Review Article

A Systematic Review of Urethral Complications Following Male Circumcision: The Importance of Provider Training

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Abstract

Background: Male circumcision is one of the most common elective surgical procedures worldwide. Adverse events affecting the urethra may occur following the procedure. **Aim:** The aim of this paper is to provide a review of the existing literature on urethral complications of male circumcision. **Materials and Methods:** A search of PubMed and Google Scholar was conducted between November 20, 2020, and November 30, 2020 and updated on January 12, 2021. Several keywords related to male circumcision were searched on the two databases. A further manual search of the reference lists of relevant papers was carried out. Studies that reported frequencies of urethral complications following circumcision were included in the analysis. A total of 83 candidate papers were identified and studied before arriving at 38 studies that contained sufficient information suitable for the analysis. **Results:** Overall, we found that the reported frequencies of urethral complications of male circumcision varied (range 0.01% to 39%; median 1.7%). Meatal stenosis (MS) and urethrocutaneous fistula (UCF) were by far the most frequently reported urethral complications of male circumcision with cases reported in 30 and 18 studies, respectively. Meatitis and urethral stricture were the other urethral complications found in our search. **Conclusion:** The urethral complications of male circumcision we found were UCF, MS, meatitis/meatal ulcer, and urethral stricture. Neonatal circumcision and circumcision by untrained providers are associated with higher incidences of urethral tragedies following male circumcision. The type of male circumcision provider is also a determinant of the frequency of complications.

Keywords: Circumcision complications, male circumcision, prevention, urethra

Introduction

Male circumcision is among the earliest and most widely practised elective surgical procedures globally.[1-3] It involves the removal of all or part of the prepuce of the penis. Around 1 in 3 males are circumcised worldwide.[1] The most common determinant of male circumcision is the religion with almost universal coverage in Muslims and Jews.[1,2] Male circumcision is also performed for medical reasons ranging from preventive to therapeutic. Male circumcision has been shown to be preventive against urinary tract infections[4] and penile cancer.[5] Despite the body of evidence and recommendations, male circumcision remains a highly contentious procedure, especially in Western societies with opponents arguing that the associated risks outweigh the benefits.

Although male circumcision is often regarded as a minor surgical procedure, it has its complications. Urethral complications following male circumcision, although uncommon,[6] have been well documented in the medical literature. The male urethra is defined as the tubular structure that extends from the neck of the bladder to the urethral meatus on the glans penis and functions to convey urine and semen to the exterior of the body. This paper aimed to provide a comprehensive review of the existing literature on urethral complications following male circumcision.

Materials and Methods

Search strategy and selection criteria

A search of PubMed and Google Scholar was conducted between November 20, 2020 and November 30, 2020 and updated on January 12, 2021. The keywords for the search were

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"male circumcision complications," "circumcision urethra injury," "complications urethra," "meatitis circumcision," "meatal ulcer circumcision," "urethra stricture circumcision," "urethrocutaneous fistula circumcision," "meatal stenosis circumcision," "urethra avulsion circumcision," and "urethra laceration circumcision." The search involved scanning through the abstracts of published literature on complications of male circumcision to identify those papers that contained information on urethral complications. A further manual search of the reference lists of relevant papers was carried out and a total of 83 candidate papers were identified. Full copies of the papers were obtained and studied. Studies that reported frequencies of urethral complications following circumcision were included in the analysis.

After studying the candidate papers, we arrived at 38 studies that contained sufficient information suitable for the analysis. One was a multinational study while 37 were from studies conducted in 17 countries. The multinational study reported on circumcisions carried out in 17 countries of low socioeconomic status. All circumcision-related adverse events affecting the male urethra were considered in our analysis. There were no publication year limitations; however, only papers published in English were included. Since meatitis can be ulcerative or non-ulcerative, reported cases of meatitis and meatal ulcer were considered as belonging to the same group with the terms henceforth used interchangeably. Although glans amputation may be accompanied by urethral injury, especially in complete amputation, it was not included in the analysis as it represents a separate entity. We excluded a study from Nigeria because it did not specify the nature of the urethral injury reported.

Analysis methods

Data extraction and analysis were done using Microsoft Excel version 15.36. We report the frequencies of urethral complications, age at circumcision, indications for circumcision, circumcision methods used, and types of circumcision providers.

Results

Urethral complications of male circumcision

Overall, we found that the reported frequencies of urethral complications of male circumcision varied (range 0.01% to 39%; median 1.7%) [Table 1]. However, higher frequencies (1.33%–100%) of urethral complications were reported in studies that only analyzed patients who had complications of male circumcision [Table 2]. Meatal stenosis (MS) and urethrocutaneous fistula (UCF) were by far the most frequently reported urethral complications of male circumcision with cases reported in 30 and 18 studies, respectively. The other reported urethral complications of male circumcision were meatitis which was reported in two studies and urethral stricture which was reported in one study.

Age at circumcision ranged from six hours to 18 years. In thirteen of the reviewed papers,[7-19] all or most circumcisions were carried out before the age of 1. Majority were performed during the neonatal period and this age group showed a high frequency of urethral complications. Ekenze and Ezomike prospectively studied 64 neonates that presented with complications of male circumcision at a Teaching Hospital in Nigeria.[15] Of these, 39% had complications affecting the urethra (MS-21.9%, UCF-17.2%). Nurses (84.4%), traditional practitioners (7.8%), and doctors (7.8%) performed the circumcision. A limitation of this study was the inability to ascertain the total number of cases performed in the population.

The most common method of circumcision was the Plastibell.[7-13,20,22-25] Other methods used in the studies we reviewed were the Gomco clamp, Guillotine, dissection, scalpel, bone cutter, freehand, and forceps-guided methods.[7,10,13,14,20,22,23,26-31] Five authors also reported that paediatric surgeons and urologists (except in one instance) used thermocautery together with some of the above techniques to perform male circumcision.[27,28,31-34] Few urethral complications were seen in those series. A Danish study examined the rate of complications following thermocautery-aided male circumcision by paediatric surgeons.[33] A total of 315 boys aged between three weeks and 16 years were circumcised and only 2 (0.6%) developed a urethral complication (MS).

Six studies did not report the type of male circumcision provider.[14,16,23,35-37] In most studies that reported the type of provider of male circumcision, doctors had the lowest urethral complication rates, followed by nurses then traditional circumcisers. One study that clearly showed this association was a Nigerian study[19] of 45 boys who presented with major complications of male circumcision at a University Teaching Hospital. A total of 29 (64.4%) boys had complications involving the urethra with UCF found in 25 (56%) and MS in 4 (8.9%). Notably, the boys had been circumcised by nurses (62.2%), traditional circumcisers (22.2%), quacks (8.9%), and doctors (6.7%).

Discussion

Urethral complications of male circumcision have significant physical, financial, psychological, and reproductive consequences. Complications of male circumcision can be classified into mild and severe. Any urethral complication is either severe or potentially severe. For a procedure as common as male circumcision, the rates of urethral complications we found in our review are high. The determinants of the high frequencies observed are age at circumcision, circumcision technique used, and type and training of the circumciser. We present results stratified by these factors to explore the association with the frequency of urethral complications.

Urethral complications of male circumcision are among the most well-known severe complications of male circumcision. Some authors have found that urethral complications of male circumcision are rare.[6,34] However, they may not be as uncommon as reported by these authors. The prevalence of meatitis, for instance, is poorly reported. Ademuyiwa *et al*. found cases of meatitis during their study but did not

Table 1: Prevalence of urethral complications in studies of male circumcision

Authors	Country	Years of study	Number of patients studied	Number of circumcised patients	Age at circumcision	Provider	Method	Indication	Overall frequency of complications (%)	Overall frequency of urethral complications (%)	Type of urethral complication (%)
Akyüz *et al.*[27]	Turkey	2009-2016	12,355	12,355	40 days-16 years	Urologist	Guillotine[a]	-	1.51	0.02	MS-0.02
Atikeler *et al.*[38]	Turkey	1999-2002	407	407	1.5-14 years	Traditional circumcisers Health technicians	-	-	85.01	2.94	MS-2.45 UCF-0.49
Cakiroglu *et al.*[28]	Multiple	2016-2019	32,000	32,000	7 days-17 years	Paediatric urologist	[a]	-	2.49	0.02	MS-0.018
Ghods *et al.*[20]	Iran	2006-2012	2389	2389	Six years and below	Surgeon	Plastibell-66.5% Conventional dissection	-	1.7	1.70	MS-1.7
Griffiths *et al.*[29]	England	1983	140	140	3 months-14 years	Surgeon	Dissection	Medical Religious	6.4[b]	2.90	MS-2.9
Jamal *et al.*[22]	Saudi Arabia	1985-1988	1000	1000	-	Medical personnel-710/1000 Nonmedical personnel-290/1000	Unknown-542/1000 Bone cutter-418/1000 Plastibell-20/1000 Dissection-20/1000	Religious	18.3	0.20	UCF-0.1 MS-0.1
Jones *et al.*[30]	UK	2015-2019	300	300	3-16 years	Surgeon	Modified guillotine	Medical	3.7	2.70	MS-2.7
Kamil[14]	Iraq	2000-2005	121	121	4-28 days	-	Bone cutter	-	5.9	1.70	MS-1.7
Karami *et al.*[11]	Iran	2007-2009	1102 intact frenulum	1102	6-36 hours	General urologist	Plastibell	-	13.80	13.80	MS-13.8
Karami[11]	Iran	2007-2009	1205 frenular hemostasis	1205	6-36 hours	General urologist	Plastibell	-	18.90	18.90	MS 18.9
Leitch[39]	Australia	Published 1970	200	200	Mean age-two years four months	Surgeon Surgical registrars Resident medical officers	-	Medical Social[c]	15.5	5.50	Meatal ulcer-4 MS-1.5
Mousavi *et al.*[23]	Iran	2013	1000	1000	1 month-12 years	-	Suture-62.4% Plastibell-37.6%	-	21	2.30	MS-2.3
Bastos Netto *et al.*[24]	Brazil	2009-2011	119	119	2-12.5 years	Surgeon	Plastibell	Medical	32.7	0.80	MS-0.8
Nguyen *et al.*[25]	USA	2013-2018	508	508	1-6 months	Paediatric surgeon	Plastibell	Cultural Religious Medical	0.20	0.20	MS-0.2
Osuigwe *et al.*[12]	Nigeria	2001	141	141	Most at 7-9 days	Doctors-53.9% Nurse/midwife-44.0% Traditional birth attendant-2.1%	Plastibell-68.1% Traditional-31.2%	-	24.1	5.60	MS-3.5 UCF-2.1

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Table 1: Contd...

Authors	Country	Years of study	Number of patients studied	Number of circumcised patients	Age at circumcision	Provider	Method	Indication	Overall frequency of complications (%)	Overall frequency of urethral complications (%)	Type of urethral complication (%)
Patel[13]	Canada	1961-1962	100	349	Most at 3-5 days	Doctors-98/100 Not specified-2/100	Plastibell Gomco clamp Unspecified	Prophylactic[d] Social Other nonmedical	55	39	Meatal ulcer-31 MS-8
Thorup *et al*.[33]	Denmark	1996-2003	315	315	3 weeks-16 years	Paediatric surgeon	[a]	Ritual	5.1f	0.60	MS-0.6
Tuncer and Deger[32]	Turkey	2014-2016	1780	1780	14 days-18 years old	Surgeon	Guillotine[a]	-	0.6	0.11	Meatitis-0.11
Tuncer and Deger[32]	Turkey	2014-2015	2062	2062	0-18 years	Paediatric surgeon	Clamp Conventional[a]	-	1	0.01	Meatitis-0.01
Yegane *et al*.[34]	Iran	2002	3205	3125	Most after two years	Traditional circumciser-43.49% Surgeon/ urologist-31.64% General practitioners/ paediatricians-18.91% Paramedical personnel-5.95%	-	-	7.39	0.90	MS-0.9

MS: Meatal stenosis, UCF: Urethrocutaneous fistula

Table 2: Prevalence of urethral complications in studies of complicated male circumcision

Authors	Country	Years of study	Number of patients studied	Age at circumcision	Provider	Method	Indication	Overall frequency of urethral complications (%)	Type of urethral complication (%)
Ademuyiwa *et al.*[35]	Nigeria	2008-2010	36	-	-	-	-	50	UCF-41.7 MS-8.3
Ahmed *et al.*[36]	Nigeria	1981-1995	48	-	-	-	-	16.65	UCF-10.4 MS-6.25
Appiah *et al.*[7]	Ghana	2012-2014	72	Neonatal-94.4% postneonatal-5.6%	Nurses-77.8% Traditional circumcisers-20.8% Doctors-8.3%	Unknown-51.4% Scalpel-44.4% Plastibell-4.2%	-	77.80	UCF-77.8
Bhat *et al.*[40]	India	2008-2012	59	-	Nonmedical personnel-most procedures Medical personnel	-	-	43.30	UCF-28 MS-15.3
Bode *et al.*[8]	Nigeria	2004-2007	23	6–19 days	Doctors-18 nurses-5	Plastibell	-	39.10	UCF-39.1
Ceylan *et al.*[41]	Turkey	1995-2004	48	-	Most by inexperienced personnel	-	-	33.40	MS-23 UCF-10.4
Dörterler[21]	Turkey	2012-2019	103	-	Circumciser/health officer-66% Physician-34%	Plastibell Unspecified	-	3.90	MS-3.9
Ekenze and Ezomike[15]	Nigeria	2006-2012	64	2–21 days	Nurses-84.4% Traditional practitioner-7.8% Medical officers-7.8%	-	-	39.10	UCF-17.2 MS-21.9
Emeka[9]	Nigeria	2015-2019	134	7–27 days	Traditional birth attendante Registered nurse Resident doctor Unregistered nurse Paediatric surgeon	Plastibell	-	2.2	UCF-2.2
Emeka[10]	Nigeria	2015-2019	182	5–16 days	Nurses-67.0% Traditional circumcisers-23.1% Doctors-9.9%	Plastibell-66.5% Guillotine-17% Free hand-16.5%	Cultural Religious Medical Other reasons	8.2	UCF-8.2
Habibullah and Sarker[42]	Bangladesh	2015-2019	150	-	Traditional circumciser pharmacy sales man	-	-	1.33	MS-1.33
Joudi *et al.*[16]	Iran	2007-2008	132	Neonatal	-	-	-	20.40	MS-20.4
Ketabchi *et al.*[26]	Iran	2010-2013	120	Neonatal-adolescent	Traditional circumcisers-80.83% Health technician-10.83% Physician-8.33%	Manual technique[f]	-	15.00	UCF-2.5 MS-12.5
Latifoglu *et al.*[43]	Turkey	1983-1997	40	-	Traditional circumciser-37/40 Surgeon-3/40	-	-	25	UCF-25
Maranya *et al.*[6]	Kenya	2004-2011	15	-		-	-	100	UCF-86.7 Hypospadic MS-6.7 Urethral stricture-6.7

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Table 2: Contd...

Authors	Country	Years of study	Number of patients studied	Age at circumcision	Provider	Method	Indication	Overall frequency of urethral complications (%)	Type of urethral complication (%)
Osifo and Oriaifo[17]	Nigeria	1998-2007	346	Neonatal-87% Postneonatal-13%	Paramedical practitioners-32.4% Nurses-27.7% Traditional healers-24.9% Doctors-15.0%	-	Religion Custom Cultural practice	21.10	UCF-21.1
Pieretti *et al*.[37]	USA	2003-2007	424	-	-	-	-	25	MS-25
Seleim and Elbarbary[18]	Egypt	2010-2015	223	Neonatal	Inexperienced surgeons	-	-	8.00	UCF-7.6 MS-0.4
Sowande and Adejuyigbe[19]	Nigeria	2003-2006	45	Neonatal	Nurses-62%[g] Traditional surgeons-22.2% Quacks-8.9% Doctors-6.7%	-	-	64.90	UCF-56 MS-8.9

[a]Thermocautery assisted method, [b]Social indications were conformity, supposed cleanliness, because it was more attractive, or because it was socially the "done thing" In 2 cases the operation was advised by the family doctor because it was "better to have it done now and got out of the way". One case was a Moslem child circumcised for religious reasons, [c]Major complications, [d]Prophylactic indications were to avoid the psychological trauma of later operations for infection, phimosis and "troubles", cleanliness and phimosis, [e]Traditional birth attendant (7.3%), Registered nurse (7.2%), Resident doctor (5.0%), Unregistered nurse (15.6%), Paediatric surgeon (3.4%), [f]Manual techniques are device methods as Gomo clamp, Plastibell, [g]Nurses were grouped together with community health officers. MS: Meatal stenosis, UCF: Urethrocutaneous fistula

report the frequency because the study only focused on complications that were of surgical relevance.[35] Moreover, because meatitis is a mild condition that usually resolves spontaneously, it is likely that cases are under-reported by both patients and researchers. Patel,[13] in his study of the problems of routine male circumcision, found meatal ulcers in as many as 31/100 (31%) of the patients. The high rate of meatal ulcer was observed even though 98% of the circumcisions were performed by doctors. Patel noted that the ulcers were mostly mild and were present at different periods post circumcision.

An inverse relationship was observed between age at circumcision and the risk of urethral complications. Most of the reported urethral complications occurred in males circumcised during the neonatal period and infancy. Furthermore, neonatal circumcision was associated with a higher incidence of urethral complications than infant circumcision. This finding may be related to the characteristic of the genitalia of younger children which is smaller and thus more difficult to manipulate. Lucas *et al*.[45] found that males below the age of 15 were more likely to develop UCF following voluntary medical male circumcision (VMMC) than males aged 15 or above. Over the four years study period, approximately 14.9 million VMMC were conducted in 15 African countries. Among the under 15 age group, 40 cases of UCF were observed following more than 6.5 million VMMC. In the 15 years and above group, just a single case of UCF was observed after 8.3 million VMMC. The circumcision procedures that resulted in UCF were conducted by different providers of circumcision including doctors (17%), nurses (12%), clinical officers (7%), assistant medical officers (2%), and unknown (61%). According to the authors, a less matured genitalia is constitutionally more fragile. In addition, the relatively closer proximity of the urethra to the skin in young males predisposes it to injuries during circumcision. Similarly, Ghods *et al*. reported a higher incidence of MS in younger age groups.[20] In the study, boys circumcised with the plastibell device or conventional dissection were followed up for 12 months. Significantly, 15% of neonates developed MS as compared to 1.4% of non-neonates. Only a minority of studies in our review reported reasons, for which circumcision was performed. We did not find any relationship between indication for circumcision and frequency of urethral complications.

Several authors have established that the frequency of complications of male circumcision varies depending on the type and training of the male circumcision provider.[34,36,43,44,47] According to the nature and level of their medical qualification, different types of male circumcision providers exist in a spectrum occupied at one end by paediatric surgeons and urologists and at the other end by traditional circumcisers and quacks. Our review of literature also revealed that the incidence of urethral complications is dependent on the type and training of the provider of male circumcision. Untrained providers here are circumcisers who have not undergone formal training to acquire the necessary knowledge, skills, and experience needed to perform male circumcision safely

and efficiently. One study that clearly showed the varying complication rates by type of provider was a Nigerian prospective study of 141 subjects.[12] In male circumcisions undertaken by doctors, urethral complications occurred in 2/76 (2.6%) of patients. In contrast, the proportion of patients that developed urethral complications of male circumcision following male circumcision procedures by midwives and traditional birth attendants (TBA) were 5/62 (8%) and 1/3 (33.3%), respectively. The authors concluded that the status (Type) of the circumcision provider was associated with the rate of complications with the highest complications seen in TBA and the lowest in doctors. A second study that shows this association is another Nigerian study on complications of neonatal circumcision with the plastibell device.[9] No urethral complications were observed in boys circumcised by doctors (paediatric surgeons and resident doctors). UCF developed in boys circumcised by unregistered nurses (0.8%) and TBA (0.2%). Yegane *et al*. studied the prevalence of late complications of circumcision in 3205 Iranian boys.[34] MS (0.9%) was the urethral complication found in the boys. A total of 1359 (43.49%) boys were operated by traditional circumcisers, 989 (31.64%) by general surgeons or urologists, 591 (18.91%) by general practitioners or paediatrician, and 186 (5.95%) by paramedical personnel. The frequency of MS by medical qualification of the provider was traditional circumcisers (0.36%), urologists/general surgeons (1.21%), general practitioners/paediatricians (1.35%), and paramedical personnel (2.15%). The authors highlighted the likelihood that traditional circumcisers in Iran are experienced and this may be the reason for the lower complication rate in them. The study further suggested that ineffective education and restricted experience were the reasons for high complications among untrained doctors (general practitioners/paediatricians) and paramedics. The study recommended that circumcision should be conducted by trained surgeons. Thus, even among providers with similar medical qualifications, for example, doctors, training on circumcision ensures less urethral complications.

Our review found that thermocautery-assisted circumcision had few circumcisions. We also observed that all circumcisions carried out using thermocautery-assisted methods were conducted by paediatric surgeons or urologists (except one study where the subspecialty of the surgeons was not stated).[27,28,31-34] The reason for this may be that the technical complexities of using the thermocautery device are beyond the skill levels of untrained providers. The significance of this finding is that, policies recommending the use of thermocautery in male circumcision might drive untrained circumcision providers to seek for formal trainings that will enable them to undertake thermocautery assisted circumcision. However, the proposed policies must be accompanied by public education on the superior safety profile of thermocautery-assisted circumcision and the need to always consider it first except when it is contraindicated. In different studies where thermocautery-assisted circumcision was performed, different circumcision techniques were used. Arslan *et al*. found no urethral complication after 5871 boys were circumcised with thermocautery in Sudan.[46] While the four weeks follow-up period in the study may be too short to determine the true scale of some urethral complications such as MS, it is worthy to note that the other urethral complications, if present, are seen within that four weeks period. The authors concluded that trained male circumcision providers can perform circumcision safely. The type of thermocautery device used in this study and all studies in our review where thermocautery assisted circumcision was performed was the bipolar thermocautery. Monopolar electrocautery should be avoided in male circumcision.[47]

Conclusion

Urethral complications are some of the most feared complications of male circumcision. Despite their significant morbidity, their prevalence has been poorly reviewed. Our analysis revealed that circumcision in male neonates is associated with a higher incidence of urethral tragedies. Urethral complications were uncommon when circumcision was performed by doctors. There is a need to come up with standardized definitions of specific urethral complications to improve the reporting of complications and facilitate future analysis. Thermocautery-assisted male circumcision in the hands of trained surgeons has low rates of urethral complications.

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Conflicts of interest

There are no conflicts of interest.

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