

Serum parathyroid hormone and faecal calcium levels in horses on oxalate-containing grasses.

Jennifer Stewart¹, Oliver Liyou² and Margaret Wilkinson³

1. 7 Todd St O'Connor ACT 2602 Email: drjhs@tpg.com.au
 2. Equine Veterinary and Dental Services, 51 Duncans Lane, Clarenza, via South Grafton, NSW, 2460 Email: oliver.liyou@westnet.com.au
 3. Endocrine Laboratory, PaLMS Pathology, Royal North Shore Hospital, St Leonards, NSW, 2065 Email: atlasvet@hotmail.com

Introduction

Nutritional secondary hyperparathyroidism (NSH), induced by a diet with a persistent imbalance of calcium and phosphorus, has been described in unweaned foals, stabled horses and grazing horses in Australia, Canada, Ethiopia, Hawaii, Hong Kong, Japan, Malaysia, Netherlands, New Zealand, Panama, the Philippines, South Africa, Spain, Thailand, the United Kingdom and the United States. Diets commonly implicated were composed predominantly of bran, grain, grass hay, unimproved pasture and pasture high in oxalates.

Many tropical and sub-tropical grasses, including buffel, pangola, setaria, kikuyu, green panic, guinea, signal and purple pigeon contain oxalates – which bind calcium to form insoluble calcium-oxalate, significantly interfering with mineral utilization by horses. Grasses with more than 0.5% oxalate or calcium:oxalate ratios of less than 0.5 result in a negative calcium balance.

Persistently decreased serum ionized calcium or magnesium stimulates production of parathyroid hormone (PTH). Dietary oxalate produces a net loss of calcium and phosphorus primarily through the faecal route, however diagnosis of NSH can only be made when high parathyroid hormone levels are demonstrated.

Case History

Over the past 20 years, clinical cases of 'bighead' have been observed on properties in NSW and Queensland. On some affected properties other horses presented with ill-thrift, intermittent shifting lamenesses, ligament and tendon problems, watery nasal discharge, mild swelling of the distal pasterns, sinusitis, upper respiratory tract noise, difficulty chewing, dental pain, and separation of the upper and lower incisors. Difficulty in passing a stomach tube was noted in some cases.

Due to the wide distribution of oxalate-containing pastures and evidence of sub-clinical NSH, in May and June 2010, a survey of serum PTH, calcium, phosphorus, alkaline phosphatase and creatinine, and faecal calcium levels was undertaken in a random sample of horses in NSW.

Survey population and serum parathyroid hormone and faecal calcium levels

The survey population comprised 85 horses, ranging from one to 22 years of age and included pony club horses; spelling, yearling and pregnant thoroughbreds; Australian stockhorses and eventing horses. Some horses had swelling of the maxilla and mandible, others from the same properties had histories of musculo-skeletal problems, and others had no history of any abnormality. The diets varied from full hand feeding, hand feeding plus grazing, to grazing oxalate-containing grasses.

PTH measured by in-house polyclonal antibody chemiluminescent assay, using human PTH 1-84 standards (Peninsular Labs, California, USA). Serum biochemistry was measured using Hitachi Clinical chemistry analyser. Faecal calcium was measured by hydrolysing and ashing faecal samples and calcium measured by atomic absorption spectrophotometry.

The equine PTH reference range for this assay is up to 150pg/mL.

Results

1. PTH levels: ranged from 14 to 952 pg/mL. The lowest values of 14 and 29 were found in two horses grazing native pasture in the Canberra region and the highest values in one horse grazing setaria (744 pg/mL) and one grazing kikuyu (952 pg/mL). Values below 150 ranged from 14 to 128 (mean 71), values above 150 ranged from 154 to 952 (mean 407).
2. Serum calcium, phosphorus and creatinine: were all within normal range.
3. Alkaline phosphatase: ranged from 90 IU/L to 800 IU/L. In horses with elevated PTH levels, ALP ranged from 200 to 812 IU/L (mean 403). In horses with PTH below 150, ALP ranged from 105 to 331 IU/L (mean 267).
4. Faecal calcium: ranged from 0.85 to 7.45 mmol/g. In horses with elevated PTH levels, faecal calcium ranged from 2 to 7.45 mmol/g (mean 4.6). In horses with PTH below 150, faecal calcium ranged from 0.85 to 3.1 mmol/g (mean 2.2).

Six horses which were grazing kikuyu and twice daily hand-fed lucerne and a calcium supplement, had elevated PTH, ALP and faecal calcium levels.

HORSE	Br	Age	Sex	Diet	PTH pg/mL	Ca mmol/L	P mmol/L	Creatinine umol/L	ALP IU/L	Manure Ca mmol/dry gram
Opal	ASH	3y	Mare	setaria	766	2.98	0.79	89	812	7.03
Danny	ASH	5y	Gelding	setaria	101	2.77	1.52	102	115	1.25
Gorgie	ASH	13y	Mare	setaria	394	2.35	1.26	155	169	2
Jewel	ASH	10y	Mare	setaria	250	2.33	1.14	187	144	2
Chicko	ASH	5y	Gelding	setaria	54	3	1.06	155	210	2.05
CC	ASH	15y	Gelding	setaria	688	2.22	1.24	126	425	4.55
Zera	ASH	4y	Mare	setaria	744	2.44	1.41	110	520	6.2
Ralphie	ASH	4y	Gelding	setaria	157	2.85	1.14	96	800	7.45
Ruby	ASH	3y	Mare	setaria	402	2.65	1.15	100	458	5.2
				kikuyu, weight gain, copra, chaff, minerals						
Jet	pony	10y	Mare		154	2.5	1.69	96	302	n/a
Flynn	pony	18y	Gelding	kikuyu, pellets, hay	173	2.61	1.14	90	404	4.5
Demi	pony	5y	Mare	kikuyu, lucerne	168	2.69	3.01	88	209	3.15
Angel	y	9y	Mare	kikuyu	172	2.48	2.22	92	200	3.9
Isobel	Tbred	14y	Mare	kikuyu, lucerne	164	2.41	2.98	54	263	n/a
Perfect	Tbred	8y	Preg	kikuyu, lucerne, calcium	158	2.74	0.87	120	228	n/a
Mirror	Tbred	7y	Preg	kikuyu, lucerne, calcium	484	2.47	0.99	88	210	4.9
Buster	pony	12y	Gelding	kikuyu, pellets	147	3	1.23	88	256	2.5
Saintly	pony	13y	Gelding	kikuyu, pellets	268	2.02	1.66	96	502	n/a
Muriel	ASH	8y	Preg	kikuyu	884	2.23	1.54	128	796	7
Emalc	TBred	9y	Gelding	kikuyu	952	2.39	2	87	520	n/a



Relevance to Clinical Equine Practice

The results of this survey indicate that elevated serum PTH levels are occurring in horses grazing oxalate-containing grasses. It is interesting to note that six horses grazing oxalate-containing pasture and fed daily with lucerne and a calcium supplement (which might ordinarily be thought to provide sufficient calcium) had elevated PTH, ALP and faecal calcium levels.

When the clinical signs are subtle, diagnosis of NSH is difficult. The bighead 'end-stage', occurs primarily in young horses. In adult horses the degree of parathyroid overactivity is often too low to result in the classical clinical findings, however serum PTH concentration is an excellent tool for the diagnosis of NSH.

Elevated serum PTH levels are associated with osteoporosis. The onset of clinical signs, which can precede radiographic changes by up to 14 weeks, occurs within 2-8 months of grazing high oxalate pasture. Radiographic changes appear sooner and progress faster in the maxilla and mandible than in the canon bones, but there is extreme porosity of the entire skeleton. To assist veterinarians identify horses at risk, further surveys planned in spring and summer should provide additional information on seasonal and dietary factors which may increase the risk of NSH.