

Sexual Medicine

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The effect of male circumcision on sexual satisfaction and function, results from a randomized trial of male circumcision for human immunodeficiency virus prevention, Rakai, Uganda

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OBJECTIVE

To investigate the relationship between adult male circumcision and sexual satisfaction and function in men, as observational studies on the effect of adult male circumcision on sexual satisfaction show conflicting results.

SUBJECTS AND METHODS

We investigated self-reported sexual satisfaction and function among men enrolled in a randomized trial of male circumcision for human immunodeficiency virus (HIV) prevention conducted in Rakai, Uganda. In all, 4456 sexually experienced HIV-

negative males aged 15–49 years were enrolled; 2210 were randomized to receive immediate circumcision (intervention arm) and 2246 to circumcision delayed for 24 months (control arm). Men were followed up at 6, 12 and 24 months, and information on sexual desire, satisfaction and erectile dysfunction was collected. These variables were compared between the study arms and over time within the study arms, using chi-square or Fisher's exact tests. The trial registration number is NCT00425984.

RESULTS

There were no differences between the study arms at enrolment and problems with sexual satisfaction and function were reported by <2% of participants in both study arms at all time points. At 6 months, no difficulty with

penetration was reported by 98.6% of circumcised men and 99.4% of controls ($P = 0.02$), and no pain on intercourse was reported by 99.4% circumcised and 98.8% of uncircumcised men ($P = 0.05$). There were no differences between the study arms in penetration or dyspareunia at later visits. Sexual satisfaction increased from 98.0% at enrolment to 99.9% at 2 years among the controls ($P < 0.001$), but there was no trend in satisfaction among circumcised men (enrolment 98.5%, 2 years 98.4%, $P = 0.8$).

CONCLUSION

Adult male circumcision does not adversely affect sexual satisfaction or clinically significant function in men.

KEYWORDS

male circumcision, HIV, randomized trial, sexual satisfaction and function, Uganda

INTRODUCTION

Several observational studies of the effect of male circumcision on penile sensitivity, sexual satisfaction and dysfunction have shown conflicting results [1–8], ranging from decreased satisfaction and function, to improvement following circumcision. Interpretation of these results is difficult because men circumcised in adulthood were highly selected due to medical indications for surgery, circumcised infants cannot provide before and after comparisons, sample sizes were small and follow-up was short.

The efficacy of male circumcision for prevention of human immunodeficiency virus (HIV) in men has been proven in three randomized trials conducted in sub-Saharan Africa [9–11], and the WHO now recommends the procedure as a component of HIV prevention programmes [12]. However, there is a need to ensure that the procedure is acceptable, and acceptability might be affected by the perceived or actual effects of surgery on sexual function and satisfaction.

Opponents of circumcision, using results from selected observational studies, have argued that the procedure impairs sexual function, and reduces sexual pleasure and satisfaction through keratinization of the glans, removal of the most sensitive preputial tissues,

and loss of the 'gliding' mechanism provided by the foreskin [13]. Anthropologists have also speculated that by potentially reducing sexual excitability, circumcision might facilitate control of adolescent males' sexuality in certain populations [14]. Thus, understanding how circumcision impacts sexual pleasure will be important in formulating public health messages to promote circumcision as an HIV prevention strategy [15–17].

We report results of the effect of male circumcision on sexual satisfaction and function from a randomized trial of male circumcision for HIV prevention conducted in Rakai, Uganda.

SUBJECTS AND METHODS

The trial design has been described previously [3], but in brief, the trial enrolled HIV-negative uncircumcised males aged 15–49 years. All participants provided informed consent for screening and for randomization to immediate circumcision (intervention arm), or circumcision delayed for 24 months (control arm). The men agreed to and received their HIV results and counselling. All surgeries were performed by trained medical officers and were conducted in fully equipped outpatient theatres located in a central facility. Details of surgery, using the 'sleeve procedure', and follow up are provided elsewhere [3].

The trial enrolled 4996 HIV-negative males. There were 2474 participants randomized to receive immediate circumcision, of whom 2210 (89.3%) were sexually active at time of enrolment and thus could provide information on their sexual experiences before and after circumcision. There were 2522 men randomized to the control arm, of whom 2246 (89.1%) were sexually active at enrolment.

All men randomized to the intervention arm provided written informed consent for surgery and they were strongly advised to refrain from sexual intercourse after surgery until the wound was certified by a clinician to be fully healed. All participants were advised to practice safe sex (i.e. sexual abstinence, monogamy with an uninfected partner and consistent condom use), and were offered free condoms.

At baseline and all follow-up visits, at 6, 12, and 24 months after enrolment, information

on sexual experience were collected by male interviewers using a standardized questionnaire. The questions were derived from the International Index of Erectile Function [18] and the relevant questions are given in the Appendix. This information included general sexual desire and satisfaction, as well as sexual dysfunction such as failure to achieve or maintain a full erection, difficulty inserting the penis, difficulty ejaculating and pain in the penis during or after intercourse. Men who reported any problem with sexual satisfaction or function were seen by programme medical officers for management and referral to a urologist when necessary.

This trial was reviewed and approved by two Institutional Review Boards (IRBs) in Uganda and two IRBs in the USA, and monitored by a National Institutes of Health Data Safety Monitoring Board. The trial is registered with Clinical Trials. Gov, number NCT00425984.

We compared rates of reported sexual satisfaction and sexual dysfunction between the study arms and over the follow-up time within the study arms, among men who had sexual intercourse prior to enrolment. Only sexually active men were included in the analysis to enable comparisons before and after circumcision in the intervention arm.

Tests of statistical inference were based on chi-square or the Fisher's exact tests for proportions and chi-square for trend in analyses of changes over time.

RESULTS

There were no statistically significant differences in socio-demographic characteristics or sexual behaviours at enrolment, indicating that randomization achieved adequate comparability between the study arms (Table 1).

Table 2 shows the rates of reported sexual satisfaction and function by study arm and follow-up visit. Problems with sexual satisfaction and function were rare (<2%) at all time points. At baseline, 98.4% (4384/4456) of men reported their sexual desire as 'medium or high' and 98.2% said they were sexually 'satisfied or very satisfied'. At the time of enrolment, there were no statistically

Characteristics, behaviours	Intervention arm, n (%)	Control arm, n (%)	P
All	2210 (100)	2246 (100)	
Age, years			
15–19	465 (21.0)	488 (21.7)	0.56
20–24	643 (29.1)	648 (28.9)	
25–29	434 (19.6)	468 (20.1)	
30–49	668 (30.2)	642 (28.6)	
Religion			
Catholic	1485 (67.2)	1551 (69.1)	0.81
Protestant	588 (26.6)	558 (24.8)	
Muslim	98 (4.4)	96 (4.3)	
Saved	14 (0.6)	13 (0.6)	
None/Other	25 (1.1)	28 (1.2)	
Marital status			
Currently married	1167 (52.8)	1173 (52.2)	0.31
Previously married	146 (6.6)	127 (5.6)	
Never married	897 (40.6)	946 (42.1)	
Education			
None	133 (6.0)	140 (6.2)	0.67
Primary	1477 (66.8)	1491 (66.4)	
Secondary	506 (22.9)	503 (22.4)	
Tertiary	94 (4.3)	112 (5.0)	
Sex partners in past year			
0	223 (10.1)	220 (9.8)	0.57
1	1162 (52.6)	1153 (51.3)	
2+	825 (37.3)	873 (38.9)	

TABLE 1
Selected baseline socio-demographic characteristics and behaviours

significant differences between the study arms in the frequency of low sexual desire ($P = 0.26$), lack of sexual satisfaction ($P = 0.37$), ability to achieve or maintain an erection ($P = 0.07$), vaginal penetration ($P = 0.2$), ejaculation ($P = 0.9$), and penile pain during or after sexual intercourse ($P = 0.9$) (Table 2).

The frequency of most problems related to sexual desire, satisfaction and function remained unchanged or diminished over time during follow-up. Of note, 0.8% of circumcised men reported erectile problems at enrolment and 0.3% reported such problems at the 2-year follow-up. At enrolment, 1.5% of circumcised men reported difficulties with penetration and this diminished to 0.6% over 2 years ($P < 0.001$). At enrolment 1.2% of the intervention arm men experienced dyspareunia, and this declined significantly to 0.1% 2 years after circumcision ($P < 0.001$). There were also significant temporal declines in these problems among uncircumcised controls. There were no statistically significant differences between the study arms in reported sexual desire, the ability to

achieve or maintain an erection, and normal ejaculation during follow up (Table 2). At the 6 month visit there was a small but statistically significant difference in problems with penetration and pain. Normal vaginal penetration was reported by 98.6% of circumcised men and 99.4% of uncircumcised men ($P = 0.02$), but there were no differences in penetration at subsequent visits. Also, at 6 months, 99.4% of circumcised men and 98.8% of controls reported no pain during or after intercourse ($P = 0.05$), and there were no significant differences between the study arms at later visits. Thus, these minor differentials were transient and confined to the first 6 months after surgery.

The control arm participants reported a modest increase in sexual satisfaction over time from 98.0% at enrolment to 99.9% at the 24 months follow-up (chi-square for trend, $P < 0.001$). However, such temporal trends did not occur among circumcised men in whom sexual satisfaction was 98.5% at enrolment and 98.4% after 24 months. As a consequence of the slight increase in reported satisfaction among the controls and the unchanged levels in the circumcised

men, the differences in self-reported sexual satisfaction between the intervention and control arms were statistically significant at 12 months (98.9% vs 99.7%, respectively, $P = 0.007$) and at 24 months (98.4% vs 99.9%, respectively, $P = 0.004$). However, the absolute differences in the rates of sexual satisfaction between the study arms were minor (0.8% at 12 months, and 1.5% at 24 months).

DISCUSSION

To the best of our knowledge, this is the first randomized trial to report on prospective examination of the effect of adult male circumcision on sexual satisfaction and function. The proportion of men reporting sexual dissatisfaction or sexual dysfunction in this population was low (<2%), whereas in the Kenyan trial, 7% of men in both study arms reported erectile dysfunction at enrolment [10].

During the follow-up, there were no statistically significant differences between the study arms in reported sexual desire, erectile function and ejaculation, and the frequency of men reporting normal function increased over time in both study arms (Table 2). There was a small but statistically significant increase in reported sexual satisfaction among the control men, but no significant change over time was reported by the intervention arm men (Table 2). This resulted in small but statistically significant differences in satisfaction between the study arms at follow-up. We have no explanation for these divergent trends in sexual satisfaction, which could have occurred by chance. Also, given the very large sample sizes in this trial, even small absolute differences of no clinical relevance may achieve statistical significance.

Previous observational studies examined the effect of circumcision on sexual pleasure and function, but most had small sample sizes, short follow-up times, or assessed highly selected populations circumcised for pre-existing medical or religious reasons, or recruited participants in response to anti-circumcision newsletters. These studies reported contradictory results and cannot be interpreted [1–8].

The modest temporal trends of improvement in sexual difficulties in both study arms may be due to the health education and medical care provided during the trial. Men who

TABLE 2 Sexual function and satisfaction by study arm (*P* in italics) and follow-up visit

Study arm and sexual function	Enrollment <i>n/N</i> (%)	Follow-up, <i>n/N</i> (%)			<i>P</i> *
		6 months	1 year	2 years	
Medium/high self-described sexual desire					
Control	2205/2246 (98.2)	2041/2075(98.34)	1965/1991(98.7)	746/753(99.1)	0.05
Intervention	2179/2210(98.6)	1981/2009(98.6)	1954/1973(99.0)	741/746(99.3)	0.06
<i>Difference between arms, P</i>	<i>0.26</i>	<i>0.52</i>	<i>0.37</i>	<i>0.57</i>	
Sexual satisfaction rated as satisfied or very satisfied					
Control	1910/1948 (98.1)	1738/1748 (99.4)	1701/1706 (99.7)	689/690 (99.9)	<0.001
Intervention	1880/1908 (98.5)	1714/1729 (99.1)	1697/1715 (99.0)	676/687 (98.4)	0.81
	<i>0.37</i>	<i>0.30</i>	0.007	0.004	
No difficulty to achieve and maintain an erection					
Control	2211/2246 (98.4)	2056/2075 (99.1)	1986/1991 (99.8)	752/753 (99.9)	<0.001
Intervention	2189/2210 (99.1)	1987/2009 (98.9)	1962/1973 (99.4)	744/746 (99.7)	0.03
	<i>0.07</i>	<i>0.57</i>	<i>0.13</i>	<i>0.56</i>	
No difficulty with vaginal penetration					
Control	2200/2246 (98.0)	1737/1748 (99.4)	1699/1706 (99.6)	689/690 (99.9)	<0.001
Intervention	2176/2210 (98.5)	1704/1729 (98.6)	1712/1715 (99.8)	681/685 (99.4)	<0.001
	<i>0.20</i>	0.02	<i>0.20</i>	<i>0.18</i>	
No difficulty with ejaculation					
Control	1935/1947 (99.4)	1740/1747 (99.6)	1704/1706 (99.9)	689/690 (99.9)	0.01
Intervention	1897/1908 (99.4)	1722/1729 (99.6)	1712/1715 (99.8)	683/685 (99.7)	0.08
	<i>0.87</i>	<i>0.99</i>	<i>0.66</i>	<i>0.56</i>	
No pain during or after intercourse					
Control	1923/1947 (98.8)	1727/1748 (98.8)	1691/1706 (99.1)	687/690 (99.6)	0.07
Intervention	1887/1910 (98.8)	1719/1729 (99.4)	1707/1715 (99.5)	684/685 (99.9)	<0.001
	<i>0.93</i>	0.05	<i>0.14</i>	<i>0.32</i>	

*Chi-square for trend.

reported any sexual problems were referred to medical officers or a urologist for management. Many of the reported sexual problems were of a psycho-social nature, which could be managed by counselling. Thus, programmes providing circumcision for HIV prevention need to train personnel to manage or refer sexual problems. The declines in sexual problems in both arms over time emphasizes the need to assess these factors in randomized trials, because if observations were confined to circumcised men alone, one might falsely conclude that surgery led to diminished difficulties with erection, penetration and dyspareunia (Table 2), whereas comparable trends among control participants suggest that this cannot be attributed to circumcision *per se*.

A significantly higher proportion of men in the circumcision than the control arm reported difficulty with penetration in the first 6 months after circumcision, although the differences were minor (0.8%). This might be due to incomplete keratinization of the scar, and there were no differences between

the study arms at 12 and 24 months after surgery suggesting any problem was transient. Thus, studies of sexual dissatisfaction or dysfunction related to circumcision must allow sufficient time for scar formation to be completed, and men should be forewarned that, in a small minority of cases, they may experience some temporary difficulty with penetration. Many observational studies assessed sexual function at <6 months after surgery and therefore might observe higher rates of dissatisfaction or dysfunction due to incomplete scar keratinization. Circumcised men reported significantly less dyspareunia at 6 months, as has been reported in some observational studies [5]. The lower rates of dyspareunia after circumcision may be due to reduced rates of phimosis, paraphimosis and genital ulceration, which are less frequent in circumcised men and which may be associated with pain on intercourse [6,7].

There are limitations to the present study. Questions regarding sexual desire or

satisfaction are, of necessity, subjective and refer to the individual's self-perception. The questionnaire focused on difficulties with sexual function and did not ascertain more subjective aspects of sexual satisfaction such as changes in time to ejaculation, subjective intensity of orgasm or the partner's satisfaction with intercourse [19]. Also, circumcision status could not be completely concealed from the interviewers so there is a theoretical possibility that interviewer bias might affect participant response.

Understanding how circumcision affects sexual pleasure is important in formulating public health messages to promote the acceptability of circumcision as an HIV-prevention strategy. In KwaZulu Natal, South Africa, those men who thought that circumcised men enjoy sex more than uncircumcised men were seven times more willing to be circumcised, and men who thought that women enjoy sex more with circumcised men were over five times more willing to have the procedure [15]. In Uganda, Koenig *et al.* [16] noted that sexual

dissatisfaction can be grounds for marital dissolution or extramarital relationships for both men and women, and Philpott *et al.* [17] have stressed the importance of incorporating discussions of sexual pleasure into effective public health messaging strategies. Thus, our findings that circumcision had no adverse effects on sexual satisfaction or function are reassuring and provide important information for future programmes.

In conclusion, >98% of men reported sexual satisfaction and normal sexual function after circumcision in this rural population and we conclude that adult male circumcision does not have clinically significant deleterious effects on sexual pleasure or function at 2-years' follow-up in a rural Ugandan population aged 15–49 years.

CONFLICT OF INTEREST

Melanie Beacon is an employee of the sponsor. Source of funding: NIH.

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Abbreviations: HIV, human immunodeficiency virus; IRB, Institutional Review Board.

APPENDIX

QUESTIONS ON SEXUAL SATISFACTION

I would like to ask you questions about sexual experience.

Sexual desire refers to a feeling that may include wanting to have sexual intercourse or thinking about having sex. How has your level of sexual desire generally been? (PROMPTED)

None at all	1
Low	2
Medium	3
High	4

In the past 6 months, have you experienced difficulty in inserting your penis during intercourse?

Yes	1
No	2

If Yes, How frequently does this occur? (PROMPTED)

Rarely	1
Frequently	3
Occasionally	2
Always	4

In the past 6 months, have you had difficulty in ejaculating when you had sex?

Yes	1
No	2

In the past 6 months how often have you had a problem regaining erection after ejaculation? (PROMPTED)

Never	1
Sometimes	2
Always	3

In the past 6 months have you experienced pain in your penis during or after intercourse?

Yes	1
No	2

If Yes, How frequently does this occur? (PROMPTED)

Rarely	1
Occasionally	2
Frequently	3
Always	4
No response/don't know	7

Is the pain severe, moderate or mild/minor?		Very dissatisfied	5	Problem of insertion	1	2
Mild/minor	1	No response	9	Prolonged interval between	1	2
Moderate	2	Other (specify)	6	orgasms		
Severe	3	Specify _____.		Difficult in ejaculation	1	2
Over the past 6 months, how would you		If dissatisfied (coded 3 or 5 above) what was		Pain on intercourse	1	2
generally rate your satisfaction with sexual		the nature of your dissatisfaction?		Spouse complaints about my	1	2
intercourse? Do you feel; (PROMPTED)			Yes No	sexual performance		
Very satisfied	1	Level of sexual desire	1 2	Other (specify)	1	2
Satisfied	2	Getting erections	1 2	Specify _____.		
Dissatisfied	3	Maintain erection longer	1 2			