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PERSONALIZED MULTIDISCIPLINARY POSTOPERATIVE CARE ALGORITHM FOR NEWBORNS WITH CONGENITAL INTESTINAL OBSTRUCTION: A PROSPECTIVE STUDY

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ABSTRACT

Objective: To evaluate the clinical effectiveness of a personalized multidisciplinary postoperative care algorithm in newborns undergoing surgery for congenital intestinal obstruction (CIO).

Background: Congenital intestinal obstruction represents a major surgical and neonatal care challenge worldwide. Despite technological advances, postoperative morbidity and prolonged recovery remain significant concerns. Emerging evidence supports individualized multidisciplinary care models to optimize outcomes in this vulnerable population.

Methods: A prospective controlled study was conducted between 2022 and 2024, including 82 newborns diagnosed with CIO. Patients were allocated into two comparable groups: Group I (n=42) received standard postoperative care, and Group II (n=40) was managed with a personalized multidisciplinary algorithm comprising guided thermoregulation, structured early nutrition, targeted infection prevention, and comprehensive clinical monitoring. Primary outcomes included time to stabilization of vital functions, frequency of postoperative complications, duration of hospitalization, mechanical ventilation, and overall clinical improvement. Comparative statistical analysis was performed using Student's *t*-test and χ^2 test.

Results: Baseline demographic and clinical variables were statistically similar between groups. Group II demonstrated significantly faster stabilization of body temperature, respiratory function, and hemodynamic parameters ($p<0,01$). Infectious complications and feeding intolerance occurred less frequently in Group II ($p<0,05$). Hospital stay and duration of mechanical ventilation were significantly reduced in Group II ($p<0,001$). Overall clinical improvement ≥75% was significantly higher in Group II ($p<0.05$). Mortality differences showed a favorable trend but did not reach statistical significance.

Conclusions: Implementation of a personalized multidisciplinary postoperative care algorithm significantly improves clinical recovery and reduces complication rates in newborns with CIO. These findings support the adoption of individualized postoperative strategies in neonatal surgical practice.

Keywords: congenital intestinal obstruction, neonatal surgery, postoperative care, personalized rehabilitation, multidisciplinary algorithm.

INTRODUCTION

Congenital intestinal obstruction (CIO) is a critical neonatal surgical condition requiring prompt diagnosis and intervention. It constitutes a significant source of neonatal morbidity and remains a leading indication for emergency pediatric surgery in the early neonatal period [1–3]. The spectrum of CIO includes atresia's, stenoses, malrotation with volvulus, and other obstructive anomalies of the small and large intestine. Despite advances in perioperative care, improvements in surgical technique, and widespread use of neonatal intensive care,

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postoperative morbidity and extended hospital stay continue to challenge clinicians globally [4,5].

Historically, postoperative management of CIO has been standardized with protocols emphasizing life support stabilization, broad-spectrum antibiotics, and conventional nutritional rehabilitation. However, these generalized approaches often fail to address individual patient variability in physiological response, thermoregulation capacity, nutritional tolerance, and susceptibility to infection [6,7]. A growing body of literature suggests that multidisciplinary and personalized postoperative care models - incorporating tailored thermal control, optimized nutrition sequences, proactive complication prevention, and real-time clinical monitoring - can improve outcomes and shorten recovery times in neonatal surgical cohorts [8-12].

Given these insights, we conducted a prospective comparative study to examine the clinical efficacy of a structured personalized care algorithm in the postoperative management of neonates with CIO. We hypothesized that individualized care would significantly enhance vital function recovery, reduce complication rates, decrease dependence on mechanical ventilation, and shorten hospital stay compared to standard postoperative protocols.

MATERIALS AND METHODS

This prospective controlled comparative study was conducted at the Neonatal Surgery Department of the Samarkand Regional Children's Multidisciplinary Center between January 2022 and December 2024. Eighty-two neonates diagnosed with congenital intestinal obstruction and requiring surgical correction were enrolled. Written informed consent was obtained from the parents or legal guardians. Newborns with significant congenital anomalies unrelated to intestinal obstruction, or those with severe comorbidities (e.g., major cardiac defects), were excluded.

Group Allocation

Participants were divided into two groups based on postoperative care models:

- *Group I (Control, n=42):* Standard postoperative care according to institutional protocols.
- *Group II (Personalized, n=40):* Management according to a comprehensive, individualized multidisciplinary algorithm.

Both groups were comparable in terms of demographic characteristics, birth weight, gestational age, and primary diagnosis.

Personalized Care Algorithm

The personalized postoperative care protocol for Group II consisted of:

1. *Thermoregulation:* Continuous monitoring using infrared and contact thermometers with individualized environmental and skin temperature control [13].
2. *Early Nutritional Support:* Initiation of parenteral nutrition within hours after surgery, followed by structured transition to enteral feeding under clinical nutritionist supervision [14].
3. *Infection Prevention:* Targeted antibiotic stewardship guided by pathogen surveillance, timely sepsis screening, and prophylactic strategies.
4. *Comprehensive Monitoring:* Frequent evaluation of vital signs, wound assessment with atraumatic dressings, biochemical parameters (glucose, electrolytes, lactate), and early identification of deviations.

Outcome measures focused on evaluating the effectiveness and safety of postoperative management in newborns with congenital intestinal obstruction. The primary endpoints included the time required to achieve stabilization of vital physiological functions, specifically normalization of body temperature, restoration of adequate respiratory function defined by oxygen saturation levels above 95%, and attainment of hemodynamic stability. The study also assessed the incidence of early postoperative complications, including infectious, metabolic, and wound-related events.

Additional outcome parameters comprised the total duration of hospitalization and the length of mechanical ventilation support. Nutritional recovery was evaluated by measuring the time to complete transition to enteral feeding and by assessing feeding tolerance. Overall clinical

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improvement was determined using a standardized clinical scale, with significant improvement defined as achieving at least 75% functional recovery. Mortality within the first 30 postoperative days was recorded as a key safety outcome.

Statistical Analysis

Quantitative data were reported as mean ± standard deviation (SD) and compared using Student's *t*-test. Categorical data were analyzed using χ^2 test. A *p*-value <0,05 was considered statistically significant. Statistical software (SPSS v25) was used for all analyses.

RESULTS

Baseline characteristics of study participants are summarized in Table 1. Both groups were statistically comparable, indicating valid group allocation and minimizing confounding biases.

Table 1. Baseline Demographic and Clinical Characteristics

Parameter	Group I (n=42)	Group II (n=40)	*p*-value
Gestational age (weeks)	38,2 ± 1,1	38,1 ± 1,3	0,76
Birth weight (g)	2950 ± 370	2900 ± 390	0,58
Male sex (%)	61,9% (26/42)	62,5% (25/40)	0,95
Jejunal atresia (%)	42,9% (18/42)	42,5% (17/40)	0,97

A comparative analysis of baseline demographic and clinical characteristics demonstrated that the study groups were well balanced and statistically comparable at the time of inclusion, which supports the internal validity of subsequent outcome comparisons.

The mean gestational age of newborns in Group I was 38.2 ± 1.1 weeks, while in Group II it was 38.1 ± 1.3 weeks, with no statistically significant difference between groups (p = 0.76). This indicates that both cohorts consisted predominantly of term neonates with a similar degree of physiological maturity at birth. Comparable gestational age is an important factor, as prematurity can substantially influence postoperative adaptation, thermoregulation, and the risk of complications.

Birth weight distribution was also similar between groups. The average birth weight was 2950 ± 370 g in Group I and 2900 ± 390 g in Group II (p = 0.58). These values fall within the normal range for term neonates and suggest that neither group had a disproportionate representation of low birth weight infants, which could otherwise act as a confounding factor affecting recovery dynamics and nutritional tolerance.

The gender structure of the cohorts showed an almost identical proportion of male newborns: 61.9% (26/42) in Group I and 62.5% (25/40) in Group II (p = 0.95). Such a balanced sex distribution minimizes the potential influence of sex-related biological variability on surgical and postoperative outcomes.

Regarding the underlying pathology, jejunal atresia represented the most frequent form of congenital intestinal obstruction in both groups, occurring in 42.9% (18/42) of patients in Group I and 42.5% (17/40) in Group II (p = 0.97). The nearly identical prevalence of this key diagnostic category confirms the clinical comparability of the cohorts in terms of disease structure and surgical complexity.

Overall, the absence of statistically significant differences across all baseline parameters indicates that the two groups were homogeneous before the initiation of postoperative management strategies. This comparability strengthens the reliability of the subsequent analysis by suggesting that observed differences in clinical outcomes are likely attributable to the postoperative care approaches rather than to preexisting demographic or clinical disparities.

Recovery of Vital Functions

Comparison of recovery times for key physiological parameters is shown in Fig. 2.

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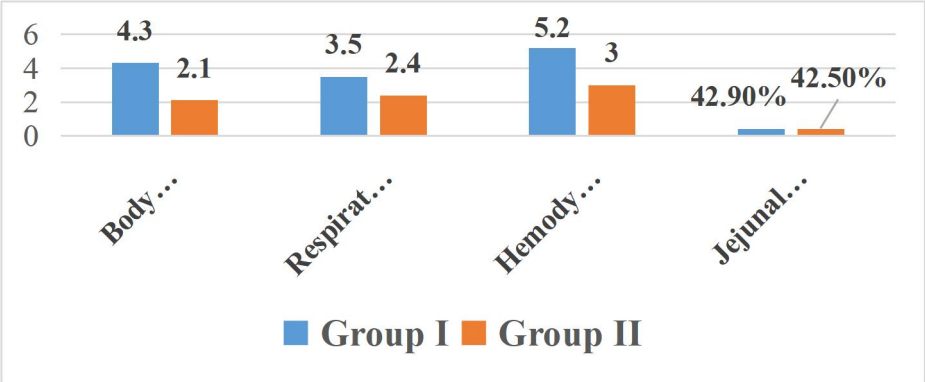

Fig. 2. Postoperative Recovery Indicators

Group II showed significantly faster stabilization across all monitored physiological parameters.

Postoperative Complications Incidences of early complications are reported in Table 3.

Table 3. Early Postoperative Outcomes

Outcome	Group I (%)	Group II (%)	*p*-value
Infectious complications	28,6 (12/42)	10,0 (4/40)	0,028
Feeding intolerance	23,8 (10/42)	7,5 (3/40)	0,035
Wound-related issues	9,5 (4/42)	2,5 (1/40)	0,17
Average hospitalization (days)	24,1±6,3	17,6 ± 4,5	<0,001
Mechanical ventilation (days)	5,4±1,5	3,2 ± 1,0	<0,001
Overall improvement ≥75%	71,4 (30/42)	92,5 (37/40)	0,012
Mortality	9,5 (4/42)	2,5 (1/40)	0,17

A comparative analysis of postoperative outcomes revealed substantial clinical advantages in the group managed with the personalized care algorithm. Infectious complications occurred significantly more frequently in Group I than in Group II, affecting 28,6% of patients (12/42) versus 10,0% (4/40), respectively (p=0,028). This finding indicates that individualized preventive and monitoring strategies were associated with a meaningful reduction in early postoperative infections.

Similarly, feeding intolerance was observed in 23,8% of newborns in Group I (10/42), compared with only 7,5% in Group II (3/40), demonstrating a statistically significant difference (p=0,035). The lower incidence of nutritional intolerance in Group II suggests improved adaptation to early structured nutritional support and more effective gastrointestinal recovery.

Wound-related complications were less common in the personalized care group, occurring in 9,5% of patients in Group I (4/42) and 2,5% in Group II (1/40). Although this difference did not reach statistical significance (p=0,17), the observed trend favors the individualized management approach.

Important differences were also identified in organizational and recovery indicators. The average duration of hospitalization was significantly shorter in Group II, with a mean stay of 17,6±4,5 days compared to 24,1±6,3 days in Group I ($p < 0,001$). In parallel, the duration of mechanical ventilation was markedly reduced in the personalized care cohort, averaging 3,2±1,0 days versus 5,4±1,5 days in the standard care group ($p<0,001$). These findings indicate faster clinical stabilization and more efficient postoperative recovery in Group II.

A significantly greater proportion of patients in Group II achieved substantial overall clinical improvement, defined as at least 75% recovery on the standardized clinical scale. This level of improvement was documented in 92,5% of newborns in Group II (37/40), compared with 71,4% in Group I (30/42), representing a statistically significant difference (p=0,012).

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Mortality rates showed a favorable trend toward reduction in the personalized care group, with deaths occurring in 9,5% of patients in Group I (4/42) and 2,5% in Group II (1/40). However, this difference did not reach statistical significance (p=0,17). Overall, the results demonstrate that the personalized postoperative care algorithm was associated with improved clinical outcomes, reduced complication rates, and enhanced recovery efficiency.

Group II experienced a significantly reduced incidence of infectious and feeding-related complications. Although wound-related differences and mortality trends did not reach statistical significance, the overall improvement was significantly higher in the personalized care cohort.

DISCUSSION

In this prospective study, the implementation of a personalized multidisciplinary postoperative care algorithm for newborns with congenital intestinal obstruction demonstrated clear clinical advantages over standard postoperative care.

Faster stabilization of vital physiological parameters in Group II aligns with evidence indicating the benefits of individualized thermoregulation protocols. Neonates are particularly sensitive to thermal stress due to limited heat conservation mechanisms, and controlled environmental and skin temperature optimization can significantly enhance metabolic equilibrium after surgical stress [15,16].

Nutritional Rehabilitation. Early initiation of structured nutrition, mediated by specialized clinical nutrition teams, notably expedited the transition to full enteral feeding in Group II. This is consistent with international guidelines advocating early minimal enteral nutrition to support gut mucosal integrity and reduce infectious risks [17,18].

Complication Reduction. Lower rates of infectious and feeding intolerance complications suggest that proactive infection prevention, biochemical monitoring, and individualized care sequencing contribute substantially to improved neonatal postoperative outcomes. Neonates are at high infection risk postoperatively due to immaturity of immune defenses, and tailored antibiotic stewardship coupled with surveillance protocols likely contributed to the favorable results in Group II [19,20].

Hospitalization and Ventilation. Shorter hospitalization and reduced mechanical ventilation duration in Group II underscore organizational benefits and resource optimization, critical factors in neonatal care units where capacity and costs are ever-pressing concerns.

While mortality reduction showed a favorable trend, it did not achieve statistical significance - likely due to sample size limitations. Larger multicenter studies are warranted to validate mortality outcomes and further refine personalized algorithms.

CONCLUSION

A structured personalized multidisciplinary postoperative care algorithm significantly enhances clinical recovery, reduces the incidence of early postoperative complications, and shortens the duration of hospitalization in newborns with congenital intestinal obstruction. The implementation of this individualized approach was associated with faster stabilization of vital physiological functions, improved tolerance to nutritional support, and a reduced need for prolonged mechanical ventilation, all of which contribute to more efficient postoperative adaptation in this vulnerable patient population.

Importantly, the observed improvements extend beyond immediate clinical indicators and reflect meaningful organizational and practical benefits. Shorter hospital stays and fewer complications may reduce the burden on neonatal intensive care resources, optimize the use of medical infrastructure, and lessen psychological stress for families. The higher rate of overall clinical improvement in the personalized care group underscores the value of coordinated multidisciplinary management involving surgeons, neonatologists, anesthesiologists, and clinical nutrition specialists [18-20].

Although the reduction in mortality did not reach statistical significance in this cohort, the favorable trend suggests that larger multicenter studies could further clarify the survival benefits of individualized postoperative strategies. Future research should focus on long-term

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developmental outcomes, cost-effectiveness analyses, and the refinement of standardized personalized care protocols adaptable to different healthcare settings [12-18].

Overall, our findings support the integration of individualized, multidisciplinary postoperative care algorithms into routine neonatal surgical practice as an effective strategy to improve clinical outcomes and enhance the quality of care for newborns with congenital intestinal obstruction.

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