

Papers and Originals

Acute Poisoning: Organization and Work-load of a Treatment Centre

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The Atkins Report (Central Health Services Council, 1962) included among its recommendations the establishment of district and regional poisoning treatment centres. Apart from the nominal designation of certain hospitals no action appears to have been taken. Between 1962 and 1966 the admission of poisoned patients increased by about 80% (General Register Office, 1964, 1968), and other reports (Backett, 1965; Ellis, Comish, and Hewer, 1966) estimated that between 10 and 19% of acute medical admissions to hospital were on account of poisoning. The health authorities therefore considered it advisable to review the situation. The ensuing Hill Report (Central and Scottish Health Services Councils, 1968) highlighted the epidemic nature of acute non-fatal poisoning in adults and teenagers and reiterated that poisoning treatment centres based on the district general hospital or its existing complex should be established, staffed, equipped, and designated throughout the country. All cases of self-poisoning in adults should be admitted to these centres, where a consultant with a special interest in the management of cases of poisoning would be available. These units should have seven-day psychiatric cover and laboratory support for the qualitative and quantitative estimation of the commonly ingested poisons.

Such a centre has evolved at the Royal Infirmary of Edinburgh over the past 90 years (Matthew, 1966), and during recent years it has functioned in the manner recommended in the Atkins and Hill Reports. In view of the current interest in acute poisoning it is opportune to examine the work-load and problems associated with the day-to-day administration of this unit.

Edinburgh Poisoning Treatment Centre

Structure and Staffing

The poisoning treatment centre is a self-contained unit situated adjacent to the accident and emergency department, through which all admissions pass. An intercom system allows rapid communication between the unit, the accident and emergency department, the anaesthetic department, and the laboratory dealing with chemical toxicology.

The accommodation consists of two side-rooms, each with four beds, usually occupied (for nursing reasons) by women, and a 12-bed ward for men. When pressure on beds for women is great the allocation of patients can be quickly reversed. A single room is available for severely ill patients.

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The centre is under the administrative charge of one consultant physician, who is supported by a registrar and a senior house officer, one of whom is first on call on alternate evenings and weekends. There is also a resident house officer who rotates with two of his colleagues to provide night cover. All members of the medical staff have additional duties in the general wards of the hospital and man the Scottish Poisons Information Bureau, which is located within the poisoning treatment centre. Sufficient general nursing staff under a sister-in-charge (Salmon grade 6) is available. None of the nurses is trained in mental nursing.

Psychiatric assessment is carried out by staff from the near-by teaching mental hospital. A registrar is seconded full-time, in rotation, for six-month periods, and is assisted by psychiatric research fellows. A consultant psychiatrist is present at two sessions each week, and during 6 p.m. to 9 a.m. an emergency roster is staffed by senior registrars in the region. A social worker is a full-time member of the team, and a health visitor and a mental health officer attend daily part-time.

A chemical toxicology subunit of the University Department of Clinical Chemistry in the Royal Infirmary was set up in 1964. Two members of the graduate staff of this department, one senior technician and one junior technician on rotation, were appointed to this work, so that the toxicological and biochemical aspects of diagnosis and treatment could develop in depth together. A senior member of the staff of the subunit rather than the general biochemist on call undertakes both emergency toxicological and biochemical investigations in poisoned patients, since experience has shown that without regular practice even the simpler toxicological analyses are likely to present difficulties.

Current Work-load

The unit serves a population of about half a million in Edinburgh and the surrounding district. All adult cases of poisoning are admitted, regardless of the severity of the poisoning, and this admission policy has not changed for many years. The number of admissions has doubled in the past five years, and in 1968 there were 1,067 admissions (634 women and 433 men). Kessel, McCulloch, Hendry, Leslie, Wallace, and Webster (1964) showed that during 1962 90% of all poisoned adults admitted to hospital from the catchment area were passed through the unit; the corresponding figure for 1967 was 95%. The rates for attempted suicide for both persons and admissions

TABLE I.—1968 Rates for Attempted Suicide per 100,000 Population Aged Over 15 in the City of Edinburgh

	Male	Female
Persons	157	196
Admissions	195	234

in 1968 are shown in Table I. Aitken, Buglass, and Kreitman (1969) reported the changes in rates and methods of self-poisoning between 1962 and 1967.

The distribution of admissions according to the days of the week and hours of the day is shown in Table II. Sixty-four per cent. of admissions occurred between 6 p.m. and 9 a.m., and half of these (one-third of all admissions) were during the five-hour period between 10 p.m. and 3 a.m. Despite reports of an increased incidence of attempted suicide in the spring (Stengel, 1964), over the years there has been no consistent pattern in the numbers admitted each month to this unit.

TABLE II.—Admission of 1,067 Poisoned Patients by Time of Day and by Day of Week

Hours	%	Hours	%	Day	%
08.00	3	20.00	11	Sunday	17
10.00	5	22.00	13	Monday	15
12.00	9	24.00	14	Tuesday	15
14.00	10	02.00	8	Wednesday	13
16.00	10	04.00	3	Thursday	11
18.00	12	06.00	2	Friday	14
				Saturday	14

The duration of stay of patients is shown in Table III. Seventy-four per cent. of cases were discharged within three days of admission and 92% within six days. Longer stays were usually on account of complications of the poisoning, delay in transfer to psychiatric or geriatric hospitals, or elderly or problem patients whose discharge to the community awaited the availability of support by the social services.

TABLE III.—Duration of Stay of 1,067 Poisoned Patients

Days	%	Days	%	Days	%
0-	13	4-	6	7-	1
1-	39	5-	3	8-14	3
2-	22	6-	2	14+	2
3-	9				

Medical Aspects

The principal poisons and the number of times each was encountered in 1968 are shown in Table IV. So far as could be ascertained from the history 74% of patients took only one

TABLE IV.—Number of Occasions on Which Poisons were Encountered in 1968

Poison	No.	%
Barbiturates	340	26
Aspirin preparations	182	14
Benzodiazepines	153	12
Mandrax	126	10
Tricyclic antidepressants	74	6
Other hypnotics	55	4
Carbon monoxide	58	4
Phenothiazines	46	3
Miscellaneous	270	21

TABLE V.—Depth of Coma and Drug Ingested by 222 Unconscious Patients

Drug	Coma Grade*		
	Grade 2	Grade 3	Grade 4
Barbiturates	41	42	27
Mandrax	15	14	4
Others	45	30	4
Total	101	86	35

* Depth of coma graded according to Matthew and Lawson (1966).

TABLE VI.—Duration of Coma and Drug Ingested in 220 Patients

Duration (hr)	Barbiturates	Mandrax	Others	Total
< 12	64	25	66	155
13-18	8	4	9	21
19-24	7	—	3	10
25-48	20	—	1	21
49-72	4	1	—	5
73-96	5	2	—	7
97+	—	1	—	1

poison, 14% took two or more poisons, and 6% took three or more simultaneously; alcohol was taken before or at the time of self-poisoning by at least 30% of patients. A combination of self-poisoning and self-injury (usually wrist-slashing) was carried out by 18 patients. Ninety-four per cent. of poisonings were deliberate, 5% accidental, and in the remainder (12 cases) a decision on whether the act was deliberate or accidental was not possible. Two hundred and twenty-two (21% of all admissions) were unconscious on admission to hospital. The depth of coma and the major drugs responsible are shown in Table V, the duration of coma in Table VI, and the supportive measures required until consciousness was regained in Table VII.

TABLE VII.—Supportive Measures Required in Management of 222 Unconscious Patients

Procedure	No. of Cases	%
Endotracheal intubation	54	24
Assisted ventilation	14	6
Bronchoscopy	2	—
Vasopressor drugs	15	7
Blood volume expansion	8	4

One thousand and one patients ingested their poison, gastric aspiration and lavage being carried out in 49% according to the criteria of Matthew, Mackintosh, Tompsett, and Cameron (1966); in 7% this was performed after endotracheal intubation. In a further 3% of patients gastric lavage had been carried out in other hospitals before transfer to this unit. Thirty-four (19%) of the patients who ingested salicylate were treated by forced alkaline diuresis. During the year haemodialysis was used on only one occasion in an attempt to remove poison (paraquat). Acute renal failure was satisfactorily managed by peritoneal dialysis in one patient, while two others required haemodialysis after initial peritoneal dialysis. Seven patients (0.7% of all admissions) died during the year. Table VIII gives particulars of these deaths, only three of which were directly due to poisoning.

TABLE VIII.—Details of Deaths in 1968

Sex	Age	Poison	Cause of Death	Comment
M	15	Paraquat	Poisoning	Respiratory failure
F	18	Paracetamol. Ferrous sulphate	Poisoning	Acute massive necrosis of liver
M	41	Orphenadrine	Poisoning	Cardiac arrest
F	77	Barbiturate	Atherosclerosis. Diabetes mellitus	
M	78	Coal gas	Cerebrovascular accidents	Transient cerebral ischaemic attack before poisoning. Blood-stained C.S.F. on admission. Died 12 days later
F	About 70	Barbiturate	Chronic uraemia. Respiratory infection	Conscious on admission. Blood urea 360 mg./100 ml. Extensive pneumonia
M	56	Mandrax	Acute myocardial infarction	Two previous myocardial infarctions and necropsy evidence of recent infarction. Carcinoma of prostate. Died after regaining consciousness

Laboratory Aspects

All biochemical requests from the poisoning treatment centre are channelled through the toxicology laboratory. In this way specimens can be processed and used most efficiently; at the same time prompt action is taken on samples which have been mislabelled or delayed in transit. A wide range of analyses can be carried out, since the techniques available include thin-layer, gas, and ion-exchange chromatography, ultraviolet and infrared spectrophotometry, spectrofluorometry, and atomic absorption spectroscopy.

All blood gas analyses are carried out by the staff of the subunit, but responsibility for other biochemical assays—for example, electrolyte, glucose, and enzyme estimations—rests

with the routine diagnostic laboratory, except when investigations must be made urgently. The number of urgent requests is in fact very small in relation to the total number of admissions; currently, there are on average nine per month, of which about half can be dealt with between 9 a.m. and 6 p.m.

In an analysis of the annual work-load of the toxicology laboratory and its changing pattern (Table IX), 85% of these estimations were performed specifically for the poisoning treatment centre and the remainder originated from other wards and hospitals, general practitioners, and industrial medical officers. The breakdown of estimations by substances (Table IX) is to some extent arbitrary, and gives no indication of multiple investigations carried out on a particular sample or on a particular patient. Nor do the data reflect the relative effort involved in actually performing the various estimations.

TABLE IX.—*Nature and Number of Toxicological Analyses Carried Out in the Department of Clinical Chemistry*

Estimation	1958	1964	1965	1966	1967	1968
Barbiturates	32	368	1,487	1,074	588	493
Salicylate	27	321	400	870	770	267
Carboxyhaemoglobin	—	48	150	132	53	65
Methaqualone	—	—	20	141	222	165
Miscellaneous	79	—	414	3,120	1,442	429
Total	138	737	2,471	5,337	3,075	1,419

The large number of barbiturate estimations carried out in 1965–6 and of salicylate estimations in 1966–7 is partly due to intensive study of treatment of these forms of poisoning. The subsequent fall in the numbers of these estimations is due to the use of standard forms of treatment and to the development of simple side-room methods for detecting these drugs in blood specimens (Clow and Smith, 1967; Brown and Smith, 1968). By contrast the trend in methaqualone estimations fairly accurately reflects the annual incidence of poisoning with Mandrax (methaqualone plus diphenhydramine) rather than changes in clinical or laboratory practice. The figures for carboxyhaemoglobin determinations show a downward trend in recent years, thus reflecting the falling incidence of carbon monoxide poisoning.

The miscellaneous group of estimations reflects poisoning with wide varieties of other prescribed drugs and of noxious substances ranging from nitrogen peroxide to trichloroethylene and lysol. In 1958 bromide and sulphonamide estimations constituted the major part of the group, but these drugs were rarely seen during 1965–8. During this period, however, about 10 chemically distinct types of prescribed drugs—mainly hypnotics or tranquillizers—were regularly encountered.

Psychiatric Aspects

The Hill Report recommends that *all* adult patients sent to hospital with poisoning should be seen by a psychiatrist; one reason for this is that the severity of the poisoning is no indication of the degree of psychiatric morbidity. The depth of coma on admission and the recommended psychiatric management of self-poisoned patients admitted during 1968 are shown in Table X. It will be seen that the proportion recommended

TABLE X.—*Depth of Coma on Admission and Recommended Psychiatric Management of Self-poisoning Cases in 1968*

Disposal	Level of Consciousness			All Cases %
	Conscious or Drowsy %	Unconscious but Responsive %	Unconscious and Unresponsive %	
Inpatient care	20	31	28	22
Outpatient care	36	38	34	37
Other	44	31	38	41
Total	100 (N=788)	100 (N=179)	100 (N=32)	100 (N=999)

for further inpatient care bore little relation to the depth of coma on admission.

The purpose of psychiatric assessment of patients who have poisoned themselves is twofold; firstly, to determine the appropriate further management, and, secondly, to establish a therapeutic contact so that the maximum benefit can accrue from further psychiatric care should this be required. The temptation to pay particular attention to the circumstances before ingestion should not be at the expense of a detailed personal history and examination of the mental state on recovery. The assistance of the social worker in obtaining a history from a relative is invaluable.

Two-thirds of the patients had some form of personality disorder, and only one-third demonstrable depression. Other psychiatric states, such as schizophrenia, epilepsy, dementia, or subnormality, accounted for about 10% of admissions (Kessel, 1965; Aitken and Carstairs, 1968). Interpersonal strife (particularly marital) due to emotional instability was encountered in nearly 70% of admissions, and social disorganization in terms of overcrowded housing, financial debt, employment difficulties, and crime was seen in 40% of admissions.

In view of the high proportion of depressed or psychopathic patients attention should be paid to their reaction on staff. Close liaison must be maintained between those in different roles within the unit, and meetings are held regularly. Nursing staff welcome informal discussion, especially on the handling of disturbed patients or relatives. The psychiatrists must be attentive to the need for emergency assessment, such as for a patient demanding his own discharge; the physicians often work at pressure, and so must the psychiatrists when the occasion demands. This view is supported by Watson (1969).

After physical recovery it is the responsibility of the psychiatrists to make appropriate arrangements for further management; Table X shows the further care recommended for the patients admitted in 1968. Twenty per cent. of patients were actually transferred for inpatient treatment at local mental hospitals. Only 14 patients required detention under a section of the Mental Health Act. Twenty-nine per cent. of the men and 41% of the women were offered outpatient psychiatric appointments, two-thirds to see a psychiatrist attached to the unit and one-third to see elsewhere a psychiatrist under whose care they had been previously. It is, however, known that rather less than half the patients in fact attend, and frequently their next psychiatric contact will be on the occasion of another overdose or self-injury. Because of this failure to attend the outpatient department, and because of the high incidence of social pathology, the social worker, mental health officer, and health visitor have an essential role in the management of those patients discharged to the community.

The proportion of those admitted who have had previous episodes of attempted suicide and those who have already received psychiatric treatment are shown in Table XI. Many patients were known to this centre or the catchment area mental hospital. The figures in Table XI show the considerable need for an effective aftercare service such as that devised by Hicks (1969). McCulloch, Philip, and Carstairs (1967) showed that 25% of successful suicides in Edinburgh had made an attempt in the preceding 10 years.

TABLE XI.—*Previous History of Patients Admitted in 1968*

	% Male (N=337)	% Female (N=506)
Number of suicidal attempts:		
None	77	81
One	11	11
Two	3	3
Three	9	4
Psychiatric treatment:		
None	63	72
Inpatient—within previous year	21	14
Inpatient—before previous year	16	13

Medical Records

Patients passing through this unit provide the staff with a wide variety of experience. The fallibility of memory requires provision of reliable statistics and case-finding facilities to provide data not only for research and teaching but also for feedback to the staff to correct misconceptions.

Since 1967 medical, laboratory, and psychiatric information for each admission has been recorded on code sheets in a form suitable for transfer to two 80-column punch cards. Monthly print-outs are obtained, a card to a line, so that at a glance down a column cases with designated information can be extracted. This method is adequate for detecting infrequent occurrences, such as barbiturate automatism (Aitken and Proudfoot, 1969). Automated card-sorting can be used if the distribution in any row is scattered. At intervals the information is processed to yield statistics such as those reported in this paper.

Discussion

This paper seeks to summarize the experience of an established poisoning treatment centre and to compare its organization and needs with the recommendations of the Hill Report (Central and Scottish Health Services Councils, 1968) on the hospital treatment of acute poisoning.

We firmly believe that poisoned patients should be managed in special units, and we go further than the Hill Report, which states that such management "may be an advantage." The size of the population served by this unit and the large number of admissions achieve economic use of the professional and technical skills available. In particular we feel it is unlikely that psychiatric assessment can be available so readily if consultants and registrars have to visit general hospitals on an irregular basis. Rapid discharge of patients is usual (Table III) and often demanded; this is possible only if a regular daily psychiatric service is provided, together with supportive social work. The policy of admitting all patients regardless of the severity of poisoning and having all interviewed by psychiatrists is in agreement with the Hill Report and is justified by the lack of significant correlation of the recommended psychiatric disposal with an index of the severity of physical illness (Table X).

The treatment of various types of poisoning in this unit has been presented elsewhere (Matthew and Lawson, 1966, 1967; Lawson and Brown, 1967; Matthew, Proudfoot, Brown, and Smith, 1968; Proudfoot, Noble, Nimmo, Brown, and Cameron, 1968; Lawson *et al.*, 1969; Proudfoot and Brown, 1969; Matthew, Proudfoot, Aitken, Raeburn, and Wright, 1969; Noble and Matthew, 1969). Observations on the psychiatric aspects of attempted suicide have been reported by Kessel (1965), Kessel and McCulloch (1966), McCulloch and Philip (1967), and Kreitman, Smith, and Tan (1969).

Chemical Toxicology Service

The only major issue in the Hill Report with which we find ourselves at variance is the matter of laboratory support. The report recommends that a chemical toxicology service with staff and facilities for the determination of blood levels of carbon monoxide, salicylate, alcohol, barbiturates, and iron, and for quantitative detection of urinary phenothiazines should be available at short notice, day and night. The factual basis for this recommendation is not given in the report, and since there has been no published comment we present in detail our own views.

Chemical toxicology has traditionally been regarded as the province of the forensic chemical pathologist, and this largely accounts for the lack of experience from which the staff of hospital laboratories suffer. Necropsy studies, however, can be conducted at leisure, whereas the clinician has imposed on the

methods of the chemical toxicologist the conflicting demands of speed, accuracy, and specificity. It is pertinent, however, to reconsider the need for such demands.

In cyanide, coal-gas, and morphine poisoning antidotes are used immediately, and while a retrospective analysis is desirable there is no need for an urgent level. When antidotes are less readily available, and need not necessarily be used with the utmost urgency, as in iron or organophosphorus poisoning, appropriate emergency investigations are in our opinion justified.

Poisonings for which antidotes are available are, however, a very small part of the work-load of a treatment centre; poisoning from hypnotic and tranquillizing drugs (Table IV) makes the greatest demands on the facilities. The approach to the treatment of poisoning with these drugs varies from hospital to hospital, and this, together with the experience of the physicians in assessing the severity of poisoning, determines the nature of the demands on the laboratory.

In this centre forced diuresis and peritoneal or haemodialysis in sedative poisoning have been abandoned for all but a minority of selected cases in favour of intensive supportive treatment. As the physicians have gained experience from continual contact with toxicological problems the comfort of an emergency blood drug level is no longer required; it rarely influences management. Thus prolonged clinical exposure has played a major part in the reduction of the work-load of the subunit for chemical toxicology and also explains the very low number of emergency calls on laboratory staff. With experience it is usually possible to identify clinically, shortly after admission, the desperately ill patient for whose proper management a whole range of emergency biochemical and toxicological investigations are necessary. The detailed study of such cases is often rewarding (Davidson and Eastham, 1966; Proudfoot and Brown, 1967; Proudfoot *et al.*, 1968; Matthew, Logan, Woodruff, and Heard, 1968). Such patients are, however, uncommon, and even in these cases a laboratory service which will provide electrolyte estimations and arterial blood gas analysis on a 24-hour basis is, in our opinion, of much greater value than one providing blood levels of drugs on the same basis.

Severe salicylate poisoning, on the other hand, requires energetic measures to remove the poison, and until recently intensive laboratory support has been mandatory. This problem has been resolved, firstly, by the introduction of a rapid and simple method of estimating the plasma salicylate level in the ward side-room (Brown and Smith, 1968), and, secondly, by the development of a regimen of forced alkaline diuresis which can be instituted without fear of severe hypokalaemia or marked acid-base changes (Lawson *et al.*, 1969). Salicylate intoxication is common (Table IV), and these measures have greatly reduced the number of salicylate levels, blood gas analyses, and electrolyte estimations carried out in our laboratory. Laboratory support is now necessary only in grave salicylate poisoning (Proudfoot and Brown, 1969).

The present report, like others (Burston, 1969), draws attention to the large variety of drugs which patients may consume in overdose (Table IV); indeed, many ingest several drugs simultaneously. The chemical problem in a severely poisoned patient then becomes a matter of "which drugs?" rather than "how much drug?" The comprehensive "screening" of blood specimens for drugs is at present almost impossible to carry out on an urgent basis, and in some types of poisoning—for example, paracetamol, tricyclic drugs, or paraquat—it may be a valueless exercise if more than a day or so has elapsed since ingestion. In such circumstances analyses of urine specimens can be helpful in a qualitative sense, but here again effective "screening" is not easy (Tompsett, 1968); though the presence of many common poisons can be excluded by suitable schemes of analysis, there is always a possibility of overlooking, or being unable to identify, a new or unusual drug.

In summary, therefore, we agree with the Hill Report that the laboratory service associated with treatment of poisoning should be part of the activity of the hospital biochemical laboratory; indeed, we consider it essential that the chemical toxicology and the clinical chemistry of poisoning be fully integrated. At the same time, however, the establishment of poisoning-treatment centres, with specially interested physicians using standard regimens of treatment, would certainly minimize the routine work-load of the laboratory and give rise to far fewer demands for emergency biochemical work than the Hill Report envisages.

Staff Problems

Special units dealing solely with the treatment of poisoned patients present particular problems of staff organization and morale. The great number of admissions at weekends and the fact that one-third of all admissions occur between 10 p.m. and 3 a.m. together make unusually heavy demands on the time and good humour of resident medical officers. The performance of gastric lavage, frequently on drunken and abusive patients, at such hours is likely in course of time to engender hostile feelings that are aggravated by the monotonous regularity with which a considerable proportion of these patients return. Poisoned patients constitute 21% of those requiring resuscitation on arrival at this hospital (Jenkins, McQuillan, and McNair, 1969). Though the rewards of successful management are great, they are diminished by having to cope with a large number of patients who are not physically ill.

It is for these reasons that we believe that every member of the medical team should have professional interests outside the unit and that the more junior nursing staff should change duties frequently. Experience suggests that four months is the optimum duration of appointment of the resident medical officer. It is desirable, therefore, that when poisoning-treatment centres are established the junior medical and psychiatric staff should participate in a rotation scheme.

The personality and behaviour of many patients, particularly "repeaters" who are not physically ill, is such as to make their prolonged presence intolerable in a unit primarily geared structurally and psychologically to resuscitation and intensive medical and nursing care. We believe that it is essential that these patients be assessed psychiatrically and either discharged or transferred to appropriate care as soon as possible. Indeed, it would be preferable from all points of view if after initial medical assessment all patients not physically ill or potentially so could be admitted direct to a psychiatric ward within the general hospital. Should their physical condition then deteriorate appropriate action could be promptly taken. Further psychiatric assessment and the opportunity for treatment would be possible and many patients would not require transfer to local mental hospitals. This would also fulfil the desirability for continuity of care by the same psychiatric team who established the initial contact. Until such time as the psychiatric services can assess all mildly poisoned patients immediately after their arrival at hospital or until psychiatric wards become available within all general hospitals, the poison-

ing treatment unit must rely heavily on the mental hospitals accepting with a minimum of delay those patients recommended for transfer.

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