The influence of the full blood count on medical inpatient management

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Aim. This investigation studied the use of the full blood count (FBC) in a general medical inpatient ward at Groote Schuur Hospital.

Objectives. To determine the relative frequency of the reasons for which FBCs were requested (clinically indicated v. routine) and how they influenced patient management.

Patients. One hundred and sixty-five consecutive general medical inpatients admitted to the ward between September and December 1993 were included. Each patient underwent an FBC and differential white cell count prior to entering the ward.

Design. After taking a history and examining the patient, the physician responsible for each of the 165 patients completed a questionnaire.

Outcomes measured. Physicians had to indicate whether the FBC was routine or clinically indicated and how the FBC result influenced their patient management.

Results. In 67.9% of cases the FBC was considered to be clinically indicated, while in 32.1% of cases it was routine. Although it was felt that 76.4% of the clinically indicated tests influenced patient care, patient management was changed in only 24.7% of cases. In the case of routine tests, care was influenced in only 2.0% of cases.

Conclusion. Routine tests have a very low clinical yield. There is no substitute for good clinical judgement and the practice of routine tests must be reviewed, as much time, money and patient discomfort could be saved by the elimination of unnecessary investigations.

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Clinical behaviour should constantly be audited in order to improve patient care. Over the years certain practices have become so much part of the culture of our institutions that they are applied without question to every patient.[1-3] Routine tests have been shown to result in a clinical yield so small[4-7] that their cost cannot be justified. One study[8] has shown that only 0.14% of routine full blood counts (FBCs) on hospital admission directly influenced patient care.

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The FBC is a commonly requested test among all disciplines and is often regarded as part of the admission work-up of all patients.[9-11] This test is requested in nearly 100% of medical inpatients at our institution.

This study set out to investigate how routine FBCs influenced medical inpatient management. The objectives were: (*i*) to determine how often FBCs were requested because of clinical indications; (*ii*) to determine how often FBCs were routinely requested; and (*iii*) to determine how often routinely requested tests influenced patient management.

Patients and methods

The study was conducted in a general medical inpatient ward at Groote Schuur Hospital between September and December 1993.

Phase 1

Prior to the study, the frequency of FBC requests was evaluated in 100 consecutive admissions. Ninety-six patients had the test done. The 4 remaining patients had all been admitted with uncomplicated acute myocardial infarctions.

Phase 2

One hundred and sixty-five consecutive admissions to the ward were included. Each patient underwent a FBC (a batch test consisting of five components, viz. haemoglobin, white cell count, platelets, mean corpuscular volume and haematocrit) and a differential white cell count prior to entering the ward to ensure that the results were available for completion of the questionnaire. The questionnaires were completed by the specialist in internal medicine, who was the consultant in each case. The results were known to the registrar responsible for the patients, but were only made known to the consultant after he/she had completed the relevant section on the questionnaire. After taking a history and examining the patient, the consultant had to indicate whether he/she felt a FBC was needed in order to manage the patient. The result was then made known and the consultant indicated whether and how the results had influenced their patient management. On the basis of the consultant's opinion, the FBC was allocated to either of two groups — clinically indicated or routine. Consultants were also asked whether they had found out the FBC results inadvertently. In cases where this had happened the questionnaire responses were excluded from the analysis.

In order to assess the degree of agreement between clinicians, an independent panel of two clinicians examined the results of the first 50 patients entered into the study. The panel followed the same two-step procedures as the consultants in a blinded fashion, relying only on clinical notes; thereafter a consensus decision was made.

Analysis

FBC results were classified as normal, slightly abnormal and definitely abnormal according to pre-set criteria based on laboratory reference ranges. Definitely abnormal tests were tests that had one or more of the following: (*i*) a haemoglobin value < 10 or > 16 g/dl; (*ii*) a white cell count of < 3 or > 15 x 10^9/l; (*iii*) a platelet count of < 100 or > 600 x 10^9/l; (*iv*) a neutrophil count of < 1.8 or > 8 x 10^9/l; and (*v*) an absolute lymphocyte count of < 1.2 x 10^9/l. Slightly abnormal tests were tests that showed a marginal increase or decrease in haemoglobin, white cell count and/or platelets and marginal shifts in the white cell lines.

The responses from the questionnaires were analysed with Epi-Info 5.1. Most of the results are presented as simple frequency proportions and are displayed in two-by-two tables.

The degree of agreement between the clinical consultants and the panel with regard to the first 50 patients was assessed by means of the kappa statistic.[10]

Laboratory costs associated with the performance of a FBC were estimated by multiplying the cost of one test with the number of tests performed in general medical wards over the period of 1 year. The rates currently used by the Groote Schuur haematology laboratory were taken as the cost of a single FBC. Rates assigned to the test are in accordance with those used by the South African Institute for Medical Research and are allocated according to the number of work units spent in doing the test. For the FBC, an amount of R14.10 has been allocated. Other indirect and opportunity costs are not taken into account.

Results

The 165 questionnaires were completed by five different consultants, 87.3% being completed by three of them. In 4 (2.4%) cases the physician knew the results inadvertently.

Some of the variables had missing values, either because the FBC results were not available at the time of completion of the questionnaire or because the consultant had not completed the particular question. The questions where consultants had to indicate whether clinically indicated and routine tests influenced patient care had 6 and 4 missing values respectively. For test outcome, 6 values were missing.

In the 165 patients who underwent FBCs, 112 (67.9%) of these were judged to be clinically indicated and 53 (32.1%) routine.

Usefulness of test

Eighty-one (76.4%) clinically indicated tests were felt to have assisted in patient care, while only 1 (2.0%) routine test assisted in care. The single routine test that influenced care was that of a 57-year-old woman admitted with a hypertension-related cerebrovascular accident. Her FBC showed a mild abnormality — haemoglobin level 10.9 g/dl — and following iron studies, she was given oral iron therapy.

Of the clinically indicated tests only 24.7% led to a change in patient management, i.e. either a change in diagnosis, change in medication or the ordering of additional investigations. The remaining 75.3% served only to confirm or support the initial clinical diagnosis.

Test results

Sixty-seven (42.2%) of all tests were normal. Forty-two (26.4%) showed borderline abnormalities and 50 (31.4%) were significantly abnormal. If the borderline tests are accepted as abnormal, 92 (57.8%) of all tests could be considered abnormal. With these criteria, 73 (67.0%) of the clinically indicated tests were abnormal, while 19 (38.0%) routine tests were abnormal (Table I).

Table I. Outcome of tests

	Clinical decision	
Test result	Indicated	Routine
Normal	36 (33.0%)	31 (62.0%)
Abnormal	73 (67.0%)	19 (38.0%)

Analysis of clinician responses

There was considerable variation in the frequency with which clinicians felt that a test was clinically indicated or routine, as well as in their deciding whether clinically indicated tests assisted in patient management (range 27.8 - 91.8%). This wide variation appeared to be related to differences in patient mix in respect of severity of illness and actual diagnoses managed by the individual clinicians. This aspect was not examined in detail.

Assessment of the degree of agreement between the clinicians and the consensus opinion of the panel showed moderate agreement in deciding whether the test was needed (kappa statistic = 0.49). There was, however, marginal agreement in deciding whether the clinically indicated test assisted in patient care (kappa = 0.06). In the case of routine tests that were abnormal for these 50 cases, the numbers were too small for the use of the kappa statistic. However, in 8 out of 9 cases there was agreement that the abnormal routine test did not assist in patient care. In 4 of the 8 cases the patient had a mild anaemia (haemoglobin level ranging from 10.9 to 11.2 g/dl) and in the other 4 cases a marginally raised white cell count (the highest being 10.4 x 10^9/l) was recorded in patients who had already been diagnosed clinically as having a definite infective condition. In the one case of mild anaemia in a 57-year-old woman, already outlined above, the clinician felt that the FBC assisted, while the panel felt it did not.

Sensitivity of clinical judgement

The sensitivity of the clinicians' judgement was high in predicting the finding of an abnormality on the FBC: 86.7%, with a positive predictive value of 80% (Table II).

Table II. Sensitivity and specificity of clinical suspicion

	Test outcome	
Clinical suspicion	Abnormal	Normal
High suspicion of abnormality	a	b
	52 (80.0%)	13 (20.0%)
Low suspicion of abnormality	c	d
	8 (40.0%)	12 (60.0%)

Sensitivity = 86.7% (a/a+c).
Specificity = 48.0% (d/b+d).
Positive predictive value = 80% (a/a+b).

Discussion

Our study shows that clinicians consider the FBC to be a useful test on admission to a general medical ward. Two out of three inpatients will have a clinical indication for a FBC. In three out of four clinically indicated tests, information is obtained that in some way assists patient care. Information is mainly useful in the diagnostic process of confirming or excluding certain diagnoses. Usefulness is confirmed by the observation that one test out of four actually leads to a change in diagnosis, change in medication or to the ordering of additional investigations. FBC results were almost evenly distributed between normal (42.2%) and abnormal (57.8%).

Clinical judgement has a high sensitivity (86.7%) in predicting an abnormal FBC. This indicates that clinical judgement is a good screening test for abnormalities in the FBC and consequently for tests that will assist patient management.

If there is no clinical indication for the FBC, there is a very low probability (2.0%) that the result will assist patient management. In the one instance of an abnormal routine FBC, a mild iron deficiency anaemia was detected in a 57-year-old woman, incidental to her admission because of a cerebrovascular accident. The clinician indicated that the FBC had assisted with patient care. In this instance the panel disagreed on two grounds. Firstly, the FBC had not assisted in management of the condition for which the patient had been admitted. Secondly, the presence of a mild anaemia (haemoglobin level 10.9 g/dl) could have been detected by a finger-prick haemoglobin test. It was the view of the panel that this test should be performed on all general medical inpatients in whom a FBC is not done.

A number of studies similar to ours[1,6,7] have also shown that routine FBC tests in general medical inpatients or outpatients are of little value beyond their detecting occasional unsuspected cases of borderline anaemia, usually nutritional. These studies were conducted in the USA and Israel and it is interesting to note similar findings in our context.

In the first phase of our study, we found that 96% of general medical inpatients had a FBC performed on admission. During the second phase clinicians considered only 67.9% of tests to be clinically indicated, suggesting that more than one-quarter of patients usually admitted to a medical ward will undergo a FBC without a reasonable expectation that the result will assist with patient care.

Approximately 10 000 patients are admitted to the general medical wards at Groote Schuur Hospital annually. The quoted cost of an FBC at this institution is R14.10. Direct savings on 2 500 unnecessary FBCs would amount to R35 250 if FBCs were only performed when clinically indicated.

Approximately 50 abnormal results will not be reported, but most of these can probably be detected by a fingerprick haemoglobin test if this were performed in every instance. Similar direct savings could possibly also be achieved in disciplines other than general medicine.

Routine tests other than screening tests of proven efficacy[1,3,6-8,12-14] serve little useful purpose in hospital practice. In contrast, the need for tests which are useful can readily be identified by clinical judgement.[15] This has been demonstrated in respect of the FBC in a general medicine

setting and has illustrated the importance of clinical auditing, especially of procedures performed so regularly that they have become a routine that is considered universally indicated.

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