

Early versus late duodenal atresia repair in preterm and low birth weight neonates

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Abstract

Aims

Duodenal atresia (DA) is a common cause of neonatal intestinal obstruction requiring surgical correction. The timing of repair in very low birth weight (VLBW, <1.5 kg) and extremely preterm (<32 weeks gestation) neonates remains debated. Early repair may reduce total parenteral nutrition (TPN)-associated morbidity, whereas delayed repair may mitigate anaesthetic and technical risks in fragile neonates.

Methods

A retrospective 20-year review (2004–2024) was conducted at a tertiary paediatric surgical centre. Infants <1.5 kg and/or <32 weeks were classified as early repair (≤ 14 days) or delayed repair (> 14 days). Outcomes included postoperative complications, time to full enteral feeding, hospital stay, and mortality.

Results

Sixteen infants met inclusion criteria. Of these, 7 (43.8%) underwent early repair and 9 (56.2%) underwent delayed repair. There were no significant differences in comorbidities or overall complication rates between groups. Time to full feeds was shorter in the early repair group (median 11 vs 40 days, $p = 0.013$). No surgery-related deaths occurred (0 [0%] in both groups).

Discussion

Early repair of DA in stable preterm or VLBW infants is feasible and safe when undertaken by experienced teams. Surgical timing should be guided by physiological stability rather than arbitrary gestational or weight thresholds. Further studies are needed to refine evidence-based guidelines.

Introduction

Congenital duodenal atresia (DA) occurs in approximately 1 in 7,000 to 40,000 live births and is frequently associated with anomalies such as Trisomy 21 (30–40%), cardiac defects, and malrotation. Advances in neonatal care and surgical techniques have markedly improved survival from under 50% in the 1960s to over 95% in modern series. The standard surgical correction—duodenoduodenostomy—is well established, but its optimal timing in very preterm and VLBW neonates remains unclear.

In these fragile infants, surgical intervention must balance immediate technical risks (e.g., bile duct injury, anastomotic leak) against the complications of prolonged parenteral nutrition (PN), including cholestasis, sepsis, and thromboembolism. Several recent large-scale studies, including the NSQIP analysis by Mack et al.¹, have suggested that delaying repair does not significantly reduce morbidity. Conversely, Deguchi et al.² reported that early repairs in infants <34 weeks or <1.5 kg were associated with increased postoperative complications, highlighting the need for individualized management.

Methods

This retrospective cohort study reviewed all neonates with duodenal atresia treated between January 2004 and May 2024 at Children's Health Ireland, Crumlin. Inclusion criteria were birth weight <1.5 kg or gestational age <32 weeks. Early repair was defined as surgery ≤14 days of life and delayed repair as >14 days.

Recorded variables included gestational age, birth weight, age at operation, presence of trisomy 21, type of comorbidity (none, major cardiac, or other associated anomalies), and diagnostic timing (antenatal or postnatally diagnosed). Operative variables included use of a trans-anastomotic tube (TAT), duration of parenteral nutrition (PN), and time to full enteral feeds. Post-operative complications were classified according to the Clavien-Dindo grading system. Specific complications recorded included anastomotic leak, PN-associated cholestasis, necrotising enterocolitis (NEC), and central line-associated thrombosis.

The primary outcome was postoperative complication rate. Secondary outcomes included peri-operative nutritional parameters (duration of PN and time to full feeds).

Continuous variables were expressed as median and interquartile range (IQR) and compared using the Mann-Whitney U test. Categorical variables were expressed as counts and percentages and compared using the Fisher's exact test. All analyses were performed using R (version 2024.12.1+563) with statistical significance defined as $p < 0.05$.

Results

Patient characteristics

A total of 16 preterm or very low birth weight (VLBW) infants with duodenal atresia were included. Of these, 7 (43.8%) underwent early repair (≤ 14 days of life) and 9 (56.2%) underwent delayed repair (> 14 days). The median gestational age (GA) was slightly higher in the early repair group (31+1 weeks, IQR 30+4–31+3) than in the delayed group (30+0 weeks, IQR 27–32; $p = 0.48$). Birth weight was significantly greater in the early repair group (1.64 kg, IQR 1.10–1.90) compared with the delayed group (1.01 kg, IQR 0.55–1.95; $p = 0.05$). Trisomy 21 was present in 2 patients (29%) in the early group and 2 (23%) in the delayed group ($p = 1.00$). Major cardiac defects were observed in 4 (57%) early and 4 (45%) delayed repair cases ($p = 1.00$).

Table 1. Patient demographics and preoperative characteristics

Characteristic	Early Repair (n = 7)	Delayed Repair (n = 9)	p-value
Gestational age (weeks), median (range)	31 (27–32)	30 (24–31)	0.48
Birth weight (kg), median (range)	1.64 (1.10–1.90)	1.01 (0.55–1.95)	0.05
Trisomy 21, n (%)	2 (29)	2 (23)	1.00
Major cardiac defect, n (%)	4 (57)	4 (45)	1.00

Operative and postoperative outcomes

Operative details and outcomes are shown in Table 2. The median age at surgery was 4 days (range 2–11) in the early group versus 59 days (40–83) in the delayed group ($p < 0.001$). Time to full feeds was significantly shorter in the early repair group (median 11 days, range 7–40) than in the delayed group (median 40 days, range 11–>90; $p = 0.013$). A trans-anastomotic tube (TAT) was used in 5 patients (71%) in the early group and 5 (56%) in the delayed group ($p = 0.63$).

Table 2. Operative and postoperative outcomes

Outcome	Early Repair (n = 7)	Delayed Repair (n = 9)	p-value
Age at surgery (days), median (range)	4 (2–11)	59 (40–83)	<0.001
Time to full feeds (days), median (range)	11 (7–40)	40 (11–>90)	0.013
TAT used, n (%)	5 (71)	5 (56)	0.63
Any complication, n (%)	4 (57)	5 (56)	1.00
Anastomotic leak, n (%)	1 (14)	0 (0)	0.44
TPN associated Cholestasis, n (%)	1 (14)	4 (44)	0.31
NEC, n (%)	1 (14)	2 (22)	1.00
Central line thrombosis, n (%)	1 (14)	1 (11)	1.00
Mortality, n (%)	0 (0)	0 (0)	1.00

An antenatal or postnatal diagnosis was documented in two-thirds of patients overall, with no significant difference between delayed (100.0%) and early (33.3%) repairs ($p = 0.400$). The use of a trans-anastomotic tube (TAT) was similar between groups (55.6% vs 71.4%, $p = 0.633$). Time spent on parenteral nutrition and time to reach full enteral feeds were also comparable ($p = 1.00$ and $p = 0.906$, respectively). For delayed repairs, time on PN was <7 days in 33.3%, 8–13 days in 11.1%, and >14 days in 33.3%, while for early repairs these were 42.9%, 14.3%, and 28.6%, respectively. Median time to full feeds exceeded 90 days in 33.3% of delayed repair cases and 42.9% of early repair cases.

Post-operative complication rates, graded by the Clavien-Dindo classification, were similar between groups ($p = 0.468$). Among delayed repairs, 33.3% experienced no complications, 44.4% had grade II, 11.1% grade IIIb, and 11.1% grade IV events. In the early repair group, 57.1% had no complications, 14.3% had grade II, and 28.6% had grade IIIb, with no grade IV or V complications in this group. The overall complication profile included one anastomotic leak (14%) in the early repair group, PN-associated liver disease (cholestasis) in four delayed (45%) patients and one early (15%) patient, and central line-associated thrombosis in one patient in each group (11–14%).

Discussion

This study reinforces that early duodenal atresia repair can be safely performed in stable preterm and VLBW infants. Our findings align with recent large database analyses such as

Mack et al.¹, which demonstrated that delaying surgery beyond the first week of life does not reduce morbidity and may prolong ventilation duration. Morbidity in these patients is primarily driven by prematurity-related complications rather than the timing of repair itself.

Deguchi et al.² and Chen et al.⁴ identified higher complication rates in infants operated on before 34 weeks gestation or <1.5 kg, supporting a selective approach rather than rigid timing criteria. In contrast, Chiarenza et al.³ and Weller et al.⁶ showed that minimally invasive or early open repair is safe when performed by experienced teams. Collectively, these studies highlight the importance of individualized decision-making based on physiological readiness, comorbidity profiles, and institutional expertise.

Our findings support an “early-but-optimized” strategy—proceeding with repair once the infant is physiologically stable, irrespective of arbitrary gestational or weight thresholds. This may reduce prolonged PN exposure while avoiding undue operative risk. Further prospective multicentre studies are needed to refine evidence-based guidelines for surgical timing in this population.

In conclusion, repair of duodenal atresia in VLBW and extremely preterm neonates can be safely undertaken in selected cases. Early repair should be considered once cardiorespiratory stability is achieved, as delaying surgery does not clearly reduce morbidity. A multidisciplinary, individualized approach remains essential for optimal outcomes.

Declarations of Conflicts of Interest:

None declared.

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