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Review Article

Preoperative hemostasis assessment in adenotonsillar surgery: is it really necessary?

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ABSTRACT

Background: Adenoidectomy, tonsillectomy and adenotonsillectomy are among the most frequently performed procedures in otorhinolaryngology. Postoperative hemorrhage is, undoubtedly, the most feared complication of this kind of surgery. The authors aim to clarify the role of preoperative hemostatic assessment in adenotonsillar surgery, by reviewing the available literature on the subject.
Methods: Articles adressing preoperative assessment on adenotonsillar surgery were searched in PubMed® database, since its publication till April 2020.
Results: The role of hemostasis preoperative assessment in adenotonsillar surgery is still controversial, since some authors recommend its application in a selective range of patients, while others support its universal use. Most studies showed that a normal hemostatic study does not exclude the possibility of an hemostatic disease, and that most changed results are not correlated with the probability of postoperative hemorrhage. Hence, international recommendations discourage the screening of otherwise healthy patients, although most health care professionals continue to conduct preoperative tests in a systematic manner.
Conclusions: The authors emphasize the need to discuss the subject and to protocol the preoperative approach for these patients, given the confusing and divergent existing data, in such frequently performed procedures in the otolaryngology field.

Keywords: Tonsillectomy, Preoperative, Elective surgical procedures, Hemorrhage, Hemostasis

INTRODUCTION

Adenoidectomy, tonsillectomy and adenotonsillectomy are among the most frequently performed procedures in otorhinolaryngology. Despite the constant innovation in surgical techniques and the progressive optimization of perioperative care, these procedures are still associated with some complications and considerable morbidity. The most common factors contributing for such morbidity include postoperative pain, nausea and vomiting, difficulties in oral intake, bleeding and dehydration. Postoperative hemorrhage is, by far, the most feared complication, with an estimated incidence between 0.6 and 13% in several reported studies, with those who need major intervention (such as blood transfusion or returning to the operating room) being around 1.2-6%.[1-3] This wide variation described in the literature could be explained by the existence of several definitions and different criteria for identifying and reporting these postoperative complications.[1]

The rationale for routine preoperative screening is to identify potential unsuspected hemostatic disorders in otherwise healthy patients, and then, be able to minimize the risk of perioperative complications, by implementing directed medical measures and applying the most

appropriate surgical decision.[4,5] The need for this laboratory study has been questioned and debated over the recent years.[4] The American Academy of Otolaryngology–Head Neck Surgery Current Opinion advises laboratory evaluation only for patients whose family background or medical history suggests a bleeding disorder, or if genetic information about the biologic family is unavailable.[6] Of course the patient history may be unreliable due to several reasons, or may even be unknown. Because of this, many physicians continue to systematically request preoperative hemostasis assessment, based on the believe that it can detect even a very small percentage of occult bleeding disorders, this way being worth the time and cost to the patients and health care system.[7]

The aim of our study was to clarify the role of preoperative hemostatic assessment in ENT elective surgery, mainly tonsillectomy and adenoidectomy, by reviewing the available literature on the subject.

METHODS

Articles addressing preoperative assessment on adenotonsillar surgery were searched in PubMed® database from its inception through April 2020. The following medical terms were used: "adenoidectomy", "tonsillectomy", "adenotonsillectomy", "preoperative assessment", "pediatric ENT surgery" or "postoperative bleeding". A total of 102 articles were selected. Exclusion criteria were the following: clinical case-reports, studies describing exclusively preoperative studies in surgeries other than ear, nose and throat ones, non-human studies, and papers not written in portuguese, english, italian or spanish language.

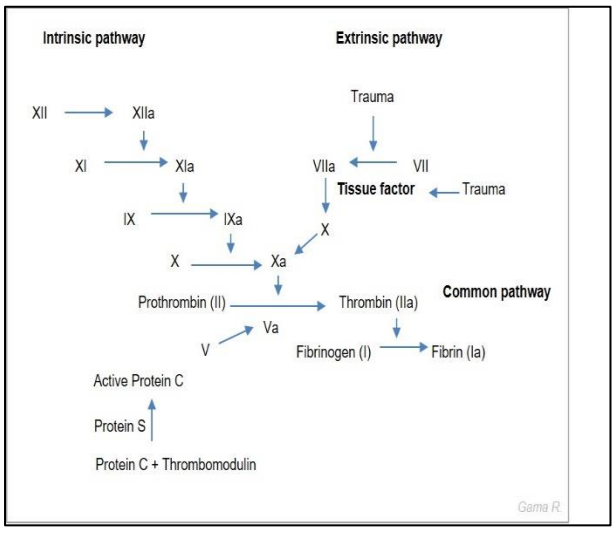

Figure 1: Coagulation pathways.

RESULTS

A total of 25 articles were included after abstract processing: 8 prospective studies (Table 1), 14 retrospective studies (Tables 2 and 3), and 3 systematic reviews and meta-analysis (Table 4).

Prospective studies

From the 8 prospective studies included, 4 of them analyzed only children undergoing adenotonsillar surgery; the other 4 included adult population undergoing tonsillectomy (Table 1). Burk included 1603 children and concluded that coagulation screening tests have high specificity but low sensitivity, thus a low positive predictive value of the bleeding risk.[8] However, although the low positive predictive value of bleeding risk, they concluded that coagulation tests allow to detect occult hemostatic disturbs, recommending its routine use before this kind of surgical procedure. Kang and Bolger support the same recommendation, arguing that an initially abnormal coagulation profile may identify those more likely to bleed after surgery (22.6% versus 5.5%), as well as the finding about clinical history, which failed to detect any previously unrecognized coagulation disorder, being the preoperative hemostatic screening essential for the detection of occult hemostatic defects, allowing for appropriate alterations in perioperative care.[9,10] On the other hand, some authors recommend selective preoperative hemostatic assessment. Zagolski and Gabriel found that a prolonged aPTT did not statistically correlate with postoperative bleeding rate, in such a way that, in healthy patients, coagulation test results are irrelevant for the course of tonsillectomy and postoperative bleeding.[11,12] Jhonson found no association with post op complications or postoperative admissions, and Close and colleagues found a 2% rate of bleeding in patients with no history and normal screening study.[13,14]

Retrospective studies

Reviewing the retrospective reports, it was verified that only 3 reports actually recommended the routine use of preoperative assessment (Tables 2, 3). Two major and recent studies, with an elevated number of patients included, support the selective use of preoperative assessment before adenotonsillar surgery. Yonekura included 13.018 children who underwent adenotonsillar surgery and other pediatric non-cardiac surgeries.[15] It was verified that 1 patient needed postoperative transfusion; 37 patients needed postoperative reoperation for surgical bleeding after tonsillectomy; and finally no statistically significant difference in postoperative reoperation for surgical bleeding was found between patients with or without preoperative coagulation tests. Beloeil studied 312991 children; the incidence of re-operation for bleeding after adenoidectomy and re-admission within 7 days after adenoidectomy and tonsillectomy were very low, and not different between patients with or without preoperative tests.[16] They concluded that standard laboratory coagulation tests and ABO blood typing before surgery and anaesthesia are still performed routinely even in clinical situations in which they are not medically justified.

Table 1: Prospective studies.

Author (year)	Tests	No. of subjects	Age	Surgery	Results	Conclusions	Recommendations
Zagólski et al (2010)[11]	aPTT, PT, INR, Plt	222	Adults, children	Tonsillectomy	Prolonged aPTT did not statistically correlate with postoperative bleeding.rate	In healthy patients, coagulation test results are irrelevant for the course of tonsillectomy and postoperative bleeding	Selective
Gabriel et al (2000)[12]	aPTT, PT, BT, Plt	1479	Children	Tonsillectomy	Postoperative haemorage did not statistically correlate with abnormal coagulation tests.	Laboratory tests do not predict postoperative bleeding.	Selective
Close et al (1994)[14]	aPTT, PT	96	1-40 years	Tonsillectomy	2% bleeding in patients with no history and normal screeming study	Routine measurement of aPTT and PT in asymptomatic patients is not useful for predicting postoperative bleeding	Selective
Kang et al (1994)[9]	aPTT, PT, BT, Plt	1061	Children	Tonsillectomy ± adenoidectomy	Higher bleeding rate in patients with an initially abnormal coagulation profile	An initially abnormal coagulation profile may identify those more likely to bleed after surgery (22.6% vs. 5.5%).	Routine BT and aPTT
Burk et al (1992)[8]	aPTT, PT, BT, Plt	1603	Children 3-16 years	Tonsillectomy ± adenoidectomy	Coagulation screening tests have high specificity but low sensitivity, thus a low positive predictive value of the bleeding risk.	Although the low positive predictive value of bleeding risk, coagulation tests allow to detect occult hemostatic disturbs.	Routine
Bolger et al (1990)[10]	aPTT, PT, INR, Plt	52	Adults, children	Tonsillectomy ± adenoidectomy	PT was prolonged in 5.8%, aPTT in 11.5%, and BT in 9.5%. Six patients (11.5%) were considered to have important laboratory abnormalities.	Clinical history failed to detect any previously unrecognized coagulation disorder.Laboratory screening therefore improved preoperative detection of occult hemostatic defects and allowed for appropriate alterations in perioperative care.	Routine
Nigam et al (1990)[31]	Hb	250	Children	Tonsillectomy ± adenoidectomy	Two children were clinically found anaemic preoperatively, and this was confirmed on blood testing	the practice of routine preoperative estimation of haemoglobin is unnecessary, traumatic and expensive, and therefore requires	Selective

Continued.

Author (year)	Tests	No. of subjects	Age	Surgery	Results	Conclusions	Recommendations
					There was only 1 instance of secondary haemorrhage and this occurred in a 12- year-old girl. Her haemoglobin preoperative level was 13.2	reconsideration.	
Jhonson et al (1988)[13]	Plt	220	Adults	Ambulatory surgery	No association with post op complications or post op admissions	Preoperative assessment only if indicated by history and physical examination.	Selective

aPTT – activated partial thromboplastin time; BT – bleeding time; Hb - hemoglobin ; INR – international normalized ratio ; Plt – platelet count; PT - prothrombin time

Table 2: Prospective studies.

Author (year)	Tests	No. of subjects	Age	Surgery	Conclusions	Recommendations
Yonekura (2019)[15]	aPTT, PT, Plt, ABO blood typing	13.018	1-17 years-old	Tonsillectomy And other paediatric non-cardiac surgeries	Postoperative transfusion in 1 patient Postoperative reoperation for surgical bleeding after tonsillectomy in 37 patients No statistically significant difference in postoperative reoperation for surgical bleeding was found between patients with or without preoperative coagulation tests.	Selective
Beloeil (2017)[16]	aPTT, PT, Plt, ABO blood typing	312.991	2-18 years-old	Tonsillectomy ± adenoidectomy	The incidences of re-operation for bleeding after adenoidectomy and re-admission within 7 days after adenoidectomy and tonsillectomy were very low and not different between patients with or without preoperative tests. Standard laboratory coagulation tests and ABO blood typing before surgery and anaesthesia are still performed routinely even in clinical situations in which they are not medically justified.	Selective
Spektor et al (2016)[26]	aPTT, PT, Plt	2237	Children	Tonsillectomy	When reviewing the data, we found that there were 8 of 91 patients (9%) in the bleeding group and 4 of 151 patients (3%) in the control group who had undergone pre-operative hematological lab tests to screen for coagulopathy, and labs were reported as abnormal in 2 of the post-tonsillectomy hemorrhage patients and 1 of the control	Selective

Continued.

Author (year)	Tests	No. of subjects	Age	Surgery	Conclusions	Recommendations
					patients. The difference in the number of patients who underwent this analysis between groups was not significant (p = 0.062, 2-sided Fischer's exact test).	
Zaher et al (2014)[23]	aPTT, PT, Plt	703	Children	Tonsillectomy ± adenoidectomy	In predicting perioperative hemorrhage, both the clinical history and laboratory screening demonstrated high specificity but a very low positive predictive value due to poor sensitivity and the low prevalence of hemorrhage. Our results confirmed previous findings of the limitations of preoperative coagulation screening. Start we recommend using a structured approach to document bleeding history, completing a standardized questionnaire to improve positive predictive value, and reserving preoperative screening for patients with a history of a bleeding disorder and/or clinical examination results that are positive for bleeding.	Selective
Licamelli et al (2008)[32]	Bleeding questionnaire, aPTT, PT, Plt	7730	1-21 years	Tonsillectomy ± adenoidectomy	Bleeding questionnaire is effective for identifying patients with bleeding disorder, requiring coagulation testing and treatment before surgery.	Selective (If positive questionnaire)
Windfuhr et al (2004)	aPTT, PT, Plt	6966	5months – 93 years	Tonsillectomy ± adenoidectomy	Normal coagulation values do not rule out coagulation disorders. Post tonsillectomy haemorrage secondary to unidentified coagulation disorder is extremely rare. Normal coagulation values and an insignificant history do not rule out coagulation disorders.	Selective
Asaf et al (2001)[33]	aPTT, PT	416	1-18 years	Tonsillectomy ± adenoidectomy	Routine coagulation tests are not indicated unless a medical history of bleeding tendency is suspected.	Selective
Howells et al (1997)	aPTT, PT	339		Tonsillectomy	PT/aPTT provides no addictional information than does a bleeding history for the general paediatric population.	Selective

aPTT – activated partial thromboplastin time;BT – bleeding time; Hb - hemoglobin; INR – international normalized ratio ; Plt – platelet count; PT - prothrombin time..

Table 3: Retrospective studies.

Author (year)	Tests	No. of subjects	Age	Surgery	Results	Conclusions	Recommendations
Zwack et al (1997)[17]	aPTT, PT	4374	2-17 years	Tonsillectomy ± adenoidectomy	Laboratory screening has a very low positive predictive value in detecting occult bleeding disorders or	PT/aPTT do not predict perioperative bleeding.	Selective

Continued.

Author (year)	Tests	No. of subjects	Age	Surgery	Results	Conclusions	Recommendations
					perioperative hemorrhage; thus, we feel it should be used selectively.		
Myssiorek et al (1996)[7]	aPTT, PT, Plt	1138	Adults (8%) and children (92%)	Tonsillectomy ± adenoidectomy	There were 14 patients with abnormally elevated PT/PTT. Two of these patients bled postoperatively and were subsequently diagnosed with von Willebrand's disease. However, due to the small number of abnormal coagulation profiles, statistical significance could not be assessed.	PT/PTT is an excellent screening device for occult hemostatic defects, and that when these defects are recognized a full hematologic workup is warranted.	Routine
Perez et al (1995)[18]	aPTT, PT, Plt	3131	Adults and children	Elective surgery	the value of routine preoperative tests to detect clinically unapparent abnormalities in ASA I and II patients is very small. Our study provides further evidence against the practice of systematic preoperative tests in these patients undergoing elective surgery.	Need for selective and rational ordering of preoperative tests, based on clinical assessment.	Selective
Manning et al (1987)[34]	aPTT, PT	994	Children	Tonsillectomy ± adenoidectomy	17/27 patients with initial abnormal clotting values had no coagulopathic condition on further investigation. PT and aPTT failed to predict and thus alter bleeding outcomes.	Screening aPTT/PT should be reserved for patients with known or supsected coagulopathies.	Selective PT, PTT
Smith et al (1990)[19]	aPTT, PT	91	Adults Children	Tonsillectomy ± adenoidectomy	Of 91 consecutive patients undergoing tonsillectomy, adenoidectomy, or both, four had abnormal preoperative coagulation profiles. Of these patients, one had von Willebrand disease, one had hypofibrinoginemia, and two had a transient acquired lupus-like anticoagulant.	Coagulopathies occur frequently enough to justify preoperative screening even in the absence of positive history.	Routine
Handler et al (1986)[35]	Hematocrit, aPTT, PT, and BT	1445	Children	Tonsillectomy ± adenoidectomy	There were no significant differences among the nonbleed and postoperative hemorrhage patients with respect to age,	No difference between bleeders and nonbleeders.	Routine PT, PTT, hemorrhage time

Continued.

Author (year)	Tests	No. of subjects	Age	Surgery	Results	Conclusions	Recommendations
					sex, indication for operation, preoperative hemoglobin, or coagulation profile.		

aPTT - partial thromboplastin time;BT – bleeding time; Hb - ; INR – international normalized ratio ; Plt – platelet count; PT - prothrombin time

Table 4: Systemic reviews and meta-analysis.

Author (year)	Study design	Purpose	Tests	N. of subjects	Conclusions	Recommendations
Eckman et al (2003)[36]	Review 1966-2002	To assess the value of haemostatic tests in screening for bleeding risk	aPTT, PT, Plt, BT	General surgery 6 studies Adenotonsillectomy 4 studies Angiography 1 study Gynaecological surgery 1 study	Routine testing has no benefit in assessment of bleeding risk.	Selective
Krishna et al (2001)[20]	Meta-analysis	To assess the value of preoperative coagulation for patients undergoing tonsillectomy	aPTT, PT	Tonsillectomy 3384 prospective studies 8988 retrospective	No difference in the rate of post-tonsillectomy bleeding in patients with abnormal or normal coagulation studies.	Selective
Munro et al (1997)[4]	Review 1978-95	To assess the value of haemostatic tests in screening for bleeding risk	aPTT, PT, BT	6 studies in adults (n=10108) 3 children (n=3287) 3 adults and children (n=488) 11 NS (n=12550) Total=26505	No link between abnormal test results and postoperative excessive bleeding. The evidence does not support a policy of routine preoperative testing for bleeding disorders.	Selective

aPTT - partial thromboplastin time;BT – bleeding time; Plt – platelet count; PT - prothrombin time

Zwack and colleagues (n= 4374 children) found that laboratory screening has a very low positive predictive value in detecting occult bleeding disorders or perioperative hemorrhage.[17] Perez et al (n=3131) showed that the value of routine preoperative tests to detect clinically unapparent abnormalities in American Society of Anesthesiologists (ASA) I and II patients is very small, providing even further evidence against the practice of preoperative tests in all these patients, and supporting the need rational and selective ordering of preoperative tests, based on clinical assessment.[18]

On the other hand, on the study conducted by Myssiorek et al (n=1138), there were 14 patients with abnormally elevated PT/PTT; two of these patients had postoperatively hemorrhage and were, after laboratory studies, diagnosed with von Willebrand's disease.[7] Although these results did not achieved statistical significance due to the small number of cases with abnormal coagulation profiles, the authors suggest that PT and aPTT analysis is an excellent screening device for the detection of occult hemostatic defects, and that, when these defects are recognized, a full hematologic workup is warranted to prevent bleeding after surgery. Also Smith (n=91) reported, in their studied population, only four cases with abnormal preoperative coagulation profile; however, out of these patients, one was diagnosed with von Willebrand disease, another one with hyperfibrinogenemia, and two with a transient acquired lupus-like anticoagulant.[1] Although small, this report made the authors to conclude and to show that coagulopathies occur frequently enough to justify preoperative screening, even in the absence of positive clinical and familiar history.

Systematic reviews and meta-analysis

All three systematic reviews and meta-analysis included in this report recommend, based on its results, a selective application of preoperative hemostatic assessment in otherwise healthy patients. However, not all of them stick to the study of adenotonsillar surgery; only Krishna et al performed a meta-analysis to assess the value of preoperative coagulation for patients undergoing tonsillectomy, which involved 3384 prospective studies and 8988 retrospective ones.[20] They observed no difference in the rate of post-tonsillectomy bleeding in patients with abnormal or normal coagulation studies, supporting its selective use before surgery.

DISCUSSION

The need for preoperative hemostatic laboratory study before adenotonsillar surgery remains a controversial and very debated subject. Routine preoperative tests for children do warrant a reconsideration of their clinical utility, as they are costly, time consuming and especially stressful and even painful for children.[15] In fact, previous studies have shown that false positive results can lead to delay in surgery, and potentially to costly and harmful incorrect treatments.[21] Additionally, other studies showed that true abnormalities found in healthy patients did not greatly influence treatment approaches, which supports the lack of requirement for routine testing in healthy patients.[4] Despite this evidence, some recent studies continue to report over-requesting of preoperative tests, reflecting the lack of clear guidelines or consensus with level 1 evidence concerning preoperative testing, especially in children.[16]

The most frequently requested preoperative screening tests include prothrombin time (PT), activated partial thromboplastin time (aPTT), and platelet count (Plt). Here we resume its utility and clinical significance.

Platelet Count (Plt)

Platelet count (Plt) is measured using an automated counter, together with red cell and white cell counts. Thrombocytopenia is defined as a platelet count below 150,000 platelets per mm3, 22 and is a very rare finding, particularly if we consider that we are dealing with apparently healthy children with no bleeding history; several causes may be at the origin of this problem, both congenital or acquired. The most common acquired causes of thrombocytopenia in children are those caused by infection; immune thrombocytopenic purpura can occur in response to a viral infection, and is generally self-limiting, with spontaneous remission, but can have major hemorrhagic repercussions in this context. Iatrogenic causes are usually caused by drugs such as heparin, a cause that is not usually seen in children., and congenital causes are extremely rare. From the congenital causes, von Willebrand disease is the most common disorder, which constitutes a disturbance of platelet function rather than a quantitative problem; it is caused by missing or defective von Willebrand factor (VWF), a clotting protein.[23] It has a variable penetration, so it may not present with a prolonged aPTT, mainly in the mild forms of the disease. Similarly to what happens in patients suffering from thrombotic thrombocytopenic purpura or idiopathic thrombocytopenic purpura, von Willebrand's disease can occur without major clinical manifestations before surgery; these hemostatic disturbances will most likely be detected in a clinical history collection with a hemorrhagic risk questionnaire; a history of bruises in places of difficult trauma, gingival hemorrhage, frequent epistaxis or the presence of petechiae is proven to be more useful in measuring hemorrhagic risk than the laboratory value of platelet count.[11,24]

Prothrombin time (PT), activated partial thromboplastin time (aPTT)

Activated partial thromboplastin time (aPTT) is the time needed for prothrombin to be converted to thrombin so a clot can form. The longer this time, the longer the time required for blood clotting. This parameter provides assessment of the intrinsic pathway, as well as the

common coagulation pathway (Figure 1).[24] APTT is more frequently used to screen for deficits in intrinsic pathway factors, such as factors VIII or IX (found for example in hemophilia patients). It may also be prolonged in deficits of factor XII, pre-kallikrein or high molecular weight kininigen, as well as in the presence of lupus anticoagulant, conditions that do not increase the hemorrhagic risk.[25]

Prothrombin time (PT) reflects the main coagulation pathway (or 'extrinsic' pathway). It is very short (12–13 seconds in normal individuals), and is used to assess the function of factor VII as well as those factors common to the intrinsic pathway (II, V, X, and fibrinogen). An isolated increased PT can only be due to a factor VII deficiency, which is very rare as an inherited deficiency (1 in 500 000 in the general population).[10,25]

The International Normalized Ratio (INR) represents the relationship between the patient's prothrombin time and a standard prothrombin time value, reflecting the time required for blood to clot relatively to an average predetermined value. It is useful, for example, to monitor of patients taking vitamin K antagonists (VKA), but has no utility in non-selective preoperative screening.[24]

It becomes relevant to mention that these described tests are not enough to explore the entire hemostatic system. Some disturbances with potential bleeding risk disrupt neither aPTT nor PT, as in the case of factor XIII or antiplasmin deficiency, for example. Besides, hemostatic function in vivo involves not only the clotting system, but also blood vessels and endothelial cell system, and secondarily the fibrinolytic system.[24]

The role of hemostasis preoperative assessment in adenotonsillar surgery is still controversial. The present literature on the subject highlights the fact that a normal hemostatic study does not exclude the possibility of hemostatic disease, and that changes in test results are not correlated with the probability of postoperative hemorrhage.[26] Besides, international guidelines from American Society of Anesthesiologists, National Institute for Health and Care Excellence (NICE) and French Society of Anesthesiology and Intensive Care, recommend not to obtain baseline laboratory studies in patients without significant systemic disease, as well as to avoid routine preoperative coagulation and ABO blood type screening tests for elective pediatric surgery.[27-29]

Unfortunately, despite these recommendations, health care professionals continue to conduct preoperative tests in a systematic and universal manner before adenotonsillar surgery in healthy children. It is observed a regular unnecessary preoperative tests being performed, proving the poor compliance to guidelines by otorhinolaryngologists.[28] Several factors justify this behavior, namely the personal experience that does not agree with the data of most studies, the existing reports that represent a divergent position from the guidelines, in addition to the medico-legal pressures that health professionals are subject to in their daily lives, which are increasingly prevalent.[30]

Concluding, preoperative assessment of bleeding risk in adenotonsillar surgery should be based on patient's clinical history, including personal and family background, and physical examination. By reducing unnecessary testing, several deleterious acts can be avoided, including venopunctures, extra cost, delays in surgery, potential false positive results that may induce anxiety in patients and respective families, and possible harmful effects from incorrect treatment.

CONCLUSION

The role of hemostasis preoperative assessment in adenotonsillar surgery is still controversial. Most studies show that a normal hemostatic study does not exclude the possibility of hemostatic disease, and that changes in test results are not correlated with the probability of postoperative hemorrhage. Besides, international guidelines do not recommend routine preoperative coagulation and blood tests for these elective procedures. Despite the recommendations, most health care professionals continue to conduct preoperative tests in a systematic manner. The authors emphasize the need to discuss the subject and to properly protocol the preoperative approach for these patients, given the fact that existing data are confusing and divergent, in such frequently performed procedures in the otolaryngology field.

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