



General Surgery

SCAR COSMESIS AND POST-OPERATIVE PAIN: A COMPARISON BETWEEN DIATHERMY AND SCALPEL IN OPEN INGUINAL HERNIOPLASTY – AN ORIGINAL ARTICLE

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ABSTRACT **BACKGROUND:** Effectiveness of electrosurgery in cutting through muscle, fat, fascia, small vessels and nerves is widely known, but controversy exists with regard to using diathermy to directly cut skin. It is believed that incision by electrosurgical devices result in cosmetically inferior scar.
METHOD: This is a Prospective Observational Study conducted by the Department of General Surgery at a tertiary care center in Kochi, India between December 2014 and October 2016. Patients undergoing Open Inguinal Hernia Repair were assigned to either diathermy or scalpel groups. Scar cosmesis was assessed at 6 weeks after surgery using the Patient Observer Scar Assessment Scale (POSAS) and pain at the incision site was measured on first post operative day using Visual Analog Scale (VAS).
RESULTS: Scar cosmesis in diathermy group was found to be significantly better than the scalpel group ($p < 0.05$). The pain scores on post-operative day one were also significantly lower in the diathermy group compared to incisions made with scalpel ($p < 0.05$).
CONCLUSION: Diathermy can be safely used to incise skin without causing a cosmetically inferior scar and also is associated with less post-operative pain.

KEYWORDS : Cautery, cosmesis, diathermy, electrosurgery, incision, POSAS, scalpel, VAS, Visual-Analog Scale

INTRODUCTION

The term 'Diathermy' is derived from the Greek words 'dia' meaning through, and 'thermos' meaning heat. It is used to refer to the deliberate heating of tissues for the purposes of hemostasis and cutting usually by absorption of high-frequency electrical currents.

The effectiveness of Electrosurgery in cutting through muscle, fat, fascia, small vessels and nerves is widely known, but controversy exists with regard to using diathermy to directly cut the skin^{1,3}. Traditionally, surgeons use a scalpel to make the initial skin incision and use cautery only to divide the soft tissues. It is believed that the thermal burns inflicted on the epidermal margins of the incision by electrosurgical devices will result in suboptimal healing and a cosmetically inferior scar⁶⁻¹³. Numerous trials have been conducted recently to assess the credibility of this myth and it has been consistently demonstrated that there is no significant difference in scar cosmesis or wound infection rate between incisions made using a scalpel and incisions made using cautery. In fact, some studies even showed that the incisions made with cautery are associated with a reduced incision time, less bleeding and post-operative pain^{2,10-13}. But such trials are often subject to many biases.

In spite of these new findings, many surgeons still prefer the age old technique of cutting skin with a scalpel, perhaps due to habit or a lack of belief in the validity of those trials. This study is a real world study, conducted outside the rigors of randomized trials, done to compare the final scar cosmesis and post-operative pain of incisions made with diathermy and scalpel.

MATERIALS & METHODS

This is a single centre prospective observational study comparing scalpel and diathermy for making the skin incision in Open Inguinal Hernia repair conducted in the Department of General Surgery at Amrita Institute of Medical Sciences, Kochi, Kerala. Our study included all patients above the age of 18 years who underwent elective open inguinal hernia mesh hernioplasty between December 2014 and October 2016. Patients with bilateral hernias were also included as two separate incisions to be observed. However, patients who had a pre-existing groin scar, those undergoing emergency surgery, patients with illnesses that impede wound healing like connective tissue disorders and patients on systemic steroids were excluded from the study. Patients with anemia, hypoproteinemia and keloid scar tendency were excluded from the study population as these may interfere with normal

healing and confound the final result. Informed consent was taken from all included patients and this study was approved by the ethics committee of the institution. All procedures performed in this study were in accordance with the ethical standards of the institution and the 1964 Helsinki Declaration and its later amendments. The study was registered with researchregistry.com and assigned the ID researchregistry3298.

The patients were assigned to either of the two groups of scalpel or diathermy depending on the instrument used to make the initial skin incision. The choice of instrument used to make the incision was determined by personal preference of the operating surgeon. Out of the four units in our department, two units routinely used diathermy whilst the other two units used scalpel to incise the skin. Patients in the scalpel group had their skin incised by a standard Number 15 surgical scalpel whereas those in the diathermy group were incised using a standard Bovie monopolar cautery pencil at 24W Pure cut mode on a Valleylab Force FX electrosurgical unit, a standard machine used by surgical teams all over the world. After the procedure, all the skin incisions were then apposed using continuous subcuticular suture using 3-0 Poliglecaprone.

The primary outcome measure was scar cosmesis. The scar was assessed six weeks after surgery using the Patient Observer Scar Assessment Scale (POSAS) by both a general surgeon and the patient themselves with a score ranging from 6 to 60, with 6 being equal to normal uninjured skin and 60 being the worst possible scar imaginable³. Both the patient and the observer were blinded as to which group the patient was assigned to. The patient and observer scales each consist of six attributes that were assigned a score ranging from 1 to 10. The attributes in the observer scale are vascularity, pigmentation, thickness, smoothness, pliability and surface area. The patient scale grades the presence of pain, itching, differences in color, stiffness, smoothness and thickness when compared to normal skin. The scores of each individual attribute are summed up and the mean of both sums is taken as the final score for each scar.

Post-operative pain was a secondary outcome measured in this study and was assessed by a blinded surgeon on post-operative day 1 using the Visual Analog Score (VAS), with the score ranging from 0 to 10 with 0 indicating no pain and 10 indicating the worst pain imaginable^{1,2}. All patients received intravenous Paracetamol 1gm thrice daily for analgesia for the first post-operative day which was switched to oral

Paracetamol 500mg tablets thrice daily from post-operative day 2 onwards.

All data (VAS, POSAS score) was recorded on spreadsheets using Microsoft Excel 2013 and analyzed for any significant differences between mean VAS and POSAS scores of the two study arms using the Student's t-test. SPSS was used for all statistical analysis. A p value <0.05 was considered statistically significant.

RESULTS

Our study consisted of 248 patients in total (123 patients in the Scalpel group and 125 patients in the Diathermy group). Of the total patients in the study 52 had bilateral hernias (27 in the Scalpel group and 25 in the Diathermy group). Each incision was assigned to respective groups. At conclusion we had 150 incisions each in both Scalpel and Diathermy groups. Demographic data has been illustrated in Table I and Sex distribution in Figure I. None of the patients in this study developed surgical site infection.

The mean POSAS scores, which measures the primary outcome, were assessed by a blinded surgeon and the patient themselves were found to be significantly better in the diathermy (p < 0.001) group. Similarly, the mean VAS scores for pain on post-operative day 1 were significantly lower for the diathermy group (p < 0.001) requiring less analgesia and ambulating earlier when compared to the Scalpel group. Of the 300 surgeries done, none of the patients suffered from infection that required intervention. We have compared our results with similar studies in Tables II and III respectively. The POSAS and VAS scores of comparing our study with other related studies have been represented in Figure II.

Table I: Demographic data and Results

No	Criteria	Scalpel	Diathermy	P value
1.	Age (Mean)	57.04 +/- 13.728	58.07 +/- 13.176	0.969
2.	Sex	Male – 112, Female -11	Male –123, Female – 2	0.29
3.	Unilateral	96	100	
	Bilateral	27	25	
4.	Diabetes	42	47	0.307
5.	POSAS Score (Mean)	15.02 +/- 0.66	14.59 +/- 0.674	<0.001
6.	VAS Score (Mean)	3.96 +/- 1.19	2.58 +/- 0.67	<0.001

Table II: Comparison of mean POSAS scores

GROUPS	Cautery	Scalpel	P value
Present Study	14.59 ± 0.674	15.02 ± 0.66	<.001
Aird et al ¹	19.2 ± 8	20 ± 7.4	0.684
Kadyan et al ⁶	14.5 ± 0.9	17.3 ± 0.87	Not given

Table III: Comparison of mean VAS scores

GROUPS	Cautery	Scalpel	P value
Present Study	2.58 ± 0.67	3.96 ± 1.19	<0.001
Aird et al ¹	1.68	3.13	0.018
Kadyan et al ⁶	2.5 ± 0.66	4.13 ± 1.02	<0.0005
Ayandipo et al ²²	1.06 ± .81	1.92 ± 0.87	=0.001

Figure – I: Sex Distribution

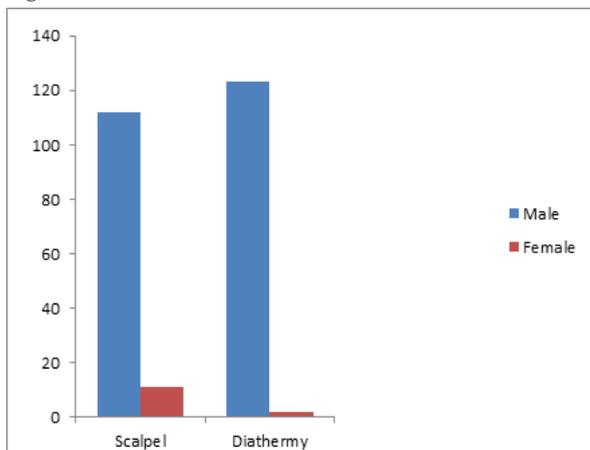
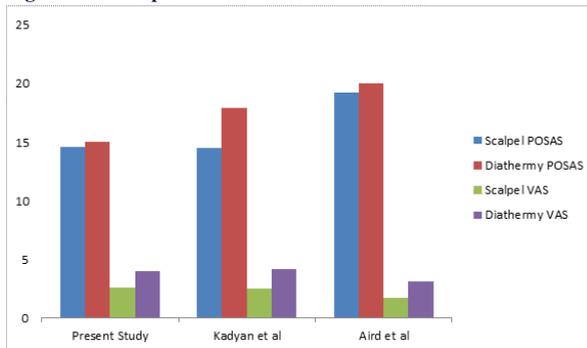


Figure – II: Comparison of various studies



DISCUSSION

In this single centre observational study, we compared the differences in scar cosmesis at 6 weeks and pain on post-operative day one using standardized objective scales. Demographically, the patients included in both the groups in our study were similar with no significant differences (Table I). Age and Sex distributions of the patients in our study were similar to those in a North American study¹ with most patients being male and aged above 45 years.

A Dutch trial³ showed that the POSAS was a reliable and feasible scale for the assessment of linear scars, with good internal consistency and agreement among observers and patients. Hence the POSAS was chosen to assess the post-operative scars in this study.

Our study findings for scar cosmesis are similar to the results of similar trials examining abdominal wound incisions which were done by Aird et al¹ and Kadyan et al⁶, both of which consistently show a lower POSAS score for the diathermy group. The study done by Kadyan et al⁶ found values that were very similar to those of our study as illustrated in Tables II and III. The slightly higher POSAS scores recorded in the Canadian trial¹ may be attributed to the lighter skin of the Caucasian patients, making scars more apparent to the observer when compared to the darker skinned Indian population.

Post-operative pain as measured by the Visual Analog Scale was found to be significantly lower in the diathermy group in our study which corroborates with the findings of two separate meta-analyses by Aird et al¹ and Nasir Zaheer Ahmad et al⁸ respectively and a prospective study by Kadyan et al⁶. Another systematic review⁷ showed that diathermy compared to scalpel was associated with less blood loss but there was no differences in post operative pain. A few studies that did not use any objective scale to definitively quantify pain still demonstrated reduced post-operative pain in the diathermy group^{13,14} compared to the scalpel group. The reduced pain in diathermy may be attributed to the cauterization of the free nerve endings on the edges of the incision¹⁵, which impaired the frequency of impulse transmission along the nerve fiber and compromised the perception of pain after the initial healing process.

None of the patients in our study had wound infection requiring intervention contrary to findings of animal studies that indicated diathermy's association with higher rates of wound infection. However numerous human trials conducted since then have disproved the animal studies results^{8, 13, 15, 16}. It has been theorized that with diathermy, the higher subcutaneous oxygen tension caused by local tissue heating enhances the resistance of the wound to infection⁶. It's the type of surgery performed that influences wound infection rates than the modality used to make the incision¹⁷. A separate group¹⁸ came to similar conclusions in their meta-analysis finding no statistically significant difference in the rate of post-operative wound complications, hospital stay or scar cosmesis. None of the patients included in either arms of our study developed seroma post operatively contrary to the finding in the study done by Marsh et al¹⁹ which found a higher rate of seroma formation in the diathermy arm, thought to be caused by extensive injury to vascular and lymphatic vessels in the skin caused by cautery.

Advantages of electrocautery over scalpel have been proven in a meta-analysis done by Nasir Zaheer Ahmad et al⁸ where diathermy was found to produce cosmetically better scar with less post operative pain when compared to scalpel. Scalpels predispose to accidental injury in the operating room which can be avoided by use of electrocautery which in turn also reduces chances of transmission of blood borne infections like Hepatitis B, C and HIV¹³. However, the use of

diathermy has been associated with electro-surgical injuries to the surgeon and accidental burns to the patient on rare occasions which may be aggravated by use of alcoholic antiseptics like chlorhexidine²⁰. The result of our study disproves the belief that the use of diathermy on skin results in an exaggerated inflammatory response and devitalization of tissues surrounding the incision causing a worse scar and more pain^{1, 4, 7-10}. Our study has demonstrated that diathermy could be safely used to incise skin without causing a cosmetically inferior scar or increased pain compared to scalpel.

The limitations of the present study include a relatively small sample size from a single institution, the inclusion of only scars on the groin and not more cosmetically sensitive regions and the objective measurement of only scar cosmesis and pain would be minimal as demonstrated by previous investigators^{21,22}.

CONCLUSION

Based on the significantly lower POSAS and VAS scores in this study, we recommend the use of diathermy to make the skin incision while performing open inguinal hernia mesh hernioplasty. As evidenced in this study the use of diathermy does not result in cosmetically inferior scar, moreover reduced post-operative pain by use of the same would help in reducing post operative analgesics and would also have positive effect on patient satisfaction and quality of life. Replacing diathermy with scalpel would markedly reduce the risk of accidental injuries in the operating theatre thus preventing blood borne infections also.

DISCLOSURE

The authors declare no conflicts of interest.

Abbreviations:

POSAS: Patient-Observer Scar Assessment Scale, VAS: Visual Analog Scale

REFERENCES

1. Aird LNF, Bristol SG, Phang PT, Raval MJ, Brown CJ. Randomized double-blind trial comparing the cosmetic outcome of cutting diathermy versus scalpel for skin incisions. *Br J Surg.* 2015; 102(5):489-94.
2. Jamali KS, Khan NA, Jawed M, Shaikh U. Diathermy incisions v/s surgical scalpel incisions; outcome in general surgery. *Professional Med J* 2015;22(11):1550-1524
3. Annekatrinen van de Kar AL, Corion LUM, Smeulders MJC, Draaijers LJ, van der Horst CM a M, van Zuijlen PPM. Reliable and feasible evaluation of linear scars by the Patient and Observer Scar Assessment Scale. *Plast Reconstr Surg.* 2005; 116:514-22.
4. Aird LNF, Brown CJ. Systematic review and meta-analysis of electrocautery versus scalpel for surgical skin incisions. *Am J Surg.* 2012;204(2):216-21.
5. Chau JKM, Dzigielewski P, Mlynarek A, Cote DW, Allen H, Harris JR, et al. Steel scalpel versus electrocautery blade: comparison of cosmetic and patient satisfaction outcomes of different incision methods. *J Otolaryngol Head Neck Surg.* 2009 Aug; 38(4):427-33.
6. Kadyan B, Chavan S, Mann M, Punia P, Tekade S. A prospective study comparing diathermy and steel scalpel in abdominal incisions. *Med J Dr DY Patil Univ* 2014; 7(5):558.
7. Ly J, Mittal A, Windsor J. Systematic review and meta-analysis of cutting diathermy versus scalpel for skin incision. *Br J Surg.* 2012; 99(5):613-20.
8. NasirZaheer Ahmad, Aftab Ahmad Meta-Analysis of the Effectiveness of Surgical Scalpel or Diathermy in making Abdominal Skin incisions. *Ann Surg* 2011; 253:8-13.
9. Chauhan HR, Charpot RV. A comparative study to evaluate the outcome between electrocautery versus scalpel skin incision in tension free inguinal hernioplasty : a tertiary care teaching centre experience. *Int Surg J* 2016; 3:516-20.
10. Groot G, Chappell EW. Electrocautery used to create incisions does not increase wound infection rates. *Am J Surg.* 1994; 167(6):601-3.
11. Talpur AA, Khaskheli AB. Randomized, clinical trial on diathermy and scalpel incisions in elective general surgery. *Iran Red Crescent Med J.* 2015;17:e14078
12. Ayandipo OO, Afuwape OO. Diathermy versus scalpel incision in a heterogeneous cohort of general surgery patients in a Nigerian teaching hospital, *Niger J Surg.* 2015;21:43-7
13. Kearns SR, Connolly EM, McNally S, McNamara DA, Deasy J. Randomized clinical trial of diathermy versus scalpel incision in elective midline laparotomy. *Br J Surg.* 2001;88:41-4
14. Gilmore M, McCabe JP, Kaar K, Curtin W. Diathermy versus scalpel incisions for hemiarthroplasty: A randomized prospective trial. *J Bone Joint Surg Br* 2004;86:129
15. Hussain SA, Hussain S. Incisions with knife or diathermy and postoperative pain. *Br J Surg.* 1988;75:1179-1180
16. Arnaud JP, Adloff M. Electrosurgery and wound healing: An experimental study in rats. *Eur Surg Res* 1980;12:439-43
17. Pearlman NW, Stiegmann GV, Vance V, Norton LW, Bell RC, Staerckel R et al. A Prospective study of Incisional Time, Blood loss, Pain and healing with carbon dioxide laser, scalpel and electro-surgery. *Arch Surg* 1991;126:1018-20
18. Ismail A, Abushouk AI, Elmarazy A, Menshawy A, Menshawy E, Ismail M, Samir E, et al. Cutting electrocautery versus scalpel for surgical incisions: a systematic review and meta-analysis. *J Surg Res.* 2017 Dec;220:147-163
19. Marsh DJ, Fox A, Grobbelaar AO, Chana JS. Abdominoplasty and seroma: a prospective randomized study comparing scalpel and handheld electrocautery dissection. *J Plast Reconstr Aesthet Surg.* 2015;68:192-196
20. Massarweh NN, Cosgriff N, Slakey DP. Electrosurgery: history, principles, and current and future uses. *J Am Coll Surg.* 2006; 202:520-530.
21. Stupart DA, Sim FW, Chan ZH, Guest GD, Watters DA. Cautery versus scalpel for abdominal skin incisions: a double blind randomized crossover trial of scar cosmesis. *ANZ J Surg.* 2016 Apr;86(4):303-6.
22. Ayandipo OO, Adigun TA, Afuwape OO, Idowu OK. Comparison of postoperative pain in diathermy and conventional scalpel Skin incision after mastectomy in Ibadan, Nigeria. *Afr J Med Med Sci.* 2015 Mar; 44(1):27-31