

At What Age Range Should Children Be Circumcised?

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Background: Although male circumcision is a surgical intervention that is frequently performed in children, there is no consensus about the age at which it should be performed.

Objectives: The purpose of this study was to determine the best age range for routine male circumcision with respect to a child's health and the cost.

Patients and Methods: This clinical trial was conducted in the affiliated hospital of the Erzincan University of Medical Sciences, Turkey, in 2014. The circumcised children were evaluated in 3 groups: <1 year old (Group 1), 1-7 years old (Group 2), and >7 years old (Group 3). To obtain a satisfactory Wilton sedation score, midazolam 0.1 mg/kg IV was administered first. If adequate sedation was not achieved, ketamine 2 mg/kg IV was also administered. If adequate sedation was still not achieved, general anesthesia was administered via a laryngeal mask. At the end of the surgery, the groups were compared in terms of post-anesthesia recovery duration, complications, discharging duration, and cost.

Results: A total of 603 children were circumcised, 374 in Group 1, 94 in Group 2, and 135 in Group 3. Midazolam was sufficient for sedation in 364 Group 1 patients (97.3%), 6 Group 2 patients (6.3%), and 38 Group 3 patients (28.1%). The shortest post-anesthesia recovery duration after surgical intervention and time until discharge, the lowest cost, and the fewest anesthesia complications were observed in Group 1 ($P < 0.05$ for all).

Conclusions: Although almost all of the <1 year-old children could be sedated with midazolam alone, most of the >1 year-old children required ketamine or general anesthesia. Performing circumcision when children are less than 1 year old decreases the risk of complications due to anesthesia and lowers the costs compared with performing the procedure on older children.

Keywords: Circumcision; Age Groups; Anesthesia

1. Background

Circumcision is the surgical removal of the foreskin. A great variety of materials, devices and techniques are used for circumcision. The goal is to ensure that safety and morbidity are minimized regardless of the technique that is employed (1). Male circumcision has been performed for thousands of years. It is the most frequently implemented surgical intervention in children, and one third of all the men in the world are circumcised. The necessity of circumcision varies depending on religious beliefs and social structures in society. The procedure may also be performed for medical reasons (2). However, the issue of when to perform elective circumcision is still debated (3, 4). Circumcision is routinely performed in Muslim and Jewish cultures; however Muslims perform circumcision at age 6, whereas Jews perform it immediately after birth. Although a few minor surgical interventions can be performed under local anesthesia in childhood, sedation or general anesthesia are used for most surgical interventions (5). Different anesthesia methods

are applied for circumcision, depending on the age of the patient (6). Penile block or caudal block is used as the analgesia during circumcision. The patient is sedated with midazolam, a combination of midazolam and ketamine, or general anesthesia with a laryngeal mask (5, 7, 8).

2. Objectives

This study was carried out to determine the best age range for performing routine male circumcision with respect to anesthetic approach, complications and costs.

3. Patients and Methods

This clinical trial was conducted at the affiliated hospital of Erzincan University of Medical Sciences (Turkey) between June and December 2014. The approval of the Ethics Council of the university and the informed consent of the parents of the children were obtained. The children who were scheduled for circumcision only were included in this study. The children who had medical indications for circumcision, such as phimosis, balanitis, in addition

to hypospadias anomaly and bleeding disorders were excluded. The male children applying to our hospital for circumcision were divided into 3 groups based on age: Group 1 consisted of children younger than 1 year, Group 2 consisted of children ages 1-7, and Group 3 consisted of children older than 7. Routine physical examinations and laboratory examinations were performed. In preparation for surgery, the patients were sedated to achieve a Wilton sedation scale score equal to or higher than 3 (sitting or lying comfortably, eyes-open, cooperative, not crying) (9). Midazolam 0.1 mg/kg and atropine 0.02 mg/kg IV were first administered. If adequate sedation was not achieved, 2 mg/kg IV ketamine was administered. If adequate sedation was still not achieved, general anesthesia was given through a laryngeal mask (1% sevoflurane, 50% O₂, 0.2 mg/kg rocuronium bromide). A penile block was provided with 3 mg/kg lidocaine hydrochloride diluted with a 1/1 physiologic saline solution. The average duration of surgery was 15 minutes. After circumcision, the children with a modified Aldrete recovery score ≥ 9 were transferred to the service (10, 11). Analgesia (pudendal block) and the surgery was performed by the same surgeon for all of the patients. The anesthesia procedures, adequacy of sedation and anesthesia complications were assessed by the five anesthesiologists, but the surgical complications were evaluated by the surgeon. Double vision was evaluated in children > 6 years old. The groups were compared regarding the duration of postanesthesia recovery, complications, time until discharge, and cost statistically.

3.1. Statistics

Continuous variables were shown as medians (minimum-maximum) and categorical data were presented as percentages. The one-sample Kolmogorov-Smirnov test was used to evaluate whether the distribution of continuous variables was normal. The continuous variables among groups were compared with Kruskal-Wallis test. The categorical variables were compared appropriately with chi-square or Fisher exact test. A 2-sided P value < 0.05 was considered significant in all analyses. Data were analyzed using SPSS 17.0 version (SPSS Inc, Chicago, Illinois).

4. Results

This study included a total of 603 children. There were 374 children in Group 1 (< 1 year), 94 children in Group 2 (1-7 years old), and 135 children in Group 3 (> 7 years old). In Group 1, sedation was achieved with midazolam for 364 children (97.3%), and the addition of ketamine was required for 10 children (2.7%). In Group 2, sedation was achieved with midazolam alone in only 6 children (6.3%), ketamine was required for 64 children (80.8%), and general anesthesia was required for 12 children (12.8%). In Group 3, sedation was achieved with midazolam in 38 children (28.1%), the addition of ketamine was needed

for 51 patients (38%), and general anesthesia was required by only 4 children (3%). For 42 children in Group 3, no sedation was needed (31.1%). These values are summarized in Table 1. Anesthesia and surgical complications are presented in Tables 2 and 3. The groups were compared statistically in terms of cost (\$), post-anesthesia recovery duration (minutes), time until discharge (hours), and complications (Table 4). The cost, post-anesthesia recovery duration, time until discharge, and anesthesia complications for Group 1 were significantly lower than those for Groups 2 or 3, and those of Group 3 were significantly lower compared with Group 2 ($P < 0.001$). No significant difference was found with respect to the surgical complications ($P > 0.05$).

Table 1. Distribution of Administered Anesthesia Methods Among the Groups ^a

Anesthesia Methods	Group 1	Group 2	Group 3
Midazolam	364 (97.3)	6 (6.3)	38 (28)
Midazolam + ketamin	10 (2.7)	76 (80.9)	51 (38)
General anesthesia	-	12 (12.8)	4 (3)
No sedation	-	-	42 (31)
Total	374 (62)	94 (15.5)	135 (22.5)

^a Data are presented as No. (%).

Table 2. Anesthesia Complications

	Group 1	Group 2	Group 3	Total
Respiratory depression	0	3	2	5
Vomiting	1	4	4	9
Bronchospasm	0	2	1	3
Allergic reactions	1	4	3	8
Double vision	0	15	20	35
Cardiac arrest	0	0	0	0
Total	2	28	30	60 ($P < 0.05$)

Table 3. Surgical Complications

	Group 1	Group 2	Group 3	Total
Bleeding	3	1	2	6
Infection	2	1	1	4
Incomplete circumcision	1	0	1	2
Meatal stenosis	0	0	0	0
Urethral fistula	0	0	0	0
Glanular necrosis and amputation	0	0	0	0
Total	6	2	4	12 ($P > 0.05$)

Table 4. Statistical Analyses of Groups^a

	Group 1	Group 2	Group 3	P Value
Cost (US \$)	13.01 (11.01-14.25)	15.80 (13.36-26.50)	13.53 (13.00-27.67)	< 0.001
Post-anesthesia recovery duration, min	1.00 (0.50-7.50)	7.00 (0.50-15.00)	3.00 (0.00-15.00)	< 0.001
Discharge duration, hours	1.00 (0.16-3.50)	3.00 (0.75-5.00)	1.50 (0.08-5.00)	< 0.001
Surgical complication, %	1.6	3.2	3.7	0.317
Anesthesia complication, %	0.5	24.5	17.8	< 0.001

^a The numbers in parenthesis indicate Range.

5. Discussion

Most of the debates about the best age at which to perform male circumcision focus on the following age groups: neonatal and infancy period, phallic stage (age 3-4) and school age (2, 12, 13). We aimed to approach this question from a different viewpoint. Although male circumcision is considered an ethical problem in the world, 30% of all men are circumcised. Except for emergency cases, circumcision is usually performed for religious, medical, or hygienic reasons. Moreover, it has been reported to have socio-sexually positive aspects (14). The issue male circumcision that it is performed routinely some communities in the world what age should be done and which anesthesia methods should be used are discussed. El Bcheraoui stated that adverse events associated with male circumcision are reduced if the procedure is performed during the first year of life (15).

Circumcision is a painful surgical procedure. Therefore, appropriate anesthesia and postoperative analgesia is required (16). When circumcision is performed in children older than 6, as is customary for Muslims, sevoflurane general anesthesia and penile block are typically used. For neonatal circumcision, which is implemented more frequently in Jewish societies, local anesthetic pomades are administered. It has been reported that the <1 age circumcision increased the respiratory problems after the general anesthesia. Thus, the use of general anesthesia during circumcision should be reserved for patients who are older than 1 (6). The most important ethical issue to be discussed about circumcision is the analgesia and anesthesia. Which analgesia and anesthesia methods should be implemented in which age groups (17)? A combination of midazolam and ketamine is frequently used as sedoanalgesia in children (5, 18). In our study, general anesthesia was not required for any of the subjects < 1 year old, and sedation was achieved with midazolam alone in 97% of these patients. The rate of complications due to anesthesia was lower for patients who were sedated with midazolam than for those who received both midazolam and ketamine. The highest rate of complications due to anesthesia was observed in children who received general anesthesia. This may explain why group 1, which did not include any patients who underwent general anesthesia, experienced significantly fewer complications related to anesthesia than group 2, and group 3 experienced sig-

nificantly less complications related to anesthesia than group 2 ($P < 0.001$). Analgesia was achieved via a penile block. The shortest post-anesthesia recovery period was observed in group 1 (1.1 minutes), and the longest period was observed in group 2 (7.2 minutes) ($P < 0.001$).

It has been reported in the literature that neonatal circumcision is less painful and is associated with fewer complications, but it requires more experience on the part of the surgeon. However, there are reports of increasing surgical complications associated with neonatal circumcision (19-21). The youngest child in our series was 1 month old, while the oldest patient was 14 years old; thus, no neonatal circumcision was performed. With respect to surgical complications, no statistically significant difference was found among the groups ($P > 0.05$). For boys in the phallic period experiencing phimosis, topical steroid treatment is recommended as a nonsurgical alternative to circumcision to avoid castration anxiety (22). Armagan et al. reported that circumcision in the phallic period doesn't affect psychosexual functions (13). Cueloglu et al. found that the risk of premature ejaculation is higher in children circumcised after age 7 (23). Children who are under the 1 year old are excluded in these discussions. These findings suggest that it is better to perform circumcision when boys are < 1 year old, when the anesthesia complications are also at a minimum.

A longer hospitalization is associated with an increased risk of infection as well as increased costs (24). Although the cost per circumcision in a comprehensive series in Florida was \$6,263, it can reach as high as \$15 in other countries (12, 25). The cost of neonatal circumcision have been an average \$38 in Canada (26). In our study, Group 1 had the shortest mean time until discharge (1.00 hours), and Group 2 had the longest time until discharge (3.00 hours). Similarly, the lowest cost was found in Group 1 (\$13.01), whereas the highest cost was found in Group 2 (\$15.80). With respect to the time until discharge and cost, Group 1 was found to be lower than Group 2, and Group 3 was found to be lower than Group 2 ($P < 0.001$). The surgeon's tools used in circumcision are the same for all age groups and thus don't affect the cost. The main factor contributing to the cost is the anesthesia method used. The use of general anesthesia results in a longer hospital stay and higher costs than the use of sedative

agents. In our study, sedation or anesthesia was not needed for some of the boys who were > 9 years old [42 children (31%)]. Sedation or administration of anesthesia was required for 2 of 3 children. The use of midazolam alone ensured the lowest complication rate, fastest post-anesthesia recovery time and shortest time to discharge. Midazolam by itself provided effective sedation in 97% of the children in Group 1, 6% of the children in Group 2, and 28% of the children in Group 3.

One limitation of this study is that the youngest child in our series was 1 month old, while the oldest one was 14 years old. This study would also have benefitted from having an equal number of patients in each group to provide a diffuse statistical distribution. One of the strengths of this study was that it revealed that most people in Turkish society want male circumcision to be performed when boys are under one year of age, as evidenced by the fact that 62% of the circumcisions in this series were performed on children less than 1 year old.

In conclusion, adequate analgesia for circumcision can be provided via pudendal block. It is important to ensure a child is not scared or crying during circumcision. This can be accomplished with the use of midazolam for children younger than 1 year old. Compared with performing circumcision on older children, performing circumcision when a child is < 1 year old is associated with minimal anesthetic complications, a shorter time until discharge and lower cost. Moreover, these young children are not at risk of being affected psychologically by the procedure.

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Authors' Contributions

1- Study concept and design: Senol Bicer 2- Acquisition of data: Senol BiASer, Ufuk Kuyrukluylidiz 3- Analysis and interpretation of data: Senol Bicer, Fethi Akyol 4- Drafting of the manuscript: Senol Bicer, Ufuk Kuyrukluylidiz, Fethi Akyol, Murat Sahin, Orhan Binici, Didem Onk. 5- Statistical analysis: Senol Bicer, Didem Onk 6- Study supervision: Senol Bicer, Ufuk Kuyrukluylidiz, Murat Sahin 7- Patients' examination: Senol Bicer, Ufuk Kuyrukluylidiz, Fethi Akyol, Murat Sahin, Orhan Binici, Didem Onk. 8- Performing the circumcision: Senol Bicer 9- Administering anesthesia: Ufuk Kuyrukluylidiz, Fethi Akyol, Murat Sahin, Orhan Binici, Didem Onk.

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