Focused Screening of Metabolic Bone Disease in Preterm Infants: The Montreal Children's Hospital Experience

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EPIQ Evidence-based Practice for Improving Quality

BACKGROUND

- Metabolic bone disease of prematurity (MBDP) remains a significant comorbidity in very low birthweight and premature neonates.
- Significant variation exists in the screening methods, timing, and initiation of treatment.
- Recent literature suggests that **repetitive neonatal-procedural pain** in early life can be associated with smaller thalamic volumes, which can be associated in turn with MRI changes and impact functional outcome[1] .
- Judicious use of **laboratory assessment and procedures** is therefore an important objective in the NICU and should be considered when using screening and management algorithms for MBDP.

OBJECTIVES

- To conduct an audit of the MBDP clinical practice guideline at the Montreal Children's Hospital both before and after the modification of the guideline, assessing adherence and effectiveness pre- and post-alteration.
- To describe the findings.

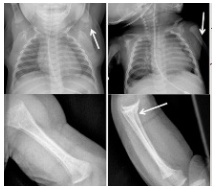


Figure 1

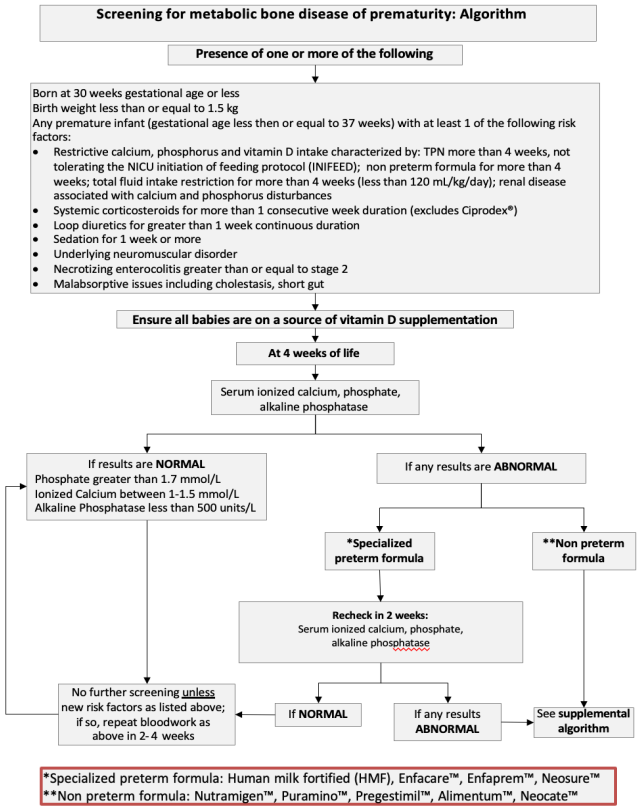
METHODS

	Before	After
Study design	Retrospective Observational Study	
Population	< 30 weeks and/or < 1 500 g	< 30 weeks and/or < 1 000 g
Admission period	Jan. 1st to July 1st, 2020	Jan. 1st to Dec. 31st, 2022

Both screening and diagnosis of MBDP

- Bone-mineral status was evaluated by initial screening of serum-ionized calcium, phosphate and alkaline phosphatase once the infants were on full enteral feeds at 4 weeks of life, and subsequently repeated depending on the values.
- MBDP was considered normal if alkaline phosphatase was less than 500 units/L, in the presence of a phosphate greater than >1.7 mmol/L, and ionized calcium between 1-1.5mmol/L.

INTERVENTION: MBDP GUIDELINE ALTERATION



DATA / FINDINGS

Alteration of MBDP guideline	Before guideline changes	After guideline changes
Number of patients	167	53
Number requiring calcium & phosphate supplements	13[2]	9
Number of patients with MBDP for each risk factors	NEC[3] with cholestasis (3), Sedation (4) Glucocorticoids (4), Loop diuretics (9)	NEC with cholestasis (2), Surgical NEC (1), Sedation (6), Glucocorticoids (8), Loop diuretics (5)
Non-preterm formula usage	All 13	7 out of 9
Duration of total parenteral nutrition	> 30 days	> 1 ½ months (average 5–6 weeks post-delivery)
Time to develop MBDP	5–7 weeks	5–6 weeks
Diagnosis of fractures	None	None
Average weight at discharge	3.6 kg	3.8 kg
MBDP patients testing frequency	<3 times = zero patient 3-6 times = 3 patient >6 times =10 patient	<3 times = zero patient 3-6 times = 9 patient >6 times =zero patient
Non-MBDP patients testing frequency	Once (66%), 2–3 times (22%), 4–7 times (12%)	Once (30%), 2–3 times (61%), > or= 4 times (9%)

DISCUSSION

- The revised MBDP guideline has enhanced the identification of at-risk infants while reducing frequency of blood procurement. A **minority**, those on **non-preterm formula**, developed significant MBDP requiring mineral supplementation.
- To streamline neonatal care procedures, it is recommended to focus MBDP screening and management algorithms on infants using non-preterm formula with low phosphate and high alkaline phosphatase.
- Given our findings that showed **increased risk of MBDP in preterm infants on non-preterm formula**, the guideline was modified so as to screen and treat earlier with appropriate calcium and phosphate supplementation while decreasing the frequency of blood procurement.
- Based on our results, we recommend not to test for parathyroid hormone, 25-OH vitamin D and tubular absorption of phosphate as a first line but only in those who have persistent low phosphate levels despite supplementation.

CONCLUSION

- Our findings suggest that being on non-preterm formula places the preterm population at higher risk for MBDP and earlier monitoring of these patients with appropriate laboratories resulted in supplementation of calcium and phosphate.

References: (1) Duerden, E. G., and al. (2018). Early procedural pain is associated with regionally-specific alterations in thalamic development in preterm neonates. *Journal of Neuroscience*, 38(4), 878–886; **(2):** Of the 13 patients,10 neonates were <30 weeks and <1000gr **(3)**: NEC Necrotizing enterocolitis; **Figure 1**: Stacy E. Rustico, Andrew C. Calabria, Samuel J. Garber, Metabolic bone disease of prematurity. *Journal of Clinical & Translational Endocrinology*, (2014) 1: 3.