CUA GUIDELINE

Canadian Urological Association guideline on the care of the normal foreskin and neonatal circumcision in Canadian infants (abridged version)

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Introduction

Circumcision is the oldest planned operative procedure in the history of human civilization, but there continues to be a lack of consensus and strong opposing views on whether universal neonatal circumcision should be adopted as a public health measure. The American Academy of Pediatrics 2012 guideline on male circumcision (MC), reversed its prior stand, stating that the "health benefits of newborn male circumcision outweigh the risks" and justify access to the procedure if the parents so choose.[1]

The following set of guidelines will investigate and provide evidence regarding the benefits of neonatal MC, its potential complications and the care of the normal foreskin in early childhood, adapted for the Canadian population and healthcare system. A more comprehensive version of this guideline describing the detailed evidence to support the proposed recommendations and including sections on MC trends, indications of pediatric MC, cost analyses, and training implications is provided in the online version of this guideline (available at *cuaj.ca*). The evidence presented is classified according to the Oxford system of evidence-based medicine, with a summary using the GRADE system.[2]

Methods

Systematic literature searches were conducted in MEDLINE, including pre-MEDLINE EMBASE, BIOSIS Previews®, Web of Science® – with Conference Proceedings, and the Cochrane Central Register of Controlled Trials electronic bibliographic databases, and were restricted to either adult or pediatric studies (</> 18 years) (January 2000–March 2013). An additional limited review was conducted until June 2016 to include any subsequent significant studies. All searches were restricted to studies published in the English language. The search strategy is described in the online version of the guideline. After excluding duplicate records and non-relevant studies, a total of 233 studies out of 2674 were included in this analysis, although some studies are only discussed in the detailed version of this guideline.

Care of the normal foreskin in childhood and management of physiological phimosis

The prepuce arises from the coronal margin by a combination of folding and epithelial outgrowth and has an outer and inner layer separated by Dartos fascia. At birth, the inner foreskin is fused to the glans penis and should not be retracted until spontaneous retraction occurs over the first few years of life. In the absence of clinical scarring suggesting pathological phimosis (Fig. 1), history of recurrent urinary tract infections (UTIs), or balano-posthitis (Fig. 2), no intervention is required for physiological phimosis. Ballooning of the foreskin during voiding is not associated with obstructed voiding and is not an indication for circumcision.[3] Vigorous retraction has the potential to cause micro-tears leading to scarring and an iatrogenic true phimosis. Therefore, normal foreskin care in early childhood starts once the foreskin is retractable and this occurs at varying ages. Indications for urological consultation include suspicion of true phimosis with evident scarring, Lichen sclerosis of the foreskin (Fig. 3), recurrent episodes of balano-posthitis or recurrent UTIs, and delayed retraction of the foreskin past 8–10 years of age.[4]

Fig 1. Pathological phimosis.

Treatment of physiological phimosis

Several observational studies and randomized trials have investigated the role of topical steroids and preputial stretching in resolving physiologic phimosis. A recent meta-analysis and several randomized controlled trials (RCTs) show significant success (60–80%) when using topical steroid creams as a treatment modality for physiological phimosis.[5-9] Success rates are not dependent on steroid potency.[10] Side effects are rare and there was no suppression of the hypothalamic-pituitary-adrenal axis provided therapy was limited to eight weeks for each course.[11] Success with this treatment modality lies in differentiating physiological and true phimosis, active counselling, and selecting patients when they are age-appropriate to attempt this treatment modality. Physiological phimosis does not require treatment unless the child has recurrent UTIs or balano-posthitis. In some instances, in an older pre-pubertal child, topical steroid therapy can be initiated for persisting physiological phimosis.[4]

Recommendations (care of the normal foreskin and physiological phimosis):
1. **Neonatal examination of the foreskin and urethral meatus should be part of routine clinical assessment of all newborn boys. Continued examination of the foreskin, without forcible retraction, is recommended during yearly physical examinations to rule out pathological phimosis and document natural preputial retraction *(Level 5, Grade D)*.**
2. **Persistent physiological phimosis in the absence of recurrent balano-posthitis or UTIs is not an indication for circumcision *(Level 5, Grade D)*.**
3. **Topical steroids are the first line of treatment for physiological phimosis with good success rates and low risk of complications *(Level 1b/2b, Grade A)*.**

Fig 2. Balano-posthitis.

4. **Moderately low-potency steroids (triamcinolone, clobetasone, hydrocortisone, mometasone) have similar success compared to a highly potent steroid (betamethasone) *(Level 2b, Grade B)*.**
5. **Patient selection to ensure compliance, demonstrating the technique of steroid application and retraction and continued retraction after initial success is important to achieve success following topical steroid therapy for physiological phimosis *(Level 5, Grade D)*.**
6. **Recurrence of physiological phimosis is common if retraction is not carried out after initial success and a repeat course of topical steroid therapy is recommended *(Level 2b/3, Grade C)*.**

Fig 3. Lichen sclerosus of the foreskin.

Circumcision and risk of UTIs

Prior evidence indicates that neonatal MC decreases the risk of UTIs,[12] but there is ongoing debate on the magnitude and duration of this effect. The role of circumcision in preventing UTIs must be studied in two distinct subgroups: males with normal urinary tracts and those with recurrent UTIs or urological conditions predisposing to UTIs like antenatal hydronephrosis, vesico-ureteric reflux (VUR), posterior urethral valves, neurogenic bladders, and primary megaureters. In boys without predisposing urological conditions, the estimated incidence of UTI in the first 10 years of life varies from 1–2%.[12,13] In a meta-analysis of febrile infants (males and females 0–24 months), Shaikh et al estimated the prevalence of UTI was 7 %, with males under three months having the highest prevalence.[14]

Boys with normal urinary tracts

Previous studies have shown that the risk of UTI is increased in uncircumcised males.[13,15-21] In a case-control study from Australia that included children with urological abnormalities, Craig et al showed that the protective effects of MC in infants, was marginally significant (odds ratio [OR] 0.03; 95% confidence interval [CI] 0.06–1.1); however, this effect was not observed beyond infancy (OR 0.2; 95% CI 0.01–3.7).[21] A systematic review (SR) by Singh-Grewal supported the beneficial effects of MC on pediatric UTI risk (OR 0.13; 95% CI 0.07–0.23).[16] Assuming a 1–2% circumcision complication rate and a 1% UTI risk in normal infants, universal neonatal circumcision is hard to justify based on a number needed to treat (NNT) of 111.[16] Even if we accept a lower complication rate of 0.2% and a 2% UTI risk, given the effectiveness of UTI treatment, six UTIs will be prevented at the expense of one MC complication. A recent SR conducted by Morris et al calculated the lifetime risk of a UTI to be 32% in uncircumcised males compared to 9% in circumcised males.[22] The authors suggested a lower NNT of 4.2 (95% CI 2.2–27) for preventing one UTI, albeit, over a lifetime.

Boys with abnormal urinary tract

In urological conditions like high-grade VUR, posterior urethral valves, and primary megaureters, the risk of UTI is higher. In patients with VUR, circumcision was more effective than antibiotic prophylaxis alone or surgical correction in preventing UTIs and the occurrence of new dimercaptosuccinic acid (DMSA) abnormalities.[23-25] Similar results were seen in boys with posterior urethral valves[26] and infants with significant antenatal hydronephrosis.[27] In this subset of boys, with a risk of recurrent UTI (assuming 10% UTI risk, the NNT is 11) and for boys with urological abnormali-ties (assuming 30% UTI risk high-grade VUR, the NNT is four), a circumcision should be considered.[16] Topical steroid treatment of physiological phimosis to allow retraction and hygiene or antibiotic prophylaxis are other viable options for these children.

Recommendations (circumcision and UTIs):
1. **Neonatal circumcision decreases the risk of UTI during early childhood (Level 2a), but the overall risk of UTI is low in infant males beyond three months of life and decreases further beyond infancy (Level 2b–4).**
2. **There is paucity of Level 1 evidence to justify recommending universal neonatal circumcision to prevent UTIs in normal males.**
3. **A stronger effect of neonatal circumcision in preventing UTIs in boys with posterior urethral valves and significant antenatally detected hydronephrosis has been demonstrated and, therefore, it is recommended that a discussion regarding MC with the parents is advisable for these neonates (Level 3–4, Grade C).**

Circumcision and risk of sexually transmitted infections

A decreased risk of human immunodeficiency virus (HIV) and other sexually transmitted infections (STIs) is the primary argument driving a change in risk-benefit assessment of MC.

1. HIV

A recent Public Health Agency of Canada reported an estimated HIV prevalence rate of 208 per 100 000 population, with an 11.4% increase compared to 2008 estimates.[28] Men who have sex with men (MSM) accounted for 47% of prevalent infections, followed by intravenous drug users (17%) and heterosexual individuals (17.6%).

Based on RCTs conducted in high HIV prevalence sub-Saharan Africa, there is clear Level 1 evidence that MC reduces the risk of HIV infection in heterosexual men (Table 1).[29-31] In 2007, the WHO and UNAIDS recommended MC in HIV-prevalent areas in combination with the promotion of "ABC" (abstinence, behaviour change, and correct and consistent condom use).[29] The protective effect of circumcision against HIV infection has been attributed to decreased coital trauma, decreases in prevalence of Langerhans cells, as well as increased keratinization of the glans.[32-34]

Female to male HIV transmission

Several RCTs and a meta-analysis of 15 observational studies conducted in 2000 supported a protective effect of MC against HIV infection (adjusted relative risk [RR] 0.42; 95% CI 0.34–0.54%).[29-31,35,36] A Cochrane review of the three African trials supported the finding that MC is protective

Table 1. The three randomized trials on circumcision and HIV prevention											
Study (location, time period)	Allocation concealment	Blinding	Inclusion criteria	n	Followup	Lost to followup	AEs	Outcomes	ITT RR (95% CI)	As treated RR (95% CI)	Covariate adjusted RR
Auvert et al (South Africa, 2002–2005)	Partial	Study personnel	Male 18–24, wishing to be circumcised	3274	Stopped at 63% of total anticipated person-years	251 (8%), 30% in circumcised and 33% uncircumcised	3.8%	Intervention: 20/1546 Control: 49/1582	0.42 (0.25–0.70)	0.24 (0.14–0.44)	0.39 (0.23–0.66)
Bailey et al (Kenya, 2002–2006)	Unclear	HIV testers, nurses counselling and doing questionnaires partially blinded	HIV-negative, 18–24 years	2784	Stopped at 87% followup	86% (1501) completed 24-month followup, overall 1283/2784 (46%) did not complete trial	1.7%	Intervention: 22/1388 Control: 47/1392	0.47 (0.28–0.78)	0.45 (0.27–0.76)	0.44–0.47
Gray et al (Uganda 2002–2006)	Partial	None specified	HIV-negative, 15–49 years	4996	Stopped at 72% person-time accrual	22% at 24 months followup	8 %	Intervention: 22/2387 Control: 45/2430	0.49 (0.28–0.84)	0.45 (0.25–0.78)	0.49 (0.29–0.81)

AE: adverse events; CI: confidence interval; ITT: intention-to-treat; RR: relative risk.

against female to male HIV transmission (IRR 0.5; 95% CI 0.34–0.72 at one year and IRR 0.46; 95% CI 0.34–0.62 at two years).[36]

Male to male HIV transmission

Evidence of an association between circumcision status and HIV infection in MSM is limited to observational studies, often not stratified by receptive and insertive roles. It is believed that men who practice an insertive role could likely benefit from MC, while those who perform a receptive role may have little or no protection. In a Cochrane review by Wiysonge et al (six cohort, 14 cross-sectional, one case-control; 71 693 participants), risk for HIV acquisition in MSM males was not altered by MC (OR 0.86; 95% CI 0.7–1.06).[37] In a subgroup analysis of men reporting an insertive role, MC was found to be protective (OR 0.27; 95% CI 0.17–0.44). A previous meta-analysis by Millett et al in 2008 similarly concluded that MC is not protective against MSM HIV transmission.[38]

Male to female HIV transmission

MC can potentially decrease female partner HIV infection directly or indirectly by reducing overall male prevalence of HIV at the population level; however, a Ugandan RCT and a meta-analysis of observational studies found that MC did not provide any protective effects against male to female HIV transmission.[39,40]

Several factors need to be considered to make appropriate recommendations for our population. The MC rate in the three African countries ranged from 10–20% and HIV prevalence from 7–25%. In contrast, the Canadian MC rate is around 35–40% and HIV prevalence is much lower, leading to a potentially higher NNT. In addition, in Canada, only a small proportion of HIV transmission is attributed to heterosexual activity and evidence suggests that MSM men are not protected by MC. Variations in sexual practices, education, behaviour (condom usage), differences in STI prevalence, and access to healthcare are likely to modify the magnitude of the protective effects. In addition, the long-term effectiveness of MC beyond two years is available only for the Ugandan trial.[41] The possibility of behavioural disinhibition leading to unsafe sexual practices, which can potentially offset the protective effect of MC, has been documented in several followup studies of the African RCTs.[41,42]

Recommendations (circumcision and HIV):
1. **Female to male transmission: There is compelling evidence that MC reduces the risk of HIV transmission from female partners to male *(Level 1 A, Grade A)*. The magnitude of the effect may not be similar to the African trials in Canada and is not established for neonatal MC.**
2. **Male to male transmission: Based on current evidence, MC does not provide protection for men who have sex with men *(Level 2a)*.**
3. **Women partners: Based on current evidence, MC is not protective for female partners *(Level 2a–b)*.**
4. **Based on current evidence, universal neonatal circumcision cannot be recommended to prevent HIV infection *(Grade B)*.**

2. Human papilloma virus (HPV)

Human papilloma virus (HPV) is the most common STI worldwide and up to 75% of Canadians will have at least one lifetime HPV infection.

The effect of MC on HPV is difficult to interpret, as HPV infection can be transient and can affect multiple genital areas. In addition, HPV prevalence, incidence, clearance, and viral load are all potential outcomes with differing health implications.

HPV in men

Two meta-analyses were conducted evaluating the effect of MC on HPV.[43,44] Albero et al analyzed data from 14 observational studies and two RCTs.[44] Accepting heterogeneity, data from the two RCTs showed a strong inverse association between MC and high-risk HPV prevalence (OR 0.67; 95% CI 0.54–0.82). The 14 prevalence studies showed a similar pooled result of HPV prevalence. There was no association between MC and incident HPV infections or clearance. A previous MA conducted by Larke et al also showed similar prevalence results (OR 0.57; 95% CI 0.45–0.71).[43] There was weak evidence that MC was associated with decreased HPV incidence (RR 0.75; 95% CI 0.57–0.99) or clearance (RR 1.33; 95% CI 0.89–1.98).

HPV in female partners

Two trials conducted on HIV-positive and -negative men in Uganda analyzed transmission of HPV to female partners.[45,46] In the first trial on HIV-negative men, the prevalence of HR-HPV infection in female partners was lower in the circumcised group (PRR 0.72; 95% CI 0.60–0.85).[45] The clearance rate for all genotypes (except HPV 16) was improved in females with circumcised partners (p=0.014). In a second trial on female partners of HIV-infected men, Tobian et al showed that MC was not associated with lower HR-HPV prevalence (PRR 1.07; 95% CI 0.86–1.32).[46]

The benefits of MC on HPV prevalence and incidence has to be balanced against the effectiveness of condom usage and HPV vaccination.[47,48]

Recommendations (circumcision and HPV):

1. **HPV prevalence in men: Current evidence suggests a modest decrease in HPV prevalence in the glans and coronal sulcus up to two years following MC (Level 1b). The protective effect is partial, does not cover all high-risk types, and is weaker further away from the glans and coronal sulcus. It is not clear whether this effect will persist into adulthood following neonatal circumcision.**
2. **HPV clearance in men: There is no evidence (except a single RCT on HIV-negative men) that MC increases HPV clearance (Level 1b–2b). Theoretically, if MC increases clearance this may also inflate the impact on HPV prevalence.**
3. **HPV incidence or acquisition in men: There is no convincing evidence to suggest that MC decreases HPV acquisition or affects HPV incidence in HIV positive or negative men (Level 1b–2b evidence).**
4. **HPV in female partners: MC possibly lowers prevalence, incidence, and clearance in female partners of HIV-negative men (Level 1b–2b).**
5. **As a public health intervention, universal neonatal MC is not justifiable given access to HPV vaccination and baseline socioeconomic and educational status (Grade B).**

3. Non-ulcerative STIs, genital ulcer disease (GUD), and ulcerative STIs

The most common non-ulcerative STIs are gonorrhea, Chlamydia, and Trichomonas infections. Two RCTs have addressed the role of MC in these infections.[49,50] In the Kenyan study, there was no association between MC and non-ulcerative STIs (hazard ratio [HR] 0.64; 95% CI 0.50–0.82), although condom usage was protective.[49] The South African trial showed lower Trichomonas vaginalis infection in men in an as-treated analysis (adjusted OR 0.47; 95% CI 0.25–0.92).[50] A meta-analysis of 30 observational studies failed to identify a statistically significant association between non-ulcerative STIs and MC.[51] In another prospective study, uncircumcised male partners had a higher risk of Trichomonas vaginalis infection compared to circumcised partners of Trichomonas vaginalis-infected women (OR 1.8; 95% CI 1.1–3.2).[52] In a prospective cohort study, MC did not have any protective effect on female partners with regards to chlamydial, gonococcal, and trichomonal infections.[53]

Herpes simplex virus (HSV), *T. pallidum* (syphilis), *H. ducreyi* (chancroid), and *K. granulomatis* (donovanosis) are the common causes of GUD. Women and men with GUD and HSV-2 have a higher risk of acquiring or transmitting HIV and conversely HIV infection increases the risk of GUD.[54,55] In a meta-analysis of observational studies, MC was not associated with a decreased risk of HSV-2 seropositivity (RR 0.88; 95% CI 0.77–1.01).[56] There was a protective effect of MC on syphilis seropositivity (RR 0.67; 95% CI 0.54–0.83) and the results for chancroid infections was unclear. In HIV-positive men, Tobian et al showed a lower risk of HSV-2 seroconversion in the circumcised group (adjusted IRR 0.70; 95% CI 0.55–0.91).[57] Consistent condom usage had a slightly higher protective effect. In HIV-negative men, the partial protective effect of MC against HSV-2 seroconversion was similar.[58] Multivariate analysis of South African RCT data did not show a protective effect of MC against HSV-2 seroincidence (IRR 0.68; 95% CI 0.38–1.22).[59] Mehta et al conducted an RCT in Kenya and observed that HSV-2 incidence did not differ by circumcision status (RR 0.94; 95% CI 0.7–1.25), but HSV-2 incident infection tripled the risk of HIV acquisition.[60]

Male to male HSV-2 transmission

In a Cochrane review of MSM males, MC did not have a protective role in preventing syphilis (OR 0.96; 95%

CI 0.82–1.13) or HSV-2 infections (OR 0.86; 95% CI 0.62–1.21).[61]

Non-ulcerative and ulcerative STIs in female partners

Gray et al followed HIV-negative women married to men randomized to circumcised and non-circumcised groups.[62] Adjusted analyses suggested a 22% circumcision efficacy for GUD (95% CI 0.61–0.99), a 45% efficacy for Trichomonas (95% CI 0.34–0.89), and a 18% efficacy for bacterial vaginosis (95% CI 0.74–0.91). In the Ugandan RCT on HIV-negative men, MC did not reduce the risk of HSV-2 acquisition in women partners.[63]

Recommendations (circumcision and ulcerative/non-ulcerative STIs):
1. **Currently, there is no significant evidence to support the protective role of MC in the acquisition of non-ulcerative STIs, although there may be a protective effect on acquisition of Trichomonas infections (Level 2a–b, Grade B).**
2. **Currently, there is no significant evidence to support the protective role of MC for males and females in the acquisition of ulcerative STIs (Level 2–4, Grade C).**
3. **There is weak evidence of a partial protective effect of MC against HSV-2 infections in adult men following MC (Level 2a–b).**

Circumcision and penile cancer

In a MA of eight studies, Larke et al showed that MC <18 years of age was protective against invasive penile cancer (OR 0.33; 95% CI 0.13–0.83).[64] In a matched case-control study, Tsen et al showed that phimosis was a strong risk factor for invasive penile cancer.[65] The protective effect of neonatal MC was not statistically significant when the analysis was restricted to those who did not have a history of phimosis (OR 0.79; 95% CI 0.29–2.6). In another case-control study from Denmark, penile cancer was associated with phimosis (OR 4.9; 95% CI 1.85–13.0), but not childhood circumcision (p=0.33).[66] Daling et al also showed that after excluding patients with phimosis, lack of childhood MC was not a risk factor for penile cancer.[67] Penile cancer is strongly associated with other risk factors like smoking, sexual practices, and HPV infection, which can be modified, as opposed to universal MC.[68]

Recommendations (circumcision and penile cancer):
1. **Circumcision decreases the risk of penile cancer (Level 2–3).**
2. **However, given the low incidence of invasive penile cancer, the partial protective effect of MC, and the availability of other preventive strategies (like HPV vaccination, condom usage, and smoking cessation programs), it is difficult to justify universal neonatal circumcision as a preventive strategy for preventing penile cancer (Grade B).**

3. **Recognition and treatment of phimosis during regular health visits is recommended to decrease the risk of penile cancer (Level 5, Grade D). A genitourinary exam during puberty is recommended to ensure preputial retractability and hygiene, and counsel regarding HPV vaccination and safe sexual practices (Grade D).**

Circumcision and prostate cancer

A recent case-control study showed no protective effect of MC on prostate cancer (OR 0.87; 95% CI 0.74–1.02).[69] Another population-based study from Montreal also demonstrated no significant overall protective effect of MC (or infant MC), but the results where significant for men circumcised at ≥36 years of age (OR 0.55; 95% CI 0.30, 0.98).[70] A U.K. study did not find any significant correlation between MC and prostate cancer.[71]

Recommendations (circumcision and prostate cancer):
1. **There is no convincing evidence to suggest any protective effect of MC against prostate cancer (Level 3–4, Grade B).**

Role of the foreskin in sensation and sexual function

There is ongoing controversy regarding the impact of circumcision on penile sensitivity and sexual satisfaction. The primary question is whether loss of sensory nerves in the foreskin or a possible decrease in glans sensitivity impacts sexual satisfaction, after accounting for several confounders.

A recent meta-analysis included 10 studies to assess the impact of MC on sexual function.[72] There were no significant differences in sexual desire, dyspareunia, premature ejaculation, ejaculation latency time, or erectile dysfunction between circumcised and uncircumcised men. A secondary analysis of the Ugandan RCT showed no long-term differences in 4456 men for sexual desire, satisfaction, and erectile dysfunction.[73] A similar trial from Kenya found contradictory results where uncircumcised men reported an increase in sexual satisfaction.[74] In a study multinational study, a stopwatch and a blinded timer were used to measure intravaginal ejaculation latency time (IELT); results showed that MC and condom use did not impact IELT.[75]

Sexual function in partners

In an analysis of self-reported sexual experience in women partners of men before and after circumcision, Kigozi et al showed no changes in 57% and improved sexual satisfaction in 40%.[73] In a study comparing uncircumcised and circumcised homosexual men, Mao et al noted no differences in sexual difficulties or type of anal sex practiced.[76]

Conclusions (circumcision and sexual function): There is lack of convincing evidence that adult male circumcision impacts sexual function *(Level 3-4, Grade C).*

Contraindications of neonatal circumcision

Neonatal circumcision should be performed on stable infants who do not have associated congenital anomalies of the penis (Figs. 4–9). In some off these conditions, MC can be performed with appropriate technical modifications. Children with blood dyscrasias can undergo MC after appropriate treatment.[77]

Anesthesia for neonatal circumcision

It is clear that neonatal circumcision must be performed with adequate anesthesia and analgesia.[78,79] The adverse physiological and behavioural responses of inadequate pain control in neonates is convincing, can lead to potential complications, and alter long-term pain responses in the neonate. Different methods used for providing anesthesia and/or analgesia during circumcision includes general anesthesia, topical anesthetics, penile nerve blocks, oral sucrose-glucose administration, non-nutritive sucking, caudal block, and various combinations of the above.[78,79]

The three topical anesthetic options currently available include lidocaine-prilocaine 5% cream (EMLA), tetracaine 4% gel, and liposomal lidocaine 4% cream. Dorsal penile nerve block (DPNB) and ring blocks are effective techniques to manage circumcision-related pain. Based on the Cochrane review by Brady-Fryer, a DPNB is the most effective intervention for circumcision-related pain, with the caveat that the injection is performed appropriately.[78] Oral administration of sucrose, glucose, or parenteral acetaminophen are not sufficient as sole measures for relieving the pain associated with circumcision.[78-80]

Recommendations for anesthesia and analgesia for neonatal circumcision:
1. A DPNB with a ring block, using proper technique, is the most effective technique to provide anesthesia during a neonatal circumcision *(Level 1–2, Grade A).*
2. Topical local anesthetics alone are inferior to nerve and ring blocks and require an adequate time interval for efficacy; they can be used as an adjunct to penile blocks *(Level 1–2, Grade A).*
3. Oral sucrose, non-nutritive sucking, music, and other environmental interventions should only be used as an adjunct to the above methods *(Level 1–3, Grade A).*

Complications of circumcision

Neonatal circumcision is a safe surgical procedure and complications vary depending on surgeon experience, technique used, age at MC, anatomical factors, and the accuracy and degree of postoperative reporting. Proper preoperative assessment to recognize possible complicating anatomical factors (penoscrotal webbing, ventral skin deficiency, suprapubic fat pad) and adequate postoperative instructions to ensure retraction of the residual shaft skin can prevent most complications.

Overall complication rates

Several studies have investigated the complication rates of neonatal MC.[81-86] A recent SR on complications of neonatal MC noted a wide 0–16% (median 2%) range of adverse events in 16 prospective studies.[81] The previous AAP Task Force on Circumcision reported a complication rate of 0.2–0.6%,[83] while the Canadian Pediatric Society published complication rates as high as 2%.[84]

Post-circumcision complications can be divided into

Fig 4. Hypospadias.

Fig 5. Epispadias.

Fig 6. Peno-scrotal webbing.

Fig 7. Concealed penis.

early and late complications.[81-87] Early complications include bleeding, infection, glans necrosis/amputation, delayed or early slippage of circumcision devices, and very rarely, death. Late complications include inadequate skin removal, inclusion cysts, adhesions and skin bridges, suture sinus tracts, ventral curvature, secondary buried penis and phimosis, urethro-cutaneous fistulae, and meatal stenosis.[87]

Conclusions regarding circumcision complications:

1. **Complication rates following neonatal MC range from 0.6–2%, depending on accuracy of reporting. Given the variability in complication rates and risk of delayed complications, the overall complication rate for neonatal MC may be higher than quoted in the literature *(Level 2–4).***
2. **Operator experience, recognition of contraindications to MC, technique used, age, and patient-related variables can potentially impact complication rates *(Level 4, Grade D).***

Summary of results and recommendations

The benefits of neonatal MC have to be analyzed at the individual and societal level and be objectively balanced against the complication rates, healthcare costs, and implications to our healthcare system. For a minority of Canadian neonates, there are well-defined advantages of a circumcision, but the magnitude of these benefits is not clearly defined. In addition, the protective benefits of MC are not comprehensive, may not last over a lifetime and can be achieved by other preventive health measures, which do not involve a surgical procedure.

The GRADE system is an appropriate method to employ when the evidence is variable in quality and generalizability.[2] We did not perform a GRADE effects calculation

Fig 8. Ventral curvature.

Fig 9. Megameatus intact prepuce hypospadias variant.

Table 2. Benefits of circumcision classified by GRADE recommendations

Clinical benefit	Direction of evidence	Amount of effect	Level of evidence	GRADE quality of evidence	GRADE strength of recommendation
Decreased risk of UTI	Positive	0.07–0.23	Level 2	Low-quality	Weak
Decreased risk of HIV	Positive	0.34–0.62	Level 1	High-quality	Strong*
Decreased risk of HPV prevalence	Positive	0.57–0.77	Level 1	Moderate-quality	Weak
Decreased risk of HPV incidence	Unclear	NS	Level 2	Low-quality	Weak
Decreased risk of HSV	Positive	0.36–0.91	Level 2	Moderate-quality	Weak
Decreased risk of penile cancer	Positive	0.13–0.83	Level 2	Low-quality	Weak

*Concerns related to external validity of data for Canadian population. HPV: human papilloma virus; HSV: herpes simplex virus; UTI: urinary tract infection.

analyses for our outcomes, but used the methodology to objectively classify the quality of evidence we present to support our recommendations (Table 2).

A decision to proceed with neonatal MC requires a thorough discussion on the pros and cons of the procedure. This would allow parents contemplating a MC to make a well-informed choice. Given the socioeconomic, educational status, and health demographics of our population, universal neonatal circumcision cannot be justified based on the current evidence available.

Competing interests: The authors report no competing personal or financial interests.

This paper has been peer-reviewed.

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