

The Practice of Medical Toxicology*

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ABSTRACT

Two hundred twelve consecutive cases presenting to a medical toxicologist related to chronic occupational exposure (49%), acute occupational exposure (24%), and nonoccupational exposure (27%). Chief complaints were respiratory (36%), behavioral (28%), neuropathy (17%), and organic brain syndrome (10%). In 90% of patients, litigation was in process or under consideration. Referrals were from plaintiff attorneys (37%), from employers, insurance companies, and defense attorneys (26%), and from physicians (24%). Outcome of assessment revealed 55% to be unrelated to toxic substances, 39% probably related, and 6% positively related.

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INTRODUCTION

Medical toxicology is a new medical specialty with certification of physicians first offered in 1975. Twenty-six of the 30 physicians certified from 1975 through 1977 reside in the United States [1]. In the absence of a residency in medical toxicology, most of the diplomates have primary training in other specialty areas such as pediatrics, emergency medicine, or clinical pharmacology, which they continue to practice privately or as faculty or staff in universities or industry. The qualifications for the boards specify that after 1984 candidates must have completed an approved 2-year residency in medical toxicology. The only residency now existing in the world was initiated in 1976 in Montevideo, Uruguay [2]. Several centers in the United States have active interest in developing a residency but no program is likely to be initiated prior to 1980.

The professional and economic feasibility of medical toxicology as a single specialty has not yet been demonstrated. It is assumed that increased interest in the impact of toxic substances on human health will generate positions in industry, governmental agencies, and universities for graduates of a medical toxicology residency. Only a few individuals in the United States have accumulated experience with a private practice limited completely to medical toxicology.

The opening of an office for the practice of medical toxicology in a professional building near the Texas Medical Center was preceded by 14 years of full time involvement in clinical toxicology based in laboratory, academic, and clinical research and service institutions. Consultation on diagnosis and treatment of human illness thought to be related to toxic substances was provided as requested. As a part-time private practitioner, 1300 cases were attended of which approximately 900 were admissions to intensive care units for acute poisoning. Patient attendance varied from 1 to 96 hours. During the peak hospital-based practice in 1967, seven patients were attended concurrently as admitting physician in five intensive care units. With the emergence of the full-time emergency physician and the hospital-based intensive care physician, the need for the toxicologist as a primary care practitioner has decreased and the practice was limited to consultation only.

METHODS

A retrospective analysis was conducted on the records of 212 consecutive cases presenting in private office for the practice of medical toxicology.

Except for consultations requested on patients already in the hospital, all procedures were performed on an outpatient basis. Patients from out of town generally stayed at a nearby hotel for the 1 to 3 days

required for clinical evaluation. Toxicologist-patient contact averaged about 3 hours and included the usual medical evaluation including complete physical and neurological examination. Most patients were in addition administered a brief neuropsychological test battery and an MMPI. Special attention was given to occupational history starting with the last year in school. All jobs held and all potential occupational exposure to toxic substances were explored. Inquiry was made into food habits, drug use, hobbies, and avocations. Employers were sometimes contacted to further clarify the nature of toxic hazards, although frequently this was not helpful. When required, additional diagnostic procedures, such as laboratory examinations, EMG, EKG, pulmonary functions, and complete Halsted-Reitan neuropsychological batteries, were obtained during subsequent days. Copies of the hospital records and reports from previous physicians were reviewed. Inquiry was made concerning other individuals who sustained the same or similar exposure. Epidemiologic investigation frequently provides increased certainty to the determination of the etiologic relationship. Occupational health and industrial hygiene monitoring records were obtained, if possible.

Assessment of causal relationship frequently required literature searches using Medline and Toxline data base and manual search of the toxicology library. Recovery of appropriate original publications varied from 1 or 2 to more than 50 reprints. A final decision on etiology sometimes required 3 to 4 weeks depending upon literature availability.

Based upon the above data and the clinical experience of the author, the etiologic role of toxic substances was assigned to one of three categories: none, probable, or positive. Cases where exposure was clearly insufficient, where the clinical syndrome is one not associated with the substances involved, where clinical manifestations did not occur in an appropriate time frame, or where other disease processes clearly provided a more tenable hypothesis were assigned to "none." Where the clinical syndrome was one reasonably associated with the alleged substance, where the time frame was appropriate, where sufficient dose appeared probable or when multiple cases occurred from the same environment, and where no more reasonable medical cause could be determined, the cases were assigned to "probable." Although a causation was not proven beyond any doubt, it was more likely than not, permitting these cases to meet the test of reasonable medical probability. Cases were assigned to "positive" when in addition to the conditions for probable, objective evidence supported overwhelming exposure, environmental monitoring established the presence of the toxic substance in hazardous quantities, characteristic biochemical changes occurred in the patient and/or the substance, or its derivatives were identified in biological specimens in quantities consistent with potential, hazardous exposure. Some cases clearly meeting the

Criteria for "positive" concerning a brief acute intoxication were downgraded to "probable" or "none" when the chief complaint was continuing long-term disability with questionable or no relationship to the initial acute episode.

RESULTS

Referral sources for 212 consecutive cases presenting to a private medical toxicology office are displayed in Table 1. Referral from plaintiff attorney offices accounted for more than one-third. Such cases often are not yet involved in any legal action but are referred for advice to the patient and the attorney concerning probability of causal relationship. Physician referrals amounted to one-fourth of the cases. Referrals from insurance companies provided 11.7%. 10.4% were referred by defense attorneys and legal action of some type always was in process. Other patients and self-referral accounted for 8%. All other sources provided 8.4%.

Source of alleged exposure is presented in Table 2. 73.1% originated from the work place, and 10.4% were nonoccupational acute exposures of which about half were acute hospital care patients. Miscellaneous circumstances accounted for approximately 13%. "Unknown" included patients who believed themselves to be poisoned but could not account for route or occasion when poisoning might have occurred.

The nature of clinical complaints is presented in Table 3. Multiple systems frequently were involved, but only major complaints are listed.

TABLE 1. Distribution of 212 Consecutive Cases by Referral Source

Source	n	%
Attorney—plaintiff	78	36.7
Physician	52	24.0
Insurance company	25	11.7
Attorney—defense	22	10.4
Patient	17	8.0
Employer	9	4.2
Union	5	2.3
Service organization	3	1.4
Industrial Accident Board	1	0.4

TABLE 2. Distribution of 212 Consecutive Cases by Type of Exposure

Type	n	%
Occupational chronic	104	49.4
Occupational acute	50	23.7
Nonoccupational acute	22	10.4
Drug abuse	9	4.2
Adverse drug effect	7	3.3
Unknown	7	3.3
Nonoccupational chronic	6	2.8
Self-inflicted	5	2.3
Other	2	0.9

TABLE 3. Presenting Problems in 212 Consecutive Cases^a

Organ system	n	%
Respiratory	76	36.0
Behavioral	60	28.0
Neuropathy	36	17.1
Organic brain syndrome	21	9.9
Skin	17	8.0
Death	15	7.1
Cardiovascular	9	4.2
Hematopoietic	8	3.8
Other	8	3.8
Cancer	6	2.8
Hepatic	6	2.8
Coma	5	2.3
Trauma	2	1.0
Renal	1	0.5

^aMultiple system involvement occurs.

TABLE 4. Geographic Distribution of 212 Consecutive Cases

		n	%
Greater Houston		134	63
Other Texas cities	15		
Tyler	9		
Beaumont	15		
Dallas-Fort Worth	13		
Austin	2		
Galveston	3		
El Paso	1		
Victoria	1	59	27
Other states			
Wyoming	1		
Alaska	3		
Nevada	1		
Pennsylvania	1		
Louisiana	6		
Indiana	1		
Arkansas	2		
Florida	1		
Ohio	1		
Utah	1		
Massachusetts	1	19	9
Total		212	

Some patients had minor complaints involving almost every organ system. The respiratory system was most frequently involved. Behavioral problems excluding organic brain syndrome were very common, with anxiety neurosis with or without depression the most common. Neuropathies were the third most frequent presentation. Among 212 cases, in 15 the issue was the cause of death.

Geographic distribution is shown in Table 4: 63% originated in the

TABLE 5. Assessment Outcome by Referral Source for 121 Consecutive Cases

Referral source	Number	Percentage distribution		
		None ^a	Probable ^b	Positive ^c
Attorney—plaintiff	42	45	47	7
Physician	28	67	25	7
Insurance company	15	40	53	6
Attorney—defense	14	64	28	7
Patient (self)	9	67	33	0
Employer	7	71	28	0
Union	3	33	67	0
Service organization	2	50	50	0
Industrial Accident Board	1	100	0	0
Total cases:	121	55	39	6

^aNone: No toxicologic basis.

^bProbable: Toxicologic basis confirmed clinically i.e., reasonable medical probability.

^cPositive: Toxicologic basis established beyond any reasonable doubt.

greater Houston area, 27% were referred from other Texas cities, and 8% were from out of state.

Assessment outcome is presented in Table 5 for 121 consecutive cases. Etiology was determined to be toxic substances in 45% and unrelated to toxic substances in 55%. The relationship could be considered "positive" in only 6% of the cases.

Table 6 displays an inventory of substances alleged to have caused poisoning. This illustrates the diversity of substances which come under consideration. As indicated in Table 5, the etiologic role could not be supported in 55% of the cases.

DISCUSSION

The private practice of medical toxicology involves an adult population almost exclusively. Association of the illness with employment is

TABLE 6. Inventory of Substances Alleged as Causes of Poisoning

Substance	Number	Subtotal	%	Substance	Number	Subtotal	%
Pharmaceuticals		15	7	Alcohol	3	1.5	
Metals		38	18	Inorganics	23	11	
Aluminum alkyl	2			Ammonia	3		
Antimony	1			Asbestos	2		
Arsenic	8			Carbon monoxide	2		
Chromium	1			Chlorine	2		
Lead	15			Dust, inorganic	3		
Manganese	1			Fluoride	3		
Mercury	5			Hydrogen sulfide	1		
Molybdenum	1			Hydrochloric acid	2		
Nickel	2			Nitrogen dioxide	1		
Titanium	1			Silica	2		
Vanadium	1			Sulfur dioxide	2		
Pesticides		22	10	Aliphatics	33	16	
Chlordane	2			Acetone	1		
DDVP	1			Carbon tetrachloride	1		
Diazinon	2			Chloramine	1		
Dursban	1			Ethyl acrylate	1		
Disyston	1			Formaldehyde	1		
Leptophos	7			Hydrazine	1		
Malathion	2			Phosgene	1		
Naled	1			Methyl bromide	1		
Parathion	2			Methyl ethyl ketone	2		
Propanil	1			Methylene chloride	1		
Zinc phosphide	2			n-Hexane	8		
Aromatics		20	9	Perchloroethylene	2		
Aniline	1			1,1-Trichloroethane	3		
Benzene	1			Styrene	2		
Bisphenol	3			Vinyl chloride	7		
Dichlorobenzene	1			Others	3	1.5	
Dinitrochlorobenzene	1			Cyclonite	2		
Polychlorinated biphenyl	1			Cyclohexane	1		
Pyridine	3			Organic vapors	19	9	
Toluene	4			Unknown substances	36	17	
Toluene diisocyanate	5						

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alleged in 75% of the cases. Nonoccupational personal injury is alleged in about 15% of the cases. Some type of litigation has been initiated or is being considered in 90% of the cases. The major issue to be resolved is causation, while consultation on treatment is less frequently required. Exposure to toxic substances had terminated weeks to years prior to examination in most cases. Because exposure usually was remote in time, unequivocal proof of association with toxic substances was rarely possible.

Because the outcome of litigation is influenced frequently by the toxicology consultation, the results are almost always scrutinized closely by all parties in the adversary system. Rendering an opinion after a brief office consultation is rarely satisfactory. The spectrum of substances involved in a routine office practice is so broad that most cases become miniature clinical and literature research projects before an opinion can be developed. The time invested in each case differs significantly from the usual medical practice, ranging from an hour to as much as 30 hours.

The frequency of involvement of the medical toxicologist with medical legal problems is a reflection of our chemosynthetic environment. Since the overwhelming majority of toxic substances are products of human manufacture, routes for economic recovery for injuries through the judicial system are potentially open. Despite the apparent high liability for requirement of sworn testimony, depositions or court appearances occurred on the average of two times per month.

As is common with malpractice cases, potentially toxic exposures become the subject of litigation as the result of comments made by physicians which are inappropriate or misunderstood by the patient. Association of an illness with employment is sometimes made rather indiscriminately without an understanding of the relationship. Many of the 55% of cases classified as unrelated were precipitated by comments such as "those chemicals have eaten away half your lung," "I would never work out there with all those poisons," "everyone knows these chemicals cause cancer," or "let me have your spinal cord because I'm doing research on whether lead causes your disease." The physician's role in provoking morbidity unrelated to toxic substances has been discussed [3].

In contrast, the work-related neuropathies are commonly misdiagnosed as amyotrophic lateral sclerosis or multiple sclerosis. The nature of a patient's occupational exposure to toxic substances often is not explored as a routine part of the clinical evaluation.

Experience with the private practice of medical toxicology affirms the continuing need to encourage more emphasis on clinical toxicology in the medical curriculum. More general recognition of medical toxicology is needed to permit consultation early in the clinical course of an illness.

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