Contemporary Themes

An aid to reducing unnecessary investigations

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Summary and conclusions

The number of investigations carried out on patients with the same condition varies greatly. The reason is largely inappropriate investigation. The known progressive increase in the use of laboratory facilities could be slowed down if unnecessary tests were eliminated. A computer-based medical information system, house officer information system, was used to eliminate the ordering of unnecessary tests. Analysis showed that patients cared for while the system was in operation were less likely to have unnecessary tests, which lead to a saving of £1·34 per patient in laboratory costs.

Introduction

Several observers have pointed out that the use of laboratory resources is rising rapidly. The annual growth rate for both radiology and pathology services is about 6% a year, and over ten years the work load in these services has increased by 80%.[1] If this increase in demand resulted in improved care then it might be justified. The evidence about the usefulness of pathological investigations suggests that they should be used sparingly. For a long time it has been known that the history is the most important part of the patient's assessment.[2] Hampton *et al*,[3] comparing the usefulness of the history, physical examination, and laboratory tests in reaching a diagnosis, found only seven patients out of 80 where the laboratory tests were useful. A study by Sandler[4] showed that routine haematology and urine testing contributed to only 1% of the diagnoses.

The requesting patterns of different physicians vary considerably.[3 5] Ashley *et al*[5] comment that the wide variation may indicate lack of professional concensus about the use of diagnostic facilities. Variation may occur for other reasons. A particular doctor may have firm views about which tests are warranted by a set of medical circumstances. It is more than likely, however, that for medical inpatients his junior staff will order the tests they think appropriate. Two types of mistakes may occur—either the omission of a useful test or the ordering of an unnecessary one.

A solution to the problem of test variation is to have protocols defined for a range of medical problems based on some concensus view about the investigations needed for given situations.

This report describes the effectiveness of a computer-based information system in reducing the number of unnecessary tests.[6]

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Method

A computer-based clinical information system, house officer information system (HOIS), containing protocols for investigating 79 common acute medical problems has been developed. Information specified includes data from the history, physical examination, and laboratory tests. After a patient has been examined his name and list of medical problems are entered into the system. The system responds to this input with a printed sheet for each of the problems. Each sheet contains information useful in managing that problem.

The effect of the computer system was examined in two ways. Firstly, the investigation pattern of one junior doctor (Dr A) was examined during a six-month period without the use of the computer system and was then re-examined over a six-month period while using the computer system. Secondly, the investigation pattern of another doctor (Dr B) was noted while not using the computer system. This was compared with the investigational habits of a single doctor (Dr C) who used the computer system. None of the doctors were told that their ordering of investigations would be investigated.

A sample of patients' records were examined and a note made of all investigations ordered. A test was judged spurious if its request could not be justified by the patient's condition or results of his other tests. The patients whose records were examined were all acute medical cases admitted under the care of one physician in one of two hospitals. Most had either asthma, chronic obstructive airways disease, congestive cardiac failure, hypertension, or pneumonia. The principle diagnosis of all the patients was included in the 79 for which protocols were available.

TABLE I—*Spurious tests ordered by Dr A before and during the use of HOIS*

	Before HOIS	With HOIS	χ^2 or exact test	Significance level
No of cases	69	63		
Erythrocyte sedimentation rate	4	—	Exact test	NS
Haemoglobin, white cell count	4	2	0·52	NS
Urea, electrolytes	6	5	0·25	NS
Biochemical profile	6	1	Exact test	0·024
Cardiac enzymes	10	4	2·3	NS
Platelets	15	—	Exact test	>0·001
Total No of tests	45	12	28·6	>0·001
Average No of tests per patient	0·65	0·19		

NS = Not significant.

TABLE II—*Spurious tests ordered (without HOIS and with HOIS)*

	Before HOIS	With HOIS	χ^2 or exact test	Significance level
No of cases	86	69		
Erythrocyte sedimentation rate	14	2	7·4	>0·01
Haemoglobin, white cell count	15	1	15·05	>0·001
Biochemical profile	10	—	Exact test	>0·001
Cardiac enzymes	12	—	Exact test	>0·001
Glucose	1	1	—	NS
Uric acid	—	1	—	NS
Cholesterol	—	1	—	NS
Chest radiography	1	—	—	NS
Electrocardiography	5	3	0·17	NS
Total No of tests	58	9	46·16	>0·001
Average No of tests per patient	0·93	0·16		

NS = Not significant.

The number of spurious tests in the various groups was compared using the standard χ^2 test calculated for a 2×2 table. If any of the cells in the table contained less than two the exact test was used.

Results

The number of tests judged to be spurious was reduced for Dr A when he used the computer system. The overall reduction attained statistical significance (table I). There was a similar reduction in the second study, and the difference between the number of spurious tests again reached statistical significance (table II).

Comparison of the number of spurious tests in the two studies showed no statistical significant difference between them (table III).

From the cost of these tests (table IV) the possible average saving per patient may be calculated. In this study the spurious tests cost about £1·34 per patient. Extending this figure to all the acute medical patients admitted to British hospitals in one year gives a sum of over £1 m.

TABLE III—*Comparison of numbers of spurious tests in the two studies*

	1st study	2nd study	χ^2	Significance level
Before HOIS				
No of cases	69	86		
No of patients with spurious tests	45	58	0·08	NS
With HOIS				
No of cases	63	69		
No of patients with spurious tests	12	9	0·89	NS

NS = Not significant.

TABLE IV—*Savings by Dr A from reducing number of spurious tests (costings taken from Stilwell*[7])

	Cost of tests	Tests saved over 63 patients	Saving
Erythrocyte sedimentation rate	£3·01	3·65	£10·99
Haemoglobin, white cell count	£3·01	1·65	£4·97
Urea, electrolytes	£1·91	0·47	£0·91
Biochemical profile	£1·91	4·48	£8·55
Enzymes	£3·50	5·13	£17·96
Platelets	£3·01	13·70	£41·22
			£84·6
Saving per patient			£1·34
Extended over the country—£1 million			

Discussion

The four major factors likely to influence the ordering of investigations here are (*a*) the type of patient, (*b*) the policy of the consultant, (*c*) change in the doctors, or (*d*) the influence of the computer system.

The patients were all general medical emergencies admitted to the same two hospitals from the same area. Though patients with any medical condition were considered, over three-quarters of them suffered from one of the five conditions mentioned above. They were all admitted under the same consultant. In the first study the investigational practice of the same junior doctor was examined with and without the computer system. Possibly his practice might have changed independently of the influence of the computer system, but it is more reasonable to attribute the change to the influence of the computer system.

The evidence from the second study, though slightly weaker because different doctors were concerned in the studies with and without the computer, confirms the results of the first study. The proportion of spurious tests ordered and the subsequent improvement is very similar in the two studies (table III). The evidence strongly suggests that HOIS did influence the investigational habits of those using it.

The growth in laboratory usage, unmatched by any perceived improvement in patient care, is a matter for attention. The elimination of unjustifiable requests for investigation is a good first step to the better use of laboratories and containment of their costs.

The number of unnecessary tests fell from 42 to 12 in the first study, and from 58 to 9 in the second. It is unlikely that this change affected the quality of care. Though extrapolation of the average saving per patient to all acute medical patients in England begs many questions, savings could undoubtedly be made.

Unnecessary investigations are ordered because of ignorance, lack of thought, vagueness, and duplication. Ignorance is shown by a mistaken view of the usefulness of a test—for example, plain abdominal radiography in dyspepsia. Investigations may be requested in an unthinking manner. Myocardial infarction is common in elderly patients: serum cardiac enzyme concentrations, as a marker for this condition, are often asked for: this investigation may be requested, through habit, in patients who have only a slight chance of having had a recent heart attack.

When blood is taken for one test other tests may also be requested on the vague basis that they might conceivably be useful. Estimation of blood glucose concentration is needed to monitor diabetic patients, and perhaps the urea and electrolyte concentrations might also be asked for though there is no strict indication for these tests.

Duplication may arise in two ways. Occasionally two doctors of the same medical team will order the same investigation due to a misunderstanding as to whose responsibility it is. An investigation may be re-ordered because the report is delayed or lost.

No exact reason can be given here for the ordering of unnecessary tests, but examination of the type of test suggests that vagueness is the most likely cause. Those tests for which a statistical significant difference was shown in one or both studies —that is, erythrocyte sedimentation rate, haemoglobin concentration, white cell count, and, to a lesser extent, biochemical profile, are those that are used as screening tests rather than diagnostic for specific conditions. They are the tests that are often done "just to see things are all right" when blood is taken for other purposes.

The two other tests that reached statistical significance (platelets and cardiac enzymes) are used for specific inquiries. Lack of thought is the most likely reason for the over-ordering of these tests.

References

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