Radiofrequency coblation tonsillectomy

Radiofrequency coblation is a new technology that is finding favour as a method for performing tonsillectomy. Its benefits include reduced pain and postoperative morbidity but there is controversy regarding possible increased postoperative haemorrhage rates.

Radiofrequency coblation is a new surgical technology that is increasingly being used for a variety of surgical procedures. It is a non-heat driven process where radiofrequency energy is applied to a conductive medium (usually saline) causing a localized plasma field around electrodes, breaking molecules into inert low molecular weight gasses (Sergeev and Belov, 2003). Whereas conventional diathermy produces temperatures over 400°C (Wiatrak and Willging, 2002) coblation produces tissue destruction with minimal energy scatter at a low temperature (approximately 60–70°C), resulting in little adjacent tissue damage (Chinpairoj et al, 2001). Despite the low temperatures, small blood vessels are sealed by the process, producing minimal haemorrhage and minimizing morbidity (Sergeev and Belov, 2003). It became commercially available in 1995 and is now used extensively in ear, nose and throat (ENT), as well as cardiac surgery, orthopaedics, spinal surgery, cosmetic and restorative surgery (Sergeev and Belov, 2003). This article reviews the use of radio-frequency coblation for tonsillectomy.

Tonsillectomy

Tonsillectomy remains one of the most common ENT procedures performed (Timms and Temple, 2002) with over 50 000 tonsillectomies being performed in English NHS trusts in 2003/4 (Brown et al, 2005). The first description of a tonsillectomy was recorded in the first century AD by Cornelius Celsus where he described blunt removal of the infected tonsils with a finger (Curtin, 1987). Since that time there has been an evolution of accepted techniques with the most significant advances following the advent of modern anaesthesia and airway protection during dissection.

The traditional dissection or 'cold steel' technique is the method to which others have always been compared. Many papers have studied monopolar and bipolar diathermy, the harmonic scalpel, sub-total tonsil reduction and other techniques, with respect to their effects on postoperative morbidity (Leach et al, 1993; Moralee et al, 1994; Nandapalan and McIlwain, 1995; Toma et al, 1995; Murthy and Laing, 1998; Warnock and Lander, 1998). In the UK, there are many different techniques practised with respect to tonsillectomy. The cold-steel technique seems to be falling from favour, with only 10% of tonsillectomies being performed using dissection and ties only for haemostasis (Timms, 2004; Brown et al, 2005). The majority of cases are now performed using cold dissection with bipolar diathermy to control bleeding vessels (Lowe et al, 2004).

Postoperative pain remains as the biggest concern to both parents and patients following tonsillectomy (Warnock and Lander, 1998). This pain is often present for more than 7 days with patients frequently requiring visits to their GP between days 4–7 with concerns over pain levels and poor oral intake (Warnock and Lander, 1998). Using standard techniques, there is also some evidence that pain levels actually increase between days 3–5 (Timms and Temple, 2002). The exact reasons for this remain unclear although it has been hypothesized that it is as a result of contraction of the exposed pharyngeal constrictor muscle fibres. The resultant poor oral intake may necessitate readmission to hospital for intravenous fluids and rehydration.

Any new technique that reduces postoperative pain following tonsillectomy stands to make a huge impact on the quality of life of a massive number of patients each year. Earlier return to work for adult patients and carers also has epidemiological and economic benefits to society. Health-care providers also need to weigh up the increased costs of new technology, especially where disposable equipment is required. In many areas of the world, however, the issue of prion exposure is a concern that encourages the use of disposable instruments (Hopkins et al, 2003) and the increased cost is slightly less relevant.

Radiofrequency coblation was first used for tonsillectomy in 1997 (Timms, 2004). There is an increasing pool of evidence regarding coblation tonsillectomy, with 5% of all UK tonsillectomies now being performed by this method (Brown et al, 2005). There are many areas of controversy, not least the issue of postoperative haemorrhage rates.

Coblation tonsillectomy technique

The disposable coblation probe consists of a series of alloy electrodes on the tip of the wand (*Figure 1*). An irrigation sheath (*Figure 2*) allows a constant flow of saline (which should be chilled in the fridge to further reduce tissue temperatures) over the electrodes. A suction channel clears excessive saline from the field. A standard Boyle–Davis tonsillectomy gag is used and the tonsil is pulled medially by Dennis–Brown forceps or another instrument, accord-

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Figure 1. Coblation wand tip electrodes.

ing to personal preference. Experienced surgeons recommend the use of an operating microscope or surgical loupes (*Figure 3*) to allow better visualization of the fibres surrounding the tonsil capsule (Timms, 2004).

The coblation setting can be varied according to preference but most individuals use a power setting of 7. Early coblation wands did not allow separate adjustment to the coblation and coagulation settings but new units and wands now allow individual control of both settings (*Figure 4*) and also have the advantage of only irrigating the wand tip when the coblation probe is active, thus minimizing the need to frequently clear the tonsil bed of pooled saline. New probes have been released which include a disposable cord, avoiding the need for reusable cables to be sterilized between procedures.

Figure 2. Coblation wand with irrigation sheath.

Figure 3. Coblation tonsillectomy performed with the aid of surgical loupes for magnification.

It is important to angle the tip of the wand to reduce the 'footprint' of the electrodes on the tissue and a 'feather-touch' technique is advocated. These little pearls of operative wisdom make a huge difference with regards to tissue trauma (*Figure 5*) and consequent postoperative pain (Timms, 2004). The low temperatures produced by coblation theoretically reduce damage to the pharyngeal constrictor muscles and minimize postoperative trismus. The trismus is hypothesized to be responsible for much of the pain following tonsillectomy and reducing pain therefore allows for an earlier return to normal diet and activities (Timms and Temple, 2002).

Figure 4. Foot pedal control of coblation wand and settings.

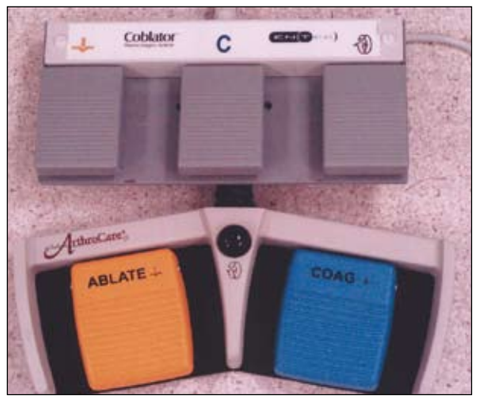

Figure 5. Typical intraoperative appearance of the tonsillar fossa when using the coblation tonsillectomy method.

Postoperative outcomes

In a randomized group of paediatric tonsillectomy patients, coblation (over bipolar dissection) produced a marked reduction in analgesic requirements, pain scores (e.g. 3.2 *vs* 7.2 visual analogue scale at day 3) and improved healing when the tonsil fossae were examined at day 9 (Temple and Timms, 2001). Other groups have reproduced these findings in paediatric patients, again showing less pain, with most parents describing the postoperative pain of their child as 'better than expected' (Stoker et al, 2004). In adult patients, when one tonsil was removed normally and the other using coblation, pain scores were far lower for coblation and healing was accelerated with the tonsil fossae showing less granulation tissue when examined on day 9 following surgery (Timms and Temple, 2002).

In a study of 101 children, return to '70% of normal activity' occurred earlier in the coblation group and analgesia requirements at day 5 were less than in the standard tonsillectomy patients (Chang, 2005). However, not all studies have produced such dramatic results. A study comparing coblation and traditional methods found no significant differences in postoperative pain, otalgia, swallowing or analgesia use, although the exact methodology used to obtain haemostasis in the 'traditional' group was not defined in the paper (Philpott et al, 2005). If ties were used, as opposed to diathermy, lower levels of postoperative pain would be expected as there is a well-established link between the use of diathermy and increased postoperative pain (Murthy and Laing, 1998). There also does not appear to be any major advantage of 'tonsillotomy' (where the capsule is left intact) over total coblation tonsillectomy (Arya et al, 2003).

Haemorrhage rates

Delayed postoperative haemorrhage usually occurs between days 5–10 (Alexander et al, 2004). This may be precipitated by dehydration or an infection in the tonsil bed where there is disruption of the healing process and surface blood vessels are exposed (Alexander et al, 2004). There has been some concern that coblation may actually produce an increase in the rates of postoperative haemorrhage.

A study of coblation *vs* diathermy dissection suggested a significantly higher postoperative haemorrhage rate in the coblation group (22.2% *vs* 3.4%) (Noon and Hargreaves, 2003), although there were only 36 patients in the coblation group and it is now well recognized that there is a significant learning curve while a surgeon becomes familiar with the coblation wand (Timms et al, 2004). More worrying are the results collected from the large UK National Prospective Tonsillectomy Audit of 33 921 patients (Brown et al, 1995), which showed postoperative bleed rates of 1.7% with cold dissection, 2.7% for cold dissection and bipolar diathermy, 4.6% for bipolar diathermy dissection, 6.6% for monopolar diathermy dissection and 4.6% for coblation. These data were derived from readmitted patients within 28 days of the initial procedure. These findings have not been constant and a large study from the USA showed no difference in postoperative haemorrhage rates when coblation was compared to standard techniques (Divi and Benninger, 2005). Data from the UK's most experienced coblation tonsillectomist only showed a 2.9% bleed rate (Belloso et al, 2003).

The discrepancy between these studies is difficult to explain but it may well be that a proportion of cases of minor bleeding not requiring admission to hospital were not included in the UK data for 'cold-steel' procedures as routine specialist tonsillectomy follow up is not normally performed in the NHS. However, many surgeons follow up their cases of coblation tonsillectomy because of their curiousity regarding the potential benefits of this new technique. This introduces a potential source of error in the UK audit figures. Surgical technique may also be relevant and further long-term studies of the learning curve in coblation tonsillectomy and its effects on bleed rates need to be performed before this matter can be finally put to rest.

Conclusions

Radiofrequency coblation tonsillectomy is a relatively new technique, which is increasing in favour among the ENT community, currently used in 5% of all tonsillectomies. Most studies are consistent in reporting lower levels of postoperative pain and analgesic requirements, which may significantly improve the quality of life of these patients and allow earlier return to work and regular activities. The main concern with this technique is the apparent increase in postoperative haemorrhage rates. As with any new surgical technique, there is a learning curve where less experienced surgeons may experience more complications, however, more studies are required to settle this issue. BJHM

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Alexander RJ, Kukreja R, Ford GR (2004) Secondary post-tonsillectomy haemorrhage and informed consent. *J Laryngol Otol* **118:** 937–40
Arya A, Donne AJ, Nigam A (2003) Double-blind randomized controlled study of coblation tonsillotomy versus coblation tonsillectomy on postoperative pain. *Clin Otolaryngol Allied Sci* **28:** 503–6
Belloso A, Chidambaram A, Morar P et al (2003) Coblation tonsillectomy versus dissection tonsillectomy: postoperative hemorrhage. *Laryngoscope* **113:** 2010–13
Brown P, Ryan R, Yung M et al (1995) *National Prospective Tonsillectomy Audit.* British Association of Otolaryngology - Head & Neck Surgeons Comparative Audit Group and Clinical Effectiveness Unit Royal College of Surgeons England, London
Chang KW (2005) Randomized controlled trial of Coblation versus electrocautery tonsillectomy. *Otolaryngol Head Neck Surg* **132:** 273–80
Chinpairoj S, Feldman MD, Saunders JC et al (2001) A comparison of monopolar electrosurgery to a new multipolar electrosurgical system in a rat model. *Laryngoscope* **111:** 213–17
Curtin JM (1987) The history of tonsil and adenoid surgery. *Otolaryngol Clin North Am* **20:** 415–19

KEY POINTS

- Tonsillectomy is a common ear, nose and throat procedure which is associated with significant postoperative morbidity.
- Radiofrequency coblation tonsillectomy causes less collateral tissue damage as a result of the low temperatures used compared with other electrosurgical methods.
- Lower postoperative pain scores with this technique result in earlier return to normal activities with potential quality of life and economic benefits.
- The trend for the use of disposable instruments and prevention of prion disease transmission makes the coblation method attractive.
- Higher postoperative haemorrhage rates have been reported with the coblation technique compared to most other accepted methods for performing tonsillectomy, but the discrepancies between studies require further investigation into this complication.

Divi V, Benninger M (2005) Postoperative tonsillectomy bleed: coblation versus noncoblation. *Laryngoscope* **115:** 31–3
Hopkins C, Geyer M, Topham J (2003) Post-tonsillectomy haemorrhage: a 7-year retrospective study. *Eur Arch Otorhinolaryngol* **260:** 454–5
Leach J, Manning S, Schaefer S (1993) Comparison of two methods of tonsillectomy. *Laryngoscope* **103:** 619–22
Lowe D, Van der Meulen J, Brown P et al (2004) Tonsillectomy technique as a risk factor for postoperative haemorrhage. *Lancet* **364:** 697–702
Moralee SJ, Carney AS, Cash MP et al (1994) The effect of fibrin sealant haemostasis on post-operative pain in tonsillectomy. *Clin Otolaryngol* **19:** 526–8
Murthy P, Laing MR (1998) Dissection tonsillectomy: pattern of post-operative pain, medication and resumption of normal activity. *J Laryngol Otol* **112:** 41–4
Nandapalan V, McIlwain JC (1995) Tonsillar fossa obliteration and post-operative pain. *Clin Otolaryngol Allied Sci* **20:** 127–9
Noon AP, Hargreaves S (2003) Increased post-operative haemorrhage seen in adult coblation tonsillectomy. *J Laryngol Otol* **117:** 704–6
Philpott CM, Wild DC, Mehta D et al (2005) A double-blinded randomized controlled trial of coblation versus conventional dissection tonsillectomy on post- operative symptoms. *Clin Otolaryngol Allied Sci* **30:** 143–8
Sergeev VN, Belov SV (2003) Coblation technology: a new method for high-frequency electrosurgery. *Biomed Eng* **37:** 22–5
Stoker KE, Don DM, Kang DR et al (2004) Pediatric total tonsillectomy using coblation compared to conventional electrosurgery: a prospective, controlled single-blind study. *Otolaryngol Head Neck Surg* **130:** 666–75
Temple RH, Timms MS (2001) Paediatric coblation tonsillectomy. *Int J Pediatr Otorhinolaryngol* **61:** 195–8
Timms MS (2004) Coblation tonsillectomy: a personal view. *ENT News* **13:** 5–7
Timms MS, Temple RH (2002) Coblation tonsillectomy: a double blind randomized controlled study. *J Laryngol Otol* **116:** 450–2
Timms MS, Belloso A, Morar P et al (2004) Increased post-operative haemorrhage seen in adult coblation tonsillectomy. *J Laryngol Otol* **118:** 247–8
Toma AG, Blanshard J, Eynon-Lewis N et al (1995) Post-tonsillectomy pain: the first ten days. *J Laryngol Otol* **109:** 963–4
Warnock FF, Lander J (1998) Pain progression, intensity and outcomes following tonsillectomy. *Pain* **75:** 37–45
Wiatrak BJ, Willging JP (2002) Harmonic scalpel for tonsillectomy. *Laryngoscope* **112:** 14–16