
Blood tests and dual energy x-ray absorptiometry for diagnosing osteopenia in neonates.

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Abstract

Background The Monash Newborn Unit at Monash Medical Centre, Clayton is developing evidence-based guidelines for diagnosis and management of infants with osteopenia. The Centre for Clinical Effectiveness (CCE) was asked whether diagnosis of osteopenia in neonates using a single blood marker, tubular reabsorption of phosphate (TRP), was as accurate as diagnosis using a suite of blood tests, including TRP; calcium; phosphorus; alkaline phosphatase (ALP); albumin; electrolytes, urea, and creatinine (EUC); and parathyroid hormone (PTH), which is the current practice. The 'gold standard' reference test for diagnosing osteopenia is dual energy x-ray absorptiometry (DEXA).

Question In neonatal patients who are <32 weeks gestational age at birth or <1000g birth weight, is TRP as accurate as a suite of blood tests including TRP, calcium, phosphorus, ALP, albumin; EUC and PTH in diagnosing osteopenia?

Methods We included all trials published in English. We searched Medline, EMBASE, All EBM, and CINAHL in June 2009. Studies were selected and appraised by two reviewers in consultation with colleagues, using inclusion, exclusion and appraisal criteria established a priori.

Results Our search resulted in 95 articles, with 17 studies reviewed in full text. There were no articles meeting our study selection criteria.

Conclusion We did not find any articles that met our selection criteria to establish whether TRP is as accurate as a suite of blood tests including TRP, calcium, phosphorus, ALP, albumin; EUC and PTH in diagnosing osteopenia in neonates.

Background

The Monash Newborn Unit at Monash Medical Centre, Clayton is developing evidence-based guidelines for diagnosis and management of infants with osteopenia.

The Centre for Clinical Effectiveness (CCE) was asked whether diagnosis of osteopenia in neonates using a single blood marker, tubular reabsorption of phosphate (TRP), was as accurate as diagnosis using a suite of blood tests, including TRP; calcium; phosphorus; alkaline phosphatase (ALP); albumin; electrolytes, urea, and creatinine (EUC); and parathyroid hormone (PTH), which is the current practice. The 'gold standard' reference test for diagnosing osteopenia is dual energy x-ray absorptiometry (DEXA).

Question

In neonatal patients who are <32 weeks gestational age at birth or <1000g birth weight, is TRP as accurate as a suite of blood tests including TRP, calcium, phosphorus, ALP, albumin; EUC and PTH in diagnosing osteopenia?

Methods

Study selection criteria

Patient	Inclusion: Neonatal infants who are <32 weeks gestational age at birth, <1000g birth weight or intrauterine growth restricted, including neonates using diuretics, steroids, or unfortified breastmilk.		
Intervention	Inclusion: TRP assessment alone and assessment using a suite of blood tests consisting of TRP; calcium; phosphorus; ALP; albumin; EUC; and PTH.		
Comparison	Inclusion: DEXA.		
Outcomes	Inclusion: Accuracy; specificity; sensitivity. Exclusion: Any non-comparative outcomes.		
Study type	For the specified outcomes, systematic reviews and diagnostic cohort studies in which consecutive, representative participants each receive all of the tests of interest are sought. If these studies are not available then evidence from lower quality studies is sought.	Publication Date	1980 onwards
		Language	English

Search strategy

Evidence source	Date of search	Date restriction/issue searched
All EBM (Ovid) *	June 17 th 2009	2 nd Quarter 2009
Medline (Ovid)	June 17 th 2009	1948 to Present Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) and Ovid OLDMEDLINE(R)
CINAHL plus (Ovid)	June 17 th 2009	1980 to 2009
EMBASE	June 17 th 2009	1980 to 2009

*(including The Cochrane Database of Systematic Reviews, DARE, CENTRAL and ACP Journal Club)

Search terms in Medline*

Patient	((preterm or pre-term or premature or low birth weight) AND (neonat\$ or newborn\$ or infant\$ or infancy or baby or babies or exp infant, newborn/ or exp infant/)) AND (osteopenia or osteomalacia or rickets or exp bone diseases/ or exp bone diseases, metabolic/ or exp osteomalacia/ or exp rickets/ or phosphate depletion syndrome or osteopathy or osteopathi\$)
Intervention	tubular reabsorption of phosphate or tubular re-absorption of phosphate or TRP or blood exam\$ or blood test\$ or diagnos\$ test\$ or exp neonatal screening/ or dual energy x-ray absorptiometry or DEXA or dual x-ray absorptiometry or DXA or exp absorptiometry, photon
Comparison	
Outcomes	-

* Similar terms (appropriately translated) were used in other databases.

Data collection and analysis

Studies were selected and appraised by two reviewers in consultation with colleagues using study selection and appraisal criteria established a priori.

Results

An initial search returned 95 articles which were reviewed by title and abstract. When a decision could not be made based on title and abstract alone, full text was retrieved. Seventeen full text articles were retrieved for further review. There were no articles meeting our study selection criteria.

Discussion

While we were unable to identify any studies addressing the question for this review, we did identify three other studies which may be of interest. A study by Backstrom et al 2000 evaluated the sensitivity and specificity of ALP with DEXA for bone mineral density¹. In 43 preterm infants, serum ALP and inorganic phosphate measurements were compared to DEXA measurements to determine if the outcomes of bone mineral density and volumetric bone mineral density measured using each technique could be correlated at three and six months corrected age (using DEXA measurements of the radius and ulna as the comparator). The sensitivity and specificity of ALP and phosphate measurements were also compared to DEXA.

Hori et al 1995 investigated the correlation between calcium and phosphorus to DEXA for bone mineral content and density². This study measured in 21 preterm infants calcium, phosphorus, and osteocalcin levels, and compared these to DEXA measurements at the lumbar spine. The outcomes were bone mineral content and density, and the correlation between the chemical measures and DEXA.

Tsukahara et al 1993 investigated the correlation between biochemical measures and DEXA for bone mineral density³. Forty infants were studied. The biochemical measures used included serum calcium, phosphorus, TRP, ALP, parathyroid hormone, as well as urinary calcium/creatinine, osteocalcin, calcitonin, and 25-hydroxyvitamin D. The comparative technique was DEXA measurements at the lumbar spine. The outcomes were bone mineral density and bone mineral status, and the correlation between the biochemical measures and DEXA measurement.

These studies did not assess the accuracy of a single blood marker compared to use of the full suite of blood tests with DEXA as a reference standard.

Conclusion

We did not find any articles that met our selection criteria to establish whether TRP is as accurate as a suite of blood tests including TRP, calcium, phosphorus, ALP, albumin; EUC and PTH in diagnosing osteopenia in neonates.

References

1. Backstrom MC, Kouri T, Kuusela AL, Sievanen H, Koivisto AM, Ikonen RS, and Maki M, *Bone isoenzyme of serum alkaline phosphatase and serum inorganic phosphate in metabolic bone disease of prematurity*. Acta Paediatrica, 2000. 89(7): p867-873.
2. Hori C, Tsukahara H, Fujii Y, Kawamitsu T, Konishi Y, Yamamoto K, Ishii Y, and Sudo M, *Bone mineral status in preterm-born children: assessment by dual-energy X-ray absorptiometry*. Biology of the Neonate, 1995. 68(4): p254-258.
3. Tsukahara H, Sudo M, Umezaki M, Fujii Y, Kuriyama M, Yamamoto K, and Ishii Y, *Measurement of lumbar spinal bone mineral density in preterm infants by dual-energy X-ray absorptiometry*. Biology of the Neonate, 1993. 64(2-3): p96-103.

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