Impact of Respiratory Care Bundle on Bronchopulmonary Dysplasia and Pulmonary Hypertension in Preterm Infants

V. Mallette MD, FRCPC | **C. Drolet** MD, FRCPC | **A. Hébert** MD, MHSc, FRCPC

CENTRE DE RECHERCHE | CHU de Québec Université Laval

EPIQ

AIM

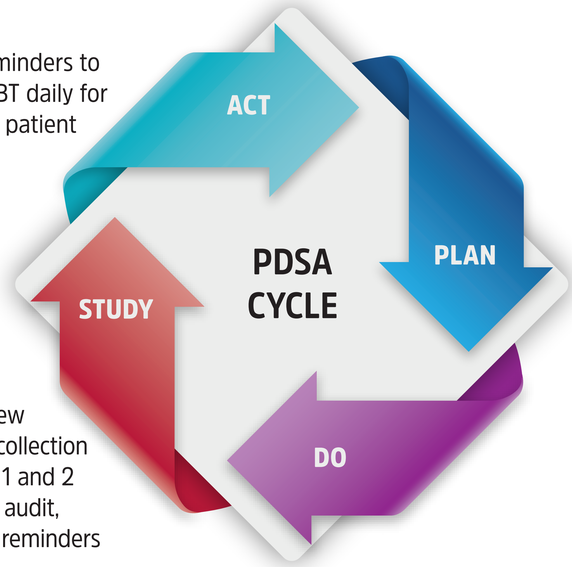
Improve the incidence of broncopulmonary dysplasia and chronic pulmonary hypertension in preterm infants born at less than 29 weeks of gestation.

IMPORTANCE

- Bronchopulmonary dysplasia (BPD) is one of the most common complications of prematurity.
- It is often associated with chronic pulmonary hypertension (PH).
- These complications increase the risk of mortality, long-term cardiovascular and neurodevelopmental consequences.
- Various strategies, including the implementation of a respiratory care bundle have been employed to reduce the risk of BPD. The impact of this approach remains unclear.

ACT

- Create reminders to use the SBT daily for intubated patient



PLAN

- Literature review
- French translation of the respiratory care bundle
- Adaptation of the respiratory care bundle to align with our local pratices
- Development of a spontaneous breathing trial (SBT) tailored to our unit using existing tools
- Define the two different periods (pre and post-implementation) and the characteristics, values and parameters to be analyzed for each patient

STUDY

- Chart review and data collection for epoch 1 and 2
- No official audit, Real-time reminders

DO

- Standardization of the invasive ventilation mode in our unit (volume-controlled ventilation)
- Implementation of the spontaneous breathing trial
- Education sessions on practice changes for physicians, RT and nurses

RESULTS

TABLE 1 - CLINICAL CHARACTERISTICS

Variables*	Pre-Bundle (n=49)	Post-Bundle (n=51)	P value
Gestional age (weeks)	26.5 (1.5)	26.7 (1.7)	0.37
Birth weight (g)	903 (221)	928 (263)	0.63
Multiple births	13 (27)	8 (16)	0.22
Inborn	43 (88)	46 (90)	0.76
Antenatal steroids	44 (91)	47 (94)	0.95
Chorioamnionitis	23 (40)	20 (39)	0.31
Maternal hypertension or preeclampsia	8 (17)	10 (20)	0.8
Intestinal complication			
Spontaneous perforation	2 (4)	2 (4)	1
Necrotizing enterocolitis	2 (4)	2 (4)	1
Patent ductus arteriosus medically treated	26 (79)	23 (66)	0.29
Culture proven sepsis	12 (24.5)	7 (14)	0.21
Intraventricular hemorrhage grade 3+	3 (6)	5 (10)	0.72
Death after 36 weeks (corrrected age)	2 (4)	0 (0)	0.24
Duration of hospitalization (days)	104 (38)	102 (29)	0.92

*Means (SD)analysed with Wilcox on Mann Whitney Test or n (%) analysed with x^2 test.

TABLE 2 - RESPIRATORY OUTCOMES

Variables*	Pre-Bundle (n=49)	Post-Bundle (n=51)	P value
BPD at 36 weeks corrected age	37 (76)	39 (77)	1
Duration of invasive ventilation* (days)	18 (18)	12 (15)	0.08
Duration of pressure-targeted ventilation (days)	7 (7)	2 (5)	<.0001
Change to synchronized intermittent mandatory ventilation mode pre-extubation	14/38 (37)	3/32 (9)	0.01
Use of spontaneous breathing test pre-extubation	0/38 (0)	21/32 (66)	<.0001
Successful first extubation attempt	18/38 (49)	21/32 (66)	0.22
Duration of non-invasive ventilation (days)	42 (19)	43 (17)	0.22
Post-natal steroids use	15 (31)	19 (37)	0.53
Diuretics use	25 (51)	25 (49)	1

*Means (SD)analysed with Wilcox on Mann Whitney Test or n (%) analysed with x^2 test.

TABLE 3 - PH OUTCOMES AND Tn ECHO DATA

Variables*	Pre-Bundle (n=40)	Post-Bundle (n=41)	P value
PH, n (%)	2 (4)	1 (2)	0.84
RVET/PAAT ratio	4 (1.3)	3.9 (0.7)	0.96
Estimated pulmonary pressure (mm Hg)	29.3 (6.1)	26.9 (6.2)	0.27
TAPSE	10.2 (1.4)	10.2 (1.5)	0.76
Right ventricular ejection fraction (%)	47.6 (7.1)	52.8 (8)	0.02
Eccentricity index (end systole)	0.97 (0.1)	0.95 (0.1)	0.47

* n (%) analysed with x^2 test or mean (SD) analysed Wilcoxon Mann Whitney or Student-t test.
RVET/PAAT: right ventricular ejection time/pulmonary acceleration time, TAPSE : Tricuspid annular plane systolic excursion.

CONCLUSION

- The incidence of BPD was unchanged between the pre and post-bundle implementation.
- No significant difference in PH was observed.
- Compare to the literature our rate of PH is low.

LESSONS LEARNED

- Adherence to the respiratory care bundle was gradual, which may have limited the impact on our BPD and PH incidence.
- Consistency and compliance challenging to sustain.
- There are notables positives practice changes in the post-bundle epoch:
  - › Less pressure-targeted ventilation.
  - › Reduction of ventilation mode changes before extubation.
  - › Reduction in the duration of invasive ventilation.

NEXT STAGE

- Maintain compliance to the respiratory care bundle.
- Enhance the use of the spontaneous breathing trial.
- Development of a systemic post-natal corticosteroids protocol for preterm at high risk of BPD.