

September 20th, 2023 15:00 - 17:00

Pulmonology E-Poster (STATION 3)

ID 15. Ventilatory response to added deadspace in infants exposed to second-hand smoke in pregnancy

Doctor Allan Jenkinson¹, Dr Nadja Bednarczuk¹, Dr Ourania Kaltsogianni¹, Dr. Emma Williams¹, Dr. Rebecca Lee¹, Dr. Ravindra Bhat¹, Dr. Theodore Dassios¹, Prof. Anthony Milner², Prof. Anne Greenough²

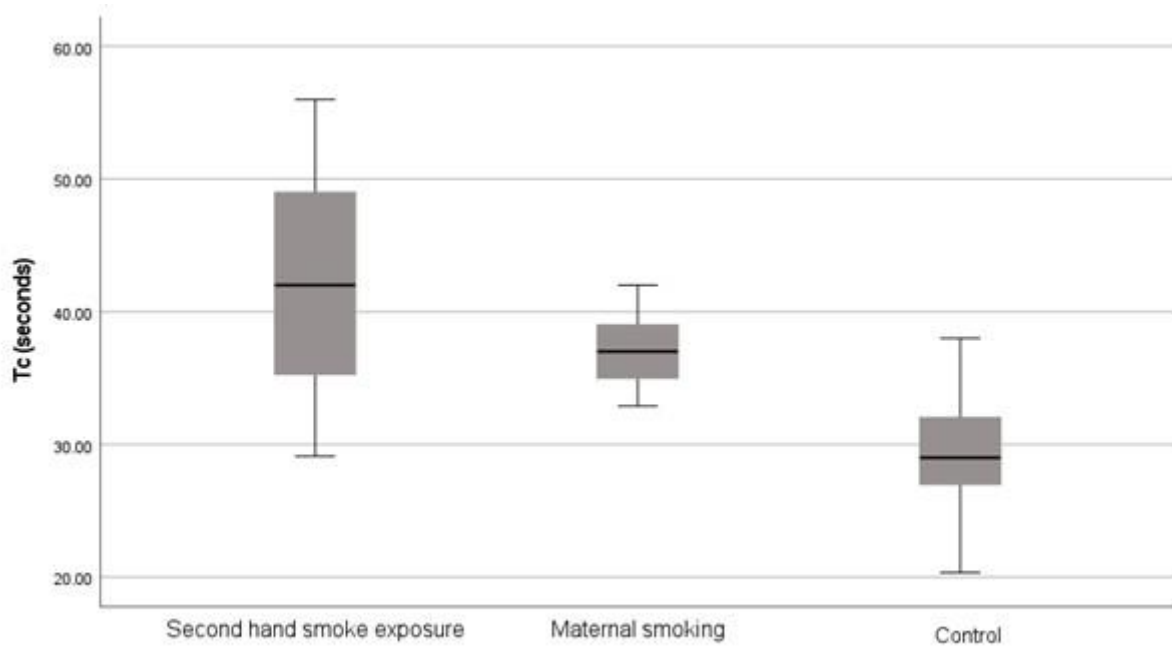
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Background: Maternal cigarette smoking in pregnancy can adversely affect infant respiratory control. In-utero nicotine exposure has been shown to blunt the infant ventilatory response to hypercapnia, which could increase the risk of sudden infant death syndrome. The potential impact of maternal second-hand smoke exposure, however, has not yet been determined. The aim of this study was to assess ventilatory response to added dead-space (inducing hypercapnia) in infants with second-hand smoke exposure during pregnancy, in infants whose mothers smoked and controls (non smoke exposed).

Methods: Infants breathed through a face mask and specialised "tube-breathing" circuit, incorporating a dead space of 4.4 ml/kg body weight. The maximum minute ventilation (MMV) during added dead space breathing was determined and the time taken to achieve 63% of the MMV calculated (the time constant (Tc) of the response). Infants were studied on the postnatal ward prior to discharge home.

Results: Thirty infants (ten in each group) were studied with a median gestational age of 39 [range 37 -41] weeks, birthweight of 3.1[2.2-4.0] kg and postnatal age of 33 (21-62) hours. The infants whose mothers had second hand smoke exposure (median Tc 42 seconds, p=0.001) and the infants of cigarette smoking mothers (median Tc 37 seconds p=0.002) had longer time constants than the controls (median Tc 29 seconds) [Figure 1]. There was no significant difference between the Tc of the infants whose mothers had second smoke exposure and those whose mothers smoked (p=0.112).

Conclusion: Second hand smoke exposure during pregnancy was associated with a dampened newborn ventilatory response.



A box plot of the time constants of the response to added dead space by maternal smoking status.

ID 255. The acute effects of apnoea on the developing brain of premature infants

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Background: Apnoea frequently occurs in premature infants. These episodes can result in decreased cerebral oxygenation and are associated with reduced cognitive ability later in life. However, whether apnoea is causative or just associated with later-life neurodevelopmental outcome remains unclear. Understanding the short-term impact of apnoeas on the developing infant brain is important to disentangle these effects. We investigated how apnoea directly impacts the ongoing brain activity of premature infants. In line with findings of earlier investigations, we hypothesised that the cortical activity is suppressed during apnoea.

Methods: Vital signs and cortical activity with 8-channel electroencephalography (EEG) were recorded in 122 infants during 128 separate recording sessions at the Neonatal Intensive Care Unit, University Hospitals Leuven (Belgium). Respiratory signals of the vital sign recordings were converted to inter-breath intervals (IBIs) using a dynamic amplitude detection algorithm. Apnoea was defined as a pause in breathing (i.e., IBI) of at least 15 seconds. EEG data were time-locked to the end of the apnoea and their amplitudes were calculated using the Hilbert transform. Time-frequency EEG amplitudes during and after apnoeas were statistically compared to periods of regular breathing.

Results: A total of 254 apnoeas were identified with a duration of 18.1 [15.0 – 48.0] sec (median [range]). The mean EEG amplitude over all channels decreased during and after the apnoea compared to regular breathing (Figure 1). All eight EEG channels showed reduced EEG amplitudes over a broad frequency range (1-30 Hz), suggesting that episodes of apnoea impact the whole cortex. Amplitude reduction was related to change in heart rate.

Conclusion: Cortical activity decreases during and after apnoea in premature infants over the whole cortex and over a broad frequency range. As brain activity, and the temporal patterning of this activity, drives brain development, frequent disruptions of activity during critical periods may have an effect on neurodevelopment.

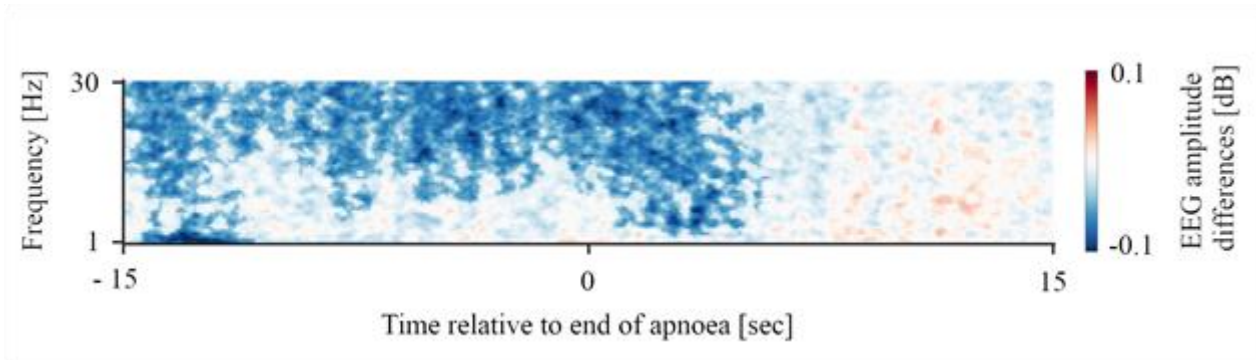


Figure 1. EEG amplitude changes during and after the apnoea. Amplitude differences are averaged over channels before statistical assessments. Opaque (i.e., dark blue) samples are significant.

ID 375. DIAPHRAGM FUNCTION IN VERY PRETERM INFANTS AT 36 WEEKS' POSTMENSTRUAL AGE

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Background: Understanding how bronchopulmonary dysplasia (BPD) and antenatal and postnatal factors influence efficiency of diaphragmatic function in very preterm infants. We hypothesised, that diaphragmatic efficiency is impaired during spontaneous breathing in infants with BPD. Moreover, we hypothesised that diaphragmatic efficiency is influenced by adverse antenatal and postnatal factors.

Methods: Diaphragmatic efficiency was assessed in a single centre, prospective observational study in preterm infants. Transdiaphragmatic pressure (Pdi) and respiratory flow were measured during quiet sleep at 36 weeks' postmenstrual age (PMA). Transdiaphragmatic pressure was normalized to tidal volume (Pdi/V_T). Diaphragmatic work of breathing/minute was calculated from the inspiratory pressure time integral (PTIdi) and respiratory rate product. Factors predictive for each outcome were identified from multivariable linear regression.

Results: Very preterm infants (n = 182) were measured at a median (IQR) 35.6 (1.3) weeks' PMA. Infants with BPD had a lower Pdi/V_T (p = 0.007) and lower PTIdi·min⁻¹ (p = 0.022) but higher minute ventilation (p = 0.032) and similar respiratory rates (p = 0.419) compared to infants without BPD. Birthweight Z score was an independent negative predictor for Pdi/V_T (R² = 0.08, p < 0.001) while average early postnatal energy intake was an independent positive predictor for both Pdi/V_T (R² = 0.037, p = 0.007) and PTIdi·min⁻¹ (R² = 0.06, p = 0.001). Gestation, chorioamnionitis and duration of mechanical ventilation did not contribute to the final model.

Conclusion: Preterm infants with BPD had increased minute ventilation despite reduced transdiaphragmatic force and diaphragmatic work of breathing compared to infants without BPD, which could be explained by recruitment of accessory muscles. Efficiency of the diaphragm is likely influenced by other antenatal and postnatal factors.

ID 456. DIRECT LARYNGOSCOPY VERSUS INDIRECT VIDEOLARYNGOSCOPY FOR INTUBATING NEWBORN MANNEQUINS: A RANDOMISED CROSSOVER STUDY

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Background: When intubating babies, standard laryngoscopes (SL) are used to look directly into the mouth (direct laryngoscopy), whereas videolaryngoscopes (VL) display the view of the larynx obtained with a camera on a screen (indirect laryngoscopy). Trainees who perform direct laryngoscopy with an Acutronic VL have greater first attempt success rate when a mentor views the screen; and trainees acquire competence more quickly with C-MAC VL than SL. We compared the performance of intubators using SL, Acutronic and C-MAC in two mannequins.

Our aim was to compare direct laryngoscopy with a standard laryngoscope (SL) to indirect laryngoscopy with 2 videolaryngoscopes (VL) for endotracheal intubation of newborn mannequins.

Methods: We conducted a randomised crossover study in a university maternity hospital in Dublin, Ireland. Twenty-five clinicians - 6 senior doctors, 18 trainee doctors and 1 advanced neonatal nurse practitioner were included.

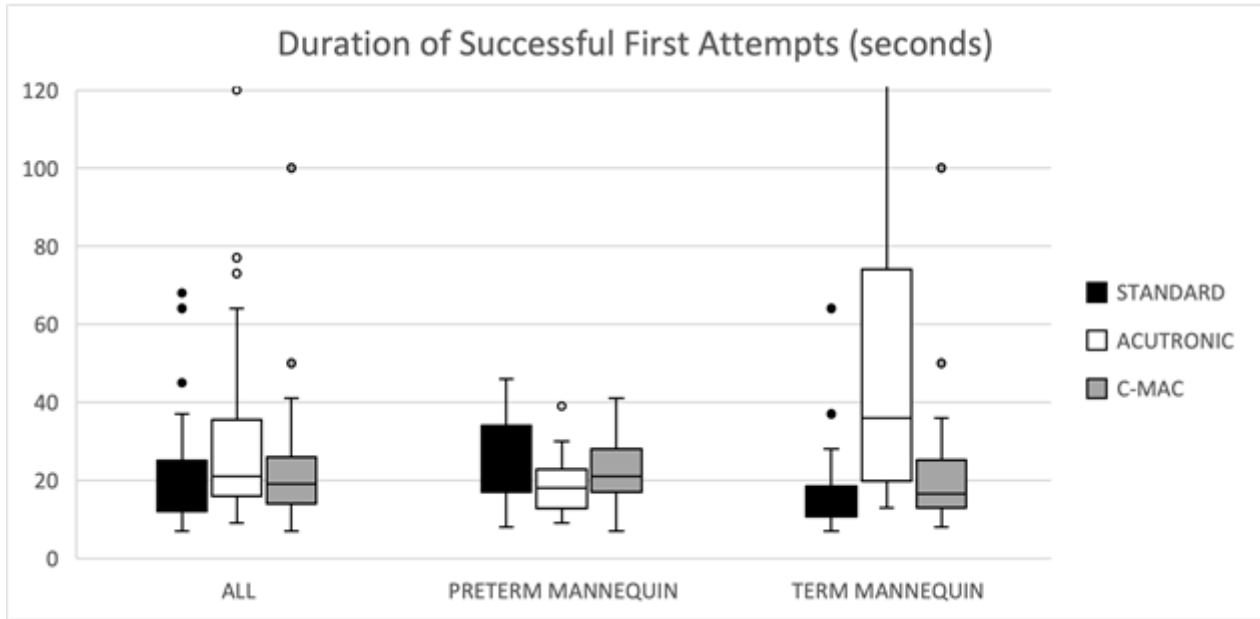
This was a crossover study- each participant used a SL (Heine, Germany), and two VLs – the InfantView (Acutronic, Switzerland) and C-MAC (Karl Storz, Germany) – to intubate a preterm and a term newborn mannequin in randomly assigned order.

The main outcome measures were success at first attempt, duration of successful attempts, participant preferences for devices.

Results: Twenty-four (6 senior, 18 trainees) doctors and 1 advanced nurse practitioner participated. Success at first attempt and duration of successful attempt were similar for the SL and C-MAC for both mannequins. The success rate was lower and the duration of attempts longer with the Acutronic VL in the term mannequin.

Conclusions: Participants performed similarly using direct laryngoscopy or indirect laryngoscopy with the C-MAC when intubating mannequins. Most participants preferred the C-MAC.

Direct laryngoscopy with SL and indirect laryngoscopy with C-MAC by intubators across levels of experience merit comparison in a randomised trial in newborns.



Duration of Successful First Attempts (seconds)

ID 762. VENTILATION PATTERNS OF THE IPSI- AND CONTRALATERAL LUNG IN CONGENITAL DIAPHRAGMATIC HERNIA

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Background: Congenital diaphragmatic hernia (CDH) is characterised by severe pulmonary hypoplasia in one lung. The resultant lung disunity makes the management of CDH complex and largely based on expert-opinion. We aimed, for the first time, to describe function in each of the ipsilateral (hypoplastic) and contralateral CDH lungs over time.

Methods: Prospective, observational study including infants diagnosed with left-sided CDH (feasibility sample size). Electrical impedance tomography (EIT) images of both lungs, with measures of ventilator and cardiorespiratory parameters were made over 20 minutes of stable care pre-operatively, within 2-8 days after surgery and prior to discharge. Regional tidal ventilation (Centre of Ventilation; CoV), aeration and flow patterns were calculated between right and left lung. CoV is the mean point of ventilation from the anatomically most right-hand (0%) to the most left-hand (100%) regions. The ideal CoV in healthy normally developed lungs is 47%. Aeration was calculated by the relative end expiratory lung volume in the left lung as a percentage of whole lung volume at each time point.

Results: Fourteen infants were included, with a median (range) gestational age 38+5 weeks (34+0 to 41+1 weeks), observed-to-expected lung-to-head ratio 49% (24-65%), 36% liver in thorax and 86% Type B or C lesions. 7 infants received high-frequency ventilation at some stage in admission. Ventilation was predominantly right-sided, however, left lung ventilation increased from pre-surgery (all intubated) with a CoV 24% (21-39%) to 33% (26-38%) at discharge (none receiving invasive respiratory support). Left lung aeration did not change; 31% (26-40%) of overall aeration pre-surgery, 26% (21-32%) post-surgery and 32% (27-43%) pre-discharge.

Conclusion: For the first time we have demonstrated that lung function changes with time in CDH, and a detailed understanding of this change, and the differences in ventilation between each lung is possible at the bedside using EIT. This offers the potential to individualise respiratory care by respecting the individual mechanics of each lung.

ID 605. FIVE-YEAR EXPERIENCE OF USING PERCUTANEOUS PIGTAIL CATHETERS FOR MANAGEMENT OF NEONATAL PNEUMOTHORAX: A CHANGING TREND

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Background: Pneumothorax, the most common air leak syndrome, is potentially a life-threatening condition in neonates with little compensatory pulmonary reserve. Hemodynamically significant pneumothorax requires drainage with large-bore chest tubes traditionally, and more recently the use of modified small-caliber percutaneous pigtail catheter has been suggested as a less invasive approach. This study aims to explicate the effectiveness and safety of pigtail catheter drainage systems in treating neonates with pneumothorax exploring ease of insertion, rates of air-leak resolution, recurrence rates as well as potential procedural complications.

Methods: This was a retrospective observational audit reviewing medical records of newborn with symptomatic pneumothorax admitted to tertiary neonatal intensive care unit of KK Women's and Children's Hospital, Singapore between January 2018 and December 2022, and treated with pigtail catheters as the initial treatment approach for drainage. Demographic data, details related to pneumothorax, drain related parameters as well as outcome and efficacy parameters were studied related to the method of intervention.

Results: At our institution, the incidence of diagnosed pneumothorax was 0.3% among the live-born infants (157 neonates out of 52334 live births). About 1/3rd of symptomatic pneumothorax neonates needed drainage (52/157) due to hemodynamic compromise, of which, 45 infants underwent pigtail insertion. Baseline demographic data including gestation at birth, birth weight, gender, mode of delivery and APGAR score of ≤ 5 at 5 minutes of life were noted for the study group. The procedure timing (32 ± 45 min), time for radiological clearance and resolution of air leak (17 ± 32 hours), duration of drain in-situ (3.7 ± 4 days), re-adjustment (15%), recurrence (2 cases) and complication rate (none) were observed. Half of the infants who underwent pigtail insertion required sedation with Morphine (51.1%) and there was no increased need of invasive ventilation post intervention. Smaller caliber (8.22 ± 1.6 Fr) catheter was required for pneumothorax drainage with pigtail catheter and insertion reported to be more operator friendly and requires about 4-year of post-graduate experience to achieve successful insertion.

Conclusion: Pigtail catheters, in terms of efficacy and safety, achieved success in pneumothorax drainage with no significant recurrence and complication rates. Our study encourage that pigtail catheters should be considered as routine treatment of choice in treating neonatal pneumothorax.

VARIABLES	PIGTAIL CATHETER DRAINAGE (n =45)
Gestational age in weeks; mean ± SD	34.6 ± 5.2
Birth weight in grams; mean ± SD	2387 ± 962
Gender (Male: Female); n (%)	26 (57.8%): 19 (42.2%)
Caesarean section; n (%)	32 (71.1%)
Meconium-stained liquor; n (%)	10 (22.2%)
Antenatal corticosteroids; n (%)	12 (26.7%)
Apgar score ≤ 5 at 5 min; n (%)	7 (15.6%)
Associated Lung Disease; n (%)	42 (93.3%)
RDS; n (%)	13 (28.9%)
TTNB; n (%)	15 (33.3%)
MAS; n (%)	2 (4.4%)
Others; n (%)	12 (26.7%)
Surfactant use; n (%)	25 (55.6%)
Day of life at occurrence of pneumothorax; mean ± SD	1.67 ± 2.15
median (IQR)	1 (1 - 1)
Location (Right: Left: Bilateral); n	18: 23: 4
Needle aspiration prior to intervention; n (%)	8 (17.8%)
Time from diagnosis to intervention in hours; mean ± SD	1.2 ± 3.8
Size of Catheter in Fr (6:8:10); n	12:16:17
mean ± SD	8.22 ± 1.6
Sedation required during intervention; n (%)	23 (51.1%)
Operator level – resident: specialist; n (%)	27 (60.0%): 18 (40.0%)
Operator's reported ease of insertion (Range of 1-5; from least difficult to most)	1.33 ± 0.48
Operator's experience in years; mean ± SD	4 ± 4
Procedure timing in min; mean ± SD	32 ± 45
Ventilation mode (non-invasive: invasive)	
Prior to intervention; n (%)	18 (40.0%): 27 (60.0%)
Post-intervention; n (%)	17 (37.8%): 28 (62.2%)
Maximum FIO2 requirement	
Prior to intervention; mean ± SD	50 ± 30
median (IQR)	35 (30 - 100)
Post-intervention; mean ± SD	44 ± 31
median (IQR)	30 (20 - 75)
Reduction in FIO2 requirement post- intervention; mean ± SD	6 ± 7
Drain adjustment post-intervention; n (%)	7 (15.5%)
Time for radiological clearance in hours; mean ± SD	17 ± 32
median (IQR)	1.5 (0 - 31.5)
Total duration of drain in days; mean ± SD	3.7 ± 4
median (IQR)	2 (2 - 4)
Total duration of hospitalisation in days; mean ± SD	30 ± 53
median (IQR)	8 (4 - 30)
Total duration of hospitalisation in days (excluding deaths); mean ± SD	33 ± 58
median (IQR)	9 (6 - 26)
Survival; n (%)	38 (84.4%)

TABLE 1: Demographics and Pigtail Catheter Drainage details

ID 603. CONGENITAL DIAPHRAGMATIC HERNIA WITH THE PRESENCE OF LIVER HERNIATION IS ASSOCIATED WITH WORSE CLINICAL COMORBIDITIES AND WITH SURROGATE MEASUREMENTS OF LUNG HYPOPLASIA

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Background: Congenital diaphragmatic hernia (CDH) is a rare malformation that occurs in 1:4000 infants. It is associated with a mortality rate up to 50% and severe comorbidities, such as lung hypoplasia, pulmonary hypertension (PH), and cardiac dysfunction. Antenatal measurements of lung-to-head ratio and liver herniation have been used as predictive tools, however these markers are mainly associated with postnatal survival.

Methods: We reviewed the surgical and clinical management of infants with CDH who were admitted to a surgical centre in London between April 2019 to December 2022. We further explored the differences between infants with left-sided CDH with liver herniation (LCDHup), left-sided with no liver herniation (LCDHdown) and right CDH (RCDH). Data were retrospectively collected from the electronic medical records and analysed using SPSS v26.

Results: A total of 42 infants with mean (range) gestational age of 38 (31-41) weeks and birth weight of 2.8 (1.66 – 3.83) kg were included. Three infants died before surgical repair and one after (total 9.5%). 12% of all infants had fetoscopic endoluminal tracheal occlusion (FETO) procedure, 81% were left sided CDH, 40% had liver herniation, 21% underwent extracorporeal membrane oxygenation (ECMO) and the mean ECMO duration was 11 days. 52% had pulmonary hypertension and 21% had abnormal cranial ultrasounds. 92% (36) of those who had surgery had a thoracoscopic repair, and only 4 had the procedure converted to an open repair. Age (days) at surgery was significantly higher in LCDHup compared to LCDHdown ($p=0.006$). PH was more frequent in LCDHup than LCDHdown ($P=0.003$). Persistent PH at discharge was higher in the RCDH compared to LCDHdown ($P=0.002$). Reported abnormal cranial ultrasound was more frequent in LCDHup compared to LCDHdown, and between RCDH and LCDHdown ($P<0.001$).

Conclusion: Mortality rate was lower compared to most of the published literature and thoracoscopic repair was the primary surgical approach for the majority. CDH with liver herniation was associated with worse comorbidities and surrogate measurements of lung hypoplasia and pulmonary hypertension, such as CO₂ levels, ventilation days and mean airway pressure. Further research with a larger cohort should focus on the comparison between LCDHdown, LCDHup and RCDH.



	No Liver herniation (Left-Right CDH) mean (confidence interval)	With Liver herniation (Left-Right CDH) Mean (confidence interval)	P
Gestational Age (weeks)	38.6 (37.8 – 39.2)	35.9 (34.3 – 37.5)	0.013
Birth Weight (Kg)	3.0 (2.8 – 3.2)	2.7 (2.3 – 3.1)	<0.001
Sex (female:male)	9:13	9:8	0.45
Apgar 5 min	8 (8 – 9)	6 (5 – 8)	0.006
Age at surgery (days)	5.8 (2.6 – 8.9)	14.1 (8.4 – 19.8)	0.008
Days of mechanical ventilation	11.7 (6.8 – 16.7)	29.2 (20.6 – 37.7)	<0.001
Admission pH	7.33 (7.27 – 7.39)	7.23 (7.15 – 7.32)	0.039
Admission CO2 (bPa)	5.58 (4.73-6.43)	7.61 (5.74 – 9.48)	0.020
Highest mean airway pressure pre-surgery	10 (9 – 11)	11 (10 – 12)	0.040
Antenatal diagnosis: Postnatal diagnosis	13:9	17:0	0.003
Presence of PH	6	14	0.001
Use of Inotropes and vasopressor pre-surgery	2	7	0.002
Persistent PH at discharge	2	7	0.056
ECMO	3	5	0.23
Abnormal cranial ultrasound	0	8	<0.001

Table 1. Comparison of clinical variables between CDH with and without liver herniation

ID 797. Use of Non-Invasive Positive Pressure triggered ventilation-a bridge between conventional ventilation and CPAP. One centre's experience

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¹New Cross Wolverhampton

Background and objectives

- Use of NIPPVTr as a new ventilatory modality was commenced in 2020
- Designed to be used as a step down to CPAP following extubation and also as a rescue form of ventilation prior to re-ventilation Methods
- Cohort: Babies born at 23-32 weeks gestation and admitted to a tertiary NICU
- Study period: September 2020- 2021
- Inclusion criteria: inborn infants Data collected included demographics, antenatal and postnatal management including complications.

Results

- 113 patients identified as meeting gestation requirement for inclusion
- 86 fitted inclusion criteria
- 46.5% Babies receiving NIPPVTr at any point (n=41) NIPPVTr parameters n=41
- Median weight when starting NIPPVTr = 895g (range 555 – 1390g)
- Median Max PIP 18 (range 11 – 27)
- Had steroids whilst on NIPPVTr = 6/41 patients
- Failed NIPPVTr (defined as requiring escalation of respiratory support) = 16/41
- At gestations up to an including 27/40, babies received NIPPVTr in preference to other modalities
- From 28/40 and above this trend was reversed
- Babies from both the NIPPVTr and non-NIPPVTr cohorts were equally matched for gender and ethnicity
- Babies who received NIPPVTr had a significantly lower median weight compared to those who did not
- The range of weights between both groups was equivalent
- The majority of babies did receive surfactant in the first 4h following delivery
- Intestinal perforation occurred in 9% of patients overall, with an even split between those receiving NIPPVTr versus those who did not
- Barotrauma (pneumothorax) was exclusive to those who were not receiving NIPPVTr
- 2/3 of all patients at these gestations were discharged home on home oxygen regardless of ventilatory modality
- All secondary outcome measures (except death) were significantly more likely in the group who did not have NIPPVTr (p<0.01).

Conclusion

- Although a relatively new modality of ventilation, NIPPVTr has been used frequently since its introduction
- Gestation and weight are not barriers to its use
- Overall outcomes were significantly better in those babies who had NIPPVTr versus those who did not in all areas measured except for mortality, where both groups were evenly matched
- Overall mortality in the study was only 8%

ID 850. NEONATAL ADMISSIONS WITH SEVERE RSV BRONCHIOLITIS DURING THE 1ST POST PANDEMIC SEASON AFTER THE RELAXATION OF ISOLATION MEASURES IN A TERTIARY CARE CHILDREN'S HOSPITAL IN ATHENS, GREECE

Doctor Aikaterini Lappa¹, Doctor Efthymia Charachousou¹, Doctor Margarita Diamantopoulou¹, Doctor Theodora Spiliotopoulou¹, Doctor Maria-Eirini Polymenopoulou¹, Doctor Eftychia-Ioanna Dimitrakopoulou¹, Doctor Ioanna Petsani¹, Doctor Varvara Kourti¹, Doctor Konstantina Katechi¹
¹Children's Hospital "H Agia Sophia"

Neonatal admissions with severe RSV bronchiolitis during the 1st post pandemic season after the relaxation of isolation measures in a tertiary care children's hospital in Athens, Greece.

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BACKGROUND: RSV bronchiolitis is the most common viral infection of the lower respiratory tract, that represents the main cause of illness and hospitalisation in neonates. The majority of patients respond to supportive care, however endotracheal intubation and mechanical ventilation may be required. The different socio-sanitary measures adopted to prevent the spread of SARS-CoV-2 infection also helped to contain the transmission of other respiratory viruses. Our objective was to describe the rising disease severity of RSV cases coinciding with the relaxation of isolation measures.

METHODS: We reviewed the medical records of RSV positive neonates who were admitted in a neonatal intensive care unit of a tertiary care hospital in Athens during this year's epidemic period. We compared them with data from the previous post pandemic periods. Identification was performed by RSV antigen test (nasopharyngeal aspirate samples).

RESULTS: Among the 56 neonates with RSV bronchiolitis who were hospitalised, 5 (8.9%) required invasive mechanical ventilation. 4 were full term and 1 was late preterm. None of them had any risk factors for severe disease apart from their age group. They required mechanical ventilation for an average of 7 days and remained intubated for a median of 2.4 days. Interestingly, on admission, all of them had right upper lobe atelectasis on chest X-ray. 2/5 demonstrated significant hyponatremia. All the patients made a full recovery after a median of 14.2 days of hospitalisation. None of the RSV positive inpatient neonates required intubation during the previous epidemic seasons.

CONCLUSION: During the 2022-2023 epidemic period, a significant increase in the frequency and severity of RSV bronchiolitis cases was observed. On the contrary, during the previous epidemic periods after the implementation of public health measures due to COVID-19 pandemic, a dramatically lower percentage of both hospitalisation and severity of RSV infection was recorded.