



Contents lists available at ScienceDirect

Journal of Pediatric Surgery

journal homepage: www.elsevier.com/locate/jped surg.org

How does circumcision performed under regional anesthesia affect sleep, feeding, and maternal attachment in babies aged 0–4 months?

Fatih Akova^{a,*}, Gunay Budagova^b^a Department of Pediatric Surgery, Biruni University School of Medicine, Istanbul, Turkey,^b Department of Child and Adolescent Psychiatry, Biruni University School of Medicine, Istanbul, Turkey

ARTICLE INFO

Article history:

Received 15 September 2021

Revised 19 December 2021

Accepted 30 December 2021

Available online xxx

Keywords:

Circumcision

Breastfeeding

Sleep

Maternal attachment

Maternal attachment inventory

Mother-infant interaction

ABSTRACT

Background: There is no consensus whether circumcision performed in the first months of life has negative effects on feeding, sleep, and maternal attachment in babies. This prospective study aimed to investigate this relation in the first months of life. This study is the first to investigate the effects of circumcision on feeding, sleep, and maternal attachment simultaneously.

Methods: The study group consisted of 75 families with their babies aged 0–4 months. Surgical circumcision procedure under regional anesthesia was applied to all patients. The questionnaires were used to evaluate the babies' feeding and sleeping habits, and the Maternal Attachment Inventory (MAI) was used to assess mother-baby attachment level. All assessments were performed before and one month after the circumcision.

Results: The mean age of the patients when circumcision was performed was 75 (74.52 ± 37.03) (3–120) days. The mean ages of mothers were 32 (32.51 ± 4.05) years. There was no statistically significant change in the sleep habits and feeding status of babies before and after circumcision. The mean maternal attachment value before circumcision was 101 (98.89 ± 6.77) points, while it was 103 (101.36 ± 4.21) points after circumcision. This result indicates that the maternal attachment score increased significantly after circumcision ($p < 0.001$).

Conclusions: The circumcision performed under regional anesthesia between 0 and 4 months did not have any negative effect on sleep, feeding, and maternal attachment in babies.

© 2022 Elsevier Inc. All rights reserved.

1. Introduction

Circumcision is an elective surgical procedure that consists of surgical removal of the shaft skin and inner foreskin to reveal the glans. The global prevalence of circumcision is estimated to be 38%–39%. It is an elective procedure that is ritual to many societies but medical for a minority in others [1]. It is most frequently performed in newborns, followed by infants and children, and it can be performed at any age, with significant differences in complication rates and costs [2].

The consensus statement of the American Academy of Pediatrics on male circumcision suggests that boys with urological abnormalities may benefit additionally from circumcision in reducing the risk of urinary tract infections [3]. In this report published in 2012, it was concluded that the benefits of circumcision outweigh its potential risks [3].

Some experts do not recommend neonatal circumcision in the first days of life because circumcision is a painful and stressful process for the newborn and negatively affects sleep cycles and maternal attachment (MA) [4].

It has been demonstrated that babies respond to circumcision, which is associated with pain and tissue damage, in simple ways that include vocalization, facial expression, body movements, and autonomic activity [5]. In a report by the American Academy of Pediatrics Task Force on Circumcision in 1989, attention has been drawn to behavioral changes caused by circumcision [6]. It has been found that approximately 90% of circumcised babies change their behavior significantly after circumcision [7]. Differences in sleep patterns and higher irritability have been observed among circumcised babies [8].

It is crucial to determine the psychological and behavioral effects of circumcision, on babies. Our study is the first prospective study in the literature to investigate the effects of circumcision under regional anesthesia on the sleep and feeding habits as well as MA of babies, utilizing a validated healthcare questionnaire approach.

Abbreviations: MA, Maternal attachment; MAI, Maternal Attachment Inventory.

* Corresponding author at: Yenibosna merkez m. Değirmenbahçe c. No:17 c2b blok daire:31, 34197, Bahçelievler, Istanbul, Turkey.

E-mail address: fatihakova@yahoo.com (F. Akova).

<https://doi.org/10.1016/j.jpedsurg.2021.12.026>

0022-3468/© 2022 Elsevier Inc. All rights reserved.

Please cite this article as: F. Akova and G. Budagova, How does circumcision performed under regional anesthesia affect sleep, feeding, and maternal attachment in babies aged 0–4 months? Journal of Pediatric Surgery, <https://doi.org/10.1016/j.jpedsurg.2021.12.026>

2. Methods

2.1. Study participants

Our study group consisted of families with babies aged 0–4 months who underwent circumcision surgery at Biruni University Medical Faculty Hospital Pediatric Surgery Clinic between April 2020 and January 2021. Babies who underwent general anesthesia and had additional surgical interventions other than circumcision were excluded from the study and were accepted as exclusion criteria. Circumcision with general anesthesia and additional surgical intervention were not included in the study because they may be an extra condition that may affect maternal attachment. Families who applied to the clinic were informed about the study, and 75 families agreed to participate in the study. After the surgery was planned for circumcision, the families were given the sociodemographic form, questionnaires about nutrition, sleep, and Maternal Attachment Inventory (MAI) before the procedure. The mothers were interviewed before surgery. During the interview, the sociodemographic form and information about the surgery were filled out by the pediatric surgeon. Additionally, information about the risks of the surgery and possible postoperative complications was given. A child psychiatrist asked the mothers to fill in the questionnaires on the sleeping and feeding habits as well as the MAI. Mothers and their babies were invited to the pediatric surgery outpatient clinic for follow-up one month after surgery. Seventy-five babies who were circumcised in the previous month, the mothers were asked to fill out the questionnaires about sleep and nutrition as well as MAI again. After the questionnaires were completed, they were reviewed by the clinicians. Approval was obtained from the local organizing Ethics Committee (no.2020/39-35).

2.2. Data collection

Questionnaires on sleep and feeding habits were prepared by a pediatric surgeon and a child-adolescent psychiatrist and consisted of questions related to the babies' total sleep times as well as sleeping and feeding habits.

MAI was used to measure MA. Muller formulated the MAI questions in line with the literature examining maternal adaptation and MA [9]. Muller examined whether MAI could be used after the postpartum period. Cronbach's alpha was found to be 0.76 at the fourth month postpartum, and Cronbach's alpha = 0.85 at the eighth month. As a result, MAI was accepted as 26 items. [10].

Since MAI is a self-administered scale that measures maternal emotions and behaviors that show love, it can be applied to women who are literate and can understand what they read. Each item is a 4-point Likert-type, 26-item scale with responses ranging from "always" to "never." Each item includes direct statements, and points are calculated as follows: a response of "always" corresponds to 4 points, "often" to 3 points, "sometimes" to 2 points, and "never" to 1 point. The total score is obtained by calculating the sum of all items; high scores indicate high maternal attachment. The lowest score to be obtained from the scale is 26, whereas the highest is 104 [9,10].

In the study "Adaptation of Maternal Attachment Scale to Turkish Society" adapted to Turkish in 2009 by Kavlak and Şirin, the Turkish validity of MAI was assessed by Kavlak and Şirin. Cronbach's alpha internal consistency reliability score of Turkish validity MAI was found to be 0.77 in mothers with 1-month-old babies and 0.82 in mothers with 4-month-old babies [11].

The most effective analgesic technique during neonatal circumcision was defined as regional anesthesia applied as a circumferential block around the penis, combined with oral sucrose, and lidocaine/prilocaine cream applied before the procedure [12]. In our

practice, this method was also used. Regional anesthesia was prepared by diluting a 1:1 saline solution with 0.5% 0.1 mg/kg bupivacaine hydrochloride and applying it as a circumferential penile block 5 min before circumcision. During the procedure, breast milk and sucrose were administered orally if needed. All patients were operated on by the same surgeon. The families of the patients were not present with the babies during the circumcision.

The circumcision procedure was applied to all patients surgically. First of all, if there is phimosis, the dorsal slit was made and the outer skin part of the prepuce was marked and incised with the help of a scalpel. Then, the inner surface of the prepuce was cut with the help of scissors and the prepuce tissue was completely excised with the help of bipolar cautery, and the bleeding was controlled and sutured with 6.0 polyglactin. No serious postoperative complications were observed in any patient. After the procedure, analgesia was provided with 10 mg/kg oral acetaminophen and a gel-like cream containing lidocaine applied around the glans.

2.3. Data analysis

Independent categorical variables were analyzed using the Pearson–McNamer and exact Chi-square tests. Differences between pre- and postoperative MA in the two groups were analyzed using the Mann–Whitney U test, and comparison among more than two groups was done using the Kruskal–Wallis test. Categorical variables were expressed as numbers and percentage values in descriptive statistical analyses. SPSS Windows version 24.0 package program was used for statistical analyses, and $p < 0.05$ was considered statistically significant.

3. Results

Seventy-five families who had a circumcision operation for their 0–4 months old baby participated in our study. The mean age of the patients at circumcision was 75 (74.52 ± 37.03 ; 3–120 days). The mean ages of mothers and fathers were 32 (32.51 ± 4.05) and 35 (34.79 ± 4.17) years, respectively. We observed that 72% of the patients were older than 60 days. Other sociodemographic data of the families are summarized in Table 1.

Analyses related to feeding and sleeping habits before and after circumcision:

There were no significant differences ($p = 0.180$) in the average number of times of breastfeeding observed before (9.89 ± 3.66) and after circumcision (9.70 ± 3.80). Similarly, the average breastfeeding time (minutes) before circumcision (21.59 ± 9.76) and after circumcision (20.85 ± 10.35) were statistically similar ($p = 0.564$). It was observed that the average sleep times (hours) observed before circumcision (16.31 ± 2.36) and that after circumcision (16.24 ± 2.29) were similar ($p = 0.329$). The longest daytime sleep duration (hours) observed before circumcision was (2.33 ± 0.90), whereas that after circumcision was (2.31 ± 0.87); these values were statistically similar ($p = 0.590$). Similarly, the frequency of waking up at night (times) before circumcision was (1.53 ± 0.74), whereas that after circumcision was (1.55 ± 0.74); no significant difference ($p = 0.549$) was observed. Furthermore, no significant differences were observed in terms of crying frequency assessment before and after circumcision both (2.00 ± 0.68) ($p = 0.995$). We observed no significant differences in the average number of times of breastfeeding observed, the average breastfeeding time, the average sleep time, the longest daytime sleep duration, the frequency of waking up at night, and the crying frequency assessment. Detailed results of the analyses are presented in Table 2.

Other analyses related to feeding and sleeping habits before and after circumcision.

Table 1

Sociodemographic data.

Age group(days)	< 60	N21	(%)28.0
	> 60	54	72.0
Birth order of the child	1.	48	64.0
	2.	19	25.3
	3.	5	6.7
	4.	3	4.0
Mother's educational status	Middle school	4	5.3
	High school	9	12.0
	University	62	82.7
Is the mother employed?	Yes	54	72.0
	No	21	28.0
Mother's profession	State official	30	40.0
	Worker	15	20.0
	Self-employment	10	13.3
	Housewife	20	26.7
Mother's health problem	No	68	90.7
	Yes	7	9.3
Mother's history of previous surgery	No	58	77.3
	Yes	17	22.7
Parents' marital status	Together	74	98.7
	Divorced	1	1.3
Kinship between parents	Yes	2	2.7
	No	73	97.3
Family type	Nuclear family	71	94.7
	Extended family	4	5.3
Monthly net income (US dollars)	1 000–2 000	12	16.0
	2 000–4 000	41	54.7
	≥4 000	22	29.3
Number of children in the family	1	46	61.3
	2	21	28.0
	3	5	6.7
	≥4	3	4.0
Sad incident in the last period	Yes	7	9.3
	No	68	90.7
Child's history of previous surgery	Yes	2	2.7
	No	73	97.3
Previous circumcision experience	Yes	14	18.7
	No	61	81.3
Concerns about circumcision	Yes	26	34.7
	No	49	65.3
	Complication	7	26.9
	Ache	2	7.7
	Separation	1	3.8
	Impaired body integrity	2	7.7
More than one reason	14	53.8	

Table 2

The evaluation results of the number of breastfeeding (BF) before and after circumcision, the duration of breastfeeding and the time of sleep, the longest sleep time during the day (LSD), the frequency of waking up at night, and crying frequency. (*p* values were obtained from Wilcoxon or paired *t*-test, SD: standard deviation, Min-max: Minimum–maximum).

	Before circumcision			After circumcision			<i>p</i>
	Median	Mean ± SD	Min–max	Median	Mean ± SD	Min–max	
Number of BF (times)	10	9.89 ± 3.66	0–20	10	9.70 ± 3.80	0–20	0.180
BFduration (min)	20	21.59 ± 9.76	5–60	20	20.85 ± 10.35	0–60	0.564
Sleep duration (hour)	16	16.31 ± 2.36	10–20	16	16.24 ± 2.29	10–20	0.329
LSD (hours)	2	2.33 ± 0.90	1–5	2	2.31 ± 0.87	1–5	0.590
Frequency of waking up at night	2	1.53 ± 0.74	0–3	1	1.55 ± 0.74	0–3	0.549
Crying frequency	2	2.00 ± 0.68	1–4	2	2.00 ± 0.68	1–4	0.995

The breastfeeding experience of 97.8% of the 46 babies with good breastfeeding experience before circumcision continued to be good after circumcision, whereas 96.6% of the 29 babies with moderate or poor breastfeeding experience before circumcision continued to have a similar experience after circumcision. There were no significant differences in the breastfeeding experience before and after circumcision (*p* = 0.990). All the 47 babies (100%) fed with breast milk before circumcision continued to be fed with breast milk after circumcision. Similarly, 28 babies (100%) fed with breast milk and formula before circumcision continued on these after circumcision. No significant difference was found in feeding type be-

fore and after circumcision (*p* = 0.999). We found a similar pattern in babies without breast refusal, i.e., 97.1% of the 69 babies who did not have breast refusal before circumcision continued this after circumcision, and no significant difference in breast refusal was observed before and after circumcision (*p* = 0.235). Six babies who had difficulties in care before circumcision continued to have such difficulties after circumcision, and 98.6% of the 69 babies who did not have any difficulties in care before circumcision continued this pattern after circumcision. There was no significant difference in difficulty in care observed before and after circumcision (*p* = 0.998). Similarly, no significant difference was

Table 3
Other analyses related to feeding and sleeping habits before and after circumcision. No statistically significant difference was found in terms of sleep and feeding before and after circumcision in the observations ($p > 0.05$) (p values were obtained from McNamer test).

		After circumcision n (%)	n (%)	p
Before circumcision (feeding)	Breastfeeding experience			
	Good	45 (97.8)	Medium, bad	0.990
	Medium, bad	1 (2.2)	1 (3.4)	
	Feeding type		28 (96.6)	
	Breast milk	47 (100)	Breast milk, formula	0.999
	Breast milk, formula	0 (0)	0 (0)	
	Breast refusal	0 (0)	28 (100)	
	Yes	2 (2.9)	No	0.235
	No	67 (97.1)	1 (100)	
	Maintenance difficulty		0 (0)	
Yes	6 (100)	No	0.998	
No	0 (0)	1 (1.4)		
Breastfeeding interruption		68 (98.6)		
Yes	2 (2.9)	No	0.223	
No	67 (97.1)	1 (100)		
The way of going back to sleep at night		0 (0)		
Before circumcision (sleep)	Physical contact	61 (98.4)	By themselves	0.995
	By themselves	1 (1.6)	0 (0)	
	Falling asleep		13 (100)	
	Physical contact	67 (100)	By themselves	0.500
	By themselves	0 (0)	2 (25)	
	Sleep patterns regularity		6 (75)	
	Regular	19 (100)	Irregular	0.999
	Irregular	0 (0)	0 (0)	
	Not calm down while crying		56 (100)	
	Cuddling	47 (94)	Breastfeeding	0.995
Breastfeeding	3 (6)	2 (8)		
Calming down with the mother's presence		23 (92)		
Immediately	26 (92.9)	After a while	0.895	
After a while	2 (7.1)	1 (2.1)		
		46 (97.9)		

found in breastfeeding interruptions before and after circumcision ($p = 0.223$) (Table 3).

Among the babies who required physical contact to fall back to sleep after a sleep interruption at night, 98.4% of the 62 babies continued this sleep habit after circumcision, whereas all 100% of the 13 babies who slept on their own before circumcision continued to sleep on their own after circumcision. No significant difference was observed in this regard ($p = 0.995$). Of all 67 babies who fell asleep requiring physical soothing prior to surgery, no change in habit was observed post-surgery.

Similarly, no change in sleeping habits was observed after circumcision in 75% of the 8 babies who slept on their own before circumcision. There was no statistically significant difference in the way of falling asleep before and after circumcision ($p = 0.500$). No significant difference ($p = 0.999$) was observed in the sleeping pattern of babies with regular and irregular sleep patterns before and after circumcision. Among the babies whose way of calming down while crying before circumcision was cuddling, 94% of the 50 babies continued to calm down through cuddling after circumcision. Meanwhile, 92% of the 25 babies whose way of calming down while crying before circumcision was breastfeeding continued this habit after circumcision. There was no statistically significant difference before and after circumcision in terms of calming down while crying ($p = 0.995$). In 92.9% of the 28 babies whose reaction to the presence of the mother was in the form of calming down immediately before circumcision continued this pattern

after circumcision. In a similar trend, 97.9% of the 47 babies whose reaction before circumcision to the presence of the mother was to cry a little and then calm down continued this pattern after circumcision. There was no significant difference in terms of response to the presence of the mother before and after circumcision ($p = 0.895$). Detailed results of the analyses are presented in Table 3.

3.1. Analysis of MA before and after circumcision

The median MA scores obtained using MAI adapted to the Turkish population were 101 (98.89 ± 6.77) and 103 (101.36 ± 4.21) points, respectively, before and after circumcision; the difference was (95% confidence interval) -2.46 (-3.14 – 1.77). This result indicates that the MA scores increased significantly after circumcision ($p < 0.001$) (Table 4).

There was no difference in MA before and after circumcision in babies both younger and older than 60 days ($p = 0.376$). Similarly, no difference in MA was observed before and after circumcision in babies with birth weight less than or more than 3300 g ($p = 0.845$). Moreover, no significant difference was observed in MA and other variables (birth order of the child, birth type, mother's education status, mother's employment status, mother's occupation, maternal health problems, family income status, family type, previous circumcision experience) before and after circumcision. ($p > 0.05$) (Table 5).

Table 4

Overall maternal attachment before and after circumcision. The difference between maternal attachment before and after circumcision was analyzed using the Mann–Whitney U test (SD: standard deviation).

	Before Median	Mean±SD	After Median	Mean±SD	Difference (% 95 CI)	p
Overall	101,00	98,89±6,77	103,00	101,36±4,21	-2,46 (-3,14 -1,77)	<0,001

Table 5

Maternal attachment before and after circumcision. The difference between maternal attachment before and after circumcision in the two groups was analyzed using the Mann–Whitney U test, and the comparison in more than two groups was analyzed using the Kruskal–Wallis test. (SD: standard deviation).

	n	Mean	SD	Median	Mean 95% confidence interval Lower Upper	p
Age (days)						
<60	21	-2.81	3.19	-2	-4.26 -1.36	0.376
>60	54	-2.33	3.00	-1.5	-3.15 -1.51	
Birth weight (grams)						
<3300	33	-2.27	2.32	-2	-3.09 -1.44	0.845
>3300	42	-2.61	2,52	-2	-3.71 -1.52	
Birth order of the child						
First	48	-2.29	2.82	-2	-3.11 -1.47	0.086
Second	19	-1.89	2.31	-1	-3.01 -0.78	
Third	5	-3.00	2.00	-4	-5.48 -0.52	
Fourth	3	-8.00	7.00	-5	-25.39 9.39	
Mother's education level						
Middle school	4	-4.25	7.85	-0.5	-16.74 8.24	0.804
High school	9	-2.33	2.18	-1	-4.01 -0.66	
University	62	-2.37	2.71	-2	-3.06 -1.68	
Is the mother employed?						
Yes	54	-2.35	2.82	-2	-3.12 -1.58	0.687
No	21	-2.76	3.32	-2	-4.41 -1.11	
Mother's profession						
Officer	30	-2.20	3.03	-1	-3.33 -1.07	0.763
Worker	15	-2.60	2.44	-2	-3.95 -1.25	
Self-employed	10	-2.40	2.76	-2	-4.37 -0.43	
Housewife	20	-2.80	3.71	-2	-4.54 -1.06	
Maternal health problem						
Yes	7	-3.71	3.25	-3	-6.72 -0.71	0.181
No	68	-2.34	3.02	-2	-3.07 -1.61	
Income (US dollars)						
1 000-2 000	12	-3.33	2.50	-3	-4.92 -1.75	0.068
2 000-4 000	41	-2.51	3.08	-2	-3.49 -1.54	
≥4 000	22	-1.91	3.24	-0.5	-3.34 -0.47	
Family type						
Nuclear family	71	-2.51	3.08	-2	-3.24 -1.78	0.641
Extended family	4	-1.75	2.36	-1	-5.51 2.01	

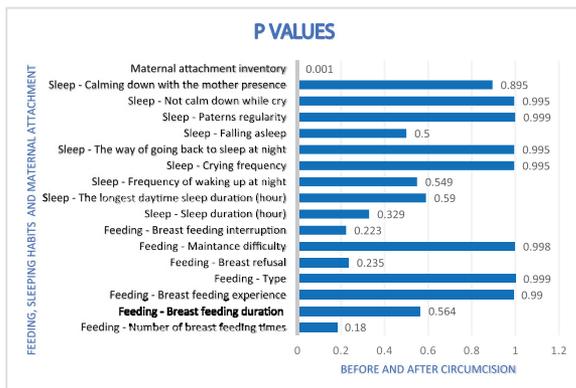


Fig. 1. A summary of the all statistical p values of the study.

A summary of the all statistical p values of the study is presented in Fig. 1.

Correlation analysis of variables with MA difference before and after circumcision. A weak and significant negative correlation was observed between maternal age and difference in MA (differ-

ence MA Spearman correlation coefficient $\rho = -0.232, p = 0.045$) ($n = 75$).

4. Discussion

This is the first prospective study to examine the effects of circumcision performed under regional anesthesia on sleep, feeding habits, and MA of 0–4 months old babies (newborn and early infant period). A control group was not included in the study since the changes of the aforementioned parameters before and one month after circumcision were examined.

There are clamp methods defined especially in newborn babies for circumcision procedures. Three surgical devices are commonly used to perform in neonatal circumcision. Clamping techniques are defined as procedures that can be performed especially in newborn circumcisions [3]. However, in our study group, babies who were circumcised by the surgical method, which were preferred due to surgical habits and because there were also infants other than newborn babies, were included in the study.

Circumcision is considered physically traumatic, especially in the absence of regional anesthesia and activation of the hypothalamic–pituitary–adrenal axis, and it is assumed that circumcision will be responsible for changes in sleep architecture

[13]. Our results revealed that circumcision has no negative effect on sleep duration and sleep habits. This may be because regional anesthesia was applied in our study. In the literature, negative effects on sleep were generally observed immediately after circumcision and for a short duration. In contrast, in our study, we analyzed the conditions that may occur in 1 month after circumcision, after the healing process was completed, and no negative effects were found.

It suggests that women who want to breastfeed their male babies may have to weigh the benefits of circumcision with those of breastfeeding if circumcision is found to impair breastfeeding. However, in spite of the widespread opinion that circumcision may impair breastfeeding, the evidence on which this claim is based is weak [14]. Using the Brazelton Neonatal Behavioral Assessment Scale, babies before and after circumcision were examined, and it was observed that 4 h after circumcision, 90% of babies responded differently to stimuli compared to the preoperative period. Approximately half of the babies were more active, agitated, and moody after circumcision, whereas the other half were calmer and became drowsier; however, within 24 h, most of them returned to there before the circumcision responses [15]. This evidence is largely derived from observational studies of the short-term effects of circumcision on infant behavior and MA [15,16].

In a previous study, no evidence was found to support the claims that neonatal circumcision caused breastfeeding problems in the early period or was a factor in the emergence of diseases such as atopic dermatitis, asthma, and gastrointestinal problems that may occur due to lack of breastfeeding in childhood [17]. Similarly, it has been demonstrated that early circumcision performed before discharge from the hospital after birth does not have a significant effect on newborn feeding behaviors in bottle-fed male babies [18].

The opinion that circumcision interrupts breastfeeding and has negative effects on breastfeeding is often strongly advocated [19,20]. However, in this study, no evidence was found to support these claims.

In previous reports examining the relationship between mother–infant interaction and circumcision, there are data suggesting that some parents regretted their decision to perform circumcision for their baby, and some remember the day they watched their baby's circumcision as the worst day of their lives [21]. These feedbacks were generally received after circumcision procedures without anesthesia and after circumcision procedures considered very painful. In our study, we believe that there was no negative effect on MA since the procedure was performed under regional anesthesia, in a room where the family was not present. Contrary to the results in the literature, our results showed that MA was positively affected after circumcision and that MAI scores increased statistically significantly. It may be more appropriate to interpret this result as that the circumcision does not have any negative side effects in the long term, rather than considering this finding as a positive effect of circumcision on attachment. It is known that the first attachment behavior between mother and baby occurs right after birth, and it takes shape between the next 6 and 24 months [22]. As the child's needs are met, an ongoing connection to the mother gradually develops step-by-step in the baby's cognitive world [23]. Based on these observations, it was concluded in our study that maternal love and the adaptation process, which increased one month after circumcision, positively affected mother–infant attachment. We believe that as the circumcision procedure was performed by the use of appropriate regional anesthesia without causing pain, the babies were not traumatized during the procedure. In addition, the longer fasting period and higher probability of complications associated with general anesthesia have been minimized with regional anesthesia. The fact that the circumcision was performed in the operating room without the

presence of family members may also have contributed to the fact that the mother was not adversely affected by the procedure. Furthermore, the fact that the baby did not receive general anesthesia suggests that families may be less affected by the circumcision procedure before and after the procedure.

Although studies show that circumcision has effects on infant behavior and psychophysiology, the direction and duration of these effects still require clarification. We believe that our study is one of these steps taken toward the elucidation of the aforementioned aspects.

In our study, we demonstrated that circumcision with regional anesthesia in the first 4 months of life does not have a negative effect on sleep, feeding, and MA in babies. Particularly, we observed an increase in the MAI scores. However, randomized and prospective studies with larger populations are needed to clarify and support these findings.

Authors' contributions

All authors have made substantial contributions to the conception and design of the study, acquisition, analysis, and interpretation of data, drafting the article and revising it for important intellectual content and final approval of the version to be submitted. Conflict of interest: The authors report no proprietary or commercial interest in any product mentioned or concept discussed in this article.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of Competing Interest

None.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.jpedsurg.2021.12.026](https://doi.org/10.1016/j.jpedsurg.2021.12.026).

References

- [1] Morris BJ, Wamai RG, Henebeng EB, et al. Erratum to: estimation of country-specific and global prevalence of male circumcision. *Popul Health Metr* 2016;14: Erratum in: *Popul Health Metr*. 2016;14:11. doi:10.1186/s12963-016-0080-6.
- [2] BT Many, Rizeq YK, Vacek J, et al. A contemporary snapshot of circumcision in US children's hospitals. *J Pediatr Surg* 2020;55:1134–8. doi:10.1016/j.jpedsurg.2020.02.031.
- [3] American Academy of Pediatrics task force on circumcision. Male circumcision. *Pediatrics* 2012;130:e756–85. doi:10.1542/peds.2012-1990.
- [4] Lander J, Brady-Fryer B, Metcalfe JB, et al. Comparison of ring block, dorsal penile nerve block, and topical anesthesia for neonatal circumcision: a randomized controlled trial. *JAMA* 1997;278:2157–62. doi:10.1001/jama.1997.03550240047032.
- [5] Boyle GJ, Goldman R, Svoboda JS, et al. Male circumcision: pain, trauma and psychosexual sequelae. *J Health Psychol* 2002;7:329–43. doi:10.1177/135910530200700310.
- [6] American Academy of Pediatrics Report of the task force on circumcision. *Pediatrics* 1989;84:388–91. Erratum in: *Pediatrics*. 1989;84:761.
- [7] Marshall RE, Stratton WC, Moore JA, et al. Circumcision I: effects upon newborn behavior. *Infant Behav Dev* 1980;3:1–14. doi:10.1016/S0163-6383(80)80003-8.
- [8] Anders TF, Chalemian RJ. The effects of circumcision on sleep-wake states in human neonates. *Psychosom Med* 1974;36:174–9. doi:10.1097/00006842-197403000-00009.
- [9] Müller ME. A questionnaire to measure mother-to-infant attachment. *J Nurs Meas* 1994;2:129–41. doi:10.1891/1061-3749.2.2.129.
- [10] Müller ME. Prenatal and postnatal attachment: a modest correlation. *J Obstet Gynecol Neonatal Nurs* 1996;25:161–6. doi:10.1111/j.1552-6909.1996.tb02420.x.
- [11] Kavlak O, Şirin A. The Turkish version of Maternal attachment Inventory. *J Hum Sci* 2009;6:188–202.

- [12] Sharara-Chami R, Lakissian Z, Charafeddine L, et al. Erratum to: combination analgesia for neonatal circumcision: a randomized controlled trial. *Pediatrics* 2017;140:e20171935 <https://doi.org/10.1542/peds.2017-1935>. *Pediatrics*. 2018; 141:e20180500. <https://doi.org/10.1542/peds.2018-0500>.
- [13] Anand KJ, Brown MJ, Causon RC, et al. Can the human neonate mount an endocrine and metabolic response to surgery? *J Pediatr Surg* 1985;20:41–8. doi:10.1016/s0022-3468(85)80390-0.
- [14] Circumcision Information and Resource Pages.circumcision vs. child Health, Breastfeeding and Maternal Bonding; 2005. Available from: <http://www.cirp.org/library/birth>. Accessed 28 Jul 2006.
- [15] Marshall RE, Porter FL, Rogers AG, et al. Circumcision: II. Effects upon mother-infant interaction. *Early Hum Dev* 1982;7:367–74. doi:10.1016/0378-3782(82)90038-x.
- [16] Dixon S, Snyder J, Holve R, et al. Behavioral effects of circumcision with and without anesthesia. *J Dev Behav Pediatr* 1984;5:246–50. doi:10.1097/00004703-198410000-00004.
- [17] Fergusson DM, Boden JM, Horwood LJ. Neonatal circumcision: effects on breastfeeding and outcomes associated with breastfeeding. *J Paediatr Child Health* 2008;44:44–9. doi:10.1111/j.1440-1754.2007.01202.x.
- [18] Gattari TB, Bedway AR, Drongowski R, et al. Neonatal circumcision: is feeding behavior altered? *Hosp Pediatr* 2013;3:362–5. doi:10.1542/hpeds.2012-0082.
- [19] Hill G. Breastfeeding must be given priority over circumcision. *J Hum Lact* 2003;19:21.
- [20] Lee N. Circumcision and breastfeeding. *J Hum Lact* 2000;16:295.
- [21] O'Mara P. Circumcision: the rest of the story. Santa Fe, NM: Mothering Magazine; 1993.
- [22] Kaplan HI, Sadock BJ, Grebb JA. Kaplan and Sadock's synopsis of psychiatry: behavioral science and clinical psychiatry. Baltimore: Williams & Wilkins; 1994. p. 161–5.
- [23] Ainsworth MDS, Blehar MC, Waters E, et al. Patterns of attachment: a psychological study of the strange situation. London: Psychology Press; 2015.