IT IS TIME TO CHANGE METHOD OF SKIN INCISION FROM SCALPEL TO ELECTROCAUTERY

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KEY WORDS

Electrocautery, scalpel, skin incision,

ABSTRACT

The use of electrocautery to incise the skin is still debated. Aim of the present study is to contribute at the use of electrocautery for skin incision as safe procedure both for patients and surgeons.

PATIENTS AND METHOD

Patients submitted to abdominal surgery, in which the skin have been incised by electrocautery from 2016 to 2021 have been considered. Sex, age, kind of disease, kind of incision have been considered at moment of surgical procedure. In the post-operative period wound infection, post operative pain, healing time, cosmetic results have been also considered.

RESULTS

A total of 281 patients (119 females, 162 males) with a median age of 60 years were scheduled for abdominal surgery. Most of the patients have submitted to surgical procedures involving the small and large intestine (160 patients, 56.9 %). Others patients were operated for liver, gallbladder, spleen or pancreas (41 patients, 14.5 %), esophagus stomach or duodenum (4 patients, 1.4%) disease. Finally, some patients undergone to hernioplasty (57 patients, 20.2 %). The majority of procedures were performed with a laparotomy incision (248), the others with laparoscopy (33). The incidence of wound related complications was 2 %, and all these 6 patients had peritonitis due to a perforation of a viscus. These 6 patients have been excluded from the scar evaluations. Patients refer pain classified as 1-2 in a numerical rating scale from 0 to 10. Wound has healed in about 710 days, and result was judged excellent both by patients and surgeons. Cosmetic results have been evaluated 2 weeks and 6 months after from surgical procedure. All the patients have been satisfied of their scar.

CONCLUSIONS

In spite of its limitations this study supports the use of electrocautery for skin incision. Nevertheless the knowledge electrocautery mechanism are of utmost importance to archive these results.

INTRODUCTION

Electrosurgery was introduced in the clinical practice for the first time in 1926 by Harvey Cushing (1) and since then it gradually has become a more and more one of the most used devices in surgical practice (1).

The use of an electrode, delivering pure sinusoidal current during cutting diathermy incision, allows to divide tissue by cell vaporization without damage to adjacent areas (2).

Even if evidence suggests that diathermy can be used safely for skin incision (3), most surgeons use scalpel for skin incisions and coagulation diathermy for deeper tissues (4).

The aim of this retrospective study is the evaluation of wound infections, the healing time, the postoperative pain of patients submitted to a skin incision using the electrocautery. We will analyze also the cosmetic results judged both by surgeons and patients.

PATIENTS AND METHOD

Patients submitted to abdominal surgery in which the incision of the skin have been done by electrocautery, from 2016 to 2021, have been considered. Sex, age, kind of disease in relation to the organ affected and type of surgical procedure and related incision have been investigated. Patients with diabetes mellitus, coagulation disorders and those submitted to a treatment of steroids and anticoagulant; patients previously operated with scar in the site of the second operations, or with anemia or with active source of infection in any part of the body where excluded from the study.

The skin incision has been classified into laparotomic or laparoscopic, in elective or emergency surgery. The laparotomic included large (large midline as xipho-umbilical or umbilical pubic incision, subcostals or pararectal) and small (small midline no more than 7 cm, inguinal, McBurney) skin incisions. The laparoscopic on the opposite involve incisions from minimum of 1 cm or less for introduction of trocars, and a maximum of 10 cm to extract organ. The subcutaneous layer has been closed using an interrupted suture using Vycril®3-0 on the opposite the skin suture has been done using metallic clips.

All patients have been submitted to general or spinal anesthesia. Antibiotic prophylaxis was done, following the guidelines related to the disease (5). Patients submitted to hernioplasty of laparoscopic cholecystectomy or any procedure in which the literature have reached a consensus any antibiotic treatment including the prophylaxis have not been done (5).

The outcomes considered are wound infections, post-operative pain, healing time, cosmetic results. The post operative pain has been related to the administration of paracetamole 1 gr every 12 hours for the first 3 days. The healing time and cosmetic results have been evaluated both during the hospitalization or in the out patients clinics, after 10 from surgical procedure at moment of ablation of metallic clips, and/or 20 days after the surgical incision with final clinical evaluations of the scar. Finally considering the medical records and operative reports, patients were contacted 6 months later by phone by resident in surgery ask them to evaluate their scar. The patient was asks simple to define their scar as acceptable and consequently patient satisfied or not acceptable so patient not satisfied.

We, also, consider the reported injury to surgeons or theater workers during the surgical procedure. Particularly we have reported the burns from hole in the gloves related to an absent respect of the isolated generator circuit

The skin incision has been done using the following rules: the cutting diathermy have been used to incise the skin. If bleeding comes from the dermis, the coagulation diathermy has been shortly used using the tip of the headpiece, without forceps. To incise the skin we have used a Valleylab force TX Medtronic Italy equipped with standard diathermy pen electrode, set on cutting mode for skin at 20 KHz sinusoidal current and on coagulation mode at K40 Hz both for skin and for deeper tissues (6).

Electrosurgery works by electrons' handling on living tissue using an alternating current density sufficient to create heat within tissue cells to destroy them.

It is mandatory to consider the mode of use electrosurgery. In the cutting mode, a continuous current produce extreme heat causing vaporization so the conversion of the cells into steam. When we use the electrosurgery unit into cutting mode for the skin the cells vaporize and the tissue is divided with a minimum devitalization, the thermal damage is minimal and it is not propagated to neighboring cells. Differently the coagulation mode that cause high thermal damage and necrosis of adjacent cells.

RESULTS

A total of 281 patients (119 females, 162 males) with a median age of 60 years were scheduled for abdominal surgery. All the patients affected by one of the contraindications listed in materials and method have been excluded from the present study. We have collected the patients according to the site of origin of the disease. Most of the patients have submitted to surgical procedures involving the small and large intestine (160 patients, 56.9%). Others patients were operated for liver, gallbladder, spleen or pancreas (41 patients, 14.5%), esophagus stomach or duodenum (4 patients, 1.4%) disease. Finally, some patients undergone to hernioplasty (57 patients, 20.2%). And at the least we have grouped as miscellaneous some patients undergoing procedures that concerned the subcutaneous or unspecified (19 patients, 6.7%) (table 1).

Most of the procedures were performed with a laparotomy incision (248 patients, 88.3%), the others with laparoscopy (33 patients, 11.7%) as shown in table 2. Into the group of laparotomic incisions 158 patients have a large incision and 93 have a small incision. In the group of laparoscopic in all 33 patients we needed to widen the skin incision beyond the 10 mm necessary to introduce the trocar. 203 patients of the total underwent emergency surgeries and 78 patients elective operations.

The incidence of wound related complications was 2%, this percentage related to infections were recorded in patients undergoing emergency surgery with laparotomic incisions and all these patients had peritonitis due to a perforation of a viscus. These 6 patients have been excluded from the scar evaluations.

Patients refer pain classified as 1-2 in a numerical rating scale from 0 to 10, with zero meaning “no pain” and 10 meaning “the worst pain imaginable (7). And this was just in the first 24 hours after the procedure. No one patients have reported pain after this period from the surgical procedure. During the follow-up controls, we noticed that the wound has healed in about 7-10 days, but at the end of the healing the aesthetic result was judged excellent both by patients and surgeons.

Cosmetic results have been evaluated by surgeons in out patients clinics 2 weeks after from surgical procedure. 6 months later all the remnant 275 have been submitted to telephonic interwiew and all the patients have defined the cosmetic results acceptable. Consequently, all these patients have been satisfied from the surgeon work.

No incidental burns of the hands of surgeons have been reported. Finally no scalpel have been used and no accidental puncture have been reported.

DISCUSSION

The use of electrocautery is not still accepted worldwide from all surgeon as a safe method both for patients and surgeon to incise not only the different layers of the wall but also the skin.

The number of surgeons using the electrocautery to incise the skin, remain very low as the majority of them continue to use the scalpel. Despite the electrocautery protect the surgeon and the team working at the operative table, both by direct injuries and the risk of blood disease transmission, the scalpel is still used for almost the 80% of the surgeons (8,9).

The hypothesis that the electrocautery can reduce the tensile strength, can increase the rate of infection and an increased zone of wound necrosis histologically proved related to the scalpe use have been postulated in experimental studies (10). This suggestion has never proved clinically and seems more related to the use of coagulation diathermy more than cutting diathermy (10). In effect cutting diathermy produces rapid tissue vaporization; on the opposite the coaugulation diathermy cause charring and necrosis that may predispose to wound infection. So if the skin is incised with the cutting diathermy and the coagulation is reserved in this phase just to stop a small bleeding from dermis, these cited negative effect have never encountered in any study.

After the skin division the coagulation diathermy can be usually used to divide the deeper tissue. This technique has been applied in our casuistic. In this way there is no difference also in wound infections. This technical behaviour have to be stressed especially with young residents in order to adequately use the electrocautery with lowest possible generator setting to avoid complications.

All the patients can be submitted to this technique in order to have beneficial effects. This method should be avoided in patients in which the wound infection can have a substantial risk factor not related to the kind of incision (6). In our study the wound infection has been related to the peritonitis that have been diagnosed in all the patients that intraoperatively reported a viscus hole. In this kind of patients operated in the set of the emergency the diathermy does not prevent from the wound infection, as reported in the literature. In our opinion all the remnant beneficial effect demonstrated in the literature, like reduction of bleeding, reduction in time of incision and so on, remain active and represents a valid reason to use the diathermy also in these patients. A hypothesis of future work, where only wound infection can be represented as complication, using a randomized study can clarify this aspect. If all the remnant advantages can be preserved, the electrocautery can be used in all the patients in which currently is no recommended.

The use of scalpel causes the bleeding of the skin incised and this condition need the coagulation using the electrocautery. For this maneuver the surgeon needs to abandon the scalpel and to take another instrument. This can explain the loss of blood and also the time spent to do this change of instruments. This aspect is not detectable using the electrocautery. Moreover it is important to add at these sentences the fact the modern electrosurgical handpeace have two buttons one for cutting diathermy and the second one for coagulation diathermy. This condition does not need to exchange different instruments, as both cutting and coagulation can be done just changing the button of the same handpeace. The subcutaneous bleeding may be controlled using just diathermy. This aspect does not alter the results that concern only the method used for the skin incision. In literature many articles have demonstrates that, the kind of coagulation of the deeper layer, do not affect the result of the skin in relation to the kind of incision used (11-16).

There is no risk to increase the infection rate using the electrocautery as different meta-analysis have exclude this condition (4,17-18). Our results show a rate of wound complications included in the range from 1,9% (19) to 40 % (20) reported in a recent manuscript of Cochrane (21). In our report

the majority of our patients have been operated in emergency surgery and it is mandatory to consider the clinical conditions associated. They could have developed wound infection due to factors independent from the incision, such as wound contamination, peritonitis or other intrabdominal infections. Some patients that developed a wound infection were affected by cancer and this is one of the main causes of immunologicas disorders that can impact also in the result of these studies.

The time of incision was not the aim of this study but is intuitive the shorter time for the electrocautery in relation to the scalpel. This meaning is not only intuitive but have been demonstrated scientifically by many studies (4). Many studies shown that the diathermy incision may be quicker to perform incision of the skin than scalpel (4,18,22). Scalpel incision can lead to bleeding of the dermis more frequently and involves the need to perform hemostasis with electrosurgical units, which not only takes longer, but can also cause infections. In fact the coagulation mode, as used in scalpel incision, cause a big thermal damage and necrosis of adjacent tissues (23).

Another advantage of the use of diathermy is the absence or inappreciable postoperative pain. In effect the literature supports a small benefit in terms of early postoperative pain in the patients treated with diathermy skin incision rather than scalpel (3). We estimate the post-operative pain based on analgesic post-operative medications: the amount of orally administered analgesics was slightly less related to other patients of surgical unit operated with scalpel. Moreover when the patients in which the diathermy have been used to incise the skin, and he has been visited post operatively in the outpatients clinics, do not refer any record of post operative pain in their scar. The explanation of the very small amount of pain reported by the patients is probably due to the effect of the diathermy ablation that destroy the localized sensory nerve. This have also been explained by studies in which the group of patients treated by electrocautery required only half dose of analgesic in the post operative period (24). Other studies have well demonstrated that patients in which the skin have been incised with electrocautery have less pain 24 or 48 hours after the procedure in relation to patients in which the incision have been done using the scalpel (22). All our patients have, depending from nature of surgical procedure, a slight of more important analgesic medications. So we cannot affirm for sure that the slight pain recorded by patients is related to the kind of procedure adopted for skin incision, due to the interference of the antinflammatory

medications. What we can affirm is that the related pain after the procedure have been classified as very low or absent.

Wound healing is another point of discussion. This study is not randomized with scalpel incision, but we can affirm that between the method to close the skin we have used the less refined. All the patients without complication have been clips removal in a maximum 10 days with a satisfied result both for surgeons and patients.
The cosmetic result was unbelievable judged positively by all the patients interweaved by telephone call after 6 months. This was more appreciated result as no particular suture technique were applied as all the patients have been their skin sutured by metallic clips.

In terms of cost it must also be considered that while the electrosurgical unit is an essential tool in all duration of surgical intervention, the scalpel is not used except to incise the skin, so it constitutes an unnecessary expense that could be avoided.

The transmission of infections among health care workers has been associated with accidental inoculation injuries due to sharp instruments. Surgical scalpels are reported to be the second most frequent source of these accidental injuries after suture needle injuries in operating theatres (18) and is estimate that injuries due to the scalpel cause 18 % of all sharps injuries in the operating rooms (4). So considering the recent increase in bloodborne diseases makes exclusion of the scalpel represents an attractive option to eliminate disease related to the scalpel use (22).

The safety of the work place remain a problem for all the person inside the operative room. The plume has still indicate as one of the problem when electrocautery in used for skin incision. The problems related to this plume is its contents (chemical and cellular debris) that can be both potential risks to spread bacterial, viral and chemical diseases, and the risk of carcinogenesis due to the presence of chemical that can have the potential for tumor development. In our experience to decrease this risk we use a double aspiration in order to decrease or eliminate the effect of plume during the skin or abdominal layer incision using the electrocautery. This is not a complete method to avoid the plume but in this way the plume remains limited to the aspirator and do not interest macroscopically the inhalation of all members of operative rooms.

During the use of electrocautery, the cleaning of the tip is strongly recommended. In fact this negligence can cause the growing of escar on the tip of the electrode and as consequence we can have arcing until the flaming of the escar. Usually the tip is cleaned with a scratch pad but this action can cause grooves in the tip electrodes and in this way the eschar can increase in size. So the recommendations are to clean the tip electrode with a sponge to avoid the damage of the tip and the increase of the eschar.

CONCLUSIONS

The present is a retrospective study with all limitations for this type of study. However the outcomes of this research support the use of electrocautery for skin incisions.

The undoubtedly advantages reported in this study in terms of wound infections, healing time, postoperative pain and cosmetic results in association with economic gain for saving in the purchase of scalpes, represent a formidable motivation for the surgeons to abandon the scalpel in favors of diathermy. Nevertheless the knowledge electrocautery mechanism are of utmost importance to archive these results.

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applicable.

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Author contribution
Adriana Toro, Chiara Mazzone e Iacopo Sarva' contributed to the study design, Emanuele Gaspare Fontana, Alessandro Terrasi e Martina Rapisarda contributed to data collection, Adriana Toro contributed to data analysis and writing, Isidoro Di Carlo contributed to review .

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The data sets used and analyzed during the current study are available from the corresponding author upon reasonable request.

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Table 1. Patient's pathology

Pathology site	**Patient's number**
Ileus, appendix, colon, rectum	160
Esophagus, stomach, duodenum	4
Liver, gallbladder, pancreas, spleen	41
Abdominal wall	57
Miscellaneous	19

Table 2. Surgical procedure

Surgical procedure	281
- Laparotomy	248
- Laparoscopy	33