The study of the factors affecting the time of ring fall off in circumcision using Plastibell

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ABSTRACT

Introduction: Circumcision is one of the oldest surgeries and is commonly done in various communities. One of the most common methods of this operation is using a ring or plastible. Given that one of the complications of circumcision by the ring is a delay in the ring fall off, this study is done with the purpose of determining the factors that affect the time of the ring fall off. Materials and Methods: This study was done in case series—prospective way. At first, local anesthesia was performed in the form of ring block and using 0.2 cc lidocaine 2% per kg body weight with an insulin syringe and then, by making a linear incision on the foreskin, a ring of the right size was placed on the glans. The foreskin was stretched on the ring and the 0–2 or 0–3 suture was tied to the ring groove and finally, the foreskin was removed from the distal part to the ring. Parents were asked about age, size of suture used, time of ring fall off, and status of sitz bath usage and were recorded even they done completely, incompletely, or not. Results: Finally 465 patients started the study with the average age of 7.55 ± 4.72 months. The average time of the ring fall off was 66.7 ± 60.2 days. People who had used the sitz bath completely (92.6 ± 36.2 days), compared to those who had used incompletely (63.8 ± 66.2 days) or no use at all (93.9 ± 58.2 days), they had shorter ring retention time ($P < 0.001$). Also, people who used 0–3 suture had shorter ring retention time compared to those who used 0–2 suture (82.6 ± 42.2 days versus 56.2 ± 27.8 days and $P < 0.001$). There was a significant relationship between age of ring retention and age, and the time of the ring fall off is shorter in those who are younger and the "less than or equal to 3 months" age group had the least time of the ring fall off. Conclusion: The results of this study showed that there is a significant relationship between the duration of the ring fall off and the age of individuals and the use of a sitz bath and the use of thinner suture (0–3).

Keywords: Circumcision, ring or plastibell, the ring fall off

Introduction

Circumcision is the foreskin removal of the penis. This is one of the oldest performed surgeries³⁸ and is been more than 5000 years.³⁹ This surgery is common among infants and babies in different communities, due to religious, cultural, social, and medical reasons.³⁹ Men worldwide are circumcised with a ratio of 1: 6³⁸ to 1: 4.³⁹ There are several methods for circumcision that the most common modern tool for infants is plastibell circumcision.¹¹ In this method, both generalized anesthesia and local anesthesia can be used. If generalized anesthesia is used, a local injection should be performed after the ring has been fixed until the local anesthesia lasts for at least 2 h. In this method, local anesthesia is performed in two ways: dorsal nerve block or penile ring block. Dorsal nerve block alone is not sufficient for local anesthesia and to control pain it’s better to use a combination of this and penile ring block, although the use of penile ring block can cause bruises and hematoma, usually, local anesthesia is generally recommended for infants.¹⁷ To perform this procedure,
a posterior incision is created in the foreskin, so that the glans penis appears. Then, the ring is positioned over the glans to be projected out through the hole at the top of the ring. Then, the foreskin returns on the ring and is clamped with a suture that is firmly attached to the groove. In the end, the remaining foreskin to the proximal ring is cut by scissors and the plastic handle is separated from its place.\textsuperscript{[1]}

If the size of the ring is smaller than the glans, the ring pressure on the glans, causing many problems, including necrosis and strangulation of the glans and followed by difficulty in urinating\textsuperscript{[6]} and obstruction in the canal. Another complication of the smaller ring that is visible after the smaller ring falls off from the glans, is the painless edematous ring that is visible transiently after the ring falls off the glans. In addition, insufficient amounts of the foreskin are separated following a smaller ring than glans. If the ring size is larger than the glans, the ring slides on the glans\textsuperscript{[1]} and the foreskin is separated more than desired. The benefits of this method are that there is not much bleeding, so it can also be used in hemophilia boys.\textsuperscript{[8]} This method is a fast, easy, accessible, and reliable method. In addition to these advantages, this method can be misused such as bleeding and infection, delay in ring fall off, which can be the source of infection, hematoma, and extra mucus.\textsuperscript{[11,12]}

Ring separation usually occurs within 12 days, if the ring is not separated from the glans within 15 days, it is considered as the remaining ring. This complication can be for the sake of excessive pressure on the glans during ring placement or choose the smaller ring than the glans.\textsuperscript{[13]} Also, delay in ring fall off or incomplete ring separation is seen if the foreskin is thick and the clamping thread is loose.\textsuperscript{[7]} Ring removal is usually done by sedating the patient and manually. If this fails, the ring is removed by a strong pair of scissors, in rare cases, none of these will help the ring to be removed and the patient should be re-anesthetized.\textsuperscript{[11]} There is a clear positive relationship between the age and weight of infants and the time of ring fall off, which means that ring separation occurs sooner than normal infants’ weight and at low ages due to the thinner foreskin. The complications of plastibell have improved in different studies; however, bleeding is still a serious problem.\textsuperscript{[9]} So, the purpose of this study is to investigate the factors affecting the time of the ring fall off in circumcision using plastibell.

### Materials and Methods

This study was done in case series—prospective way. The statistical population includes all cases referred to Amir Almomenin Hospital in Semnan, Iran which was supposed to be circumcised using the ring. The sampling method was a census. In this study, a researcher questionnaire was used to collect data about independent and underlying variables such as (age, the size of the used thread, how to use a sitz bath, and the length of the ring retention time). Written consent was obtained from all patients before entering the study.

### Inclusion criteria

1. Children who were supposed to circumcision using a ring were checked for congenital anomalies such as hypospadias before entering the study.

### Exclusion criteria

1. Bleeding following the ring (in this case, the ring will be pulled out and stitched)
2. The ring stick (it’s incomplete separation and migration of the ring to the proximal penis)
3. Failure to visit and patient inability to follow-up.

### Method

Before circumcision, patients were examined in terms of congenital anomalies such as hypospadias and excluded from the study if anomalies were present. In all cases, circumcision was performed by a surgeon. At first, local anesthesia was performed in the form of ring block using 0.2 cc lidocaine 2\% per kg body weight with an insulin syringe and then, by making a linear incision on the foreskin, a ring of the right size was placed on the glans. The foreskin was stretched on the ring and then the 0–2 or 0–3 suture was tied to the ring groove (by double ligation method), and finally the foreskin was removed from the distal part to the ring. After performing the ring, no wound dressing was laid, and patients were instructed to place their child in the sitz bath three times a day for 15 min. Mothers were also advised to use acetaminophen syrup or drops in case of child’s restlessness.

The first visit was on the 4\textsuperscript{th} day after the circumcision, and parents were also asked to come back when the ring was falling off. Parents were asked to the time the ring fell in each patient according to the day and status of the sitz bath and were recorded even they done completely, incompletely, or not.

### Data analysis method

After data collection, the database was generated by SPSS 19 software and descriptive information was extracted in tables and charts. Linear regression analysis and correlation tests were used to investigate the relationship between age and duration of the ring fall. Age grouping was also performed according to the results and the mean duration of ring fall in different groups and mean age difference in two groups of threads were analyzed using t-test. The mean age difference in different groups according to the status of sitz bath (complete, incomplete, or non-use) was also analyzed using analysis of variance test.

### Ethical considerations

The checklists were nameless and included only raw data and figures. Research units have also been assured that we are committed to protecting their information and that this information will remain confidential. On the other hand, all research units received written consent and were assured that if they did not consent to continue participating in the project; they had the right to cancel their participation at any project’s level.
Results

In total, 490 patients were enrolled in the study and were circumcised. 12 patients were excluded due to no referral. In six cases, the ring was removed by the surgeon due to reasons such as incomplete fall off the ring, migration of the ring to the proximal side, and in seven cases, the ring was removed and sutured due to bleeding on the same day. All of these were excluded from the study and finally, 465 patients were studied.

The mean age of circumcision cases was 7.55 ± 4.72 months. The average time of the ring fall off was 7.66± 2.6 days. The minimum duration was 3 days in 11 infants ranging in age from 15 days to 6 months and the maximum was 21 days in a 4-year-old child.

Of the 465 patients were studied, 316 people (68%) were completely and 81 people (17.4%) were incompletely used sitz baths. Also, 68 people (14.6%) did not use a sitz bath during having the ring.

Of the 465 patients were studied, in 267 people (57.4%) 0–2 thread was used and in 198 (42.6%) 0–3 thread was used.

Of 301 people, 64.7% were in the age group of less than or equal to 3 months, 137 people (29.4%) were in the age group of 3–12 months, 17 people (3.6%) were in the age group of 12 to 24 months, and 10 people (2.1%) were older than 24 months.

The results show that there is a significant relationship between the use of sitz bath and the size of used thread with the duration of the ring laying to fall off (P < 0.001), as seen in Table 1, if you use the sitz bath, the ring fall off time will be significantly decreasing (6.92 days for complete use of sitz bath versus 9.93 days if not used) and people who were used 0–3 thread (thinner thread) for them, they had shorter fall off duration than those who were used 0–2 thread (thicker) for them.(6.82 ± 2.42 days versus 8.27 ± 2.56 days). The results showed that there was a significant and relatively direct relationship between the time of the ring fall off and the age of the cases (P < 0.001 and R = 0.365, respectively). This means that as the age increased, the time of the ring falls off was significantly increased, in other words, when the people’s age be more, the time of the ring would remain in the circumcision place will be increased.

Overall in the study, observed seven cases of bleeding followed by circumcision, which in five cases 0-3 thread was used (with the age of 6.5, 3, 4 and 3.5 months) and in two cases 0–2 thread was used (with the age of 3 and 3.5 months). As regards, the bleeding that happened on the same day as circumcision, they did not use a sitz bath. Regarding the relationship between bleeding and thread size, the study showed that there was no significant relationship between the two (0.74% in 0–2 thread versus 2.46% in 0–3 thread, P > 0.05).

Chart 1: Investigating the relationship between time of the ring fall off and age

| Age (month) Mean±SD | P     | Time of the ring fall off (day) mean±SD | Number-Percent | Variable   |
|---------------------|-------|----------------------------------------|----------------|-----------|
| 7.55±4.72           |       | 7.66±2.6                               | 465-100%       | Total     |
| 8.65±6.85           | <0.001* | 9.93±2.58                             | 0 (non-use) (68-14.6%)       | Sitz bath |
| 10.12±5.81          |       | 8.63±2.06                              | 1 (incomplete use) (81-17.4%)          |           |
| 6.33±3.98           |       | 6.92±2.36                              | 2 (complete use) (316-68%)            | Used thread |
| 9.34±5.86           | <0.001b | 8.27±2.56                              | 2 (0-2) (267-57.4%)               |           |
| 3.45±1.18           |       | 6.82±2.42                              | 3 (0-3) (198-42.6%)               |           |

*<i>t</i>-test between the “non-use” and “complete use” groups. *<i>t</i>-test
The mean time of ring fall off in the present study was 7.66 ± 2.6 days. In the study of Samad et al., the average drop time was 10.3 days[13] and in another study, its average was 11 days. In the same study, it was mentioned that the time for the ring fall off was 5–8 days that have been announced from the manufacturer. The difference is that they have used the ring for a younger age.[11] The higher fall off time in our study was also probably due to the fact that in our study we use a ring for infants up to 6 years old.

In Samad's study, the average time of the ring fell off in 8.7 days in the below 3 months age group and was 16.8 days in the above 5 years age group. In our study, the lowest time of ring fall was in the below 3 months age group (2.27 ± 7 days) which was significantly different from other age groups. Also, the average time of ring fall in the below 1 year age group was significantly different from those above 2 years old, which emphasizes the effect of age at the time of ring fall. In explaining the cause of this relationship, it has been noted that at a younger age the foreskin is thinner and more easily necroses and separates.[17]

In the present study, it was shown that the use of a sitz bath is effective in an earlier ring fall off. As it was observed, in cases where the sitz bath was used completely (3 times a day), the ring was separated almost 3 days earlier than those not using it. In addition, as mentioned in the results, among the three factors studied in this study, the sitz bath had the most effect at the time of the ring fall off. In similar studies, although the use of a sitz bath has been suggested,[26][11] its effect on the time of ring fall has not been investigated, and usually, in many studies, the effect of age on ring fall has been discussed. Anyway, the present study has identified a strong relationship between the daily and regular use of a sitz bath at the time of ring fall. To justify this relationship, Winter's study can be mentioned. In this study, it was noted that the epithelialization rate of the wound in the wet environment was increased by 50% that when the wound was in the dry environment.[17]

Regarding the effect of thread size or in other words, the thread diameter used for ring closure, the present study showed that the use of thinner thread is effective in earlier ring fall. No similar study was found in this case either. In one study, double-ligation zero silk thread was used for the thread that closes on the ring; because they believed it would knot better. The author of this article noted that the size of the zero thread helps the

### Table 3: Multivariate linear regression analysis to Investigate the concurrent role of different variables in reducing time of the ring fall off and to examine their predictive effects on this time

| P     | Coefficient (not standardized) | Variable                                |
|-------|--------------------------------|-----------------------------------------|
| <0.001| −1.374                         | Using sitz bath (0=non-use, 1=complete use) |
| <0.001| −1.104                         | Thread used (2=2-0, 3=3-0)              |
| <0.001| 0.904                          | Age (month)                             |
| <0.001| 11.987                         | Fixed                                   |

Model (predictor formula). Falling time (days) = −1.374 × Waterbath + (−1.104 × suturetype) + (0.094 × age) + 11.987

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gradual fall of the ring (which were 5–12 days). We also used double-ligation silk thread of course, the threads we used were thinner (0–2 or 0–3). In the same study, it was noted that if thinner threads were used, it was more likely to open and separate the ring. Considering this probability, the cases in which our study was complicated and excluded from the study, and was no significant relationship with ring impaction (as observed in six patients and need to remove the ring) and the thread size. Also, there was no significant relationship between bleeding (seven cases) and the size of the used thread.

The physical definition of pressure and its relation to force and surface can be used to justify the relationship between thinner thread and earlier ring fall off. The pressure applied to a surface has a direct relation with the force and has the opposite ratio with the surface, and if the applied force at the surface is constant, the applied pressure at the smaller surface is greater. If the applied force by the fixed thread to the skin be a constant value, the 0–3 thread that has less cross-section, imports the more pressure on the underside, which is a foreskin and contains vessels, and as a result, the vessels are more easily closed and the foreskin necroses sooner, and so, the ring will fall off apart sooner.

In the end, it is worth noting that the high number of acceptable sample sizes greatly enhances the generalizability of the results and minimizes the probability of bias. In addition, one of the other strengths of this study was the recency of the study conducting in the region, because differences in the prevalence of one or more variables, in different geographical areas for genetic, geographical and cultural reasons, have always been of interest to health and medical researchers. Due to this that in the proposed study, the descriptive aims were to better understand the epidemiology and burden of this problem in society, and considering that in descriptive epidemiology, the researcher on the disease answers three questions about who, when and where, conducting this study in Semnan, for the first time in a large and diverse sample population, was an effective task.

**Conclusion**

Overall, the results of this study showed that there is a significant relationship between the duration of ring fall and the age of individuals and the use of a sitz bath and the use of thinner threads (0–3). Therefore, circumcision is recommended to be done at a young age, especially under 3 months older, using thinner threads, and daily and regularly sitz bath after the circumcision to reduce the prevalence of the ring retention.

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**Conflicts of interest**

There are no conflicts of interest.

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