comment of Withering (1785) about digitalis is applicable to drugs used at the present time: "The use of the Foxglove is getting abroad and it is better the world should derive some instruction, however imperfect, from my experience, than that the lives of men should be hazarded by its unguarded exhibition, or that a medicine of so much efficacy should be condemned and rejected as dangerous and unmanageable."

REFERENCES

- Cluff, L. E., Thornton, G. F., and Seidl, L. G. (1964). *J. Amer. med. Ass.*, **188**, 976.
 Dunlop, D. (1965). *Brit. med. J.*, **2**, 437.
 Elwood, P. C., Pemberton, J., Merrett, J. D., Carey, G. C. R., and McAulay, I. R. (1965). *Brit. J. industr. Med.*, **22**, 27.
 Hoddinott, B. C., Gowdey, C. W., Coulter, W. K., and Parker, J. M. (1967). *Canad. med. Ass. J.*, **97**, 1001.
 Hurwitz, N., and Wade, O. L. (1969). *Brit. med. J.*, **1**, 531.
 Kendall, M. G. (1948). *Rank Correlation Methods*, pp. 1-8. London.
 Modell, W. (1964). *Clin. Pharmacol. Ther.*, **5**, 265.
 Moser, R. H. (1964). *Diseases of Medical Progress*, 2nd ed. Springfield, Illinois.
 Norman, P. S., and Cluff, L. E. (1966). In *Drugs of Choice*, 1966-7, pp. 30-47, edited by W. Modell, St. Louis.
 Ogilvie, R. I., and Ruedy, J. (1967). *Canad. med. Ass. J.*, **97**, 1450.
 Schimmel, E. M. (1964). *Ann. intern. Med.*, **60**, 100.
 Seidl, L. G., Thornton, G. F., Smith, J. W., and Cluff, L. E. (1966). *Bull. Johns Hopk. Hosp.*, **119**, 299.
 Smith, J. W., Seidl, L. G., and Cluff, L. E. (1966). *Ann. intern. Med.*, **65**, 629.
 Withering, W. (1785). *An account of the foxglove, and some of its medicinal uses; with practical remarks on dropsy and other diseases*. Birmingham.

Admissions to Hospital due to Drugs

NATALIE HURWITZ,* M.B., CH.B., PH.D.

Brit. med. J., 1969, **1**, 539-540

Summary: In a survey of adverse drug reactions in wards of two Belfast hospitals for 52 weeks in 1965-6, 2.9% of 1,268 patients seen were admitted to hospital because of adverse reactions to drugs taken for therapeutic reasons and 2.1% were admitted because of self-poisoning. Patients admitted because of adverse drug reactions were older than those admitted because of self-poisoning and stayed in hospital longer. Among the drugs which caused the adverse reactions were digitalis preparations, antibiotics, corticosteroids, anticoagulants, analgesics, and tranquillizers. Hypersensitivity and side-effect types of reactions were the most common. Barbiturates were the most frequently used drugs in suicidal attempts.

Introduction

A survey of adverse reactions to drugs among 1,268 patients admitted to hospital was carried out in 1965 and 1966. The methods used and the definition of adverse reactions to drugs have been described (Hurwitz and Wade, 1969). In this paper 64 patients, of whom 37 were admitted because of adverse reactions to drug therapy and 27 because of self-poisoning with drugs, are described.

Results

Age and Sex of Patients and Duration of Stay in Hospital.—The age distribution of the patients is shown in the Chart. Patients admitted because of adverse reactions to drugs had a median age of 60 years. Those admitted because of self-poisoning had a median age of 27 years. Of those admitted for adverse reactions 20 were men and 17 women, and 10 men and 17 women were admitted because of self-poisoning. The duration of stay in hospital is shown in Table I.

* Research Assistant, Department of Therapeutics and Pharmacology, the Queen's University of Belfast.

Patients Admitted Because of Adverse Reactions

Thirty-seven of the 1,268 patients in the survey (2.9%) were admitted because of adverse reactions to drugs which were thought to be the entire reason for the admission of 25 and an important factor in the admission of 12. Most of the reactions were of the hypersensitivity or side-effect type; 11 were of life-threatening severity and the rest were moderate. Three reactions were classified as documented, three as possible, and the remainder as probable.

TABLE I.—Duration of Stay in Hospital

Days	No. of Patients	
	Adverse Drug Reactions	Self-poisoning
1-7	9	12
8-14	8	6
15-21	4	3
22-28	7	1
29-56	6	3
57+	3	2
Total	37	27
Median duration	18 days	9 days

Overdosage.—Six patients were admitted to hospital because of the effects of taking a dose of a drug in excess of that which had been prescribed by the physician. One man aged 57 inadvertently took the larger dose of warfarin (5-mg. tablet) because he was "out of" the 3-mg. tablet. After a few days he noticed bruising of the hands and face followed by epistaxis, haematemesis, melaena, and haematuria. Three patients took more than their prescribed dose of digitalis preparations and had cardiac arrhythmias. A woman who had bronchial asthma was admitted to hospital because of palpitations after she had used an isoprenaline spray repeatedly for several hours. A man aged 29 years had, over a period of three years, taken 50% more than his prescribed dose of methylprednisolone to obtain relief from bronchial asthma. He had gained 4½ stone (33 kg.) because of fluid retention and had striae on the abdomen, legs, and arms. He had become aggressive, which was a change from his previous personality.

Toxic Effects with Therapeutic Dose.—A patient taking the prescribed dose of warfarin as regulated by Thrombotest was admitted with severe melaena and collapse. Four patients developed cardiac arrhythmias with and without vomiting while being treated with digoxin. Another patient on guanethidine suffered from postural hypotension.

Age distribution of patients admitted to hospital with illness due to drugs compared with age of all patients studied.

Conditioned Intolerance.—A man aged 75 was admitted with a cardiac arrhythmia. He was taking digoxin in a dose which he had previously been able to tolerate well and hydroflumethiazide, but had omitted potassium supplements. The serum potassium was low (2.3 mEq/l.) and the digitalis toxicity was attributed to this.

Side-effects.—Ten patients were admitted with gastrointestinal symptoms such as diarrhoea due to quinidine. One patient had purpura due to prednisone. Two patients were admitted with severe haematemesis and melaena after taking small doses of aspirin, and one of these was later found to have an asymptomatic duodenal ulcer. Corticosteroids were thought to have precipitated left ventricular failure in a man aged 81 who had no previous heart disease. A man aged 76 who was confused on admission was found to have a serum bromide level of 84 mg./100 ml. as sodium bromide and as the level fell his confusion lessened. A woman aged 59 with chronic bronchitis and auricular fibrillation treated with digoxin was given oral propranolol for 12 days. She then developed vomiting, followed by cardiac failure, and was admitted to hospital, where she died.

Hypersensitivity.—One patient, later reported by McDevitt and Glasgow (1967), developed lupus erythematosus after four months' treatment with procainamide. Another patient was admitted with Stevens-Johnson syndrome after five weeks' treatment with phenytoin. A patient with bronchial asthma and eczema developed severe bronchospasm and a rash after three days' treatment with ampicillin. A man aged 60 was admitted with aplastic anaemia after taking phenylbutazone for two months. Four patients had rashes attributed respectively to sulphadimidine, tetracycline, chloramphenicol, and chlorpropamide. One patient had urticaria and pruritus thought to be due to tablets containing phenacetin and aspirin. Two patients were admitted with jaundice, in one caused by chlorpromazine and in the other attributed to diphenoxylate.

Idiosyncrasy.—A man aged 22 was admitted with an oculogyric crisis after taking 60 mg. of trifluoperazine.

Admission Due to Self-poisoning

There were 27 patients (2.1%). The drugs most commonly taken in suicidal attempts were barbiturates. The drugs used by 20 patients had been prescribed previously for their own treatment. Six patients took drugs prescribed for a relative. One patient took nitrofurantoin which "happened to be in the house." Only one patient, a girl of 13 years, purposely bought the drug (aspirin) from a pharmacist.

There were no deaths, but 12 patients were severely ill and two were in coma for several days.

Discussion

Although 64 (5%) hospital admissions were due to drugs and 37 (2.9%) were a result of adverse reactions to drugs, only 11 patients (0.9% of admissions) had adverse reactions other than self-poisoning which were severe or life-threatening and there was only one death. Seidl, Thornton, Smith, and Cluff (1966) at the Johns Hopkins Hospital reported that 5% of patients admitted to their hospital were admitted as a result of adverse reactions to drugs.

Some of the admissions due to adverse reactions were due to misuse of drugs by patients and could possibly be avoided by better instructions to patients. With many of the modern potent drugs adverse reactions are an almost inevitable consequence of the therapeutic efficacy of preparations. Before admission the clinical features of the patient had seldom been recognized to be a result of drug therapy. It is probable that many adverse reactions to drugs which occur in the community do not give rise to hospital admission, but the prevalence of such reactions is not known.

Most of the patients who attempted suicide by self-poisoning used drugs which were readily available to them. A reduction in the incidence of self-poisoning might be brought about by prescribing drugs, especially barbiturates, less frequently for patients or by prescribing them in smaller quantities. However, suicidal attempts by means other than drugs might increase.

If modern potent pharmacological drugs are to be used it is inevitable that some admissions to hospital will occur, either as a result of self-poisoning or as a consequence of adverse reactions to drugs. It would seem likely, however, that the size of this problem has not been fully appreciated to date, and that with greater awareness of it some of the admissions would have been prevented.

We are indebted to the Nuffield Provincial Hospitals Trust, who generously gave financial support to the project reported in this and the previous two papers. We wish to record our indebtedness to Dr. J. D. Merrett, of the Department of Medical Statistics, the Queen's University of Belfast, for his advice and help. We wish to thank the medical and nursing staff at the Belfast City Hospital and Purdysburn Hospital who gave so much help and were so tolerant to repeated questions. We are indebted to Staff Nurse Mary Best for assistance in the recording of data.

Details of the individual drugs which caused each reaction, and of the patients who developed reactions, are contained in an appendix which is available on request to the authors.

REFERENCES

- Hurwitz, N., and Wade, O. L. (1969). *Brit. med. J.*, **1**, 531.
- McDevitt, D. G., and Glasgow, J. F. T. (1967). *Brit. med. J.*, **3**, 780.
- Seidl, L. G., Thornton, G. F., Smith, J. W., and Cluff, L. E. (1966). *Bull. Johns Hopk. Hosp.*, **119**, 299.