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Surgical techniques and post-tonsillectomy haemorrhage.

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Abstract

Purpose: Some controversies have recently arisen regarding the frequency of post-operative haemorrhagic complications in relation to the surgical procedures adopted for tonsillectomy.

The authors set out to verify the relationship between different surgical techniques and post-operative haemorrhage based on the analysis of data derived from multi-centric studies appeared in the last fifteen years.

Materials and methods: Multi-centric English and Italian studies pertaining to the frequency of post-tonsillectomy haemorrhage secondary to different surgical techniques published between 2000 and 2015 were selected.

The data relevant to post-surgical haemorrhagic complications were elaborated by ANOVA test.

Results: Eight multi-centric studies were analysed. The mean frequency of post-tonsillectomy haemorrhage was: 1.13% for primary haemorrhage, 5.37% for secondary haemorrhage and 6.5% as overall for cold dissection and cold haemostasis; 0.99% for primary haemorrhage, 2.91% for secondary haemorrhage and 3.9% as overall for cold dissection with hot haemostasis; 1.31% for primary haemorrhage, 7.38% for secondary haemorrhage and 8.69% as overall for hot dissection with hot haemostasis. Statistical comparison did not show significant differences between the frequencies of post-tonsillectomy primary, secondary and total haemorrhage in relation to the surgical techniques employed.

Conclusion: A great variability in the frequency of haemorrhagic complications reported in the selected articles was found, regardless of the surgical technique employed. These findings, together with lack of a statistically significant difference in post-tonsillectomy haemorrhage between the techniques employed, must be carefully considered by professionals involved in health organization in clinical wards and the relative problems linked to medical liability.

Keywords: Tonsillectomy, Post-tonsillectomy haemorrhage, Post-tonsillectomy complications.

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Introduction

Adeno-tonsillar pathology and the surgical treatments that this condition may require still raise concerns leading to the formulation of several guidelines, particularly in relation to potential post-operative complications [1-3]. Studies in literature present no uniform results regarding the general frequency of post-tonsillectomy haemorrhage and the possible relationship between the type of surgical technique employed and the rate of haemorrhagic complications [3-5].

Post-tonsillectomy haemorrhage, in addition to representing one of the most feared complications of this operation, also constitutes an important cause of medical-legal dispute in otolaryngologic field, in which data from international literature can be referred to for various purposes [6].

Recent national guide-lines published in Italy on the appropriateness of tonsillectomy, as well as studies specifically devoted to the safety of surgical techniques in tonsillectomy, have supplied particularly rigid addresses on this topic, that appear to be in contrast with

some scientific data and that deserve a greater critical examination [7-16].

Aim of Study

The present study has set out to verify the frequency of post-tonsillectomy haemorrhagic complications reported in recent studies and the possible differences in post-tonsillectomy haemorrhage rate according to the most employed surgical techniques.

Materials and Methods

A med-line bibliographic inquiry was carried out using Pub-med, Scopus and Inter-Wiley as database, inserting the key words "post-tonsillectomy haemorrhage" and "post-tonsillectomy bleeding" and restricting the research to studies published between 2000 and 2015.

231 studies were identified; from these the multi-centric English language, papers were extrapolated in which the three most commonly used dissection and haemostasis techniques were analysed (cold dissection with cold haemostasis, **CD/CH**; cold dissection with hot haemostasis, **CD/HH**; hot dissection with hot haemostasis, **HD/HH**) in relation to the percentage of post-surgical haemorrhage (primary, secondary and total) [17].

Thus, eight studies were selected reporting data on the frequency of post-tonsillectomy haemorrhage relative to the three techniques under examination (Tables 1-3), excluding a multi-centric study in English language, as only the total percentage of post-operative bleeding was reported and including a multi-centric Italian study, conducted in 15 centres between 2002 and 2008 and published in 2011 [23,25].

Table 1. *Frequency of post-tonsillectomy haemorrhage relative to cold dissection with cold haemostasis CD/CH*

Author	N° patients	Primary Haemorrhage	Secondary Haemorrage	Total Haemorrhages
Raut et al. [18]	92	17/92=18.47%	0	17/92=18.47%
Raut et al. [19]	32	1/32=3.13%	4/32=12.5%	5/32=15.62%
NPTA [20]	1327	8/1327=0.6%	10/1327=0.75%	18/1327=1.36%
Walker et al. [16]	13	0	1/13=7.69%	1/13=7.69%
Lowe et al. [21]	4279	35/4279=0.82%	41/4279=0.96%	76/4279=1.78%
Tomkinson et al. [22]	6207	43/6207=0.69%	17/6207=0,27%	60/6207=0.97%
Motta et al. [23]	5327	41/5327=0.77%	29/5327=0.54%	70/5327=1.31%
Soderman et al. [24]	1164	35/1164=3%	21/1164=1.8%	56/1164=4.81%

Table 2. *Frequency of post-tonsillectomy haemorrhage relative to cold dissection with hot haemostasis CD/HH*

Author	N° patients	Primary Haemorrhage	Secondary Haemorrhage	Total Haemorrages
NPTA [20]	4444	19/4444=0.43%	108/4444=2.43%	127/4444=2.86%
Walker et al. [16]	480	1/480=0.21%	26/480=5.42%	27/480=5.63%
Lowe et al. [21]	13706	66/13706=0.48%	173/13706=1.26%	239/13706=1.74%
Tomkinson et al. [22]	8506	64/8506=0.75%	84/8506=0.99%	148/8506=1.74%
Motta et al. [23]	5697	36/5697=0.63%	106/5697=1.86%	142/5697=2.50%
Soderman et al. [24]	10276	354/10276=3.44%	566/10276=5.51%	920/10276=8.95%

Table 3. *Frequency of post-tonsillectomy haemorrhage relative to hot dissection with hot haemostasis HD/HH*

Author	N° patients	Primary Haemorrhage	Secondary Haemorrhage	Total Haemorrhages
Raut et al. [18]	91	0	14/91=15.38%	14/91=15.38%
Raut et al. [19]	18	1/18=5.55%	3/18=16.67%	4/18=22.22%
NPTA [20]	4864	22/4864=0.45%	178/4864=3.66%	200/4864=4.11%
Walker et al. [16]	618	2/618=0.32%	26/618=4.21%	28/618=4.53%
Lowe et al. [21]	12983	58/12983=0.45%	291/12983=2.24%	349/12983=2.69%
Motta et al. [23]	2532	1/2532=0.04%	61/2532=2.41%	62/2532=2.45%
Soderman et al. [24]	2470	58/2470=2.35%	176/2470=7.12%	234/2470=9.47%

Table 4. *Average percentage of post-operative haemorrhage (primary, secondary and total) for each surgical technique*

Type of Surgery	Mean %	Standard Dev.
CD/CH		
Primary Haemorrhage	1.13%	0.012
Secondary Haemorrhage	5.37%	0.068
Total Haemorrhages	6.5%	0.069
HD/CH		
Primary Haemorrhage	0.99%	0.012
Secondary Haemorrhage	2.91%	0.020
Total Haemorrhages	3.9%	0.028
HD/HH		
Primary Haemorrhage	1.31%	0.020
Secondary Haemorrhage	7.38%	0.061
Total Haemorrhages	8.69%	0.075

In Lowe et al. [21] paper, the data, divided by the authors into two groups- before and after guidance. They were analysed with reference to the global series [26].

ANOVA test was used to compare the surgical techniques under study, considering $p<0.05$ as the minimum level of statistical significance. The data analysis was conducted using software R, of the R Development Core Team, free software, distributed under the GNU GPL license.

Results

The data, both absolute and in terms of percentage frequency, relative to post-operative hemorrhage are reported in Table 4.

No significant differences were found in the frequency of primary, secondary and total haemorrhage among the different surgical techniques employed (Table 5).

Table 5. *Comparison between the frequency of primary, secondary and total post-operative haemorrhage among the different surgical technique employed*

Primary haemorrhage	
General mean	1.15%
Deviation between groups	3.340506e-05
Deviation in the groups	0.004297007
p-value	0.9326776
Secondary haemorrhage	
General mean	5.34%
Deviation between groups	0.0064643
Deviation in the groups	0.05768868
p-value	0.3844713
Total haemorrhage	
General mean	6.49%
Deviation between groups	0.007411413
Deviation in the groups	0.07194556
p-value	0.41378063

Considerations

Tonsillectomy is amongst the most commonly performed surgical, although the scientific literature hardly ever provides the prevalence of tonsillectomy and adenotonsillectomy [27,28]. Some data are found for Denmark: approximately 7,000 annual tonsillectomies, Scotland: 14,530 (sum from 2002-2005) and 3,605 (sum from 2006-2007), Sweden [29,30]: about 10,000 procedures per year, England with Wales: 19,250 tonsillectomies per year, Italy [31,32]: 44,000 (2000) and 59,916 (2002) and 51,983 (2003), France [7,33]: about

50,000 pediatric tonsillectomies each year, Great Britain: 78,000 (during 1994 and 1995) and about 90,000 annual surgical procedures, and USA [34-36]: 1,400,000 (1959) and 500,000 (1979), 286,000 (1994) as well as 287,000 children (1996) and 530,000 and 250,000 annual pediatric tonsillectomy [37-44]. In Italy the rate of tonsillectomy reported is of 10.7 (2000), 10.5 (2002), 9.1 (2003) and 9.4 (2004) per 10,000 inhabitants [45].

Some authors point out how the continuing disagreement regarding the indication for tonsillectomy leads to different rates of this surgical procedure both between nations and within single countries [45-48].

The choice of which surgical technique to employ in tonsillectomy is of great practical importance considering that this can either favor or reduce the probability of post-operative hemorrhage [7].

Our investigation focused on the three most commonly used techniques in tonsillectomy that is CD/CH, CD/HH and HD/HH [49].

Previous studies suggest that the different surgical techniques for tonsillectomy have different impacts on post-operative mortality even though no technique has ever been described as the "gold standard" [50,51].

Hot techniques however remain the most performed techniques in many countries [52]: hot dissection is used in about 50% of tonsillectomies in Great Britain, whereas in Australia 64% of tonsillectomies are performed using various types of "hot" techniques [53,54]. In the same way an investigation carried out in the USA in 2011 indicates the mono-polar cauterization as the most widespread technique used for hemostasis for tonsillectomy [55]. In Sweden the majority of procedures are carried out by hot techniques, whereas the cold techniques are seldom used nowadays [52].

Mowatt et al. [55] report a significantly lower frequency of primary haemorrhage in subjects who underwent a hot technique or cold procedures with hot hemostasis, whereas the frequency of secondary haemorrhage was higher in subjects who underwent cold technique surgery, although not significantly (the data was significant only when coblation was used).

Lowe et al. [20], in the "Prospective National Audit" for the National Health Service, conducted a survey involving 277 hospitals and including data relative to 33,921 patients: the authors found hemorrhagic episodes more frequently in subjects operated by the "hot" techniques.

The reliability of the results however has been questioned by the authors themselves for the imprecise definition of primary or secondary hemorrhage (e.g. hemorrhage that has onset in the first 24 h sometimes extends beyond this temporal limit) or for the partial informations supplied by responders. The authors also note that the higher frequency of post-operative haemorrhage in subjects operated by cold technique but in which hot hemostasis was carried out, could depend on the energy "dosage" employed.

Hilton et al. [56] underlines the advantages that diathermy offers (reduced bleeding during surgery; shortening of surgical time), but also points out that the risks are practically negligible: in fact, its use brings about an actual increase in the number of bleeding episodes of only 1-2%.

However, hemorrhagic complications occur at very variable rates, and are reported in literature as between 0.3% and over 10% [45] independently of the surgical technique used; this could depend on a series of biases in the evaluation of the hemorrhagic event, amongst which we consider important to point out the following:

Definition of bleeding

Many authors only report those haemorrhages that have required second surgery, whilst others report all the episodes of post-tonsillectomy bleeding [5]; thus, in the publications in which only the haemorrhages that needed surgical treatment are considered, the rate of post-tonsillectomy hemorrhage is lower, but mortality percentages rise, compared to those studies in which all hemorrhages are reported [57].

In this regard, Tomkinson et al. [22], not only reports the incidence of primary and secondary post-surgical hemorrhage, but also distinguishes slight hemorrhagic complications (primary and secondary) from those that have required second surgery, thus giving a more precise evaluation of the true risk of post-operative bleeding associated with the surgical technique employed. In the same way Soderman [24] reports the percentages of post-operative bleeding, also specifying the percentage of patients that had required second surgery.

Chronology of hemorrhagic complication

The lack of information on the time interval between surgery and the onset of the hemorrhage renders the differentiation between primary and secondary bleeding unreliable [58].

Definition of surgical technique

Some studies indicate the cold technique as the "gold standard" for dissection, but the technique used to achieve hemostasis is not reported and therefore it is impossible to establish whether the cold technique was used alone or a hot hemostasis was performed [59,60-68].

In the present study only those scientific publications in which both the dissection and hemostasis techniques were specified, were selected, and in which the primary hemorrhage was distinguished from secondary one, with an accurate chronology of the hemorrhagic event.

Other variables and the role of the surgeon

The greater frequency of hemorrhage in those subjects in which hot hemostasis was performed could have been due to heat damage, caused by diathermy coagulation of the vessels responsible for intra-operative bleeding [40,51]. However, cold dissection, just as any potential sutures for

hemostasis, must be carried out with an extreme caution in order to avoid vascular damage, which could lead to successive bleeding [61-63,67,69].

It is probable, therefore, that the skill and experience of the single surgeon represents an important factor in the origin of these events.

In the Italian multi-centic study of 2011, Motta et al. [23,68,70] did not find any statistically significant difference regarding the frequency of primary, secondary and total haemorrhage, in relation to the surgical techniques employed.

On the other hand, the authors note that the rate of haemorrhage reported by some of the medical institutions that took part in the study was significantly higher for the same techniques used; in light of these results, the authors conclude that this variability can be attributed to possible errors in the individual behavior of the surgeon himself, rather than the kind of technique adopted.

Age of patient

Michael et al. [64] in a study on 337 cases (145 operated by cold technique, 192 by hot technique) observed a higher frequency of haemorrhage in the adults compared to the children, confirmed by Mosges in a paper published in 2011, according to which the increased frequency of bleeding in adults could be due to variables independent of the surgical technique, such as the variability in compliance of patients with the post-operative instructions (post-surgical diet and physical rest), smoking, presence of comorbidity, conditions of the tonsils and coagulation defects [65].

In this regard, Tomkinson et al. [22] underline that in patients over 12 years of age, the risk of post-operative bleeding (primary or secondary), that required a surgical treatment, was 1,5 to 3 times greater than the population of patients under 12 years of age.

This data is confirmed by Walker [16] who, in the evaluation of the frequency of post-tonsillectomy haemorrhage, observes how this increased in a statistically significant way above all for secondary haemorrhage in the different groups of patients according to age, with a risk which ranges from 0.6% in the patients below 4 years of age to 10.1% in the patients over 18 years of age.

The findings emerged from the present study regarding the comparison between data from multi-centric studies do not demonstrate any difference in primary, secondary and total hemorrhage frequency between the three surgical techniques studied, differently from other authors [8-12,27].

The differences between mean percentages of post-operative bleeding do not appear to be attributable to the technique employed, but to the "experimental" variability that includes a set of not easily definable factors, as they are intrinsic to the surgery [67].

The findings that we have reported suggest greater caution in recommending excessively rigid practical addresses regarding the surgical methods to prefer in performing tonsillectomy. It should be added that for each of the surgical techniques considered, a wide variability in the rate of haemorrhage is generally verified, especially with regard to the hot techniques. This leads to the necessity for a critical analysis not so much of general surgical orientations but of individual behavior, in order to identify possible deviations from the standard reference.

Conclusion

The results of our investigation did not show statistically significant differences regarding post-tonsillectomy haemorrhage between the considered surgical techniques.

A considerably low frequency of hemorrhagic complications following tonsillectomy surgery with a notable difference between the studies emerged from the publications examined.

The onset of these complications can be conditioned, regardless of the technique used, by other factors, amongst which the most important the experience of the surgeon and the modalities with which diathermy of bleeding vessels is carried out. These data integrate the results of similar and recent studies on this issue, raising doubts on the value of the strict clinical recommendations regarding the choice of techniques to use for tonsillectomy.

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