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# Neonatal circumcision: Risks and benefits

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## INTRODUCTION

Circumcision in the male refers to the surgical removal of the prepuce (ie, foreskin) of the penis. The procedure is centuries old and continues to be performed for a variety of religious, cultural, and medical reasons.

Parents of newborn males often have questions about circumcision: Is it necessary? What are its benefits? What are its risks? In addition to these medical issues, other factors that influence parental decision-making include the father's circumcision status, opinions of family members and friends, a desire for conformity in their son's appearance, and the belief that the circumcised penis is easier to keep clean [1-3].

The risks and benefits of circumcision will be reviewed here, with the focus on circumcision of neonates. Procedures for neonatal circumcision are discussed separately. (See "Neonatal circumcision: Techniques".)

## BACKGROUND

**Normal penile development and anatomy —** (See "Neonatal circumcision: Techniques", section on 'Development and anatomy'.)

**Prevalence and epidemiology —** The United States is the only country in the developed world where the majority of male infants are circumcised for nonreligious reasons. Circumcision rates in the United States vary according to geographic area, socioeconomic status, religious affiliation, insurance coverage, hospital type, and racial and ethnic group. The overall prevalence is estimated to be approximately 80 percent for males aged 14 to 59

years, with most of these procedures performed in newborns [4]. Circumcision rates are highest in the Midwestern states (74 percent), followed by the Northeastern states (67 percent) and Southern states (61 percent), and are lowest in the Western states (30 percent) [5]. The rate is higher in non-Hispanic White Americans (91 percent) than in non-Hispanic Black Americans (76 percent) and Mexican Americans (44 percent) [4].

Circumcision rates outside of the United States vary widely, from less than 5 percent to over 90 percent of males [6].

There are no studies that give reliable data about the number of males who are circumcised after birth for elective or surgical indications.

## COUNSELING

Parents or caregivers should receive factually correct, nonbiased information about the potential medical benefits and risks of neonatal circumcision and should understand that the procedure is elective. This discussion needs to consider the social, cultural, and religious aspects of the procedure, and the parents' personal preferences, which may be more important to them than a decision based on medical benefits alone [1-3,7,8]. In cross-sectional studies performed in the United States, 40 to 67 percent of parents reported they chose to have their son circumcised because of its hygienic and medical benefits; 23 to 37 percent had the procedure performed for social reasons (eg, father circumcised); and 11 to 19 percent of procedures were performed for religious reasons [9-12].

Ideally, counseling is provided when parents or caregivers first begin to consider circumcision, which may be early in pregnancy or before. Written informed consent is obtained prior to the procedure. (See "Neonatal circumcision: Techniques", section on 'Informed consent'.)

Parents or caregivers who are considering deferring circumcision until their son reaches an age where he can make an informed decision should be informed that circumcision performed in adults has greater risks and costs, more procedure and postprocedural discomfort, and a longer recovery period than newborn circumcision [13]. It also delays protection from sexually transmitted infections, which is important if the male becomes sexually active before the procedure is performed.

## POTENTIAL BENEFITS

Circumcision has been associated with a number of medical benefits, including lower rates of urinary tract infection (UTI), penile cancer, penile inflammation, penile dermatoses, and

sexually transmitted infections [14-18]. A lower rate of UTI is the major benefit during infancy.

In the uncircumcised male, the preputial space provides a warm moist environment that both traps pathogens and bodily secretions and is favorable to their survival and replication, while the foreskin itself is susceptible to microabrasions that are thought to facilitate acquisition and transmission of infection. In contrast, the keratinized glans of the circumcised male is thought to create an unfavorable environment for these processes.

**Reduction in urinary tract infection —** UTI is uncommon in males at any age. The effect of circumcision on UTI has been studied primarily in infants because they have a higher prevalence of UTI than older males. UTIs in infants can result in pyelonephritis requiring hospitalization and, rarely, septicemia and death. In infants with congenital uropathy, UTI can have serious sequelae, such as renal scarring and lifelong renal insufficiency. If the urinary tract is normal, long-term sequelae from UTI are unlikely.

Comparative studies consistently report that circumcised male infants have significantly fewer UTIs than uncircumcised male infants [15,16]; however, there are no data from a large randomized trial [19]. In a systematic review of 12 studies including data on over 400,000 males primarily under 1 year of age, circumcision reduced the risk of UTI by almost 90 percent (odds ratio [OR] 0.13, 95% CI 0.08-0.20) [16]. Another meta-analysis found that among febrile male infants less than 3 months of age, the prevalence of UTI in circumcised and uncircumcised infants was 2.4 and 20.1 percent, respectively [15]. It is estimated that 7 to 14 of 1000 uncircumcised male infants will develop a UTI during the first year of life, compared with 1 to 2 of 1000 circumcised male infants [5]. As discussed above, long-term sequelae from UTI are unlikely if the urinary tract is normal.

There is some evidence that periurethral flora contains fewer pathogens after circumcision than before circumcision [20,21]. Uncircumcised male infants under 6 months of age have higher numbers of uropathogenic bacteria bound to the mucosal surface of the foreskin and at the urethral meatus than infants who have been circumcised [22]. This colonization probably plays a role in the pathogenesis of urinary infection. However, factors other than circumcision may affect the observed rate of UTI in these reports [23]. As an example, most hospitalized premature infants are not circumcised. Since premature infants have a higher rate of UTI than term infants, the inclusion of premature infants in a series may confound the data. Other factors that can affect UTI rates include the method of urine collection, type and timing of circumcision, and breastfeeding status (protective effect [24]).

The reduction in UTI associated with circumcision has also been observed after infancy. In a 2013 systematic review of primarily unrandomized studies, adult uncircumcised men had a higher rate of UTI than circumcised men (RR 3.4, 95% CI 0.92-12.7) and the lifetime risk of UTI in uncircumcised and circumcised men was 32.1 and 8.8 percent, respectively (RR 3.65,

95% CI 1.15-11.8) [25]. Lack of circumcision was estimated to account for 23 percent of UTIs during the lifetime of males.

The prevalence of UTIs in uncircumcised adult males increases with age and certain disease states, such as diabetes mellitus [26,27]. (See "Acute simple cystitis in adult males" and "Urinary tract infections in children: Epidemiology and risk factors", section on 'Lack of circumcision'.)

**Infants with congenital uropathy** — In male infants with serious congenital uropathies, such as high-grade vesicoureteral reflux, posterior urethral valves, severe megaureters, ureteroceles, and prune belly syndrome, reduction in UTIs by circumcision may have greater potential benefit. Prospective randomized trials have not been performed, but the retrospective evidence described above supports this hypothesis. In the author's practice, he tells parents or caregivers that a circumcision has the potential to be beneficial, especially when the baby has an associated uropathy. For patients with physiologic phimosis, treatment with topical steroids may be just as effective as circumcision to reduce the risk of UTI, thereby avoiding circumcision [28,29].

**Reduction in risk of some cancers** — Compared with uncircumcised men, circumcised men appear to have a lower risk of penile cancer, and their sexual partners may have a lower risk of cervical cancer.

**Penile cancer** — Squamous cell cancer of the penis is a rare disease. The age-adjusted incidence in the United States is less than 1 per 100,000 males, comparable to that in other developed countries [30,31].

A systematic review and meta-analysis found a strong protective effect of childhood/adolescent circumcision on invasive penile cancer (OR 0.33, 95% CI 0.13-0.83, 3 studies) [17]. In two studies, the protective effect did not persist when analyses were restricted to boys with no history of phimosis, suggesting at least some of the increased risk of cancer is related to phimosis, which can be the result of poor penile hygiene [32]. There was no association between circumcision and penile intraepithelial neoplasia and in situ penile cancer.

The number of newborn circumcisions that would need to be performed to prevent one case of penile cancer has been estimated to range from 909 to 322,000, and 2 to 644 complications would be expected per cancer prevented [33-35]. Given the low risk of penile cancer and the possibly modest reduction in risk with circumcision, it is unclear whether this benefit is clinically important when evaluated against the cost of the procedure and the risk of procedure related complications (see "Carcinoma of the penis: Epidemiology, risk factors, and pathology", section on 'Risk factors'). Furthermore, these data were obtained prior to widespread use of the human papillomavirus (HPV) vaccine for girls, as well as boys (see

"Human papillomavirus vaccination"). Vaccination may reduce the prevalence of HPV related disease, diminishing the role of circumcision in prevention of these diseases.

**Cervical cancer in partners —** Cervical cancer is more common in the sexual partners of uncircumcised men. A partial explanation for the link between cervical cancer and lack of male circumcision is that circumcised men have a lower prevalence of HPV infection than uncircumcised men [36], they are less likely to transmit HPV to their partners [37], and their partners have lower high-risk HPV DNA load [38].

In a study that pooled data from 1913 couples enrolled in one of seven case-control studies, circumcised men were less likely than uncircumcised men to have HPV infection (OR 0.37, 95% CI 0.16-0.85 after adjustment of confounders) and male circumcision was associated with a trend for reduced risk of cervical HPV and cervical cancer (OR 0.75, 95% CI 0.49-1.14) in the female partner [39]. Among monogamous women, the reduced risk of cervical cancer was statistically significant when the male partner had engaged in high-risk sexual behaviors (early age at first sexual intercourse, a high lifetime number of sexual partners, sexual intercourse with prostitutes) (OR 0.18, 95% CI 0.04-0.89) [39]. (See "Cervical intraepithelial neoplasia: Terminology, incidence, pathogenesis, and prevention", section on 'Role of human papillomavirus'.)

As discussed above, these data were obtained prior to widespread use of the HPV vaccine for girls, as well as boys (see "Human papillomavirus vaccination"). Vaccination may reduce the prevalence of HPV related disease, diminishing the role of circumcision in prevention of these diseases.

**Reduction in penile inflammation and retractile disorders —** In case series, penile problems are described more often in uncircumcised males [18,40,41]. The best available data were reported by a prospective cohort study of 635 New Zealand boys followed from birth to age 8 years [18]. The rates of penile inflammation and phimosis were higher in uncircumcised boys (penile inflammation: 14.4 versus 7.6 per 100 boys 0 to 8 years of age; phimosis 3.7 versus 0 per 100 boys 0 to 8 years of age).

Properly performed neonatal circumcision prevents phimosis, paraphimosis and balanoposthitis. A reduction in penile inflammatory and retractile disorders is important because, although they can often be treated medically [42-44], chronic inflammation and repeated forceful retraction may cause scarring and secondary phimosis, which sometimes requires surgical intervention [27,45-47]. However, good penile hygiene also may prevent penile inflammatory and retractile disorders, highlighting the importance of teaching uncircumcised boys routine penile care and hygiene. (See "Care and complications of the uncircumcised penis in infants and children" and "Balanitis and balanoposthitis in children and adolescents: Clinical manifestations, evaluation, and diagnosis" and "Paraphimosis: Clinical manifestations, diagnosis, and treatment".)

**Reduction in HIV and other sexually transmitted infections** — There is high-quality evidence that circumcision protects against acquisition of HIV, HPV, and probably herpes simplex virus type 2 (HSV-2), and also some evidence that it may protect against trichomonas and chancroid infection (see "Prevention of sexually transmitted infections", section on 'Male circumcision'). Circumcision does not protect against infection from gonorrhea, chlamydia trachomatis, or syphilis.

The effects of male circumcision on preventing HIV transmission from men to women and on acquisition of other STIs are discussed elsewhere. (See "Prevention of sexually transmitted infections", section on 'Other STIs' and "Prevention of sexually transmitted infections", section on 'HIV infection'.)

**Easier hygiene** — Genital hygiene (washing the entire penis, including the glans, with soap and water while bathing) is important for all males and is generally easier in the absence of a foreskin.

Uncircumcised boys should be taught the importance of washing beneath the foreskin on a regular basis when the foreskin is fully retractable. Good hygiene may prevent many problems associated with the foreskin [32], but can be difficult to maintain in uncircumcised boys, even in developed countries. Studies of middle class British and Scandinavian schoolboys concluded that penile hygiene is usually not well-maintained [48,49]. Care of the uncircumcised penis is described separately. (See "Care and complications of the uncircumcised penis in infants and children".)

## POTENTIAL DISADVANTAGES

**Procedure related complications** — An accurate complication rate is difficult to determine, as the largest studies are retrospective and based on coding diagnoses and inconsistent definitions. In addition, data have generally not been stratified to account for timing of the procedure, technique, provider type, setting, length of follow-up, timing of complications, and severity of complications.

- In two studies that included a total of over 200,000 circumcisions performed in US hospitals, the rate of complications during and in the first month after the procedure was approximately 0.2 percent [33,34].

- A systematic review identified 16 prospective studies of complications following neonatal and infant circumcision by a variety of providers from 12 countries and primarily using the Plastibell [50]. The median frequency of any adverse event was 1.5 percent (range 0 to 16 percent) and the median frequency of any serious adverse event was 0 percent (range 0 to 2 percent); nine studies reported no serious adverse events,

but three studies reported that 1 to 2 percent of boys had a serious complication, including amputation of the glans penis, infection requiring antibiotics and meatal ulcer. Complication rates were slightly lower in 10 retrospective studies.

Complications/sequelae of circumcision are listed below and discussed and illustrated in more detail separately (see "Complications of circumcision"):

- Inadequate skin removal, which may result in an unsatisfactory cosmetic appearance and revision of the procedure. This is a common complaint, although the frequency is poorly documented in the literature.
- Bleeding, which is usually mild and controlled with local pressure, but surgical intervention and transfusion may be required on rare occasions.
- Infection, which is usually mild and treated by local antibiotics, but sepsis can occur and death has been reported.
- Urethral complications, including urethrocutaneous fistula. Meatal stenosis is an unintended consequence of circumcision but is not related to the procedure itself. Meatal stenosis can occur when urine from a wet diaper irritates the exposed ventral urethral meatus of the circumcised penis, causing a chemical dermatitis with subsequent scarring. Meatal stenosis rarely if ever occurs in uncircumcised males since the foreskin protects the meatus from scarring.
- Glans injury, including penile amputation.
- Removal of excessive skin, which may result in a denuded penile shaft.
- Epidermal inclusion cyst (results from inadvertently burying healthy skin that has no place to naturally slough off).
- Adhesions, which range from mild to dense.
- Skin bridges.
- Cicatrix (a circumferential scar that usually develops at the incision line and is often associated with a hidden penis).
- Anesthetic complications. (See "Neonatal circumcision: Techniques", section on 'Pain control'.)

Complications are more common among premature newborns, newborns with congenital anomalies, and circumcisions performed after the newborn period or by untrained/poorly trained providers who may use nonsterile techniques [5].

**Sexual dissatisfaction —** The prepuce contains specialized sensory mucosa [51]; concern exists that the end of the penis may become less sensitive and sexual sensation may be decreased when the foreskin is removed [52]. However, most circumcised males do not describe psychological trauma or decreased sexual function, sensation, or desire as a result of the procedure. In a systemic review of 36 studies, circumcision was not associated with decreased sexual arousal, sensitivity, or satisfaction [53].

**Pain —** Surgical excision of the foreskin is painful. Although pain control was not provided in the past, safe and effective methods of pain control exist and should be provided to all infants undergoing the procedure [26,54]. The preferred method is subcutaneous ring or dorsal penile nerve block. Topical anesthetic creams are an acceptable alternative but should be avoided in infants who are low birth weight because of a higher incidence of skin irritation in this population. (See "Neonatal circumcision: Techniques", section on 'Pain control'.)

**Other —** In the era before use of anesthesia for circumcision, infants were observed to be less interactive and feed less frequently after the procedure [55,56]. This raised concerns that stress, pain, and fatigue related to circumcision may contribute to breastfeeding failure. However, changes in infant behavior do not appear to last longer than 24 hours [56], and anesthesia reduces procedure-related pain and its sequelae [57,58]. A longitudinal birth cohort study that examined the association between neonatal circumcision and breastfeeding found no evidence that neonatal circumcision disrupts exposure to, or outcomes of, breastfeeding [59].

## OPINIONS OF ORGANIZATIONS AND GROUPS

Professional societies and lay groups have expressed a wide range of views concerning the advantages and disadvantages of routine circumcision. Several pediatric and urologic experts feel that circumcision should be advocated as a prophylactic public health measure [9,54,60-64], and there is increasing commentary from the pediatric literature suggesting that male circumcision may be an effective prophylactic intervention for disease prevention in the United States and other countries [65,66]. Other groups oppose circumcision on a human rights basis, saying the infant is not allowed to decide whether or not he wants to be circumcised and the procedure constitutes genital mutilation [62]. In 2012, a German court in Cologne ruled that circumcising young boys represents grievous bodily harm, but was overruled by a higher court. Still others believe the procedure decreases sexual pleasure [52].

- In 1996, the Canadian Paediatric Society (CPS) issued a clinical practice guideline which stated, "The overall evidence of the benefits and harms of circumcision is so evenly

balanced that it does not support recommending circumcision as a routine procedure for newborns" [67].

- In 2012, the American Academy of Pediatrics (AAP) task force on circumcision of the male infant concluded that "the health benefits of newborn male circumcision outweigh the risks; furthermore, the benefits of newborn male circumcision justify access to this procedure for families who choose it. Specific benefits from male circumcision were identified for the prevention of urinary tract infections, acquisition of HIV, transmission of some sexually transmitted infections, and penile cancer. Male circumcision does not appear to adversely affect penile sexual function/sensitivity or sexual satisfaction" [68]. Compared with their previous statement, this statement is a stronger affirmation of the health benefits of circumcision. However, the AAP did not recommend routine circumcision. They said, "Parents should weigh the health benefits and risks in light of their own religious, cultural, and personal preferences, as the medical benefits alone may not outweigh these other considerations for individual families" [68]. However, this statement expired in 2017 and has not since been renewed.

- The American College of Obstetricians and Gynecologists (ACOG) endorsed the conclusions of the AAP discussed above [69].

- In 2012, the American Urological Association (AUA) reaffirmed their 2007 policy that stated, "The American Urological Association, Inc (AUA) believes that neonatal circumcision has potential medical benefits and advantages as well as disadvantages and risks... is generally a safe procedure when performed by an experienced operator... When circumcision is being discussed with parents and informed consent obtained, medical benefits and risks, and ethnic, cultural, religious and individual preferences should be considered. The risks and disadvantages of circumcision are encountered early whereas the advantages and benefits are prospective" [70].

In addition, the World Health Organization (WHO) has recommended that male circumcision be considered as part of a comprehensive HIV prevention package in Africa and other countries with high HIV prevalence and low rates of male circumcision [71]. They stated that a human rights-based approach to promotion of male circumcision requires measures that ensure that the procedure be carried out safely, with informed consent, and without coercion or discrimination, and have published guidance for providing these services [72]. The effect of male circumcision on HIV transmission is discussed elsewhere. (See "Prevention of sexually transmitted infections", section on 'Male circumcision'.)

## SOCIETY GUIDELINE LINKS

Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See "Society guideline links: Neonatal circumcision".)

## INFORMATION FOR PATIENTS

UpToDate offers two types of patient education materials, "The Basics" and "Beyond the Basics." The Basics patient education pieces are written in plain language, at the 5th to 6th grade reading level, and they answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials. Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are written at the 10th to 12th grade reading level and are best for patients who want in-depth information and are comfortable with some medical jargon.

Here are the patient education articles that are relevant to this topic. We encourage you to print or e-mail these topics to your patients. (You can also locate patient education articles on a variety of subjects by searching on "patient info" and the keyword(s) of interest.)

- Basics topics (see "Patient education: Should I have my baby circumcised? (The Basics)" and "Patient education: Care of the uncircumcised penis in babies and children (The Basics)")
- Beyond the Basics topics (see "Patient education: Circumcision in baby boys (Beyond the Basics)")

## SUMMARY AND RECOMMENDATIONS

- **Indication –** Male circumcision (removal of the prepuce or foreskin) is almost always an elective procedure performed for religious, cultural, or medical reasons. The prevalence varies across the world. (See 'Background' above and 'Prevalence and epidemiology' above.)
- **Informed consent –** Parents or caregivers of newborn males should be provided with accurate, unbiased, written information about the potential risks and benefits of circumcision. This information should be in a language that they understand and they should have the opportunity to discuss this information with the operating practitioner prior to deciding whether or not to have their infant son circumcised. (See 'Counseling' above.)

- **Risks and benefits of procedure –** We educate parents or caregivers about neonatal circumcision. Benefits of circumcision in men include reduction in the rates of urinary tract infection (UTI), penile cancer, some sexually transmitted infections, penile inflammatory and foreskin retractile disorders (eg, phimosis and paraphimosis), as well as easier hygiene. These benefits, which extend over a lifetime, need to be weighed against the potential risks of the circumcision procedure, which are often short-term, and in the context of the low incidence of UTIs and penile cancer in uncircumcised men. (See 'Potential benefits' above.)

- **Reduction of sexually transmitted infections –** Circumcision protects the male from acquisition of HIV, human papillomavirus (HPV), and probably herpes simplex virus type 2 (HSV-2). There is also some evidence that it may protect against trichomonas and chancroid infection. Male circumcision also confers benefits to female partners by reductions in cervical cancer and acquisition of some sexually transmitted infections and bacterial vaginosis. (See 'Cervical cancer in partners' above and "Prevention of sexually transmitted infections", section on 'Male circumcision'.)

- **Complications –** Procedure-related complications are uncommon and typically managed without difficulty. These include inadequate foreskin removal, bleeding, and localized infection. Serious complications are rare. (See 'Procedure related complications' above.)

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