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Research Paper

POSTSURGICAL HYPOMAGNESAEMIA AND HYPOCALCAEMIA INDUCED PSYCHOSIS: SIGNIFICANCE OF PATIENT COMPLIANCE- A CASE REPORT

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Abstract

A 30 year old female was hospitalized with complaints of multiple bony swellings all over the body since 3 months with no other associated complaints and significant family history. On examination, patient had bony swellings on right side of mandible, left frontal region and left knee joint which were prominent. Radiological investigations revealed osteolytic lesions. Increase in Serum alkaline phosphatase =1080U/ml, Serum Parathyroid Hormone>1900mg/dl, Serum Calcium=10.2mg/dl &Serum Phosphorus= 2.1mg/dl suggested increase in osteoclastic activity and hyperparathyroidism. CT scan of whole body and USG parathyroid revealed hypo echoic lesion on posteroinferior aspect of left lobe of thyroid gland along with left inferior thyroid artery.

Patient was subjected to parathyroidectomy. Postoperatively, patient recovered uneventfully. Histopathological examination revealed it to be parathyroid chief cell adenoma. She was supplemented with tab. Shelcal and tab. Calcitriol. On follow up after 3months, Patient was readmitted with sleep disturbances, irritability, confusion, trembling, apprehension, nervousness with an episode of tetanic convulsions and urinary incontinence. The history revealed patient non compliance. On reinvestigation, hypomagnesaemia and hypocalcaemia were detected. Serum Calcium level was 7.5mg/dl and Serum Magnesium was 0.5mg/dl. Patient was treated with inj. Magnesium Sulfate 0.4mg/dl I.M. x 4 days, Tab. Shelcal TDS, Tab Calcitriol 1 O.D.Patient condition improved on 4th day. On 9th day, patient was reinvestigated. Serum Magnesium was 1.2mg/dl and Serum Calcium was 10mg/dl. So, patient was discharged on 10th day. Hence, the case is reported for postsurgical Magnesium and Calcium deficiencies that led to CNS manifestations which were reverted on correcting the deficiencies.

Key Words: Affective Disorder, Hypocalcaemia, Hypomagnesaemia, Parathyroid Adenoma

INTRODUCTION:

Magnesium (Mg^{++}) is an essential trace mineral that is involved as a co-enzyme in numerous enzyme reactions in organisms. As Mg^{++} also influences the nervous system via its actions on the release and metabolism of neurotransmitters and other mechanisms, abnormal magnesium metabolism has been implicated in several neuropsychiatric disorders with prominent mood and physical symptoms (e.g. migraine, epilepsy, chronic pain)[1,2,3,4].

A relation between Mg^{++} and affective disorders has also been suggested

since low CSF levels of magnesium have been observed in patients with suicidal behaviour [5].

The two most basic requirements for the normal functioning of brain are sufficient energy supply and an optimal presence of biochemical involved in transmitting messages. Magnesium and calcium (Ca^{++}) are crucial in both, the production of energy, neurotransmitters, and for maintaining the integrity of blood brain barrier. Solid neuroscience connects Mg^{++} to neurological disorders [6].

Hypomagnesaemia is a common entity occurring in upto 12% of hospitalized patients and the incidence increases in intensive care settings to as high as 60 – 65 % where, nutrition, diuretics, aminoglycosides etc. play major role [7].

Even a mild deficiency of magnesium can cause increased sensitivity to noise, nervousness, irritability, mental depression, confusion, twitching, trembling, apprehension and insomnia.

Observational and experimental studies have shown that Mg^{++} is essential in regulating CNS excitability thus magnesium –deficiency may cause aggressive behaviour [8], depression or suicide [9]. Magnesium essentially calms the brain, diminishes clouded thinking, confusion, disorientation, marked depression and even the terrifying hallucinations.

CASE REPORT:

A 30 year old female was hospitalized with complaints of multiple bony swellings all over the body since 3 months with no other associated complaints and significant family history. On examination, patient had bony swellings on right side of mandible, left frontal region and left knee joint which were prominent (figure 1).

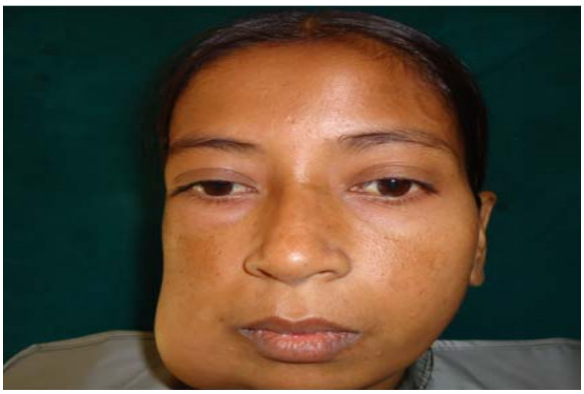

Figure -1 shows patient with multiple bony swellings

(as shown by the arrows)

Hence the patient was subjected for clinical investigations. Hematological findings revealed that, all routine blood investigations were normal while serum Alkaline Phosphatase was 1080U/L. (normal= 245 -770U/L) which was suggestive of osteoclastic activity. Serum Calcium=10.2mg/dl (normal=9-11mg/dl), Serum Phosphorus =2.1mg/dl (normal= 2-4mg/dl) raising possibility of hyperparathyroidism which was confirmed by markedly elevated Serum Parathyroid Hormone levels which was >1900pg/ml (normal=11.2-79.5pg/ml).

On radiological examination the orthopantomogram showed multilocular radiolucent lesions present in right side of

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mandible involving body (figure-2)

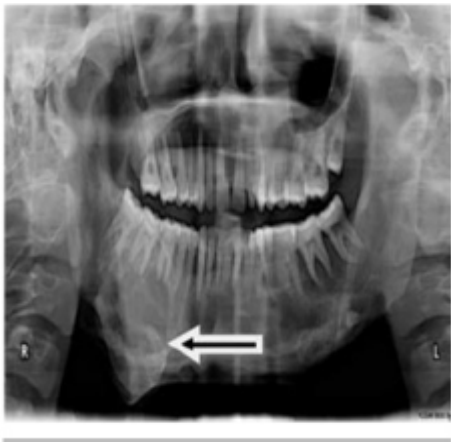

Figure – 2. Orthopantomogram showing Multilocular radiolucent lesion (arrow) present in right side of mandible involving body. Typical loss of lamina dura was not very evident**.**

However, typical loss of laminar dura was not very evident. X-ray skull anterior and posterior view showed osteolytic lesions in left frontal region (figure-3). X-ray left knee joint anterior posterior and lateral view showed osteolytic lesions (figure-4)

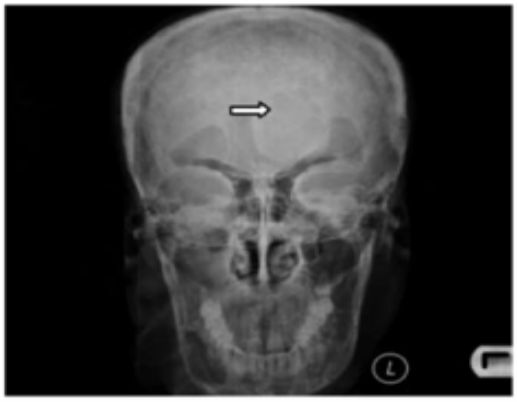

Figure – 3. X-ray skull anterior/posterior

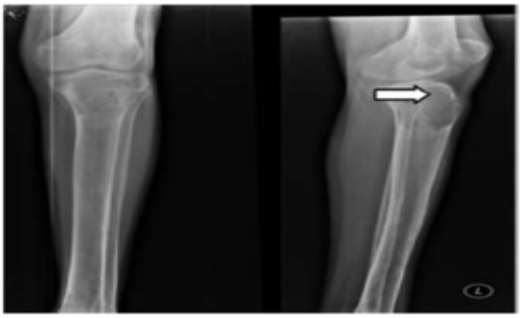

Figure – 4. X-ray left knee joint view showing osteolytic lesion in left anterior /posterior and lateral view Frontal region(arrow) showing osteolytic lesion (arrow).

The ultrasonographic examination showed osteolytic lesions and hypoechoic lesions of 21×10×11mm on posteroinferior aspect of left lobe of thyroid gland while the colour doppler (figure-5) study of USG in the neck showed left inferior parathyroid was found enlarged and presence of hypoechoic lesion at inferior pole of left thyroid gland which was located along with branch of left inferior thyroid artery.

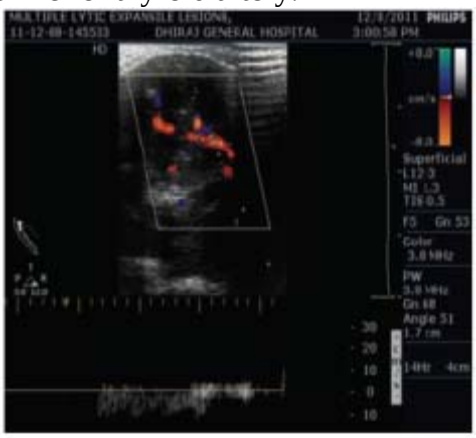

Figure – 5. Ultra sonography colored Doppler of neck shows presence of hypoechoic lesion at inferior pole of left thyroid gland.

Following this patient was subjected to extended investigation with CT scan, axial view of neck that showed parathyroid adenoma on left side posterior to thyroid gland (figure-6).

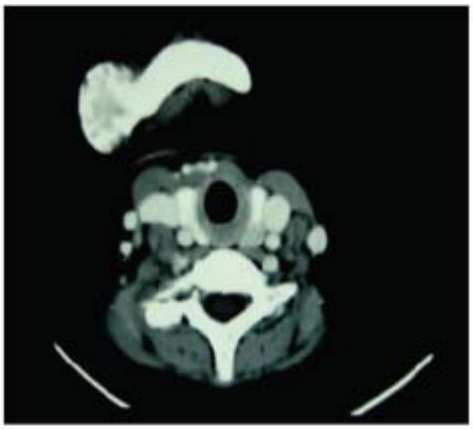

Figure – 6. Computerized scan neck (axial view) showing (white arrow) parathyroid adenoma on left side posterior to thyroid gland.

Patient was subjected to histopathological examination which revealed Parathyroid Chief Cell Adenoma. Hence the patient was subjected to parathyroidectomy.

Post operatively, patient recovered uneventfully and was put on Ceftriaxone, Shelcal and Calcium with active $VitD_3$ (Calcitriol) to tide over temporary hypercalcemia with consequent tetany which usually occurs on removal of PTH tumors.

Parathyroid assay was done postoperatively which was now within normal range 23.5pg/ ml and patient was discharged with advice to continue treatment with Shelcal and Calcitriol while patient came for follow up after 3months. She had complaints of sleep disturbances, irritability to loud noise, confusion, trembling, apprehension, and nervousness with an episode of tetanic convulsions.

On history: - It was revealed that patient was non-compliant to the postoperative treatment for about 2months. Patient was readmitted and was subjected for expert opinion of the specialist. The patient was also subjected for re-investigation .All routine blood investigations were normal while serum magnesium was 0.5mg/dl (normal=1.5-2.5mg/dl). Serum Calcium was 7.5mg/dl (normal=9-11mg/dl)

Following this, patient was prescribed with, Injection Magnesium Sulphate ($MgSO_4$) 0.4mg/dl Intramuscular (I.M.) × 4 days, Tablet Shelcal 500mg TDS ×6 months and Tablet Calcium with active $Vit.D_3$ (Calcitriol) 1 tablet OD ×6 months.

Patient condition improved on 4^{th} day. On 9^{th} Day Patient was reinvestigated Serum Magnesium was 1.2mg/dl. Serum Calcium was 10mg/dl. So, Patient was discharged on 10^{th} day.

DISCUSSION:

It has been estimated that at least half of the surgical cases with hypoparathyroidism have psychiatric symptoms and that psychiatric disorders are probably higher still in idiopathic hypoparathyroidism (IHP) [10, 11].

Concerning the role of magnesium in mental health, Magnesium has pivotal role in the regulation of calcium ion flow within neurons. Without magnesium the

neuron operates much like an automobile without brakes, blasting calcium through the synapses causing great harm to the brain with severe disruption of thinking, mood and behavior. Sapolsky [12] writing in "Stress, the Aging Brain and the Mechanisms of Neuron Death" in 1992 suggested that magnesium depletion was likely to be deleterious to neurons possibly by causing NMDA-coupled calcium channels to be biased towards opening.

Sapolsky was correct as damage to neurons results into depression, related mood and behavior disorders [12].

A direct impact of magnesium on the function of the transport protein p-glycoprotein at level of the blood brain barrier (BBB) has been demonstrated to be possibly influencing the access of corticosteroids to the brain [13, 14]. Lithium carbonate increases serum / plasma Mg^{++} level that is useful in treatment of mood disorders. Recently, studies have shown relationship between mechanism of action of mood stabilizers and magnesium metabolism.

Depression has long been recognized as associated to central catechol aminergic deficiency. Relation between catecholamines and magnesium has been described where poor activity of peripheral catecholamine is associated with low serum Mg^{++} level [15].

A low Ca^{++} / Mg^{++} ratio is associated with increased release of catecholamines that lowers tissue Magnesium levels [16].

CONCLUSION

Magnesium deficiency increases susceptibility to the physiologic damage produced by stress. The adrenergic effects of physiological stress induced a shift of magnesium from the intracellular to the extracellular space increasing urinary excretion and eventually depleting body stores [17].

Magnesium deficiency causes serotonin deficiency with possible resultant aberrant behaviours, including depression, suicide or irrational violence.

It is known that glutamate, magnesium and calcium are involved in the N-methyl-D-aspartate (NMDA) nerve cell electrical conduction activity across brain cell synapses. Too much calcium ion and glutamate and not enough magnesium ion, particularly in the hippocampus, play a vital role in brain cell synaptic dysfunction leading to depression and other mood and behavioral disorders. There is a cascade of mental illnesses associated with magnesium deficiency and they can be arranged according to the severity of magnesium deficits. Our observation from the case correlates with the work of Seelig MS which suggests that hypomagnesaemia and hypocalcaemia play major role in affecting behavioral status [16].

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