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Predicting early and delayed bleedings in children who undergo adeno-tonsillectomy surgery. Is it really possible?

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Adenoidectomy and tonsillectomy (AT) are two of the most commonly performed paediatric surgical procedures. Even if surgery-related bleedings in paediatric patients are considered uncommon events, AT surgery has a non-negligible incidence of bleeding complications which occur in about 2–7% of cases, both early and delayed, and range from mild to life threatening [1]. The causes generally recognized are surgical trauma, ineffective local haemostasis or local infections. An inherited bleeding disorder can be responsible of these complications only in a minority of cases and, if this circumstance occurs, the diagnosis is challenging for the physicians. Several studies have addressed the issue concerning the definition of the best strategy to screen paediatric patients at potential risk of bleeding during or after surgery. Currently, an approach based on the personal bleeding history is considered more cost-effective than a complete haemostatic screening. Several researchers have worked in order to obtain a standardization in collecting the haemorrhagic tendency; so a variety of bleeding questionnaires have been described for adults and the most common used is the bleeding score (BS) validated by Rodeghiero *et al.* as screening tool in adults with suspected type 1 Von Willebrand disease (VWD) [2]. Recently the BS used in the adults has been adapted for use in children. A group of specific paediatric symptoms were added: postcircumcision bleeding, cephalohaematoma, macroscopic haematuria, bleeding from the umbilical stump, conjunctival haemorrhage, postvenepuncture bleeding [3]. The resulting Paediatric Bleeding Questionnaire (PBQ), with its scoring system, has been evaluated by Bowman *et al.* in term of diagnostic accuracy for VWD and has revealed a sensitivity of 83% and a specificity of 79%, with a positive predictive value and negative predictive value of 0.14 and 0.99 respectively [4]. The efficacy of these scores was also been evaluated in paediatric patients with inherited platelets disorders [5].

The diagnostic accuracy of PBQ in identifying bleeding tendencies has been tested recently in children undergoing AT surgery [6]. The PBQ has revealed to have a low positive predicting value (PPV) and a low sensitivity against a high specificity and negative predicting value (NPV) (97% and 98% respectively) in identifying patients at high risk of bleeding after elective surgery but was not indicated as an effective screening tool due to the limited population size. Moreover, in other precedent surveys, both the clinical history and laboratory tests, such as platelets count (PLT), prothrombin time (PT), activated partial thromboplastin time (APTT), failed to suggest an increased bleeding risk or to reveal a mild bleeding disorder (MBD) [1,7,8].

Different AT-surgery techniques and antibiotic prophylaxis have widely reduced the risk of bleeding [9]

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but it is still uncertain if a latent MBD could be responsible of some surgery-related bleeds. The aim of our study was to evaluate the efficacy of PBQ, standard laboratory tests (PLT, PT and APTT) and bleeding time (BT) in predicting the bleeding risk in a population of children undergoing AT surgery. We also evaluated the bleeding history in parents (through the administration of BS) to find out if a positive result could suggest an increased risk of bleedings among children, given the inherited nature of the most part of coagulation disorders.

We prospectively enrolled 72 consecutive children candidate to AT surgery. Seven patients were lost during follow-up. The final group consisted in 65 children, 44 males (67.7%) and 21 females (32.3%), aged 3–13 (mean age 6.32 yrs ± 1.96). We took a personal bleeding history in every child through administration of PBQ. PBQ was considered abnormal if higher than 2. We performed a complete haemostasis laboratory testing that consisted of PT-ratio, APTT-ratio, PLT and BT. The latter was performed with a paediatric Surgicutt®(ITC, Edison (New Jersey), USA) device following the Ivy method modified. The BT was preferred to other techniques (such as PFA-100) as the dedicated laboratory staff was not available every day and because the BT is a test worldwide available and not requires technical personnel in the field of coagulation for its execution. PLT was considered abnormal at less than 100.000/mm^3. BT was considered prolonged if it lasted more than 7 mins. BS was considered abnormal if higher than three in fathers and higher than five in mothers. Irrespective of PBQ, BT and BS results, children underwent AT surgery. The same surgical staff performed all adeno-tonsillectomies. Each child received intra-operatively antifibrinolytic prophylaxis with tranexamic acid 500 mg and antibiotic prophylaxis with amoxicillin-clavulanate (875 +125 mg) bid, according to local protocol. Postoperative observation was achieved for at least 48 h and, in case of delayed bleeds, the patient was invited to return immediately at observation.

Table 1. This table illustrates the main population characteristics (sex distribution, mean and median age) and the frequencies of normal and pathological paediatric bleeding questionnaire (PBQ), bleeding time (BT) and bleeding score (BS). SD= Standard Deviation

	Total	Normal	Pathological
Population, *n*	65		
Male, *n* (%)	44 (67.7)	–	–
Female, *n* (%)	21 (32.3)		
Mean age, years ± SD	6.32 ± 1.96	–	–
Median age, years	6		
PBQ, *n* (%)	65 (100)	61 (93.85)	4 (6.15)
BT, *n* (%)	61 (100)	52 (85.25)	9 (14.75)
BS, *n* (%)	130 (100)	123 (94.62)	7 (5.38)
Fathers, *n* (%)	65 (100)	61 (93.85)	4 (6.15)
Mothers, *n* (%)	65 (100)	62 (95.38)	3 (4.62)

The main population characteristics are showed in Table 1. Thirty-eight adeno-tonsillectomies and 27 adenoidectomies were performed. In three children APTT-r were altered at a first laboratory determination, probably due to the presence of transitory inhibitors. They resulted normal after 3 weeks and after normalization of inflammation parameters (C-reactive protein and WBC count). Four patients out of 65 (6.15%) had a PBQ ≥ 2 and seven (5.38%) out of 130 BSs were abnormal. Sixty-one BT were performed, of these nine (14.75%) were prolonged. There was not a statistical correlation between the prolonged BTs and the abnormal PBQs or BSs (p not significant). Only one patient (1.54%) experienced early postoperative bleeding that required readmission to the operating room. This 3-years-old girl had a PBQ value of 0. She had never been subjected to any haemostatic challenge before AT surgery. Her BT was 8 mins, while her father BS was 4. Coagulation assessment has resulted in upper borderline value for APTT-r, which was 1.13. Her parents refused any second level investigation. In one patient the abnormal PBQ was correlated with an abnormal BS in the parents. Nor the BT nor the laboratory assessment of this child was altered. He did not experienced peri- or postoperative haemorrhage. In our setting, PBQ has revealed a poor ability in selecting children at risk of bleeding after surgery. Similarly, performance of BS in the parents and of the BT proved to be poor. Although these markers of bleeding were correlated with the single haemorrhage we observed, in all the other cases the abnormal PBQ, the abnormal BS or the prolonged BT did not identify a bleeding phenotype. Even if we cannot exclude that the administration of antifibrinolytic therapy has reduced the bleeding incidence in our population, we assumed that if a symptomatic bleeding disorder was present, this prophylaxis would not be able to effectively reduce the risk of bleeding. In our case series, PBQ showed a very low PPV and sensitivity against a good specificity and NPV (93.3% and 98.3% respectively), similarly to outcomes reported by Sim *et al.* [6]. Although these specificity and the NPV are desirable for a screening tool, our observation is not conclusive due to the limited sample size of our population and larger studies are required to confirm these data. No significant alteration in the laboratory assessment was found in our case series, even in the single case of bleeding we observed. According to previous surveys that did not identify in the laboratory screening an effective tool to detect children at risk of bleeding, in our study laboratory assessment failed to suggest an increased bleeding tendency in children [1,7,8]. Anyhow, in our institution, the routine coagulation assessment maintains its mandatory use before surgery, adhering to the recommendations of the Italian society of haemostasis and thrombosis

[10], to detect a bleeding disorder even in absence of an history suggestive for bleeding tendencies and to respond to the need of obtaining a baseline test in case of peri and postoperative bleeding complications. Considering the results of this study, the failure of the PBQ, BS and BT in identifying an increased bleeding risk in paediatric patients could be related to their the poor sensitivity combined with the low prevalence in absolute of bleeding disorders and the resulting low probability that latent MBDs are responsible of AT surgery-related bleeds. Therefore, peri and postoperative haemorrhages seems to be unpredictable events, even if the small size of our population does not allow us to give any conclusive consideration as larger surveys are required. The use of BT as a screening tool showed similar results in our population. Moreover, it should be taken into account that, even if the BT was executed always with the same technique, due to its inter-operator dependency the results could be confounded in part by this variable. As to the BS, it did not demonstrate a superior ability in detecting children at risk of bleeding than the same PBQ.

The AT surgery-related bleedings remain unpredictable events. The *in vitro* (coagulation assessment) and *in vivo* (bleeding time) tests we performed did not increase the rate of prediction of bleeding complications. The PBQ has shown an elevated specificity and NPV, so it could find a role as support tool to the preoperative bleeding risk assessment but these data need to be confirmed in larger surveys, given the small size of our population.

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Mirko Di Capua designed the study, enrolled the patients, administered paediatric bleeding questionnaires and bleeding scores, performed bleeding times and statistical analysis, wrote the article; Maria Livia Burzo designed the study, enrolled the patients, administered paediatric bleeding questionnaires and bleeding scores, performed bleeding times and statistical analysis, wrote the article; Mariagiovanna Di Palo enrolled patients, administered paediatric bleeding questionnaires and bleeding scores, performed bleeding times; Anna Marino enrolled patients, performed adenotonsillectomies; Giuseppe Di Lorenzo enrolled patients, performed adenotonsillectomies; Massimo Mesolella enrolled patients, performed adenotonsillectomies; Rosaria Mormile contributed Surgicutt® bleeding time kits; Giovanni Di Minno designed the study; Anna Maria Cerbone designed the study.

Disclosures

The authors stated that they had no interests which might be perceived as posing a conflict or bias.

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