

Is routine pre-operative blood testing in children necessary?

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ABSTRACT

Objectives: To determine the value of routine pre-operative investigations in children scheduled to undergo routine minor elective surgical procedures under general anesthesia.

Methods: We conducted a retrospective chart review of 342 children who presented for elective minor surgical procedures in the Division of Pediatric Surgery, King Khalid University Hospital, Riyadh, Saudi Arabia from January 2004 to December 2004. Pre-operative investigations (full blood count, urea and electrolytes) were analyzed in terms of frequency of abnormalities and whether or not the preoperative management was changed when the results were abnormal. We also examined the relationship between abnormal results and complications and the costing of the tests.

Results: During a one year period, 342 children were admitted to the pediatric surgical unit for routine minor

elective surgery. A total of 684 tests were performed, of which 63 (9.2%) were abnormal. Nine children had abnormal hemoglobin results (the lowest was 8.5 g/dL). Thirty-two children had clinically insignificant platelets or white blood cell counts. There were 22 abnormal electrolyte results. These abnormalities were very insignificant. No case was postponed because of these investigations. Three complications arose, none of which could have been predicted by the pre-operative screening tests.

Conclusion: This results indicate that pre-operative blood testing in children undergoing minor surgical procedures has very limited value in patient management. It may be unpleasant for the patient and parents. A careful history and physical examination are of greater importance than routine laboratory test in determining a child's fitness for surgery.

Saudi Med J 2006; Vol. 27 (12): 1831-1834

Routine pre-operative investigations are performed in most patients admitted for elective minor surgery with the aim of identifying patients at a high risk of complications. Despite the fact that routine screening tests has no major role in the management of the elective surgical patients, these tests continue to be performed in many hospitals. It is generally accepted that the clinical history and physical examination represent the best method of screening for the presence of disease. Performing routine laboratory tests in patients who appear healthy

after such screening is invariably of little use and a waste of resources.¹ Several pre-operative screening investigations in the general surgical population have been evaluated and their usefulness questioned.^{2,3} Routine laboratory screening does not remove the possibility of peri operative complications. In this study, we investigated the value of traditionally accepted pre-operative investigations in otherwise healthy children admitted to our unit for routine minor surgery.

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Received 30th May 2006. Accepted for publication in final form 16th August 2006.

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Methods. The medical records of the patients who underwent routine elective minor surgical procedures in the division of Pediatric surgery, King Khalid University Hospital, Riyadh, Saudi Arabia between January 1, 2004 and December 31, 2004 were reviewed with respect to their age, gender, diagnosis, results of pre-operative investigations (full blood count (FBC), urea and electrolytes) and operative and post-operative complications. Pre-operative investigations were assumed to be those performed on the day of admission or the following day before surgery. It is routine practice in our hospital, as in many other hospitals, for these investigations to be performed on all patients presenting for elective minor surgery. Patients were excluded if they had any other active or ongoing diseases on admission, or medications that reflected active medical disease, which could influence the outcome of surgery, such as steroids. All abnormal results were identified. The numerical value of each result was classed as abnormal when its value fell outside the normal range as determined by the stated reference range on the hospital blood form (mean \pm 2 standard deviations). Changes in patient management or decision making because of the abnormal blood test result were noted. All complications occurring during operative and postoperative periods were noted in detail stating whether the pre-operative blood tests were normal or not. The hospital laboratory provided the cost of the individual investigation. The data were analyzed to determine the frequency of laboratory abnormalities and their effects on cancellations, intra operative and postoperative complications.

Results. During a one year period, 342 children were admitted to the pediatric surgery ward for routine elective minor surgery. There were 212 males and 130 females with a mean age of 4 years (range from 1 month to 12 years). **Table 1** shows the various categories of procedures that were performed. A total of 684 tests were performed pre-operatively. Sixty-three of 684 (9.2%) results were abnormal. Abnormal hemoglobin results were obtained in 9 patients (2.6%), the lowest being 8.5 g/dl in a 2-year-old boy with right inguinal hernia. The other 8 had hemoglobin levels between 9-10 g/dL. No operation was canceled because of an abnormal result, and no blood transfusions were administered to this group of children during this period. Twenty-one children had abnormal platelet counts. Only one, otherwise, healthy child, had a low platelet count ($121 \times 10^9/L$) and the other 20 children had higher platelet counts, the highest count being $596 \times 10^9/L$. No action was taken, and no complications relating to an abnormal platelet

Table 1 - The results of arthroscopic and cadaveric findings.

Surgical procedures	Number
Inguinal hernia	152
Undescended testis	117
Hydrocele	22
Umbilical hernia	13
Epigastric hernia	4
Esophageal stricture	10
Thyroglossal cyst	9
Branchial sinus	5
Other lumps	10
Total	342

count were observed. Abnormal white cell counts (WBC) were found in 11 children of whom none were $<3.0 \times 10^9/L$, and only 2 were $>14 \times 10^9/L$. No pre-operative management was altered due to abnormal WBC count and no complications arose. There were 22 abnormal urea and electrolytes results from 342 tests. There were 12 abnormal potassium results, but no one was outside the traditionally accepted surgical anesthetic limits of 3.2-5.8 mmol/L. Ten children had abnormal sodium results. The lowest value was 132 mmol/L and the highest was 147 mmol/L. There was no associated anesthetic intervention in any of these patients and there was no operative or postoperative complication. Three complications occurred, 2 wound infections and one hematoma at the wound site, all of which were in-patients with normal full blood count and normal urea and electrolytes. In our hospital, the cost to do one FBC is 10 Saudi Riyals and for urea and electrolytes is 12 Saudi Riyals. The total cost of this study group was 7,524 Saudi Riyals. This does not include the labor charges.

Discussion. A policy of "routine" blood testing before operations has become ingrained in surgical and anesthetic practice. Performing an investigation in order to detect an abnormality seems a very reasonable course of action. However, before ordering investigations, one should ask oneself the following questions: 1. Will this investigation yield more information not revealed by history or physical examination? 2. Will the results of the investigation alter the management of the patient? These 2 questions are of paramount importance if the burden of work on nurses, junior doctors, and on biochemistry and hematology services are to be reduced, and if patients are not to be subjected to further investigations on

the basis of a borderline abnormal result. Delahunt and Turnbull⁴ and later Kaplan et al⁵ demonstrated that many pre-operative screening investigations in the general surgical population rarely detected abnormalities, and when abnormalities were detected management was not altered significantly. Wilson et al⁶ demonstrated that in 96% of cases, the decision regarding fitness for elective surgery can be made on the basis of the history and physical examinations alone. In our series, 63 of 684 tests (9.2%) were abnormal, a figure which is very similar to that found by Johnson⁷ and Johnson et al.⁸ No case was postponed as a result of these investigations. Blerly et al⁹ believed that the elimination of unnecessary routine tests is of great importance, particularly in healthy patients undergoing elective surgery. Korvin et al¹⁰ found abnormal complete blood count in fewer than 4% of screening tests when they were searching for expected abnormal results that would lead to a new diagnosis in patients who were admitted to a general hospital both electively and through the emergency department. We found abnormalities in only 12% of complete blood counts in patients admitted for routine elective surgery in our unit. In 9 patients, we found low hemoglobin levels, the lowest being 8.5 gm/dL. Detecting a minor or moderate degree of anemia before a minor surgical procedure may not contribute to the general health of the child. Mild degrees of anemia may not be detected clinically from the medical history or physical examination.¹¹ However, mild anemia should not increase the risk of general anesthesia and the anesthetic techniques need not to be modified in any way to accommodate the mildly anemic state.¹² The minimal safe level of hemoglobin required before administration of general anesthesia in children is unknown. There is no published evidence that operating on children with mild anemia is unsafe.¹³⁻¹⁵ The prevalence of unanticipated elevations of white blood cell counts is very low. Turnbull et al¹⁶ and Rohrer et al¹⁷ assessed management changes related to abnormal white cell counts and found that no patients underwent a management change. In these 2 studies that allow the calculation of likelihood ratios for abnormal white cell counts, the findings suggested that unanticipated elevated white blood cell count is unrelated to perioperative morbidity. The white blood cell counts were abnormal only in 3.2% of children in our series. No antibiotic was given pre-operatively or post operatively in the cases with elevated white blood cell counts. No management was altered, and no complication arose due to the abnormal results. The majority of the abnormalities in our series especially the high platelet counts (20 cases) seemed to be an aberration of the normal range rather than a significant

clinical feature. Most of these abnormal results were coincidental findings in tests performed routinely along with the hemoglobin, and there were no indications for them to have been specifically requested. There was no evidence from the clinical records that these results made any difference to the clinical course or outcome. No further tests were deemed necessary in this group. For these reasons, routine platelets counts are not recommended before surgery unless the history and physical examination suggest a high likelihood of thrombocytopenia or thrombocytosis. The relationship between electrolyte abnormalities and perioperative morbidity and mortality is poorly defined. Pre-operative routine biochemistry testing in routine elective minor surgery has an extremely low yield of abnormal results. In our study, only 3.5% of the children had abnormal potassium level but none were outside of traditionally acceptable surgical and anesthetic limits of 3.2-5.8mmol/L.¹⁶ Other abnormalities that were detected in urea and electrolyte testing were also very insignificant. These findings are very similar to that found by Kaplan et al⁵ and Turnbull et al.¹⁶ Hypokalemia has been a traditional concern for physicians managing surgical patients. Even when identified during routine pre-operative screening, minor hypokalemia does not appear to be a risk factor for adverse events. No rationale can be constructed for baseline electrolyte investigations. Introduction of guidelines in ordering pre-operative laboratory investigations on patients scheduled for minor elective surgery can lead to a significant reduction in such testing. Although the savings per patient are small, their cumulative value can be substantial. The cost of analyzing the sample is not the only price to pay; collecting a blood sample from a child can often be an unpleasant experience for all concerned, child, parents and operator. This review has confirmed that most abnormalities detected on routine pre-operative laboratory testing are clinically irrelevant. We believe that routine pre-operative blood tests are not indicated in all children, and we have recommended: a) A detailed clinical history and physical examination should be performed and findings from these should guide the selection of tests; b) History of premature birth, a pre-existing medical condition. Failure to thrive, recent history of blood loss, a significant family history or signs of pallor or poor nutrition elicited on clinical examination are indications for further investigation.

In conclusion, routine pre-operative testing of all patients before minor elective surgery is unjustified. The frequency of unanticipated abnormalities, or abnormalities shown to change patient management is too low to justify a practice pattern of testing all

patients. The practice of selective testing of children, after a careful history and physical examination should decrease the discomfort of the child and family and reduce laboratory costs without compromising safety and quality of care.

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