Original Article

# Changing trends of syphilis among blood donors in Bastar region, Chhattisgarh: A retrospective study

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## ABSTRACT

**Background and Aim:** Prevalence of sexually transmitted infections (STIs) shows regional variations. Various epidemiological studies report a diminishing prevalence of syphilis including other bacterial STIs and a rising incidence of viral STIs. However, a resurgence of syphilis has been observed and reported. The aim of our study was to find out the trends of syphilis among blood donors in Bastar region. **Materials and Methods**: This study was carried in a blood bank, attached to the Government Medical College in Bastar region, Chhattisgarh. This was a retrospective study. A total of 12,680 blood donors were screened for syphilis during 3 years (from 2011 to 2013) by Syphichik Rapid Dipstick test (Modified *Treponema pallidum* hemagglutination assay) and data was analyzed with respect to sero-reactive cases. **Results:** Out of 12,680 blood donors screened for transfusion transmitted infections, 134 donors were sero-reactive for syphilis, five donors had co-infections syphilis and hepatitis B infections, while four donors had syphilis with human immunodeficiency virus (HIV) infections. Prevalence of syphilis was more in replacement donors than voluntary donors and was in raising trend. **Conclusions**: Prevalence of syphilis among blood donors was in raising trends in this region and was more in replacement donors. The most common co-infections in our study were syphilis with hepatitis B infection, followed by syphilis with HIV infection. Increasing prevalence of syphilis among the donors underscores the concern about growing infection of this disease in the community as these blood donors represent the highly selective community. Proper counseling prior to blood donation, brief medical examination of blood donors and awareness about syphilis among blood donors may increase the safety of blood as well as community.

**Key words**: Blood donors, prevalence, syphilis

## INTRODUCTION

Accurate figures on the incidence of syphilis are not available in most of the developing countries. Population-based studies have shown the seroprevalence to vary widely depending on the group tested.[1,2] Serological surveys in India have revealed high seroprevalence rates ranging from 9.07% among high risk sexually transmitted infection (STI) patients in Himachal Pradesh to 21.9% in long distance truck drivers in central India.[3,4]

Prevalence of STIs shows regional variations. Various epidemiological studies report a diminishing prevalence of syphilis, including other bacterial STIs and a rising incidence of viral STIs.[5] However, a resurgence of syphilis has been

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|---|---|
| Quick Response Code: | Website: www.caijournal.com |
| | DOI: 10.4103/2225-6482.159226 |

observed and reported by some.[6,7] Using blood donors as a prevalence source may underestimate the actual prevalence because donors are generally a highly selected population.[8] Genital ulcerative diseases, including syphilis, increase the risk of transmission of human immunodeficiency virus (HIV).[9,10] In addition, HIV infection may cause more severe manifestations of early syphilis or more rapid progression to late syphilis.[11-13]

Despite minor differences, syphilis presents similarly in HIV-infected and HIV-uninfected patients. In primary syphilis.[12,14] Approximately, one-fourth of HIV-infected patients present with concomitant lesions of both primary and secondary stages of syphilis at the time of diagnosis.[12,15]

Studies suggest that syphilis, like many other acute infections, causes transient increases in the viral load and decreases in the CD4 cell count that resolve after the infection is treated.[16-19] It is possible that these transient increases in viral load contribute to the increased risk of HIV transmission among patients with concordant HIV infection and syphilis.[20,21] The aim of our study was to find out the trends of syphilis among blood donors in Bastar region.

## MATERIALS AND METHODS

The study was carried in a blood bank, attached to the Government Medical College in Bastar region, Chhattisgarh. This was a retrospective study. A total of 12,680 blood donors were selected for blood donation after clinical history and brief medical examination by blood bank officer during the study period that is, from 2011 to 2013. The collected blood bags were screened for transfusion transmitted infections (TTIs). Hepatitis C virus (HCV) was screened by SD BioLine anti-HCV test, manufactured by Bio Standard Diognostics Pvt. Ltd., Maneshwar, Gurgaon, India, while hepatitis B surface antigen was screened by RAPITEST, manufactured by Yuvraj Biobiz Incubator India Pvt. Ltd., Chennai, India. HIV was screened by HIV 1 + 2 Immunodot test kit, manufactured by Span Diagnostic Ltd., Surat, India, while malaria was screened by one-step malaria HRP-II (p.f) and LDH (p.v) antigen rapid test manufactured by Bio Standard Diagnostics Pvt. Ltd., Maneshwar, Gurgaon, India. Syphilis was screened by Syphichik Rapid Dipstick test[22] (Modified *Treponema pallidum* hemagglutination assay [TPHA]), which detects the presence of IgM and IgG class of *Treponema* specific antibodies, manufactured by Qualpro Diagnostics, Verna, Goa, India.

### Principle of the test

Based on the principle of immunochromatography, a unique two-site immunoassay on a membrane. As the test sample flows through the membrane assembly of the test dipstick, the recombinant *Treponema* antigen-colloidal gold conjugate forms a complex with *Treponema* specific antibodies in the sample. This complex moves further on the membrane to the test region where it is immobilized by the recombinant *T. pallidum* antigens coated on the membrane leading to the formation of a pink to deep purple colored band at the test region, which confirms a positive test result. Absence of this colored band in test region indicates a negative test result. The unreacted conjugate and the unbound complex if any, along with rabbit IgG gold conjugate move further on the membrane and are subsequently immobilized by the goat anti-rabbit antibodies coated on the control region of the membrane assembly, forming a pink to deep purple colored band. The control band serves to validate the test results.

### Specimen collection and preparation

No special preparation is necessary prior to specimen collection by approved techniques. Though fresh serum/plasma was preferable, serum/plasma specimens may be stored at 2-8°C for up to 24 h, in case of delay in testing. Hemolyzed or contaminated specimens were not used. Turbid specimens were centrifuged or allowed to settle, and only the clear supernatant was used for testing.

### Testing procedure and interpretation of results

1. Bring kit components, specimen to room temperature prior to testing. Open the pouch and remove the dipstick. Once opened, the dipstick must be used immediately
2. Add three drops of diluent buffer into a clean (12 mm × 75 mm) test tube by holding the dropper bottle vertically
3. With the help of the dropper provided dispense one drop of serum/plasma to the sample pad just below the arrows
4. With the arrows pointing downwards place the dipstick with the sample into the test tube containing diluent buffer
5. Read the results at the end of 15 min as follows:
   Negative: Appearance of only one pink to deep purple colored band on the dipstick
   Positive: Appearance of two distinct pink to deep purple colored bands on the dipstick
6. The test should be considered invalid if neither the test band nor the control band appears. Repeat the test with a new dipstick
7. Although, depending on the concentration of treponemal antibodies in the specimen, positive results may appear as early as 2-3 min, negative results must be confirmed only at the end of 15 min.

### Performance characteristics

In an in-house evaluation Syphichik was run in parallel against standard TPHA, 100% correlation was found in 103 samples.

### Limitations of the study

1. Syphichik detects the presence of treponemal antibodies; thus, a positive result indicates a past or present infection

2. Low levels of antibodies to *T. pallidum* such as those present at a very early primary stage of infection can give a negative result. But a negative result does not exclude the possibility of exposure to or infection with *T. pallidum*
3. Syphichik detects treponemal antibodies in serum/plasma
4. The major limitation of the study is that there is no previous data available from this rural area for comparison and analysis of trends.

Screened sero-reactive samples of syphilis were sent to the microbiology department for confirmation and all sent samples were sero-reactive, confirmed by TPHA method in the Department of Microbiology.

## RESULTS

Table 1 shows the distribution of blood donors. Majority of donors in our study were voluntary male donors constituted about 63.28% of total donors, while replacement male donors constituted about 36.14%.

Among TTIs, the most common infection in our study was syphilis, followed by hepatitis B infections as shown in Table 2.

Table 3 shows the distribution and trend of TTI's among blood donors. We identified increasing trend of sero-reactivity for syphilis, which was found to be significant. Whereas other TTIs show variable trend of sero-reactivity among blood donors and not found to be significant on Chi-square for linear trend.

In the present study, the prevalence of co-infections was very low (0.08%). Whereas, most common co-infection among blood donors associated with syphilis was found to be hepatitis B (3.7%), followed by HIV (2.9%).

## DISCUSSION

Majority of donors in our study were voluntary male donors constituted about 63.28% of total donors, while replacement male donors constituted about 36.14%. Among TTIs, the most common infection in our study was syphilis (1.05%) followed by hepatitis B infections (0.34%). TTIs were more common among replacement donors compared to voluntary donors in our study. No female donors were sero-reactive for TPHA in our study. It may be because of very small number of female donors in the study. No donors were sero-reactive for malarial parasite in our study. It may be because of donor's selection with no history of fever. We identified increasing trend of sero-reactivity for syphilis that was found to be significant. Whereas other TTIs shows variable trend of sero-reactivity among blood donors and not found to be significant on Chi-square for linear trend.

**Table 1: Year-wise distribution of blood donors**

| Year-wise | Voluntary donors | | Replacement donors | |
|---|---|---|---|---|
| | Male | Female | Male | Female |
| 2011 | 2109 | 15 | 1691 | 5 |
| 2012 | 2914 | 13 | 1312 | 11 |
| 2013 | 3001 | 17 | 1580 | 12 |
| Total=12,680 (100) | 8024 (63.28) | 45 (0.36) | 4583 (36.14) | 28 (0.22) |
| Total=12,680 (100) | 8069 (63.63) | | 4611 (36.37) | |

Figures in the parenthesis shows percentages

**Table 2: Sero-reactivity for TTIs among blood donors**

| Prevalence year-wise | 2011 (%) | 2012 (%) | 2013 (%) | Total donors = 12,680 |
|---|---|---|---|---|
| TPHA | 21 (0.55) | 45 (1.05) | 68 (1.48) | 134 (1.05) |
| HBsAg | 13 (0.34) | 17 (0.40) | 13 (0.28) | 43 (0.34) |
| HIV | 06 (0.15) | 07 (0.16) | 06 (0.13) | 19 (0.15) |
| HCV | 01 (0.02) | 0 | 02 (0.04) | 03 (0.02) |

Figures in the parenthesis shows percentages; TTIs: Transfusion transmitted infections; TPHA: *Treponema pallidum* hemagglutination assay; HBsAg: Hepatitis B surface antigen; HIV: Human immunodeficiency virus; HCV: Hepatitis C virus

**Table 3: Trend of TTI's among blood donors**

| TTIs | Voluntary donors | | | Replacement donors | | | Chi-square for trends |
|---|---|---|---|---|---|---|---|
| | 2011 | 2012 | 2013 | 2011 | 2012 | 2013 | |
| TPHA* | 07 | 13 | 21 | 14 | 32 | 47 | 0.013 |
| HBsAg | 05 | 06 | 04 | 08 | 11 | 09 | 0.163 |
| HIV | 02 | 02 | 01 | 04 | 05 | 05 | 0.39 |
| HCV | 0 | 0 | 01 | 01 | 0 | 01 | 0.50 |

*$P < 0.05$; TTIs: Transfusion transmitted infections; TPHA: *Treponema pallidum* hemagglutination assay; HBsAg: Hepatitis B surface antigen; HIV: Human immunodeficiency virus; HCV: Hepatitis C virus

In the present study, the prevalence of co-infections was very low (0.08%). Whereas most common co-infection among blood donors associated with syphilis was found to be hepatitis B (3.7%), followed by HIV (2.9%).

In the present study, of the total blood donors voluntary donors constituted 63.63%, while replacement donors were 36.37%. This is comparable to the study done by Bhattacharya *et al.*[23] who has noticed a predominance of voluntary donors. In contrast, a predominance of replacement donors was noted by Singh *et al.*[24] (82.4%), Kakkar *et al.*[25] (94.7%), Singh *et al.*[26] (84.43), Pahuja *et al.*[27] (99.48%) and Arora *et al.*[28] (68.6%).

In a study carried out by Fasola *et al.*[29] observed that most common infection was hepatitis B (13.2%) among blood donors, followed by HIV (7.6%), HCV (3.6%) and no donors had syphilis infection.

Chikwem *et al.*[30] observed that the most common infection was hepatitis B (14.84%) among blood donors, followed by HIV-1 (5.77%), while *Plasmodium falciparum* accounted for 4.12% and *T. pallidum* for 3.57%.

Garg *et al.*[31] observed that hepatitis B (3.4%) was the most common infection among blood donors followed by

HIV (0.44%), hepatitis C infection (0.28%)and syphilis was 0.22%.

A study was done by Chandra *et al.*[32] observed that hepatitis B infection was most common (1.96%) among blood donors, followed by hepatitis C infection (0.85%), HIV (0.23%) and syphilis was 0.01%.

In a study done by Bhawani *et al.*[33] observed that hepatitis B (1.41%) was most common infection, followed by hepatitis C infection (0.84%), HIV (0.39%) and syphilis was 0.08%.

Shrestha *et al.*[34] found that hepatitis C infection (0.64%) was most common infection among blood donors, followed by hepatitis B (0.64%), syphilis (0.48%) and HIV 0.12% of total donors.

Study was done by Mathai *et al.*[35] observed that most common infection among blood donors was hepatitis C infection (1.4%), followed by hepatitis B infection (1.3%) and both HIV and syphilis each was seen in 0.2% of donors.

Compared with the above studies except study done by Chikwem *et al.*, prevalence of syphilis in our study was higher (1.05%) and it was in rising trends every year. It may be because of low awareness about syphilis among donors or people of this tribal area. Syphilis (1.05%) was the most common infection among blood donors, followed by hepatitis B infection (0.34%) in our study.

Many factors favor mixed infections including a high degree of epidemiological similarity between the HIV and hepatitis viruses. They have similar routes of transmission, risk factors such as high-risk sexual behavior and a higher prevalence with other sexually transmitted diseases such as syphilis. Syphilis infection can increase the susceptibility to HIV infection.[36]

In a study by Kaur *et al.*[36] observed association of syphilis and hepatitis B with HIV infection in blood donors. Prevalence of co-infection was high in many studies.[37-41]

A trend toward higher co-infectivity also prevails in replacement donors compared to voluntary donors.[36]

Gupta *et al.*,[42] Otuonye *et al.*[43] and Patil *et al.*[44] have observed a definite correlation between positivity of HIV and syphilis. Therefore, serological screening for syphilis serves as a surrogate test for HIV-infected donors.

Compared with the above studies, prevalence of co-infection in our study was low (0.08%) and the most common co-infection associated with syphilis was hepatitis B infection followed by HIV infection.

Mujeeb and Mehmood reported high positivity rate of hepatitis B (4.9%) and comparable rate for hepatitis C (2.4%) from Karachi in family/replacement donor.[45]

A study was done by Sultan *et al.*[46] observed higher prevalence of TTIs in replacement donors compared with regular voluntary donors.

In a study done by Pallavi *et al.*[47] observed the prevalence of TTI (HIV, HBV, HCV, venereal disease research laboratory [VDRL] and malaria) was higher in replacement donors compared with voluntary donors.

Studies[24,26,27] have showed high seropositivity rate in replacement donors compared to voluntary donors.

Compared with above studies, in our study, high seropositivity for TTIs was also found in replacement donors compared to voluntary donors.

In a study done by Pallavi *et al.*[47] the prevalence of TTI showed a decreasing trend among voluntary donors, a similar finding was noted by Singh *et al.*[24] in VDRL reactivity. Pahuja *et al.*[27] have also noted a decreasing trend in the prevalence of TTI. In contrast, Bhattacharya *et al.*[23] have reported a significant increase in the TTI seroprevalence.

Compared with above studies, a raising trend in prevalence of syphilis was found in our study. It may because of low awareness about syphilis among blood donors as well as people of this tribal region.

## CONCLUSIONS

Prevalence of syphilis among blood donors was in raising trends in this region and was more in replacement donors. The most common co-infections in our study were syphilis with hepatitis B infection, followed by syphilis with HIV infection. Increasing prevalence of syphilis among the donors underscores the concern about growing infection of this disease in the community as these blood donors represent the highly selective community. Proper counseling prior to blood donation, brief medical examination of blood donors and awareness about syphilis among blood donors may increase the safety of blood as well as community.

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**How to cite this article:** Kumar A, Jyoti V, Prajapati S, Baghel R, Gangane N. Changing trends of syphilis among blood donors in Bastar region, Chhattisgarh: A retrospective study. Community Acquir Infect 2015;2:51-6.
**Source of Support:** Nil, **Conflict of Interest:** None declared