STUDENT ORIGINAL RESEARCH

The Impact of Infant Feeding Method on Post-Urologic Surgery Recovery Outcomes

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ABSTRACT

Objectives/Background

Breastmilk is rich in immunoglobulins, carbohydrates, fats, vitamins, and other nutrients, which have numerous health benefits for infants. Many studies have been done on the copious health benefits of breastfeeding for infants; however, there is scant literature comparing surgical outcomes in infants who were breastfed versus infants fed solely with infant formula. This study aimed to show that breastfed infants have less postoperative pain overall and spend less time in the post-anesthesia care unit (PACU) than formula and clear liquid-fed infants.

Methods

A retrospective chart review was conducted on 168 male infants aged 0-12 months who underwent circumcision at Nemours Children's Hospital in Orlando, Florida, from January 2014 to December 2020. The infants were sorted based on their feeding methods: breast, formula, or clear liquid fed. Postoperative face, legs, activity, cry, consolability pain score, the type/amount of pain medication administered, and postoperative time of discharge were compared among the three cohorts.

Results

Patients fed infant formula spent an average of 15.42 minutes less in the PACU when compared with infants fed clear liquids ($p = 0.023$). There were no significant differences in PACU time between breastfed versus infant formula-fed patients or breastfed versus clear liquid-fed patients.

Conclusions

The results indicate little difference in recovery outcomes among infants who were breastfed, formula-fed, or given clear liquids in the PACU. There was a faster discharge and lower recovery time on formula-fed infants versus clear liquid-fed infants, probably because they were more satisfied.

INTRODUCTION

Breastmilk is known to have numerous health benefits for infants and is often considered the best source of their nutrition. These benefits include brain, immunological, and gastrointestinal development by providing essential nutrients for infant growth.

Breastmilk has significant immune-boosting effects on infants due to its high levels of immunoglobulins.[1,2] Breastmilk also contains many beneficial microbes and oligosaccharides that reduce infection and regulate microflora in the gastrointestinal tract.[2] This allows for the proper synthesis of folate and vitamins K, B6, and B12, all essential for infants.[1] Such immunologic benefits have led to breastmilk being referred to as the first "immunization" infants receive. Breastfed infants also have significantly lower rates of diarrhea, upper respiratory tract infections, obesity, and immune-mediated diseases such as asthma, eczema, food allergies, and even type 1 diabetes.[1,3]

In addition to immune and developmental benefits, breastmilk has also been demonstrated to have analgesic effects for infants. Multiple studies have shown that for infants who underwent venipuncture and heel prick blood collection, those who were given breastmilk on pacifiers during the procedure had reduced pain scores compared with infants who were offered water on pacifiers, swaddled, or who were just held by their mothers.[4,5] Pain score quantification included parameters of crying, grimacing, and heart rate differences.

Infant formula is an alternative feeding method that was developed to closely mimic the properties of breastmilk. Soy or cow's milk is often used for the formula base with supplemental ingredients such as casein protein, vitamins, minerals, iron, and fat blends.[6] Although infant formula tries to emulate the nutritional composition of human breastmilk, there is a question of whether it can mimic the analgesic effects of breastmilk.

Although many studies have been done on the numerous health benefits of breastfeeding for infants, there is scant literature comparing surgical outcomes in infants who were breastfed versus infants fed solely with infant formula. The primary goal of our study was to explore the difference in post-urologic surgery recovery outcomes among male infants who were breastfed, formula-fed, or given clear liquids (i.e., apple juice, oral electrolyte solution) in the post-anesthesia care unit (PACU) in terms of their postoperative Face, Legs, Activity, Cry, Consolability (FLACC) pain score, the type/amount of pain medication administered, and their postoperative time of discharge.

We hypothesize that infants who were given breastmilk will have less postoperative pain overall and will spend less time in the PACU compared with infants who were given infant formula and clear liquids.

METHODS

We performed a single-site retrospective chart review consisting of male infants classified as American Society of Anesthesiologists 1 or 2, aged 0-12 months, who underwent a circumcision under general anesthesia and regional anesthesia. All patients received presurgical caudal analgesia (1 ml/kg of 0.2% ropivacaine, maximum of 20 ml) after mask induction of general anesthesia and intravenous line placement. Data were collected from the electronic medical record (Epic Systems Corporation, Verona, WI) on patients who underwent these procedures from January 2014 to December 2020 at the Nemours Children's Hospital in Orlando, Florida. Only one surgeon performed all cases. We received approval from our institutional review board. Data from 167 patient charts were used in the final analysis. Information collected from patient charts included surgical service, date of birth, surgery date, primary procedure name, postoperative medication administered, time in the operating room, time out of the operating room, total PACU time, postoperative FLACC pain score, and patient feeding method. Infants who did not receive caudal analgesia were excluded. -

The patient data were divided into three groups based on the postoperative feeding method, as noted in the chart. These three groups included breastfed, infant formula-fed, and clear liquid-fed (water, oral electrolyte solution, or apple juice). For breastfed infants, mothers directly nursed the patients in the postoperative unit. Variables analyzed included postoperative FLACC pain score, type of pain medication received, and postoperative time of discharge (total time spent in PACU). The FLACC pain scores were then averaged for each patient and recorded as one score. The FLACC scores for each feeding group were analyzed using descriptive statistics and the analysis of variance test. The type of pain medication administered was organized into three data groups: morphine/fentanyl (opioids), acetaminophen/ibuprofen, or none. The type and amount of medication administered to infants in each feeding group were analyzed using descriptive statistics and analysis of variance test. The time of discharge was recorded as a sum of time spent in phases 1 and 2 of the PACU. Mean differences in time spent in the PACU between groups were analyzed using the Tukey Honestly Significant Difference test. All data were analyzed using SPSS version 27.0 (IBM Inc., Armonk, NY) with the significance value set at $p < 0.05$.

RESULTS

There was no statistically significant difference among the demographics (Table 1). Breastfed infants received the lowest amount of morphine and/or fentanyl among the three groups, with 9.5% of breastfed infants receiving morphine and/or fentanyl compared with 20.3% of formula-fed infants and 12.5% of clear liquid-fed infants. Breastfed infants also received the lowest amount of ibuprofen and/or acetaminophen among the three groups, with 9.5% of breastfed patients receiving ibuprofen and/or acetaminophen compared with 15.6% of formula-fed infants and 20.0% of clear liquid-fed infants. In addition, a higher percentage of patients in the breastfed

Medication Group	Feeding Group, N (Percentage of Total)		
	Clear Liquids N = 40	Breastmilk N = 63	Infant Formula N= 64
Morphine, fentanyl	5 (12.5)	6 (9.5)	13 (20.3)
Ibuprofen, acetaminophne	8 (20.0)	6 (9.5)	10 (15.6)
None	27 (67.5)	51 (81.0)	41 (64.1)

Table 1: Type and Amount of Medication Taken Per Feeding Group
Note: Analysis of variance difference between groups (p = 0.851).

Feeding Group	Mean FLACC Pain Score	N
Clear liquids	0.7000	40
Breastmilk	0.7872	63
Infant formula	1.3003	64

Table 2: Mean FLACC Pain Scores Per Feeding Group
Note: Analysis of variance difference between groups (p = 0.138); FLACC, Face, Legs, Activity, Cry, Consolability.

Milk		Mean Difference (I-J) in Time Spent in PACU	P
Clear liquids	Breastmilk Infant formula	7.542 15.416*	0.402 0.023*
Breastmilk	Clear liquids Infant formula	-7.542 7.874	0.402 0.279
Infant formula	Clear liquids Breastmilk	-15.416* -7.874	0.023* 0.279

Table 3: Mean Difference in Time Spent in Post-anesthesia Care Unit (PACU) Between Feeding Groups
****The mean difference is significant at α = 0.05 (p = 0.023).***

feeding group received no medication at all (81.0%) compared with formula-fed infants (64.1%) and clear liquid-fed infants (67.5%). These differences, however, were not statistically significant.

The average FLACC pain scores were 0.79 for breastfed infants, 0.70 for the clear liquid-fed group, and 1.30 for the infant formula-fed group. There was no significant difference in the average FLACC pain scores between the groups (p = 0.138 between groups), as summarized in Table 2.

There was a statistically significant decrease in total time spent in the PACU for formula-fed infants compared with the clear liquid group. These results are summarized in Table 3. Patients fed infant formula spent an average of 15.42 minutes less in the PACU when compared with infants fed clear liquids (p = 0.023). There were no statistically significant differences in PACU time between breastfed versus formula-fed infants or breastfed and clear liquid-fed infants. The difference between the total time spent in PACU between breastfed and formula-fed infants was 7.87 minutes (p = 0.279), and the difference between breastfed and clear liquid-fed infants was 7.54 minutes (p = 0.402). These differences were not statistically significant.

DISCUSSION

Our study showed a statistically significant difference in total time spent in the PACU between the infant formula-fed and clear liquid-fed groups. Infants fed formula spent an average of 15.42 minutes less in the PACU compared with the clear liquid group. However, there were no significant differences in the total time breastfed infants spent in the PACU compared with formula-fed and clear-liquid-fed infants. These findings may be attributed to these babies feeling fuller and more satisfied, as formula is denser than clear liquid or breast milk.

A fascinating result was a nonsignificant decrease in the amount of pain medications needed, both opioids and nonopioids, in breastfed babies. This trend may turn out to be significant in a future large randomized study.

When a child needs to undergo surgery, it can be one of the most stressful times in a parent's life, especially in the newborn/infant phase. Parents' lack of control over the situation often results in attempting to do anything that may be remotely helpful for the child. Breastmilk and breastfeeding have been touted in our society as being the best method of infant nutrition because of their many known immunological benefits. However, many unsubstantiated benefits are also anecdotally attributed to breastmilk, such as improved recovery and lessened pain after surgery. Mothers of infants undergoing surgery may feel anxious and guilty if they do not (or cannot) offer breastfeeding to their infants post-surgery.

There are some important limitations to our study. The first is the small sample size. In addition, this study looked at differently fed infants during a very small snapshot of the recovery period–their time in the PACU only–even though post-surgical recovery is a much longer process. Our study also looked at the pain scores, medication requirements, and PACU times after multiple surgical procedures, and it is not statistically powered enough to look at each type of surgical procedure individually. It could very well be that the infant feeding method may affect the recovery after some types of surgical procedures and not others. The retrospective nature of our study is an additional limitation.

CONCLUSION

This study shows no significant difference between breastmilk-fed and formula or clear liquid-fed infants in pain score, pain medication requirements, or PACU time. In the future, and as a follow-up study, it would be insightful to analyze infant health outcomes based on long-term feeding methods rather than just short-term ones in the PACU. It would also be worthwhile to have a larger sample size in a prospective, randomized control trial that could be analyzed by surgical procedure type.

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