

Male neonatal circumcision: indications, controversies and complications

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Circumcision is one of the oldest surgical procedures performed today. The practice of circumcision in males and females arose in many ancient cultures. Conflicting theories have been proposed to account for this ritual, including a sacrifice or sign of submission to a deity, a fertility offering, a mark of tribal identification, a rite of passage to adulthood, and a means of humiliating and marking vanquished enemies [1]. Circumcision was performed in ancient Egypt and as a ritual by Jews and is described in Genesis [2].

Male circumcision became a common medical practice in the 19th century, with improved anesthetic, surgical, and antiseptic techniques. The prevention of masturbation was one of the primary indications for circumcision. With the “medicalization” of circumcision, such misconceptions about the role of circumcision persist [3]. Approximately one man in six is circumcised worldwide. Circumcision is the fifth most common procedure performed in the United States today [4]. In 1992, nearly 1.2 million circumcisions were performed, with 62% of newborn males undergoing the procedure [5]. The practice of circumcision the United States increased dramatically following World War II and peaked in the mid-1970s, when the American Association of Pediatrics (AAP) stated it was not a medically necessary procedure [2]. The AAP reversed its stance, however, after evidence documented an increased risk for urinary tract infections (UTIs) in uncircumcised male infants [6]. At present, routine neonatal circumcision is neither recommended nor condemned by the AAP [7]. It is left to the physician to discuss the pros and cons of

circumcision, including the controversy, potential medical benefit, and complications involved with this procedure.

Controversies

Risk for urinary tract infection

Uncircumcised infant males are at increased risk for UTI, especially during the first year of life [6,8–14]. The increase in risk is presumably secondary to increased periurethral bacterial colonization. The incidence of UTI in uncircumcised males is low and ranges between 1 in 100 and 1 in 140. UTI risk seems to be reduced in circumcised males by up to 10 fold. Many of the studies examining the role of circumcision in preventing UTI have not assessed and controlled systematically for other factors, including breastfeeding, that may decrease risk. A recent study has suggested that tight covering of the urethral meatus by the prepuce may increase the risk for UTI [15]. The low risk for UTI in uncircumcised males does not warrant mandatory circumcision. See later discussion for the role of circumcision in those at higher risk for UTI.

Anesthesia/analgesia

Neonatal circumcisions usually are performed within the first several days of life. Before the 1990s, anesthesia was not used routinely. In a recent survey of physicians stratified by specialty and geography, 35% of pediatricians, 60% of family practitioners, and 70% of obstetricians responding to a questionnaire performed at least one circumcision per month. Of these physicians, only 45%

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reported using anesthesia for the procedure. Pediatricians were more likely to use anesthesia (71%) than family practitioners (56%) or obstetricians (25%). Recent training was a factor in anesthetic use in primary care doctors but not in obstetricians. The most common reasons cited for not using anesthesia were concern over adverse reactions and the opinion that the procedure does not warrant anesthesia [5].

There is no question that newborn infants exhibit responses to pain, whether measured by physiologic or behavioral means [16]. Behavioral and physiologic differences have been demonstrated in neonate boys undergoing circumcision as measured by increased heart rate, prolonged crying, and decreases in oxygen tension. These responses are ameliorated by the injection of local anesthesia [17].

Several methods of pain control have been described [18]. Eutectic mixture of local anesthetics (EMLA cream) decreases crying interval and cardiac response to neonatal circumcision compared with placebo [19–21]. This technique may be limited in its efficacy during maximum trauma and carries the risk for inducing methemoglobinemia when used in quantities greater than 1 g. EMLA cream should not be used in conjunction with other drugs that can induce methemoglobinemia, including sulfa drugs [22,23].

Dorsal penile nerve block using 1% lidocaine reduced pain during neonatal circumcision in controlled trials. The most frequent complication of this procedure is bruising, with hematomas occurring rarely. The potential for systemic absorption may be limited by aspirating before injecting and injecting at the 10-o'clock and 2-o'clock positions rather than in the midline [24,25]. Circumferential injection of 1% lidocaine at the midshaft of the penis (ring block) may be more effective than dorsal nerve block and EMLA cream at ameliorating pain with circumcision [22].

Allowing the infant to suck on a cloth soaked with sweet wine often is used in religious circumcisions. This technique may reduce the stress and trauma of the procedure, as evidenced in a study comparing sucrose on a pacifier versus water. Such "comfort" measures may reduce pain, but are not a substitute for anesthetic methods [26].

Sexual function

The function of the prepuce in human sexual response continues to be debated. Many groups

object vehemently to the practice of circumcision because they believe the procedure is a form of mutilation and permanently inhibits sexual function.

To consider whether removal of the foreskin may alter sexual function negatively, one must first consider the function of the prepuce. The prepuce is a specialized mucosal surface lined by squamous epithelium similar to mucosa of the mouth, vagina, and esophagus. It is rich in nerves with multiple Meissner's corpuscles that are similar to nerve endings in the fingertips and lips [27]. During sexual intercourse the foreskin is thought to provide a gliding mechanism for the penis during thrusting and may prevent the loss of vaginal secretions [28].

Circumcision removes the protective barrier of the glans penis, resulting in increased keratinization of the glans. Removal of the prepuce effectively stops the production of *smegma*, the exudate of dead skin cells and oils that may have pheromonic properties [29]. Masters and Johnson [30] found no differences in glanular tactile sensation in circumcised men. They did not study, however, alterations in fine touch that may be affected by circumcision. The glans is insensitive to light touch, heat, and cold and is a primitive sensory organ. Thus, characterization of glans sensation pre- and postcircumcision may not delineate true alterations in sensation associated with removal of the prepuce [27].

In a recent survey of men undergoing circumcision, a significant number of patients noted worsened erectile function and decreased penile sensitivity, but noted improved satisfaction. These seemingly conflicting outcomes may be explained by the hypothesis that curing the underlying problem (phimosis in 64% and recurrent balanitis in 17%) was of greater importance to most patients responding to the survey [31]. Contrary results, however, were found in a prospective sexual function survey of men before and 12 weeks after circumcision. There was no statistically significant difference in reported sexual drive, erection, ejaculation, or overall satisfaction. This study had limitations, however; the study population was composed of men undergoing circumcision for medical conditions of the prepuce, and thus their perceptions of function may have been altered [32].

Laumann and colleagues [33] used the National Health and Social Life Survey (NHSLs) to compare rates of sexually transmitted diseases (STDs), sexual dysfunction, and sexual practices. Although no differences were found in rates of the former

two categories, circumcised men were more likely to engage in elaborate sexual practices, including masturbation and anal intercourse. Removal of the prepuce may alter sensation, resulting in the individual seeking alternative forms of stimulation. The latter study is especially intriguing because circumcision was performed in the 19th century to prevent masturbation [3].

One should consider the potential effects of male circumcision on the female partner. O'Hara and O'Hara [34] surveyed women having sexual experience with circumcised and uncircumcised partners. The women were recruited by classified advertisements in magazines, including an anti-circumcision newsletter. Fewer than half (49%) of the surveys mailed to respondents to the advertisements were returned. A significant number of women noted greater likelihood of experiencing vaginal orgasm, less discomfort, and greater intimacy with an uncircumcised partner. Although this study had methodologic flaws, it underscores the need to consider the female partner when investigating sexual function outcomes postcircumcision.

Circumcision and malignancy

Circumcision during infancy seems to decrease risk for penile cancer, whereas later circumcision does not [35]. Squamous-cell carcinoma of the penis is rare in circumcised men. Rates of penile cancer vary in uncircumcised men, depending on many variables, including geographic location, presence of phimosis, number of sexual partners, and cigarette smoking. Although the risk for developing penile cancer may be higher in uncircumcised men versus circumcised men, the overall incidence is low in developed countries, perhaps demonstrating that hygienic measures may play a key role in preventing the development of cancer [7,36–42].

Circumcision and sexually transmitted diseases

Prevention of STDs has been a commonly cited indication for circumcision since the procedure became “medicalized” [3]. A report that Jewish men had lower rates of syphilis fueled this theory in the 19th century [43,44].

In Van Howe's [44] recent review of the literature, only 31 studies with identifiable controls were found and analyzed. This review found no clear evidence that circumcision prevents STDs. If one considers syphilis alone, there are many

conflicting studies regarding the role of the prepuce in disease risk [33,45,46]. Uncircumcised men may be at increased risk for infection with HIV, but several studies have shown circumcised men to be at higher risk, and others show no effect of circumcision status [47–50]. Such conflicting studies yield the conclusion that circumcision as a routine procedure cannot be justified as a means of preventing STDs.

Indications and contraindications

Contraindications

Circumcision generally is not performed in premature infants. It should not be performed in children with congenital anomalies of the penis, including hypospadias, epispadias, chordee, penile webbing, and concealed penis. Any child with blood dyscrasias should not undergo circumcision.

Indications

The medical indications for circumcision remain controversial. The religious beliefs of the parents must be respected when considering circumcision [51–53].

Phimosis

Phimosis is the most common diagnostic code used in conjunction with circumcision [54]. A basic understanding of the embryology/physiology of the prepuce is important in understanding what is a pathologic state of the penis. Preputial development begins at 8 weeks gestation and is complete by 16 weeks, when the mucosa of the prepuce and glans are contiguous. The process of desquamation or exfoliation of the underlying epithelial tissue pushes the two surfaces apart, resulting in lysis of the physiologic adhesions and resolution of the physiologic “phimosis.” This process happens gradually and is usually complete by 3 years of age, although it may persist until the age of sexual maturity. Thus, this type of phimosis is not a disease or medical condition, but is a natural process and not an indication for circumcision [54–57].

True or pathologic phimosis is far less common and is associated with white, cicatricial, scarred tissue present at the preputial ring. The symptoms include irritation of the skin, dysuria, bleeding, and occasionally urinary retention and enuresis. Although circumcision is curative, alternative treatments, including preputioplasty (dorsal slit) or the

application of steroid creams, should be considered [54,57].

Urinary tract infection

Although UTIs are more likely to occur in uncircumcised males younger than 6 months of age, the overall incidence of UTI in this age group is low [10,11]. After 6 months of age, the association is not seen, likely because of the resolution of physiologic adhesions/phimosis. Circumcision should be discussed with parents of infants in whom UTI would pose an increased risk for renal injury, including infants with vesicoureteral reflux, obstructing hydronephrosis, and posterior urethral valves and other congenital anomalies. The use of prophylactic antibiotics or alternatives to circumcision as discussed above, however, should be considered.

A multicenter study examined patients with vesicoureteral reflux and a prenatal history of hydronephrosis [58]. The authors noted a statistically significant difference in 63% of the uncircumcised boys with reflux and UTIs compared with 19% of the circumcised boys, despite each group being on antibiotic prophylaxis. This finding suggests that removal of the prepuce may protect against UTIs in boys with reflux.

Complications

Circumcision is a safe surgical procedure that is well tolerated in nearly all patients. There are known risks attendant to the procedure, however, that should be discussed with the patient's parents to ensure that informed consent is obtained. The incidence of complications varies between 0.2% to 3% [2,57].

Death

Death from circumcision is rare, but has been described in the literature. Recently, the death of a 5-week-old boy from bleeding-related complications was reported [59]. During one period in New York City, however, no fatalities were reported in 500,000 consecutive neonates undergoing circumcision [60].

Bleeding

Bleeding is the most common complication of circumcision [2]. A common site of bleeding is from the vessels of the dorsal dartos fascia that may be in spasm at the conclusion of the procedure and then begin to ooze. Most bleeding can be controlled

with direct pressure or application of silver nitrate to an obvious bleeding vessel. Occasionally it is necessary to explore the wound, especially if a hematoma is present or the vessel is deep within it. One should consider hematologic evaluation of the patient if the bleeding is persistent or significant. The use of a dressing has not affected complication rates of other penile surgery and likely does not matter in circumcision [61].

Suture sinus tracts

Suture sinus tracts occur when a simple suture becomes epithelialized before absorption of the suture material. A skin bridge is formed that may collect dirt and bacteria, thus presenting a hygienic issue. Suture sinus tracts frequently are unnoticed by the patient, and their true risk to the patient is uncertain. They may be excised if associated with recurrent infections or poor hygiene.

Infection

Infection is an infrequent complication of circumcision despite the infant penis's dirty environment. The excellent blood flow to the penis likely explains the low infection rates. Infecting organisms are typically skin flora, but prophylactic antibiotics are not used typically in pediatric circumcision. Good postoperative care of the wound is important to prevent complications, including infection [57]. Parents often fear touching the penis postcircumcision because of anxiety about hurting their child. It is important to reassure them that the penis should be cleaned regularly at diaper changes. The author prescribes an antibiotic ointment to be applied at diaper changes.

Phimosis and concealed penis

Phimosis may occur after circumcision for several reasons. Typically, there is redundant inner preputial skin that may slide back over the glans, resulting in cicatricial contraction of the incision and trapping of the penis. If there is abundant suprapubic fat and the dartos attachments to the skin are loose, the penis may become buried or concealed. The surgeon performing circumcision should take care to ensure that the adhesions of the prepuce to the glans are taken down completely. Occasionally there is a discrepancy between too much dorsal skin and too little ventral skin. If standard circumcision is performed, the penis may become buried. The pediatric urologist should have command of the many different techniques

to treat penile concealment because each situation can be different, requiring a different approach [62].

Adhesions

Adhesions occurring after circumcision can be divided into two forms: surgical and nonsurgical (or congenital). At birth, most uncircumcised males have adhesions of the inner preputial skin to the glans as discussed above. The adhesions gradually resolve as the underlying skin exfoliates, creating smegma, a white exudate of dead skin cells and keratin that often is misdiagnosed by parents and pediatricians as an infection. The smegma often seems to be a pearl-like ball of tissue that is extruded from beneath the adhesion. Parents should be reassured that this is a natural process and not infectious.

Surgical adhesions may occur as the circumferential incision heals to the glans. During this healing process, a skin bridge may form between the circumcision incision and the glans [2,57]. These skin bridges typically occur on the dorsal surface, but may surround the penis completely. The skin bridges at first are almost transparent in infants. As the child ages, the skin bridge thickens. Skin bridges present a hygienic issue because dirt may collect beneath them. Although usually simple to excise, if they are circumferential and have persisted for years, excision may be challenging. In this case, parents should be counseled as to potential deformity or scarring of the glans post-procedure.

Meatitis

Erythema of the meatus is a common finding postcircumcision, but usually resolves as the epithelial surface thickens in response to the irritation. This erythema typically does not cause symptoms, although some older children complain of pain and dysuria. Parents should be reassured as to the self-limiting nature of the erythema [2].

Meatal stenosis

Narrowing of the meatus likely occurs in response to chronic irritation of the meatus and it typically does not occur in circumcised males. Some theorize that it occurs secondary to ligation of the frenular artery after circumcision. Meatal stenosis does not require treatment unless the stream is deflected or, rarely, if it is associated with dribbling of urine, dysuria, or urinary frequency [2,57]. The author has been referred many patients

who had persistent voiding symptoms despite adequate meatotomy. The urologist should not underestimate the ability of the meatus to expand during micturition. As urine flows into the fossa navicularis, force is imparted circumferentially on the glanular urethra and meatus, creating a wider opening.

Chordee

True chordee of the corporal bodies is not a complication of circumcision. Curvature of the penis, however, may occur after circumcision if an uneven amount of skin is removed. Attention to the anatomy of the penile shaft skin during circumcision can help prevent this problem [2].

Urethrocuteaneous fistula

Urethrocuteaneous fistula is a rare complication of circumcision. Although fistulas may be congenital, one may occur if the urethra is injured during circumcision. Such injury may occur during excision of the prepuce or during wound closure [2].

Necrosis

Necrosis of the glans and corporal bodies is a rare but devastating complication of circumcision that may result from infection or from surgical complications. As a rule, the author does not use electrocautery on the penis, and uses bipolar cautery instead. Use of electrocautery in conjunction with a clamp device is a dangerous maneuver and has resulted in complete loss of the penis (W.H. Hendren, personal communication).

Amputation

Avulsion and true partial-amputation of the glans may occur, typically when a circumcision is performed using a clamp. If the injury is recognized in a timely fashion, the amputated tissue should be placed in a sponge dampened with normal saline and transported on ice with the patient. Necrotic tissue should be debrided before reattachment is attempted [2].

Hypospadias

A circumcision may cause hypospadias if the clamp is misplaced and the ventral glans is avulsed [2].

Summary

The debate about whether to circumcise infants in the neonatal period likely will continue for some

time. As the medical and ethical issues are discussed and studied, however, economic factors are beginning to limit the practice in the United States. For example, Medicaid no longer funds neonatal circumcision in 11 states [63]. Private insurers likely will follow the lead of state health insurance, and a decline in the rate of circumcision will follow. As this shift in reimbursement occurs, parents who believe that circumcision is a medically necessary practice will need to be reassured that their child may lead a healthy life with an intact foreskin.

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