

# Effectiveness and safety of radiofrequency tonsils reduction in pediatric obstructive sleep apnea

## Abstract

**Objective:** Adenotonsillectomy is a well-accepted option for treatment of pediatric obstructive sleep apnea (OSA). This study pretends to evaluate the effectiveness and safety of radiofrequency tonsils reduction in surgical treatment of pediatric OSA.

**Study design:** Retrospective study evaluating tonsils reduction after surgical treatment of pediatric OSA patients submitted to radiofrequency tonsils reduction and adenoidectomy.

**Subjects and methods:** A retrospective cohort study, including children diagnosed with: OSA, tonsils hypertrophy (Brodsky scale  $> 2/2$ ) and apnea-hypopnea index (AHI)  $> 1$  (when polysomnography was made,  $n=50$ ) who were submitted to radiofrequency tonsils reduction associated with classic adenoidectomy between 2011 and 2013 in CUF Descobertas Hospital (Lisbon). Children with recurrent tonsillitis (meeting criteria for tonsillectomy by AAO-HNS guidelines) were excluded. Outcomes measured: 1) variation in pre and postoperative tonsils size (Brodsky scale), maintenance of roncopathy, maintenance or suspicion of apnea (effectiveness outcomes); 2) postoperative hemorrhage, tonsillitis during postoperative follow up (safety outcomes). Data was collected by consulting clinical charts and by telephonic interviews made by an ENT physician. Statistical analysis was made with STATA 13.

**Results:** A population of 64 children was obtained with 22 months of median follow up. The mean age was 4 yo with 56% males. 81.25% had a preoperative Brodsky scale of at least 3/3, and 64% had moderate or severe degree of OSA. A reduction of at least 2 grades between pre and postoperative Brodsky scale was found in 75.41% and the reduction wasn't associated with the follow up time. Postoperative absence of roncopathy and apnea was reported in 93% and 100% of cases, respectively. Postoperative frequency of hemorrhage was 0% and only 3 patients (4.68%) reported tonsillitis episodes.

**Conclusion:** In our series, radiofrequency tonsils reduction proved to be an effective and safe technique in tonsils reduction, and therefore, in OSA pediatric surgical treatment.

**Keywords:** radiofrequency, tonsils reduction, tonsillotomy, pediatric obstructive sleep apnea

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**Abbreviations:** AHI, apnea-hypopnea index; CT, cumulative time; ESPO, european society of pediatric otorhinolaryngology; OSA, obstructive sleep apnea; PSG, polysomnography; SD, standard deviation; YO, years old

## Introduction

Adenotonsillectomy is a well-accepted option for treatment of pediatric obstructive sleep apnea (OSA), which more often is consequence of adenotonsillar hypertrophy causing obstruction to the upper aerodigestive airways. Hence several authors support a reduction of tonsils volume instead of extracapsular tonsillectomy.<sup>1-18</sup> In fact, a shift from tonsillectomy to tonsillotomy already happened in Sweden, where the majority of children presenting tonsils obstructive symptoms are submitted to tonsillotomy.<sup>19</sup>

In tonsils hypertrophy causing upper airway obstruction, partial techniques present several advantages, such as minimum intraoperative hemorrhage, shorter duration of surgery, lower postoperative hemorrhage, lower postoperative pain, lower swallowing and speaking difficulties.<sup>3-7,9,13-16,18</sup> Besides reduction in morbidity, partial tonsillectomy offers improvement in quality of life and satisfaction.<sup>12,17</sup> In terms of outcomes, total and partial techniques seem to be equally effective<sup>4,5,8-11,14-16,18</sup> and safe.<sup>2,3,15,16</sup> Several instruments are available

to perform partial techniques, being the radiofrequency ones very popular. Accordingly to Swedish National Registry for Tonsil Surgery records between 2009 and 2012, radiofrequency was used in 96% of tonsillotomies performed on children for upper airway obstruction (1602 out of 1676); different radiofrequency instruments were used, showing no significant differences on outcome or morbidity (except for number of days on analgesics after surgery which was superior on Coblation®).<sup>1</sup>

In Portugal, although a national survey on tonsils surgery isn't available, there's still a lot of discussion on National Otolaryngology Congresses and Meetings about the effectiveness and safety of partial techniques (tonsillotomy, tonsils reduction or partial tonsillectomy). This study pretends to evaluate the effectiveness and safety of radiofrequency tonsils reduction in surgical treatment of pediatric obstructive sleep apnea.

## Materials and methods

### Study design and setting

We conducted a retrospective cohort study developed at a Portuguese private hospital in Lisbon, Portugal (CUF Descobertas Hospital). It included a pediatric population between 1 and 10 years old, submitted to radiofrequency tonsils reduction associated with

classic adenoidectomy, between January 1st 2011 and December 31st 2013. The study was authorized by the Hospital Ethics Committee.

### Study population

All children were operated on the same hospital, by the same surgeon, with the following eligibility criteria.

**Inclusion criteria:** Children with obstructive sleep apnea (ICD-10 G47.3) Case Definition: Snoring child And Clinical suspicion for OSA and Palatine tonsils hypertrophy (Brotsky scale > 2/2) and/or Apnea-hypopnea index (AHI) > 1.

- Submitted to tonsils reduction with radiofrequency associated with classic adenoidectomy, between January 1st 2011 and December 31st 2013 at CUF Descobertas Hospital (Lisbon)
- Age < 10 years old

### Exclusion criteria

- Children with recurrent tonsillitis (meeting criteria for tonsillectomy by AAO-HNS guidelines), craniofacial abnormalities, neuromotor disease and coagulopathy
- Submitted to extracapsular tonsillectomy or intracapsular tonsilotomy with electrocautery
- No records on clinical charts
- Refuse to respond telephonic questionnaire

Eligible participants meeting at least one exclusion criteria were excluded.

### Data collection and analysis

Data was collected by consulting clinical charts and by telephonic interviews made by an ENT physician. Statistical analysis was made with STATA 13.

### Study outcomes

The outcome measures were classified as effectiveness or safety outcomes.

**Effectiveness outcomes:** Variation in pre and postoperative tonsils size (Brotsky scale), postoperative roncopathy maintenance and postoperative suspicion of apnea.

**Safety outcomes:** Postoperative hemorrhage and tonsillitis during postoperative follow-up.

Outcome variables were obtained from review of clinical charts: tonsils size (Brotsky scale), maintenance of roncopathy, suspicion of apnea, troubled sleeping, postoperative hemorrhage, postoperative tonsillitis or any other complication worth mentioning. Except for tonsils size, which is an objective measure that implies clinical observation, all the other variables were confirmed by a telephonic interview conducted by an ENT doctor trained investigator. To assess possible regrowth of tonsils with time a linear regression model was applied.

## Results and discussion

### Results

We obtained a final population of 64 children (n = 64, out of an 110 initial sample, 40 being excluded for electrocautery intra or extracapsular tonsillectomy and 6 for no clinical records on charts

or lost to follow-up), with median follow up of 22 months (IQR=26 min=1 max=46). The mean age was 4 years old (SD 1.7 YO. min. 1, max. 10), with 56% males (Table 1).

**Table 1** Cohort Characteristics (N = 64)

Gender	% (N)
Female	44
Male	56
Age	Yo
Mean	4,02
S.D	1,79
Min	1
Max	10
Follow-up Time	Months
P50	22
IQR	26
Mean	20,14

Min-Minimum; Max-Maximum; Sd-Standard Deviation; Yo- Years Old; P50-50<sup>th</sup> Percentile; IQR-Interquartile Range

81.25% of the children had a preoperative Brodsky scale of at least 3/3 (Table 2); 94% had a postoperative Brodsky scale of 2/2 or less (Table 3). A moderate or severe degree of OSA (AHI ≥ 5 events per hour) was found in 73% of all children that underwent sleep study (n=50), representing 64% of the sample (Table 2).

**Table 2** Preoperative Variables (N = 64)

Tonsils Size (Brodsky)	% (N)
1-Jan	0
2-Feb	18,75 (12)
3-Mar	51,56 (33)
4-Apr	29,69 (19)
Sleeping Test	% (N)
Yes	78,12 (50)
No	21,88 (14)
Preoperative AHI	% (N)
>1 and ≤5	14,06 (9)
>5 and ≤10	37,50 (24)
≥ 10	26,56 (17)
P50	8

AHI-Apnea-Hypopnea Index; P50-50<sup>th</sup> Percentile

Regarding the difference between pre and post operative Brodsky scale, a reduction of at least 2 grades was found in 75.41% (Figure 1), and the reduction was not associated with the follow up time (Table 3). In the postoperative period, absence of roncopathy and apnea was reported in 93% and 100% of cases, respectively (Table 3). Postoperative frequency of hemorrhage was 0%, including early or late hemorrhages. 3 patients (4.68%) reported tonsillitis episodes (representing 0.83 episode/year of follow up) (Table 4).

**Table 3** Postoperative Variables-Effectiveness Variables (N = 64)

Roncopathy Resolution	% (N)
Yes	93,75 (60)
No	6,24 (4)
Apnea Suspicion	% (N)
Yes	64 (100)
No	0 (0)
Tonsils Size (Brodsky)	% (N)
1-Jan	84,38 (54)

Table Continued...

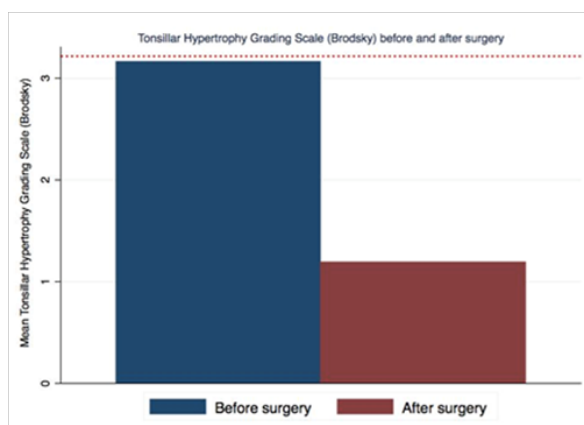
Roncopathy Resolution	% (N)
2-Feb	12,50 (8)
3-Mar	3,12 (2)
4-Apr	0
Variation in Tonsils Size* (Downgrading)	% (N)
0	1,64 (1)
1	22,95 (14)
2	50,82 (31)
3	24,59 (15)
Tonsils Reduction Relation with Follow-up Time	
n	64
t	-0.07
p	0,94
95% CI	-7.89; 7.35

\*Difference between pre and postoperative Brodsky scale - value in grades  
t - Linear Regression Test; p - p Value; 95% CI - 95% Confidence Interval

**Table 4** Postoperative Variables - Safety Variables (N = 64)

Hemorrhage	% (N)
Early	0 (0)
Late	0 (0)
Infections*	% (N)
Yes	4,68 (3)
No	95,32 (61)

\*Tonsillitis Treated with Antibiotics

**Figure 1** Variation in pre and postoperative tonsils size-Brodsky scale (N = 64).

## Discussion

This study conducted an evaluation of a 64 children cohort submitted to radiofrequency tonsils reduction associated with classic adenoidectomy for surgical treatment of obstructive sleep apnea. The median age was 4years old, and no gender differences were found. On the initial clinical evaluation 81% of children presented with significant tonsils hypertrophy with at least grade 3 on Brodsky scale (3/3) and at least 64% presented with apnea-hypopnea index (AHI) of at least 5 events/hour. Despite tonsils size is surely implicated on etiology of OSA, it could not reliably predict the severity of OSA. Additionally, although OSA severity degree given by AHI is still on debate, the authors assumed an AHI>5 as a moderate level of OSA, a cutoff with clinical significance also used in other studies such as Volsky et al. (20).

In this series, radiofrequency tonsils reduction associated with classic adenoidectomy seems to be an effective technique, since

93% and 100% of parents reported resolution of snoring and had no suspicion of apnea or troubled sleeping, respectively. For the 4 remaining snoring children we found factors other than adenotonsillar hypertrophy that could contribute to roncopathy in 3 of them: 2 cases of septal deviation and 1 case of obesity. The 4th case had an overall improvement after surgery, maintaining only an intermittent and position dependent roncopathy, with no need of further treatment, given the benignity of the situation.

We also found objective signs of efficacy on tonsils reduction when pre and postoperative tonsils size where compared: a significant reduction in tonsils size was achieved, with objective downgrading of at least 2 grades in Brodsky scale found in 75% of patients. Regarding the duration of the reduction effect, we found that the reduction is stable on time, since there was no correlation between Brodsky postoperative grading and time of follow-up.

The technique is also safe with 0 records of postoperative hemorrhage or any other reported complication. Regarding postoperative infections, there were only 3 cases out of 64 that reported tonsillitis, counting less than 1 episode per year, which were easily controlled with just one antibiotic cycle. These outcomes are similar to the studies previously mentioned<sup>2,3,4,9,10,16,18</sup> showing that radiofrequency tonsils reduction is an effective and safe technique overall, and also in our series.

Still, our study has some limitations:

- It's a retrospective study with the disadvantages of this type of study (selection and sample biases, no randomized sample, recall bias). We are designing a prospective study to overtake these limitations and produce more valid results.
- The sleeping test performed was a portable device at home, which is not the Gold Standard Polysomnography; sleep testing was performed in 78% of cases and only before surgery; and sleeping tests were done outside the Hospital. Regarding the diagnostic test used, although PSG is the Gold Standard, this test is actually on debate given its high costs and low access; international experts are analyzing alternatives to PSG, such as sleeping tests with portable devices, a tendency mentioned in several conferences about pediatric OSA at ESPO 2016 in Lisbon. Since we had no financial support, we couldn't perform sleeping tests in the whole sample: we required the exam for all patients but only those with private insurances had access to it; still, we had a sleeping test coverage in 78% of the sample, which is a very high value considering the absence of sponsoring, especially in Portugal, where a sleeping test in children is rarely performed. For the same reason, and since at least 93% had a significant clinical improvement, we did not ask for a postoperative sleeping test. Also the tests were done elsewhere, and important measures such as CT90 were not available on clinical charts records for the whole sample, so we used the variable systematically recorded in all cases, the AHI.
- Absence of important morbidity measures, such as postoperative pain and number of days on analgesics, due to the study design: we did not measure pain since surgeries occurred at least 2years before data collection, so we have chosen not to introduce an important recall bias which would produce results that would not be reliable. But from our experience, which is now more than 250 cases operated using radiofrequency tonsils reduction since 2011, patients rarely refer pain more than 2days, it's usually mild and requires just 2 or 3days on acetaminophen.

Despite the limitations previously described, it is at our knowledge an innovative study with clinical relevance: reducing tonsil using radiofrequency is possible and also tempting, since the technique is effective on diminishing tonsils size, and appears to cause less complication than extracapsular dissection. It also served as a preliminary study to support the rationale for a prospective study, which we are designing, with PSG before and after surgical treatment, and including measures of other important morbidity variables, such as postoperative pain, dysphagia, return to normal diet, return to school and quality of life.

## Conclusion

In our series, radiofrequency proved to be an effective and safe technique in tonsils reduction, and therefore, in OSA pediatric surgical treatment.

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## Conflicts of interest

Author declares there are no conflicts of interest.

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