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Hepatitis in clinical laboratories: A three-year survey

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SYNOPSIS In a survey of laboratories where members of the Association of Clinical Pathologists worked, hepatitis was reported from 5% of 244 in 1970, 7% of 215 in 1971, and 2% of 337 in 1972. Of the 36 laboratories reporting hepatitis, a modest excess tested specimens from haemodialysis, transplant, and haemophilia units and performed tests for HB Ag. The average annual attack rate for staff of all types was 111 per 100 000 with higher rates for biochemists (268 in science graduates and 204 in technicians) and medical haematologists (258). Tests for HB Ag were positive in 17 cases and negative in 15; nine were untested. No case was fatal and only 10 of the 41 required admission to hospital. Fourteen had a history of contact with 'high-risk (haemodialysis) specimens', but the most frequently suspected source of infection was personal contact with jaundiced or HB Ag-positive individuals and only in three cases were laboratory accidents suggested as the suspected source of infection. The findings indicate a need for caution and sensible safety precautions but not for exaggerated alarm.

Because of increasing concern about the possible hazards of viral hepatitis to laboratory staff and the paucity of facts with which to evaluate this risk, the Microbiology Committee of the Association of Clinical Pathologists (ACP) asked me to make a survey by means of a questionnaire sent to members of the Association. A preliminary enquiry in 1971 suggested a rising incidence, since hepatitis was reported from 58 of 285 laboratories for the five-year period from 1964 to 1969 compared with 32 of 289 for the single year 1970; of the 127 cases 87 were technicians, predominantly working in biochemistry or haematology (Grist, 1973a). In order to reduce bias, eg, higher response rate from laboratories with recent cases, an annual survey was initiated, the results of which are now presented for the years 1970-72.

Methods

Precoded questionnaire forms were distributed in June 1971 to ACP members, in February 1972 to those who responded in 1971, and in January 1973 to the entire membership. Form B accepted information about the number and type of staff in post on 1 January of the year in which it was distributed, whether specimens were received from any of four suspected high-risk sources (haemodialysis or transplant units, haemophilia or drug addiction centres), how 'hepatitis high-risk' specimens (undefined) were dealt with, and whether tests for 'Au-SH antigen' (HB Ag) were carried out in the laboratory and if so how they were dealt with. Form C was returned for each hepatitis case, providing details of age, sex, employment, and laboratory discipline, type of hepatitis diagnosed, whether jaundiced or admitted to hospital or fatal, result of tests for HB Ag, whether in contact with 'high-risk (haemodialysis)' specimens, and suspected source of infection. It should be noted that for the enquiry no definition of hepatitis was imposed and the diagnoses of those returning forms were accepted. After return of the forms, the laboratories were allocated code numbers, forms were scrutinized for completeness and to eliminate reduplication, eg, return of forms by more than one ACP member from the same laboratory, and the data transferred to punch cards at Glasgow Northern Hospitals Medical Records Department for analysis.

Results

Preliminary findings were reported in a symposium at the Royal Society of Medicine (Grist, 1973a) and presented to meetings of the ACP in Cambridge (Grist, 1973b) and Coventry (Grist, 1974). A few

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Sources of Specimens and Type of Work	1970		1971		1972	
	Total Laboratories (244 = 100%)	Laboratories with Hepatitis (12 = 100%)	Total Laboratories (215 = 100%)	Laboratories with Hepatitis (14 = 100%)	Total Laboratories (337 = 100%)	Laboratories with Hepatitis (10 = 100%)
Haemodialysis Unit						
No. laboratories accepting	69 (28%)	6 (50%)	63 (29%)	8 (57%)	85 (25%)	5 (50%)
No. laboratories not accepting	175	6	152	6	252	5
Transplant Unit						
No. laboratories accepting	40 (16%)	4 (33%)	38 (18%)	6 (43%)	56 (17%)	3 (30%)
No. laboratories not accepting	202	8	177	8	281	7
Haemophilia Centre						
No. laboratories accepting	44 (18%)	4 (33%)	40 (19%)	4 (29%)	65 (19%)	3 (30)
No. laboratories not accepting	199	8	175	10	272	7
Drug Addiction Centre						
No. laboratories accepting	26 (11%)	1 (8%)	28 (13%)	3 (21%)	38 (11%)	1 (10%)
No. laboratories not accepting	216	11	185	11	299	9
Hepatitis B Antigen Tests						
No. laboratories performing	37 (15%)	3 (25%)	34 (16%)	4 (29%)	56 (17%)	3 (30%)
No. laboratories not performing	206	9	181	10	281	7

Table I *Numbers of laboratories with various work characteristics in relation to occurrence of hepatitis*

Procedures for 'High-risk' Specimens	1970		1971		1972	
	Total Laboratories (244 = 100%)	Laboratories with Hepatitis (12 = 100%)	Total Laboratories (215 = 100%)	Laboratories with Hepatitis (14 = 100%)	Total Laboratories (337 = 100%)	Laboratories with Hepatitis (10 = 100%)
Tested by general staff	204 (84%)	10 (84%)	176 (82%)	11 (79%)	286 (85%)	10 (100%)
Tested by special unit staff	20 (8%)	1 (8%)	22 (10%)	2 (14%)	28 (8%)	0
Not accepted	12 (5%)	1 (8%)	17 (8%)	1 (7%)	23 (7%)	0
Tested on designated mechanized apparatus	5 (2%)	0	4 (2%)	0	11 (3%)[1]	2 (20%)
Tested on mechanized apparatus in general use	128 (53%)	8 (66%)	111 (52%)	7 (50%)	176 (52%)[1]	6 (60%)
Not tested on mechanized apparatus	99 (41%)	4 (33%)	97 (45%)	7 (50%)	148 (44%)[1]	2 (20%)

Table II *Numbers of laboratories dealing with 'hepatitis high-risk' (undefined) specimens in different ways*

[1]No reports by two laboratories

minor corrections of the figures have now been made. Information was received from 422 laboratories altogether: 244 for 1970, 215 for 1971, and 337 for 1972: 146 laboratories responded for all three years. Hepatitis was reported from 12 laboratories (5%) in 1970, 14 (7%) in 1971, and 10 (2%) in 1972.

CHARACTERISTICS OF LABORATORIES REPORTING HEPATITIS

Tables I and II summarize the findings. The numbers of laboratories reporting hepatitis in different years were small, but of these an excess reported testing of specimens from haemodialysis and transplant units, and a smaller excess tested haemophilia centre specimens and undertook HB Ag testing (table I). No increased attack rate for hepatitis appeared to be associated with testing specimens from drug addiction centres, with refusal or acceptance of 'hepatitis high-risk' specimens or their handling and testing by different methods (table II). Further analysis distinguishing HB Ag-positive or- negative hepatitis revealed no additional features.

The laboratories reporting hepatitis were scattered throughout the country and showed no space-time clustering except the following: (a) one laboratory in north-west England reported two HB Ag-positive cases in science graduate biochemists in February 1971; (b) one laboratory in Scotland reported in December 1971 one HB Ag-negative case (technician, microbiology) and one untested case (technician, morbid anatomy) and had previously reported HB Ag-positive cases in one science graduate microbiologist (July 1970) and one medical graduate

Year	Total Staff	Hepatitis Cases Reported				
		HB Ag+	HB Ag−	NT[1]	Total	Rate per 100 000
1970	11 217	4	3	6	13	116
1971	10 573	7	7	3	17	161
1972	15 103	6	5	0	11	73
1970-72	36 893	17	15	9	41	111

Table III *Hepatitis cases reported and annual attack rates per 100 000*

Not tested for HB ag

Employment Category	*Discipline*[1]	*Hepatitis Cases Reported*				*Total at Risk*	*Rate per 100 000*
		1970	*1971*	*1972*	*Total (HB Ag)*		
Medical	Morbid anatomy	1	1	0	2 (1)	1431	140
Medical	Haematology	0	2	1	3 (1)	1164	258
Medical	Biochemistry	0	0	0	0 —	564	0
Medical	Microbiology	0	0	0	0 —	994	0
Science	Morbid anatomy	0	0	0	0 —	115	0
Science	Haematology	0	0	0	0 —	214	0
Science	Biochemistry	0	2	1	3 (2)	1120	268
Science	Microbiology	1	0	0	1 (1)	317	316
Technician	Morbid anatomy	0	2	0	2 (1)[2]	3138	64
Technician	Haematology	1	3	4	8 (4)[3]	6885	116
Technician	Biochemistry	7	0	3	10 (5)[4]	4900	204
Technician	Microbiology	1	4	1	6 (2)[5]	5188	116
Porters and aides	—	0	0	1	1 (0)	2471	40
Domestics	—	0	0	0	0 —	2345	0
Secretaries	—	0	1	0	1 (0)	3619	28
Others	—	2	2	0	4 (0)	2428	165
Total	All	13	17	11	41 (17)	36893	111

Table IV *Average annual attack rates of hepatitis per 100 000*

[1]Morbid anatomy includes a few cytology and cytopathology
Haematology includes blood transfusion and a few immunology
[2]One case not tested for HB Ag
[3]Two cases not tested for HB Ag
[4]Four cases not tested for HB Ag
[5]Two cases not tested for HB Ag

(morbid anatomy, June 1971); (c) one laboratory in the Midlands reported two HB Ag-negative cases in March and April 1971 (a serum separator and a specimen booker). Three other laboratories reported more than one case but these were separated by five months or more and in several instances were of different HB Ag status.

ATTACK RATES OF HEPATITIS IN STAFF

Table III summarizes the hepatitis incidence reported in the total staff of the laboratories. Similar numbers gave positive and negative reactions in tests for HB Ag, although only half the cases were tested in 1970, more than three-quarters were tested in 1971, and all were tested in 1972. Table IV shows the average annual hepatitis incidence over the three years by employment category and major discipline of pathology at the time of illness where relevant (10 patients had worked in other disciplines or changed discipline within the previous three months, but reallocation and recalculation of rates showed no important differences). The highest rate, in science-microbiology, carries doubtful significance because of the small numbers involved but more convincingly high rates were shown in the categories science-biochemistry, medical-haematology, and technician-biochemistry; more than half (9/17) of cases in these four categories were HB Ag-positive, compared with only a third (8/24) of the remainder. No HB Ag-positive cases were reported in ancillary staff.

CLINICAL AND EPIDEMIOLOGICAL FEATURES OF HEPATITIS CASES

The seasonal distribution showed eight cases in the first quarter, 16 in the second quarter, three in the third quarter, and 14 in the fourth quarter of the year. The age and sex distribution of cases showed a slight male excess and a concentration of cases in

	HB Ag Test Results		*Untested (9)*	*Total (41)*
	Positive (17)	*Negative (15)*		
Sex				
Male	10	9	3	22
Female	7	6	6	19
Age (yr)				
<20	3	1	3	7
−30	6	6	5	17
−40	3	3	1	7
−50	4	4	0	8
>50	0	1	0	1
Not known	1	0	0	1

Table V *Age of and sex hepatitis cases*

Severity	*HB Ag Test Results*		*Untested (9)*	*Total (41)*
	Positive (17)	*Negative (15)*		
Jaundiced	17	14	9	40
Admitted to hospital	5	3	2	10
Fatal	0	0	0	0

Table VI *Severity of hepatitis*

Contact History	HB Ag Test Results		Untested (9)	Total (41)
	Positive (17)	Negative (15)		
Yes	9	4	1	14
No	8	10	8	26
Not recorded	0	1	0	1

Table VII *History of contact with 'high-risk (haemodialysis)' specimens*

Suspected Source of Infection	HB Ag Test Results		Untested (9)	Total (41)
	Positive (17)	Negative (15)		
Personal contact with jaundiced person	1	1	1	3
Personal contact with anicteric HB-Ag-positive person	3	0	0	3
Transfusion or injection[1]	0	0	0	0
HB Ag laboratory accident	1	0	0	1
Other laboratory accident	1	0	1	2
Other suspected source	3	1	1	5
Not known	8	13	7	28

Table VIII *Suspected sources of infection of hepatitis cases*

[1]Including drug, anaesthetic, dental procedure

young adults (table V). No case was fatal and only 24% required hospital admission, this crude criterion of severity showing little difference between HB Ag-positive and other cases (table VI). A history of contact with 'high-risk (haemodialysis)' specimens was given more frequently in HB Ag-positive cases than others (table VII) but again the figures are small.

Table VIII summarizes the 'suspected sources of infection' reported for the cases, without implication that these were necessarily the actual sources of infection. Personal contact with jaundiced or anicteric HB Ag-positive persons was mentioned most often as the suspected source of infection. The laboratory accidents comprised (*a*) finger-stab with Pasteur pipette manipulating HB Ag-positive serum; (*b*) cut glove finger two weeks before illness (irrelevant?); and (*c*) unspecified. In other cases suggestions of possible sources of infection comprised 'specimens' (six cases), a leaking container of HB Ag-positive blood (one), repeated venepuncture of HB Ag-positive patient (one), use of AutoAnalyzer (one), a cut finger (one), domestic contact (one), and a recent visit to San Francisco (one HB Ag-negative case).

Human normal immune globulin had been administered prophylactically in three icteric cases: two HB Ag-positive cases attributed respectively to a finger stab by an infected pipette and to personal contact with an anicteric HB Ag-positive patient; one HB Ag-negative case following personal contact with jaundice.

Discussion

This type of survey is inherently limited by what can practicably be asked by postal questionnaire, and by the response of members of the Association in relation to the number of laboratories they represent which in turn constitute a selected sample of the clinical laboratories of the country. The apparent rates of hepatitis may be too high if interest and awareness increase the response rates from laboratories where hepatitis occurred, though this is less likely for the second year of the study when only those responding in the first year were approached.

The validity of the data is limited by members' responses to the individual questions. An indicated diagnosis of 'hepatitis' was accepted. Most cases were jaundiced; the single report of anicteric hepatitis suggests that this form of hepatitis was either less common or more probably was poorly recognizable. The survey provides no information about the overall incidence or prevalence of hepatitis B infection or carriage. From the practical point of view, however, it seems adequate to take cognizance of the definite clinical illnesses reported.

Some problems beset the classification of the disciplines of pathology, particularly with the growth of new specialties during the three years. For practical purposes cytology was classified under morbid anatomy, blood transfusion and immunology under haematology. Some cases of work in several disciplines presented difficulty: where possible, the main discipline was used for classification (a few individuals were entered under more than one discipline). Similarly, half-time workers were counted the same as full-timers since the coding did not permit a distinction, but the numbers involved were small and introduced little error.

Although a somewhat higher risk of hepatitis was associated with testing specimens from haemodialysis and transplant units and from haemophilia centres, specimens from drug addiction centres surprisingly showed no significantly increased risk in this survey (table I). Perhaps these last were handled with particular care, and a combination of awareness and better safety arrangements may explain the only modestly increased risk in laboratories testing for HB Ag. Since few laboratories had special arrangements for handling 'high-risk' specimens, the data of table II are inadequate to evaluate

the effectiveness of restricting the staff and apparatus used for these tests.

Although not all cases were tested in the first two years of the study, the figures in table III suggest that at least half the cases were of hepatitis B which was particularly found in the higher-incidence groups of biochemists (science graduate and technician) and haematologists (medical), the highest rate of hepatitis B in those tested being found in biochemical technicians (5/6). Both hepatitis B and A can be acquired parenterally and from blood—most often type B—and both infections can be acquired in normal, non-occupational life—most often type A. Control values to evaluate the attack rates in table IV are hard to find, but the low rates in domestics and secretarial staff may be closer to average population experience. (It should be noted that no data are available to compare the age and sex characteristics of these occupational groups.) Approximate attack rates for the general population in the range 27-51 per 100 000 can be calculated from the notifications of 'infectious hepatitis' from England, Wales, and Scotland listed in World Health Statistics Reports of the World Health Organization for the years 1970-72.

An American study of Yale-New Haven Hospital personnel in 1952-65 showed a hepatitis attack rate of 51 per 100 000 employees per year compared with 15 per 100 000 in the general population of Connecticut (Byrne, 1966). A more recent survey of the staff of laboratories working on hepatitis showed the combined 'incidence' of icteric and anicteric hepatitis to be 7·4% in the USA and 5·2% in other countries, with HB Ag detected in 42% (LoGrippo and Hayashi, 1973) but these data cannot be converted to annual attack rates for comparison. The high rates of HB Ag and antibody carriage found in a survey of American haemodialysis centres also cannot be converted into annual incidence rates (Szmuness, Prince, Grady, Mann, Levine, Friedman, Jacobs, Josephson, Ribot, Shapiro, Stenzel, Suki, and Vyas 1974).

In an outbreak of hepatitis B with two fatalities in a Canadian clinical laboratory biochemists predominated (17 of 22 cases); subsequent serological tests for HB surface antibody as an indicator of previous subclinical as well as clinically apparent infection gave positive results in 33 (26%) of 126 bench workers (14 with a history of hepatitis) but in none of 37 students and administrative staff (Bishai, Labzoffsky, Rhodes, Zbitnew, MacKay, and Dempster, 1974).

It is encouraging that in the cases in the present survey hepatitis was predominantly mild, most of the patients not even requiring admission to hospital. The severe or even fatal cases occasionally reported probably result from infection with large amounts of infectious virus in the body fluids of some immunodepressed patients, particularly following accidental spillage or inoculation. In the event of definite exposure to infection by known HB Ag-positive material, a limited supply of specific human immunoglobulin is now available for prophylaxis (Kerr, 1973).

It should be recognized that the sources of infection listed in table VIII were merely those suspected, not definitely proven to be relevant, though in several cases they were probably relevant. It was notable that few laboratory accidents were mentioned and that personal contact with known or probably infected individuals was the commonest suspected source. Nevertheless it is to be hoped that unnecessary hazard to laboratory staff from the use of unsatisfactory containers for specimens will be reduced (Madeley, Urquhart, McMichael, and Grist, 1974).

Overall, the findings of the survey are not alarming, show some increase in hepatitis where expected, and particularly suggest room for improvement of safety standards in the practice of biochemistry and haematology. It is planned to continue the survey in simplified form in order to increase the significance of the findings and reveal any marked trends.

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