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Pre-operative haematological investigations in paediatric orofacial cleft repair: Any relevance to management outcome?

Anthony T. Adenekan, Aramide F. Faponle, Fadekemi O. Oginni[1]

ABSTRACT

Aim and Objectives: To determine the value of routine pre-operative haematologic investigations in children undergoing orofacial cleft repair. **Background:** Although routine pre-operative laboratory screening tests are carried out traditionally, some studies suggest that they are not absolutely necessary in the management of elective surgical patients. **Materials and Methods:** This is a prospective cohort study carried out at a tertiary health facility located in Nigeria. A review of the laboratory investigations in 116 paediatric orofacial cleft patients undergoing surgery during a 6-year period was undertaken. Pre-operative laboratory investigations and peri-operative transfusion records were analysed for the frequency and impact of abnormal results on treatment plan and outcome using the Statistical Packages for the Social Scientists 16.0. **Results:** All the children had pre-operative packed cell volume (PCV) check on admission for surgery. The PCV ranged from 23% to 43%, mean was 32.9 (±3.7%). Twenty-two children (18.6%) had sub-optimal PCV (<30%). Patients with the lowest PCV values (23% and 26%) were transfused pre-operatively. The lowest post-operative PCV was 23%, mean 30.8 (±3.3%). There was no occasion of post-operative blood transfusion. Eighty-six patients (72.9%) had full or partial serum electrolyte and urea analysis. Screening for sickle-cell disease was rarely done. Fourteen intra- and post-operative complications were recorded. None of these were predictable by the results of pre-operative screening tests carried out. All the children were discharged home in satisfactory condition. **Conclusions:** Routine laboratory testing has minimal impact on management and outcome of orofacial cleft surgeries. However, haematocrit screening may be appropriate, particularly in clinically pale patients.

Key words: Cleft lip and palate, general anaesthesia, outcomes, paediatric, pre-operative laboratory tests, repair

Departments of Anaesthesia, and [1]Oral and Maxillofacial Surgery, Obafemi Awolowo University Teaching Hospital, Ile-Ife, Nigeria

Address for correspondence:
Dr. Anthony Taiwo Adenekan,
Department of Anaesthesia, College of Health Sciences, Obafemi Awolowo University, Ile-Ife, Nigeria.
E-mail: tonieadenekan@yahoo.com

INTRODUCTION

The tradition of running routine multiphasic screening laboratory tests for patients undergoing surgical procedures (especially electives) dates back to the 1960s.[1] It was thought logical at that time to order tests to detect abnormalities that might lead to increased morbidity or mortality in the peri-operative period.[1] This was a norm followed dogmatically over decades until its relevance came under the scrutiny of researchers for diverse reasons.

The drive for cost containment among other reasons has led anaesthetists to reassess the benefits of routine pre-operative laboratory tests.[2,3] Additionally, the need for judicious use of limited available resources in developing nations may be another compelling reason. The commonest of these investigations is the haemoglobin level. It serves as an index of assessing oxygen delivery to the tissues as well as a baseline for the evaluation of intra-operative blood.[4]

In most parts of North America and Europe, the incidence of anaemia in otherwise healthy children is extremely low but relatively higher in infants aged <1 year (due to physiological anaemia); and in patients with chronic disease.[2] The prevalence of anaemia in children in developing countries is high, approaching 50% in some studies depending on the age group and the cut off haematocrit used.[5,6] Failure to thrive and repeated infections sometimes seen in orofacial cleft patients may contribute to the severity of the anaemia.[7] Coincidentally, the optimal time for cleft lip and palate repair is before and around the age of 1 year.

Presently, many orofacial cleft patients in developing nations are reached through surgical outreach programmes, some of which have limited facilities for routine blood tests before surgery. Delahunt and Turnbull[8] at Wellington Hospital, New Zealand, and Kaplan *et al*.[9] at California, San Francisco, claimed that they have no major role in the management of elective

surgical patients; however, these tests are performed in many hospitals routinely.[3] Hodges and Hodges in their report on 336 cleft lips and 41 cleft palates operated in 20 centres across Uganda over a period of 8 months recorded no mortality despite no performance of routine pre-operative laboratory tests.[10] Contrariwise, our treatment protocol like in many other hospitals includes carrying out a series of haematological tests on all patients undergoing cleft surgery under general anaesthesia. This study was designed to appraise the pattern of routine pre-operative blood tests carried out in orofacial cleft paediatric patients undergoing surgical repair at our centre; and to establish the relevance of these tests to patients' management and outcome.

PATIENTS AND METHODS

The study population comprised of all paediatric patients who had orofacial cleft repair at the Obafemi Awolowo University Teaching Hospital, Ile-Ife, Nigeria, between May 2004 and April 2010. Approval for this study was obtained from the Hospital Ethics Committee. We recorded patients' sociodemographic data, diagnosis and pre-operative haematological investigations carried out by the managing surgeon and the available results at the time of surgery. These include full blood count, electrolytes, urea and creatinine, haemoglobin electrophoresis and blood grouping and cross matching in isolation or varying combinations. Relevant events like pre-operative and or post-operative blood transfusion, and surgical procedure performed were documented. The standard range of normal values (usually cited on the hospital's investigation request forms) was adopted as normal results in this study, while values outside the range were considered as abnormal. All abnormal results were identified and followed up for consequent changes in patient management plan. Such modifications were noted.

Patients were further followed up into the intra- and post-operative periods for attending complications. Such complications were noted in detail and matched with pre-operative clinical investigation results. Adult patients and children with underlying systemic diseases/syndromic clefts were excluded from the study. Data was entered into the Statistical Packages for the Social Scientists 16.0 for Windows Product and analysed using simple descriptive statistics.

RESULTS

One hundred and sixteen (116) children met the inclusion criteria. They were 55 males and 61 females. The age distribution is shown in Figure 1. Their mean age was 3.1 years (±4.0 years) with a range from two months to 17 years. Table 1 shows the procedures performed on the children. The results of various investigations performed are summarised in Table 2. Sixty-seven (12.3%) of the 545 results values obtained were abnormal.

All the children had pre-operative packed cell volume (PCV) on admission for surgery. Values obtained ranged from 23% to 43% with a mean of 32.9% (±3.7%). Twenty-two children (18.6%) had sub-optimal PCV (<30%). The lowest values (23% and 26%) were obtained in a five-month-old girl with unilateral cleft lip and palate and a three-month-old girl with bilateral transverse facial cleft (macrostomia), respectively. Both patients were transfused pre-operatively on anaesthetist's request. Four other children with PCV range of 22% to 26% during work up as outpatients had their surgery rescheduled for pre-operative PCV build up to ≥28%. Post-operative PCV was requested in only 32 (27.6%) of the patients by the managing surgeons. Although the lowest post-operative PCV was 23% with a mean of 30.8% (±3.26%), there was no occasion of post-operative blood transfusion.

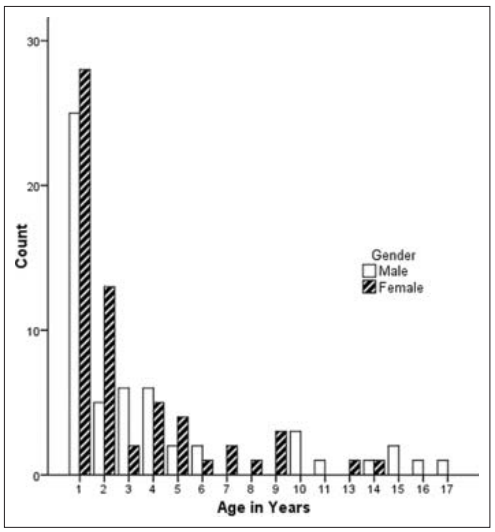


Figure 1: Graphic illustration of patients age distribution by gender

Table 1: Procedures performed

Procedure	Frequency (%)
Primary cheiloplasty	83 (71.6)
Palatoplasty	26 (22.4)
Secondary cheiloplasty only	2 (1.7)
Palatoplasty + secondary cheiloplasty	4 (3.4)
Approximation of orbicularis oris, commissuroplasty, and Z-plasty repair of skin flap bilaterally	1 (0.9)
Total	116 (100)

Table 2: Pattern of blood investigations done by their outcome, actions taken and complications

Test	No. (%) of tests	Abnormal results No. (%)	Abnormal test result		No. of patients with complications	
			Action	No action	Normal result	Abnormal result
Pre-op. PCV*	116 (100)	22 (19)	2	20	11	2
Post-op. PCV†	32 (27.6)	11 (34.4)	0	11	1	4
WBC count‡	7 (6)	0	-	-	1	0
Platelets	7 (6)	0	-	-	1	0
Sodium	83 (71.6)	1 (1.2)	0	1	9	0
Potassium	84 (72.4)	2 (2.4)	0	2	9	0
Bicarbonate	82 (70.7)	2 (2.4)	0	2	9	1
Urea	85 (73.3)	18 (21.2)	0	18	6	3
Creatinine	28 (24.1)	10 (35.7)	0	10	3	0
GXM§	11 (9.5)	-	0	0	-	-
Total	535	66 (12.2)	2	64	50	10

*Pre-operative PCV, †Post-operative PCV, ‡White Blood Cell count, §Grouping and cross matching of blood. NB: Variation in total for different tests is due to surgeons' pattern of request and available laboratory facility at the time of surgery

Eighty-five children (73.3%) had partial or full serum electrolyte and urea analysis done. One (1.2%) of the 84 children with serum sodium result had a value of 144 mmol/l (reference range in our hospital=120-140 mmol/l). Management was however not altered for this case and no complication was noted. Two patients (2.4%) had abnormal serum potassium 5.4 mmol/l and 5.5 mmol/l, respectively, exceeding our hospital reference range (3-5 mmol/l) but falls within the traditionally acceptable limits of 3.2 to 5.8 mmol/l for surgical anaesthetic patients. Both patients had uneventful Millard's cheiloplasty with no alteration in management plan. Two other children had bicarbonate levels of 18 mmol/l and 19 mmol/l (our reference range, 20-30 mmol/l). Treatment plan was not altered in these cases, but one patient had post-operative wound dehiscence. Eighteen cases of low serum urea results were noted ranging from 1.4 to 2.4 mmol/l (Reference range 2.5-5.8 mmol/l), all requiring no alteration in pre- and intra-operative treatment plan. Ten out of the 28 available creatinine values were also lower than the lower limit of our reference range (50-132 μmol/l) but none of them had complications.

Of the seven cases that had genotype done, two were HbAS while the others were HbAA. Eleven children had blood grouped and cross-matched for surgery; five of them with pre-operative PCV range of 27% to 29% and the rest with PCV≥30%. None of the children had either intra- or post-operative transfusion.

The intra- and post-operative complications recorded (14) are shown in Table 3. These complications are largely unpredictable by the pre-operative screening tests carried out. All the children were discharged home in satisfactory condition.

Table 3: Pattern of intra- and post-operative complications reported

Complication	Frequency
Bradycardia	2
Tachyarrhythmia	3
Post-extubation bronchospasm	1
Post-extubation laryngeal oedema	1
Pneumonitis 24 hours post op	2
Wound Dehiscence	2
Palatal fistula	3

DISCUSSION

Prior to hospitalising and preparing a patient for surgery, the surgeon usually has screened out a number of patients based on routine physical examinations. The decision to run certain laboratory investigations on patients undergoing orofacial cleft repair under general anaesthesia is usually that of the surgeon. These are done to convince the surgeon as well as the anaesthetist that patient is indeed fit to undergo a procedure under general anaesthesia. These practises have become norms in many practises (ours inclusive) but can our clinical judgement be sufficient or near sufficient?

Our review shows that no patient undergoing orofacial cleft repair under general anaesthesia was taken without a pre-operative PCV irrespective of clinical findings on routine pre-operative history taking and physical examination. Ansermino *et al.*[4] reported a similar finding among children undergoing orofacial cleft repair at the St Andrew's Centre for Plastic Surgery and Burns, Broomfield Hospital. Each child in their series had at least a complete blood count pre-operatively.

Although Ansermino *et al.*[4] recorded a lowest PCV of 27% in a 3-month-old ex-premature infant presenting

for cleft lip repair, we found 23%. The difference observed is possibly a reflection of the peculiarities of the poor resource nations with challenges of poverty, malnutrition, and sub-optimal medical care.[11]

Traditionally, patients will not be accepted for general anaesthesia without result of at least PCV for medicolegal reasons.[4] This appears to be the reason for routine pre-operative PCV in all the children in our study. Delahunt and Turnbull,[8] and later Kaplan *et al*.[9] demonstrated that many pre-operative screening tests in the general surgical population rarely detected abnormalities, and when abnormalities were detected, management was not altered significantly. Wilson *et al*.[12] believe that the decision regarding fitness for surgery can be made on the basis of history and physical examination only in more than 95% of patients presenting for surgery. Pre-operative management plan was altered in only six (5.2%) of our 116 patients with two of these patients transfused, and the other four placed on haematinics before surgery.

The "Kilners rule of 10" (10 g/dl haemoglobin, 10 weeks of age and 10 pounds of bodyweight for cleft lip repair; and 10 g/dl haemoglobin, 10 months of age and 10 kg bodyweight for cleft palate repair) was strictly observed in time past; with improvement in quality of anaesthesia over the years, the pre-operative haematocrit and age of closure have been safely reduced by clinicians.[7,13,14] The lowest accepted pre-operative PCV for surgery in this study was ≥27%. This reflects the concern of the attending anaesthetists with regards to the safety of the patients. Gunawardana *et al*.,[15] in their study on 200 children with orofacial cleft in Sri Lanka, concluded that there were no differences in peri-operative morbidity between those with PCV of 27% to 30% and those with PCV >30%. Most anaesthesiologists in the USA now accept haematocrits in the mid-20's for elective surgical procedures, provided there are no other systemic problems.[2] Also, there are reports of uneventful minor surgeries on children with PCV of 25.5% from the Middle East.[16,17]

It has been demonstrated that the amount of blood loss during orofacial cleft repair depends on the operation technique, the surgeon's experience and the timing of cleft closure.[18] Although blood loss is usually insignificant during cleft lip repair, it may be significant occasionally during palatoplasty, especially in the hands of an inexperienced surgeon. The availability of blood for patients with the starting PCV of <24% has been recommended.[7] Decision on pre-operative grouping and cross-matching was primarily that of the managing surgeons, and appears not to have been closely guided by the pre-operative PCV in this series.

There was no occasion of intra- or post-operative blood transfusion in any of our patients. This decision was based on clinical assessment (and occasionally post-operative PCV) of the children. Similar finding was reported by Fillies *et al*.[18] However, Doyle and Hudson[19] in 1992 reported peri-operative blood transfusion in 10% and 16.8% of their patients with cleft lip and cleft palate, respectively. We opine that this may be related to the age of their patients at the time of surgery with a mean age of 4.4 months compared with mean age 3.1 years in our series.

Sickle-cell disease (SCD) is a common genetic condition in Nigeria with carriers of the mutant gene (Hb AS) constituting 24% of the population.[20] A prevalence of 3% amongst newborns was recently reported by Odunvbun *et al*.[21] in Benin, Nigeria. SCD is the sixth leading cause of death in children under 5 years of age in Nigeria. Infections and acute anaemic sequestration crisis are the most common causes of death in children with SCD.[21]

In developed countries, newborn screening programmes have been established to ensure early diagnosis of the disease. This was predicated on an 84% reduction in the incidence of pneumococcal sepsis (the most serious complication of SCD in infants) in a double-blind, randomised, placebo-controlled trial when prophylactic oral penicillin was initiated by the age of three months.[22] In most developing countries (including Nigeria), newborn screening is yet to be established and consequently, diagnosis is often delayed.[21] This is reflected in the findings of this study.

Recommended newborn screening tests include haemoglobin electrophoresis, isoelectric focusing, high-performance liquid chromatography and DNA analysis. These tests have comparable accuracy, and choice of method is usually based on local availability and cost.[22] Solubility testing methods and sickle cell preparations are inappropriate diagnostic techniques for many reasons, including tendency to miss haemoglobin C and other genetic variants, inaccuracy in the newborn due to predominance of foetal haemoglobin and failure to detect sickle haemoglobin in persons with severe anaemia. Although newborn screening has an impact in reducing the morbidity and mortality associated with SCD when it is combined with a comprehensive healthcare programme, it is not done routinely in Nigeria. Based on the high incidence figures reported, we advocate that this programme be established routinely for every baby in Nigeria. In the absence of routine screening programme, any opportunity to screen paediatric patients for SCD should not be

missed to minimise the burden of the disease. Reason(s) for screening in only seven of these patients is (are) not clear from this study. Nevertheless, measures are routinely taken in our patients to prevent peri-operative hypoxia, dehydration and hypothermia, which can precipitate vaso-occlusive crisis in SCD patients.

Sixty-seven (12.3%) of the 545 test results in this study were abnormal. This is comparable with the 10% abnormal results found by Majed and Emad[16] in their review of 860 pre-operative blood tests in 430 paediatric patients who had minor elective surgical procedures under general anaesthesia. The relationship between electrolyte abnormalities and peri-operative morbidity and mortality is poorly defined (in this study and in previous reports). Like others, we have elicited that pre-operative routine biochemistry testing in routine elective minor surgery has an extremely low yield of abnormal results.[17] In our study, there were only two abnormal potassium results (2.4%) out of the 84 documented. These were within the traditionally acceptable limits of 3.2 to 5.8 mmol/l for surgical anaesthetic patients. Other abnormalities detected in electrolytes, urea and creatinine were also insignificant. These show that results showing a slight variation from the standard range might not indicate significant disease, but rather a normal population distribution, unlikely to affect the performance or outcome of the surgical procedure and are in keeping with previous findings.[4,9,17,23] It is therefore important that the ability to detect unsuspected conditions that might affect the risk of surgery needs to be weighed against the financial cost, the time, effort and difficulty of obtaining a blood sample and the emotional effect on the child and family.[4]

In conclusion, our review confirms that most abnormalities detected on routine laboratory tests in children undergoing cleft surgeries are clinically irrelevant. History and examination to assess for general fitness for anaesthesia and surgery may actually be adequate in majority of the patients. Those apparently pale might benefit from haematocrit screening to assess response to nutritional supplements and haematinics. Routine serum electrolytes, urea and creatinine screening particularly appear not to play any positive role in the management of our patients. Routine screening for SCD is rarely performed but advisable based on available evidences on its benefits. Although we extend this prospective type of study to a larger group of patients undergoing other surgical procedure, the findings of the current study suggest that they should be performed only when there are definite indications for them on patient's physical assessment.

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