all times to avoid compromise of the airway—particularly when a patient in coma is transferred from one hospital to another. Yet two-thirds of the patients in this study who were in coma when transferred to the neurosurgical unit arrived without an endotracheal tube in place; some of these patients were not even appropriately positioned to minimise the risk of airway obstruction.

Some might regard this investigation as evidence that the organisation for care for patients with head injuries should be reviewed, so as to ensure that more of these patients receive direct neurosurgical supervision soon after injury. In the West of Scotland only 4% of patients admitted to hospital after head injury eventually come to the regional neurosurgical unit, a similar proportion as in the regions served by the Aberdeen and Dundee neurosurgical units.^{1,2} Because head injuries are so common, considerable redeployment of beds and of medical manpower would be needed if neurosurgeons were to take primary responsibility for an appreciably greater proportion of acute head injuries. Before recommending such a radical reorganisation we must consider the scale of the problem, and whether there are better ways of identifying the relatively small number of patients who are at risk from complications, and who may require neurosurgical investigation or treatment. This is one purpose of the epidemiological study of head injuries in Scotland currently being conducted from this department.

Whatever the findings of that study there is obviously need for closer collaboration between neurosurgeons, primary surgeons, and specialists in accident and emergency, so that appropriate guidelines for different local conditions may be established. How this might best be achieved is beyond our scope here, which is to show the need for a critical review of the

care of patients with head injuries in the acute stage. One possibility would be to establish a system of confidential reporting of patients who "talk and die" after head injury, similar to that which has proved useful in identifying preventable factors contributing to maternal mortality.

This investigation is part of the Scottish Head Injury Management Study, supported by the Chief Scientist Organisation of the Scottish Home and Health Department. We thank the University Department of Neuropathology in the Institute of Neurological Sciences for their collaboration, and the consultants of the Division of Neurosurgery for allowing us to report on their patients. Dr Rose was on secondment from the University of Texas Medical Branch in Galveston, and Dr Valtonen from the University of Helsinki.

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Contemporary Themes

Improving drug compliance after hospital discharge

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Summary

The effect of counselling on medication errors was assessed in 165 elderly patients after leaving hospital. Counselling was effective, with counselled patients making under one-third of the errors made by uncounselled patients. Three types of memory aid were tried to supplement counselling. The pill wheel increased errors, a tablet identification card was unhelpful, and only a tear-off daily calendar seemed to improve results modestly. Counselling was virtually as effective in improving compliance in poorly orientated patients.

A designated member of staff should spend about 15 minutes with each elderly patient before discharge to ensure that the discharge drug regimen is fully under-

stood and remembered, that old tablets are destroyed and that other people's tablets are not taken.

Introduction

Drug-induced disease in the elderly is commoner than is often realised. Poor drug compliance plays a substantial part in this problem. Studies of elderly patients have shown that half do not take the drugs prescribed¹ and that from 25% to 59% of patients make errors in their medication.² Many patients do not understand their regimens³ and in more than one-third of patients the resulting errors actively endanger their health.² The problems of tablet schedules are aggravated in the elderly because many elderly are mentally frail yet have no relative or friend to supervise their drug taking. In a general practice survey 87% of patients over 75 years old taking tablets were responsible for their own medicines.⁴ One-third of this group were taking more than four types of tablet a day.

Methods of improving drug compliance centre on drug counselling and memory aids. Wandless and Davie⁵ improved drug compliance in a group of well-orientated hospital inpatients by using calendars and tablet identification cards. We have assessed the value of drug counselling and memory aids in

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improving drug compliance in elderly patients at home after discharge.

Patients and methods

We studied an unselected group of 165 consecutive discharges from the department of geriatric medicine, Sherwood Hospital. Patients were allocated by rotation to one of three groups.

COUNSELLED GROUP

Sixty patients were seen by the clinical pharmacist (MP) before discharge. The name and purpose of the tablets or syrup or both were explained, also the dose and time of administration. The patient was asked to repeat the instructions until a satisfactory grasp of the drug schedules was obtained. The patients were also asked to destroy all their old tablets and not to take other people's tablets. At the end of each interview an assessment was made of the retention of information (good, moderate, or poor). About 15 minutes was spent with each patient.

COUNSELLED GROUP WITH MEMORY AIDS

Forty-five patients were counselled as above before discharge. They were also issued with one of three types of memory aid: (1) a pill wheel with a separate compartment for each day. Each compartment was subdivided to allow a maximum of four times daily medication; (2) an individually prepared tear-off daily calendar detailing each day's drug schedule,⁵ and (3) a tablet identification card showing a sample of each tablet beside its daily dosage schedule.⁵

UNCOUNSELLED GROUP

The remaining 60 patients were given their medication in the routine manner before discharge. The usual brief description of tablet types was given, but without intensive counselling.

METHODS

To obtain a realistic cross-section of discharges no patient discharged home on oral medication was excluded because of mental

frailty or poor visual acuity. Patients were rated on the Mental Status Questionnaire (MSQ)⁶ (0-17, with 12 being taken normally as the lowest value compatible with an independent existence at home). Tablets for all patients except those with pill wheels were made up in the standard manner in glass bottles with screw-on caps, which contained one week's supply. The labels were clearly typed and dated, giving the routine instructions from the hospital pharmacy—for instance, Digoxin 0.25 mg—one tablet to be taken each morning. When patients were illiterate or had poor visual acuity colour markings were used on the bottle labels. All patients could open the bottles, extract the tablets, and convey them to their mouths. Patients given pill wheels were taught to manipulate them correctly.

Patients came to the day hospital at Sherwood on the seventh day after discharge. They were asked to detail dose schedules fully and the purpose of each tablet. Drug compliance was checked, and a further weekly supply and memory aid were dispensed. Patients then attended the day hospital twice weekly. Random spot checks were also carried out at home by ETM each week. Detailed reassessments were made six and 12 weeks after discharge.

Four types of medication error were assessed: (1) underdosage: having taken less than half the week's medication at the weekly day hospital visit; (2) overdosage: having consumed the week's medication in four days or less at a home spot check; (3) old medication: regularly taking drugs from old prescriptions stocked at home; and (4) other people's tablets: regularly taking drugs originally dispensed for another person (at least one tablet a day). The results were analysed using the χ^2 test with Yates's correction for small numbers throughout.

Results

The three groups were similar in age, sex, MSQ, and number of tablets taken (table I). No patients were lost to follow-up. Table II shows the number of patients making each type of medication error one week after discharge and table III the errors made 12 weeks after discharge. The error survey at six weeks gave intermediate results. The most striking finding was the considerable increase in patients taking their tablets correctly in the counselled group. This improvement was seen at both one and 12 weeks after discharge. It was highly significant in better-orientated patients (MSQ 12 or more) but was still significant in those with MSQ below 12.

Multiple errors were also much commoner in uncounselled patients. By 12 weeks uncounselled patients were making errors in 3.2 times as many categories as counselled patients without aids. By then, the average uncounselled patient was making errors in 1.7 of the four categories. Counselling was particularly efficient in reducing the use of old medicines and other people's tablets (37 errors reduced to three at 12 weeks). Counselling was still effective in poorly orientated patients. Its effect there was powerful enough for a higher proportion of counselled low-MSQ patients to be taking tablets correctly than of uncounselled high-MSQ patients at 12 weeks.

Adding memory aids to counselling produced mixed results. Overall compliance was poorer but most of the errors occurred with the pill wheel. All 15 patients with the pill wheel were taking less than half their tablets at 12 weeks and six exasperated patients had tipped the pill wheel contents out into a bottle. The group with tablet cards or calendars, however, performed at least as well as the counselled group—on comparing patient numbers taking tablets correctly or incorrectly in uncounselled or calendar/card groups, $\chi^2 = 10.19$ ($P < 0.01$) at 12 weeks. Of the two aids, the tablet card did not appear to

TABLE I—Characteristics of patients studied

	Counselled	Counselled plus aids	Uncounselled
Men	5	3	5
Women	55	42	55
Mean age	79.7	78.8	81.2
Mean mental status questionnaire rating ..	12.0	12.3	13.0
Mean No of preparations taken	2.04	2.20	2.04
Mean No of tablets a day ..	5.89	5.70	6.10

TABLE II—No of patients making each type of medication error one week after discharge

	MSQ 12 or more			MSQ below 12		
	Counselled (n = 21)	Counselled plus aids (n = 20)	Uncounselled (n = 26)	Counselled (n = 39)	Counselled plus aids (n = 25)	Uncounselled (n = 34)
Underdosage	1	4	8	12	13	16
Overdosage	1	1	6	7	5	10
Old medication	0	0	8	2	4	10
Other people's tablets	0	0	2	0	1	8
Total	2	5	24	21	23	44
No of patients taking medication correctly	19	15	12	19	17	8

MSQ = Mental status questionnaire rating.

Comparing No correct with No with errors (DF = 1):

Counselled v uncounselled—MSQ ≥ 12 : $\chi^2 = 8.29$, $P < 0.01$; MSQ < 12 : $\chi^2 = 3.92$, $P < 0.05$.

Counselled plus aids v uncounselled—MSQ ≥ 12 : $\chi^2 = 2.78$, $P < 0.1$; MSQ < 12 : $\chi^2 = 0.01$, NS.

Counselled plus aids v counselled—MSQ ≥ 12 : $\chi^2 = 0.81$, NS; MSQ < 12 : $\chi^2 = 1.92$, NS.

TABLE III—No of patients making each type of medication error 12 weeks after discharge

	MSQ 12 or more			MSQ below 12		
	Counselled (n = 21)	Counselled plus aids (n = 20)	Uncounselled (n = 26)	Counselled (n = 39)	Counselled plus aids (n = 25)	Uncounselled (n = 34)
Underdosage	3	6	10	14	14	19
Overdosage	1	1	7	8	5	9
Old medication	0	0	10	2	6	16
Other people's tablets	0	2	2	1	1	9
Total	4	9	29	25	26	53
No of patients taking medication correctly	17	12	9	15	6	5

MSQ = Mental status questionnaire rating.

Comparing No correct with No with errors (DF = 1):

Counselled v uncounselled—MSQ ≥ 12 : $\chi^2 = 8.30$; $P < 0.01$; MSQ < 12 : $\chi^2 = 4.03$, $P < 0.05$.

Counselled plus aids v uncounselled—MSQ ≥ 12 : $\chi^2 = 2.0$, NS; MSQ < 12 : $\chi^2 = 0.32$, NS.

Counselled plus aids v counselled—MSQ ≥ 12 : $\chi^2 = 1.28$, NS; MSQ < 12 : $\chi^2 = 0.86$, NS.

improve compliance compared to counselling alone. Using a pill calendar seemed to improve compliance modestly, but this effect did not reach statistical significance. Small patient numbers prevent firm conclusions on these individual aids. Comparison of tables II and III shows that about 80% of errors present after 12 weeks had already occurred by the end of the first week. This was also true of patients taken individually. It was valid for all types of counselling and all types of error apart from the use of old medication, which increased slightly more between one and 12 weeks.

Patients in all three groups were taking an average of 2.08 types of preparation giving a mean consumption of 5.91 tablets a day. The most commonly prescribed drugs, in descending order, were digoxin, diuretics, potassium supplements, levodopa preparations, laxatives, emepromium bromide, antidepressants, hypotensives, thyroxine, oral hypoglycaemics, and hypnotics. The distribution of drug types was similar in all three groups. Underdosage was particularly common with two types of tablet, of which the worst was Slow-K. Of the 61 patients on Slow-K 36 were taking less than half their tablets after 12 weeks. To see whether the poor compliance with this commonly-prescribed drug was unduly influencing the conclusions, the results above were recalculated excluding any Slow-K errors. None of the significance levels or conclusions were affected. The other unpopular drugs were hypotensive agents. Of 21 patients taking these tablets, 14 were taking less than half their weekly quota after 12 weeks. Nine of them had stopped or reduced their tablets because of unacceptable postural hypotension.

At 12 weeks only 14 of the 60 uncounselled patients were making no substantial errors in their medication, whereas 31 of the 60 counselled patients and 18 of the 45 counselled patients with aids were making no substantial errors. In all counselled patients the clinical pharmacist graded each patient's comprehension of the drug schedule after counselling as good, moderate, or poor. After 12 weeks patients with good initial comprehension were making errors in 0.49 categories per patient, those with moderate initial comprehension in 0.59 categories, and those with poor initial comprehension in 1.22 categories per patient. The difference between good, moderate, or poor is statistically significant. Thus the pharmacist's initial assessment did correlate with subsequent performance, although the rather similar figures for good and moderate comprehension suggest that these two categories were hard to distinguish. Also a few patients made no errors despite poor initial comprehension.

At 12 weeks patients were asked to detail their drug schedule—what each tablet was for, how many tablets they should take, and how often. While 68% of counselled patients and 67% of counselled patients with aids could recall their regimens satisfactorily, only 42% of uncounselled patients could do so—a highly significant difference ($P < 0.01$).

Although the lowest MSQ score considered compatible with an independent life is 12, a total of 98 of the 165 consecutive patients scored below this and 36 scored below six. Of the 165 patients, 136 were discharged to live alone and all but four were in charge of their own medication. These figures did not vary significantly between groups.

Discussion

Many older patients are discharged into conditions that discourage regular drug taking. Over 80% of these patients were

discharged to live alone and almost 60% had an MSQ rating lower than normally thought reasonable for an independent life. Since these discharges were unselected these figures may well be typical of many centres. Our uncounselled group shows the size of the problem normally caused by medication errors. By 12 weeks after discharge half the patients were taking less than half their tablets, while a further quarter were seriously overdosing themselves. Less than one-quarter were still taking their tablets properly.

A 15-minute tablet instruction session before discharge proved highly effective in reducing medication errors for at least 12 weeks after discharge. Differences between counselled and uncounselled groups were highly significant, and counselled patients made less than one-third of the errors made by uncounselled patients. Counselling was almost as effective in poorly orientated patients (MSQ 0-11) as in well-orientated patients (MSQ 12-17). Thus all patients should benefit from counselling. Medication errors tended broadly to fulfil the pharmacist's initial assessment of regimen comprehension, but many unexpectedly good results occurred in patients with only poor or moderate initial comprehension. Thus the message may be getting through, even when it does not seem to be.

We tried three types of memory aid to supplement counselling. The pill wheel was the worst. Patients found it hard to get tablets out of its small compartments. Most of them became exasperated with it so that after 12 weeks all 15 patients were taking fewer than half their tablets. Another aid—a card describing the regimen—did not seem to improve the compliance further. A tear-off calendar did give a modest further improvement in tablet taking. It was laborious to produce, however, and is unlikely to be feasible for routine treatment. Since four-fifths of the errors noted at 12 weeks had already occurred one week after discharge, an early check on medication after leaving hospital could greatly reduce errors.

Two types of tablet caused particular problems. After 12 weeks, about 60% of patients on Slow-K were taking less than half their tablets. Long-term compliance may be even worse. A survey of elderly people visited at home¹ has shown that of 58 patients on diuretics only 12 were still taking potassium supplements. Since Slow-K is not taken regularly, perhaps a once-daily potassium-sparing diuretic such as amiloride should become the routine form of potassium supplement in the elderly. Hypotensives were also poorly tolerated. Two-thirds of patients were taking less than half these drugs 12 weeks after leaving hospital. Most had reduced or stopped them because of severe postural hypotension. Thus we probably need to stop and think before prescribing any hypotensive for an old person. In our study patients were discharged on an average of 2.08 types of preparation. This is lower than figures of 2.54,⁷ 2.73,¹ and 2.78⁸ found in other surveys. Nevertheless, they were still taking an average of 5.91 tablets each day. Since most patients were mildly disorientated, these regimens must be a considerable mental strain and a potent source of anxiety to them. Errors increase rapidly as the number of prescribed drugs rises³ so that

the regular taking of vital drugs may be jeopardised by essential prescribing. Every drug prescribed to an elderly patient needs a long hard look.

A major problem of drug compliance trials is assessing the practical clinical importance of the errors found. We included only substantial under- or over-dosage—patients had to be taking all their drugs at roughly under half or over double the prescribed dose to be noted. The large error rates we found may well underestimate the problem. Both old medication and other people's tablets may be outdated and may produce drug interactions or overdosage when taken with the prescribed regimen. Their effects are potentially as serious as under- or over-dosage and have been given equal weight in the analysis. The most frequently prescribed drugs were digoxin, diuretics, potassium supplements, and levodopa preparations. Substantial misuse of any of these drugs can be dangerous, so the high incidence of serious errors found—particularly in the uncounselled patients—is clinically important.

Our main recommendation is that a designated member of staff, preferably the clinical pharmacist, should talk to each

elderly patient for about 15 minutes before discharge to make sure that he understands and remembers his drug regimen. This technique greatly reduces medication errors in even the most confused patients.

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Clinical Topics

Presentation of rheumatoid arthritis and its relation to prognosis*

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Summary

A review of published reports in an attempt to relate the way rheumatoid arthritis presents to its manner of progression and prognosis has provided few positive answers. Certain, but not all, studies indicate that cases with an acute explosive onset do better than those of more insidious onset, but the latter have almost certainly lasted longer by the time they come under medical supervision. Cases of monarthritis and palindromic (remittent) arthritis do better than polyarthritic and persistent cases, but true diagnosis of the former is often uncertain. Undoubtedly persistent high-titre seropositivity and nodule formation are bad prognostic pointers.

A plea is made for a more intensive study of the early case: if any therapeutic agent now or in the future can reverse the inflammatory process this is surely the time it is most likely to do so. This is the curable end of what is now an incurable disease.

*Based on a postgraduate lecture given at the Robert Jones and Agnes Hunt Orthopaedic Hospital in Oswestry on 5 March 1977.

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Introduction

Rheumatoid arthritis is a peculiar disorder; its many modes of presentation and its various patterns of progress make one wonder if it is not several pathological processes with many different starting factors rather than a single entity. This is important when it comes to assessing the value of different therapeutic agents. We put, let us say, a series of 100 patients together, and if drug A does not work in most and fails to ease pain, stiffness, and swelling we consider it a failure. But drug A may work like a charm in 10 or 20% of these cases and fail in the others and so gets lost in the statistical analysis. It would seem logical to look for these differences that may prove highly informative early in the disease.

A study of how the disease starts may possibly clarify not only causes and prognosis but also treatment. It would seem more logical to study early cases than the advanced; in most reported case histories the disease has been present for several years.

Types of onset

Rheumatoid arthritis may start in many ways.

ACUTE MONARTHRITIS

In 1973 Rasmussen *et al*¹ in Copenhagen reported on 65 patients with monarthritis of over three months duration, who had been observed on average for three years. Only four developed rheumatoid arthritis. The largest group (46 cases) were labelled "benign arthritis";