Detection and Elimination of Hepatitis in a Haemodialysis Unit using Hepatitis Associated Antigen

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Despite the recognised hazard of hepatitis to patients and staff of haemodialysis units, the Royal Free Hospital Unit, which has treated chronic renal failure since 1963, had no major outbreak until 1969 by which time, in addition to clinical and biochemical methods, screening for Hepatitis Associated Antigen (HAA Antigen), which we interpret as indicating the presence of the virus, was also available.

MATERIAL AND METHODS

The Unit operates an integrated haemodialysis and transplantation programme, with a strong emphasis on training for home haemodialysis. At the time of this outbreak of a total of 98 patients, 74 were on home dialysis, 8 were in training, 9 were permanently based on the Hospital Unit, and 7 had functioning renal grafts. The total number of staff including a changing population of medical, technical and lay members allocated to the Unit, was 50.

An indication of the work load imposed on the Unit by such a population is given by the fact that between 80 to 110 haemodialyses are carried out in the Unit each week. In addition to which, approximately 15 patients per week also attend for transplantation follow-up, home dialysis medical check-ups, or emergencies.

The dialysis techniques and home training programme have been described to this Association previously (Baillod et al., 1967). Patients are trained in self dialysis whether they will dialyse at home or in the Hospital. Kill dialysers, individualised for each patient are used three times and sterilised by formalin. Single patient automatic dialysate production and control units are used, sterilised by heat. Access to the blood stream was by external arterio-venous shunt in two thirds, and by internal fistula in one third. The latter patients are trained in self venepuncture.

Each patient receives at least 30 hours of haemodialysis per week, usually in three ten hour periods, or more frequent shorter periods in the case of
those who are ill or in training. Sterile disposable equipment such as packs, lines, syringes and needles is used as far as possible. Each patient is provided with his own non-disposable items.

The policy of minimal blood transfusion previously described to this Association (Crockett et al, 1967) has been maintained.

RESULTS (Table I)

During the outbreak 11 cases of clinical hepatitis occurred, 3 in patients and 8 in members of the staff. Nine of these cases were icteric, 4 of which were severe (one with precoma). There were no fatalities, however, and all made a complete recovery with return of aspartate transaminase levels to normal within a maximum of 12 weeks. After the second case had occurred in a member of the staff the whole dialysis population was screened for HA antigen.

<table>
<thead>
<tr>
<th>Table I. Duration of antigenaemia</th>
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<td></td>
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<tr>
<td>----------------------------------</td>
</tr>
<tr>
<td>Symptomless</td>
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<tr>
<td>Hepatitis</td>
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The Antigen was located using the two dimensional immunodiffusion technique and known antiserum (Fox et al, 1969). This screening was continued at 2 - 4 week intervals. Over the six months of the outbreak 98 patients and a changing population of 82 staff members were screened.

In addition to cases of clinical hepatitis, screening showed a further 7 people to have a positive HA Antigen, but these remained completely symptomless and had no clinical or biochemical evidence of hepatitis. The two staff members who became HA Antigen positive did so later in the outbreak, and it is interesting to note that one of these was Rhodesian and one Nigerian — five to eight per cent of tropical populations being HA Antigen positive (Blumberg et al, 1968).

However, five symptomless HA Antigen patients were detected with the first full screening of the population early in the outbreak. Since no member of the staff had had any previous history of hepatitis or known contact with the disease outside the Unit, it seemed likely, therefore, that the originator of the outbreak would be one of these five HA Antigen positive patients (Table II).
Table II. Symptomless HA Antigen positive patients (July 1969)

<table>
<thead>
<tr>
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<th>Hepatitis History</th>
<th>Previous HA Antigen status</th>
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<tbody>
<tr>
<td>P.1</td>
<td>Jaundice with acute renal failure (1957)</td>
<td>Unknown</td>
</tr>
<tr>
<td>P.2</td>
<td>Nil</td>
<td>Unknown</td>
</tr>
<tr>
<td>P.3</td>
<td>Nil</td>
<td>Negative March 1969</td>
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<tr>
<td>P.4</td>
<td>Known hepatitis contact (April-June 1968)</td>
<td>Unknown</td>
</tr>
<tr>
<td>P.5</td>
<td>Nil</td>
<td>Negative February 1969</td>
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P.1 had had jaundice of unspecified aetiology associated with gastro-enteritis and acute renal failure, twelve years before starting haemodialysis. In the intervening period renal function had been adequate. Dialysis patients have been known to carry the HA Antigen for at least three years (Turner & Bruce White, 1969), therefore although the intervening period is long, P.1 cannot be totally excluded as a possible originator of the outbreak. P.2 had no previous history of hepatitis, but again cannot be definitely excluded since there was no previous information about her antigen status. P.3 and P.5 may be confidently excluded since stored frozen serum was available from March and February respectively and was HA Antigen negative on screening.

P.4 was the only patient known to have had recent contact with other cases of hepatitis. He had been addicted to Methadone. Two of his associates with whom he had shared syringes had hepatitis in April and June 1968 (retrospective discovery). Furthermore, he was the only one of these patients using a fistula as opposed to a shunt. A shunt has advantages for self dialysis in that there need be no blood spillage, whereas with a fistula some skin contamination with blood is unavoidable. This becomes a danger for the staff whenever it is necessary for them to introduce or adjust needles, as for example during the early stages of training. In this particular patient also, personality and psychological difficulties greatly complicated dialysis, which was frequently disrupted, resulting in blood spillage and staff intervention with inevitable contamination. It is likely that the initial transfer to the staff occurred at this stage.

From the Epidemiology chart (Figure 1) the time relationship of the presence of P.4 in the Unit to the outbreak is evident. The first clinical case occurred in a member of the staff twelve weeks after he began haemodialysis and the last case occurred ten weeks after he had been established on Home Dialysis. All five patients initially found to be HA Antigen positive had ample opportunity for contact with each other and with the staff. The period of
concurrent hospital dialysis varied between four and fourteen weeks. For at least part of this time these patients would have shared the same dialysis room.

FREQUENCY OF ANTIGEN DETECTION (Table III)
In the eleven patients and staff who had acute clinical hepatitis, HA Antigen was detected in six. In three of the four staff members in whom the antigen was not detected, the period of antigenaemia may have been missed by late screening. There were two cases, however — one a patient, the other a member of staff — in whom despite immediate screening at the onset of symptoms, no antigen was detected.

Table III. Frequency of antigen detection in acute clinical hepatitis

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<tr>
<th></th>
<th>Total cases</th>
<th>Antigen detected</th>
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<tbody>
<tr>
<td>Patients</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Staff</td>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>

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In two members of staff, on the other hand, the detection of antigenaemia by routine screening a few days prior to the onset of clinical symptoms allowed immediate isolation and rest to be instituted.

DURATION OF ANTIGENAEMIA (Table I)

London et al (1969) made the point that it is the dialysis patients who tend to be symptomless, but have prolonged antigenaemia, whereas the staff have clinical hepatitis and antigenaemia of brief duration. We find that this distinction is not absolute. Thus, two members of staff, both from tropical populations were symptomless and had prolonged antigenaemia, while three patients had overt attacks of hepatitis and antigenaemia of brief duration. We were interested to observe that these latter three patients were regarded as being fit. Whereas the five symptomless patients with prolonged antigenaemia had either dialysed for a shorter length of time (their physical rehabilitation being thus incomplete), or they had been readmitted for reasons of intercurrent medical illness. It is possible that the pathological and clinical response depends at least in part upon the state of health of the subject at the time of exposure to the virus.

HOST/VIRUS RESPONSE

In some outbreaks of hepatitis in haemodialysis units it may not be possible to discern these two patterns of response to exposure to the virus. It may be that a greater virulence in the strain of the virus involved will mask any distinction in the way various subjects respond. A more virulent virus could, by providing a greater antigenic stimulus, produce more cases of clinical hepatitis both in staff and patients, fit and unfit. Immunosuppression, either the result of disease or of therapy following transplantation, may also suppress the ability of the host to raise antibody against the antigenic stimulus of the virus. Three of our patients with functioning renal grafts have recently become HA Antigen positive without developing symptoms. This complication following transplantation has been noted previously by Moore and Hume (1969).

SOURCE OF INFECTION

It is likely that in an environment of haemodialysis the chief vehicle of infection would be blood. This is supported by the fact that the staff affected were all involved in direct contact with the patients or with blood samples. Secondly, we believe that the use of a fistula for access to the blood stream in an uncooperative patient was very probably responsible for initial dissemination of the virus. Thirdly, we noted the presence of digital formalin dermatitis in two members of the staff who developed hepatitis and this could have provided a portal of entry.
EXISTING POLICY AND PRECAUTIONS

Our present policy is to screen for HA Antigen all prospective patients, staff and donor blood. Subsequently, all patients and staff are screened at monthly intervals. Avoidance of blood contact is best achieved by pursuing a home dialysis programme, emphasising self dialysis, including self venepuncture and with minimal blood sampling. The infrequent recourse to blood transfusion reduces the risk of infection from donor blood. The greatest problem is posed by the HA Antigen positive patient needing hospital dialysis since prolonged barrier nursing is likely to prove inadequate unless complete isolation can be provided. Contrary to initial hopes, we have found that an improved state of health achieved either by intense dialysis or successful renal transplantation does not terminate a prolonged anaemia state.

CONCLUSIONS

In conclusion we have found screening for HA Antigen in patients and staff during this outbreak to be invaluable. Symptomless carriers have been detected and isolated. Staff on two occasions have been sent off duty prior to the development of symptoms of hepatitis. The probable originator of the epidemic was detected. Regular screening will, we anticipate, reduce the risk of introducing a fresh infection. We believe that HA Antigen screening undoubtedly contributed to an earlier termination of the outbreak which, in view of the population involved could have reached much greater proportions.

REFERENCES


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