Hospital Topics

Trial of strategy for reducing the use of laboratory tests

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Abstract

Clinical guidelines and a weekly review of medical records were introduced into a medical unit in a teaching hospital to promote a more discriminating use of laboratory tests. This strategy resulted in an immediate reduction in the average number of requests each week from 74 to 27 haematological tests (64%) and 158 to 58 biochemical tests (64%). During a period of 10 weeks after the strategy was introduced (the intervention period) the mean number of haematological tests for each person decreased from 2·0 during the baseline period to 1·1 (45% reduction; $p<0·01$) and the mean number of biochemical tests decreased from 4·4 to 2·7 (39%; $p<0·0001$). The decrease in the number of repeat requests was greater than that for new requests and accounted for half the reduction in use. There was no significant change in the number of tests requested from an adjacent medical unit that was not exposed to the interventions.

This strategy is worthy of trial in other specialties and hospitals, but attention will have to be paid to possible difficulties in sustaining reductions in use over long periods of time.

Introduction

The use of diagnostic tests has increased rapidly during the past 30 years,[1-4] and unnecessary testing may now be commonplace in clinical practice.[5-9] The Royal College of Radiologists, for example, found that the use of radiological procedures was unduly high in hospitals participating in multicentre studies.[5] In one medical outpatient clinic fewer than 10% of investigations led to changes in diagnoses derived from histories and physical examinations[6]; in another clinic routine haematology and urine tests contributed to less than 1% of diagnoses.[7] In some hospitals more than 90% of investigations conducted on emergency medical admissions were found to be unimportant in the management of patients.[8 9]

Many consultants at the University Hospital of Wales have encouraged discrimination in the use of diagnostic tests by their junior staff, but in response to appeals by the local health authority for greater efficiency in the use of clinical resources we decided to conduct a trial to determine if the use of diagnostic tests could be reduced further by introducing clinical guidelines and holding a weekly review of the use of tests.

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Methods

The interventions were applied in one general medical unit of 32 beds (unit A). The medical staff consisted of three consultants and five junior doctors who did not change during the study. Most beds were occupied by emergency admissions.

The consultants met on several occasions to discuss diagnostic policies and by a process of consensus formulated provisional guidelines on the use of tests for the nine commonest medical emergencies in patients admitted to the unit—namely, myocardial infarction, overdose, haematemesis and melaena, pneumonia and exacerbation of chronic bronchitis, congestive cardiac failure, stroke, deep vein thrombosis and pulmonary embolism, diarrhoea, and urinary tract infection. Another common medical problem, possible lower gastrointestinal bleeding, was added to the list. The final version of the guidelines was then agreed by consultation between clinical and laboratory staff.

Each guideline was given in the form of short advisory statements, and no attempt was made to formulate more tightly controlled protocols such as algorithms. For example, the guideline for the investigation of haematemesis and melaena stated: "Full blood count and repeat after 24 hours. Group and save serum. No cross match unless transfusion required. Urea and electrolytes and liver function tests justified (but not out of hours). Early endoscopy and then barium meal (if indicated) is often helpful. Possible Mallory-Weiss is indication for urgent endoscopy. No faecal occult bloods in acute phase."

Guidelines were distributed to the junior staff at a meeting held in the unit. They were encouraged to use tests discriminately and to adhere to the guidelines when possible. It was emphasised that the guidelines were merely advisory and clinical judgment was still paramount. Any failure to order a test would not be criticised by the consultants. An appropriate rule of thumb was devised: "If in doubt, leave it out—and ask." Apart from this advice no changes were made in the normal procedures for requesting tests by junior staff or consultants.

After the introduction of the guidelines each consultant in turn conducted a weekly review of medical records with junior staff. At this 45 minute meeting the use of investigations for patients discharged from the unit during the previous week was reviewed. The main purpose was to detect overinvestigation. The value of individual tests was discussed and decisions taken on which tests were unnecessary.

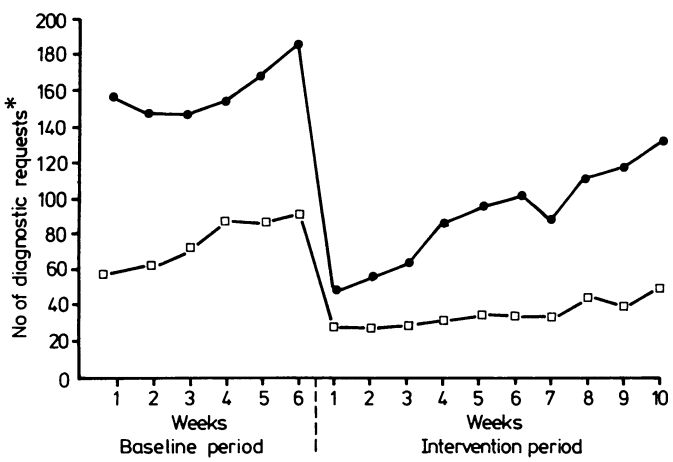
Data were collected on the use of haematological and biochemical tests for patients in unit A during a six week baseline period and 10 week intervention period from the beginning of April to the end of July 1984. The guidelines were introduced during a transition week, between the baseline and intervention periods. Identical data were collected during the same periods from another medical unit (B) in the same hospital; the guidelines were not introduced into this unit, and a weekly review of medical records was not conducted. During the baseline period junior staff in both units were not informed that diagnostic requests were being monitored. During the intervention period staff in unit A were aware that requests were being monitored but staff in unit B were not informed officially of the monitoring.

Patients admitted to each unit were identified on the routine daily printout of hospital admissions; haematological tests performed on specimens from these patients were retrieved from a computerised file of all requests made in the hospital; data on biochemical tests were obtained from the "back copies" of request forms submitted to the laboratory. A request for several tests to be performed on one specimen of blood by a multichannel analyser was counted as one request. Data were not collected on the patient's diagnosis, the doctor making the request, and whether the request was made out of hours and for diagnostic or treatment purposes as such information of adequate validity could not be obtained from routine statistical sources. We did not want to introduce a special data collecting system that might affect clinicians' behaviour. In the analysis of data the significances of differences in the number of requests for each patient between the baseline and intervention periods were determined using the Mann-Whitney test.

Results

The use of tests was observed for 389 patients during the baseline period and 531 patients during the intervention period. Of these 531 patients, 297 were in unit A. In both units the men to women ratio was roughly 1:1, and the average age of patients was 55. During the 16 weeks of the study medical staff in the two units made 5939 requests for haematological and biochemical tests.

The figure shows the number of requests made each week in unit A, expressed as moving averages within the baseline and intervention periods to smooth out week by week fluctuations. (The average for each week is based on that week and the ones before and after except for the first and last weeks, which are based only on two weeks' data.) After the introduction of the guidelines and weekly review of medical records the number of requests for both categories of tests fell rapidly. During the baseline period an average of 74 haematological tests and 158 biochemical tests were requested each week.



Biochemical and haematological requests during baseline and intervention weeks in unit A. Biochemical tests (●—●); haematological tests (□—□).
* Moving average for each week within baseline and intervention periods.

During the first three weeks of the intervention period an average of 27 haematological tests and 58 biochemical tests were requested, corresponding to a 64% reduction in both categories of request. During the intervention period, however, the number of requests increased towards baseline values so the overall reduction in haematological and biochemical requests between the baseline and intervention periods was 54% and 47%, respectively.

The number of tests carried out in a ward during a period of time is affected by the number of patients and whether they are at the start, middle, or end of their stay as more diagnostic tests are usually performed soon after admission. When requests between the baseline and intervention periods were compared, therefore, the analysis was restricted to patients whose admission and discharge took place within one of these periods. In the 693 patients who fulfilled this criterion 3625 tests were performed during the study period.

In unit A between the baseline and intervention periods the mean number of requests for each patient fell significantly from 2·0 to 1·1 (a 45% reduction) for haematological tests and from 4·4 to 2·7 (39% reduction) for biochemical tests (table I). These reductions were almost equivalent to one haematological test and two biochemical tests for each patient. In unit B the mean number of haematological tests for each patient fell from 1·6 to 1·4 (a 13% reduction) and the number of biochemical tests fell from 4·6 to 3·4 (26% reduction); these changes were not significant.

TABLE I—*Mean number of haematological and biochemical requests for each patient during baseline and intervention periods in units A and B**

	Baseline period	Intervention period	Reduction in number of requests (%)†	p Value
		Haematological tests		
Unit A	2·0	1·1	0·9 (45)	<0·01
Unit B	1·6	1·4	0·2 (13)	0·89
		Biochemical tests		
Unit A	4·4	2·7	1·7 (39)	<0·0001
Unit B	4·6	3·4	1·2 (26)	0·18

* Unit A received guidelines and weekly review; unit B acted as control.
† Reduction from baseline period to intervention period.

The distribution of the numbers of tests among the patients changed in unit A between the baseline and intervention periods. The number of patients having no tests increased from 27 out of 155 (17%) to 66 out of 251 (26%) and those having between one and five tests increased from 52 out of 155 to 121 out of 251, whereas the proportion having more than five tests decreased from about a half to a quarter of the patients. In contrast, in unit B the distribution of the numbers of tests among patients was similar during the two periods.

During the baseline period roughly a third of the requests in units A and B were for repeat tests—that is, tests already performed on the patients during the same period of admission (table II). In both wards the fall in the number of repeat requests was much greater than that for new requests, though the changes in unit B were not significant. The reduction in the number of repeat requests accounted for nearly half of the decrease in the total number of requests in unit A.

TABLE II—*Mean number of new and repeat diagnostic requests for each patient during baseline and intervention periods in units A and B**

	Baseline period	Intervention period	Reduction in number of requests (%)†	p Value
		New requests		
Unit A	4·4	3·0	1·4 (32)	<0·0001
Unit B	3·8	3·4	0·4 (11)	0·26
		Repeat requests		
Unit A	2·0	0·8	1·2 (60)	<0·002
Unit B	2·3	1·4	0·9 (39)	0·26
		Total number of requests		
Unit A	6·4	3·8	2·6 (41)	<0·0001
Unit B	6·1	4·8	1·3 (21)	0·25

* Unit A received guidelines and weekly review; unit B acted as control.
† Reduction from baseline period to intervention period.

Table III shows the changes found in unit A between the baseline and intervention periods for the most commonly performed tests. The number of requests for each patient for each test fell significantly by a minimum of 30% from the baseline level. Tests for cardiac enzymes (aspartate transaminase and 2-hydroxybutyrate dehydrogenase) were almost eliminated, but this may be attributed to a policy change by the biochemistry laboratory during the intervention period in which only a creatine phosphokinase test

TABLE III—*Mean number of requests for each patient for commonly used tests during baseline and intervention periods in unit A**

Test	Baseline period	Intervention period	Reduction in number of requests (%)†	p Value
Aspartate transaminase	0·38	0·02	0·36 (95)	<0·0001
2-hydroxybutyrate dehydrogenase	0·35	0·02	0·33 (94)	<0·0001
Erythrocyte sedimentation rate	0·34	0·11	0·23 (68)	<0·0001
Blood glucose	0·62	0·24	0·38 (61)	<0·0001
Liver function	0·72	0·36	0·36 (50)	<0·0001
Full blood count	0·72	0·50	0·22 (31)	<0·05
Creatine phosphokinase	0·42	0·29	0·13 (31)	<0·0001
Urea and electrolytes	0·90	0·63	0·27 (30)	<0·01

* Unit A received guidelines and weekly review.
† Reduction from baseline period to intervention period.

was performed when "cardiac enzymes" were requested. The mean number of requests for each patient for blood glucose concentrations and erythrocyte sedimentation rate estimations also showed fairly large reductions from 0·62 to 0·24 (61% reduction) and 0·34 to 0·11 (68%), respectively. Except for the tests for cardiac enzymes, mentioned above, no significant decrease in the use of specific tests occurred in unit B.

Discussion

In unit A the immediate and substantial decline in the use of tests on introduction of the guidelines and weekly review of medical records suggests that these interventions had an effect on the use of tests. During the first week of the intervention period the house staff did not change and there was no industrial action or other disruption in the unit that might have accounted for the rapid fall. Furthermore, there was no important change in an adjacent medical unit (unit B) not exposed to the guidelines. In addition, in the hospital as a whole the number of weekly requests for haematological tests, as recorded in routine laboratory statistics, did not change between the baseline and intervention periods. The total number of requests for biochemical tests over the previous three years, however, did show some seasonal variation with a lower number of requests in late spring and early summer; this may have accounted for some of the reduction in the number of biochemical requests made during this study.

Although the changes that occurred in unit B were not significant and probably occurred by chance, there may have been some spillover effect from one unit to another, as noted in other studies.[10] Staff may have become aware that tests were being monitored; the guidelines may have been disseminated by junior medical staff in unit A, and discussion about the interventions in unit A may have taken place between the staff of both wards. Seasonal variations in biochemical requests might also have affected the number of requests made in unit B.

Interestingly, there was a greater reduction in the number of repeat requests than new requests. This may have occurred because junior staff thought that reducing repeat tests was a safer option and routine monitoring—for example, haemoglobin concentrations—was discouraged. Repeat testing may have occurred after longer intervals, which would also have caused an overall reduction in number. About half the reduction in the total use of tests was due to a reduction in the number of repeat requests; thus clinicians should pay particular attention to this aspect of diagnostic testing if they wish to reduce the use of tests.

The guidelines and weekly review of medical records were quite acceptable to medical staff. The findings during the weekly reviews indicated that all the doctors in unit A had changed their practice and none consistently ignored the guidelines. The consultants found that formulating the guidelines and discussing them with junior staff during the weekly review was educational and improved their own critical thinking in the selection of diagnostic tests. Both junior and senior staff thought that the reviews were interesting and useful; any worries house officers had about possible hazards of reduced testing were dispelled by discussion with consultants. Indeed, the reviews did not identify any omissions considered to have serious consequences for patients, an observation confirmed by a study in the United States in which the patients of clinicians with low levels of test use did not have less satisfactory outcomes than the patients of clinicians who used more tests.[11] In unit A enthusiasm for the weekly reviews was such that medical staff decided to continue the intervention after the trial had finished.

Compliance with the guidelines was not examined other than during the review of medical records. Studies concerned with implementing guidelines—for example, on the use of skull radiography in patients with head injuries—have shown that even where substantial reductions take place considerable non-compliance with guidelines may occur.[12-15] The main effect of guidelines may be to trigger greater discrimination in the use of tests rather than compliance with the specific advice contained in the guidelines. Thus details of the guidelines may not be critical in promoting change.

In the only other similar trial conducted in the United Kingdom review of the use of tests was incorporated into a weekly audit of medical records.[16] The ensuing reductions in use were no greater than in a non-audited ward. It was suggested that the high proportion of emergency admissions did not provide scope for substantial reductions. The audit did, however, cover many aspects of clinical care, which may have diluted any motivation to change patterns of requesting. In addition, medical staff were not issued with clinical guidelines.

In a controlled trial conducted by Martin *et al* in the United States weekly chart reviews of the unnecessary use of tests resulted in a 47% reduction in test use.[17] The control group, which may have been exposed to some interventions, also reduced its use of tests, but to a lesser extent than in the intervention group. On withdrawing the chart reviews, the doctors continued to use fewer tests during the next four months. This sustained reduction in use is encouraging given that in our study there appeared to be some increase in use during the intervention period. It may be that an initial waning of interest by junior staff is counterbalanced by repeated exposure to consultants' attitudes and factual information about testing, leading to long term reductions in use.[17]

The results of this trial suggest that the introduction of clinical guidelines and weekly review of medical records can have an effect on the use of laboratory tests, at least in the short term. The effect is dependent on the enthusiasm of the medical staff. We now need to determine if the same is true for a wider spectrum of clinicians, including those in other specialties; how the change can be sustained over a long period of time; and what the impact of the change is on laboratory activity. Meanwhile, we recommend that clinicians interested in using diagnostic tests more discriminately formulate their own guidelines and determine the effect of reviewing the medical records of patients discharged from their wards.

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