Session 6: Optimising Surgical and Intensive Care
Chairs: Irma Capolupo and Krisa Van Meurs (Kouji Nagata virtual)

28th April 15.30 – 17.30

23 Early pre- and postoperative enteral nutrition in infants with symptomatic congenital diaphragmatic hernia.

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28 UTILITY OF NEURALLY ADJUSTED VENTILATORY ASSIST (NAVA) IN WEANING AND EXTUBATION OF NEONATES WITH CONGENITAL DIAPHRAGMATIC HERNIA (CDH)

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49 Heart rate control with landiolol hydrochlorid in CDH infants with ventricular dysfunction.

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128 Anti-reflux surgery in children with congenital diaphragmatic hernia: A prospective cohort study on a controversial practice

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Early pre- and postoperative enteral nutrition in infants with symptomatic congenital diaphragmatic hernia.

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Background:
Congenital diaphragmatic hernia (CDH) is a serious congenital malformation. Survival has increased, but remained stable over the last decades and focus has shifted to the associated morbidities. Failure to thrive is common, but data is lacking on initial nutritional support of CDH-infants. Enteral nutritional support is challenged by critical illness, sedation, displaced abdominal organs and surgical intervention and current guidelines advocate withholding enteral feeds until after CDH-repair.
We aimed to describe our current approach on nutritional support in CDH-infants; we reported on pre-operative enteral nutrition, parenteral nutrition and early post-operative nutrition including time to full enteral nutrition.
Methods:
Prospective register study. We collected data on nutrition; Type (breast milk, formula), volume, duration of enteral and parenteral support. Baseline data was available from our CDH-database. Enteral feeding was introduced preoperatively from day one after birth, increased step-wised (breastmilk preferred) and resumed after CDH-repair on the first postoperative day.
Results:
From 2011 to 2020, we identified 45 symptomatic CDH-infants. Twenty-two were female (51.1%), 35 left-sided (77.8%) and 40 underwent CDH-repair (88.9%). Median (interquartile range) length of stay in the intensive care unit was 14.6 days (6.0 – 26.5) and one-year mortality was 17.8%.
The infants achieved a median of 48.5 ml/kg/day (27.4 – 105.3 ml/kg/day) of enteral nutrition on the last day before surgery or before death. Postoperatively it took a median of 6.4 days (6.6 – 11.5) to reach enteral nutrition with 120 ml/kg/day and 10.6 days (12.4 – 29.6) to reach 160 ml/kg/day. In total 31 (68.9 %) needed supplemental parenteral nutrition in a median period of 8 days (5 – 18) and 11 cases had parenteral nutrition initiated before CDH-repair. No complications to enteral feeding were reported.
Conclusions:
Early enteral nutrition in CDH-infants is feasible and may have the potential to reduce time to full enteral nutrition postoperatively.

Graph

Enteral nutrition of symptomatic CDH-infants in the pre- and postoperative period. Data presented as frequency (percentage) or as median value (25th-75th percentile).

Enteral feeding	Survivors (37)	Non-survivors (8)	All (45)
Preoperative period			
Preoperative enteral nutrition, ml/day	144.0 (96.0 – 342.0)	111.5 (15.0 – 277.5)	139.0 (94.0 – 342.0)
Preoperative enteral nutrition, ml/kg/day	48.5 (31.3 - 104.8)	34.6 (4.7 – 133.2)	48.5 (27.4 – 105.3)
Preoperative enteral nutrition, Human milk, ml/day	108.0 (16.0 – 240.0)	93.5 (2.5 – 277.5)	108.0 (12.0 – 240.0)
CDH-repair performed	37 (100 %)	3 (37.5 %)	40 (88.8 %)
Time to CDH-repair, days	4.1 (3.3 – 6.9)	3.7 (2.7 – 21.0)	
Postoperative period			
CDH-repair to 120 ml/kg/day, days	6.4 (3.6 – 11.5)		
CDH-repair to 160 ml/kg/day, days	10.6 (7.6 – 20.6)		
Birth to 120 ml/kg/day, days	12.5 (8.3 – 21.6)		
Birth to 160 ml/kg/day, days	20.0 (14.4 – 29.6)		

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UTILITY OF NEURALLY ADJUSTED VENTILATORY ASSIST (NAVA) IN WEANING AND EXTUBATION OF NEONATES WITH CONGENITAL DIAPHRAGMATIC HERNIA (CDH)

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Background: NAVA synchronizes and provides proportional ventilation to patient´s respiratory effort, based on diaphragm electrical activity. CDH patients present a complex pulmonary disease. In their weaning and extubation, both lung parenchyma disease and respiratory pattern are key factors. NAVA ventilation(NAVA-MV) and non-invasive mode(NAVA-NIV) could reduce extubation failure based on better synchronization and optimization of respiratory pattern.

Methods: Retrospective cohort study. We included all CDH patients using NAVA mode for weaning/post-extubation support 2015-2021 at our unit. A retrospective cohort of CDH neonates who underwent weaning without NAVA(2009-2015) were control group. Primary aim was to determine extubation failure(first 72h reintubation). Secondary outcomes were ventilatory parameters, respiratory support length, sedoanalgesia need, morbidity and hospital stay.

Results: N=37 patients(22 NAVA, 15controls). Perinatal, diagnostic and surgical characteristics of CDH were similar in both groups(Table 1). Need for high frecuency ventilation was similar(63.6vs80%). Moderate-severe pulmonary hypertension did not differ between groups (81.8vs80%). No differences in the use of iNO(72.7vs66.7%), sildenafil(72.7vs71.4%), or ECLS(27.3vs26.7%). Extubation age was similar(17(9-30) vs 16.5(8-34)days). Extubation failure prevalence was 14.3% in NAVA vs 40% in controls. In NAVA patients, PIP were lower during ventilation days (24(21.2-30.7)vs 28.5(25-35)cmH2O, p0.049 and pre-extubation (15(12-18)vs 18(16-22)cmH2O, p0.002) and also FiO2 needs (0,31(0.27-0.45)vs 0.52(0.32-0.6), p0.011). PEEP was higher (5.9(4.6-6.5)vs 4.6(4-5.2)cmH2O, p0.013) in NAVA-MV children. All patients required continuous opioid infusion in both groups, while benzodiazepine infusion requirement was lower in NAVA group (54.5vs100%).
Post-extubation support: NAVA-NIV patients presented higher PEEP (8.5(7.5-10 vs 6.6(5.5-7.4) cmH2O, p0,000) and PIP (28(20-29.5)vs9.8(8.6-22)cmH2O, p0,000) than controls. No differences in FiO2 needs, non-invasive support duration, or home oxygen. Hospital stay was similar in both groups.

Conclusion: Extubation failure was lower in CDH patients in whom NAVA mode was use for weaning and post-extubation support.
NAVA in both invasive and non-invasive modes may play an important role in weaning and post-extubation support of these patients.

Images

	NAVA group	Control group	p
Gestational age (w)	39 (38,5-40)	38,5 (38-39,2)	0.220
Birth weight (g)	3051 (2762-3427)	3070 (2720-3280)	0.676
Male sex	68,2%	46.7%	0.307
Prenatal diagnosis	95.5%	73.3%	--
Left CDH	90.9%	93.3%	--
FETO	9.1%	20%	--
Age at surgery (d)	4.5 (3-7.5)	5 (3-11)	0,512
Patch closure	40.9%	40%	
Defect classification (B/C/D)	45.5%/ 45.5%/ 9.1%	40%/ 26.7%/ 33.3%	--
Hernia sac	13,6%	26.7%	--

Table 1. Perinatal, diagnostic and surgical characteristics of CDH patients. Cualitative variables are express as percentage, continuous variable as express as median and 25-75 quartiles. CDH: Congenital Diaphragmatic Hernia, FETO: Fetoscopic Endotracheal Occlusion.

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Heart rate control with landiolol hydrochlorid in CDH infants with ventricular dysfunction.

Dr. Lukas Schroeder[1], Paulina Monno[1], Prof. Andreas Mueller[1], PD Dr. Florian Kipfmueller[1]
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Background
It is well known that perseverative sinus tachycardia deteriorates cardiac output in patients with heart failure and ventricular dysfunction. Heart rate control potentially optimizes ventricular dysfunction due to reduction of myocardial oxygen demand, prolongation of coronary perfusion time, and diastolic filling time. Landiolol hydrochloride is an ultra-short-acting, highly selective ß1-adrenozeptor blocker, and ideal for heart rate control.
Methodic
Retrospective single-center cohort study on the NICU of the University Children´s Hospital of Bonn. Inclusion criteria: diagnosis of CDH, tachycardia >150 bpm for term and >170 bpm for preterm infants and landiolol treatment + diagnosis of PH and ventricular dysfunction. Primary Endpoint: reaching target heart rate within 24h (t-HR; 130-150bpm in term,150-170 bpm in preterm infants).
Results
30 neonates with CDH were enrolled. Baseline characteristics were as follows: birth weight 2.6 kg, mean gestational age 36 weeks, 90% left-sided hernia, 63% liver-herniation, and an ECMO incidence of 46%. 29/30 neonates reached the primary endpoint. Median dose at start of therapy was 8.8 µg/kg/min (3.9-25.3). Median time for reaching t-HR was 1.5 h (0.3-24), with a dose at achieving t-HR of 10 µg/kg/min (2.4-25.3). Mean HR decreased significantly from a baseline of 182 (±13) bpm to 171 (±17) bpm (- 6%, p=0.002) after 60 min, and 157 (±18) bpm (- 14%, p<0.001) after 120 min. Mean arterial pressure increased slightly during landiolol therapy. No drug related adverse event was reported during the period. End-diastolic RV/LV ratio decreased significantly from baseline to 24h and 48h after start of landiolol infusion (p=0.05, and p=0.002, resp.). Likewise, PH severity, right- and left-ventricular dysfunction decreased significantly from baseline to 24h after commencing landiolol therapy (p=0.012, p=0.019, and p=0.004, resp.)
Conclusion
Heart rate control with landiolol is effective, well tolerated, and might improve ventricular dysfunction and PH severity in infants with CDH.

Graph

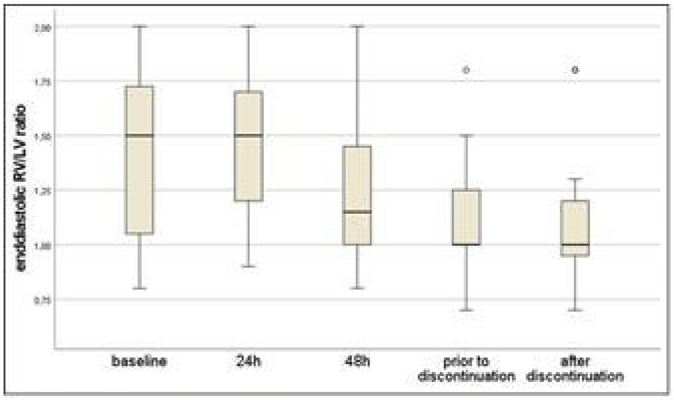

Figure 2: Echocardiographic assessment of RV/LV ratio after start of landiolol hydrochloride therapy.

Images

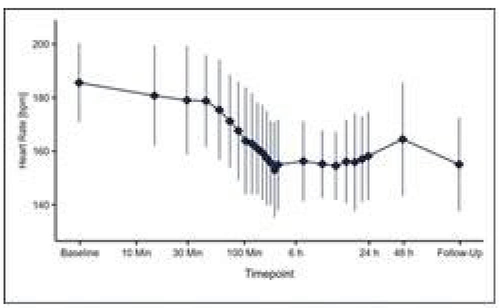

Figure 1: Heart Rate [bpm] over time, shown by the arithmetic mean±SD (the baseline value is the last available value prior to the first administration of landiolol.

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Anti-reflux surgery in children with congenital diaphragmatic hernia: A prospective cohort study on a controversial practice

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Background

Gastroesophageal reflux disease is the most frequent long-term morbidity of congenital diaphragmatic hernia (CDH) survivors. Performing a preventive fundoplication during CDH repair remains controversial. The aims of this study were to: 1) Analyze the variability in the use of fundoplication in congenital diaphragmatic hernia (CDH) neonates; 2) Identify predictive factors for preventive fundoplication; 3) Evaluate the impact of preventive fundoplication on gastro-intestinal outcomes of CDH infants with patch/muscle flap repair; 4) Identify predictive factors for curative fundoplication.

Methods

This prospective multi-institutional cohort study (French CDH Registry) included CDH neonates born in France between January 1st, 2010-December 31st, 2018. Main outcome measures included need for curative fundoplication, tube feed supplementation, failure to thrive, and oral aversion.

Results

1) Out of 29 centers (n=762 CDH neonates), 31% performed preventive fundoplication during CDH repair in selected patients (“PF-centers”).

2) In PF-centers, 11.2% neonates underwent a preventive fundoplication. Predictive factors were: prenatal diagnosis (p=0.006), intra-thoracic liver (p=0.005), fetal tracheal occlusion (p=0.002), CDH-grade C-D (p<0.0001), patch/muscle-flap repair (p<0.0001).

3) In neonates with a patch/muscle-flap repair, preventive fundoplication did not decrease the need for curative fundoplication (15% vs 11%, p=0.53), and was associated with higher rates of failure to thrive (discharge: 81% vs 51%, p=0.03; 6 months: 81% vs 45%, p=0.008), tube feeds (6 months: 50% vs 21%, p=0.02; 2 years: 65% vs 26%, p=0.004), and oral aversion (6 months: 67% vs 37%, p=0.02; 1 year: 71% vs 40%, p=0.03).

4) After CDH repair, 8% neonates (n=51) required curative fundoplication (median age: 101 days). Upon multivariate analysis, no independent predictive factors were identified.

Conclusions

Preventive fundoplication is associated with worse gastro-intestinal outcomes in children with a patch/muscle flap repair. The development of GERD requiring curative fundoplication is unpredictable, highlighting that a preventive fundoplication should not be performed in neonates with CDH.