

## Diathermy tonsillectomy: comparisons of morbidity following bipolar and monopolar microdissection needle excision

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### Abstract

Tonsillectomy is frequently associated with a considerable post-operative morbidity. In some cases reactionary or secondary haemorrhage occurs and all patients suffer a degree of post-operative pain. The use of bipolar diathermy excision has become popular because it reduces intra-operative blood loss, but all diathermy inevitably produces a degree of damage to adjacent normal soft tissues. In turn this inadvertent injury must act to increase the post-operative pain.

Monopolar dissection using a fine tungsten diathermy needle (the Colorado needle) allows sharp dissection at low power levels and in previous studies has been shown to produce a reduction in collateral tissue damage. In this prospective study the morbidity associated with tonsillectomy using this needle was compared to that following a standard bipolar dissection.

Using the monopolar needle produced no enhanced risk of reactionary or secondary haemorrhage while causing significantly less post-operative pain and a reduction in eschar. We believe that excision using this needle preserves the advantages associated with bipolar dissection while reducing local soft tissue damage.

**Key words:** Tonsillectomy; Electrocoagulation; Pain, post-operative; Soft tissue injuries

### Introduction

The first description of tonsillectomy was by Celsus in the first Century AD (McAuliffe, 1987) and, at the present time, tonsillectomy for recurrent infection is one of the most common surgical procedures performed world-wide (Goycoolea *et al.*, 1982). However, the operation is associated with pain and the risk of bleeding in the post-operative period.

Diathermy to reduce bleeding has been used for over 20 years. Using monopolar diathermy, where the current applied flows to earth through the patient, may result in thermal damage to adjacent structures at conventional power settings (Goycoo-

lea *et al.*, 1982; Weimert *et al.*, 1990; Choy and Su, 1992). Because of this, bipolar diathermy, where the area of tissue coagulation is relatively localized, has become popular (Choy and Su, 1992).

The microdissection needle used in this study (Colorado Biomedical Inc, Figure 1) is forged from tungsten and is covered with an insulating sheath of polytetrafluoroethylene (Teflon). It fits a standard cautery handpiece (Figure 2) and, being sharply pointed, allows very precise cutting and coagulation of tissues at low power levels. Tissue charring and the risks of collateral tissue damage associated with conventional monopolar surgery are thus markedly reduced (Farnworth *et al.*, 1993).

This prospective trial compared tonsillectomy morbidity when undertaken with this monopolar microdissection needle and when performed with bipolar diathermy. Differences in reactionary and

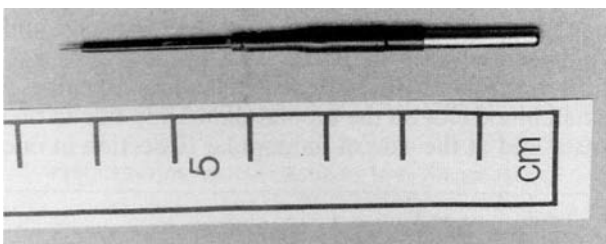


FIG. 1  
Colorado microdissection needle.



FIG. 2  
Needle and handpiece.

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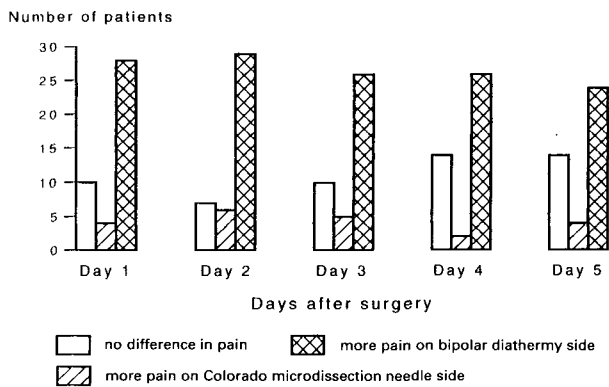


FIG. 3

Distribution of pain by tonsillectomy method for each post-operative day (n = 42).

secondary haemorrhage rates as well as the post-operative pain and the degree of soft tissue damage as assessed by eschar levels were compared for each method.

### Materials and methods

Forty-five subjects between the ages of three and 35 were initially entered into the study. All patients had a past history of recurrent tonsillitis for more than two years with sore throat, pyrexia, cervical lymphadenopathy and time lost from school or work. Patients with a history suggestive of quinsy and those with a recognized bleeding disorder were excluded.

In all cases the procedure to be used was explained and written consent was obtained from the patient or their relative prior to surgery. All surgery was performed under general anaesthetic by the same operating surgeon. A standard tonsillectomy was undertaken with the patient in a supine position and using a Boyle-Davies gag supported by Draffin bipodes. In each case the patient was randomly allocated to have one tonsil removed using bipolar dissection while the other was excised using the monopolar Colorado needle with coagulation mode selected on the handset. A Valleylab diathermy machine was used in all cases. For bipolar tonsillectomy, dissection was undertaken using forceps with 6 Watts of applied current. Using the microdissection needle the diathermy was set at 8 Watts of coagulation and 4 Watts of cutting in Blend 1 mode. In all cases dissection and excision of the tonsil was performed in the peritonsillar plane keeping as close to the tonsil capsule as possible. Diathermy alone was used for haemostasis and no ties were employed. At the end of the procedure a topical injection of 2.5 ml of the resultant solution of

a 40 mg ampoule of methyl prednisolone acetate (Depomedrone) diluted to 5 ml with normal saline was injected into the anterior pillar and the tonsillar bed on each side from a 5 ml syringe fitted with a 22 gauge spinal needle. Post-operatively all patients were given a course of oral amoxycillin for five days or an equivalent dose of erythromycin in the case of penicillin allergy. Children were prescribed standard regular doses of soluble paracetamol ranging from 250 mg to 500 mg according to body weight. In addition to paracetamol the adult group were prescribed diclofenac sodium (Voltarol) 50 mg t.d.s. on a regular basis for five days.

On discharge from hospital patients were supplied with a questionnaire based on a visual analogue scale from 0 to 10 (0 representing no pain and 10 the severest pain ever experienced) and were asked to record the pain experienced each morning on awakening on each side separately from day one to day five post-operatively. All cases were reviewed on the sixth post-operative day. Both the patient and the doctor conducting the review (who was not the surgeon who had performed the operation) were blinded as to which technique had been used on which side. At this time the tonsillar fossae were examined for eschar, oedema and clots and the eschar graded between 0 to 3 (0 equating to no eschar, 1 being minimal whiteness in the fossa, 2 being thick eschar within each fossa and 3 being slough exceeding the confines of the fossae).

### Results

One patient was excluded from the study because at surgery the peritonsillar plane was found to be obliterated on both sides by scar tissue: sharp scissor excision was therefore required to effect removal. Another two patients failed to complete the questionnaire and were excluded. Completed data on the remaining 42 patients are presented here.

The median age of the patients included was 15 years (range five to 29 years). Monopolar dissection was performed on the left in 23 and on the right in 19 cases. All patients, except one, were discharged the following morning having had an uneventful recovery from surgery. One patient had a low grade temperature and minor dysphagia and was therefore detained for observation for a further period of 24 hours before being discharged.

No patient had a reactionary haemorrhage. Three patients reported minor secondary haemorrhage and re-presented with bleeding between the third and fifth post-operative days. Examination revealed a small blood clot on the bipolar diathermy side in two cases and at the side of monopolar dissection in one

TABLE I  
THE DAILY MEDIAN AND 25-75TH CENTILE PAIN SCORES BY TONSILLECTOMY METHOD

Method	Day 1	Day 2	Day 3	Day 4	Day 5
Bipolar diathermy – median	6	6.5	5	4	3.5
25th–75th	4–8	4–8	3–8	2–7	1–6
Microdissection needle – median	4	4	3	2	2
25th–75th	2–6	2–6	0–6	0–5	0–4

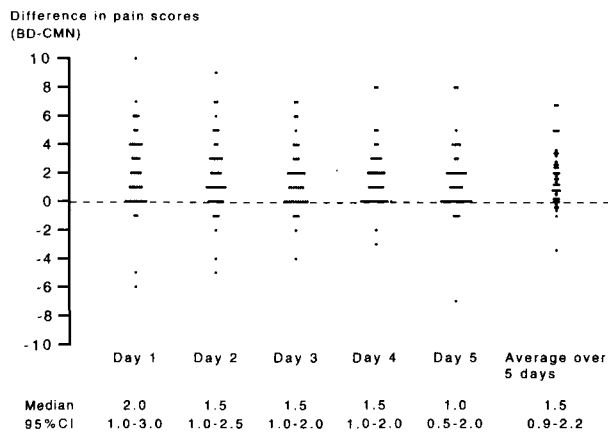


FIG. 4

Differences in pain scores between bipolar (BD) and Colorado microdissection needle (CMN) for each post-operative day (median and 95 per cent confidence intervals).

case. No further surgery was required and all patients settled on conservative treatment and with a 24-hour period of hospital observation.

The median pain scores (and the 25–75th centile) are shown in Table I. As might be expected the pain scores decreased each day after surgery for both methods of tonsillectomy. However, pain was less severe using the monopolar needle on each post-operative day. As patients served as their own controls a within person analysis was undertaken to assess which method resulted in less pain. Figure 3 shows that for each of the five days following surgery most patients experienced more pain on the side where bipolar diathermy was used than on the side where monopolar dissection had been undertaken. The results were statistically significant for each of these post-operative days (sign test,  $p < 0.001$ ). When the difference between the pain experienced on the two sides (bipolar minus monopolar scores) was assessed for each post-operative day then there was less pain on the monopolar side by an average of 1.5 pain score units. These results are shown in Figure 4 and were also statistically significant (Wilcoxon one-sample test,  $p < 0.001$ ). It is therefore apparent that lower post-operative pain was strongly associated with monopolar diathermy excision.

Oedema was minimal on both sides at follow-up. The frequency of each category of eschar grading by tonsillectomy method is shown in Table II. Grade 3 eschar was infrequent and only occurred after bipolar surgery.

The odds ratio for the bipolar diathermy side, relative to an eschar grading of 0, was 3.3 (95 per cent CI 0.6–18.3) for eschar grade 1 and 1.8 (95 per

TABLE II  
FREQUENCY OF ESCHAR GRADE BY MODE OF EXCISION

Bipolar	0	1	2 or 3	Total
Monopolar 0	1	2	3 (0)	6
1	1	5	15 (4)	21
2	1	8	6 (1)	15
Total	3	15	24	42

The frequencies given in brackets are those patients who had eschar grade 3 on the bipolar side

cent CI 0.3–9.9) for grade 2 or 3 (using a conditional logistic regression for 1:1 matching). Overall the results suggest that higher eschar grading was associated with the bipolar side for, while 10 patients had more eschar on the monopolar side, 21 had more on the bipolar side (no difference was observed for the remaining 11 cases). These differences just fail to attain statistical significance (sign test,  $p = 0.07$ ).

These results suggest that, while there is frequently less eschar on the monopolar side and the most pronounced eschar tends to follow bipolar surgery, the small numbers in each subgroup prohibits detection of a significant association between eschar grading and surgical method.

### Discussion

The two most common post-operative complications following tonsillectomy are haemorrhage and pain (Bluestone, 1977; Husband and Davis, 1996). To the patient post-operative pain is the most significant subjective symptom and the degree of pain must be related to the degree of soft tissue damage. In turn if this is associated with a degree of oral stasis then this predisposes to infection with further pain and an enhanced risk of secondary haemorrhage (Choy and Su, 1992).

It has been suggested that the use of diathermy to perform the dissection or to achieve haemostasis during tonsillectomy is more hazardous than conventional methods employing blunt dissection as it risks damaging adjacent structures (Goycoolea *et al.*, 1982; Weimert *et al.*, 1990; Choy and Su, 1992). Some authors have also reported heightened pain and delayed healing as well as an increased risk of haemorrhage following its use (Kristensen and Tveteras, 1984; Handler *et al.*, 1986) although these conclusions have been refuted by others (Mann *et al.*, 1984; Weimert *et al.*, 1990).

The microdissection needle used in this study is extremely sharp and is made of tungsten which has a high melting point (3410° C). The tip is said to resist deformation and blunting at high temperatures and the needle produces a stable high intensity point of heat at low wattage with a clean microcut and significantly less tissue charring and collateral damage than conventional monopolar cautery (Farnworth *et al.*, 1993). Using this needle for tonsillectomy therefore appears to overcome the disadvantages of conventional standard monopolar needles. Such a hypothesis was observed in practice for we consistently noted that the adjacent constrictor muscle appeared remarkably undamaged during the surgical procedure when compared to the side where the tonsillectomy was performed by bipolar dissection. This subjective impression of reduced tissue damage was re-inforced by the post-operative pain scores and was also hinted at by the reduction in degree of eschar formation which was commonly noted.

The only potential disadvantage to the technique in the routine case was that dissection with the needle must be careful and somewhat deliberate. Moreover, vessels must be adequately and carefully coagulated prior to cutting if bleeding is to be controlled for, once established, intra-operative haemorrhage is more difficult to control using the microdissection needle because of the low power settings used. It is also difficult to dissect when tissue planes are obliterated since tactile feedback is lowered and the cut produced does not naturally follow any tissue plane. However, this is also often true for dissection using bipolar forceps and it was for this reason that we found it difficult to use either method when we encountered a case where the peritonsillar space was unexpectedly obscured with fibrous tissue.

### Conclusion

We have found that tonsillectomy using a microdissection needle with a monopolar current is a practical method of removing the tonsils. Dissection is precise and the method is effective in controlling intra-operative bleeding and does not result in an enhanced risk of reactionary or secondary haemorrhage. It subjectively produces significantly less tissue damage at the time of surgery than bipolar excision and there is less post-operative pain.

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