

RISK ESTIMATES OF HIV AND HBV INFECTION TO THE DENTAL OPERATOR VIA PRICK ACCIDENTS

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Introduction

Intact skin provides an adequate barrier against transmission of microorganisms but existing lesions offer a port of entry. Through this entrance several diseases can pass in both directions, either from the patient to the operator, or vice versa.(1) Microorganisms can also invade the body via accidental percutaneous penetration with sharp contaminated instruments.

Infection risk of one exposure

Health care workers with documented prick accidents caused by instruments that were contaminated with HBV or with HIV have been prospectively tested for antibodies to HBV and HIV to determine the risk of infection after such injuries. The combined data from different surveys indicate that the risk of infection with HBV after such exposure is approximately 15% (range 6 - 30%) while the risk of HIV is less than 0.4% (2,3). Thus if a prick accident occurs with HBV or HIV contaminated instruments, the probability of infections is approximately 15% and 0.4% respectively.

Risk of transmission

The chance that instruments are contaminated with HBV or HIV depends on the number of patients carrying these viruses, which is determined by the prevalence (frequency of occurrence) of these viruses among the population. Approximately 10% of the Tanzanian population carries HBV and recent estimates indicate approximately 4% of the population being infected with HIV (4). Consequently each prick accident with blood contaminated instruments results in a 1.5%

($1/10 \times 15/100 \times 100\%$) probability of HBV infection and in a 0.016% ($1/25 \times 1/250 \times 100\%$) probability of HIV infection.

Risk in dental practice

Two recent surveys in Tanzania among dental health workers in 15 dental clinics throughout the country revealed an average of 6 (range 0-50) prick accidents per year. (5,6). The above data of transmission risk determined by prevalence, infection risk per contaminated prick accident, and occupational hazard related to the frequency of prick accidents allows quantification of the cumulative potential risk of infection with HIV and HBV to the dental health workers. By applying the multiplicative law of probability on basis of existing prevalence figures, risk of infection by one exposure and number of annual prick accidents, an estimate of the occupational risk of acquiring HIV and HBV can be calculated (Table 1 and 2).

Estimates of risk

Estimates in Table 1 clearly show that by reducing the number of annual prick accidents from 50 to 1 or even less exposes the dental health worker to a low risk of contracting HIV. Most probably the 0.4% risk of infection by one HIV contaminated prick accident is on the high side of the estimates, but on the other hand HIV prevalence figures in certain areas and among certain age groups are higher than the utilized average 4% in the calculations.

Estimates in Table 2 regarding the risk of contracting HBV are much more appalling. However, approximately 70% of the Tanzanian population has been exposed to HBV and has

Table 1. Calculated probability of occupational HIV infection for dental health workers when the prevalence of HIV among the population is 4% and the risk of acquiring the infection by one contaminated prick accident is 0.4%

Prick accidents per year	Probability of infection per year	Probability of infection for professional life span (30 yrs)
1	0.016%	0.5%
6	0.10%	2.8%*
10	0.16%	4.7%
20	0.32%	9.2%
50	0.80%	21.3%

* Multiplication law of probability $1 - (1 - pi)^n$ whereby p = prevalence, i = infection risk per contaminated prick accident and n = number of prick accidents. For instance 6 prick accidents/year during 30 years $1 - (1 - 0.04 \times 0.004)^{180} = 0.028 = 2.8\%$

Table 2. Calculated probability of occupational HBV infection for dental health workers when the prevalence of HBV among the population is 10% and the risk of acquiring the infection by one contaminated prick accident is 15%

Prick accidents per year	Probability of infection per year	Probability of infection for professional life span (30 yrs)
1	1.5%	36.5%
6	8.7%	93.4%
10	14.0%	98.9%
20	26.1%	99.99%
50	53.0%	99.99999%

developed immunity. Although not documented most dental health workers in this country are presumed to be protected by specific antibodies due to previous exposure. For dentists from abroad, particularly those from Europe where HBV prevalence is low, the high number of HBV carriers in Tanzania poses an occupational hazard. Fortunately a vaccine against HBV is available.

Occupational hazard

Dental health workers can be considered at increased professional risk of contracting HIV and (in case they have no protecting antibodies) HBV. However the collected data from the regional dental clinics do not show a high compliance with recommendations for barrier protection such as gloves, masks and eye wear (5,6) Lack of facilities may be one reason but ignorance seems also to play a role. Particularly with regard to the high frequency of prick accidents among Tanzanian dental health workers unawareness of the risks and neglect seem to be involved.

Precautions

Prick accidents can be minimized if the following recommendations are practised.

1. Disposable needles should not be recapped in a dangerous way (Fig 1), but in a safe way (Fig 2).
2. Always keep needles separated from the rest of the instruments during all procedures.
3. Discard needles in a special box.
4. Use domestic rubber gloves for domestic cleaning of instruments or alternatively expose the instruments to boiling water for 10 minutes and then perform domestic cleaning prior to sterilization.
5. Practice barrier protection of hands by using gloves during treatment. This does not prevent prick accidents, but it prevents invasion of microorganisms through existing lesions on the hand.
6. Practice barrier protection of the face (masks and eye wear) particularly during treatment procedures that may cause splashes of blood and saliva from the

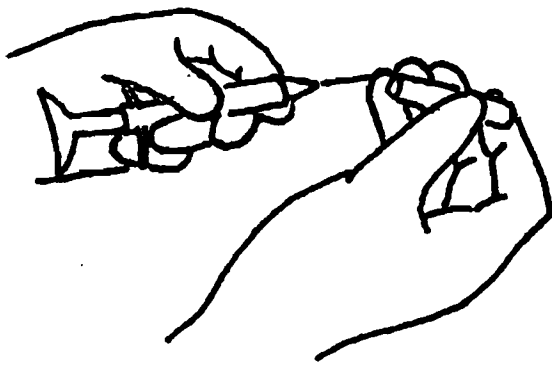


Fig 1. Dangerous way of recapping

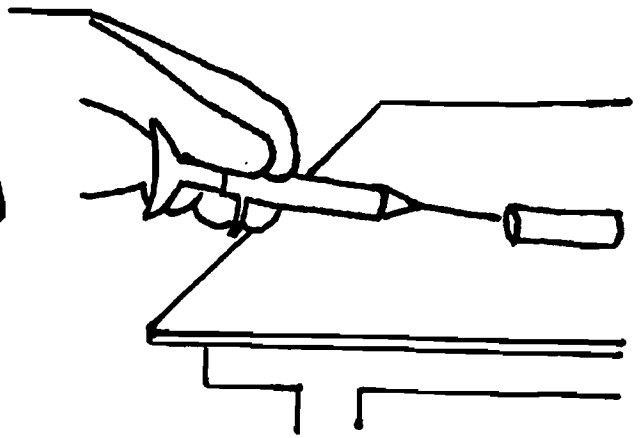


Fig 2. Safe way of recapping

patient's mouth which may contain sharp objects.

Conclusion

If dental health workers manage to reduce prick accidents, trauma and blood exposure to an absolute minimum, the chance of acquiring HIV in dental practice is alike the probability of encountering a serious traffic accident. That hazard seems to be accepted since we all participate in traffic and hence we have to accept the low occupational risk. Without trivializing the occupational risk of contracting HIV, one should realize that also for the dental health worker unprotected sexual contact poses the greatest risk of infection with HIV.

References

1. Van Palenstein Helderman WH 1992. Routes of transmission of diseases in dental

practice. This issue.

2. Grody GF, Lee VA, Prince AM et.al 1978. Hepatitis B immune globulin for accidental exposures among medical personnel: final report of a multicentre controlled trial. *J Inf Disease* 138, 625 - 628.
3. Centers for Disease Control 1988. AIDS and HIV update: acquired immunodeficiency syndrome and human immunodeficiency virus infection among health care workers *MMWR* 37, 229 - 239.
4. National AIDS Control Programme. Report no. 4. 1991 Dar es Salaam, Tanzania.
5. Awadia AK 1992. Hygienic procedures in six regional dental clinics. This issue.
6. Merchant M 1992. Hygienic procedures in regional dental clinics in Tanzania. Report DDS V. Faculty of Dentistry, Dar es Salaam, Tanzania.