Al-Azhar International Medical Journal

Volume 3 | Issue 7 Article 12

7-1-2022

# Comparison between Cold Knife, Monopolar Electrosurgery and Combining Both Methods for Abdominal Incision (Clinical Trial)

Abdelaziz Mohamed
*Obstetrics & Gynecology Department, Faculty of Medicine - Al- Azhar University*,
zezomedicine90@gmail.com

Abdelsattar Farhan
*Obstetrics and Gynecology Department - Faculty of Medicine – Al-Azhar University,Egypt,Cairo*,
drabdsattar@hotmail.com

Elsayed Eldesouky
*obstetrics and gynecology, Faculty of Medicine, Al Azhar University,Cairo,Egypt*,
elsayedeldesouky55@yahoo.com



## How to Cite This Article

Mohamed, Abdelaziz; Farhan, Abdelsattar; and Eldesouky, Elsayed (2022) "Comparison between Cold Knife, Monopolar Electrosurgery and Combining Both Methods for Abdominal Incision (Clinical Trial)," *Al-Azhar International Medical Journal*: Vol. 3: Iss. 7, Article 12.
DOI: https://doi.org/10.21608/aimj.2022.116797.1800

OPEN AIMJ ORIGINAL ARTICLE

# Comparison between Cold Knife, Monopolar Electrosurgery and Combining Both Methods for Abdominal Incision (Clinical Trial)

Obstetrics & Gynecology

**Abdelaziz Mahmoud Abdelaziz [1,*] M.B.B.Ch, Abdelsattar Ebrahim Farhan [1] MD, Elsayed Ahmed Eldesouky [1] MD**

**Corresponding Author:*
Abdelaziz Mahmoud Abdelaziz
zezomedicine90@gmail.com

***Received*** *for publication February 25, 2022;* ***Accepted*** *July 30, 2022;* ***Published online*** *July 30, 2022.*

***doi:*** *10.21608/aimj.2022.116797.1800*

***Citation:*** *Abdelziz M. , Abdelsattar E. , Elsayed A. Comparison between Cold Knife, Monopolar Electrosurgery and Combining Both Methods for Abdominal Incision (Clinical Trial).AIMJ. 2022; Vol.3-Issue7 : 64-69.*

*[1]Obstetrics and Gynecology Department, Faculty of Medicine, Al-Azhar University Cairo, Egypt.*

**ABSTRACT**

**Background:** Scalpels have been used to make abdominal surgical incisions by manually cutting through tissue with a sharp blade. Although physicians are less excited about electrosurgery, it is becoming a more essential and growing element of surgical practise. The worry of major burns and consequent scarring with electrosurgery continues, as contrasted to the scalpel, which makes a clean, incised incision with minimal tissue loss.

**Aim of the work:** To assess early and late postoperative wound complications using the cold knife.

**Patients and methods:** Over a 6-month period, patients with gynaecological conditions undergoing abdominal incisions in the Outpatient and Inpatient Clinics at El Sayed Galal Hospital, Al-Azhar University were evaluated for early and late postoperative wound complications using the cold knife, monopolar electrosurgery, and a combination of both methods in the Outpatient and Inpatient Clinics at El Sayed Galal Hospital, Al-Azhar University.

**Results:** Incision time, blood loss, VAS score over time in the first 24 hours, and the number of morphine and paracetamol pills are differing and statistically significant across the study groups. When compared to cold knife incisions, electrosurgery was proven to be safe and effective in making skin incisions in abdominal wounds, and it did not promote wound infection.

**Conclusion:** When compared to cold knife incision, electrosurgery may be deemed safe and successful in producing skin incisions in abdominal incisions due to lower wound infection rates, postoperative discomfort, and analgesic requirements.

**Keywords:** *electrosurgery; cold knife; abdominal incision.*

**Disclosure:** *The authors have no financial interest to declare in relation to the content of this article. The Article Processing Charge was paid for by the authors.*
**Authorship**: *All authors have a substantial contribution to the article.*


## INTRODUCTION

Electrosurgery is the application of radiofrequency (RF) alternating current (AC) to raise intracellular temperature in order to achieve vaporisation or a combination of desiccation and protein coagulation. As a result of these activities, tissue might be cut or coagulated. So, electrocautery is the process of destroying tissue by heating it with an electric current through a metal probe.[1]

Cutting (low voltage) or coagulation (high voltage) modes can be used to achieve the desired tissue impact. The cut approach is preferred where heat distribution is a problem, such as near the ureter, intestine, or other vital tissues. It's also a good idea to use the cut mode when desiccating a deep endometriosis lesion since the electrical current penetrates deeper into the tissue. Coagulation mode allows for improved penetration into high-resistance areas including fatty tissue and scar tissue, as well as when fulgurating a large surface area with superficial bleeders, such as after an ovarian cystectomy. [2]

Prakash et al.[3]evaluated whether electrocautery is a safe and effective means of making skin incisions for midline abdominal surgery when compared to a traditional scalpel. Electrocautery may be judged safe and successful in generating skin incisions in midline laparotomy when compared to knife incision since wound infection rates are lower and blood loss is lower. According to Charoenkwan et al.[4], the infection rate in the electrocautery group was not substantially higher.[4]

The purpose of this study was to look at early and late postoperative wound complications in patients with gynaecological illnesses who had abdominal incisions done with the cold knife, monopolar electrosurgery, or a combination of the two.

## PATIENTS AND METHODS

The cold knife, monopolar electrosurgery, and a combination of both methods were used in this RCT to evaluate early and late postoperative wound complications in patients with gynaecological conditions undergoing abdominal incisions over a 6-month period in the Outpatient and Inpatient Clinics at Al-Azhar University's El Sayed Galal Hospital.

Population:

A total of 135 patients were included in the study, with 45 people in each group. In the study, there were three groups: A scalpel incision was used on 45 women in Group 'A' to incise skin, subcutaneous tissues, and the rectus sheath until the rectus muscle was reached. Monopolar electrosurgery incisions were made from the epidermis and subcutaneous tissues of the rectus sheath to the rectus muscle in 45 women in Group 'B.' A combination scalpel and monopolar electrosurgery incision was used on 45 women in Group 'C.' (skin by cold knife and subcutaneous tissues, rectus sheath and recti muscle by monopolar electrosurgery).

Inclusion criteria:

All patients scheduled for elective gynaecological abdominal operations for benign diseases and willing to participate in the study after getting informed permission, any laparotomy for benign disorders such as:

Myomectomy.

Resection of an adenomyosis wedge.

Excision of a benign tumour on the ovary.

For prolapse, use a sling.

Subtotal or TAH + BSO

Simple ovarian cyst

**Exclusion criteria:**

**If you've had antibiotics in the last seven days, tell us about it.**

Anemia, surgically damaged tissues, immunocompromised people, and chronic medical illnesses such as diabetes, asthma, or TB

Patients who are expecting a child,

Patients who have a pacemaker and those who are taking anticoagulants.

Methods:

The following factors were considered: age, height, weight, BMI, known allergies, past medical and surgical history, and concomitant conditions.

The abdomen is examined.

A knife was used to incise the abdomen wall, including the subcutaneous tissue and the rectus sheath, and hemostasis was achieved with either simple compression or free thread tying in group A.

In group B, electrosurgery was used to open the abdomen wall, including the skin, subcutaneous tissue, and rectus sheath, and to establish hemostasis (at 45 watts with monopolar current). The electrosurgical generator from Valleylab was utilised.

A knife was used to incise the skin in group C, but electrosurgery (at 45 watts with monopolar current) was utilised to open the subcutaneous tissue and rectus sheath, as well as electrosurgery to form the rectus sheath.

Primary outcomes:

Wound incision time/ minute.

Wound infection (sepsis, seroma, hematoma, fever and gapping).

Secondary outcomes:

Pain following surgery.

Type, dosage, and duration of analgesia were required.

Wound-related blood loss shall be weighed in a sterile manner before and after surgery using weighing scales with a resolution of two grammes and dry surgical mops by the same surgical team. Suction was not used to make the incision.

On the seventh day following surgery, an unsightly scar forms.

Statistical analysis:

To enter, validate, and analyse data, Epi-Info version 6 and SPP for Windows version 8 were utilised. The data was summarised using the arithmetic mean, standard deviation, analysis of variance (ANOVA F test), median, and chi-squared test.

The threshold of significance for all of the above-mentioned statistical tests is set at 5%. (P-value).

The results were considered:

**When the likelihood of mistake is less than 5% (p 0.05), the result is significant.**

**When the chance of mistake is more than 5% (p > 0.05), it is considered non-significant.**

**When the likelihood of mistake is less than 0.1 percent (p 0.001), it is very significant.**

The lower the p-value, the more significant the findings are.

## RESULTS

Between the studied groups, there is no statistically significant difference in age or kind of operation (table 1).

There is a statistically significant difference between the groups studied when it comes to incision time. On LSD, there is a significant difference between the two groups, with the combined group having the quickest incision time. There is a statistically significant difference in blood loss across the groups studied. When compared to the LSD group, the cold knife group lost the most blood (table 2).

There is a statistically significant difference in VAS score between the tested groups in the first 24 hours. On LSD, there is a significant difference between the two groups, with the mixed group having the lowest VAS score and the cold knife group having the highest (table 3).

There is a statistically significant difference between the research groups in terms of the number of morphia and paracetamol dosages. The group that received cold knife therapy had the highest frequency of morphia and paracetamol doses when the two groups were compared (table 4).

In terms of wound dehiscence, infection, or ugly scarring, there are no statistically significant differences between the studied groups (tables 5 and 6).

| Parameter | Groups | | | Test | |
|---|---|---|---|---|---|
| | Cold knife group N=45 (%) | Monopolar electrosurgery group N=45 (%) | Combined group N=45 (%) | F/ $\chi^2$ | p |
| Age (year): | | | | 0.013 | 0.987 |
| Mean ± SD | 49.978±9.778 | 50.067 ± 7.092 | 50.244 ± 6.925 | | |
| Range | 29 – 65 | 36 – 62 | 33 – 64 | | |
| Type of operation: | | | | 15.315 | 0.052 |
| Adenomyosis wedge | 12 (26.7) | 5 (11.1) | 6 (13.3) | | |
| resection | 5 (11.1) | 8 (17.8) | 8 (17.8) | | |
| Ovarian tumor excision | 6 (13.3) | 16 (35.6) | 10 (22.2) | | |
| Hystrectomy | 9 (20) | 10 (22.2) | 13 (28.9) | | |
| Myomectomy | 6 (13.3) | 6 (13.3) | 8 (17.8) | | |
| Prolapse sling | | | | | |

F One-Way ANOVA Chi square test (Chi square)

**Table 1:** Comparison between the studied groups regarding age and type of operation

| Parameters | Groups | | | Test | | Pairwise comparison |
|---|---|---|---|---|---|---|
| | Cold knife group N=45 (%) | Monopolar electrosurgery group N=45 (%) | Combined group N=45 (%) | KW/F | p | |
| Incision time(sec): | | | | | | $P_1$ <0.001** |
| Mean ± SD | 374.022±127.11 | 303.667±97.354 | 290.222±97.354 | 8.415 | <0.001** | $P_2$ 0.002* |
| Range | 126 – 540 | 100 – 490 | 95 – 480 | | | $P_3$ <0.001** |
| Blood loss (ml): | | | | | | $P_1$ <0.001** |
| Mean ± SD | 72.611 ± 23.127 | 46.444 ± 23.804 | 37.711 ± 16.686 | 32.276 | <0.001** | $P_2$ 0.056 |
| Range | 23.4 – 106 | 10 – 90 | 15 – 70 | | | $P_3$ <0.001** |

**p ≤ 0.001 is statistically highly significant KW Kruskal Wallis group F One Way ANOVA group *p<0.05 is statistically significant

P1 the difference between cold knife and monopolar electrosurgery groups

P2 the difference between combined and monopolar electrosurgery groups

P3 the difference between cold knife and combined groups

**Table 2:** Comparison between the studied groups regarding incision time and blood loss

| VAS | Groups | | | Test | | Pairwise comparison |
|---|---|---|---|---|---|---|
| | Cold knife group N=45 (%) | Monopolar electrosurgery group N=45 (%) | Combined group N=45 (%) | KW/F | p | |
| At 4 hours: | | | | | | $P_1$ <0.001** |
| Mean ± SD | 5.489±2.041 | 4.156 ± 0.999 | 2.667 ± 1.044 | 43.03 | <0.001** | $P_2$ <0.001** |
| Range | 2 – 8 | 1 – 6 | 1 – 5 | | | $P_3$ <0.001** |
| At 8 hours: | | | | | | $P_1$ <0.001** |
| Mean ± SD | 7 ± 1.552 | 3.644 ± 1.026 | 2.178 ± 0.936 | 190.153 | <0.001** | $P_2$ <0.001** |
| Range | 3 – 9 | 1 – 5 | 1 – 4 | | | $P_3$ <0.001** |
| At 12 hours: | | | | | | $P_1$ <0.001** |
| Mean ± SD | 6.4 ± 1.421 | 2.756 ± 1.734 | 1.667 ± 0.826 | 145.367 | <0.001** | $P_2$ <0.001** |
| Range | 4 – 9 | 1 – 6 | 1 – 4 | | | $P_3$ <0.001** |
| At 24 hours: | | | | | | $P_1$ <0.001** |
| Mean ± SD | 5.511 ± 1.359 | 2.378 ± 1.542 | 1.556 ± 0.841 | 119.294 | <0.001** | $P_2$ 0.003* |
| Range | 3 – 8 | 1 – 5 | 1 – 4 | | | $P_3$ <0.001** |

**p ≤ 0.001 is statistically highly significant KW Kruskal Wallis group F One Way ANOVA group

P1 the difference between cold knife and monopolar electrosurgery groups

P2 the difference between combined and monopolar electrosurgery groups

P3 the difference between cold knife and combined groups

**Table 3:** Comparison of VAS scores in the first 24 hours between the groups investigated.

| Number of doses | Groups | | | Test | | Pairwise comparison |
|---|---|---|---|---|---|---|
| | Cold knife group N=45 (%) | Monopolar electrosurgery group N=45 (%) | Combined group N=45 (%) | KW/F | p | |
| Morphia: | | | | | | $P_1$ <0.001** |
| Median | 6 | 3 | 3 | 64.58 | <0.001** | $P_2$ 0.609 |
| Range | 3 – 6 | 1 – 5 | 1 – 4 | | | $P_3$ <0.001** |
| Paracetamol: | | | | | | $P_1$ <0.001** |
| Mean ± SD | 4 ± 0 | 3.378 ± 0.86 | 3.333 ± 0.853 | 12.779 | <0.001** | $P_2$ 0.764 |
| Range | 4 | 2 – 4 | 2 – 4 | | | $P_3$ <0.001** |

**p ≤ 0.001 is statistically highly significant KW Kruskal Wallis group F One Way ANOVA group

P1 the difference between cold knife and monopolar electrosurgery groups

P2 the difference between combined and monopolar electrosurgery groups

P3 the difference between cold knife and combined groups

**Table 4:** compares the dosages of analgesia given to the study groups in the first 24 hours.

| Parameter | Groups | | | Test | |
|---|---|---|---|---|---|
| | Cold knife group N=45 (%) | Monopolar electrosurgery group N=45 (%) | Combined group N=45 (%) | F/ $\chi^2$ | p |
| Wound dehiscence: | | | | | |
| No | 42 (93.3) | 43 (95.6) | 44 (97.8) | 1.047 | 0.871 |
| Yes | 3 (6.7) | 2 (4.4) | 1 (2.2) | | |
| Wound infection: | | | | | |
| No | 40 (88.9) | 42 (93.3) | 44 (97.8) | | |
| Yes | 5 (11.1) | 3 (6.7) | 1 (2.2) | 2.875 | 0.296 |

$\chi$2 Chi square test

**Table 5:** Comparison between the studied groups regarding wound dehiscence and infection

| Parameter | Groups | | | Test | |
|---|---|---|---|---|---|
| | Cold knife group N=45 (%) | Monopolar electrosurgery group N=45 (%) | Combined group N=45 (%) | F/ $\chi^2$ | p |
| Ugly scar: | | | | | |
| No | 39 (86.7) | 43 (95.6) | 44 (97.8) | 5 | 0.146 |
| Yes | 6 (13.3) | 2 (4.4) | 1 (2.2) | | |

$\chi$2 Chi square test

**Table 6:** Comparison between the studied groups regarding occurrence of ugly scar

## DISCUSSION

After a sharp injury, the danger of percutaneous damage among health-care providers is a hotly debated subject. Throughout the world, millions of abdominal procedures are conducted each year. Because they require cutting through the layers of skin, subcutaneous tissue, fascia (aponeurosis), muscle, and peritoneum to enter the abdominal cavity, the majority of these operations are considered as'major abdominal surgery. [5]

A scalpel is a disposable or reusable razor-sharp knife used for surgery and anatomical dissection. It comes with replaceable blades and a plastic handle with an extended blade (similar to a utility knife), and it's only used once before being thrown away. The blade and the handle make up a surgical scalpel.[5]Surgical diathermy was developed at the turn of the twentieth century to overcome the inherent disadvantages of the steel scalpel, such as a lack of hemostasis, which can result in unintended blood loss, indistinct tissue planes, longer operative times, the use of foreign material (ligature) in the wound, which can result in infection, the risk of accidental injury in the operating room, and the potential for tumour metastasis through lymphatic channels.[6] An electrosurgical incision is not the same as a true cutting incise. It works by rapidly heating tissue cells, causing them to explode into steam and leaving a cavity. When the electrode is moved forward, fresh tissue is contacted, new cells are burst, and an incision is made. This method might explain why there is less blood loss and less scar tissue after recovery.[6]

Many surgeons avoid using electrosurgery to split the skin because of the danger of severe scarring. A new approach of electrosurgery has just been proposed that uses pulsed radiofrequency to create a plasma-mediated discharge along the exposed rim of an insulated blade. With a blade held at a temperature similar to body temperature, this approach provides for great cutting. Studies comparing the radiofrequency technique to traditional electrosurgery and scalpels for making incisions in animal models indicated that the radiofrequency method performed better in terms of wound tensile strength, scar formation, and minimising blood loss and tissue damage.[7]

This study's trial adhered to the consolidated criteria, allowing for a clearer understanding of the trial's

design, analysis, and interpretation, as well as a more accurate assessment of the findings' validity.

In abdominal wounds, there hasn't been a single study that compares cold knife to monopolar electrosurgery. As a result, we evaluated early and late postoperative wound problems in patients with gynaecological diseases who underwent abdominal incisions using the cold knife, monopolar electrosurgery, and a combination of approaches.

The patients and nursing personnel had been blinded to the invasion methods for at least three days. Patients were given the chance to give informed consent and were informed about the advantages and disadvantages of both incisions. The findings of the patients' history, examination, operative, and postoperative data were recorded, and 145 women were randomly assigned to one of three groups, with incisions made with a cold knife or monopolar electrosurgery depending on the group, and evaluated intraoperatively for skin-to-peritoneum time, blood loss, and wound thickness, as well as postoperatively for pain (need for analgesic doses), wound healing, and postoperative wound complications.

In this study, there were no significant differences in age or kind of operation between the three groups. Incision time and blood loss, on the other hand, differ statistically significantly between the groups studied. On LSD, there is a significant difference between the two groups, with the combo group having the quickest incision time and the cold knife group having the largest blood loss.

Kumar et al.[6] observed that electrocautery resulted in significantly decreased blood loss during incision in a study of 80 patients undergoing head and neck surgery. Because of the coagulation and cutting modes of electrocautery, less blood is lost, resulting in coagulation. Electrocautery incision was found to be superior to scalpel incision in terms of incision time, discomfort, wound healing, and blood loss by Arsalan et al.[8], who compared electrocautery incision to knife incision over skin.

Karbhari and Patil[9] observed that cautery incisions were significantly superior than scalpel incisions in terms of incision time and blood loss in a research comparing surgical scalpels with electrocautery. Elbohoty et al.[10] studied wound-related blood loss and wound-complication rates in surgical incisions made with a scalpel vs incisions made with electrosurgery during a 6-month period at Ain Shams University's Department of Gynecology and Obstetrics. They gave an estimate of how long it would take. The electrosurgery group incision the wound in seven minutes vs 10 minutes for the knife group. They discovered that using efficient diathermy in conjunction with appropriate frequency adjustment and surgeon training yielded better outcomes than using a knife incision.

Charoenkwan et al.[4] compared the effects of electrosurgery against scalpel for large abdominal incisions. There was no clinically significant difference in mean incision time between electrosurgery and scalpel.

In our study, there was a statistically significant difference in VAS score between the two groups in the first 24 hours. The contrast between the two groups on the LSD scale is significant, with the mixed group receiving the lowest VAS score and the cold knife group receiving the highest. Arsalan et al.[8] observed that electrocautery incision is preferable than scalpel incision in terms of postoperative pain.

There was no statistically significant difference in the incidence of wound dehiscence or infection between the groups studied in our study. According to Charoenkwan et al.[4], the infection rate in the electrocautery group was not substantially higher.[4]

Prakash et al.[3] evaluated whether electrocautery is a safe and effective means of making skin incisions for midline abdominal surgery when compared to a traditional scalpel. Electrocautery may be judged safe and successful in generating skin incisions in midline laparotomy when compared to knife incision since wound infection rates are lower and blood loss is lower.

Jamali et al.[11] compared the results of diathermy with surgical knife incisions in general surgery. There appears to be no statistically significant difference when an expert surgeon uses diathermy or scalpels to incise skin.

Charoenkwan et al.[4] described wound infection episodes (4). In wound infections, there was no noticeable difference between electrosurgery and scalpel.

There was no statistically significant difference in the occurrence of ugly scars between the groups studied in our study. Dixon and Watkin[12] asked participants, surgeons, and an independent assessor to rate the cosmetic appearance of scars as good, fair, or awful.[12]

The study has serious methodological issues, such as evaluating postoperative pain using analgesic doses as a single criterion. Long-term wound complications (such incisional hernia and scarring) are still uncommon.

## CONCLUSION

When compared to cold knife incisions, electrosurgery can be considered safe and effective in generating skin incisions in abdominal incisions, with much reduced blood loss, postoperative pain, and analgesic needs. It also doesn't contribute to the spread of infection in wounds.

Conflict of interest : none

## REFERENCES

1. Fitzgerald JEF, Malik M, Ahmed I, A single blind controlled study of electrocautery and ultrasonic scalpel smoke plumes in laparoscopic surgery. *Surgical Endoscopy*. 2012; 26(2):337-42.

2. Munro MG, Energy sources for operative laparoscopy. In: Gomel V, Taylor PJ, eds. Diagnostic and operative gynecologic laparoscopy. St Louis: *Mosby-Year Book*. 1995; 25–6.
3. Prakash LD, Balaji N, Kumar SS and Kate V, Comparison of electrocautery incision with scalpel incision in midline abdominal surgery: A double-blind randomized controlled trial. *International Journal of Surgery*. 2015; 19: 78-82.
4. Charoenkwan K, Iheozor-Ejiofor Z, Rerkasem K, Matovinovic E, Scalpel versus electrosurgery for major abdominal incisions. *Cochrane Database of Systematic Reviews.* 2017; Issue 6: Art. No.: CD005987.
5. Anderson TL, Thomassee MS, Principles of electrosurgery and laser energy applied to gynecologic surgery. In: Jones HW III, Rock JA editor(s). Te Linde's Operative Gynecology, 11th Edition. Philadelphia: *Wolters Kluwer*. 2015; 249–64.
6. Kumar V, Tewari M and Shukla HS, A comparative study of scalpel and surgical diathermy incision in elective operations of head and neck cancer, *Indian J. Cancer*. 2011; 48: 216-9.
7. Chang EI, Carlson GA, Vose JG, Huang EJ, Yang GP, Comparative healing of rat fascia following incision with three surgical instruments. *Journal of Surgical Research*. 2011; 167(1): e47–54.
8. Arsalan S, Athar A, Muhammad F, Elective midline laprotomy: Comparison of diathermy and scalpel incisions. *Professional Med J Mar*. 2011; 18 (1): 106 –11.
9. Karbhari and Patil RB, Comparative study of abdominal incision made by electrocautery and steel scalpel. *International Journal of Biomedical and Advance Research*. 2012; 3(5): 430-5.
10. Elbohoty AEH, Gomaa MF, Abdelaleim M, Abd-El-Gawad M and Elmarakby M, Diathermy versus scalpel in transverse abdominal incision in women undergoing repeated cesarean section: A randomized controlled trial. *J. Obstet. Gynaecol. Res*. 2015; 41(10): 1541-6.
11. 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): 1550-24.
12. Dixon AR, Watkin DF, Electrosurgical skin incision versus conventional scalpel: a prospective trial. *Journal of the Royal College of Surgeons of Edinburgh*.1990; 35(5): 299–301.