CASE REPORT

Rachitic chest in a young adult male: Fanconi's syndrome—idiopathic type

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SUMMARY

Presented in this paper is a case of a 36-year-old Filipino man presenting with a chronic history of intermittent proximal muscle weakness and paralysis which was associated with failure to thrive, severe bony deformities, muscle wasting and multiple electrolyte abnormalities (hypokalaemia, hypocalcaemia, hypomagnesaemia). Severe skeletal deformities led to a pathological fracture of the femoral bone and restrictive chest wall expansion during inspiration necessitating admission and consult at our institution. Correction of multiple electrolyte abnormalities was the mainstay of treatment for this case and resulted into full reversal of paralytic symptoms but skeletal and osseous abnormalities persisted. This case highlights the insidious course and subtle signs of Fanconi's syndrome leading to disfiguring skeletal deformities and abnormalities if not diagnosed early. Early suspicion and eventual diagnosis might be the key for these patients to have normal productive life devoid of crippling complications.

BACKGROUND

Fanconi's syndrome is a disease of the proximal renal tubules of the kidney in which glucose, amino acid, uric acid, phosphate and bicarbonate are passed into the urine, instead of being reabsorbed. Fanconi's syndrome primarily affects the proximal tubule of the nephron. The disease is classified as primary (inherited) or secondary (acquired). Fanconi's syndrome may present without any identifiable aetiology.¹

A thorough search of various online databases (including MEDLINE, EMBASE, Cochrane and Herdin) and upon consultation of several experts, there were only some reports noted, mostly in paediatric cases.

The objective of this paper is to present a rare case of idiopathic Fanconi's syndrome in an adult Filipino where the unabated disease has produced dramatic disfigurement. Pathophysiology, diagnosis and therapeutic options will also be discussed.

CASE PRESENTATION

This is a case of a 36-year-old man, Filipino, unemployed, presenting with a chronic (>10 years) history of intermittent proximal muscle weakness affecting ambulation leading to a paraplegic state that necessitated assistive devices for ambulation. The patient had an unremarkable childhood and normal adolescence until the age of 17 while studying as a second year college student when he started to note episodic proximal muscle weakness. Persistence of symptoms prompted consult at

Philippine General Hospital (PGH) where unrecalled doses of potassium solutions were given as treatment. The patient was informed that he had hypokalaemic episodes explaining his muscle weakness. This would be corrected with doses of potassium solution and banana. Since then, he would have recurrent and intermittent episodes of muscle weakness affecting his ambulation lasting for 3 days. No fever, nausea, vomiting, diarrhoea, cough, colds were associated. At this time, the patient claimed no exposure to heavy metals, radiation and other medications. The patient also had no vices. His family did not report any similar illness.

At age 26, he developed bony changes leading to stunted growth, chest wall deformities (pectus carinatum), severe rotator scoliosis leading to severe physical deformities affecting breathing and proper ambulation. This problem worsened and persisted up to the age of 29 leading to consult with an orthopaedic surgeon who advised surgical correction of the chest wall deformity. The patient however deferred and chose a more conservative management. When he was 35, while trying to stand up and ambulate, he sustained a sudden crack of his left femoral bone, which turned out to be a pathological fracture of the leading to significant leg-length discrepancy. The patient eventually consulted at our institution for 1 week history of worsening generalised weakness leading to paralysis of lower extremities.

A detailed physical examination noted a cachectic patient with severe skeletal deformities including pectus carinatum, rachitic chest, severe scoliosis, clavicular deformities, stunted growth, leg length discrepancy and poorly healed left femoral fracture (figure 1). He also had reduced motor strength especially on proximal muscle groups (eg, quadriceps). No Chvostek's sign was noted. There was restrictive difficulty with respiration. Other physical findings were unremarkable.

INVESTIGATIONS

Upon admission, the patient underwent several blood tests revealing severe hypokalaemia, hypophosphataemia, hypomagnesaemia, hypocalcaemia, hyponatraemia and normal anion gap metabolic acidosis (tables 1 and 2). Urine collection studies showed undiluted urine with hypermagnesuria, glucosuria and albuminuria. Urine studies did not show significant renal sodium or potassium losses (tables 3 and 4). The ECG showed prolonged QT interval consistent with significant hypocalcaemia. Thyroid function tests ordered were normal.

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Figure 1 Anterior, lateral and posterior view of the chest wall showing significant chest wall deformities and severe scoliosis.

Radiological imaging of the chest showed significant signs of osteomalacia as evidenced by porous bony trabeculae, rachitic chest, severe rotator scoliosis (figure 2). Left femoral x-ray revealed a poorly healed pathological fracture with osteoporotic features of the long bones (figure 3).

DIFFERENTIAL DIAGNOSIS

When presented with a patient with severe hypokalaemia associated with skeletal abnormalities, one would think of many congenital or genetic syndromes from childhood. Thyroid abnormalities must be ruled out since it can also present with hypokalaemia and osteoporosis. Rickets, hyperparathyroidism, multiple myeloma, Paget's disease can present with similar skeletal deformities. Other metabolic, drug-induced, infectious causes must also be ruled out.

Renal causes seem to be the most common cause of isolated severe and persistent hypokalaemia. Once determined to be of renal in origin, one can easily categorise differential diagnoses into two main groups. Those associated with metabolic alkalosis such as Gitelman's syndrome, Liddle's syndrome and Barter's syndrome and those that are associated with metabolic acidosis such as renal tubular acidosis. A simple arterial blood gas can differentiate the two groups and further narrow down the diagnosis. Hypokalaemia is usually associated with metabolic alkalosis where Gitelman's syndrome is the most common form. The presence of metabolic acidosis on the other hand pinpoints to a possible renal tubular acidosis especially if the anion gap appeared normal. Once renal tubular acidosis is suspected, one can use a simple urinalysis to differentiate proximal versus distal renal tubular acidosis (RTA). Proximal RTA would present with

Table 1 Blood chemistry

Units in mmol/L	Normal values	Hospital day 1	Hospital day 2	Hospital day 3	Hospital day 4	Hospital day 5	Hospital day 6
Random blood sugar	4.2–6.1	5.91					
Blood urea nitrogen	2.5–7.1		3.22				
Creatine*	53–106 (male)	120	94				
Sodium	136–146	128	130	132		131	
Potassium	3.5–5.0	1.5	2.5	2.5		3.5	5.1
Chloride	102–109	90		101			
Albumin	40–50		32	32	32	33	
Calcium (corrected Ca)	2.2–2.6		1.30 (1.46)	1.53 (1.69)	1.70 (1.86)	1.75 (1.89)	1.84 (1.98)
Magnesium	0.62–0.95		0.49	0.81	0.85	0.64	0.56
Phosphorus	0.81–1.4		0.66	0.57	0.47	0.58	
AST†	12–38		54				
ALT†	7–41		34				
Alkaline phosphatase‡	33–96		276				

AST, aspartate aminotransferase; ALT, alanine transaminase

*Units in $\mu\text{mol/L}$.

†Units in g/L.

‡Units in U/L.

Table 2 Arterial blood gas

	Results	Normal values
pH	7.346	7.35–7.45
pCO ₂	26.8	35–45
pO ₂	85.9	80–100
HCO ₃	14.6	22–26
Base excess	–8.8	–2 to +2
O ₂ sat	95.9%	>92%

Table 3 Urinalysis

	Results	Normal values
Colour	Light yellow	
Turbidity	Cloudy	
Albumin	+2	(–)
Ketones	(–)	(–)
Glucose	+3	(–)
pH	7.5	5.0–9.0
Specific gravity	1.010	1.001–1.035
Red blood cells	5	0–2/hpf
White blood cells	18	0–2/hpf
Epithelial cells	9	None
Casts	0	None
Bacteria	32	None

Table 4 Twenty-four hour urine collection

	Results	Normal values
Total volume (mL)	4500	500–2000
Total protein (g)	2.97	0.042–0.23
Calcium (mmol)	1.99	<7.5
Magnesium (mmol)	15.3	0.41–5.30
Creatine (μmol)	0.46	0.30–1.40
Sodium (mmol)	65	40–220
Potassium (mmol)	24.1	25–125

significant proteinuria, glucosuria and hypercalciuria, which are usually not found in distal RTA.

TREATMENT

The patient's electrolyte abnormalities were eventually corrected by supplementation with calcium, magnesium and potassium

Figure 2 Radiological images of chest and pelvis showing multiple skeletal deformities.

Figure 3 Radiological images of the femur showing inadequately healed pathological fracture and severe osteoporotic lesions at the femoral head.

tablets. The patient also prescribed vitamin D to facilitate absorption of calcium in the body. Potassium citrate was given to improve renal tubular pH and replace potassium losses.

OUTCOME AND FOLLOW-UP

The patient was eventually discharged and referred to rehabilitation medicine and the orthopaedic service to reduce complications of multiple skeletal deformities. The patient is currently able to ambulate but with residual limitations brought about by the permanent skeletal deformities incurred from the chronic uncorrected disease.

DISCUSSION

Our patient presented with severe persistent hypokalaemia associated with metabolic acidosis, glucosuria and proteinuria suggesting a diagnosis of proximal RTA. With the long-standing

clinical course and the absence of apparent cause, present literature would support the diagnosis of idiopathic Fanconi's syndrome in our patient.² Osteomalacia is the most striking feature of the disease among adults. Bone deformities such as pectus carinatum, rachitic chest wall and severe scoliosis may also be present, just as in this patient.³ Multiple electrolyte abnormalities such as hypokalaemia, hypophosphataemia, hypomagnesaemia and hypocalcaemia are also seen.⁴ Hypokalaemia and hypocalcaemia explains the muscle weakness. Low serum calcium and phosphate correlates with osteomalacia, evident with findings of porous bony trabeculae, rachitic chest, severe rotator scoliosis osteoporotic long bones.⁵ Urinary potassium losses was not observed in this patient due to the chronicity of hypokalaemia such that there is less potassium available for further loss via excretion. The patient was managed by fluid and electrolyte replacement. Thus, in the absence of any identifiable cause, this patient has the idiopathic form of Fanconi's syndrome.

Learning points

- ▶ Childhood history of failure to thrive, growth retardation, previous fractures, recurrent muscle paralysis might be a clue towards the diagnosis of Fanconi's syndrome.
- ▶ Simple screening for serum electrolytes, urinalysis and arterial blood gas give a lot of insights towards the diagnosis of this case.
- ▶ When presented with hypokalaemia due to a renal cause, simple tests like arterial blood gas and urinalysis can narrow down the differential diagnoses leading to prompt diagnosis and initiation of therapy.
- ▶ Early detection via clinical suspicion and early initiation of electrolyte replacement therapy will prevent skeletal deformities and promote a normal life to these patients.

Competing interests None.

Patient consent Obtained.

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