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Original Research Article

Retrospective study of plastic ring circumcision outcomes in Ibra Hospital, Sultanate of Oman: a study of 4251 cases

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ABSTRACT

Background: This study aimed to evaluate the outcomes of circumcision performed using the plastic ring technique in infants aged between 1 month and 12 months old.
Methods: The cases included in this study were operated in the surgical outpatient clinic of Ibra hospital in Oman using plastic ring between June 2018 and June 2023. Infants aged one-month-old to twelve-months-old were included in the study. Cases done under general anesthesia were excluded from the study, as well as infants with bleeding disorders. Circumcision was carried out for religious reasons in all cases. Post-operative complications were collected and studied.
Results: Patients fulfilling the inclusion and exclusion criteria were 4251 cases. The average age of the infants was 3.4±2.1 months. The mean period from surgery to ring separation was 7.6±3.14 days. Total complications were 214 cases (5.03%). Primary bleeding was noted in 17 cases (0.4%). Proximal ring migration happened in 75 cases (1.76%). Delayed ring separation was reported in 11 cases (0.26%). Excess mucosa that required redo circumcision was noted in 14 cases (0.33%).
Conclusions: Plastic ring circumcision performed in infants below 1 year of age is considered a safe approach and is linked to a reduced number of complications. The rate of complications is proportionally related to increasing age at time of circumcision. The rate of complications is inversely related to the experience of the surgeon performing the technique.

Keywords: Circumcision, Plastic ring, Proximal ring migration, Delayed ring separation, Complications of circumcision

INTRODUCTION

Circumcision is a cultural and religious rite, as well as a medical operation that has well-defined risks and benefits.[1] It is the surgical removal of the prepuce (which is the fold of skin that typically covers the glans penis) that has a complex history that spans various cultures and religions, it is suggested that this process began in in Ancient Egypt as early as 2400 BC. It has a religious background in Islam, Judaism and Christianity.[2]

Numerous methods, such as the plastic ring device, the Gomco clamp, and the Mogen clamp can be used to perform circumcision.[3] In infants, circumcision is a simple process as the healing phase usually takes place in the first two weeks following surgery and there is an estimated 1 to 15% chance of experiencing complications.[1,4,5] For babies under one-year-old the plastic ring gadget has been the recommended approach.[5]

Hollister introduced the plastic ring circumcision device during the 1950s.[6] Among the benefits of plastic ring

circumcision are the relative safety, the ease of training and the minimal bleeding, furthermore it does not carry the risk of severe complications such as urethro-cutaneous fistula or traumatic amputation of the glans penis.[7] This method involves the application of a secure ligature around the foreskin, which is pulled over a grooved plastic ring and the skin beyond the ligature is then removed.[8] The ligature causes a complete circular area of tissue necrosis, and the plastic ring device detaches neatly after a few days.[8]

This study aimed to evaluate the outcomes of circumcision performed using the plastic ring technique in infants aged between 1 month and 12 months old.

METHODS

Study information

The study was a retrospective descriptive study that included the plastic ring circumcision cases done in Ibra hospital, Sultanate of Oman between June 2018 and June 2023. The research and studies committee in directorate general of health services at North Sharqiya, Oman Ministry of Health has approved this study under ID No. (MOH/CSR/23/27195).

Patients

The inclusion criteria were male babies aged 1 to 12 months who underwent circumcision in the general surgery outpatient clinic under local anaesthesia. The exclusion criteria were cases performed under general anaesthesia, infants aged less than 1 month or more than 12 months, infants whose parents requested methods other than the plastic ring, and infants with bleeding disorders or a family history of such disorders (a complete blood picture and coagulation profile were done for all cases).

Data collection and analysis

A search was conducted using Al-Shifa database at Ibra Hospital, Oman, to identify patients who met the inclusion criteria (Al-Shifa system is the official hospital information management system). Patients were divided into equal groups and assigned to researchers, who reviewed each patient's file to assess for the following complications: primary bleeding, defined as bleeding occurring before the patient leaves the hospital; reactionary bleeding, defined as bleeding occurring within 24 hours of the procedure; secondary bleeding, defined as bleeding occurring after 24 hours of the procedure; hematoma, defined as a collection of blood under the skin of the penile shaft and/or suprapubic area; urine retention, defined as failure to pass urine within 6 hours of the procedure; surgical site infection, defined as swelling, redness, and purulent discharge; proximal ring migration, defined as separation of the ring with backward movement, causing the ring to become stuck over the shaft of the penis; delayed ring separation, defined as failure of the ring to separate within 10 days; and excess mucosa, defined as the need for a redo circumcision. The data were tabulated in the data collection tool and validated by independent participants, who validated at least 20% of the collected data. The collected data were statistically analyzed using statistical package for the social sciences (SPSS) version 21, which was installed on a Dell® OptiPlex 7050 desktop.

Steps of plastic ring circumcision

Informed consent was obtained from the parent(s). After proper positioning, sterilization, and draping, two millilitres of 2% lignocaine solution without adrenaline were used to perform a subcutaneous ring infiltration around the root of the penis. After 5 minutes, the foreskin was gently retracted, and any connections between the foreskin and glans were carefully severed until reaching the subcoronal sulcus. Any smegma, if present, was removed. Frenular bleeding, if present, was controlled using bipolar diathermy. A plastic ring of the appropriate size was then selected. Two mosquito artery forceps were placed at the 3 and 9 o'clock positions on the foreskin tip after repositioning it. The 12 o'clock position was then opened with fine tissue scissors, extending a few millimetres short of the subcoronal sulcus, after which the plastic ring was inserted, ensuring it covered at least the proximal two-thirds of the glans. A provided ligature was placed and firmly secured around the groove of the plastic ring. The skin distal to the ligature was excised, and finally, the plastic ring handle was removed. Postoperative care instructions were provided to the parent(s) in printed format. These instructions included: monitoring for bleeding (same day or later), urine retention, symptoms and signs of infection, and delayed ring separation beyond 10 days. Parents were advised to bring the baby for a follow-up appointment after 12 days.

RESULTS

A total of 4251 records fulfilled the inclusion and exclusion criteria. The mean age of the babies was 3.4±2.1 months. Age distribution of studied cases is given in Table 1.

The indication for circumcision was for religious reasons in all cases. The mean time from the surgery to the ring detachment was 7.6±3.14 days.

The total incidence of complications was 5.03%. Primary bleeding was noted in 17 cases (0.4%), reactionary bleeding in 55 cases (1.29%), secondary bleeding did not occur in the patients of the study. Primary bleeding spontaneously stopped in 13 cases and another ligature applied tightly in the remaining 4 cases. Removal of plastic ring with hemostasis of bleeder and suturing was done in all cases of reactionary bleeding. Hematoma was noted in 7 cases (0.16%), it was self-limited and resolved spontaneously without intervention.

Table 1: Age distribution of studied cases (n=4251).

Age (months)	Frequency, n=4251	
	N	%
1	980	23
2	1074	25
3	781	18
4	470	11
5	245	6
6	183	4
7	107	3
8	80	2
9	60	1
10	181	4
11	46	1
12	44	1
Mean±SD	3.4±2.1	

Urine retention occurred in 9 cases (0.21%) and was treated by analgesia and catheter insertion, no cases required plastic ring removal. Surgical site infection was noted in 26 cases (0.61%) and was managed by oral anti-inflammatory and antibiotic. Proximal ring migration happened in 75 cases (1.76%) and was managed by cutting the plastic ring at two radial points using small-sized bone cutting forceps. Delayed ring separation was reported in 11 cases (0.26%) and was managed by cutting the ligature in all cases, that was enough, and the ring fell spontaneously. Excess mucosa that required redo circumcision was noted in 14 cases (0.33%) and was managed by redo-circumcision under general anesthesia after 1 year of age. The incidence of complications among the studied cases is given in Table 2.

Table 2: The incidence of complications among the studied cases (n=4251).

Complications	Frequency, n=4251	
	N	%
Primary bleeding	17	0.4
Reactionary bleeding	55	1.3
Secondary bleeding	0	0
Hematoma	7	0.16
Urine retention	9	0.21
Surgical site infection	26	0.61
Proximal ring migration	75	1.76
Delayed separation	11	0.26
Excess mucosa (requiring redo circumcision)	14	0.33
Total	214	5.03

In our study we reported that there is a proportional relation between the age of the infants underwent the procedure and incidence of complications. The distribution of complications in relation to age at time of circumcision is shown in Table 3.

The results show a tendency to increase in complications with age, from 2% at 1 month to 22.7% at 12 months (Figure 1).

Table 3: Distribution of complications age-wise (n=214).

Age (months)	Frequency, n=214	
	N	%
1	20	2
2	35	3.3
3	20	2.6
4	11	4
5	14	5.7
6	17	9.3
7	16	15
8	13	16.3
9	10	16.7
10	36	19.9
11	12	26
12	10	22.7

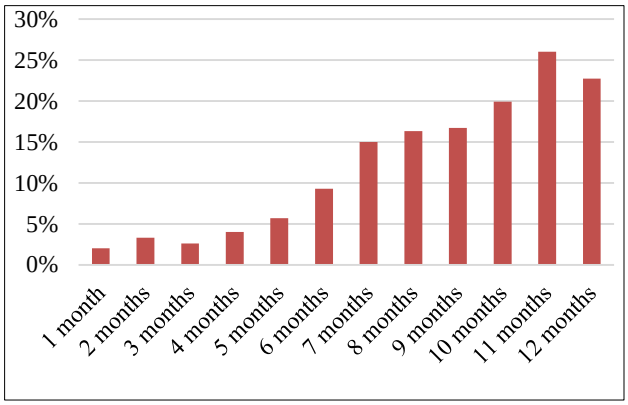

Figure 1: A graph showing a proportional relationship between age and complications of plastic ring circumcision.

DISCUSSION

The motivations for having male circumcision are primarily influenced by religious and cultural factors. Circumcision can reduce the risk of urinary tract infections, penile cancer, phimosis, and cervical cancer in female partners.[9]

Circumcision can be performed using several methods, including the scalpel method (a traditional technique involving the removal of the foreskin with a scalpel), clamp methods (devices like the Gomco clamp or plastic ring are used to crush and cut the foreskin), electrocautery, and laser circumcision.[3,10]

In our study the total incidence of bleeding was 1.69% (both primary and reactionary bleeding). There were no cases of secondary bleeding. In a study conducted by Moosa et al, they reported that out of 155 infants, 11 cases

had post circumcision bleeding (7.1%).[10] This difference may be because we used a bipolar diathermy to control frenular bleeding if noted. The incidence of bleeding in our study is comparable to that reported by Bawazir et al.[11]

The incidence of hematoma was reported by Razzaq et al to occur in 1.66% of infants of their cases.[12] In our study the incidence was 0.16%. The main cause of hematoma is relatively loose ligature allowing minor trickle of blood to accumulate beneath the skin of the shaft of the penis.[12] Hematomas noted at the base of the penis may be due to the injection of the local anesthetic.

Urine retention was noted in 9 cases (0.21%) in our study, reasons may be due to postoperative pain, positioning of the plastic ring so that it irritates the urethral opining or too small a plastic ring size that mechanically compresses and obstructs the urethra. In our study no case was due to mechanical compression of the urethra. One explanation for mechanical urethral obstruction was suggested by Hammed et al who reported "the foreskin if pulled too tight, there will be a considerable tension pulling the ring against the tip of the glans penis, thus compressing or kinking the urethra and making urination difficult or impossible".[13]

In our study, surgical site infection occurred in 26 cases (0.611%). One study reported an incidence of 5% (2/40 cases).[14] Most of the studies reported that the incidence of surgical site infection is relatively rare, thanks to the penis's robust dual blood supply.[15]

The plastic ring comes in 7 sizes (1.1 to 1.7 cm); an appropriate size should fit the glandular cone without riding up to the corona or beyond. The size is usually selected by a visual estimate of the glans girth which gets better with practice and experience, nevertheless poor selection of the ring may result in retained or proximally migrated ring.[16]

Proximal ring migration was seen in 75 patients of our study (1.76%) and has been documented by others.[17] We suspect that this may be due to the application of excessive tension on the foreskin during plastic ring placement. Marwat et al suggested that it may be due to the selection of a smaller rather than a larger plastic ring.[18] We agree with this explanation since a smaller sized ring would migrate proximally under the effect of edema of the glans. Calibration with a suitably sized plastic ring device is therefore crucial and erring on a slightly larger than smaller device would seem sensible.[19] Bode et al suggested a redesign of the plastic ring to incorporate an anti-migration component of the distal portion by its molded as a cone.[20]

The plastic ring usually detaches within 10 days and a surgical assessment is mandatory if separation has not occurred by day 15.[19] The timing of ring fall-off has been reported in various studies and was comparable to our result (7.6±3.14 days).[16,19,21] Many factors may affect the timing of ring separation: increasing weight, age and ring size was related to delayed ring separation.[1,17,22] Altokhais et al reported that using plastic ring tied by polypropylene 0 instead of the classic cotton thread resulted in their ring falling faster.[16]

Excess mucosa that required redo circumcision after plastic ring circumcision was noted in 14 cases of our patients (0.32%). In a study by Iqbal et al, they reported that (1.3%) of their cases suffered a redundant, most probably due to the inappropriately sized bell.[23]

We noted in our study that there is a tendency to increase complications with increasing age (Table 3 and Figure 1). This may be attributed to increasing weight with increasing age which was linked to delayed ring separation and proximal migration.[22] Another explanation is that with increasing age the blood supply to foreskin becomes well developed so that the ligature becomes less effective in producing complete ischemic necrosis of the distal foreskin.

To our knowledge the latest study that addressed the safety of plastic ring circumcision in Oman was published in 2006 and included only 171 cases.[24] This encouraged us to publish our paper with unprecedented number of cases in the Gulf and Middle east.

Limitations

Data validation was carried out in 20% of cases. However, the absence of complications in the patient file does not necessarily indicate that no complications occurred, as parents may choose to seek treatment at a private institute. This is unlikely in our locality, as there is no suitable private institute in the governorate to handle such complications.

CONCLUSION

Plastic ring circumcision performed in infants below 1 year of age is considered a safe approach and is linked to a reduced number of complications. The rate of complications is proportionally related to increasing age at time of circumcision. The rate of complications is inversely related to the experience of the surgeon performing the technique.

Recommendations

We recommend encouraging plastic ring circumcision in younger age preferably around 2 months of age. Based on the results of our study, neonatal plastic ring circumcision was started in our institute making benefit of the relatively low complications rate in the younger age group. We noticed that most of the complications are operator dependent, so we recommend that the surgeon performing the procedure better be well trained. Randomized controlled studies are necessary to compare the approach with alternative methods.

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