

REVIEW ARTICLE

Complications of male circumcision in Iran: A systematic review and weighted averaged analysis

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Abstract: Male circumcision (MC) is a minimal procedure to remove penile foreskin and is one of the oldest and most frequent surgical procedures in Iran, where the majority of the population identify themselves as Muslim. Despite numerous health benefits, MC is an issue of debate among pediatricians, urologists, and other medical professionals. Much of the debate stems from the lack of national guidelines and the incidence of minor or serious clinical complications. This study performed a systematic review on the current literature on male circumcision in Iran and summarized the major clinical complications reported by the studies.

Keywords: Clinical complication; Iran; Male; circumcision; systematic Review

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1. Introduction

Male circumcision (MC) is a minimal procedure to remove penile foreskin. It is now carried out on various grounds such as ritual, religious or medical (1). MC, especially in early childhood, has been well-established as a minimal surgical procedure which contributes to the prevention of urinary infections, penile cancer, oncogenic human papillomavirus (HPV) genotypes and cervical cancer, HIV, and other serious sexually transmitted diseases (2-6). The prevalence of MC is relatively high in Eastern Mediterranean countries including Iran, where most of the population identify themselves as Muslim. The report by the World Health Organization (WHO) in 2010 along with local studies in Iran have shown that nearly 95% of the male population in Eastern Mediterranean region are circumcised (7, 8).

Despite numerous health benefits, the use of MC as a routine and standard procedure for all men is of heated debates

among pediatricians, urologists, and other medical professionals (9). Much of the debate stems from the lack of national guidelines and shortage of professionals in many underprivileged settings which leads to minor or serious complications. In many communities, MC is performed by a religious or culturally accepted rather than a qualified person. The community's preference toward using traditional circumcision operators often leads to many complications which necessitates further medical assistance. For example, late complications of MC might cause clinical circumstances that indicate reconstructive urological surgeries, which are complicated and costly by nature. Minor and treatable complications usually occur at the early intraoperative phase and include pain, bleeding, swelling or inadequate skin removal. However, serious complications can occur during the procedure, including death from excess bleeding and amputation of the penile glans if the glans are not shielded during the procedure(8, 10). Late (postoperative) complications include the formation of a skin bridge between the penile shaft and the glans, infection, urinary retention, meatal ulcer, impetigo, fistulas, loss of penile sensitivity, sexual dysfunction and oedema of penile glans (8). The medical manipulation to correct MC complications can even affect patient's sexual and social life, which deteriorates quality of

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life (11). On the global level, MC complications can be as high as 50.1% of the circumcised individuals while late complications were reported in 7.7% (12). The most common primary complications are bleeding, swelling and those related to the anesthesia. Severe complications can also occur intra or post-operation including drastic urinary tract injuries, complete or partial amputation of penis or glans. Death can rarely occur due to hemorrhagic shock. Late post-operative complications include infections, cosmetic problem, excessive or insufficient skin removal, urinary retention, penile deformities, meatal stenosis, glans necrosis, fistulas, and other rare complications. Loss of penile sensitivity, sexual dysfunction, and psychological problems have also been considered by some studies (13). MC complications are attributed to several factors which are categorized into: A) pre-operative predisposing factors (bleeding disorders, neglected penile anomalies, comorbidities and the biometric characteristics), B) operator-related factors (qualification, experience), C) the method of circumcision (traditional, classic surgery, Plastibell, Gomco, Mogen, Unicirc, AcuCirc, and Winkelmann clamp), and D) the quality of postoperative care (14).

The aim of the present study was to systematically review all related studies about MC complication among Iranian males. This study aimed to provide a clearer picture of the status of male circumcision in Iran for policy makers and medical practitioners.

2. Material and Methods

This systematic review is a part of an ongoing research project entitled “delineation of men’s health status in Iran during 2010-2020” which is sponsored and executed by the Men’s Health & Reproductive Health Research Center (MHRHRC). Population of study included all Iranian men with no age restriction who have undergone Male Circumcision (MC) at any point of their lives. The study outcome was defined as any adverse clinical event which can be attributed to the circumcision. The study eligibility was defined as all types of epidemiologic studies (cross-sectional, case-control or cohort studies) reporting the study outcome among Iranian male population. International databases including MedLine (from January 1950 until July 2020), Scopus (January 1973 until July 2020), Web of Science (1900 until July 2020), and ProQuest (1938 until July 2020) and national databases including SID (August 2004 until July 2020), were used.

The keywords were defined as “complication”, “adverse”, “outcome”, “circumcision” and “men/male”. No language restriction was defined as eligible studies could have been published in either English or Farsi. Process of selecting articles was completed by two independent researchers who were a

part of the research team. Screening was initially done on study titles which led to exclusion of 201 articles. Additional 439 articles were excluded due to studying non-Iranian population, review articles on various aspects of MC, MC from non-medical perspectives (legal or religious considerations), and qualitative research. Finally, 31 epidemiologic studies met the inclusion criteria for qualitative synthesis (Figure 1). Extracted data was entered into spreadsheet while any disagreement was resolved by a third party. The spreadsheet included data regarding bibliographic information of studies (author’s name, publication year), study location, study population, type of reported adverse event, and reported epidemiologic measures (such as prevalence, relative frequency, etc.). Due to the wide variety of reported adverse events across studies, meta-analysis was not applicable. Nevertheless, data from partially similar settings (with regard to age range, method and operator of MC, route of sampling), were gathered to a separated table and pooled using the weighted average based on sample size. All quantitative measures were performed by Microsoft Excel spreadsheets.

3. Results

At the initial searching phase, 712 articles were retrieved. After removing duplicates, 671 studies were screened for eligibility, finally 31 studies were summarized. Of them one study had no full text but reported the details of outcomes and therefore, included.

Considering study sampling similarity, the most prevalent MC operator in Iran is traditional circumcisers in 45.5% (range: 43.5-48.8%) of the cases while this proportion is proved to have strong relationship with more complications, followed by surgeons and specialists in 25.74% (range: 18.5-31.6%), general practitioners in 21.40% (range: 18.9-24%) and other healthcare staff in 8.48% (range:6-10.9%). Among the prospective studies, surgeons used Plastibell or classic surgery techniques in 59.2% (range:49.6-66.5%) and 40.8% (range: 33.5-50.4%), respectively. (Supplementary appendix 1).

The most prevalent complications after MC were dissatisfaction and cosmetic or anatomic adverse outcomes reported from 4.16% (0.3-15.3) and 8.7% (0.8-22.6) of cases by Plastibell and classic surgery, respectively. The prevalence of Chordee, Granuloma, excessive removal of foreskin, and excessive residual of foreskin was reported as 0.2%, 0.7%, 1.3%, 0.04% to 3.6%, respectively.

Meatal stenosis was estimated to be 5.35% (range: 0.8% to 13.7%) in Plastibell method and 2.5% (range:1.1% to 3.6%) in classic surgery method. Interestingly, those novel techniques which left the frenular artery intact during MC tended to cause less meatal stenosis compared to routine practices which use suture ligation or hemostasis cautery on this

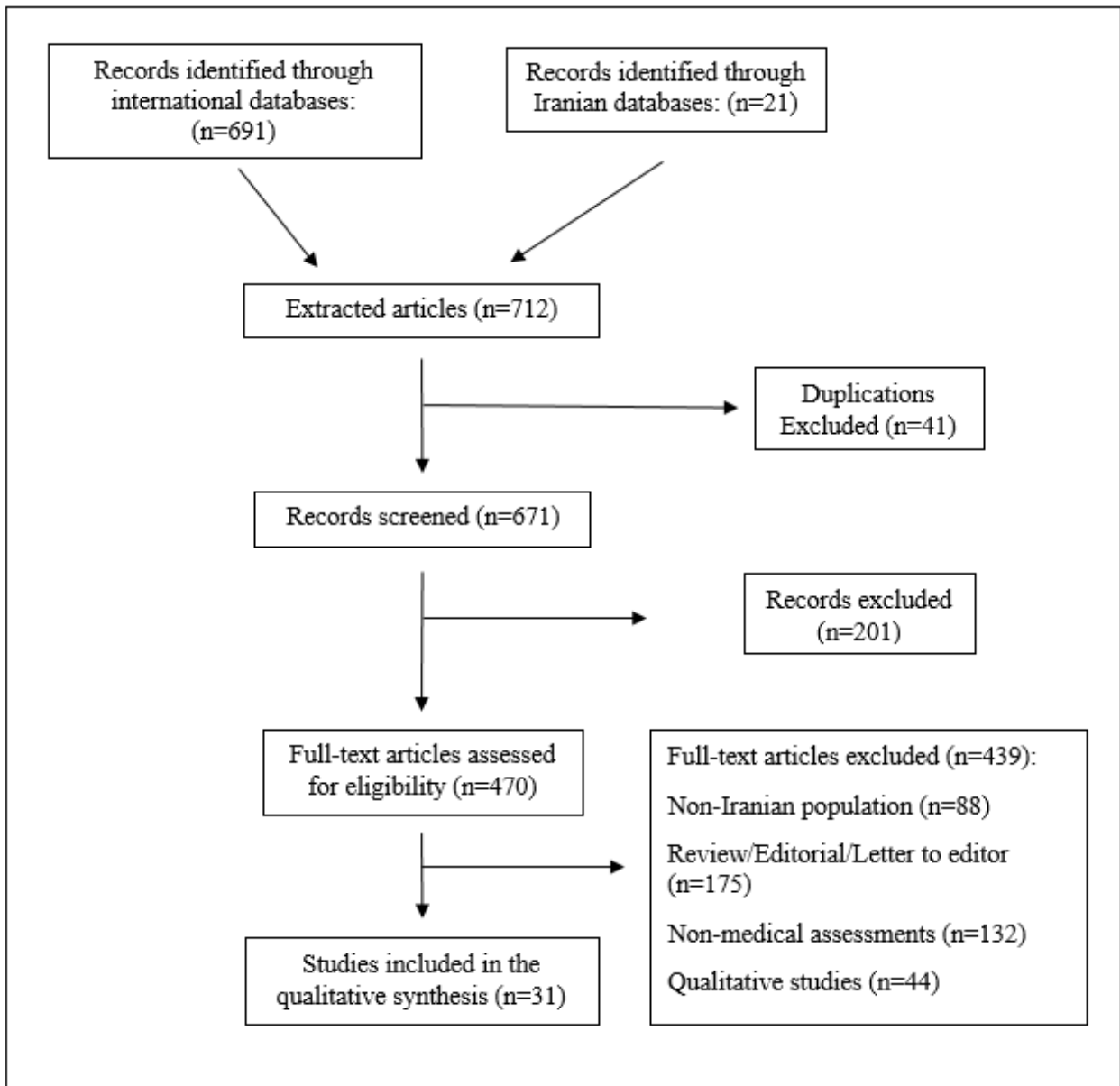


Figure 1: PRISMA Flow diagram of studies on complications of male circumcision.

artery. Performing MC on neonates was also reported to have higher chances of causing meatal stenosis. Ring displacement was estimated to occur in 0.297% (range: 0.2-0.53%) of patients with Plastibell technique. Bleeding seemed to be a less frequent early complication with relative frequency of 0.72% (range: 0.3-1.7%) and 1.005% (0.25-1.95) among normal infants circumcised by Plastibell and classic surgery, respectively. Bleeding also showed a positive correlation with age at circumcision, meaning that with increasing age at circumcision, the incidence of bleeding would increase. Another consideration in this field is the bleeding disorders

which have been reported to lead to 56.3% to 37% bleeding in children suffering from hemophilia. Infection was indeed a rare complication of MC, reporting in 0.19% (range: 0-1.05%) of Plastibell and 0.001% (range: 0-0.002%) of classic surgeries. Some other complications reported from case-series/reports included burning due to cauterization, glans ischemia and amputation, and fistula. Finally, there were some reports of complications due to anesthesia procedure including a case report of prolonged seizures. Another review on 10-year trend of MC-related deaths reported the anesthesia procedure during MC as a leading cause of death in 63% of



Table 1: Relative frequency (percent) and weighted average of reported complications according to the applied method and sample size among Iranian men

	First Author (Year)	Sample size (N)	Meatal stenosis	Bleeding	Infection	Cosmetic/anatomic	Ring displacement
Neonate	Kajbafzadeh A (2011)	105a-102b	15%a-5%b			3%a-16%b	
	Moslemi MK (2009)	3750b		0.05%b			
	Joudi M (2011)	132	20.4%				
	Dehghan G (1994)	100	53%				
Infants	Weighted average		34.4%, 15%a-5%b	0.05b		3%a-16%b	
	Mousavi SA (2015)	376b-624a	1.2%b-1.1%a			15.3%b-22.6%a	
	Moslemi MK (2011)	390a		0.25%a			
	Nadjafi-Semnani M (2018)	518b	2.9%b	1.7%b	0.4%b		0.2%b
	Karami H (2018)	1205b	13.7%b				
	Ghods K (2018)	1588b-800a	0.8%b-3.6%a				
	Mousavi SA (2008)	205b-381a		1.31%b-1.95%a	1.05%b-0a		0.53%b
	Arbabi AH (2000)	4700b		0.04%b			
Unknown	Fanaei SA (2003)	1085b-1100a		0.3%b-1%a	0%b-0.002%a	0.3%b-0.8%a	
	Vahedian M (2002)	756b		0.5%b	0.1%b		0.3%b
	Weighted average		5.35%b-2.5%a	0.72%b-1.00%a*	0.19%b-0.001%a	4.16%b-8.7%a	0.297%b
	Yegane R (2006)	3125	0.9%			0.5%	
	Kheirollahi A (2004)	3205	0.9%			0.5%	
	Fesharaki A (2005)	1000		51%	22%		
	Weighted average		0.9%	51%	22%	0.5%	

a: Classic surgery; b: Plastibell

Table 2: Comparison of other CM routine techniques with the weighted average from classic surgery and Plastibell

Method of circumcision	Meatal stenosis	Bleeding	Infection	Cosmetic or anatomy
Weighted average of Classic surgery	2.5%	1.00%	0.001%	8.7%
Weighted average of Plastibell	5.35%	0.72%	0.19%	4.16%
Sleeve method with Petroleum lubricant jelly for 6 months (Bazmamoun H., et al., 2008)	0%*	3%***	1.5%***	NR
Classic surgery in neonate (Kajbafzadeh A., et al.,2011- Moslemi MK.,et al., 2009)	15%****	NR	NR	3%*
Plastibell in neonate (Kajbafzadeh A., et al.,2011- Moslemi MK.,et al., 2009)	5%**	0.05	NR	16%****
Sleeve method (Bazmamoun H., et al., 2008)	6.6%***	18.8%****	11.7%****	NR
Plastibell with intact fernular artery (Karami H., et al., 2018- Moslemi MK.,et al., 2009.)	8.5%***	0.4%*	NR	NR
A New Technique of sutureless surgery with frelunar cautery or ligation (Asgari SA.,et al., 2011)	3.4%**	6.7%****	NR	5.8%**
classic surgery with intact fernular artery in neonate (Kajbafzadeh A., et al.,2011)	2%*	NR	NR	1%*

*Lower than weighted average of classic surgery or plastibell

**In range of weighted average of classic surgery or plastibell

***Higher than weighted average of classic surgery or plastibell

****Much higher than weighted average of classic surgery or plastibell

10-year reported MC mortalities.

4. Discussion

It is obvious that male circumcision is the most common surgery in Iran. Therefore, evaluation of its merits and disadvantages seems unnecessary. However, with a closer look, it can be claimed that in many cases, MC complications have

been considered by opponents of MC as its disadvantages. So, it seems logical that studies in this field should focus on the collection, classification, and analysis of data about MC complications in order to discover the factors involved in their occurrence and also their effective prevention methods.

A review study showed that the frequency of any MC com-

diagram 1: description of included studies on MC complications in Iran

Author,[References]	Study type	Participant	Operator	Technique	Complication
Bazmamoun H., et al., 2008, [16]	Randomized control trial	394, <2 years	Surgeon	Sleeve method -Case: Petroleum lubricant jelly for 6 months: 50% -Control: No topical medication: 50%	Case with Meatal stenosis: 0% Control with Meatal stenosis: 6.6% Case with Infection: 1.5% Control with infection: 11.7% Case with Bleeding: 3% Control with Bleeding: 18.8%
Karami H., et al., 2018, [17]	Randomized controlled trial	2307, Neonates	Urologist	Plastibell Device -Group A (1,102), intact frenulum -Group B (1,205), Frenular hemostasis by thermal cautery	12-months incidence of Meatal stenosis Group A: 8.5% Group B: 13.7% 16-months incidence of Meatal stenosis Group A: 13.8% Group B: 18.9%
Moslemi MK., et al., 2009, [18]	Randomized controlled, trial	7510, Term neonate	Urologist	Plastibell Group 1: Hemostasis with manual compression Group 2: hemostasis with ophthalmologic cautery	Bleeding: Group 1: 0.4% Group 2: 0.05% Urinary retention Group 1: 0.3% Group 2: 0.9% Delayed wound healing Group 1: 0.2% Group 2: 0.8%
Fanai SA., et al., 2003, [19]	Randomized clinical trial	2185, <2 years	General surgeons	-Plastibell:49.6% -Surgery: 50.4%	Plastibell: Bleeding: 0.3%, Infection:0% Appearance dissatisfaction:0.3% Surgery: Bleeding:1% Infection:0.002% Appearance dissatisfaction:0.8%
Nadjafi-Semnani M., et al., 2018, [20]	Prospective	518, < 12 months	Urologist	Plastibell	-14 days Follow up: Hemorrhage: 1.7% Infection: 0.4% Ring displacement: 0.2% -8 months Follow up: Meatal stenosis: 2.9%
Ghods K., et al., 2018, [21]	Prospective	2389, ≤6 years	Surgeon	-Plastibell device: 66.5% -Conventional dissection surgery: 33.5%	Meatal stenosis (after 12 month Follow up): -Plastibell: 0.8% -Surgery: 3.6%
Asgari SA., et al., 2011, [22]	Prospective	126	Surgeon	Technique of sutureless surgery with frenular cautery or ligation	-Bleeding: 6.7% -Dissatisfaction: 0.8% -Adhesion: 5% -Meatal stenosis: 3.4%
Mousavi SA., et al., 2008, [23]	Randomized clinical trial	586, Infants ≤ 12 months	Pediatric surgeon	Conventional dissection surgery: 35% Plastibell: 65%	Followed up until the wound was healed Plastibell: Infection: 1.05% Bleeding:1.31% Hematoma: 0.26% Excess mucosa: 1.31% Disposition:0.53% Delayed falling: 2.62% Surgery: Infection: 0% Bleeding:1.95% Hematoma:0% Excess mucosa:0% Disposition: 0% Delayed falling:0%

diagram 1: description of included studies on MC complications in Iran

Author,[References]	Study type	Participant	Operator	Technique	Complication
Hosseini SR. and Mohseni MG., 2011, [24]	Cross-sectional	125, <18 years 125, >18 years	Not reported	Not reported	The age of circumcision has no effect on sexual function and satisfaction
Ghani H., et al., 2012, [25]	Case- control	80, Neonate & Infant	Surgeon assistant	Classic: 50% GOMCO: 50%	1 week Follow up: -Infection: 0 in two group Bleeding volume: -Classic: 4.1 cc -Gomco: 1.3 cc
Joudi M., et al., 2011, [26]	Cross-sectional	132, adults	Not reported	Not reported	-Sever Meatal Stenosis 20.4% -Hydronephrosis 2.2%
Totonchi P., et al., 1997, [27]	Cross-sectional	181, <5 years	Not reported	-Plastibell: 49.2% -Surgery: 42.9% -Traditional: 7.9%	-Bleeding: 18.75% -Infection: 43.75% -Urinary retention: 37.5%
Vahedian M., et al., 2003, [28]	Cross-sectional	756, <6 months	Not reported	Plastibell	-Bleeding: 0.5% -Infection: 0.1% -Ring displacement: 0.3% -Early falling: 0.03%
Mousavi SA., et al., 2015, [29]	Cross-sectional	1000, <12 years	Surgeon 50.5% Non surgeon 49.5%	-Plastibell 37.6% -Classic surgery 62.4%	-Anatomic complications: 15.3% -Meatal Stenosis: 1.2% - Anatomic complications: 22.6% - Meatal Stenosis: 1.1%
Kheirollahi A., et al., 2004, [30]	Cross-sectional	3205, Elementary school boys	-Specialist: 18.5% -GP: 24% -Nurse and Paramedic: 10.9% -Traditional: 46.4%	Not reported	-Excessive residual foreskin: 2.9% -Excessive skin removed: 1.3% -Meatal stenosis: 0.9% -Granuloma: 0.68% -Excessive residual skin: 0.2% - Penile rotation: 0.5% - Chordee: 0.2% -Circumcised Hypospadias: 0.18%
Fesharaki A., et al., 2005, [31]	Cross-sectional	1000, Elementary school boys	-Specialists doctor:30.4% - GP: 20.8% - Experimental person:48.8%	Not reported	-Bleeding: 51.2% -Infection: 22% -Problem in urination: 13.4%
Haghpanah S., et al., 2013, [32]	Case-series	152, Hemophilic cases	Not reported	Not reported	- Excessive bleeding: 37% - Risk of inhibitor formation at lower ages
Mansouritorghabeh H., et al., 2013, [33]	Retrospective	424, Cases with Bleeding disorders	Not reported	Not reported	Bleeding 56.3%
Moslemi MK., et al., 2011, [34]	Cross-sectional	390	Surgeon	Conventional dissection surgery	Bleeding 0.25%
Yegane R., et al., 2006, [7]	Cross-sectional	3125, 6-12 years old	- surgeons or urologist: 31.6% - GP or Pediatricians:18.9% -Paramedical personnel:6% -Traditional circumcisers:43.5%	Not reported	-Excessive residual foreskin: 3.6% -Excessive skin removed: 1.3% -Meatal stenosis: 0.9% -Granuloma: 0.7% -Penile rotation: 0.5% -Chordae: 0.2%

Diagram 1: description of included studies on MC complications in Iran

Author,[References]	Study type	Participant	Operator	Technique	Complication
Kajbafzadeh A., et al.,2011, [35] [Abstract with full details]	Case-control	-G1:105, Neonates - G2:102, Neonates - G3:101, Infants	Not reported	-G1: Classical surgical -G2: Plastibell -G3: Conventional technique without ligation of franular artery.	Mean follow up: 9 years -Meatal stenosis: G1: 15%, G2: 5%, G3: 2% -Skin adhesion: G1: 3%, G2: 16%, G3: 1% -Decreased Meatal caliber: G1: 40%, G2: 9%, G3: 5%
Arbabi AH., 2000, [36]	Cross-sectional	4700, Hospitalized patients	Not reported	Plastibell	15 days follow up: -Bleeding: 0.04% -Inflammation: 0.06% -Delay in separation of ring: 0.06% -Excessive residual foreskin :0.04%
Dehghan G.,1994, [37]	Cross-sectional	100, Neonate	Not reported	Not reported	Meatal stenosis: - Neonate: 53% - 3-4 years: 0
Ketabchi AA., et al., 2017, [38]	Prospective	120, Referred patients: -G1: neonates (21) -G2: infants (29) -G3: children (33) -G4:Adolescents(31)	- Doctors:5% - Health tech- nicians:10% - Traditional: 85%	Classic method (no any device used)	-Insufficient fore- skin remove: 4.16% -Excessive fore- skin remove: 5.83% -Adhesions/skin bridges: 4.16% - Inclusion cysts: 5.83% -Abnormal healing: 5.83% - Meatal stenosis: 12.5% -Phimosis: 1.66% -Chordee: 4.16% -Urethra cutaneous fistula: 2.5%
Hedjazi A., et al., 2012, [39]	Cross-sectional	38	Doctors: 97% Tradi- tional: 3%	Not reported	-Death due to anes- thesia 63% -Other cause 37%
Sanaeizadeh H and Zamani N., 2011, [40]	Case Report	1, neonate	Not reported	Not reported	Prolonged and Re- current Seizures 20 minutes after the Lidocaine Ad- ministration for Circumcision
Moradi M., et al., 2017, [41]	Case Report	1, infant	Inexperienced rural circumciser	Not reported	Giant ventral fistula in the distal of the penis
Hosseini J., et al., 2019, [42]	Case-Report	1, 9 years old	Not reported	Plastibell	Glandular amputa- tion by strangulating tied suture
Hojjat A., et al., 2018, [43]	Case report	1	Physician	Classic surgery	Bladder rupture due to Total Subcoronal Urethral Ligation
Mohammadi AA., et al., 2013, [44]	Case-report	3	Inexperienced health staff	Radiofrequency scalpel	Burn
Aminsharifi A., et al., 2012, [45]	Case-Series	2	Not reported	Sleeve surgery	Ischemia or necrosis of the glans

plication could be up to 16% and tend to be more if conducted in childhood compared to infants and newborns(13). In the present study, overall MC complications were reported by three studies from two areas (Lorestan and Birjand) to be 7.4% to 8.4%, all complications including cosmetic or anatomic adverse outcomes, chordee, meatal stenosis, suture granuloma, excessive removal of foreskin, excessive residual of foreskin, ring displacement, bleeding, infection, burning, fistula, glans ischemia and amputation have been reported and compared in different methods as well as different performers.

Regardless of a few case reports on relatively severe MC complications, and due to high variability in cultural settings across Iran, the reported prevalence of MC complications obtained from limited studies with small case counts cannot be generalized to the whole Iranian population. Therefore, more epidemiologic studies, especially analytic studies, are needed to depict the status of MC and its complications in Iran.

We found that in some provinces of the country such as Lorestan and Khorasan (city of Birjand) nearly half of the MC cases are carried out by traditional operator. A strong correlation between MC complications and traditional operators are shown in various studies(15).

This systematic review was amongst the first attempts to describe the status of male circumcision in Iran from published studies until May 2020. Despite the high request for male circumcision from community, the epidemiologic data regarding this minimal surgery is deeply lacking in Iran. On the other hand, little attempts have been made from health policy-makers to develop indigenous clinical and patient management guidelines in the country. As our findings showed, a high proportion of MCs are carried out by untrained traditional operators, who have little scientific knowledge and expertise in this area.

To achieve a standard and safe guideline to perform MC in Iran, various challenges and questions are remained to be answered, questions such as how to train operators with various qualifications to perform MC, how to monitor and register the follow-up data of circumcised boys, how operators cope with complications and patient routine follow-ups, what are available resources and their credibility to control and prevent MC complications and finally, what organization/body is responsible for educating and improving general population regarding safe MC.

Despite relatively abundant literature on Mc in Iran, most of the studies are carried out in either cross-sectional or case-series designs. Evidence-based decision-making process, consequently, is hindered for male circumcision in Iran due to lack of epidemiologic evidence. It seems that there is the right time for prospective cohort studies to follow up MC complications longitudinally and to record the trend of these

complications.

Additionally, the existing literature on MC complications in the country indicates underdevelopment of this surgery compared to other similar medical fields. Therefore, it is necessary to conduct extensive and well-defined studies to collect information and practical planning in order to improve MC and, of course, reduce its complications. This information, in turn, provides the health policy makers suitable power to develop updated and scientific clinical guidelines aiming at instructions on standards circumcision procedure and complication management.

5. Conclusion

The most frequent complications of MC included cosmetic or anatomic adverse outcomes, Chordee, meatal stenosis, suture granuloma, excessive removal of foreskin, excessive residual of foreskin, ring displacement, bleeding, infection, burning, fistula, glans ischemia, and amputation. We found that no prospective epidemiologic study has been conducted to follow up MC complications and record the course of complications. Due to the inherent methodological limitations of existing literature on MC, designing of analytic prospective studies to investigate the short-term and long-term complications of MC and trials to assess the effectiveness of various novel MC techniques are warranted.

6. Appendix

6.1. Acknowledgements

This systematic review was part of a project entitled: "Delineation of Men's Health Status in Iran during 2009-2019" which has been supervised by the Men's Health & Reproductive Health Research Center (MHRHRC). The authors would like to forward their gratitude to the MHRHRC for their sincere collaboration.

6.2. Authors Contributions

All the authors have the same contribution.

6.3. Funding Support

None.

6.4. Conflict of Interest

No conflict of interest.

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