



## Onset of Feeding After Surgical Procedures in Newborns with Congenital Anomalies and Its Related Factors

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### Abstract

**Introduction:** Congenital anomalies and related surgeries are common in neonates, especially in developing countries. In recent years, early feeding after surgery has become more popular. Postoperative care protocols should be updated to reflect these changes and improve outcomes. This study aimed to assess the onset of feeding after surgical procedures in new-borns with congenital anomalies and its related factors.

**Materials and Methods:** This cross-sectional study was conducted on 90 neonates who underwent surgical procedures between 2011 and 2019 at Valiasr Hospital, Iran. The neonates' demographics, including gender, weight, type of anomaly, presence or absence of heart disease, sepsis, prematurity, duration of surgery, volume of nasogastric tube secretions, time of defecation, and time of onset of feeding were recorded. The relationship between these factors and the early onset of feeding was analyzed in the neonates using the independent t-test, Kruskal-Wallis test, and logistic linear regression ( $P \leq 0.05$ ).

**Results:** A total of 90 neonates underwent surgical procedures during the specified period, of which 43% were female, 49% had heart disease, 46% had sepsis, and 34% were premature. The mean weight of the neonates was 2726.94 (806.19) grams. The mean time to the onset of feeding was 5.92 (3.97) days after surgery. Sepsis ( $P=0.000$ ), prematurity ( $P=0.000$ ), type of anomaly ( $P=0.000$ ), weight ( $P=0.000$ ), time of defecation ( $P=0.000$ ), duration of surgery ( $P=0.000$ ), and volume of nasogastric tube secretions ( $P=0.000$ ) had significant correlations with the time of onset of feeding, but gender ( $P=0.559$ ) and heart disease ( $P=0.210$ ) had no such correlation.

**Conclusion:** Regardless of the neonates' gender and the presence of cardiac anomalies, feeding can be started earlier in full-term and overweight infants. The amount of return secretions of the nasogastric tube and the type of surgery should be considered in making this decision.

## Keywords

- Anomaly
- Infant
- Surgery
- Congenital abnormalities
- Enteral nutrition

## Introduction

Congenital anomalies and related surgical procedures have a relatively high prevalence in neonates,<sup>1-2</sup> with particularly elevated rates reported in developing countries.<sup>3-4</sup> Annually, 7.9 million infants are born with anomalies.<sup>5</sup> Intestinal atresia is responsible for approximately 95% of the cases of bowel obstruction.<sup>6</sup>

In recent decades, the concept of initiating feeding shortly after surgical procedures has attracted significant attention, leading to the development of multiple feeding protocols. For instance, according to one protocol, the onset of feeding in neonates should be 12 hours after surgery on average, with 3-5 cc of breast milk per hour.<sup>7</sup> In the past, there was not much interest in early feeding after surgical procedures of the upper gastrointestinal system.<sup>8</sup> On the other hand, some authors believe that long-term starvation after intestinal procedures and anastomosis can prevent leakage, which is a major complication of such surgical procedures. Thus, this protocol was practiced by many surgeons for a long time.<sup>9</sup> Meanwhile, current studies have shown that in children who have undergone intestinal anastomosis, it is appropriate to start oral?

feeding soon after the operation, without waiting for traditional signs such as the return of intestinal motility.<sup>10</sup>

Considering the modifications in surgical procedures over time, postoperative care protocols should be updated as well.<sup>11</sup> A previous study assessed the effect of the early onset of feeding postoperatively in neonates and showed that it does not correlate with post-anastomosis complications.<sup>12</sup> Several factors, such as growth and development, defecation, and clinical signs and symptoms, should be assessed to evaluate the effects of the route of feeding.<sup>6</sup>

The factors related to the initiation of feeding can be categorized into three groups: (I) Patient-related factors, (II) surgery-related factors, and (III) factors related to postoperative conditions. By understanding these related factors and meeting the necessary conditions, it may be possible to start feeding neonates earlier. This study was conducted to assess the onset of feeding after surgical procedures in newborns with congenital anomalies and its related factors.

## Materials and Methods

This cross-sectional study was conducted on neonates hospitalized at Valiasr Hospital who had undergone different types of surgical procedures between 2011 and 2019. The research protocol complies with the recommendations of the Declarations of Helsinki and Tokyo and was approved by the ethics committee of the Tehran University of Medical Sciences and the code of ethics of the study is (IR.TUMS.IKHC.REC.1400.012).

### Eligibility criteria:

The inclusion criteria were: Availability of medical records for neonates hospitalized at the NICU (Neonatal Intensive Care Unit) of Valiasr Hospital who had undergone different surgical procedures from 2011 to 2019, and availability of information regarding their gender, weight, type of anomaly requiring surgery, association with cardiac anomalies, prematurity, presence/absence of positive blood culture (sepsis), duration of surgical procedure, the volume of nasogastric tube secretions, time of defecation after surgery, and time of onset of feeding postoperatively in the medical records. The assessment of the nasogastric tube secretion volume was conducted by calculating the mean of the

total secretion gathered throughout the patient's hospital admission.

The neonates who had undergone minor surgical procedures such as herniotomy, placement of venous catheters, biopsy, and chest tube insertion were excluded.

### Sample size:

The sample size was calculated to be 81, assuming the effect size of 1.0, statistical power of 80%, type 1 error of 5%, and the presence of nine predictors using G-Power software. Considering the possibility of 1% loss to follow-up, 90 patients were enrolled.

### Variables:

After necessary coordination with the hospital administrator, eligible medical records were retrieved from the archives of patient's electronic records, and information regarding the neonates' gender, weight, type of anomaly requiring surgery, association with cardiac anomalies, prematurity, presence/absence of positive blood culture (sepsis), duration of surgical procedure, volume of nasogastric tube secretions, time of defecation after surgery, and time of onset of feeding postoperatively was extracted from the patient records.

### Statistical analysis:

The normality of the distribution of the data was evaluated by the Kolmogorov-Smirnov test. The independent t-test was applied to qualitative data with a normal distribution, and the Kruskal-Wallis test was employed for qualitative data that did not have a normal distribution. The linear regression was utilized for the evaluation of quantitative variables

### Result

A total of 90 neonates underwent surgical procedures during the specified period, of which 43% were female. The mean weight of the neonates was 2726.94 (806.19) grams.

(Table 1) presents the frequency distribution of the qualitative variables. As shown, 45.6% of the study population had heart disease, 37.8% were born prematurely, and 51.1% had sepsis. Also, Congenital Diaphragm Hernia (CDH) was the most common anomaly (Table 1).

**Table 1:** Frequency distribution of qualitative variables

Variables	Category	Frequency	Percentage
Gender	Female	43	47.8
	Male	47	52.2
Heart disease	Present	49	45.6
	Absent	41	54.5
Sepsis	Present	46	51.1
	Absent	44	48.9
Prematurity	Present	34	37.8
	Absent	56	62.2
Anomaly requiring surgery	CDH *	21	23.3
	Jejunioileal atresia	17	18.9
	Duodenal atresia	11	12.2
	Omphalocele	11	12.2

	Esophageal Atresia + TEF *	8	8.9
	Imperforated annus	5	5.6
	Ovarian cyst	5	5.6
	Others	12	13.3

\* CDH: Congenital Diaphragm Hernia, TEF: Trachea Esophageal Fistula

(Table 2) presents the frequency distribution of the quantitative variables. As shown, the onset of postoperative

feeding was 5.92 (3.97) days and time of defecation 2.38 (2.24) days (Table 2).

**Table 2:** Distribution of quantitative variables

Variable	Mean	Std. deviation	Minimum	Maximum
Weight (g)	2726.94	806.19	640	4400
Duration of surgery (min)	116.94	42.28	45	255
Time of defecation (days)	2.38	2.24	0	13
Volume of nasogastric tube secretions (cc)	259.43	116.27	60	595
Onset of postoperative feeding (days)	5.92	3.97	1	22

(Table 3) indicates the correlation between the onset of feeding and the qualitative variables. The results showed a significant correlation between the onset of feeding and prematurity ( $P=0.000$ ), such that the

mean onset of feeding was later in premature neonates ( $P=0.000$ ). Sepsis also had a significant correlation with the onset of feeding ( $P=0.000$ ), as feeding was started later in those with sepsis. Type of

anomaly had a significant correlation with the onset of feeding as well ( $P=0.000$ ), such that the onset of feeding was latest in the neonates with esophageal atresia (9.63

days), followed by jejunal atresia (8.71 days), and duodenal atresia (6.71 days) (**Table 3**).

**Table 3:** Relationship of onset of feeding with qualitative variables

Variable	Category	Mean time to feeding onset (days)	Std	Median time to feeding onset	minimum time to feeding onset	maximum time to feeding onset	P-value
Gender	Female	6.42	4.687	6	1	22	0.559
	Male	5.47	3.161	5	1	12	
Heart disease	Present	6.35	4.055	4	1	19	0.210
	Absent	5.41	3.853	6	1	22	
Sepsis	Present	9.18	4.145	3	1	11	0.000*
	Absent	3.95	2.161	8	3	22	
Prematurity	Present	8.52	3.770	8	1	22	0.000*
	Absent	3.20	1.720	4	1	11	
Anomaly requiring surgery	GI anomalies	7.80	4.283	7	1	22	0.000*
	non-GI anomalies	4.50	2.561	4	1	10	
	others	2.64	1.804	3	1	7	

\* GI anomalies: Tracheoesophageal atresia, Duodenal atresia, Jejunoileal atresia, Imperforate anus, GI perforation, GI obstruction, non-GI anomalies: CDH, Gastroschisis, Omphalocele, Other: Ovarian cyst, Sacro-coccygeal teratoma, congenital cystic adenomatosis, enteric cyst, choledochal cyst

(Table 4) presents the pairwise comparisons of the anomalies regarding the onset of feeding. As shown, significant differences existed between the anomalies at the time of onset of feeding. The mean time of onset of feeding in jejunal atresia was later than that in omphalocele ( $P=0.000$ ). Also, the mean time of onset of feeding in jejunal atresia was later than that in imperforate anus ( $P=0.002$ ). Moreover, the mean time of onset of feeding for duodenal atresia was later than that in ovarian cysts ( $P=0.000$ ). There were no post-operative complications observed, including any instances of anastomotic leakage (Table 4).

**Table 4:** Comparisons of the duodenal atresia and jejunoileal atresia regarding the onset of feeding

Anomalies	no.	mean	P-value*
Duodenal atresia	13	10.23	.003
Jejunoileal atresia	17	19.53	

The univariate regression analysis was used to analyze the correlation of the quantitative variables with the onset of feeding. The results showed that the time of onset of feeding had a significant direct correlation with the volume of nasogastric

tube secretions ( $r=0.947$ ,  $P=0.000$ ), time of defecation ( $r=0.952$ ,  $P=0.000$ ), and duration of surgery ( $r=0.587$ ,  $P=0.000$ ), and an inverse correlation with weight ( $r=-0.956$ ,  $P=0.000$ ) (Table 5).

**Table 5:** Correlation distribution between the onset of oral feeding and quantitative variables

Variable	Correlation (r)	P-value
Weight (g)	0.956	0.000*
Duration of surgery (min)	0.587	0.000*
Time of defecation (days)	0.952	0.000*
Volume of nasogastric tube secretions (cc)	0.947	0.000*

## Discussion

This study assessed the onset of feeding of neonates after surgical procedures and the related factors. The results showed that sepsis, prematurity, type of anomaly, weight, time of defecation, duration of surgery, and volume of nasogastric tube secretions have significant correlations with the time of onset of feeding; however, gender and heart disease had no such correlation.

In the present study, the mean time of initiation of oral feeding was 5 days after surgery. The exact date of onset of feeding for neonates after surgical procedures is a matter of debate. For instance, a recent study suggested the initiation of feeding from day 0 to day 5 (2 days after surgery on average), depending on the type of surgical

procedure.<sup>7</sup> Also, the European Society for Clinical Nutrition and Metabolism (ESPEN) Early Career Faculty guidelines suggest the initiation of oral feeding in infants after the first 24 hours, depending on the patient's tolerance and type of surgical procedure.<sup>13</sup> Moreover, two similar studies on patients with esophageal atresia recommended the initiation of oral feeding 1 day after surgery.<sup>12-14</sup>

Consistent with the present findings, another study reported that prematurity results in later initiation of oral feeding.<sup>15</sup> Prematurity exposes the infant to major complications such as infection, respiratory problems, and neurological problems.<sup>16</sup> Another study reported that preterm neonates and those with a lower birth

weight require more time to tolerate oral feeding.<sup>17</sup> Also, another study on 86 preterm infants stated that neonates born younger than 34 weeks of gestational age should start oral feeding later than others.<sup>18</sup> The present findings showed that higher birth weight was correlated with earlier initiation of feeding. The same result was reported by another study on 6146 infants born at the gestational age of 29-33 weeks, which showed that per each 100 g increase in weight, oral feeding can be started sooner by half a day.<sup>19</sup> Also, another study on 117 infants born at a gestational age <32 weeks reported that higher birth weight in preterm neonates was correlated with the earlier onset of oral feeding.<sup>20</sup>

The present results revealed that earlier defecation time was significantly correlated with the earlier initiation of feeding, which was in line with the available literature in this regard.<sup>11</sup> A study conducted on 1- to 12-month-old infants who had undergone intestinal anastomosis showed that the mean time to defecation was 3.7 days in infants with early feeding versus 4.4 days in those with delayed feeding.<sup>9</sup> Another study on 46 infants who underwent partial gastrectomy reported that the time to defecation was 50.1 hours in infants with early feeding and 69.4 hours

in controls, and this difference was statistically significant.<sup>21</sup>

Studies on the effects of gender on the onset of oral feeding are limited. The present findings showed no significant correlation between gender and the onset of feeding, which is in agreement with several previous studies.<sup>9-20</sup>

The present results showed a significant correlation between the type of surgery and the onset of feeding. Similarly, a previous study on children with a mean age of 12 months showed a significant difference in the time of initiation of feeding after colon anastomosis, ileum anastomosis, and chronic pancreatitis surgical procedures<sup>22</sup> Aroonsaeng et al.<sup>10</sup> discussed how, depending on the type of abdominal organ involvement, the initiation of feeding may vary among children. Nonetheless, another study reported that the early initiation of feeding in small volumes is beneficial and has no correlation with the type of surgical procedure.<sup>23</sup> Nematihonar et al.<sup>11</sup> conducted a study on 109 patients who had intestinal anastomosis and were aged less than 18 and more than 75 years. They found no significant correlation between the type of surgical procedure and the early onset of feeding, but they added that the information in this respect is limited and

called for further investigations on this topic.

The present results revealed a significant correlation between the volume of nasogastric tube secretions and the early initiation of feeding. This finding is also in agreement with the available literature on this subject.<sup>8-24</sup>

Large sample size and evaluation of several parameters that could potentially be correlated with the time of initiation of feeding were the main strengths of the present study; however, the cross-sectional design was a limitation of this study, as it did not allow for the discovery of any causal relationships. Future longitudinal (cohort) studies are required to assess the effects of early onset of feeding on the hospital stay, complications, and mortality rate of patients.

## Conclusion

Considering the study limitations, the results showed that the mean time of onset of feeding was 5 days after surgery in our study population. The results indicated significant correlations for positive blood

culture (sepsis), prematurity, type of anomaly, weight, volume of nasogastric tube secretions, duration of surgery, and time of defecation with the onset of feeding. It may be concluded that oral feeding may be started earlier after surgery in term neonates with higher weight, irrespective of their gender and presence/absence of cardiac anomalies. Nevertheless, the volume of nasogastric tube secretions and the type of surgical procedure should also be taken into account.

## Ethical Consideration

The study was approved by the ethics committee of the Tehran University of Medical Sciences and the code of ethics of the study is (IR.TUMS.IKHC.REC.1400.012).

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**Conflict of interests**

All authors declare that they have no conflict of interest

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