

Medical aspects of male circumcision

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BMJ 2007;335:1206-9
doi:10.1136/bmj.39385.382708.AD

Why should I read this review?

Circumcision is the commonest surgical procedure in males, because routine infant circumcision is practised in many countries for religious and cultural reasons. It originated over 15 000 years ago, being performed for religious, ritualistic, and cultural reasons, and it was not until the 19th century that the procedure was “medicalised.” It is one of the most controversial surgical interventions: proponents claim benefits such as improved hygiene and reduced risks of infection (urinary and sexually transmitted) and of penile and cervical cancer, whereas opponents deny or minimise these benefits and cite substantial complication rates and reduced penile sensation. Many parents and patients have firmly held beliefs, placing medical workers under extreme pressure at times when dealing with requests for circumcision. It is vital for all medical staff to be aware of the various indications for circumcision and the operative techniques and their complications to cope with these consultations with an evidence base.

This review concentrates solely on the medical indications for circumcision and does not address the issues of routine, religious, or ritual infant circumcision. It highlights clinical conditions frequently referred for circumcision but which are normal physiological variants and do not require surgery. It also lists the absolute medical indications for circumcision and the complications of the procedure. The various surgical techniques are listed in the table.

What is the normal anatomy of the penis and foreskin?

Preputial adhesions and physiological phimosis

During development, the epithelium lining the prepuce and the glans are contiguous, such that preputial adhesions represent a normal feature of foreskin development. Epidemiological data from two seminal papers in the past century show that, at the age of 5 years, almost 75% of boys still have preputial adhesions and this figure drops steadily until puberty.^{1,2} Preputial adhesions, therefore, are not an indication for circumcision. In addition, it was noted that 8% of 7 year olds have a physiological phimosis which resolves spontaneously, leaving a 1% incidence at puberty.²

What are the relative indications for circumcision?

Circumcision is performed for various conditions, but their natural course suggests that this is not always necessary. There are also many relative indications for

circumcision, including the prevention of penile and cervical cancer, the prevention of sexually transmitted infection, particularly HIV, and the prevention of urinary tract infection. Many surgeons would also perform a circumcision during surgery for hypospadias.

Paraphimosis

Paraphimosis occurs when the foreskin is not pulled back over the glans after retraction. A tight constricting band ensues, causing swelling of the distal penis and acute discomfort (see fig A on bmj.com). Reduction under local or general anaesthesia is nearly always possible with several minimally invasive methods; a literature review that included the Cochrane database and Medline searches failed to show that any one was better than the others.³ There is no evidence that circumcision is subsequently necessary.

Balanoposthitis and balanitis

Balanoposthitis affects about 1% of boys and occurs when there is erythema and oedema of the prepuce and glans (in balanitis the inflammation is confined to the glans). The foreskin is usually non-retractile. It is often accompanied by purulent discharge, and the inflammation may spread along the shaft of the penis associated with dysuria. Culture of the preputial discharge has shown that *E coli* and *Proteus* are the commonest organisms and that *Candida* is rare.⁴ Antibiotic treatment is the first line treatment, and most boys do not have a further attack. Circumcision should be reserved for those with recurrent balanoposthitis, although alternative methods, such as preputioplasty (an operative technique to widen the preputial ring), may achieve the same effect in preventing further episodes of balanoposthitis and leaving a retractile foreskin.

Preputial “pearls” and redundant foreskin

These conditions are completely benign and do not require circumcision. Preputial pearls (fig 1) are retained sebaceous secretions (smegma) produced by the inner foreskin layer that fail to be released because of preputial adhesions. They always resolve spontaneously. A redundant foreskin causes only pooling of urine and is treated by gently pulling the foreskin back to take up any “slack” when passing urine, and then drying the foreskin at the end of micturition. A single study examined the foreskin length and risk of penile cancer and concluded that the presence of a long foreskin increased the risk

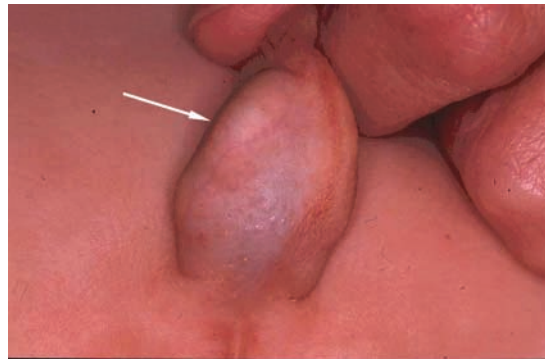


Fig 1 | Preputial "pearl"

but only in the presence of phimosis: in the study group of 23 patients with penile cancer, 78% had long foreskins, and 52% of these had phimosis.⁵ Other confounding variables known to be risk factors for penile cancer were not assessed.

Phimosis

Phimosis is defined as the inability to retract the foreskin because of a narrowed preputial opening. Differentiating between physiological phimosis and pathological phimosis is important, as the former should be managed conservatively whereas the latter requires surgical intervention.

When is a phimosis physiological?—A physiological phimosis exists when the foreskin is non-retractile but in all other aspects, including histological analysis, is normal. It may be long and usually exhibits "flowering" during attempted retraction (fig 2), and there may be blanching of the preputial skin proximal to the preputial orifice. Distinguishing between physiological and pathological phimosis remains a problem, as shown by a Canadian retrospective review of 284 consecutive referrals for phimosis⁶ and in the difficulties encountered when deciding whether to treat a phimosis. Indeed, this has led to different means of treating a "physiological" non-retractile foreskin in prepubertal boys, thereby perpetuating the misunderstanding that a foreskin must be retractile by a certain age. The large, longitudinal, population based studies of boys by Gairdner and Oster suggests that, by the age of 5 years, 10% of boys still have a physiological phimosis and that, at the age of 10 years, the incidence is 1%.^{1 2} These figures have been confirmed by studies in Japan and Taiwan, where circumcision is rare in childhood.^{7 8}

When is a phimosis pathological?—A pathological phimosis is one where the preputial orifice itself is

abnormal and scarred (fig 3). The incidence is suggested to be about 1.5% at the age of 17 years. Histological analysis of such foreskins invariably shows balanitis xerotica obliterans,⁹ the consequences of which are discussed later.

Does having a physiological phimosis at a certain age lead to a pathological phimosis later?—There are no objective data to suggest that having a physiological phimosis leads to a pathological one at any stage. Data collected over a 12 year period from a single department suggests that the incidence of balanitis xerotica obliterans peaks in early adolescence and that it is rare before the age of 5 years.⁹

Prevention of sexually transmitted infections

A literature review examined 31 studies up to 1999 to determine whether circumcision influenced the incidence of sexually transmitted infections.¹⁰ Prospective data were almost non-existent, so classic criteria to determine causality based on retrospective data were used.¹¹ The findings showed that uncircumcised males were more prone to genital ulcer disease (syphilis, chancroid, herpes simplex) as well as infection with human papillomavirus,¹² whereas circumcised men were more prone to urethritis. Further work has shown that risk factors other than male circumcision are more important for human papillomavirus infection in both sexes, such as the age at first intercourse, total number of sexual partners, and number of recent partners,¹³ although the risk profiles are slightly different for oncogenic and non-oncogenic papillomavirus. The main difficulties with many of the studies often quoted in discussions over circumcision and papillomavirus infection are the definition used to mean "circumcised" and the means used to demonstrate this.¹⁴

Prevention of HIV infection—A Cochrane systematic review in 2005 assessed the evidence for male circumcision in preventing acquisition of HIV-1 and HIV-2 by men through heterosexual intercourse.¹⁵ It included a comprehensive assessment of the quality of 37 observational studies and concluded that, although most studies showed an association between male circumcision and prevention of HIV, their results might be limited by



Fig 2 | Flowering" foreskin

Techniques of circumcision

Surgical technique	Anaesthetic
Plastibell device	Local
Bone cutters or other devices to isolate the foreskin and protect the glans penis	Local or general
Free hand sleeve circumcision using scissors or knife with suture or glue approximation	General

TIPS FOR NON-SPECIALISTS

- The only absolute medical indications for circumcision are balanitis xerotica obliterans and a scarred foreskin
- Firm evidence for relative indications is limited to recurrent balanitis and to the prevention of urinary tract infection in boys with vesicoureteric reflux or other urological abnormalities
- Many other “medical indications” have little or no evidence base, including a long foreskin, balanoposthitis, preputial concretions, physiological phimosis, and preputial adhesions
- Alternatives to circumcision for allowing foreskin retraction include steroid cream and preputioplasty.
- Complications of circumcision occur in 1-7% of cases

confounding variables, which were unlikely to have been adjusted for. More recently, two randomised controlled trials in Kenya and Uganda were terminated early on the basis of interim evidence that male circumcision provided a protective benefit against HIV infection of 53% among the 2784 Kenyan men and 51% among the 4996 Ugandan men enrolled.^{16 17} Thus, for uncircumcised men in countries where HIV is endemic, circumcision seems to have a protective effect against HIV acquisition, but it cannot be said that circumcision would show the same degree of benefit in societies where the prevalence of HIV and its pattern of spread are different.

Prevention of penile cancer

Penile cancer is more common in uncircumcised men, but there is little information on the role of ritual circumcision and its timing in the aetiology of penile cancer. A population based case-control study carried out in the United States between 1979 and 1998 included 137 men with penile cancer diagnosed (75 with in situ cancer, 62 with invasive cancer), and 671 controls identified through random digit dialling.¹⁸ Penile conditions such as tear, rash, and injury were associated with an increased risk of cancer. Among men not circumcised in childhood, phimosis was strongly associated with the development of invasive penile cancer (odds ratio 11.4 (95% CI 5.0 to 25.9)), but when the researchers excluded phimosis the presence of a foreskin did not increase the risk of invasive penile cancer (odds ratio 0.5 (0.1 to 2.5)). There was, however, a strong association between human papillomavirus infection and the development of penile cancer regardless of circumcision status. It is clear that factors other than circumcision are involved in the aetiology of penile cancer, as is highlighted by one report that 42% of men with penile cancer were previously circumcised.¹⁹

Prevention of urinary tract infection in boys with urological abnormalities

The association between urinary tract infection and the uncircumcised state was first recognised in 1982.²⁰ Since then, there have been several observational and case-control studies, and these have found a 3-7 times increased risk of urinary tract infection in uncircumcised infants compared with circumcised ones, with the greatest risk in infants under 1 year old.²¹ A meta-

analysis of the effect of circumcision in boys suggested that only those at high risk of urinary tract infection—that is, those with recurrent infections or with abnormal urinary tracts such as high grade vesicoureteric reflux—would benefit from circumcision.²²

However, a note of caution must be struck on the benefit of circumcision, even in the presence of an underlying abnormality of the urinary tract, as shown in a controlled trial published a few years ago.²³ No benefit was found for circumcision when it was performed at the same time as antireflux surgery for severe vesicoureteric reflux irrespective of the age of the patient.

Trauma

Isolated trauma to the foreskin is unusual and in young boys should always raise the possibility of non-accidental injury. Tears, zipper injuries, or crush injuries usually heal leaving a scarred foreskin, but, unless this scarred foreskin subsequently becomes non-retractile, circumcision is not indicated. Uncircumcised men also seem to have a relatively high incidence of microtrauma and frenular tearing during penetrative intercourse.

Hypospadias surgery and its variants

Traditionally, removal of residual foreskin was an integral part of hypospadias repair, but, with the advent of newer techniques, conservation and reconstruction of the foreskin is increasingly practised, partly for cosmetic reasons and partly as a result of surveys from patient groups suggesting that the intact, uncircumcised penis is preferred by both men and women during sexual intercourse.^{24 25} For patients with minimal hypospadias and a hooded prepuce (see fig B on bmj.com) circumcision was the norm, but again in these cases many surgeons are now reconstructing rather than removing the foreskin.

What are the absolute medical indications for circumcision?

Medical indications for circumcision are generally accepted as phimosis secondary to balanitis xerotica obliterans and recurrent balanoposthitis, which occur in 1.5% and 1% of boys respectively.¹²

Balanitis xerotica obliterans is a chronic skin condition of unknown cause that most often affects the glans and prepuce but sometimes extends into the urethra. Recent

Methods

This review has incorporated findings from a Medline literature search including Cochrane reviews, concentrating on the past 5-10 years, as well as textbooks on surgery and urology, and personal communications with practising experts



Fig 3 | Pathological phimosis with balanitis xerotica obliterans

SUMMARY POINTS

- 1 in 6 males in the world ends up being circumcised
- The medical indications to circumcise prepubertal boys are rare
- There are many relative indications for circumcision in childhood, but the evidence of benefit needs to be carefully appraised
- The medical indications to circumcise adults are similarly rare
- Controversy continues about the health risks of preserving an intact foreskin because of lack of evidence and of clear randomised trials
- Complications of circumcision are well documented and can be drastic
- Nearly all circumcisions are carried out for cultural or religious reasons

reports have suggested that it is under-recognised.²⁶ Its association with early penile cancer is also not fully substantiated, although a recent report suggested that the quoted incidence of 2-6% of penile cancer being preceded by balanitis xerotica obliterans is a gross underestimate.²⁷ In a consecutive series of men with penile cancer over a 54 month period, 44 patients out of 155 (28%) had balanitis xerotica obliterans.

Complications of circumcision

Informed consent requires that the specific complications of a circumcision are discussed before surgery. The incidence of complications varies between 0.034%²⁸ and 7.4%²⁹ in communities where circumcision is widely practised.

Depending on the method of circumcision, the complications described range from minor problems with the Plastibell ring if this is used, bleeding, excess skin remaining, glanular adhesions, cosmetically poor appearance, skin granuloma formation, denuding of the penis, abnormal rotation or chordee of the penis, and meatal stenosis (commoner in neonatal circumcision) to major complications such as partial or total penile amputation and formation of urethral fistula.³⁰ Altered or reduced penile sensation is also well known.^{24 31}

Conclusions

The absolute indications for male circumcision in childhood are rare and include phimosis secondary to balanitis xerotica obliterans and recurrent balanoposthitis, both of which affect about 2% of children. Preputial adhesions and pearls, ballooning on micturition, and a non-retractile foreskin are all physiological, and parents can be reassured without the need for specialist referral. Relative indications include urinary infection in association with an abnormality of the urinary tract, an abnormally formed foreskin, and the possible benefits

of a reduced risk of sexually transmitted infection and penile cancer. Specialist referral for these relative indications is justified, for worried parents, to discuss the risk:benefit ratios.

Competing interests: None declared.

Provenance and peer review: Commissioned; externally peer reviewed.

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ADDITIONAL EDUCATIONAL RESOURCES

- British Association of Paediatric Surgeons. Management of foreskin conditions. www.baps.org.uk/documents/circumcision2007.pdf
- British Medical Association. The law and ethics of male circumcision—guidance for doctors. www.bma.org.uk/ap/nsf/content/malecircumcision2006
- American Academy of Pediatrics. Circumcision. www.aap.org/moc/PRESSROOM/circQA.htm