

CASE REPORT

Vitamin D deficiency mimicking chronic tension-type headache in children

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Accepted 16 January 2016

SUMMARY

Headache, musculoskeletal pain and vitamin D deficiency, with possible inter-relationship, are common in the general population. We report cases of three premenarchal girls presenting with chronic tension-type headache and generalised body pain. The patients did not show any response to conventional therapy for tension headache. Investigations showed a severe vitamin D deficiency and biochemical osteomalacia in all three patients. The headaches and musculoskeletal pain responded markedly to vitamin D therapy. We suggest that musculoskeletal pain and headache together in a patient may be part of a single symptom complex, with vitamin D deficiency being the possible cause.

BACKGROUND

Vitamin D deficiency is associated with a number of painful conditions.¹ A few recent observations indicate that migraine and tension-type headache could be related to low serum vitamin D level.^{2–4} A few case reports and small observations have shown a beneficial effect of vitamin D therapy in patients with headache disorders.^{5–9} Earlier, we showed a relation between low serum vitamin D with tension-type headaches in adults. Supplementation of vitamin D could provide relief in chronic tension-type headache.⁹ We report cases of three premenarchal girls with chronic tension-type headache (CTTH) who had markedly low serum vitamin D levels and showed a response to the supplementation of vitamin D. One patient is described in detail and the main characteristics of the other two patients are summarised in [table 1](#).

CASE PRESENTATION**Case 1**

A 9-year-old premenarchal girl presented with a 9-month history of headache. The frequency of attacks was 3–5 times per month in the month prior. It had increased to almost daily for the earlier 4–5 months. The headache attacks used to last for about 3–4 h (range 30 min to 24 h). The pain was described as pressing, holocephalic and mostly mild-to-moderate. The headache was never throbbing. The headache intensity normally did not get worse with routine physical activity and the patient could continue her day as usual. She was not forced to lie down because of the headaches. She did not report of nausea, vomiting, photophobia, phonophobia, auras or of cranial autonomic symptoms being suffered during the attacks. The patient could not recall any precipitating factor for her headaches.

On direct questioning, she admitted having generalised body pain (especially back and lower limb pain) and easy fatigability for the past 5–6 months. Initially, the back pain and easy fatigability were infrequent and attributed mainly to overwork or excessive physical activities. The generalised body pain intensity and easy fatigability gradually progressed in severity and duration. The girl gradually curtailed her physical activity. She did not find any interrelation between her headache and generalised pain.

Prior treatments with amitriptyline, duloxetine, sodium valproate and dothiepin produced minimal or no effect. She had taken paracetamol and ibuprofen as abortive therapies for her severe headache attacks and these drugs were effective in relieving pain within about 1–2 h.

General and neurological examinations were normal apart from the presence of muscle and bone tenderness. Muscle tenderness was noted in both pericranial (anterior temporalis muscle, frontalis muscle, suboccipital muscles) and extracranial muscles (arms and lower legs). Bone tenderness was noted in the anterior tibia, radius, ulna and sternum. Tenderness was rated between 2 and 3 (0=no visible facial reaction and denial of tenderness; 1=no visible facial reaction, but verbal report of discomfort or mild pain; 2=verbal report of painful tenderness with facial expression of discomfort; and 3=marked grimacing or withdrawal, verbal report of marked painful tenderness).²

The patient was extensively investigated for headaches and easy fatigability over the months. Brain MRI did not reveal any abnormality. Her serum 25-hydroxyvitamine D level was 4.2 ng/mL (normal >30 ng/mL). In parallel, she had hypocalcaemia (7.4 mg/100 mL) (normal 8.5–10.5 mg/dL), hypophosphataemia (2.4 mg/100 mL) (normal 3–4.5 mg/dL), raised serum alkaline phosphatase 208 IU/L (normal <120 IU/L) and raised serum parathyroid hormone (intact PTH) (216 pg/mL) (normal 10–60 pg/mL). Other laboratory studies, including complete blood count, sedimentation rate, electrolytes, liver function tests and renal function tests, were normal.

The investigations for the aetiological diagnosis of vitamin D deficiency (VDD) did not reveal any abnormality. Inadequate exposure to sunlight was a more likely possibility in this patient.

The patient was treated with vitamin D (2000 IU/day) and calcium supplementation (500 mg/day). Within a few days of starting treatment, her headaches started to improve. They



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To cite: Prakash S, Makwana P, Rathore C. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2015-213833

Table 1 Main features of cases 2 and 3

	Case 2	Case 3
Age (years)	11	10
Gender	F	F
Duration of illness	6 months	1 year
Details of headaches		
Frequency	Daily	15–20 days/month for 3–4 months
Duration	30 min to 4 h	60 min to 24 h
Side/site	Bilateral frontal and temporal	Holocephalic
Quality	Non-throbbing	Non-throbbing
Severity	Usually mild to moderate. Severe in 10% attacks	Most attacks mild to moderate
Relation with physical activity	Did not get worse with routine physical activities	Did not get worse with routine physical activities
Associated symptoms	None	None
Other complaints		
Tiredness/fatigue	For 3–4 months	
Generalised body pain	For 2–3 months	For 2–3 months
Any other relevant history	Migraine for 3 years, with one attack every 3–4 months	None
Physical examinations		
Muscle tenderness (pericranial and extracranial muscle)	Present in both groups of muscles (grade 1–3)	Present in both groups of muscles (grade 1–3)
Bone tenderness	Present: anterior tibia, radius or ulna and sternum	Present
Any other abnormality	None	None
Investigations		
Brain MRI	Normal	Normal
Serum 25(OH) vitamin D	6.6 ng/mL	7.8 ng/mL
Serum calcium	Low (7.6 mg/100 mL)	Low (7.8 mg/100 mL)
Serum phosphorus	Low (2.6 mg/100 mL)	Low (2.5 mg/100 mL)
Serum alkaline phosphatase	Raised (188 IU/L)	Raised (214 IU/L)
Serum parathyroid hormone (PTH)	Raised (226 pg/mL)	Raised (136 IU/L)
Any other biochemical abnormality	None	None
Cause of vitamin D deficiency	Nutritional	Nutritional
Treatment		
Vitamin D	2000 IU/day	2000 IU/day
Calcium	500 mg/day	500 mg/day
Treatment response	(1) Tiredness disappeared in 2–3 weeks. (2) Only 5 attacks of headaches in next 6 weeks	Four mild to moderate headache attacks in next 2 months
Follow-up	Only a few attacks in 9 months	One attack/month for the next 12 months

F, female.

improved markedly after about 4 weeks (less than one headache attack a week). The bone tenderness also reduced markedly in 4 weeks, and no tenderness was noted at 8 weeks. Vitamin D level returned to near normal after 2 months (28 ng/mL). The patient was asked to take 1000 IU/day vitamin D for a very long period. The patient was followed for about 1 year and she remained nearly symptom-free.

Case 2 and 3: summarised in [table 1](#).

DISCUSSION

Chronic daily headache (CDH) is quite common in children and adolescents (2–4%).¹⁰ Patients with CDH frequently have various comorbid symptoms including pain at other sites, including generalised body pain. The inter-relation between headache and pain at other sites has not been evaluated in the literature. There has been a suggestion that both may be part of the same pain syndrome.^{2 10}

All three patients fulfilled the International Classification of Headache Disorders, third edition (ICHD-3β), diagnostic criteria for CTTH.¹¹ Besides fulfilling criteria for CTTH, these three patients had vitamin D deficiency.

There is no consensus on optimal levels of serum 25-hydroxyvitamin D, in particular, in children.

Most experts define vitamin D ‘deficiency’ as a serum 25-hydroxy vitamin D level of less than 20 ng/mL in adults and in children. Serum vitamin D level 21–29 ng/mL is considered as an ‘insufficiency’ state.¹² All three patients had serum 25 (OH) D level <8 ng/mL.

All three patients had biochemical osteomalacia according to Jenkins *et al*¹³ criteria, Bingham and Fitzpatrick criteria, and calcium × phosphate product.¹⁴ PTH is also considered the best marker of underlying histological osteomalacia.¹⁵ These suggest that musculoskeletal pain was most likely due to osteomalacia.

The temporal relation between supplementation of vitamin D and the disappearance of the headaches in all three patients suggests that vitamin D was pivotal in relieving the headaches and that the headaches were related to vitamin D deficiency.

The first case on the role of vitamin D in headaches was reported by Thys-Jacobs in 1994, in two female migraineurs.⁵ Later, we demonstrated positive effects of vitamin D supplementation in eight adult patients mimicking chronic tension-type headaches.⁹ Here, for the first time, we demonstrate the beneficial effects of vitamin D supplementation (with calcium) in three paediatric patients presenting with chronic tension-type headaches.

The association of low serum vitamin D level with chronic musculoskeletal pain is well established in the literature.¹

However, the association of vitamin D with headache is still at a speculative stage. One meta-analysis found an increasing prevalence of headaches at increasing latitude.¹⁶ One explanation could be lower levels of vitamin D at the higher latitude due to less solar exposure.

Low serum vitamin D level has been observed in some observations in migraine patients.^{4 17} A few studies have also demonstrated beneficial effects of Vitamin D supplementation (with other drugs) in headache frequency and intensity,^{7 8} although a few conflicting observations have also been reported in the literature.¹⁸ The literature on the relation between vitamin D and tension-type headache is sparse. In a retrospective observation, we demonstrated low serum 25(OH) D (<20 ng/dL) in 73% adults patients with CTTH. These patients, in parallel, had musculoskeletal pain and osteomalacia.²

No uniform guidelines regarding vitamin D supplementation for humans, regardless of whether normal or deficient, exist. Current recommendations are based on expert opinion.^{19 20} We gave 2000 IU vitamin D for the initial 2 months, which was changed to 1000 IU prospectively for the next 9–12 months.

Vitamin D deficiency usually presents as musculoskeletal pain. Various mechanisms have been proposed for the musculoskeletal pain in vitamin D deficient patients. Osteomalacia itself may cause musculoskeletal pain.² Recent observations have demonstrated vitamin D receptors in nociceptors ('pain-sensing' nerves), which may increase in vitamin D deficient states.²¹ Muscle hypersensitivity (without cutaneous hypersensitivity) has been noted in rats receiving vitamin D-deficient diets.²² Muscle hypersensitivity because of VDD has been suggested as one of the mechanisms for the generation of musculoskeletal pain. It may even precede the gross bone pathology (osteomalacia) caused by vitamin D deficiency.^{2 22}

Muscular factors are considered main aspects in the generation of pain in tension-type headache (TTH). Pericranial tenderness and electromyography (EMG) changes in pericranial muscles support this hypothesis.²³

Generalised musculoskeletal pain and headache frequently co-exist. The prevalence of chronic headache is four times higher in individuals with chronic musculoskeletal symptoms than in those without it.²⁴ Various mechanisms have been suggested for this co-existence. It also suggests that both symptoms (headache and generalised body pain) could have a common cause or a common pathogenesis. We suggest that, in a subset of such patients, the headache could be part of the generalised body pain (ie, pain in the head is a similar phenomenon to pain in another part of the body). The literature review suggests that pain semiology, muscle tenderness, other characteristics and associated comorbid conditions with CTTH are very similar to the generalised muscular pain caused by vitamin D deficiency.² Therefore, we speculate that the presence of TTH and the generalised body pain in vitamin D deficient patients could be due to a common pathogenesis.^{2 9} Mechanisms responsible for the musculoskeletal pain of VDD (or osteomalacia) could also be responsible for the generation of headache in such patients.

One of the patient had a history of migraine with a frequency of one attack in 3 to 4-month. However, her recent headache profile was suggestive of a tension-type headache. Low serum vitamin D level could be related to migraine and tension-type headache. This raises the possibility that migraine and tension type headaches could be part of the same spectrum or at least that some overlapping exists in the pathophysiology of these two common primary headaches.²⁻⁴ A prospective case control study is required to find the cause and effect relationship.

Limitation: Ours is a retrospective observation and the possibility of unrecognised selection bias and recall bias exists. Headache, musculoskeletal pain and VDD are quite common in the general population. Hence, there is also the possibility of coincidence. Moreover, we cannot rule out the possibility of another cause of secondary headache and musculoskeletal pain, as full evaluation for secondary headaches was not carried out. Treatment was not standardised as there is no uniform recommendation in the literature, in particular, for treating children.

Despite these limitations, we believe that VDD was pivotal in the generation of musculoskeletal pain and headaches. The temporal relation between vitamin D administration and disappearance of both symptoms (headaches and musculoskeletal pain), and our speculation for such correlation, favour it.

Patient's perspective

- ▶ Case 1 (Father's perspective): I am so happy she is normal now. Everyone (even myself) considered her headache as 'mental'. I am so thankful that she is not mental.
- ▶ Case 3 (Patient's perspective): Thank you doctor for helping me out from headaches. No one understood my headaches. Thanks.

Learning points

- ▶ Chronic headache and musculoskeletal symptoms frequently co-exist.
- ▶ The presence of both symptoms in a patient could be because of a common aetiology.
- ▶ Vitamin D deficiency could be an important cause for both, chronic headaches and musculoskeletal pain.

Contributors SP, PM and CR were involved in the conception and design; SP and PM were involved in the acquisition of data. SP was involved in the manuscript preparation. PM and CR were involved in the revising draft for intellectual content. SP, PM and CR were involved in the final approval of the completed manuscript. SP was the guarantor.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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