CDC HIV/AIDS Science Facts:

Male Circumcision and Risk for HIV Transmission: Implications for the United States

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This fact sheet summarizes information in four areas of male circumcision: 1) male circumcision and risk of HIV transmission; 2) male circumcision and other health conditions; 3) risks associated with male circumcision; and 4) status of HIV infection and male circumcision in the United States.

What is Male Circumcision?

Male circumcision is the surgical removal of some or all of the foreskin (or prepuce) from the penis [2].

Male Circumcision and Risk for HIV Transmission

Biologic Plausibility

Compared to the dry external skin surface, the inner mucosa of the foreskin has less keratinization (deposition of fibrous protein), a higher density of target cells for HIV infection (Langerhans cells), and is more susceptible to HIV infection in laboratory studies [3]. It has also been argued that the foreskin may have greater susceptibility to traumatic epithelial disruptions (tears) during intercourse, providing a portal of entry for pathogens including HIV [4]. In addition, the micro-environment in the preputial sac between the unretracted foreskin and the glans penis may be conducive to viral survival [2]. Finally, the higher rates of sexually transmitted genital ulcerative disease, such as syphilis, observed in uncircumcised men may also increase susceptibility to HIV infection [5].

International Observational Studies

Multiple cross-sectional, prospective, and ecologic (population-level) studies have identified lack of male circumcision as a risk factor for HIV infection.

A systematic review and meta-analysis that focused on heterosexual transmission of HIV in Africa was published in 2000 [6]. It included 19 cross-sectional studies, five case-control studies, three cohort studies, and one partner study. A substantial protective effect of male circumcision on risk for HIV infection was noted, along with a reduced risk for genital ulcer disease. After adjusting for confounding factors in the population-based studies, the relative risk for HIV infection was 44% lower in circumcised men. The strongest association was seen in high-risk men, such as patients at sexually transmitted disease (STD) clinics, for whom the adjusted relative risk was 71% lower for circumcised men.

A review that included stringent assessment of 10 potential confounding factors and was stratified by study type or study population was published in 2004 [7]. Most of the studies were from Africa. Of the 35 observational studies included in the review, the 16 in the general population had inconsistent results. The one large prospective cohort study in this group showed a significant protective effect, with the odds of infection being

42% lower in circumcised men [8]. The remaining nineteen studies were conducted in high-risk populations. These found a consistent, substantial protective effect, which increased with adjustment for confounding. Four of these were cohort studies: all demonstrated a protective effect, with two being statistically significant.

Ecologic studies also indicate a strong association between lack of male circumcision and HIV infection at the population level. Although links between circumcision, culture, religion, and risk behavior may account for some of the differences in HIV infection prevalence, the countries in Africa and Asia with prevalence of male circumcision of less than 20% have HIV-infection prevalences several times higher than countries in those regions where more than 80% of men are circumcised [9].

International Clinical Trials

Three randomized, controlled clinical trails have been undertaken in Africa to determine whether circumcision of adult males will reduce their risk for HIV infection. The study conducted in South Africa [10], was stopped in 2005 and those in Kenya [11] and Uganda [12] were stopped in 2006 after their interim analyses found that medical circumcision reduced male participants' risk of HIV infection.

In these studies, men who had been randomly assigned to the circumcision group had a 60% (South Africa), 53% (Kenya), and 51% (Uganda) lower incidence of HIV infection compared to men assigned to the wait list group to be circumcised at the end of the study. In all three studies, a few men who had been assigned to be circumcised did not undergo the procedure, and vice versa. When the data were reanalyzed to account for these deviations, men who had been circumcised had a 76% (South Africa), 60% (Kenya), and 55% (Uganda) reduction in risk of HIV infection compared to those who were not circumcised. The Uganda study investigators are also examining the following in an ongoing study: 1) safety and acceptability of male circumcision in HIV-infected men and men of unknown HIV-infection status, 2) safety and acceptability of male circumcision in the men's female sex partners, and 3) effect of male circumcision on male-to-female transmission of HIV and other STDs.

Male Circumcision and Male-to-Female Transmission of HIV

In an earlier study of couples in Uganda in which the male partner was HIV infected and the female partner was initially HIV seronegative, the infection rates of the female partners differed by the circumcision status and viral load of the male partners. If the male blood HIV viral load was <50,000 copies/mL, there was no HIV transmission if the man was circumcised, compared to a rate of 9.6 per 100 person-years if the man was uncircumcised [8]. If viral load was not controlled for, there was a non-statistically significant trend towards a reduction in the male-to-female transmission rate from circumcised men compared to uncircumcised men. Such an effect may be due to decreased viral shedding from circumcised men or to a reduction in ulcerative sexually transmitted infections acquired by female partners of circumcised men [14].

Male Circumcision and Other Health Conditions

Lack of male circumcision has also been associated with sexually transmitted genital ulcer disease, infant urinary tract infections, penile cancer, and cervical cancer in female partners of uncircumcised men [2]. The latter two conditions are related to human papillomavirus (HPV) infection. Transmission of this virus is also associated with lack of male circumcision. A recent meta-analysis included 26 studies that assessed the association between male circumcision and risk of genital ulcer disease. The analysis concluded that there was a significantly lower risk of syphilis and chancroid among circumcised men, while the reduced risk of herpes simplex virus-2 infection had a borderline statistical significance [5].

Risks Associated with Male Circumcision

Reported complication rates depend on the type of study (e.g., chart review vs. prospective study), setting (medical vs. nonmedical facility), person operating (traditional vs. medical practitioner), patient age (infant vs. adult), and surgical technique or instrument used. The most common complications are minor bleeding and local infection. In large studies of infant circumcision in the U.S., complications rates range from 0.2 to 2.0% [2]. In the recently completed South African study of adult circumcision by general medical practitioners in their surgical offices, the overall complication rate was 3.8%. The most commonly reported complications were pain (0.8%), followed by swelling or hematoma, bleeding, and problems with appearance (each 0.6%). Damage to the penis (0.3%), infection (0.2%), and delayed wound healing (0.1%) were uncommon. There were no reported deaths or problems with urination [10].

HIV Infection and Male Circumcision in the United States

In 2004, men who have sex with men (MSM) (47%) and persons exposed through heterosexual contact (33%) accounted for an estimated 80% of all HIV/AIDS cases diagnosed in areas in the U.S. with confidential name-based reporting. Blacks accounted for 49% of cases and Hispanics for 18%. Infection rates in both groups were several-fold higher than that in whites. An overall prevalence of about less than 0.5% was estimated for the general population [15]. Although data on HIV infection rates are available since the beginning of the epidemic, data on circumcision and risk for HIV infection in the U.S. are limited. In one cross-sectional survey of MSM, lack of circumcision was associated with a two-fold increased odds of prevalent HIV infection [16]. In another, prospective study of MSM, lack of circumcision was also associated with a two-fold increased risk for HIV seroconversion [17]. In both studies, the results were statistically significant and controlled statistically for other possible risk factors. In one prospective study of heterosexual men attending an urban STD clinic, when controlling for other risk factors, uncircumcised men had a 3.5-fold higher risk of HIV infection than men who were circumcised. However, this association was not statistically significant [18].

Status of Male Circumcision in the United States

In a national probability sample of adults in 1992, the National Health and Social Life Survey found that 77% of men reported being circumcised including 81% of white men, 65% of black men, and 54% of Hispanic men [19]. It is important to note that reported circumcision status may be subject to misclassification. In a study of adolescents, only 69% of circumcised and 65% of uncircumcised young men correctly identified their circumcision status as verified by physical exam [20].

According to the National Hospital Discharge Survey (NHDS), 65% of newborns were circumcised in 1999 and the overall proportion of newborns circumcised was stable from 1979 to 1999 [21]. Notably, the proportion of black newborns circumcised rose over this reporting period (58% to 64%), while the proportion of white infants circumcised remained stable (66%). In addition, the proportion of newborns who were circumcised in the Midwest increased over the 20-year period from 74% in 1979 to 81% in 1999, while the proportion of infants born in the West who were circumcised decreased from 64% in 1979 to 37% in 1999. In another survey, the National Inpatient Sample (NIS), circumcision rates increased from 48% during 1988-1991 to 61% during 1997-2000. Circumcision was more common among newborns born to families of higher socioeconomic status, in the Northeast or Midwest, and who were black [22].

In 1999, the American Academy of Pediatrics (AAP) changed from routinely recommending circumcision to a neutral stance on circumcision, noting that: "It is legitimate for the parents to take into account cultural, religious, and ethnic traditions, in addition to medical factors, when making this choice." [23] This position was re-affirmed by the Academy in 2005. This change in policy may influence reimbursement for and practice of neonatal circumcision. In a 1995 review, 61% of circumcisions were paid by private insurance, 36% were paid for by Medicaid, and 3% were self-paid by the parents of the infant [24]. Since 1999, 16 states have eliminated Medicaid payments for circumcisions that were not deemed medically necessary [25].

Considerations for the United States

There are a number of important differences that must be considered in the possible role of male circumcision in HIV prevention in the U.S. Notably, the overall risk of HIV infection is considerably lower in the United States, changing risk-benefit and cost-effectiveness considerations. Also, studies to date have focused on heterosexual, penile-vaginal sex, the predominant mode of HIV transmission in Africa, while the predominant mode of sexual HIV transmission in the United States is by penile-anal sex among MSM. In addition, while the prevalence of circumcision may be somewhat lower in racial and ethnic groups with higher rates of HIV infection, most Americans are already circumcised, and it is not known if men at higher risk for HIV infection would be willing to be circumcised, nor if parents would be willing to have their infants circumcised to reduce possible future HIV infection risk. Lastly, whether the effect of male circumcision differs by HIV-1 subtype, predominately subtype B in the U.S. and subtypes A, C, and D in Africa, is also unknown.

Summary

Male circumcision has been associated with a lower risk for HIV infection in international observational studies and in three randomized, controlled clinical trials. Male circumcision could also reduce male-to-female transmission of HIV to a lesser extent. It has also been associated with a number of other health benefits. While there are risks to male circumcision, serious complications are rare. Accordingly, male circumcision, together with other prevention interventions, may play an important role in HIV prevention in settings similar to the clinical trials.

Male circumcision may also have a role for the prevention of HIV transmission in the United States. With the results of three clinical trials showing that male circumcision decreases the risk for HIV infection, CDC is undertaking additional research and consultation to evaluate the potential value, risks, and feasibility of circumcision as an HIV prevention intervention in the U.S.

As CDC proceeds with the development of public health recommendations for the U.S., individual men may wish to consider circumcision as an additional HIV prevention measure, but must recognize that circumcision 1) does carry risks and costs that must be considered in addition to potential benefits; 2) has only proven effective in reducing the risk of infection through insertive vaginal sex; and 3) confers only partial protection and should be considered only in conjunction with other proven prevention measures (abstinence, mutual monogamy, reducing number of sex partners, and correct and consistent condom use).

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