Epidemiological Differentials of Hepatitis B Carrier State in the Army : A Community Based Sero-epidemiological Study

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Abstract

Background : Most available studies on seroprevalence of Hepatitis B in the Armed Forces and also at the national level are based on hospital patients and blood donors. Hence, there was a perceived need to undertake a seroepidemiological study on an adequately large and representative random sample of the general cross section of Army personnel, with a view to obtain the exact picture of the frequency and distribution of HBV in the Army.

Methods : A community based cross sectional study with random samples from four groups were drawn, viz recruits from the Army Medical Corps (AMC) and other Arms and Services; AMC personnel and personnel from other Arms and Services who had served for more than 10 years. A structured pretested questionnaire was administered to all participants and blood samples were drawn aseptically subsequently, with separation of serum and testing by ELISA technique for HBsAg. Multivariate analysis using multiple logistic regression procedure was done after appropriate data entry.

Results : The overall seroprevalence was 7.9% (95%CI = 6.5% to 9.26%). The differential seroprevalence in the four groups being 7.72%, 7.92%, 8.28% and 7.75% respectively. There was statistically no significant difference as regards the seroprevalence levels [$p > 0.05$]. As regards serving medical personnel, the seroprevalence was observed to be higher among personnel involved in direct nursing care. On multiple logistic regression analysis, two risk factors emerged as independent and significant predictors of hepatitis B positivity. These were history of sexual exposure with commercial sex workers (CSWs) (OR = 3.06, $p < 0.01$) and history of having taken injections from civil sources (OR = 1.92, $p < 0.001$).

Conclusion : The relatively high level of seroprevalence among recruits has led to certain recommendations on testing and further studies in specific groups, based on the findings of the study.

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Key Words : Health care workers; Hepatitis B - seroprevalence; Military personnel; Multivariate analysis; Risk factors

Introduction

Globally more than a billion human beings have evidence of exposure to Hepatitis B virus (HBV) and there are approximately 370 million carriers of this virus, most of whom come from the developing world of South East Asia and Sub Saharan Africa. The infection is a leading cause of morbidity and mortality, not only because of the acute illness but due to its chronic sequelae like chronic hepatitis, cirrhosis and hepatocellular carcinoma, accounting for more than a million deaths annually worldwide [1, 2].

Keeping in view the availability of an effective vaccine for preventing HBV infection, it is imperative to obtain valid and reliable epidemiological data from sample surveys of the target population so that effective preventive strategies can be planned. Unfortunately, available data at national level on the sero-prevalence and distribution is limited in nature. Most of the studies

are plagued with the problems of representative sampling, since the majority of such studies are based on surveys on antenatal clinic patients or voluntary blood donors [3]. Moreover, many authorities have held that epidemiological studies on blood donor populations and hospital based patients do not really represent the general population [4] since various factors determine the fact as to why people volunteer to donate blood [5]. Similar lacunae are present in the existing body of knowledge in the Armed Forces, wherein available estimates on the prevalence and distribution of HBV infection are mainly based on data available from serosurveillance of healthy blood donors or among individuals reporting to hospitals with symptoms which warrant testing for HBV infection. There was therefore, a need to undertake a sero-epidemiological study on an adequately large and representative random sample of the general cross section of Army personnel, with a view to obtain the exact picture of the frequency and distribution of HBV

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in the Army.

It was against the above backdrop that the present study was undertaken to study the prevalence of HBV infection, among representative samples of four broad groups of Army personnel, viz recruits from AMC, recruits from other Arms and Services, serving personnel from AMC who have served for more than 10 years and serving personnel from other Arms and Services who have served for more than 10 years. It was also envisaged to study the independent, adjusted role of putative risk factors in transmission of Hepatitis B in the Armed Forces settings.

Material and Methods

The study was a community based cross sectional sero-epidemiological typology, undertaken between June 1997 and December 1999. Sample size was calculated with an expected parameter estimate [proportion] of 0.035 with a view to obtain the estimates within a 95% confidence interval of 0.01 to 0.06. The minimum sample size thus worked out to approximately 230. It was attempted to study a higher sample than this minimum, in each of the four subgroups. This sample was selected from the study population of Army units and Training Centres by the method of stratified random sampling. Stratification was done for the four groups as defined earlier and final sampling was done by simple random method from the defined list of available subjects [sampling frame]. While drawing the sample, any subject who had previously tested positive for HBsAg or had been vaccinated in the past six months, was excluded from the study.

A detailed structured questionnaire was developed, pretested and validated through a pilot study. This questionnaire was used to record information from the subjects. 5 ml blood samples were drawn under aseptic conditions and serum was separated. These serum samples were transported to Virology division, where they were tested for HBsAg by ELISA method, using kits from Sanofi Pasteur Co, under personal supervision of a faculty member.

Data analysis was undertaken by a multivariate analysis using multiple logistic regression procedure. The dichotomous outcome [dependent] variable was seropositivity for Hepatitis B. The independent [predictor] covariates were:

- History of having sexual relations with CSW taken as a binary [1/0] variable
- History of having casual sex ("amateur sex")
- History of homosexual intercourse
- History of needle sharing
- History of injections for medical reasons from civil set up
- History of injections for medical reasons from military establishments, other than vaccination
- History of admission to any hospital for treatment of any disease
- History of having received blood transfusion
- History of tattooing / ear piercing

For the specific service group, recruits from AMC were kept as a baseline comparison group and hence not introduced into the mathematical model, to prevent multicollinearity. The other three groups for which risk was evaluated (keeping recruits from AMC as baseline) were recruits from other Arms / Services / AMC personnel with more than 10 years of service / serving personnel from other Arms and Services with more than 10 years service. All these three comparison groups were kept as dichotomous (i.e. belonging to that group as '1', else '0').

Results

It was observed that the overall seropositivity for HBV was 7.9% (Table 1). This was 7.85% among recruits and almost similar, i.e. 7.97% among soldiers who had already served for more than 10 years in the Army. There was no statistically significant difference as regards seropositivity among recruits as compared to serving personnel ($p > 0.05$). The findings (Table 2) indicate that the seropositivity was marginally higher among serving personnel of AMC, being 8.28% in this group. Statistically there was no difference between the four groups as regards seroprevalence.

Table 1

HBsAg positivity among Army personnel

Service group	HBsAg positive	HBsAg negative	Total
Recruits	63 (7.85%)	740 (92.15%)	803 (100%)
Soldiers	56 (7.97%)	647 (92.03%)	703 (100%)
Total	119 (7.9%)	1387 (92.1%)	1506 (100%)

Odds ratio = 0.98 (95% CI of OR = 0.66-1.46)

Chi square = 0.01; df = 1; p value > 0.05

Table 2

Seroprevalence according to categories

Service Group	HBsAg positive	HBsAg negative	Total
AMC Recruits	23 (7.72%)	275 (92.28%)	298 (100%)
Recruits (Other Arms/ Services)	40 (7.92%)	465 (92.08%)	505 (100%)
AMC Serving personnel	24 (8.28%)	266 (91.72%)	290 (100%)
Serving personnel (Other Arms/ Services)	32 (7.75%)	381 (92.25%)	413 (100%)
Total	119 (7.90%)	1387 (92.10%)	1506 (100%)

Chi square = 0.08; df = 3; p value > 0.05 (Not significant)

On evaluating the seroprevalence among various categories of medical personnel (Table 3), it was observed that in general, the seroprevalence varied between 7.3% to 8.5% among most of the categories excepting Medical Officers among whom the seroprevalence was nil. On the other hand, a higher seropositivity was observed among personnel involved in direct nursing care (12.5% among Nursing Assistants and 11.4% among Nursing Officers).

Table 3**Seroprevalence among serving AMC personnel according to category**

Group/Trade	HBsAg positive	HBsAg negative	Total
Medical Officers	0 (0%)	20 (100%)	20 (100%)
Nursing Officers	4 (11.4%)	31 (89.6%)	35 (100%)
Operating Room Assistant	2 (7.7%)	24 (92.3%)	26 (100%)
Blood Transfusion Assistant	1 (5.6%)	17 (94.4%)	18 (100%)
Lab Assistant	3 (7.3%)	38 (92.7%)	41 (100%)
Nursing Assistant	7 (12.5%)	49 (87.5%)	56 (100%)
Skin Treatment Assistant	1 (7.7%)	12 (92.3%)	13 (100%)
Others	6 (7.4%)	75 (92.6%)	81 (100%)
Total	24 (8.3%)	266 (91.7%)	290 (100%)

*Others included Radiographers, Ambulance Assistants, Drivers and Sfaivalas. Statistical analysis was not undertaken due to very small expected cell frequencies.

The detailed results of the multiple logistic regression analysis are shown in Table 4. Description of the results is as follows:-

(a) History of having indulged in sex with CSWs: It was observed that this factor earned an independent and highly significant risk of seropositivity for Hepatitis B ($p < 0.01$) with an Odds Ratio (OR) of 3.06. Thus it was apparent that sexual intercourse with CSW tends to increase the risk of Hepatitis B by more than three fold and thus risk is adjusted, i.e., independent of the possible confounding effect of other variables.

(b) History of injection in civil set up: It was observed that this risk factor too was very highly significant ($p < 0.001$) with an OR of 1.92, it was apparent that exposure to injections in civil increased Hepatitis B seropositivity by almost two fold. This risk was independent of other risk factors.

(c) Other risk factors: The other risk factors, as presented

in the Table, did not show statistically significant effect ($p > 0.05$). Of these, history of admission to a hospital, history of tattooing / ear piercing, history of homosexual exposure, history of needle sharing - serving personnel from AMC showed a slight increase in risk (albeit non significant), while history of receiving blood transfusion, history of receiving injections in the Army (apart from routine immunization), - recruits / serving personnel from other Arms and Services showed a slight reduction though statistically not significant.

Discussion

The findings of the study indicate that the overall seroprevalence was 7.85% among recruits and almost similar (7.97%) among personnel who have rendered more than 10 years of service in the Army. Thus service in the Army per se, does not seem to pose an increased risk of becoming HBsAg positive. In fact, the prevalence among recruits (7.85%) is quite high in itself. The factors accounting for this high level could include a high level of perinatal and 'horizontal' transmission during childhood, which is a very likely possibility in a developing country like ours. A strong possibility also exists that perinatal / childhood (horizontal transmission) of HBV may have been increasing in our country during the past one or two decades, thus showing a fairly high level of sero-prevalence among recruits (who are usually 17-18 years old).

The overall sero-prevalence of 7.9% as observed in this study is among the highest reported sero-prevalence in India. Thyagarajan et al (1996) have rated India to be in the intermediate prevalence zone ranging from 2% to 7% [6]. The reason that can be attributed for the higher prevalence of this study may be because other studies have mostly extrapolated data from blood donor screening, or more recently from antenatal patients. On the other hand, the present study being a community based random sample was probably in a better position to evaluate the seroprevalence in the setting of the community.

Table 4**Multiple logistic regression analysis of the various putative risk factors for seropositivity for Hepatitis B**

Variable	Beta coefficient	Odds ratio	SE	Z value	p value
History of sex with CSW	1.12	3.06	0.45	2.46	<0.01
History of injections from civil	0.65	1.92	0.21	3.08	<0.001
Serving personnel from other Arms and Services	-0.10	0.90	0.31	-0.33	>0.05
Recruits from other Arms & Services	-0.09	0.91	0.32	-0.28	>0.05
Serving personnel from AMC	0.03	1.03	0.33	0.09	>0.05
History of injections in the Army	-0.04	0.96	0.33	-0.14	>0.05
History of admission to hospital	0.12	1.13	0.24	0.51	>0.05
History of blood transfusion	-0.49	0.61	1.06	-0.47	>0.05
History of tattooing/ear piercing	0.36	1.43	0.22	1.63	>0.05
Homosexual exposure	0.52	1.68	0.79	0.66	>0.05
History of needle sharing	0.24	1.27	0.49	0.48	>0.05
History of amateur (casual) sex	0.05	1.05	0.29	0.18	>0.05

The present study indicates a slightly higher seroprevalence among serving AMC personnel as compared to the other three groups. Moreover, the prevalence appears to be marginally higher among personnel involved in direct patient care, viz Nursing Officers and Nursing Assistants. The present study was significant in that, prior to this, no study on a random probability sample in the community settings of Army personnel had been done earlier and no earlier study within the settings of Indian Army subjects has undertaken a multivariate adjusted analysis. Against these strengths, the present study has identified two important factors which independently tend to increase the risk of transmission of Hepatitis B in the Army and are also statistically highly significant ($p < 0.01$). These factors are, firstly, sex with CSWs and secondly, taking injections from civil practitioners. The former risk factor is in any case a well known determinant. The latter may have come up as important in this study, because of the possible lack of hygiene and attention to sterility requirements (control as regards sterilization of syringes / needles in the civil set up).

The present study has also identified other factors as statistically non significant which is also an important finding. For example, history of blood transfusion (all the transfusions were taken in military hospitals) and injections taken within Army set up have been found as non significant. This possibly indicates the good quality and high standard of blood banking and hospital infection control procedures that are being followed in our military hospitals and efforts must be made to maintain these achievements.

The findings of this study, thus point towards the following suggestions which need to be explored further:-

- (a) Considering the relatively high prevalence of seropositivity among recruits, coupled with the almost negligible increase during service, the case for

subjecting recruits to screening for HBsAg at the time of entry may be considered. This is likely to eliminate a large number of HBV carriers at the point of entry to Army itself, with consequent reduction in the cost of health care due to long term complications of the infection.

- (b) A larger study, exclusively on personnel of Armed Forces Medical Services, may be undertaken to study the transmission dynamics of HBV infection in this group, and identify the high risk subgroups.

The main information, education and communication (IEC) thrust for prevention of HBV transmission in the Army should therefore concentrate on educating and motivating our personnel to refrain from premarital / extramarital sex with CSWs (to avoid casual sexual encounters too) and to avoid taking injections from civil set up. These steps are likely to go a long way, not only in preventing HBV but also its uglier sibling HIV infection, in Armed Forces personnel.

It is suggested that this IEC strategy for prevention of HBV may be taken up along with the preventive strategy for HIV / AIDS, by the Armed Forces AIDS Control Organization through the IEC Nodes established all over the country.

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