

'Bone Profiles'
ACB March 2007
Dr Janet Horner, NHS Lanarkshire

Comments to :

Janet.Horner@lanarkshire.scot.nhs.uk

Baseline assumptions

1. Any biochemical test should be accurate, effective and safe
2. Any biochemical tests should add to information derived from clinical history and examination and improve the detection or elimination of a specific condition.
3. Any biochemical test or profile of tests should be used to answer a specific clinical question and help make important decisions

Potential roles of 'bone profiles'

Investigation of potential disorders of calcium or bone metabolism
Screening for disorders of calcium or bone metabolism
Monitoring of disorders of calcium or bone metabolism

Potential tests

Serum	Calcium
	Albumin
	Phosphate
	ALP
	Mg
	Creatinine
Plasma	PTH
Serum	25OHD
	125DOHD
Plasma	P5P
TmP GFR	

Potential clinical questions in the field of ‘bone profiles’:

Does my patient have hypercalcaemia?

Does my patient with hypercalcaemia have hyperparathyroidism or a parathyroid hormone independent cause?

Does my patient have hypocalcaemia?

Does my patient with hypocalcaemia have parathyroid failure?

Does my patient with hypocalcaemia have vitamin D deficiency?

Does my patient with hypocalcaemia have renal failure?

Does my patient with hypocalcaemia have hypomagnesaemia?

Does my patient have osteoporosis?

Does my patient with osteoporosis have a secondary cause of osteoporosis?

My patient has aches and pains. Do they have metabolic bone disease?

My patient has had an unusual/unexpected fracture. Do they have metabolic bone disease?

Does my patient with chronic renal disease have hyperparathyroid bone disease? Adynamic bone disease?

The answer to some of the above questions will require full clinical assessment and possibly additional radiological assessment. However below are the biochemical tests which provide additional information to help answer these questions.

Test	Ca & alb	PO4	ALP	Mg	PTH	25O HD	125 OH D	P5P	TmP GFR	Crea tinine
Clinical question										
Hypercalcaemia/hypocalcaemia?	√									
Primary Hyperparathyroidism?	√				√					
Hypocalcaemia due to hypoparathyroidism?	√				√					
Hypocalcaemia due to vitamin D deficiency?	√				√	√				
Hypocalcaemia due to renal failure?	√	√			√					√
Hypocalcaemia due to hypomagnesaemia?	√			√	√					
Osteoporosis? ⁽¹⁾										
Osteoporosis - ?secondary cause ⁽²⁾	√		√							
Vitamin D deficiency and OM?	√		√		√	√				
Hypophosphataemic OM?	√	√	√		√	√			√	

Pagets?			√							
Hypophosphatasia?			√					√		
Ix of renal bone disease	√	√	√		√					

(1) Osteoporosis and the resulting fragility fractures is the commonest metabolic bone disease. Many tools/ risk assessments have been designed to help identify patients with this condition. Most are based on age, weight, BMD, previous fracture, previous use of steroids. While high bone turnover, as evidence by raised biochemical markers of bone turnover, have in populations been identified as an independent risk factor for fracture, there is limited evidence in individuals that it improves the risk prediction.

(2) FBC, ESR, serum creatinine, transaminases, calcium, alb, ALP, Myeloma screen, Celiac screen, LH/FSH/Testosterone (♂), urinary cortisol excretion etc. can all be helpful in identifying secondary causes of osteoporosis if the clinical situation suggests the relevant underlying pathology.

Frequency of testing in monitoring situations

This depends very much on the clinical situation. eg in response to IV treatment of hypercalcaemia, serum calcium should be checked daily. Patients with primary hyperparathyroidism who are being conservatively managed should have calcium checked no more frequently than every 6 months, unless clinically unwell with symptoms of hypercalcaemia. Etc etc. The recommendations for frequency of testing can be expanded.

Conclusions

1. From the above it is clear that a ‘bone profile’ or ‘calcium profile’, which is appropriate (at least initially) to address the clinical questions which might be posed, is serum calcium and albumin.
2. The addition of ALP would be required for the investigation of possible metabolic bone disease (2y causes of osteoporosis etc). However total ALP is not specific for bone tissue and is therefore of limited value. The addition of GGT to establish if ALP arises from liver or bone not universally helpful.
3. PTH and vitamin D measurement is appropriate if there are clinical signs or symptoms of specific bone disorders or if there is an abnormality in serum calcium. They can be regarded as ‘2nd line tests’.
4. Some other investigations are specific to confirm or eliminate certain diagnoses and again are 2nd line tests.
5. The appropriate frequency of testing is very dependent on the clinical scenario and more definitive advice could be developed from existing evidence/guidelines.