

## tests (prothrombin time PT/partial thromboplastin time PTT) for healthy children undergoing elective tonsillectomy and/or adenoidectomy

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### Abstract

In some medical centers, the routine pre-operative evaluation of healthy children undergoing elective tonsillectomy and/or adenoidectomy (T and A) includes coagulation screening tests (PT, prothrombin Time; PTT, partial thromboplastin time; and INR, international normalized ratio). In this retrospective study, we determined whether there is a positive correlation between prolonged PT/PTT/INR tests in healthy children, with no prior medical history of coagulation problems, and bleeding during surgery and/or bleeding in the month following surgery. We reviewed the records of 416 elective T and A surgeries performed at the Soroka University Medical Center in Beer-Sheva, Israel, over the course of 1999. One hundred and twenty-one (29.1%) patients had preoperative prolonged PT values but only four (3.3%) of these patients experienced light bleeding during surgery. Seven (5.8%) of the 121 patients with prolonged PT tests experienced bleeding episodes during the 1st month subsequent to the surgery. Of the 65 (15.6%) patients who had prolonged pre-operative INR values, only three (4.6%) experienced light bleeding during surgery. Two (3.1%) patients with prolonged INR values experienced light bleeding during the 1st month subsequent to surgery. Sixty-one (14.7%) patients had prolonged first preoperative PTT values, only five of whom (8.2%) experienced light bleeding during surgery. Two (3.3%) of the 61 with prolonged PTT values experienced light bleeding during the 1st month subsequent to surgery. We therefore concluded that pre-operative coagulation screening tests

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provide low sensitivity and low bleeding predictive value. As such, routine coagulation tests before T & A are not indicated unless a medical history of bleeding tendency is suspected. © 2001 Elsevier Science Ireland Ltd. All rights reserved.

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## 1. Introduction

Elective tonsillectomy and/or adenoidectomy are the most common elective surgeries among children in the USA [1] with post-operative bleeding in 2–4% of cases [2]. The purpose of pre-operative coagulation screening tests (prothrombin time, PT; partial thromboplastin time, PTT; international normalized ratio, INR) is to determine, prior to surgery, if any coagulation problems exist in order to meet the special needs of the patients prior to, during and post-surgery.

The debate for the need of systematic coagulation screening tests in healthy children undergoing elective tonsillectomy and/or adenoidectomy in the absence of pre-existing health conditions is still open. The majority of children undergoing elective tonsillectomy and/or adenoidectomy are in general healthy. On the other hand, the test enables identification of diseases associated with coagulation deficiencies such as Von Willebrand Disease and hemophilia. The American Academy of Otolaryngology–Head and Neck Surgery currently recommends the screening test only for patients whose medical history or physical examination may indicate coagulation problems [3].

At the present time, most of the patients that are scheduled for elective tonsillectomy and/or adenoidectomy at the Soroka University Medical Center, undergo systematic coagulation screening tests. Here we studied the need for coagulation screening tests and their predictive value for bleeding during and post-surgery.

## 2. Methods

We performed a retrospective study that included all healthy children and adolescents having undergone tonsillectomy and/or adenoidectomy between 01/01/99 and 31/12/99 at the Soroka

University Medical Center in Beer-Sheva, Israel. The study did not include any children or adolescents with known coagulation problems. All information was obtained from the hospital's medical files for the patients.

### 2.1. Analysis and statistical methods

The sample population was subdivided into two groups:

(A) Children whose coagulation-screening test yielded a negative value, as defined by the testing center.

(B) Patients whose coagulation-screening test yielded a positive value, as defined by the testing center.

All PT values above 13.10, INR value above 1.2 and all PTT values above 39.30 were defined as prolonged and all results below these values were defined as normal.

Two outcome measures were defined as the Gold Standards for the purpose of this study:

1. Bleeding during surgery: Any excessive bleeding which occurred in the operating room (OR) and was reported as such in the medical records by the operating physician and/or by the anesthesiologist and/or the attending OR nurse.
2. Bleeding during the 1st month following surgery: Any bleeding that occurred during the 1st month after the surgery and was treated in a hospital setting.

By using  $2 \times 2$  correlation tables that were built by the preoperative PT/PTT/INR values versus bleeding outcome, we calculated the sensitivity, specificity, positive predictive value and negative predictive value.

Adenoidectomies were performed by curettage and most of the tonsillectomies were performed by bi-polar technique and electrocautery technique. Snare excision was never performed.

Table 1  
Summary of research data for pre-operative PT

Group	Group size	Bleeding during surgery	Bleeding in the first month after surgery
Normal PT	252 (60.6%)	16 (6.3%)	9 (3.6%)
Prolonged PT	121 (29.1%)	4 (3.3%)	7 (5.8%)
<i>P</i> -value		0.165	0.398

Hemostasis was routinely achieved by bipolar coagulation and rarely by the use of sutures.

### 3. Results

#### 3.1. Population description

During the study period, 416 patients were recruited retrospectively. Ages ranged from 1 to 18 (average  $6.4 \pm 3.9$  years); 232 (55.8%) were males and 184 (44.2%) were females. The majority of patients (398, representing 95.7%) are native-born Israelis, 312 (75%) were Jewish and 104 (25%) were non-Jews of Bedouin origin. Most of the patients, 279 (67%), underwent tonsillectomy as well as adenoidectomy; 134 (32.2%) underwent tonsillectomy alone; only three patients (0.7%) underwent adenoidectomy alone.

#### 3.2. PT test results (Table 1)

Of the patients, 252 (60.6%) had normal PT test results, 121 (29.1%) patients had prolonged PT values in their preoperative tests. Among the 121 (29.1%) patients who underwent surgery with preoperative prolonged PT value, four (3.3%) experienced bleeding episodes during surgery. In comparison, 16 (6.3%) of the 252 (60.6%) patients having undergone surgery with preoperative normal PT values experienced bleeding during surgery. Seven (5.8%) of the 121 patients with prolonged PT values experienced bleeding episodes during the month subsequent to surgery versus nine (3.6%) of the 252 patients with normal PT values. A total of 43 (10.3%) patients had no preoperative PT tests in their files; of these, two (4.6%) experienced bleeding during surgery and one (2.3%) bled during the month following surgery.

In regard to bleeding during surgery, pre-operative PT had low sensitivity (20%), and low positive predictive value (PPV) (3.3%). Pre-operative PT also had low sensitivity (43.7%) and low PPV (5.7%) for bleeding in the 1st month after surgery (Table 2).

#### 3.3. INR test results (Table 3)

A total of 300 patients (72.1%) had normal INR test results, and 65 (15.6%) patients had a prolonged INR value in their preoperative tests. Among the 65 (15.6%) patients who underwent surgery with pre-operative prolonged INR value at first testing, three (4.6%) experienced bleeding episodes during surgery. In comparison, 17 (5.7%) of the 300 (72.1%) patients who underwent surgery with preoperative normal INR values experienced bleeding during surgery.

Two (3.1%) of the 65 patients with prolonged INR values experienced bleeding episodes during the month subsequent to surgery versus 13 (4.3%) of the 300 patients with normal INR values. Fifty-one (12.3%) patients had no preoperative INR tests in their files; of these, two (3.9%)

Table 2  
Validity values for pre-operative PT

Gold standard	Bleeding during surgery (%)	Bleeding during first month after surgery (%)
Sensitivity	20	43.7
Specificity	66.8	68
Positive predictive value	3.3	5.7
Negative predictive value	93.6	96.4

Table 3  
Summary of research data for pre-operative INR

Group	Group size	Bleeding during surgery	Bleeding in the first month after surgery
Normal INR	300 (72.1%)	17 (5.7%)	13 (4.3%)
Prolonged INR	65 (15.6%)	3 (4.6%)	2 (3.1%)
<i>P</i> -value		0.509	0.482

experienced bleeding during surgery and two (3.9%) bled during the month following surgery.

In regard to bleeding during surgery, pre-operative INR had low sensitivity (15%), and low PPV (5%). Pre-operative INR also had low sensitivity (13%) and low PPV (3%) for bleeding in the 1st month after surgery (Table 4).

### 3.4. PTT test results (Table 5)

A total of 285 patients (68.5%) had normal PTT test results and 61 (14.7%) patients had a prolonged PTT value in their pre-operative tests. Among the 61 (14.7%) patients who underwent surgery with preoperative prolonged PTT values, five (8.2%) experienced bleeding episodes during surgery. In comparison, 14 (4.9%) of the 285 (68.5%) patients having undergone surgery with preoperative normal PTT values experienced bleeding during surgery.

Two (3.3%) of the 61 patients with prolonged PTT values experienced bleeding episodes during the month subsequent to surgery versus 13 (4.5%) of the 285 patients with normal PTT values. Seventy (16.8%) patients had no pre-operative PTT tests in their files. Three (4.3%) of these patients experienced bleeding during surgery, and two (2.8%) bled during the month following surgery.

With respect to bleeding during surgery, pre-operative PTT had low sensitivity (26.3%), and low PPV (8.1%). Pre-operative PT also had low sensitivity (13.3%) and low PPV (3.2%) for bleeding in the 1st month after surgery (Table 6).

### 3.5. Hematology clinical data

A total of 953 children were referred to the Hematology clinic during the year 1999, 25 (2.6%) of whom had prolonged preoperative coagulation

screening tests. Among the 25, 16 (64%) had prolonged preoperative coagulation screening tests prior to elective tonsillectomy and/or adenoidectomy. Hospital records indicated that 11 of the 16 (68.8%) were subsequently operated on at the Soroka University Medical Center. The remaining five patients most probably underwent surgery elsewhere.

At our Hematology clinic, the 11 patients underwent a series of tests that included part or all of the following: additional PT/PTT tests, factors 7,8, 9,11, Von Willebrand Factor and bleeding time. All patients were subsequently approved to undergo surgery with no additional preparation following negative results on their coagulation screening tests. None of these children experienced any bleeding during surgery or bleeding complications post-operatively.

Of all patients, 22 (5.3%) bled during surgery. All instances of bleeding were reported in the medical records by the operating physician and/or by the anesthesiologist and/or the attending OR nurse. Thirty-five patients were admitted to the Soroka University Medical Center during the month following surgery: 17 patients were hospi-

Table 4  
Validity values for pre-operative INR

Gold standard	Bleeding during surgery (%)	Bleeding during first month after surgery (%)
Sensitivity	15	13
Specificity	82	82
Positive predictive value	5	3
Negative predictive value	94	95.7

Table 5  
Summary of research data for pre-operative PTT

Group	Group size	Bleeding during surgery	Bleeding in the first month after surgery
Normal PTT	285 (68.5%)	14 (4.9%)	13 (4.5%)
Prolonged PTT	61 (14.7%)	5 (8.2%)	2 (3.3%)
<i>P</i> -value		0.349	0.656

talized following post-operative bleeding; 15 patients were hospitalized due to their refusal to eat and drink; three patients remained hospitalized due to secondary infection. All 35 patients recovered and were discharged. None of the patients died.

#### 4. Discussion

The issue of routine use of pre-operative coagulation screening tests for all children undergoing elective tonsillectomy and/or adenoidectomy has been investigated by many clinicians. Those who recommend the use of pre-operative coagulation tests [4–6], claim that PT/PTT are useful in the detection of inherited diseases such as Von Willebrand disease and hemophilia. Due to the fact that T and A surgery is usually the first hematological challenge, and the history of a pediatric patient may be unreliable, pre-operative coagulation tests should be performed on all children. Manning et al. [7] suggested that routine pre-operative coagulation tests may be performed as a defense mechanism in today's medical environment.

It is important to point out that since the PT test only examines the extrinsic coagulation pathway, its ability to detect inherited defects is minimal. The PTT test, on the other hand, examines the intrinsic coagulation pathway and therefore, is more suitable for the detection of an inherited disease. However, the PTT result, in some cases of inherited diseases may be normal [8]. Moreover, not all the patients with abnormal pre-operative coagulation tests will eventually bleed.

Close et al. [9] in a prospective study, concluded that preoperative PT/PTT in-patients with negative bleeding histories are not a useful predictor of post surgery hemorrhage.

Houry et al. [10] in a prospective, multi-center study of 3242 patients, compared the results of preoperative screening tests with bleeding history. Their results suggested that preoperative hemostatic screening tests should be performed only in patients with abnormal bleeding per history. Burk et al. [11], Manning et al. [7], Zwack and Derkay [12] and Howlles et al. [13] provided similar evidence.

The American Academy of Otolaryngology-Head and Neck Surgery has adopted the latter recommendation [3], i.e. that administering coagulation screening tests is needed only in children whose medical history or physical examination indicates a potential coagulation problem.

Despite this recommendation, many physicians continue to routinely administer pre-operative coagulation tests in children scheduled for elective tonsillectomy and/or adenoidectomy [14].

The present study supports the evidence that no urgent need exists for the administration of pre-operative coagulation screening tests in healthy children undergoing elective tonsillectomy and/or adenoidectomy. These tests did not provide any predictive value for bleeding tendencies during, or

Table 6  
Validity values for pre-operative PTT

Gold standard	Bleeding during surgery (%)	Bleeding during first month after surgery (%)
Sensitivity	26.3	13.3
Specificity	82.8	82.1
Positive predictive value	8.1	3.2
Negative predictive value	95	95.4

Table 7

Questionnaire for children undergoing elective T and A

	Yes	No
Bleeding after cutting or biting your tongue, lip or cheek		
Developed bruises after small injuries		
Bleeding after teeth pulled out		
Bleeding during or after surgeries		
Blood relative with bleeding disorder		
Repeated nose bleeding		

in the 1st month subsequent to, surgery. Therefore, we adopted these guidelines to carry out the test only if there is a medical history of coagulation problems. In addition to the guidelines we recommend that physicians should fill out a questionnaire directed to detect coagulation problems (Table 7). The total unnecessary number of tests for these children was more than 400 tests with an estimated cost of \$25 000 in our hospital during the year 1999.

The limitation of this study lies in the fact that it is retrospective and therefore susceptible to bias in the assessment of bleeding. The patients that were included in this study do not represent all T and A surgeries in our region. However, the selection of patients that will be operated on in the hospital is randomized and the same physicians operate on all patients in the region. Therefore we believe that our study group represents the population in our region.

Based on our results we believe that by conducting a questionnaire prior to surgery most patients will not have to undergo a PT/PTT/INR evaluation. This will result in substantial reduction in costs. Further studies are needed in order to understand what are the factors influencing T and A surgeons to perform pre-operative coagulation tests.

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### References

- [1] C.S. Derkay, Pediatric otolaryngology procedures in the United States:1977–1987, *Int. J. Pediatr. Otorhinolaryngol.* 24 (1993) 1–12.
- [2] W.E. Bolger, D.S. Parsons, L. Potempa, Preoperative hemostatic assessment of the adenotonsillectomy patient, *Otolaryngol. Head Neck Surg.* 103 (1990) 396–405.
- [3] American Academy of Otolaryngology–Head and Neck Surgery, *Clinical Indicators Compendium*, American Academy of Otolaryngology–Head and Neck Surgery Inc., Alexandria, VA, 1999.
- [4] S.D. Handler, L. Miller, K.H. Richmond, C.C. Baranak, Post tonsillectomy hemorrhage: Incidence, prevention and management, *Laryngoscope* 96 (1987) 1243–1247.
- [5] T.A. Tami, G.S. Parker, R.E. Taylor, Post-tonsillectomy bleeding; an evaluation of risk factors, *Laryngoscope* 97 (1987) 1307–1311.
- [6] J. Kang, L. Brodsky, I. Danziger, M. Volk, J. Stanievich, Coagulation profile as a predictor for post-tonsillectomy and adenoidectomy hemorrhage, *Int. J. Pediatr. Otorhinolaryngol.* 28 (1994) 157–165.
- [7] S.C. Manning, D. Beste, T. McBride, A. Golberg, An assessment of preoperative coagulation screening for tonsillectomy and adenoidectomy, *Int. J. Pediatr. Otorhinolaryngol.* 13 (1987) 237–244.
- [8] R. Hoffman, *Hematology Basic Principles and Practice*, third ed., Churchill Livingstone, 2000, pp. 1841–1850.
- [9] H.L. Close, T.C. Kryzer, J.H. Nowlin, et al., Hemostatic assessment of patients before tonsillectomy: a prospective study, *Otolaryngol. Head Neck Surg.* 111 (1994) 733–738.
- [10] S. Houry, C. Georgeac, J.M. Hay, A. Fingerhut, M.J. Boudet, A prospective multi-center evaluation of preoperative hemostatic screening tests, *Am. J. Surg.* 170 (1995) 19–23.
- [11] C.D. Burk, L. Miller, S.D. Handler, A.R. Chen, Preoperative history and coagulation screening in children undergoing tonsillectomy, *Pediatrics* 89 (1992) 691–695.
- [12] G.C. Zwack, C.S. Derkay, The utility of preoperative hemostatic assessment in adenotonsillectomy, *Int. J. Pediatr. Otorhinolaryngol.* 39 (1997) 67–76.
- [13] R.C. Howles, M.K. Wax, H.H. Ramadan, Value of preoperative prothrombin time/partial thromboplastin time as a predictor of postoperative hemorrhage in pediatric patients undergoing tonsillectomy, *Otolaryngol. Head Neck Surg.* 117 (1997) 628–632.
- [14] R.I. Patel, L. DeWitt, R.S. Hannallah, Preoperative laboratory testing in children undergoing elective surgery: Analysis of current practice, *J. Clin. Anesth.* 9 (1997) 569–575.