Haemostatic testing prior to elective surgery in children? Not always!

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Summary
In Germany, preoperative coagulation tests are commonly used, based on the belief that these tests should identify patients with an increased bleeding risk. However, published evidence does not longer support this approach for both traditional screening tests and novel techniques of global assessment of haemostasis. Unselected screening yields many false positive results and detects irrelevant disorders. It leads to postponement of surgery, anxiety in parents and patients, and is not cost effective. Even worse, it does not reliably detect relevant bleeding disorders such as the most common coagulopathy, von Willebrand disease. The bleeding history of patients and their relatives is a more effective tool to detect patients at risk. According to international guidelines and a joint statement of different German medical societies, a standardized questionnaire should be mandatory in preoperative screening. A diagnostic pathway should be employed to identify patients in whom specific tests are helpful. Because neither laboratory tests nor questionnaires can infallibly predict or exclude bleeding, guidelines for the management of these unexpected situations have to be established.

The American and British guidelines

In contrast to the German situation, preoperative haemostatic assessment by means of a laboratory workup was already discarded from the 1999 American guidelines unless an abnormality is suspected by a patient’s history and/or physical examination, or if information about the family history is not available (1). In the 2003 published British guidelines, preoperative coagulation screening is considered inappropriate unless indicated by clinical and family history for any type of procedure in adults and children apart from some high risk procedures (i. e. neurosurgery and cardiac surgery) (23). These recommendations were confirmed in 2008 by the British Committee for Standards in Haematology (6).

Limitations of coagulation testing

This break with tradition of laboratory coagulation testing in every patient undergoing surgery is the results from numerous reports on the poor sensitivity and the disappointing predictive value of especially the aPTT but also the PT (7, 28). Used in the setting of preoperative coagulation screening, more than 90% of the pathological findings affect the aPTT (3, 11). Preanalytical problems, such as
- complicated blood drawing,
- underfilled tubes, and
- long transportation time

lead to a high rate of false positive results (15), of which approximately 60% are normal when controlled in a standardized setting (17). Moreover, the aPTT is helpful to answer the question: Why does a bleeding patient bleed? (i. e. in a setting with a high pretest probability). But it was never meant to be used as an oracle in an unselected population with a very low probability to suffer from a bleeding disorder (16) to answer the question: Will this patient bleed? (i. e. in a setting with a high pretest probability). While the detection of a clinically relevant, previously unknown coagulopathy, which can be found only by an aPTT prolongation, is rare, mainly irrelevant disorders, such as deficiency of factor XII, prekallikrein and high molecular weight kininogen are diagnosed. Additionally, some aPTT test systems are very sensitive to unspecific antibodies (e. g. antiphospholipid antibodies). These antibodies are very common in children with recurrent ENT infections (the main indication for AT/TE) or after vaccination but do not cause bleedings, despite the fact that they often cause marked aPTT prolongation (21).

Each year more than 500 000 children undergo surgery in Germany, mainly for elective reasons. The most frequent procedures are adenoidectomy (AT) and tonsillectomy (TE) (5). Bleeding remains one of the major complications, with
- up to 8% in TE
- but <1% for AT (19) and most other common surgical procedures in children (11).

Postoperative bleeding is of multifactorial origin, mainly influenced by the surgical-technique, the skill of the surgeon and the postoperative behaviour of the patient (22, 35). Although underlying coagulopathies are extremely rare causes of surgery-related bleeding (36), the fear of bleeding in combination with medico-legal concerns has led to the wide employment of non evidence based coagulation testing prior to surgery and other invasive procedures.

Until recently, the obligate assessment of coagulation by laboratory tests, i. e. platelet count (PC), activated partial thromboplastin time (aPTT) and prothrombin time (PT), was part of the guidelines of the German Society for Ear-Nose-Throat-Medicine, Head and Neck Surgery (DGHNO) for AT but not for TE (9, 10). At the moment, both guidelines are under revision.

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In contrast, a normal aPTT is not a reliable result to rule out coagulopathy. In von Willebrand disease (VWD), the most common bleeding disorder, only 40% of the patients present with an aPTT prolongation. Moreover, mild but clinically significant haemophilia or female carriers of haemophilia will be missed, since some aPTT tests detect factor VIII deficiency only if the factor VIII levels are clearly below 30–50%. Factor XIII deficiency and acquired or inherited thrombocytopenias are also not detected (7, 21).

In conclusion, aPTT screening yields many false positive results (30), leading to
- unnecessary delay in surgery,
- anxiety in patients and parents and
- unnecessary further laboratory workup.
- It is not cost effective (8).

The proponents of routine coagulation testing argue, that mild coagulopathy might not be detectable otherwise, especially in the paediatric setting, were clinical bleeding might not have occurred yet. On the other side, the serious limitations of unselected aPTT screening are underestimated. In the desire to file a normal coagulation test (33) relevant coagulopathies are missed and the awareness for so-called normal surgical bleeding is mitigated, leading to a false illusion of safety (2, 11).

It has to be stressed that there is no cut-off for a safe aPTT prolongation, since the aPTT does not correlate at all with the clinical severity of a bleeding disorder. As stated, VWD patients might not show any aPTT prolongation, but factor XII deficient patients generally show aPTT prolongations similar to severe haemophilia despite a normal bleeding risk (21, 34).

**Are there alternative tests?**

The lack of aPTT screening to detect defects of the primary haemostasis raised hopes that tests like bleeding time or platelet function analysis with the PFA 100® might improve the situation. Unfortunately, the bleeding time was shown to be of equal little value as the aPTT, mainly because of the lack of standardization and poor reproducibility, especially in children. The PFA 100 seems to be more useful, especially in adults (18) and children (27), in whom a coagulopathy is suspected for anamnestic reasons.

However, the PFA 100 seems to be unsuitable for wide employment as preoperative screening method in an unselected population, because of its insufficient sensitivity and specificity to predict bleeding or to rule out a coagulopathy (34). New global tests of coagulation such as rotation thromboelastography may play a role in certain clinical settings, but have not been proven to be of value for preoperative screening (12).

**The value of the patient’s history**

During the last decades many publications focussed on the question, whether a standardized history would improve the possibility to identify patients at risk for bleeding. Because postoperative bleeding is of multifactorial origin, neither laboratory tests nor taking a history will ever infallibly rule out bleeding. But it was shown that the clinical history of the patient and of his or her relatives is the most important tool to detect a bleeding disorder, especially if standardized questionnaires are used. Questionnaires are validated for research purposes in adults (26), but were also used prospectively for clinical use in adults (18, 25) and children (13, 20).

However, while employing these tools one must remember their limitations. Small children might not have had the possibility to bleed yet. Therefore, it is recommended to use the questionnaires only after the age two years and/or the ability of the child to walk. Language problems might also hamper the reliability of the questionnaire, as well as an unobtainable family history from one or both parents. Problems also arise from misleading answers, time pressure, and failure to recall bleeding problems in the past or overestimating irrelevant problems.

Despite those problems, in comparison to aPTT screening, standardized questionnaires, carefully used, have been shown to be of more value and greater potential than

**Tab. 1 Standardized YES/NO questionnaire adapted from Eberl (13)**

<table>
<thead>
<tr>
<th>Children’s history</th>
<th>Family history (for both mother and father)</th>
<th>Mother only</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Did your child ever have unexplained nosebleeds?</td>
<td>1. Did you ever have unexplained nosebleeds?</td>
<td>1. Did you ever feel to suffer from prolonged or severe menstruation?</td>
</tr>
<tr>
<td>2. Did your child ever have unexplained bruises or haematomas?</td>
<td>2. Did you ever have unexplained haematoma?</td>
<td>2. Did you bleed after / while giving birth to a child?</td>
</tr>
<tr>
<td>3. Did your child have gum bleed??</td>
<td>3. Did you ever have gum bleeding?</td>
<td></td>
</tr>
<tr>
<td>5. Did your child suffer from umbilical cord bleeding?</td>
<td>5. Did you ever bleed during or after surgery?</td>
<td></td>
</tr>
<tr>
<td>6. Did your child bleed after loosing a tooth or tooth extraction?</td>
<td>6. Did you ever have bleedings after loosing a tooth or tooth extraction?</td>
<td></td>
</tr>
<tr>
<td>7. Did your child ever get blood transfusions / blood components?</td>
<td>7. Did you ever get blood transfusions or blood components?</td>
<td></td>
</tr>
<tr>
<td>8. Did your child take any pain relievers (esp. Aspirin) during the last 4 weeks?</td>
<td>8. Are there any diagnosed or suspected bleeding disorders in your family?</td>
<td></td>
</tr>
<tr>
<td>9. Did your child take any medication during the last month? Ever?, i.e. Valproic acid (antiepileptics), phenprocoumon, ... ?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Did your child suffer from any severe underlying diseases, such as liver disease?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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The German statement and a concept to identify patients at risk

While there are still no German guidelines ending the discussion on preoperative coagulation testing, a joint declaration of the German Society for Ear-Nose-Throat-Medicine, Head and Neck Surgery (DGHNO), the Working Group Paediatric Anaesthesiology of the German Society of Anaesthesiology and Intensive Care Medicine (DGAI), the German Society of Paediatric Medicine (DGKJ), and the Paediatric Committee of the German Society of Thrombosis and Haemostasis Research (GTH), published in the Deutsches Ärzteblatt in 2006, stressed that coagulation screening is not useful in the preoperative setting and advised to draw more attention on the patient’s and his/her relatives history (31). These recommendations have also been published and confirmed in different other German journals (2, 11, 14, 25, 28, 29, 32).

A practical concept in paediatrics would be the use of a questionnaire according to Eberl (Tab. 1) (13) as part of a clinical pathway (Fig. 1). It has to be stressed that in case of doubt (e.g. young child, history not available) laboratory testing including adequate measures to identify VWD is necessary (2). Since most cases of clinical bleeding disorders can be identified by a complete medical assessment and history, the employment of this kind of selective laboratory testing is not only more cost effective, it is also believed to be safer for the patient and reflects evidence based medicine (7).

Most postsurgical complications are not due to coagulopathies but for other reasons and parents and patients must be aware of the risk for postsurgical bleeding. Strict guidelines on postsurgical behaviour and clear instructions what to do in case of unexpected bleeding, especially for those patients undergoing one-day-procedures, have to be established. An useful leaflet has been published by the Austrian Society of Ear Nose and Throat, Head and Neck Surgery (24). Most dramatic bleeding complications after surgery are controllable, if identified early and acted on immediately.

Fig. 1 Proposed algorithm to detect children with an increased bleeding risk: There is no general evidence that it is necessary to examine the haemoglobin levels or thrombocyte count in an otherwise healthy child prior to surgery. It might be useful in selected children independent from the bleeding history.

PE: physical examination, F: factor, PT: prothrombin time, PTT: activated partial thromboplastin time, PC: platelet count, VWF: von Willebrand factor Ag and ristocetin cofactor, LA: lupus anticoagulans, FXIII*: in case of a history suggestive for FXIII deficiency

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Conclusion

The assessment of a coagulation profile is questionable – in the scope of published evidence and international guidelines. Laboratory testing is not sufficient to identify patients at risk and has serious limitations in predicting postoperative bleeding.

It is desirable that new interdisciplinary guidelines, based on evidence and experience but not on non-reflective and tradition-bound practice alone, will help to dispel medico-legal concerns to discontinue unselected laboratory screening. Taking a standardized history of a patient and his or her relatives must become mandatory before all surgeries or invasive procedures. Further laboratory testing, including VWD, should then be restricted to those, in whom
- the history is suggestive for a bleeding disorder or
- a history is not obtainable because of young age, language or social problems.

Post surgical bleeding in general is a surgical problem and rarely caused by coagulopathies. The small number of severe bleeding complications could be further reduced by
- clear guidelines for postsurgical behaviour and
- optimal strategies to manage postsurgical bleedings.

Bleeding cannot be predicted in all cases, but it can be stopped in most cases if appropriate measures are taken immediately.

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References


