Circumcision - Quo Vadis?

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Circumcision remains as the most common pediatric surgical procedure in the United States and the most controversial. Several studies have pointed out that the sociocultural, religious, and psychological factors determine not only the circumcision choice of parents but also the counseling practice of physicians.

Ritual circumcision, often imbued with great moral significance, has been part of the Muslim and Jewish cultures for millennia. Routine circumcision of neonates as prophylaxis against disease originated in the nineteenth century and was soon accepted particularly in English-speaking countries. The procedure was advocated as a way of discouraging masturbation, believed to cause mental and physical ailments. It was claimed to prevent a range of illness, such as epilepsy and rectal prolapse [33].

Currently, approximately one-sixth of the world's male population is circumcised [35]. In the United States, neonatal circumcision is the most commonly performed operation. One estimate is that 80 % of male newborns were circumcised in 1990 [36]. In contrast, the circumcision rate in Canada and Australia has recently plummeted to about 25 % of previous levels, and Great Britain and New Zeland have virtually abandoned the procedure.

In 1975, the American Academy of Pediatrics (AAP) established a task force on neonatal circumcision. It concluded that routine neonatal circumcision carried no valid medical indications (31). However, when subsequent studies reported that uncircumcised infants were at increased risk of urinary tract infection, the AAP established a second task force in 1989 who concluded: "Newborn circumcision has potential medical advantages as well as disadvantages and risks. When circumcision is being considered, the benefits and risk should be explained to the parents and informed consent obtained [26]."

This noncommittal statement from AAP has renewed the neonatal circumcision debate, with all of its emotional overtones. From proponents of neonatal circumcision, there are warnings that the intact prepuce invites bacterial colonization, which leads to ascending urethral infection, the route to acute pyelonephritis and sometimes permanent renal damage. On the opposing side, no proof exists that uncircumcised male infants who sustain urinary tract infection will have future urologic problems. Furthermore, routine circumcision is not so simple a procedure or without peril.

Because pediatric urologists and surgeons are part of this complex picture, what evidence should they consider before deciding to encourage or discourage parents about this procedure? This article sorts through the circumcision tangle and separates facts from assumptions about circumcision.

Foreskin anatomy

The foreskin develops in the fetus between the third and fifth months of gestation, with the dorsal aspect growing more rapidly. As the glandular urethra closes, so does the ventral prepuce and symmetrically covers the glans. Once the glans is completely covered, there is fusion of the inner epithelium of the prepuce and the epithelium of the glans itself, both composed of stratified squamous epithelial cells. Usually in the first three to four months of life, the squamous cells begin to keratinize and arrange as whorls ("infant smegma"). This whitish, cheesy material is made up of desquamated epithelial cells in a moist environment and may be inappropriately interpreted as purulence.

These naturally shedding skin epithelia migrate to the tip of the foreskin and escape with routine cleansing. Infant smegma is not to be confused with the oily substance produced by Tyson's glands in the adult pubertal males. Adult smegma acts as a protective lubricating function of the glans under the foreskin [10].

In the neonate, the prepuce is retractable in only 4 %. In almost 50 % of newborns, the prepuce cannot be retracted sufficiently to visualize the external urinary meatus. By six months of age, the prepuce can be completely retracted in about 20 %; by three years of age, 10 % of boys still have unretractable foreskin [12]. Complete separation of the foreskin from underlying glans, even if the prepuce is retractable, has occurred in only 37 % of six year old boys. In puberty, virtually all foreskins become retractable [24]. Since most boys in the United States are circumcised, there is little opportunity for U.S. physicians to study the natural history of the uncircumcised penis. This separation process begins at birth, and continues throughout childhood, maybe as long as 10 to 14 years.

Penile hygiene and foreskin problems in childhood

A common argument for neonatal circumcision is that it improves penile hygiene and prevents disorders such as balanitis, phimosis and paraphimosis. In a report from the United States, balanitis was more common among uncircumcised patients (6 % vs. 3%); so was penile irritation (4 % vs. 1 %) [16]. The major limitation of this study is clearly a retrospective reliance on history and the difficulty with data analysis.

Warner and Strashin in 1981 indicate that about 10 % of males not circumcised at birth will eventually require circumcision [34]. A careful assessment of the paper, however, finds no population base for which this statistic was derived. The Finnish National Board to Health in 1970 showed that 0.023 % of males require hospitalizaton for foreskin problems. In the United States, this figure is 50 times greater, most likely representing the frequent request for non-medically indicated circumcision after the neonatal period. Worldwide, foreskin problems are treated medically, rarely surgically. Inordinate attention given to the foreskin hygiene in the United States will often culminate in forced foreskin retraction. Such forced retraction involves stretching or tearing the foreskin and may be the cause of the very problem we are trying to avoid.

Link to penile and cervical cancer

Squamous cell carcinoma of the penis occurs almost exclusively in men not circumcised at birth [7,26]. It occurs much more often in developing nations where circumcision is rare and men do not practice good hygiene [9,32]. The reliability of such epidemiologic data from developing nations has, however, been disputed [33].

Swafford in 1985 updated statistics on penile cancer from Denmark and found the lifetime risk of penile cancer among uncircumcised males to be 1 in 909 cases [29]. This data remains difficult to interpret accurately, since non-random samples are the basis for much of the data. The incidence of penile cancer is so rare that statistics from countries where circumcision is practiced, i.e. United States, compared with countries where it is not practiced, i.e., Scandinavia, cannot show a significant difference. It is apparent that the incidence of penile cancer in the uncircumcised population in the United States is greater than in circumcised, but socio-economic and hygienic factors certainly play a significant role in this difference [2,19,21].

An association between cervical cancer and the presence of an intact foreskin in the sexual partner has been suspected on the basis of a low incidence of cervical cancer in Jewish women [15]. However, subsequent epidemiologic studies have been unable to confirm a protective effect of circumcision [3,18].

Association with Sexually Transmitted Disease (STD)

Data supporting a clear relationship between venereal diseases and the presence of foreskin are not convincing. Virtually all of the various reports suffer from problems in study design in that they have not been well controlled for variables such as lifestyle, personal hygiene, race, socioeconomic status, access to medical care. Recently, Cook et al reported a cross-sectional study of 2776 heterosexual men attending a sexually transmitted disease clinic where they compared the effect of circumcision after ad-

justing for age, race, area of residence. They concluded that the results do not show a definitive benefit of circumcision; although uncircumcised men were more likely to have syphilis and gonorrhea, circumcised men were more likely to have genital warts and equally likely to have nongonococcal urethritis and genital herpetic lesions [6].

In the past few years, an ominous association between an intact foreskin and human immunodeficiency virus (HIV) infection has been reported from Africa. J Neil Simonsen and co-workers at the University of Nairobi, Kenya, studied HIV infection among men attending STD clinic. They had a history of consorting with a population of prostitutes that had a documented 85 % rate of HIV seropositivity. Compared to 8 % of circumcised men, 20 % of uncircumcised ones were HIV-positive [27]. Some hypotheses for increased risk of HIV transmission are that the preputial sac may provide a protected environment that allows for more prolonged exposure of male genital epithelium to the genital or rectal secretions of the infected partner. Also the foreskin may be more susceptible to trauma with development of microabrasions during vaginal or rectal intercourse compared with that of circumcised men. Studies in the United States on the association of HIV and circumcision status are difficult to discern, in part because of the increased rate of high risk behavior and the high rate of circumcision [22].

Association with Urinary Tract Infection (UTI)

Reports of an association between an intact foreskin and UTI of infancy are primarily responsible for the resurgence of sentiment in favor of neonatal circumcision. In a series of studies, Thomas E Wiswell and his colleagues at United States Army hospitals found that uncircumcised boys had an estimated 1.1 % to 4.2 % incidence of symptomatic urinary tract infections requiring hospitalization. This morbidity is reduced to an estimated 0.1 % to 0.2 % by circumcision alone [36]. Although well designed, the studies by Wiswell and his colleagues were retrospective, involved many hospitals, and was directed to a specific (military dependents) population. Before routine neonatal circumcision could be advocated, prospective study among different socioeconomic groups merits consideration.

Further evidence that the uncircumcised infant is more susceptible to urinary tract infections comes from the International Reflux Study. When the International Reflux Study compared their pooled data base populations, the only significant difference between the two groups (European versus USA) was a higher incidence (20 % versus 10 %) of males in the European group [10]. It is quite possible that circumcision has altered the incidence of urinary tract infections in the United States.

Although this finding in itself, is not an indication for routine neonatal circumcision, it may be possible for us to define a subset of patients who may benefit from circumcision. Such a group consists of boys who are found to have prenatal hydronephrosis. Postnatal care should include antibiotic prophylaxis and circumcision while further diagnostic evaluations are being pursued.

Indications and contraindications

True medical indications for circumcision are difficult to assess since so many are done at the family's wishes. Such conditions as posthitis, balanoposthitis, phimosis, and paraphimosis are extremely rare. All of these inflammatory processes, alone or in combinations, may be indications for circumcision. However, inability to retract the foreskin in the neonate is not an indication.

Circumcision is contraindicated in essentially any penile anomaly, including hypospadias, epispadias, chordee without hypospadias, or webbed penis. In one of the rare anomalies of hypospadias, there is a split glans with a meatus and megalourethra at the subcoronal area, the megameatus-intact prepuce (MIP) variant [11]. This unusual anomaly has an intact foreskin and therefore it is difficult to detect prior to routine circumcision. These can usually be detected as the foreskin is freed up from the glans fusion. Circumcision is also contraindicated by prematurity, instability, or a bleeding diathesis.

The techniques of circumcision

In the United States, neonatal circumcision is usually performed by the obstetricians in the nursery or in some cases, in the delivery suite. In the past, no anesthesia was used; this should be discouraged today. A penile block can be easily accomplished using 2 cc of 0.5 % bupivacaine (Marcaine) and

blocking the dorsal neurovascular bundle just under the symphysis. Local infiltration of Lidocaine with 1:100,000 of epinephrine is also acceptable. Most circumcisions of newborn boys are performed using one of three mechanical aids. Regardless of the choice, the penis is first examined and adhesions between the glans and prepuce are lysed with a probe or clamp. Sometimes a dorsal slit may be required.

Plastibell: After making a dorsal slit on the foreskin, an appropriate size (chosen from a selection of diameters) Plastibell ring is placed over the glans. A heavy silk ligature is placed tightly onto a groove in the ring and the redundant foreskin is excised sharply. The ring remains in place for a period of 5 to 10 days as the edges heal. The use of too tight a ring should be avoided as it will compress the glans and lead to ischemia [8].

Gomco clamp: Most obstetricians prefer this instrument. This metal device crushes the foreskin in such a way that a symmetric incision can be made and bleeding is controlled when the clamp is removed. The edges are fused together and no extra devices are left attached [13].

Mogen clamp: This device is used most often by mohuls for ritual Jewish circumcision and requires prior supervised experience before using. It is a flat crushing device that exerts an enormous amount of compression on the foreskin edges. Since the glans retracts beneath the clamp, there is a risk of excising the tip if care is not taken. Currently this is the most common litigious circumcision injury.

In older infants, a sleeve resection of the foreskin with good cautery control for hemostasis is the most acceptable method. Use of cautery with circumcision is strictly limited to direct fulguration of individual vessels. If a metal clamp has been used and cautery applied, a severe penile burn can occur with slough of the penis.

Complications

Almost all of the complications of circumcision can be avoided by adherence to simple principles: strict asepsis, removal of the correct amount of inner and outer prepuital epithelium, and adequate hemostasis. Yet many problems arise because circumcision is looked upon as a minor procedure and therefore relegated in many centers to the newest physicians, who often perform the majority of foreskin removals with little direct supervision or prior instruction [28].

Bleeding: Excessive bleeding is by far the most common complication. The reported incidence of bleeding after circumcision ranges from 0.1 % to as high as 35 %, depending on the series [13,14,17]. Although most episodes are minor and can be controlled by compression of the incision, suturing may be required. Injection of epinephrine (1:100,000) may also be helpful [1].

Infection: The reported incidence of infection ranges from 0.5 to 10 % [10,14]. A great majority are of little consequence; however, major morbidity and mortality have been reported with staphylococcal or streptococcal sepsis [5].

Asymmetric or inapropriate excision: Circumcision lends itself to errors in that excision of tissue can be too much or too little. When insufficient skin and inner preputial epithelium are removed, the penis appears not to have been circumcised. Although not a medical threat, this is the most common cause for complaint by disgruntled parents.

Removal of too much skin from the penile shaft and excision of too little inner preputial skin is the most common technical error which lead to about 2 % incidence of post-circumcision phimosis. Because of the excessive inner preputial skin, the penis dunks beneath the junction of the inner and outer incision line, which then contracts, creating a phimosis over the top of the glans. This gives the appearance of a micropenis or hidden penis or amputation of the glans. After scar contracture, the penis cannot be reduced. An incision must be made in the dorsal aspect in a vertical fashion, and closed transversely in order to relieve this condition [20,30]. Usually these complications can be avoided by marking the location of the corona on the skin surface and completely freeing the inner preputial epithelium from the glans before excising the foreskin or applying the clamp [17].

Separation of skin edges: Pediatric urologists and surgeons are often called to evaluate raw surfaces of granulating tissue created when the skin edges of a circumcision separate widely. This defect looks very worrisome at the time, but will completely heal up without a rigid scar. Penile skin has an enormous regenerative capacity with nice elastic skin. Skin grafting procedures or scrotal skin flaps are unnecessary.

Meatitis, meatal ulcer, meatal stenosis: Meatitis is a common consequence of circumcision varying between 8 % to 31 % [17]. Meatitis and meatal ulcer may occur because the glans is no longer protected by the prepuce after circumcision, and the urethral meatus is injured by the ammonia in urine-soaked diapers [28]. The most common late complication from circumcision is meatal stenosis as a result of cicatrix formation secondary to meatitis [25]. A recent theory attributes meatal stenosis to ischemia caused by ligation of the frenular artery with circumcision [23].

Skin bridges: Another late complication after circumcision is the formation of skin bridges between the glans and the skin of the penile shaft. The bridges can tether the erect penis to cause pain and penile curvature. A possible etiology may be due to insufficient excision of inner preputial epithelium leading to a fusion of shaft skin, inner preputial epithelium and glans at a single fixed point [17]. These bridges may be incised after placement of local anesthesia in the office.

Fistulas: Urethrocutaneous fistulas may occur in the subcoronal area following circumcision with clamp or Plastibell type techniques. The fistulas presumably occur because the urethra is pulled into and crushed by the circumcision clamp or is incised either with a knife. A suture placed for hemostasis of the frenular artery may erode into the urethra. The MIP variant of hypospadias is sometimes confused as a circumcision injury [11].

Lymphedema: Lymphedema is a devastating complication of circumcision which leads to genital and perineal swellings. It probably is related to the inflammation of the healing process of the circumcision that obstructs the lymph drainage. Patients may have a family history of Milroy's disease or a presence of mild edema of their genitalia at birth. It is a definite contraindication to routine circumcision. The chronic lymphedema may require excision of the entire penile and scrotal skin with skin grafting. The results are not good [4].

Penile necrosis: Necrosis of the glans or of even the entire penis has been reported, the latter being extremely rare. Distal ischemia producing such tissue loss may result from infection, use of concentrated solutions of epinephrine, or overly vigorous attempts at hemostasis with suture or cautery. Obviously, electrocautery should not be used in conjunction with a metal circumcision clamp (e.g., the Gomco clamp).

Conclusions

The most compelling argument for circumcision is to avoid the apparently higher incidence of urinary tract infections in uncircumcised infants in the first six months of age. Whether the risk of infant UTI is great enough to recommend routine neonatal circumcision, however, remains conjecture. With increased use of ultrasound in prenatal care, a subgroup of boys with antenatal hydronephrosis may benefit from neonatal circumcision. Even if consensus is unattainable, perhaps a fresh focus on research and prospective clinical studies will begin to clarify the unresolved issues.

References

1. Benton J, Schreiner RL, Pearson J: Circumcision complication reaction to treatment of local hemorrhage with topical epinephrine in high concentration. Clin Pediatr 17:285, 1976
2. Boczko S, Freed S: Penile carcinoma in young circumcised males. NY State J Med 79:1903, 1979
3. Brinton LA, Reeves WC, Brenes MM, et al: The male factor in the etiology of cervical cancer among sexually monogamous women. Int J Cancer 44:199, 1989
4. Byars LT, Trier WC: Some complications of circumcision and their surgical repair. Arch Surg 76:477, 1958
5. Cleary TG, Kohl S: Overwhelming infection with group B beta-hemolytic streptococccus associated with circumcision. Pediatrics 64:301, 1979
6. Cook LS, Koutsky LA, Hommes KK: Circumcision and sexually transmitted disease. Am J Public Health 84:197, 1994
7. Dagher R, Selzer ML, Lapides J: Carcinoma of the penis and the anticircumcision crusade. J Urol 110:79, 1973
8. Datta NS, Zinner NR: Complication from Plastibell circumcision ring. Urology 9:57, 1977
9. DeKernion JB, Tynberg P, Persky L, et al: Carcinoma of the penis. Proceedings of the National Conference on Urologic Cancer. Washington DC, American Cancer Society 1973. p.1256-1262
10. Duckett JW: The neonatal circumcision debate. In King LR (Ed). Urologic Surgery in Neonates and Young Infants. Philadelphia WB Saunders 1988. p.291-299
11. Duckett JW, Keating MA: Technical challenge of the megameatus intact prepuce of hypospadias variant: the pyramid procedure. J Urol 141:1407, 1989
12. Gairdner D: The fate of the foreskin. A study of circumcision. Br Med J 2:1433, 1949
13. Gee WF, Ansell JS: Neonatal circumcision: a ten-year overview with comparison of the Gomco clamp and the Plastibell device. Pediatrics 58:824, 1976

14. Griffiths DM, Atwell JD, Freeman NV: A prospective study of the indications and morbidity of circumcision in children. Eur Urol 11:184, 1985
15. Herbst AL: Intraepithelial neoplasia of the cervix. In Droegemueller W, Herbst AL, Mishell DR, et al (Eds). Comprehensive Gynecology. St Louis CV Mosby 1987. p.729-766
16. Herzog LW, Alvarez SR: The frequency of foreskin problems in uncircumcised children. Am J Dis Child 140:254, 1986
17. Kaplan GW: Complications of circumcision. Urol Clin North Am 10:543, 1983
18. Kessler II: Etiological concepts in cervical carcinogenesis. Appl Pathol 5:57, 1987
19. Kochen M, McCurdy S: Circumcision and the risk of cancer of the penis: a life-table analysis. Am J Dis Child 134:484, 1980
20. Levitt SB, Smith RB, Ship AG: Iatrogenic microphallus secondary to circumcision. Urology 8:472, 1976
21. Maden C, Sherman KJ, Beckmann AM, et al: History of circumcision, medical conditions, and sexual activity and risk of penile cancer. J Natl Cancer Inst 85:19, 1993
22. Marx JL: Circumcision may protect against the AIDS virus. Science 245:470, 1989
23. Persad R, Sharma S, McTavish J, Imber C, Mouriquand PD: Clinical presentation and pathophysiology of meatal stenosis following circumcision. Br J Urol 75:91, 1995
24. Oster J: Further fate of the foreskin. Arch Dis Child 43:200, 1968
25. Ross J, Elder JS: Much said, little settled about circumcision. Contemporary Urology 3:32, 1991
26. Schoen EJ, Anderson G, Bohon C, et al: Report of the task force on circumcision. Pediatrics 84:388, 1989
27. Simonsen JN, Cameron DW, Gakinya MN, et al: Human immunodeficiency virus infection among men with sexually transmitted diseases: experiences from a center in Africa. N Engl J Med 319:274, 1988
28. Synder HM: To circumcise or not. Hospital Practice 26:201, 1991
29. Swafford TD: Circumcision and the risk of cancer of the penis. Am J Dis Child 139:112, 1985
30. Talarico RD, JAsaitis JE: Concealed penis: a complication of neonatal circumcision. J Urol 110:732, 1973
31. Thompson HC, King LR, Knox E, et al: Report of the ad hoc task force on circumcision. Pediatrics 56:610, 1975
32. Villa LL, Lopes A: Human papillomavirus DNA sequences in penile carcinomas in Brazil. Int J Cancer 37:853, 1986
33. Wallerstein E: Circumcision: The uniquely American medical enigma. Urol Clin North Am 12:123, 1985
34. Warner E, Strashin E: Benefits and risks of circumcision. Canadion Med Assoc J 125:967, 1981
35. Williams N, Kapila L: Complications of circumcision. Br J Surg 80:1231, 1993
36. Wiswell TE: Circumcision-an update. Curr Prob Ped 22:424, 1992

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