ORIGINAL ARTICLE

Electrodissection Tonsillectomy With Laryngeal Mask

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KEYWORDS
Tonsillectomy; Colorado® microdissection needle; Laryngeal ventilation mask

Abstract
Introduction: The Colorado® microdissection needle has been used for 30 years as an alternative to cold dissection. Alexander was the first to publish the results of laryngeal mask in otorhinolaryngology and maxillofacial surgery. Later on it was introduced as a standard anaesthetic technique in our speciality.
Objective: The objective of this study was to compare the results of using laryngeal mask combined with Colorado® microdissection needle in tonsillectomies. The benefits of each of these 2 techniques are already known.
Methods: We present a prospective observational study of 107 paediatric tonsillectomies associated or not to adenoidectomy. Variables analysed are pain (Brodman scale), analgesia, bleeding, uvula oedema and days up to the restoration of diet and normal life. Surgical, anaesthetic and total surgery room times are also discussed.
Results: The Colorado® electrodissection technique minimised intraoperative bleeding and the need for haemostasis. However, uvula oedema and local pain increased compared with cold dissection. There were no clinical variations in the recovery of normal life. Combining the Colorado® microdissection needle and laryngeal mask reduced intraoperative, anaesthetic and total surgery room times.
Conclusions: The combination of these two techniques is a secure, quick and effective method that derives benefits from the advantages of both of them, without increasing surgical or anaesthetic risks.
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Amigdalectomía mediante electrodissección y mascarilla laringea

Resumen

Introducción: La electrodissección con bisturí de Colorado® se utiliza desde hace 30 años como alternativa a la disección fría. Alexander fue el primero en publicar resultados de la mascarilla laringea otorrinolaringología y cirugía maxilofacial. Posteriormente se ha introducido como alternativa anestésica habitual en nuestra especialidad.

Objetivo: El objetivo de este estudio es comprobar los resultados de la aplicación combinada de estas 2 técnicas en amigdalectomías, ya por separado han demostrado sus beneficios.

Métodos: Presentamos un estudio observacional prospectivo de 107 amigdalectomías con o sin adenoidectomia pediátricas. Se analizan una serie de variables durante todo el proceso como el dolor (escala de Brodman), la analgesia, el sangrado, el edema de úvula, los días hasta normalizar la dieta, la habituación a la vida normal y los tiempos quirúrgico, anestésico y total de quirófano.

Resultados: La técnica de electrodissección con bisturí de Colorado® minimiza el sangrado intraoperatorio y la necesidad de hemostasia. El edema de úvula y el dolor local aumenta comparado con la disección en frío. No hay variaciones clínicas en cuanto a los días que tarda el paciente en recuperar su vida normal.

La combinación de la anestesia con mascarilla laringea y la electrodissección con Colorado® reduce el tiempo quirúrgico, anestésico y total de quirófano.

Conclusiones: La combinación de ambas técnicas es un método seguro, rápido y eficaz que se beneficia de las ventajas de ambas sin suponer un aumento de los riesgos quirúrgicos ni anestésicos.

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Introduction

Ideally, tonsillectomy procedures should be fast, with the least possible pain and hemorrhage, and with a postoperative recovery as satisfactory as possible. In addition to cold dissection tonsillectomy, there are various surgical techniques, such as dissection by electrocautery, radiofrequency or laser, as well as haemostatic methods including tannic acid, topical thrombin, bismuth or oxymetazoline, which are used at various centres. Each method must be used with the necessary experience in order to reduce morbidity.

Electrodisection, either with monopolar or bipolar diathermy (the use of heat produced by a high-frequency current for therapeutic purposes), has been used for 30 years as an alternative to dissection with non-electrical surgical instrumentation (blunt dissection). However, since the advent of diathermy, numerous studies have compared the various technical options, with non-homogeneous results, taking into account the population, surgical time, intra- and postoperative bleeding, and the postoperative treatment and morbidity of the procedure.

Regarding anaesthetic techniques, from the time of the initial Brain mask1–13 until the present day, various different sizes, widths and lengths have been developed, adaptable to patients according to body weight indications which provide guidance regarding the capacity of the pharynx for housing the inflatable sleeve.4,5

Alexander6 was the first to publish the results obtained with a modified laryngeal mask for otolaryngology and maxillofacial interventions in 1990, although it has since been employed by numerous authors in their habitual techniques for similar interventions.7–13 In our Service, we have used the laryngeal mask in tonsillectomy and adenoidectomy interventions for many years, thus benefitting from the advantages of this technique at our hospital.

The objective of this study is to verify the results of combining the application of 2 techniques, one surgical and the other anaesthetic, in tonsillectomy. Each of them separately has proven to be beneficial for this procedure throughout the years. We wish to evaluate if combining both techniques represents an increase of the technical difficulty and/or morbidity, and whether patients will benefit from the advantages of both.

Material and Methods

We performed a single-centre, prospective, observational study which gathered 107 tonsillectomy interventions, with and without adenoidectomy (83.2% and 16.8%, respectively), with ASA (American Society of Anesthesiology Classification) grade 0 and 1 in 31.8% of cases, grade II in 68.2% and grade III in 68.2%, and a mean weight of 20.61 kg (standard deviation [SD]: 13.59 kg), performed under general anaesthesia during a time period of 12 months, from January to December 2008.

The criteria for inclusion in the study were: young patients, aged between 3 and 20 years, who had to undergo tonsillectomy in accordance with the criteria of the Consensus Article of indications by the Spanish Society of Otolaryngology (SEORL).12,13 In our study, tonsillar hypertrophy was classified into a Friedman grade I–II in 48.6% of cases, III in 11.2% and grade IV in 40.2%, accompanied by recurrent tonsillitis in 46.7% of cases. We excluded those patients with preoperative alterations, haematological diseases, suspicion of neoplasm, uncontrolled severe systemic diseases, malformations or cognitive delays.
The guardians of all patients signed an informed consent form to allow surgery, which included the information sheets of SEORL for such intervention.

Medication and pre- and postoperative care were performed according to the protocol approved in 2009 by the Clinical Guide of our centre.14

All patients were premedicated 15 min before surgery with nasal midazolam drops at a dosage of 0.2 mg/kg. An EMLA® occlusive patch was applied in the back of the hand.

Once in the operating room, a peripheral vessel in the area treated with the anaesthetic mixture was catheterised for controlled serum therapy administration using saline solution.

In all cases we employed the Davis Boyle mouth-opener and placed patients in the Rose position (2.8% of number I, 67.3% of number II and 29.9% of number III), without any obstructions of the surgical field in 96.3% of cases. Adenoidectomy was performed using a Beckman adenotome and haemostasis through compression with gauzes soaked in serum. Tonsillectomy was performed using the cold dissection technique in 29.9% of cases and through the Colorado® microdissection technique, at a power of 30W, in 70% of cases. Adenotonsillectomies resulted from the combination of both techniques in 83.2% of cases in a single procedure. Anaesthesia was maintained throughout the entire time required for each surgical procedure, and always under demand of the surgeon, through inhalation anaesthesia with sevoflurane and repeated doses of fentanyl. Ventilatory techniques used were: manual in 25.2% of cases, spontaneous in 0.9%, assisted in 6.5% and controlled in 67.3%.

Like the surgical technique, the type of intubation depended on the experience of the anaesthetist and familiarity with the laryngeal mask for children, so that interventions were conducted with endotracheal tubes and laryngeal masks, according to the decision and experience of each anaesthetist and surgeon at the time of surgery. Cases were divided into 4 groups: (i) classical technique (CL) and tracheal intubation (TI), (ii) classical technique (CL) and mask (MK), (iii) Colorado technique (CO) and tracheal intubation (TI), and (iv) Colorado technique (CO) and mask (MK).

All patients were administered prophylactic antibiotic treatment (procaine penicillin intramuscularly and, in case of allergy, clindamycin) and intra- and postoperative analgesia including: paracetamol 15 mg/kg, tramadol 1.5 mg/kg and 2 doses of dexamethasone (0.1 mg/kg) during the procedure and at 7 am the next day. The postoperative regime at home included paracetamol 0.1 mg/kg/6–8h (Gelocatil® solution) and rescue metamizole (Nolotil® paediatric suppositories), alternating both in case of pain. Ibuprofen and aspirin were never administered.

Hospital discharge took place at 12 h of surgery. Data collection was performed during the intervention, in the postoperative period at 12 h and 8–10 days later. We studied the variables linked with intraoperative and postoperative bleeding and their resolution, the time periods of the anaesthetic and surgical interventions in the operating room, subsequent complications during postoperative visits, such as uvular oedema, pain measured on the Brodman scale,15 days until habitation to normal life and food consumption.

We conducted a study of all the variables included, expressing the results of the quantitative variables as mean and standard deviation. Categorical variables were expressed as frequencies and percentages. We performed an ANOVA test to analyse quantitative variables and a chi-square test to analyse categorical variables. We accepted an alpha risk of 0.05.

Results

Verification of proper ventilatory operation and effectiveness of the mask was confirmed in all cases by noting the appearance of proper vesicular murmur upon lung auscultation and correct levels of monitored ventilatory parameters.

There was an error in the placement of the mask in 4.7% of cases, with 10.3% (11 cases) requiring relocation or tube replacement; 8 of them due to ventilatory alterations during anaesthesia and 3 due to surgical problems during the intervention, without significant differences between groups.

Visual access to the surgical field and accessibility for placement of the mouth opener presented similar ease with the mask and with the orotracheal intubation technique.

This was measured with a visual analogue scale (VAS) by all surgeons, with a mean score of 81.28 and SD of 17.90. Complete removal of the tonsils and adenoids was achieved in all cases.

The safety of general anaesthesia was reflected by the figures for intraoperative monitoring: controlling arterial blood pressure and heart rate, mean preoperative O2 saturation measured by pulse oximetry ranging in all cases above 97% and capnography lower than 50%.

In 53.3% of patients, the airway was monitored through a laryngeal mask of the appropriate size according to the weight, following anaesthetic induction using the technique described by Brain with a SpO2 >94% in 97.2% of cases. We used an endotracheal tube in 45.8% of patients.

Haemostasis of the surgical sites was conducted without any problems using coagulation by electrocautery at 30 W or Vicryl® stitches in 46.7% (50 cases). In no case was it necessary to treat postoperative haemorrhaging.

Mean surgery time was 19.45 min, with a SD of 13.66 min. The mean anaesthetic time was 45.59 min, with a SD of 24.22 min. The mean total operating room time was 66.46 min, with a SD of 17.98 min.

At the end of the surgical procedure we proceeded to remove the laryngeal mask or endolaryngeal tube once the patient showed sufficient capacity for spontaneous ventilation following removal of anaesthetic drugs (mean final CO2 of 43.0, with SD of 6.1). In all cases, the mask was removed whilst still inflated, in order to control any blood which may have accumulated. At this time, we performed a visual inspection by direct laryngoscopy using the Macintosh blade throughout the hypopharynx and endolarynx, seeking secretions and/or blood from the surgical site, which could have overflowed the inflated sleeve of the laryngeal mask. We only found traces of blood in 2 cases (1.9%), and these were aspirated at that moment without further clinical relevance.

There were 2 episodes of laryngospasm after concluding the process. Both were reversed in less than 1 min by applying O2 through the facial mask and without requiring reintubation. Both cases appeared in the group with a laryngeal mask and endolaryngeoscopy, without representing significant differences between groups.
We compared the 4 groups and found no significant differences by gender, ASA grade or surgical indication:

I. Classical technique (CL) and tracheal intubation (TI): 17 cases (with a mean age of 8.35 years, SD: 4.51 years, and mean weight of 30.82 kg, SD: 23.09 kg).

II. Colorado electrodissection (CO) and tracheal intubation (TI): 32 cases (with a mean age of 4.34 years, SD: 3.72 years, and mean weight of 20.97 kg, SD: 12.55 kg).

III. Classical technique (CL) and laryngeal mask (MK): 14 cases (with a mean age of 4.07 years, SD: 4.32 years, and mean weight of 18.67 kg, SD: 11.92 kg).

IV. Colorado electrodissection (CO) and laryngeal mask (MK): 43 cases (with a mean age of 3.56 years, SD: 2.35 years, and mean weight of 16.84 kg, SD: 6.51 kg).

Analysis of Intraoperative Variables

Intraoperative bleeding >25 cc was observed in 36.4%, 4.5%, 31.8%, and 27.3%, respectively, in each of the 4 groups, with no further medical or surgical actions needed other than immediate haemostasis with the electric scalpel or stitches (Vicryl®) in the same surgical procedure. We found significant differences between them, showing that the cold technique led to more intraoperative bleeding than electrocautery. The need to control bleeding with Vicryl® stitches was 34.7%, 12.2%, 28.6%, and 24.5%, respectively, and the difference between the groups was also significant, with cold dissection cases showing a greater need for stitching.

When analysing the time between the groups, we observed clear differences or a clear significant trend towards them in the 3 time analyses. Time was shortened by combining the 2 techniques: surgical and anaesthetic (Table 1).

We studied possible variations in group IV (CO+MK) regarding bleeding according to the experience of the surgeon with the surgical technique, as well as regarding errors in the placement of the laryngeal mask according to the

<table>
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<th>Time Analysis by Groups.</th>
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CL, classical technique; CO, Colorado technique; min, minutes; LM, intubation with laryngeal mask; TI, tracheal intubation.

Figure 1 Distribution of uvular oedema. (A) Immediate postoperative. (B) Visit at 8–10 days. CL: classical technique; CO: Colorado technique; LM: intubation with laryngeal mask; TI: tracheal intubation; I, II and III: grading of uvular oedema.

experience of the anaesthetist. We found no significant differences.

Analysis of Variables in the Immediate Postoperative Period

Uvular oedema was classified from I to III according to its severity upon clinical examination. It presented grade III in 0%, 28.6%, 0%, and 71.4% in each group, respectively. There was a statistically significant difference, with higher values in cases of electrocautery (Fig. 1A) (P<.05).

Postoperative haemorrhage occurred in 2.8% (3 cases). None required surgical revision, as they were self-limited bleeding cases. There were no significant differences between groups.

Food consumption at 12–24h took place correctly in 73.8% of cases, with no differences between groups.

The Brodmann scale (subjective visual scale adapted to paediatric patients in order to measure pain) showed no significant differences between groups (Fig. 2).

Analysis of Variables in the Late Postoperative Period (8–10 Days)

Uvular oedema after 8–10 days also showed significantly higher values in the electrodissection groups. No clinical consequences or grade III oedemas were observed (Fig. 1B).
(Fig. 4A). The need to add rescue metamizole (Nolotil®) to the analgesic treatment was observed in 53.5% of cases, and was also significant in those groups (Fig. 4B). No patient required subsequent admission for analgesia or fluid therapy ($P < .05$).

As in the first control, the Brodman scale showed no significant differences between groups (Fig. 2).

**Discussion**

The authors who used a laryngeal mask in ORL procedures initially did so for otological interventions; placement of ventilation tubes.\textsuperscript{16, 17} Tonsillectomy took longer to incorporate laryngeal masks, not only due to fear of a possible passage of blood to the airway, but also because the thick calibre of the tube led to suspect that it would severely hamper manipulation within the surgical field. We have not suffered this problem. No significant differences were found between the groups in terms of VAS performed to assess obstruction of the surgical field or in terms of cases where it was impossible to perform the intervention indicated, where tonsillar remains had to be left due to a difficult access, where it was impossible to perform Vicryl\textsuperscript{®} suture for the same reason or where there was a need to replace the tube of the mask. The influence of the anatomy of each patient, the size of the tube, the size of the tonsils and the technique employed by the anaesthetist and the surgeon to place the blade of the mouth-opener were also considered. Neither did we find traces of blood in the endolarynx or hypopharynx when removing the tube or mask, verifying this in the same way as other authors. The protection manoeuvre using wet gauze, as is done in CO$_2$ laser ENT surgery, was useful to avoid the possibility of puncturing the mask or the risk of ignition, especially when employing electrocautery. Neither of these complications was observed in any case.

Tonsillectomy is one of the most common surgeries in the field of ORL. Various techniques, such as electrocautery, laser or radiofrequency have been introduced in recent years for this procedure in an attempt to overcome its difficulty, risk and morbidity.\textsuperscript{18-20} Postoperative complications such as pain, halitosis, fever, uvular oedema, decrease in normal activity and bleeding are the most common. The effects of antibiotic therapy in minimising postoperative symptoms such as fever, pain and better healing after
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tonsillectomy have been established since 1986,21 so we have followed such therapy in our study. The choice of surgical technique can potentially affect postoperative morbidity, surgical time and intraoperative bleeding.22 Like other authors, we believe that it is always best to employ a familiar technique.23,24

Several studies reviewed have reported the benefits of monitoring protocols which add consistency to the use of analgesia, antibiotics and steroids, in order to avoid confusing factors when analysing groups, as we have done in our study.22,25,26

Pain and bleeding are the most common problems after tonsillectomy. Several authors have presented series evaluating postoperative pain according to the analgesia doses administered, days until return to normal activity and a pain scale reported by patients, as we have done in our study with the Brodman scale15 (pain scale adapted to children), and have found a greater increase in postoperative pain using the electrocautery technique.23-27 We have found a need for more analgesia doses, revised at 8–10 days postoperatively, a difference that was not as immediate after 24 h and which did not affect the Brodman scale scores or the number of days until the return to daily life in all groups.

In terms of bleeding, for other authors, such as Robert,22,23 the electrocautery technique reduced intraoperative bleeding episodes and the surgical time required, without an increase in the risk of subsequent bleeding compared to the classical technique. In our study we obtained the same results, observing greater intraoperative bleeding and an increased need for haemostatic stitching with the classical technique, as well as, consequently, a longer surgical time than using electrocautery dissection with the Colorado® microdissection needle.

Posterior uvular oedema due to local heat from electrocautery has proven to be more pronounced and remain for longer until normalisation, but with no clinical significance. It did not require any additional therapeutic approach.

The argument used most commonly to justify the use of a mask in the procedure refers to the need to achieve an anaesthetic level which is as superficial as possible, in order to cause the least possible discomfort to the patient and reduce the duration of all the times involved in general anaesthesia. Endotracheal intubation requires a greater depth of anaesthesia, maintenance and prolonged awakening, thus notably increasing the time required compared to simple induction with a mask.30 In a similar way, the electrocautery surgical technique also manages to optimise surgical time in many cases, given the reduced need for haemostatic time and stitching after dissection compared to the classical technique. Thus, the combination of both procedures can reduce all times involved; surgical, anaesthetic and total surgery room time, as we have also shown in our study.

Conclusions

In our opinion, the electrocautery dissection technique using the Colorado® microdissection needle minimises the risk of bleeding and reduces anaesthesia time.

The use of a laryngeal mask represents an adequate method of choice for tonsillectomy interventions, with or without adenoidectomy, which does not cause obstructions in the surgical field nor hinder surgery.

The combination of a laryngeal mask in tonsillectomy through electrodisssection with a Colorado® microdissection needle represents an effective, fast and safe method, which benefits from the advantages of both techniques without increasing surgical or anaesthetic risk.

Conflict of Interests

The authors have no conflict of interests to declare.

References