

# COBLATION<sup>®</sup> Intracapsular Tonsillectomy compared with other tonsillectomy techniques: a systematic literature review and meta-analysis<sup>1</sup>

## Summary

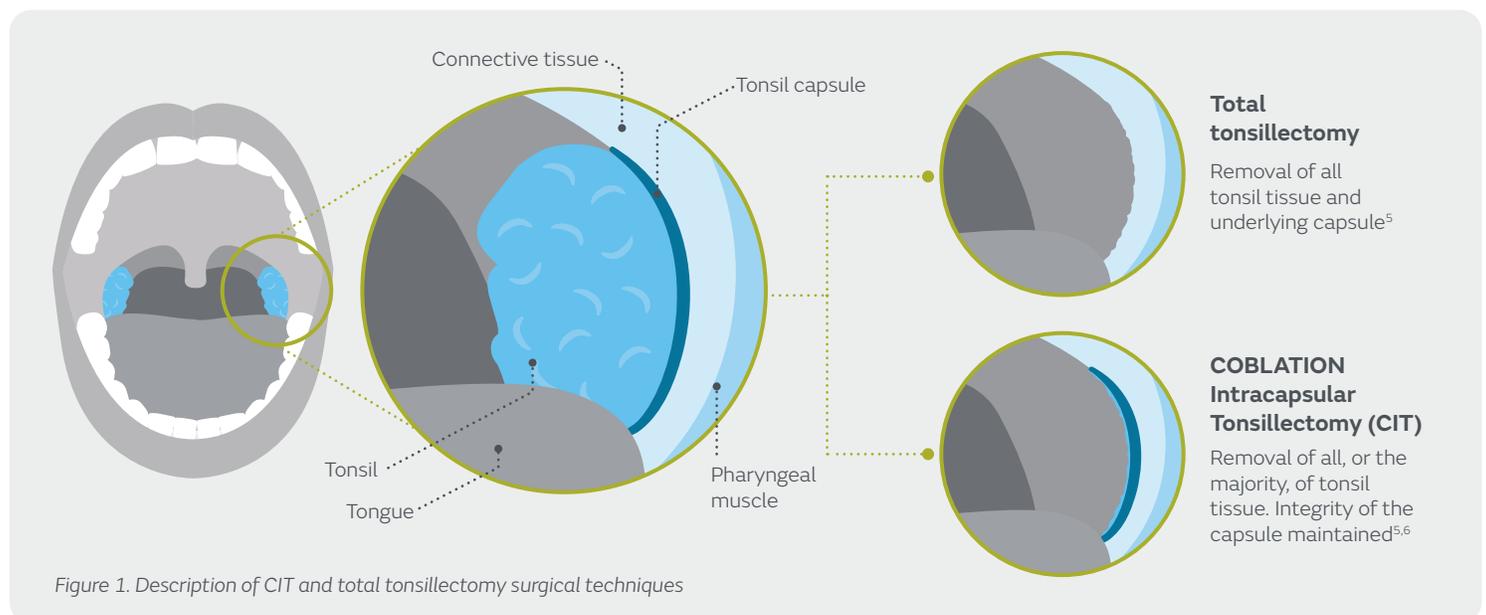
- COBLATION Intracapsular Tonsillectomy (CIT) has been proposed to improve postoperative recovery compared with total tonsillectomy<sup>2-4</sup>
- This systematic literature review and meta-analysis evaluated the outcomes of CIT in comparative studies versus other tonsillectomy techniques
- Results showed that CIT offered significant improvements in postoperative morbidity compared with total tonsillectomy, including reduced pain and faster return to normal activity and diet, while maintaining the efficacy of the procedure

## Introduction

Total tonsillectomy, involving the removal of all tonsil tissue and the underlying capsule (Figure 1), has traditionally represented the standard surgical treatment for obstructive sleep apnoea and recurrent tonsillitis.<sup>5</sup> However, intracapsular tonsillectomy, involving removal of all or the majority of tonsil tissue but maintaining the integrity of the underlying capsule,<sup>5,6</sup> is becoming more popular and now accounts for 20% of paediatric tonsillectomies in the USA.<sup>7</sup>

COBLATION Technology can be used to ablate tissue during an intracapsular tonsillectomy in a procedure termed CIT (Figure 1). CIT has been proposed to reduce postoperative morbidity compared with traditional total tonsillectomy.<sup>2-4</sup> Some authors have suggested that residual tissue preserved in intracapsular tonsillectomy techniques such as CIT may act as a 'biological dressing' to protect the underlying pharyngeal musculature (Figure 1) and reduce postoperative pain.<sup>8,9</sup>

This systematic literature review and meta-analysis evaluated the postoperative outcomes of CIT in comparative studies versus other tonsillectomy techniques.



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### Methods

#### Literature search

A systematic literature search was conducted to identify comparative studies evaluating CIT and other tonsillectomy techniques. Articles were screened for suitability according to the inclusion and exclusion criteria outlined in Figure 2.

CIT was defined as a clear intention to remove all or the majority of tonsil tissue whilst maintaining the integrity of the underlying capsule.<sup>6</sup>

#### Data extraction

Data including study and patient characteristics, procedural information and clinical outcomes were extracted from relevant articles. Key outcomes of interest included postoperative pain, time taken to pain free and analgesia free, time taken to return to normal activity and diet, efficacy and post-tonsillectomy haemorrhage rates.

#### Meta-analysis

Meta-analyses were performed for variables of interest between experimental and control procedures. For further details on meta-analysis methods, see Appendix 1.

### Results

#### Literature identified

Initial searches identified 1,171 articles. Following screening, 13 relevant studies<sup>8-20</sup> were included in the analysis (Figure 3).

In all studies, CIT was compared with total tonsillectomy, and one study<sup>9</sup> also included an arm for intracapsular tonsillectomy with a microdebrider (n=53). All meta-analyses compared CIT with total tonsillectomy.

Further details on the characteristics of included studies are provided in Appendix 2.

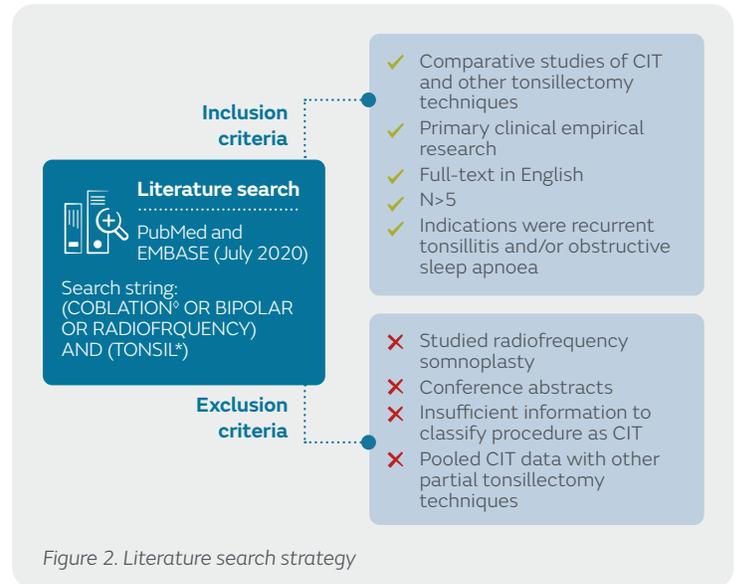


Figure 2. Literature search strategy

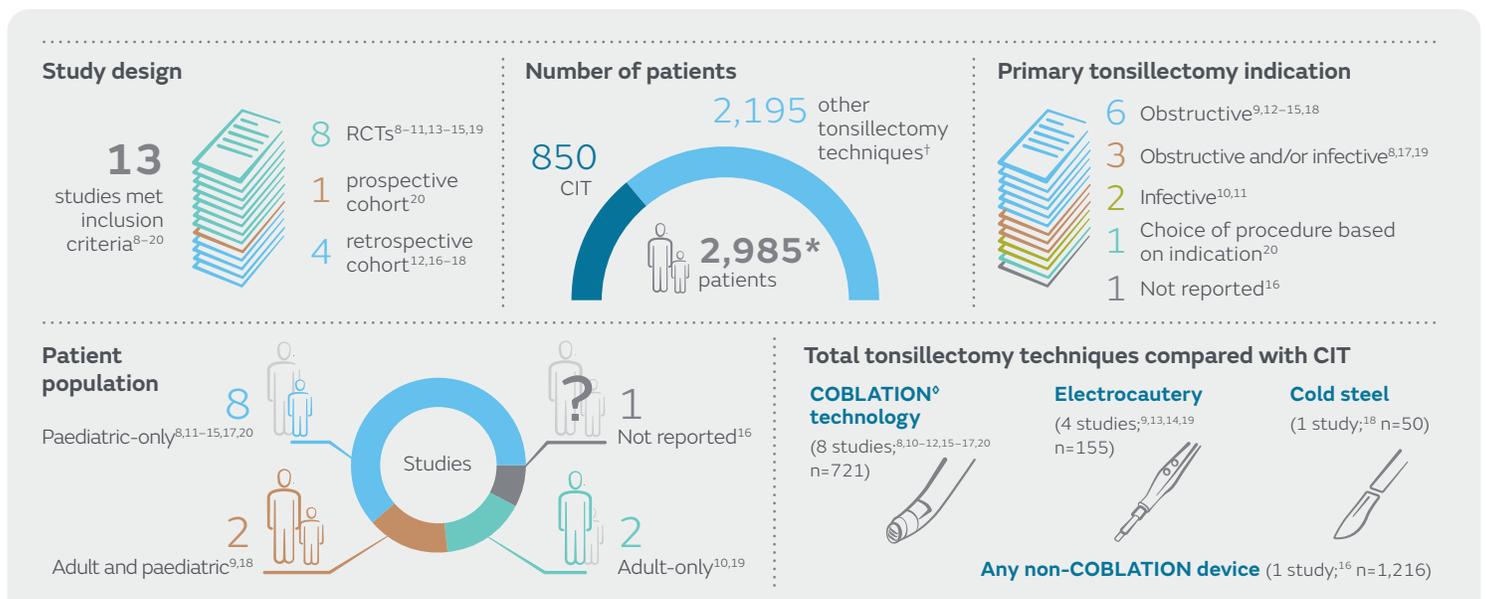


Figure 3. Overview of study characteristics

\*Total number of patients does not equal the sum of the number of patients undergoing CIT and other tonsillectomy techniques, as patients in three studies underwent procedures on both tonsils, with a different technique on each, and were counted once in this total. †Comprises patients undergoing total tonsillectomy (n=2,142) and intracapsular tonsillectomy with a microdebrider (n=53). CIT = COBLATION Intracapsular Tonsillectomy; RCT = randomised controlled trial.

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### Results (cont.)

#### Pain

##### Absolute pain

Ten studies<sup>8,10-12,14,15,17-20</sup> (n=701) reported on absolute pain scores. All studies found lower pain scores for CIT at one or more follow-up visit. Meta-analyses were conducted to evaluate postoperative pain scores at 1 day (within the first 24 hours), 1 week (between 5 and 8 days) and 2 weeks.

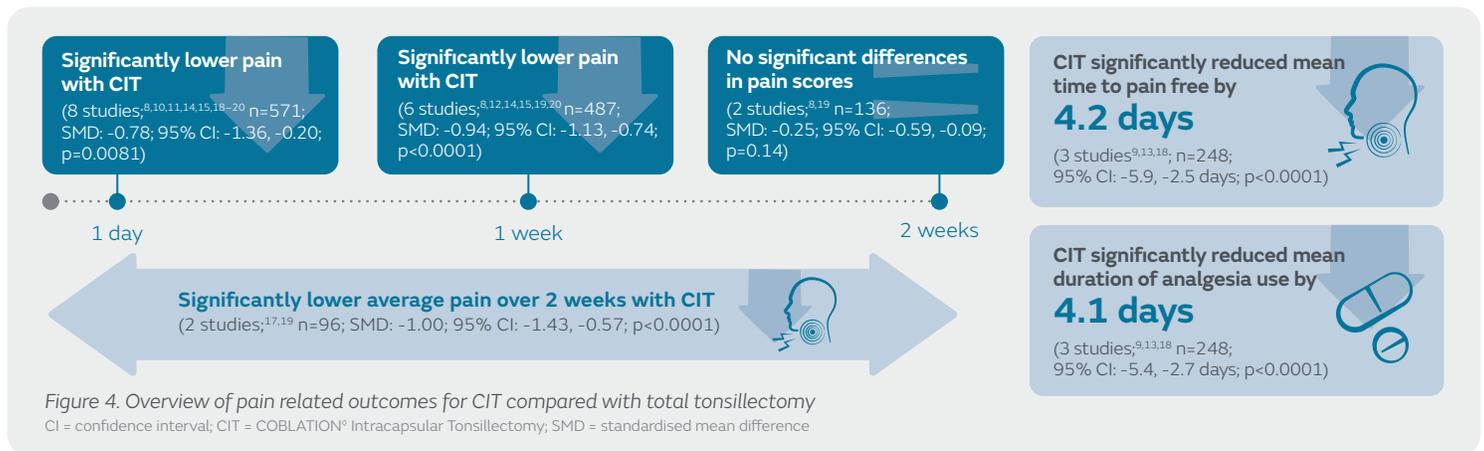
Pain scores at 1 day and 1 week were significantly lower for CIT when compared with total tonsillectomy (p=0.0081 and p<0.0001, respectively; Figure 4). While there was no significant difference in pain score at 2 weeks (p=0.14; Figure 4), average pain over 2 weeks was significantly lower for CIT (p<0.0001; Figure 4).

##### Time to pain free and analgesia free

Three studies<sup>9,13,18</sup> (n=248) reported on time to pain free and analgesia free. All studies found significantly faster time to both pain and analgesia free for CIT compared with total tonsillectomy.

In the meta-analysis, CIT significantly reduced time to pain free by a mean of 4.2 days (p<0.0001; Figure 4) and time to analgesia free by a mean of 4.1 days (p<0.0001; Figure 4).

Three additional studies<sup>12,14,15</sup> (n=250) reported other analgesia-related outcomes, including the proportion of patients requiring analgesia and analgesia use at specific time points postoperatively. Two studies<sup>12,15</sup> reported significant improvements with CIT, while another<sup>14</sup> reported no significant differences between CIT and total tonsillectomy with COBLATION<sup>®</sup> but did not provide quantitative data.



#### Return to normal

##### Activity

Three studies<sup>9,13,18</sup> (n=248) reported on time to return to normal activity for CIT compared with total tonsillectomy, and all studies reported this to be significantly faster for the former.

In the meta-analysis, CIT significantly reduced time to return to normal activity by a mean of 2.8 days (p<0.0001; Figure 5).

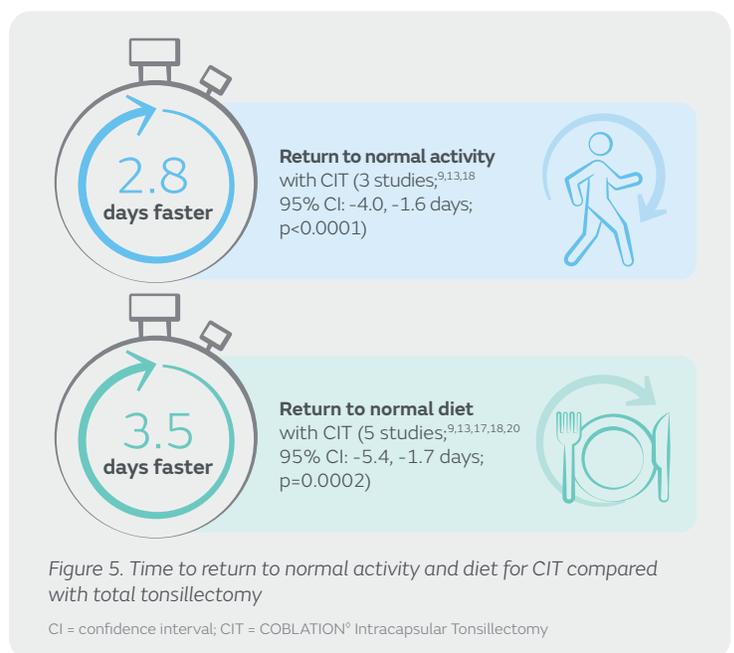
Two additional studies<sup>14,15</sup> (n=101) reported that more patients were able to return to activity at specific time points following CIT compared with total tonsillectomy.

##### Diet

Five studies<sup>9,13,17,18,20</sup> (n=400) reported on time to return to normal diet for CIT compared with total tonsillectomy.

In the meta-analysis, CIT significantly reduced time to return to normal diet by a mean of 3.5 days (p=0.0002; Figure 5).

Three additional studies<sup>12,14,15</sup> (n=181) reported that more patients were able to return to normal diet at specific time points following CIT compared with total tonsillectomy.



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### Efficacy

Two studies<sup>12,13</sup> (n=135) reported on outcomes related to the efficacy of surgical procedures to treat obstructive sleep apnoea or obstructive tonsillar hypertrophy. No significant differences between CIT and total tonsillectomy for any efficacy outcome measures were observed (Table).

Table. Efficacy outcomes

Study	Comparator	Efficacy measure	Results
Braverman et al. (2015) <sup>12</sup>	Total tonsillectomy using COBLATION <sup>o</sup> technology	<ul style="list-style-type: none"><li>OSA-18 score</li><li>Freedom from obstructive sleep apnoea symptoms</li></ul>	<ul style="list-style-type: none"><li>Similar mean postoperative OSA-18 scores (CIT: 25.5; total COBLATION tonsillectomy: 24.6)</li><li>All patients free from OSA symptoms with both techniques</li></ul>
Chan et al. (2004) <sup>13</sup>	Total tonsillectomy using electrocautery	<ul style="list-style-type: none"><li>Recurrence of obstructive symptoms</li></ul>	<ul style="list-style-type: none"><li>No significant difference in improvements in obstructive symptoms at 3 or 12 months postoperatively</li></ul>

### Complications - post tonsillectomy haemorrhage (PTH)

The incidence of PTH was reported in ten studies,<sup>9–11,13–19</sup> though two of these studies<sup>10,11</sup> did not provide sufficient information to compare rates between techniques.

A tendency for lower risk of PTH was observed with CIT compared with total tonsillectomy, though this was not statistically significant for total PTH rates (7 studies;<sup>13–19</sup> n=2,544; relative risk [RR]: 0.78; 95% confidence interval [CI]: 0.50, 1.20; p=0.2614) or total PTH rates requiring operating room management (6 studies;<sup>9,14,15,17–19</sup> n=824; RR: 0.38; 95% CI: 0.08, 1.80; p=0.2207).

### Other complications

Eight studies<sup>9,12–15,17,18,20</sup> reported complications other than PTH. One of these studies<sup>17</sup> did not provide sufficient information to determine which procedure the events were associated with.

Across all techniques the most commonly reported complications were dehydration, nausea, fever and infection. Complication rates between CIT and total tonsillectomy were similar in four studies<sup>9,14,15,18</sup> and lower for CIT in three studies.<sup>12,13,20</sup>

### Conclusion

This meta-analysis of comparative studies demonstrates that CIT leads to reduced postoperative morbidity compared with total tonsillectomy, including reduced pain and faster return to activity, while maintaining the efficacy of the procedure.

### Considerations

Although there was a tendency for PTH rates to be lower for CIT compared with total tonsillectomy, the difference was not statistically significant. This may be the result of the relatively small patient sample sizes of included comparative studies, limiting the power to detect changes in PTH rates. CIT case series with large cohorts have demonstrated lower PTH rates than have been previously described for total tonsillectomy.<sup>2,3,21</sup>

No study included in the systematic literature review was identified to be at high risk of bias, despite most included comparative studies being of relatively small size.

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### References

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### Appendix 1. Details of the methodology for data synthesis and meta-analysis

Meta-analyses were performed in R (statistical software) for comparisons of variables of interest between the experimental and control procedures. For binomial outcomes, a RR with a 95% CI was reported as the summary statistic. For continuous outcomes, a mean difference (if reported on the same scale) or standardised mean difference using Hedges g correction (if reported on different scales) with a 95% CI was reported as the summary statistic. Heterogeneity of included studies was assessed using the  $I^2$  statistic; the fixed effect model was utilised when  $I^2 < 50\%$  and the random effects model when  $I^2 > 50\%$ .

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Appendix 2. Details of studies identified via systematic literature review

Level 1: Randomised controlled trial	Level 2: Prospective, comparative	Level 3: Retrospective comparative	Study, year	Control procedure(s)	Number of patients			Indication(s)	Population	Mean age (years)	Outcomes reported
					Overall	CIT	Control(s)				
			Arya et al. 2003 <sup>10</sup>	Total COBLATION <sup>®</sup> tonsillectomy	14*	14	14	Infective	Adult	Overall: 31.9	<ul style="list-style-type: none"> <li>Absolute pain at Day 1</li> </ul>
			Arya et al. 2005 <sup>11</sup>	Total COBLATION tonsillectomy	18*	18	18	Infective	Paediatric	Overall: 9	<ul style="list-style-type: none"> <li>Absolute pain at Day 1</li> </ul>
			Chan et al. 2004 <sup>13</sup>	Total tonsillectomy using electrocautery	55	27	28	Obstructive with no history of recurrent tonsillitis	Paediatric	CIT: 6.4 Total: 5.9	<ul style="list-style-type: none"> <li>Time to pain free and duration of analgesia use</li> <li>Time to return to normal activity</li> <li>Time to return to normal diet</li> <li>Total incidence of PTH</li> </ul>
			Chang et al. 2005 <sup>14</sup>	Total tonsillectomy using electrocautery	101	52	49	Obstructive with no history of recurrent tonsillitis	Paediatric	CIT: 6.4 Total: 6.2	<ul style="list-style-type: none"> <li>Absolute pain at Day 1 and Week 1</li> <li>Total incidence of PTH</li> <li>Incidence of PTH requiring OR management</li> </ul>
			Chang et al. 2008 <sup>15</sup>	Total COBLATION tonsillectomy	69	34	35	Obstructive with no history of recurrent tonsillitis	Paediatric	CIT: 6.2 Total: 6.1	<ul style="list-style-type: none"> <li>Absolute pain at Day 1 and Week 1</li> <li>Total incidence of PTH</li> <li>Incidence of PTH requiring OR management</li> </ul>
			Hall et al. 2004 <sup>19</sup>	Total tonsillectomy using electrocautery	28*	28	28	Obstructive and/or infective	Adult	NR	<ul style="list-style-type: none"> <li>Absolute pain at Day 1, Week 1 and Week 2</li> <li>Average pain over 2 weeks</li> <li>Total incidence of PTH</li> <li>Incidence of PTH requiring OR management</li> </ul>
			Lu et al. 2017 <sup>8</sup>	Total COBLATION tonsillectomy	90	48	42	Obstructive and/or infective	Paediatric	Overall: 5.3	<ul style="list-style-type: none"> <li>Absolute pain at Day 1, Week 1 and Week 2</li> </ul>
			Wilson et al. 2009 <sup>9</sup>	Intracapsular tonsillectomy using microdebrider Total tonsillectomy using electrocautery	156	53	53 (intracapsular microdebrider) 50 (total tonsillectomy)	Obstructive with no history of recurrent tonsillitis	Adult & paediatric	CIT: 5.8 <sup>†</sup> Intracapsular microdebrider: 6.1 <sup>†</sup> Total: 6.3 <sup>†</sup>	<ul style="list-style-type: none"> <li>Time to pain free and duration of analgesia use</li> <li>Time to return to normal activity</li> <li>Time to return to normal diet</li> <li>Incidence of PTH requiring OR management</li> </ul>
			Junaid et al. 2019 <sup>20</sup>	Total COBLATION tonsillectomy	101	23	78	Obstructive and/or infective (tendency for experimental to be only used on obstructive)	Paediatric	NR	<ul style="list-style-type: none"> <li>Absolute pain at Day 1 and Week 1</li> <li>Time to return to normal diet</li> </ul>
			Braverman et al. 2015 <sup>12</sup>	Total COBLATION tonsillectomy	80	43	37	Obstructive with (control) or without (CIT) history of recurrent tonsillitis	Paediatric	CIT: 4 <sup>†</sup> Total: 5 <sup>†</sup>	<ul style="list-style-type: none"> <li>Absolute pain at Week 1</li> </ul>
			Divi et al. 2005 <sup>16</sup>	Total COBLATION tonsillectomy Total tonsillectomy using devices other than COBLATION	1,758	303	239 (COBLATION) 1,216 (non-COBLATION)	NR	NR	NR	<ul style="list-style-type: none"> <li>Total incidence of PTH</li> </ul>
			Duarte et al. 2014 <sup>17</sup>	Total COBLATION tonsillectomy	415	157	258	Obstructive and/or infective	Paediatric	Overall: 6.7	<ul style="list-style-type: none"> <li>Average pain over 2 weeks</li> <li>Time to return to normal diet</li> <li>Total incidence of PTH</li> <li>Total incidence of PTH requiring OR management</li> </ul>
			Friedman et al. 2003 <sup>18</sup>	Total tonsillectomy using cold steel	100	50	50	Obstructive without history of recurrent tonsillitis	Adult & paediatric	CIT (adult): 31.1 Total (adult): 27.2 CIT (paediatric): 6.3 Total (paediatric): 4.2	<ul style="list-style-type: none"> <li>Absolute pain at Day 1</li> <li>Time to pain free and duration of analgesia use</li> <li>Time to return to normal activity</li> <li>Time to return to normal diet</li> <li>Total incidence of PTH</li> <li>Incidence of PTH requiring OR management</li> </ul>

\*In this study, each patient underwent both intracapsular and total tonsillectomy, with a different technique used on each tonsil. For each patient, data from both tonsils were included in meta-analyses. <sup>†</sup>Represents median patient age. CIT = COBLATION<sup>®</sup> Intracapsular Tonsillectomy; NR = not reported; OR = operating room; PTH = post-tonsillectomy haemorrhage.