Epidemiol. Infect. (2000), **125**, 367–375. Printed in the United Kingdom

Community studies on hepatitis B in Rajahmundry town of Andhra Pradesh, India, 1997–8: unnecessary therapeutic injections are a major risk factor

J. SINGH[1]*, R. BHATIA[1], S. K. PATNAIK[2], S. KHARE[1], D. BORA[1], D. C. JAIN[1] AND J. SOKHEY[1]

[1] *National Institute of Communicable Diseases, 22 Shamnath Marg, Delhi-110054, India*
[2] *National Institute of Communicable Diseases, Regional Filaria Training and Research Centre, Weavers Colony, Rajahmundry-533105, Andhra Pradesh, India*

(*Accepted 13 January 2000*)

SUMMARY

In Rajahmundry town in India, 234 community cases of jaundice were interviewed for risk factors of viral hepatitis B and tested for markers of hepatitis A–E. About 41% and 1·7% of them were positive for anti-HBc and anti-HCV respectively. Of 83 cases who were tested within 3 months of onset of jaundice, 5 (6%), 11 (13·3%), 1 (1·2%), 5 (6%) and 16 (19·3%) were found to have acute viral hepatitis A–E, respectively. The aetiology of the remaining 60% (50/83) of cases of jaundice could not be established. Thirty-one percent (26/83) were already positive for anti-HBc before they developed jaundice. History of therapeutic injections before the onset of jaundice was significantly higher in cases of hepatitis B ($P = 0{\cdot}01$) or B–D ($P = 0{\cdot}04$) than in cases of hepatitis A and E together. Other potential risk factors of hepatitis B transmission were equally prevalent in two groups. Subsequent studies showed that the majority of injections given were unnecessary (74%, 95% CI 66–82%) and were administered by both qualified and unqualified doctors.

INTRODUCTION

Hepatitis B virus (HBV) infection is a worldwide problem, with more than two billion people having evidence of past or current infection and some 350 million individuals chronically infected [1]. The chronic carriers constitute the infectious pool for the spread of virus and also have a high risk of developing chronic sequelae, which include liver cirrhosis, hepatocellular carcinoma and chronic liver disease [1]. The infection spreads from this infectious pool by exposure to blood or body fluids, contaminated needles, syringes and other sharp instruments, unscreened blood and blood products, by unprotected sex, perinatally and by person-to-person contact especially during childhood [1, 2].

Many studies carried out in blood donors and antenatal mothers in different parts of the country indicate that about 3–5% of the adult population in India may be chronic carriers of HBV [3]. Only a few studies have estimated the prevalence of HBsAg in non-institutional healthy persons, especially in children [3]. However, there is some evidence that the carrier pool is built up during childhood [4]. Nevertheless, much of the HBV transmission in India remains unexplained. Perinatal transmission probably accounts for only one-third of chronic infections [5]. The sources of HBV infections not originating in the perinatal period are not entirely known. The purpose of the present study was to find out the risk factors of HBV transmission during childhood or later in life in an urban community in India.

* Author for correspondence.

MATERIALS AND METHODS

Retrospective community surveys

Rajahmundry town in Andhra Pradesh has a popu-

https://doi.org/10.1017/S0950268899003854 Published online by Cambridge University Press

Table 1. *Distribution of cases of jaundice who were tested for markers of acute viral hepatitis by age group*

Age (years)	No. of samples collected	Anti-HAV IgM +ve	Anti-HBc IgM +ve	Anti-HCV +ve	Anti-HDV +ve*	Anti-HEV IgM +ve	No. (%) laboratory confirmed viral hepatitis cases
0–4	8	3†				1	4 (50)
5–14	17	2	2‡		1‡	3	7 (41·2)
15–39	43		6‡§	1	3‡	8§	16 (37·2)
40+	15		3‡§		1‡	4§	6 (40)
Total	83	5 (6)	11 (13·3)	1 (1·2)	5 (6)	16 (19·3)	33 (39·8)

* Tested in cases found positive for HBsAg.
† One patient was carrier of HBsAg.
‡ One case each had HBV-HDV co-infection.
§ One case each had HBV as well as acute HEV infection.

lation of 326071 (1991 census) which is distributed in 90 localities. Forty-eight of these localities were randomly selected which comprised of 786 streets. Half of the streets were subsequently sampled from each selected locality and their whole population was surveyed by trained paramedics in the first fortnight of January 1998. They went from house to house to enquire about any case of jaundice (defined by the local word for jaundice and yellow eyes and urine) which had occurred within 6 months prior to the survey. They also collected data on age and sex of all persons covered during the survey. Using the same methodology, the reference population was again surveyed in the first fortnight of July 1998, but no data were collected on age and sex of the surveyed population. In this way, a total of 472 cases of jaundice were detected that occurred during the period from July 1997 to June 1998 in the 71358 population.

A medical epidemiologist (S.K.P.) examined and interviewed 278 cases of jaundice detected during the two surveys to collect epidemiological and clinical data. Parents were interviewed if the subject was a child. The cases were asked for history of the following within 6 months but 15 days prior to the survey: hospitalization due to any reason, chronic illness, administration of therapeutic injections, surgical operation, dental work, blood transfusion or donation, dialysis, shave from a barber or visit to a beauty parlour, sharing razor, tattooing, ear/nose pricking, drug addiction, alcoholism, pre/extramarital sexual exposure (in adults 15 years and above), contact with a case of jaundice in the family, neighbourhood or outside the town, and movement outside Rajahmundry town.

Venous blood samples were collected from 234 cases. These samples were transported to the local laboratories of the National Institute of Communicable Diseases (NICD). Serum samples were then transported at 4–8 °C to the main laboratories of NICD in Delhi. There, the samples were stored at −20 °C until being tested for viral hepatitis markers.

Blood samples collected within 3 months of onset of jaundice were tested by ELISA for markers of recent viral hepatitis A–E. Hepatitis A, B, and E were confirmed by the presence of anti-HAV IgM (Hepavase, General Biologicals Corp.), anti-HBc IgM (Hepanostika, Organon Teknika) and anti-HEV IgM (Genelabs Diagnostics) respectively. All the 234 samples were also tested for HBsAg (Ortho Diagnostic Systems Inc.), anti-HBc (Hepanostika, Organon Teknika) and anti-HCV (NovaPath, Bio-Rad Laboratories); those tested positive for HBsAg were also tested for anti-HBc IgM and anti-HDV (Abbott Diagnostics). Cases who were positive for anti-HCV and anti-HDV were considered to be suffering from hepatitis C and D respectively.

Cases of hepatitis B or B–D were compared to the cases of hepatitis A and E together for the prevalence of potential risk factors of parenterally transmitted viral hepatitis before the onset of jaundice. Such comparisons were also made between all anti-HBc positive and negative cases of jaundice.

Studies on injection practices

Of cases of jaundice detected during community surveys, 64 found anti-HBc positive and an equal number of anti-HBc and anti-HCV negative age and sex matched cases of jaundice were again visited in the second week of November 1998. They were no longer having jaundice at that time. This time they were interviewed by senior physicians for the number of

https://doi.org/10.1017/S0950268899003854 Published online by Cambridge University Press

injections given to them within 15 days or 5 years preceding the interview, or any time in life. All of them were also asked to recall and describe their last (latest) illness or event (for example, vaccination) for which they were given injections. Using their clinical skill, the surveyors decided whether the injections were medically indicated or not indicated. The person who administered the injection was classified as an unqualified doctor (not having an MBBS degree), qualified doctor (having at least an MBBS degree, or when paramedics gave the injection under supervision or on prescription of a qualified doctor), or a non-physician pharmaceutical dispenser. It may be mentioned that the present surveyors were not aware of the anti-HBc or anti-HCV status of these subjects.

Four doctors who had reportedly administered injections to some of our patients were visited to study their injection practices. Reported data on the morbidity and mortality of viral hepatitis in the district for the period 1994–8 were collected from the district health authorities.

Statistical methods

The data from both the exercises were analysed by using software Epi-Info version 6.02. Differences between the proportions were determined by the χ^2 test. Only matched analysis was done for the second exercise. A P value of $< 0{\cdot}05$ was considered to be significant.

RESULTS

The community reported 472 cases of jaundice during a period of 1 year which gave an annual incidence of 6·61 (95% CI 6·02–7·21) per 1000 population. Eight cases died with a case fatality rate of 1·7%.

Blood samples were collected from 83 cases within 3 months of onset of jaundice. Of them, 5 (6%), 11 (13·3%), 1 (1·2%), 5 (6%) and 16 (19·3%) were found to have acute viral hepatitis A, B, C, D and E respectively (Table 1). Overall, 33 (39·8%) cases had acute hepatitis A–E. Stratified by sex, 35·2% (19/54) of the males and 48·3% (14/29) of the females had acute viral hepatitis A–E. All the cases of hepatitis A occurred in children below 6 years of age. Cases of hepatitis E or parenterally transmitted viral hepatitis occurred in children as well as adults. The aetiology of 60·2% (50/83) of cases of jaundice could not be established (Table 1). Laboratory-confirmed viral hepatitis cases were similar to other cases of jaundice in respect to age, sex, family size, education status, occupations, hygienic practices and clinical symptoms except that the history of abdomen pain was significantly greater ($P = 0{\cdot}001$) in the latter group (data not shown).

Cases suffering from hepatitis B or B–D were compared to the cases having hepatitis E or A and E together. The results are shown in Table 2. About 54·5% (6/11) of cases having hepatitis B, 42·9% (6/14) of cases having hepatitis B–D and about 9·5% (2/21) of cases having hepatitis A or E had received therapeutic injections within 6 months but at least 15 days prior to the onset of jaundice. History of therapeutic injections was significantly higher in cases of hepatitis B ($P = 0{\cdot}01$) or B–D ($P = 0{\cdot}04$) than in cases of hepatitis A and E together. The other risk factors of parenterally transmitted viral hepatitis were equally prevalent in two groups.

Of all the cases of jaundice tested, 41·4% (96/232) were positive for anti-HBc, while 1·7% (4/231) were positive for anti-HCV (Table 3). Three cases were positive for both anti-HBc and anti-HCV. Anti-HBc was significantly more prevalent than anti-HCV ($P < 0{\cdot}0000001$). Anti-HBc prevalence rates increased from 20% in children below 5 years of age to 66·7% in persons 60 years and above (χ^2 for linear trend = 17·75; $P = 0{\cdot}00003$). HBV or HCV infections were equally prevalent in both sexes ($P = 0{\cdot}8$).

Cases of jaundice positive for anti-HBc and/or anti-HCV were also compared to the cases negative for these markers for prevalence of potential risk factors of parenterally transmitted viral hepatitis within 6 months but at least 15 days prior to the onset of jaundice (Table 4). All the risk factors were equally prevalent between the two groups except that the history of injections in the former group (41/97; 42·3%) was significantly higher than in the latter group (24/137; 17·5%) ($P = 0{\cdot}00006$).

Although 11 of 83 samples (13·3%) collected within 3 months of onset of jaundice were positive for anti-HBc IgM, 37 (44·6%) were positive for anti-HBc. Twenty-six of 83 (31·3%) persons were already positive for anti-HBc before they developed jaundice (Table 5).

Studies on injection practices

Sixty-four anti-HBc positive and 64 anti-HBc as well as anti-HCV negative cases of jaundice selected for repeat interview in November 1998 were similar in respect to age, sex, education, occupation, family size and hygienic practices. Their ages ranged from 4 to

https://doi.org/10.1017/S0950268899003854 Published online by Cambridge University Press

Table 2. *Epidemiological and clinical characteristics of cases of acute viral hepatitis in Rajahmundry*

Variable	Number of cases (%)					
	Hepatitis B	Hepatitis B, C or D	Hepatitis E	Hepatitis A or E	All cases of viral hepatitis	Cases negative for A–E markers
Number of cases	11	14	16	21	33	50
Median age in years	25	25	23·5	18	19	20
Mean age in years (S.D.)	29·09 (18·32)	28 (16·31)	26·06 (16·87)	20·86 (17·45)	23·39 (17·39)	23·9 (15·32)
Males/females	6/5	8/6	9/7	12/9	19/14	35/15
Average family size	4·5	4·5	4·5	4·8	4·7	4·9
Symptoms/signs						
Dark urine	11 (100)	14 (100)	16 (100)	21 (100)	33 (100)	50 (100)
Yellow eyes	10 (90·9)	13 (92·9)	16 (100)	21 (100)	32 (97)	50 (100)
Anorexia	8 (72·7)	11 (78·6)	12 (75)	15 (71·4)	24 (72·7)	44 (88)
Nausea	1 (9·1)	3 (21·4)	3 (18·8)	3 (14·3)	6 (18·2)	17 (34)
Vomiting	5 (45·5)	7 (50)	7 (43·8)	7 (33·3)	13 (39·4)	13 (26)
Abdomen pain	1 (9·1)	1 (7·1)	1 (6·3)	1 (4·8)	2 (6·1)	19 (38)
Fever	7 (63·6)	10 (71·4)	13 (81·3)	16 (76·2)	26 (78·8)	45 (90)
Clay coloured stool	0	0	0	0	0	4 (8)
Malaise	7 (63·6)	9 (64·3)	11 (68·8)	13 (61·9)	20 (60·6)	30 (60)
Itching	0	0	0	0	0	0
Treatment taken	11 (100)	14 (100)	15 (93·8)	18 (85·7)	30 (90·9)	50 (100)
Allopathic	2 (18·2)	4 (28·6)	8 (50)	8 (38·1)	10 (30·3)	17 (34)
Homeopathic	0	0	0	0	0	0
Ayurvedic/herbal	9 (81·8)	10 (71·4)	7 (43·8)	9 (42·9)	19 (57·6)	33 (66)
Other	0	0	1 (6·3)	1 (4·8)	1 (3·0)	
Past history of jaundice	0	0	4 (25)	4 (19)	4 (12·1)	11 (22)
Prevalence of risk factors						
Injections administered	6 (54·5)	6 (42·9)*†	1 (6·3)†	2 (9·5)*	8 (24·2)	10 (20)
Visit to a barber for shave	4 (36·4)	6 (42·9)‡	3 (18·8)‡	3 (14·3)	8 (24·2)	17 (34)
Alcoholism	1 (9·1)	1 (7·1)	1 (6·3)	1 (4·8)	2 (6·1)	5 (10)
Movement outside town	0	0§	5 (31·3)§	5 (23·8)	5 (15·2)	7 (14)
Contact with a jaundice case	0	0	1 (6·3)	2 (9·5)	2 (6·1)	3 (6)
Chronic illness before jaundice	1 (9·1)	1 (7·1)	1 (6·3)	1 (4·8)	1 (3·0)	0

* OR 7·13, $P = 0·04$.
† OR 11·25, $P = 0·03$.
‡ OR 3·25, $P = 0·2$.
§ Difference is significant, $P = 0·04$.
Note: Other risk factors were equally prevalent in all groups.

Table 3. *Prevalence of past or current HBV and HCV infections in cases of jaundice*

	HBV infection*			HCV infection†		
	No. tested	No. positive	% positive	No. tested	No. positive	% positive
Age group						
0–4	15	3	20	15	0	0
5–9	20	4	20	20	0	0
10–14	21	2	9·5	22	0	0
15–19	29	12	41·4	28	1	3·6
20–39	94	46	48·9	94	3	3·2
40–59	44	23	52·3	43	0	0
60+	9	6	66·7	9	0	0
Sex						
Male	157	66	42	157	3	1·9
Female	75	30	40	74	1	1·4
Total	232	96	41·4‡	231	4	1·7‡

* Positive for anti-HBc, anti-HBc IgM, or HBsAg.
† Positive for anti-HCV.
‡ P for difference $< 0{\cdot}0000001$.

Table 4. *Comparison between cases of jaundice found positive and negative for anti-HBc/anti-HCV*

Variable	Positive for anti-HBc or anti-HCV	Negative for anti-HBc and anti-HCV	Odds ratio (95% CI)	P value
No.	97	137		
Median age in years	26	20		
Mean age in years (S.D.)	30·41 (14·97)	22·52 (14·72)		
Males/females	66/31	93/44		
Average family size	5·1	4·9		
Injections administered	41 (42·3)	24 (17·5)	3·45 (1·82–6·55)	0·00006
Visit to a barber for shave	40 (41·2)	42 (30·7)	1·59 (0·89–2·84)	0·13
Alcoholism	9 (9·3)	8 (5·8)	1·65 (0·56–4·91)	0·45
Movement outside town	14 (14·4)	21 (15·3)	0·93 (0·42–2·05)	0·9
Contact with a jaundice case	7 (7·2)	5 (3·6)	2·05	0·2
Chronic illness before jaundice	2 (2·1)	3 (2·2)	0·94	1·0
Hospital admission	3 (3·1)	2 (1·5)	2·15	0·65
Surgical operation or dental work	1 (1)	1 (0·7)	1·42	1·0
Blood donation	1 (1)	1 (0·7)	1·42	1·0

Note: Other risk factors were equally prevalent in two groups.

63 years (mean 28 years); 75% of them were males. As shown in Table 6, about 23·4% (15/64) of the former and 4·7% (3/64) of the latter had received injections within 15 days of the second interview. Mantel–Haenszel matched-odds ratio and exact 95% CI of maximum likelihood estimate of odds ratio were found to be 13 and 1·95–552·47 ($P = 0{\cdot}001$) respectively by matched analysis. However, more than 90% in both groups had received injections some time in life (Table 6). A total of 86/117 (74%) (95% CI 66–82%) of the last injections (administered any time in life) were unnecessary as these were given to treat minor illnesses (Table 7). Whether medically indicated or not indicated, 38% (95% CI 28–46%) of the injections were prescribed by those who had no legal authority to prescribe injections.

Visit to clinics of four unqualified doctors revealed that they prescribed injections for most of the 'illnesses' (fever, diarrhoea, weakness, respiratory illnesses, skin diseases, etc.) because of their 'fast' action, and also because the people preferred them to tablets or capsules. Most of the injections adminis-

https://doi.org/10.1017/S0950268899003854 Published online by Cambridge University Press

Table 5. *Seropositivity of anti-HBc IgM and anti-HBc in samples collected within 3 months of onset of jaundice*

Age group	No. tested	No. positive for anti-HBc IgM	% positive for anti-HBc IgM	No. positive for anti-HBc	% positive for anti-HBc	HBV exposure rate before the cases developed jaundice
0–4	8	0	0	2	25	2/8 (25%)
5–9	11	1	9·1	2	18·2	1/11 (9·1%)
10–14	6	1	16·7	2	33·3	1/6 (16·7%)
15–19	11	2	18·2	6	54·5	4/11 (36·4%)
20–39	32	4	12·5	15	46·9	11/32 (34·4%)
40+	15	3	20	10	66·7	7/15 (46·7)
Total	83	11	13·3	37	44·6	26/83 (31·3)

Table 6. *Frequency of injections administered to the anti-HBc positive and negative cases of jaundice: matched analysis*

Injections administered	No. (%) positive for anti-HBc ($n = 64$)	No. (%) negative for anti-HBc and anti-HCV ($n = 64$)	Mantel–Haenszel matched odds ratio (95% CI)*	P value
In the last 15 days	15 (23·4)	3 (4·7)	13·0† (1·95–552·47)	0·001 *
In the last 5 years	54 (84·4)	53 (82·8)	1·14 (0·36–3·7)	0·5
Ever in life	58 (90·6)	59 (92·2)	0·8 (0·16–3·72)	0·5

* Exact 95% CI of maximum likelihood estimate of odds ratio.
† On unmatched analysis: OR = 6·22; 95% CI = 1·61–34·98; $P = 0·002$.
Figures in parentheses with 'n' as denominator.

Table 7. *Information about the last injection administered any time in life to the anti-HBc positive and negative cases of jaundice*

	No. (%) positive for anti-HBc ($n = 58$)*	No. (%) negative for anti-HBc and anti-HCV ($n = 59$)*	Total ($n = 117$) [95% CI of percentages]
Reason for administering the last injection			
Therapeutic injections – not medically indicated	40 (69)	46 (78)	86 (73·5%) [65·5–81·5]
Therapeutic injections – medically indicated	10 (17·2)	8 (13·6)	18 (15·4) [8·9–21·9]
Vaccine	8 (13·8)	5 (8·5)	13 (11·1) [5·4–16·8]
Who prescribed/administered the last injection			
Qualified doctor	36 (62·1)	37 (62·7)	73 (62·4) [53·6–71·2]
Unqualified doctor	21 (36·2)	22 (37·3)	43 (36·8) [28·1–45·5]
Other	1 (1·7)	0	1 (0·9) [0–2·6]

Figures in parentheses with 'n' as denominator.
* There was no significant difference between the two groups any where ($P > 0·05$).

https://doi.org/10.1017/S0950268899003854 Published online by Cambridge University Press

tered were antibiotics (mostly tetracycline and gentamycin), vitamins (mostly vitamin B complex), analgesics, bronchodilators and steroids. All of them admitted having used disposable one-time-only needles and syringes many times; during rush hours, only the needle was changed, but not the syringe. The electric heater used for sterilization was switched off immediately after the water started boiling. There was no alternative arrangement in the absence of an electric current, which was not uncommon.

DISCUSSION

Among 33 laboratory-confirmed cases of viral hepatitis, 5 (15·2%), 11 (33·3%), 1 (3%), 5 (15·2%) and 16 (48·5%) were found to have acute viral hepatitis A to E, respectively (Table 1). All five types of viral hepatitis were prevalent in the study area. Faeco-orally transmitted viral hepatitis A and E accounted for 64% (21/33) of the cases, whereas parenterally transmitted hepatitis B–D were responsible for 42% (14/33) of the cases. These data have some limitations, since in many cases, especially small children, including those who had onset of jaundice within 3 months prior to survey could not be tested because their mothers refused to provide the blood. It is therefore possible that many cases of hepatitis A that affected only children (Table 1) were missed.

About 44·6% (37/83) of cases who could be tested within 3 months of onset of jaundice were positive for anti-HBc. Eleven cases (13·3%) were also positive for anti-HBc IgM. Since IgM antibodies against HBc persist in blood for 3 months, 31·3% (26/83) of cases were perhaps already positive for anti-HBc before they developed jaundice due to a cause other than HBV infection (Table 5). This is a fair estimate of HBV exposure rate in the general community in Rajahmundry and is in agreement with the anti-HBs positivity rate of 28% in the general population of Pune in Maharashtra [6]. It is also worth mentioning that 3·4% (8/232) of all cases of jaundice were HBsAg carriers (including two cases of hepatitis D superinfection, and one case of hepatitis A as shown in Table 1).

While 41·4% (96/232) of all cases of jaundice were positive for anti-HBc, only 1·7% (4/231) were positive for anti-HCV (Table 3). Thus HCV infection was far less prevalent than HBV infection ($P < 0{\cdot}0000001$). Nevertheless, the results indicate that HCV infection is an important public health problem in the study area because more than 80% of HCV infections become chronic and can result in serious complications including liver cirrhosis and carcinoma like HBV infection [7].

As shown in Table 2, acute cases of viral hepatitis B had had significantly more injections before the illness (6/11; 54·5%) than the cases suffering from faeco-orally transmitted viral hepatitis (2/21; 9·5%). The difference between the two groups was so great, the results remained significant ($P = 0{\cdot}01$) in spite of a small number of cases in both the groups. In contrast, other potential risk factors of HBV transmission were equally prevalent in the two groups. The results indicate that injections may be playing a major role in the transmission of hepatitis B virus in Rajahmundry.

Presence of anti-HBc in cases of jaundice does not necessarily mean that the current illness was due to hepatitis B infection. It only indicates that they were exposed to the hepatitis B virus some times in life. Nevertheless, the comparison of anti-HBc positive and negative cases for the prevalence of potential risk factors of hepatitis B infection before the onset of jaundice revealed that although other risk factors were equally prevalent in two groups, the history of injections in the former group (41/97; 42·3%) was significantly higher than in the latter group (24/137; 17·5%) ($P = 0{\cdot}00006$) (Table 4). Subsequent studies indicated that the anti-HBc positive persons continued to receive injections with significantly greater frequency ($P = 0{\cdot}001$) than the anti-HBc negative persons even after they had cleared the jaundice (Table 6). These results further support the possibility of an association between the injections and HBV transmission in the study area.

Injections were found to be very popular in the study area. More than 91% (117/128) of cases of jaundice had received injections some time in life (Table 7). Seventy-four percent (86/117) of their last injections were performed to treat minor illnesses which could have been easily treated with oral medicines. Both qualified and unqualified doctors were responsible for administering these unnecessary injections. Inspection of four small private clinics run by unqualified doctors showed that all of them were performing not only unnecessary but also unsafe injections. Obviously, most patients and many doctors were not aware of dangers of unnecessary and unsafe injections [8–10]. The risk of infection from a contaminated needle is 20–40% for hepatitis B virus, 0·3% for HIV and 3% for hepatitis C virus [9,10]. The results emphasize the need to educate the community as well as health care workers about the

https://doi.org/10.1017/S0950268899003854 Published online by Cambridge University Press

risks of inappropriate and unsterile injections. Use of auto-destruct syringes may also be helpful in areas or settings where compliance with disposal of used syringes is weak [10].

Before the tests became available to diagnose hepatitis E and hepatitis C, all the cases of viral hepatitis that were negative for hepatitis A and B were diagnosed as non-A non-B (NANB) viral hepatitis. Most of the outbreaks of viral hepatitis and the majority of acute sporadic cases that came to the hospitals for treatment were found to be due to NANB hepatitis viruses [11–13]. Since epidemiological studies also indicated that NANB cases in India were predominantly enterically transmitted [11, 13], they were considered to be caused by hepatitis E virus. However, two recent studies showed that a large number of sporadic cases of NANB hepatitis were in fact negative for both HEV and HCV markers [14, 15]. The present study again showed that 60% (50/83) of cases were negative for all acute markers of viral hepatitis A–E (Table 1). Had we used earlier criteria, we would have diagnosed them as cases of NANB hepatitis, increasing its proportion tremendously. One may argue that these cases may be due to other than viral hepatitis (for example, drug toxicity), or may not be cases of jaundice at all. However, these cases were similar to laboratory confirmed cases of viral hepatitis in respect to epidemiological and clinical characteristics (Table 2). All of them were examined by a qualified medical doctor (S.K.P.) during the surveys and were considered having viral hepatitis compatible illness. At least, one third (17/50) of them were treated by qualified doctors for viral hepatitis when they were having jaundice (Table 2). Clearly, further studies are necessary to establish the aetiology of such cases. They may have been caused by viruses such as cytomegalovirus or Epstein-Barr virus or by some recently discovered agents (e.g. hepatitis TT virus) [16, 17] or agents which can not be identified by currently available laboratory tests.

Finally, 39·8% (33/83) cases of jaundice were confirmed as viral hepatitis by the laboratory (Table 1). Assuming the same proportion of viral hepatitis in all the jaundice cases, the annual incidence of viral hepatitis in the study area was estimated to be 2·62 (95% CI 2·25–2·99) per 1000 population. Conversely, in the whole district (population 1991: 4 542 369), only 775 cases of viral hepatitis were reported through routine surveillance system in 1997 and 477 cases were reported in the first 9 months of 1998. The study thus once again indicated that viral hepatitis is a major public health problem in India and that the routine surveillance data grossly underestimate the problem.

ACKNOWLEDGEMENTS

The authors thank Dr H. S. Chohan, Dr S. Champika, Dr S. Sarkar, Dr M. S. Bhuiyan, Dr G. P. Dhakal, Dr J. C. Das, Dr F. A. Peerzada, Dr K. Zoramthanga, Dr Ye Aye, Dr T. H. Maung, Dr K. P. Khanal, Mr A. A. Kareem, and Mrs Rita Bhandari (participants of the third Regional Field Epidemiology Training Programme at NICD) for collection of data for studies on injection practices. Assistance of all the staff members of NICD who helped in collection of data and testing of blood samples is also acknowledged.

REFERENCES

1. Expanded Programme on Immunization. Hepatitis B vaccine-making global progress. EPI Update, October 1996.
2. Margolis HS, Alter MJ, Hadler SC. Viral hepatitis. In: Evans AS, Kaslow RA, eds. Viral infections of humans: epidemiology and control. 4th ed. New York: Plenum Publishing Corporation, 1997; 363–418.
3. Singh J, Bhatia R, Khare S, et al. Community studies on prevalence of HBsAg in two urban populations of southern India. Indian Pediatr 2000; **37**: 149–52.
4. Tandon BN, Irshad M, Raju M, Mathur GP, Rao MN. Prevalence of HBsAg & anti-HBs in children and strategy suggested for immunisation in India. Indian J Med Res 1991; **93**: 337–9.
5. Nayak NC, Panda SK, Zucherman AJ, Bhan MK, Guha DK. Dynamics and impact of perinatal transmission of hepatitis B virus in north India. J Med Virol 1987; **21**: 137–45.
6. Sobeslavsky O. Prevalence of markers of hepatitis B virus infection in various countries: a WHO collaborative study. Bull WHO 1980; **58**: 621–8.
7. Seeff LB. Natural history of hepatitis C. Hepatology 1997; **26** (Suppl 1): 21S–28S.
8. Aylward B, Lloyd J, Zaffran M, McNair-Scott R, Evans P. Reducing the risk of unsafe injections in immunization programmes: financial and operational implications of various injection technologies. Bull WHO 1995; **73**: 531–40.
9. Simonsen L, Kane A, Lloyd J, Zaffran M, Kane M. Unsafe injections in the developing world and transmission of bloodborne pathogens: a review. Bull WHO 1999; **77**: 789–800.
10. Expanded Programme on Immunization. Safe injection practices. EPI Update, January 1995.
11. Khuroo MS, Duermeyer W, Zargar SA, Ahanger MA, Shah MA. Acute sporadic non-A, non-B hepatitis in India. Am J Epidemiol 1983; **118**: 360–4.

12. Tandon BN, Gandhi BM, Joshi YK. Etiological spectrum of viral hepatitis and prevalence of markers of hepatitis A and B infection in north India. Bull WHO 1984; **62**: 67–73.
13. Tandon BN, Gandhi BM, Joshi YK, Irshad M, Gupta H. Hepatitis virus non-A, non-B: the cause of major public health problem in India. Bull WHO 1985; **63**: 931–4.
14. Singh J, Prakash C, Gupta RS, Bora D, Jain DC, Datta KK. Epidemiology of endemic viral hepatitis in an urban area of India: a retrospective community study in Alwar. Bull WHO 1997; **75**: 463–8.
15. Singh J, Prakash C, Panda R, Bora D, Jain DC, Datta KK. Acute sporadic viral hepatitis in urban population of a tribal district in Madhya Pradesh. Indian Pediatr 1998; **35**: 105–9.
16. Linnen J, Wages J Jr, Zhang-Keck Z-Y, et al. Molecular cloning and disease association of hepatitis G virus: a transfusion-transmissible agent. Science 1996; **271**: 505–8.
17. Okamoto H, Nishizawa T, Kato N, et al. Molecular cloning and characterization of a novel DNA virus (TTV) associated with post-transfusion hepatitis of unknown eyiology. Hepatol Res 1998; **10**: 1–6.