of scalpel group as compared to 53 (21.2%) and 15 (6.1%) subjects in cautery group (p>0.05). Surgical site infection as observed by purulent collection was seen in 23 (9.1%) subjects of scalpel group as compared to 38 (15.2%) subjects in cautery group (p- 0.078).

CONCLUSIONS

The observations made in the present study showed that time required for incision was significantly less with electrocautery and it was also associated with lower intra-op blood loss and less post-op pain. Post-operative wound complication rate was comparable between the two methods. We thus concluded that diathermy should be preferred for making abdominal skin incisions for hernia repair.

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Figure 1: Incision made with scalpel (Hernia)

Figure 2: Incision made with diathermy (Hernia)

Figure 3: Scalpel incised wound on 7th post-operative day (Hernia)

Figure 4: Diathermy incised wound on 7th post-operative day (Hernia)