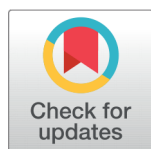


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A study to analyse changes in serum electrolytes in heterotrophic ossification following traumatic brain injury

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Abstract

Heterotopic ossification (HO), also known as heterotopic bone formation, is the presence of the lamellar bone within soft tissues where the bone physiologically does not exist. **Aims and Objectives:** To analyse changes in serum electrolytes in heterotrophic ossification following traumatic brain injury. **Material and Methods:** Brain injury patients were included in tertiary care centre and examined for heterotrophic ossification. **Result:** Significant changes were observed in serum calcium levels.

Keywords: Traumatic brain injury; heterotrophic ossification; serum electrolytes

1 Introduction

Heterotopic ossification (HO), also known as heterotopic bone formation, is the presence of the lamellar bone within soft tissues where the bone physiologically does not exist. It is a complication of numerous types of trauma, including hip arthroplasty, electrical injury, neurological injuries and thermal. Reidel first described HO in 1883, and in 1918 Dejerne and Ceillier reported that HO frequently occurred among soldiers who had experienced spinal cord trauma as combatants in World War I. (Dejerne A et al, 1918)⁽¹⁾

Three types of HO are distinguished: myositis ossificans circumscripta, myositis ossificans progressiva and localized traumatic myositis ossificans. Myositis ossificans refers rather to a condition in which ectopic bone is formed within

muscles and other soft tissues. Ectopic calcification is a mineralization of soft-tissue structures, which usually follows chemical or physical trauma, as in tendinitis calcarea. Histologically, a calcium deposit rather than new bone would be formed. (Mollan RAB, 1979)⁽²⁾

HO is a common complication of traumatic spinal cord injuries with a prevalence ranging from 5 to 50%, depending upon the studies design and the diagnosis method. The progression of HO may lead to decreases in the range of motion and ankylosis and has a negative impact on the rehabilitation processes. The most affected joints are the hips (60%-70%) and knees (20%-30%). (Hernandez AM et al, 1978)⁽³⁾

The clinical signs and symptoms of HO may include pain, stiffness, loss of joint range of motion (ROM), swelling or warmth of joint area, fever, increased

spasticity, joint pain, muscle pain, and autonomic dysreflexia and functional impairments. Whereas many studies have investigated HO after hip trauma or replacement surgery. It may appear as early as 3 wk or as late as 12 wk after the musculoskeletal trauma, spinal cord injury, or other precipitating event. (B.E. Ellerin et al, 1999)⁽⁴⁾

Risk factors including concomitant polytrauma, infection, and blast injuries, male gender, presence of prior HO, previous hip surgery and lateral and anterolateral hip approaches. Some pathologies have been associated with a higher rate of HO, such as ankylosing spondylitis, hypertrophic osteoarthritis, diffuse idiopathic skeletal hyperostosis, Paget disease, Parkinson's disease and rheumatoid arthritis. The incidence of HO in hip surgery can be vastly different in different ethnic groups. Additionally, close to 20% of patients with spinal cord injuries and traumatic brain injuries develop HO. (Bossche LV et al, 2005)⁽⁵⁾

Complications of HO include peripheral nerve entrapment, pressure ulcers, and functional impairment if joint ankylosis develops. Therefore, prophylaxis or early treatment of HO is extremely important. Once the diagnosis of early HO is confirmed, passive range-of-motion exercises to maintain joint mobility are recommended. More aggressive joint manipulation has been suggested, although the trauma resulting from this approach carries the risk of inciting further HO. (Stover SL et al, 1975)⁽⁶⁾

Biphosphonates and nonsteroidal antiinflammatory drugs (such as indomethacin and ibuprofen) have been used for the prophylaxis or treatment of HO. However, there is no consensus on which drug should be used and when treatment should begin. Radiation therapy has also successfully been used to prevent or treat HO. (Neal BC et al, 2000)⁽⁷⁾

The currently available treatments are still highly controversial. As primary prevention, risk factors such as pressure ulcers, deep venous thrombosis and limb contractures should be avoided.

Rehabilitation can play an important role not only in the prevention of contractures but also in the maintenance of a good physical condition, obviating the need for additional treatment. Importantly, forcible ROM of joints can induce microtrauma and haemorrhages, which may increase HO formation. Recent studies have shown a favorable effect of active and passive exercising of joints within the pain-free range. (Van Kuijk AA et al, 2002)

The present study is an attempt to analyze the etiologic factors of heterotopic ossification.

2 Aims and Objectives

To analyse changes in serum electrolytes in heterotrophic ossification following traumatic brain injury.

3 Materials and Methods

3.1 Inclusion criteria

1. All patients admitted and attending OPD of tertiary care center in Bhopal, India
2. Patients giving written consent to be part of study
3. Patients without previous history of major surgery
4. Patients with head injury

3.2 Exclusion criteria

1. Patients not giving written consent to be part of study
2. Patients with previous history of major surgery
3. Patients without head injury

All patients were followed up, either as part of their in-hospital stay or during their follow-up visits.

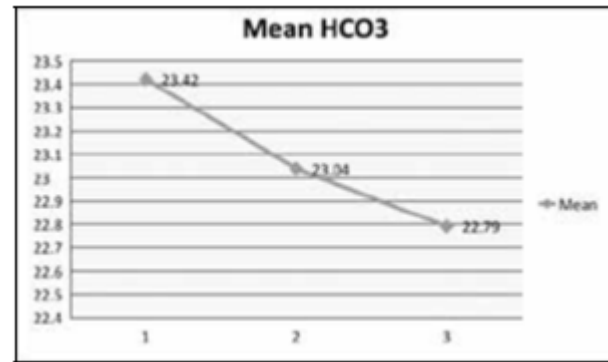
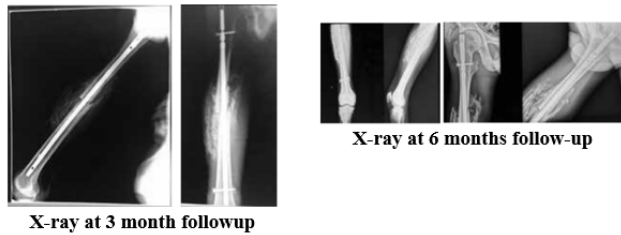
Detailed history was taken, through clinical examination done followed by biochemical investigations. Radiographs of affected extremity taken in two perpendicular views.



x-ray at the time of trauma



Immediate post-op x-ray



4 Results

Parameters	Follow Up (months)	Mean	Std. Deviation	P value
S. Po4	0	3.67	1.465	0.744
	3	3.46	.779	
	6	3.67	.868	
Calcium	0	7.83	1.494	0.004
	3	7.71	1.756	
	6	8.96	.690	
Potassium	0	4.42	1.018	0.776
	3	4.33	.761	
	6	4.50	.590	
Sodium	0	138.29	4.448	0.306
	3	134.54	21.950	
	6	140.33	3.807	
HCO3	0	23.42	2.185	0.510
	3	23.04	1.654	
	6	22.79	1.719	

5 Discussion

Heterotopic ossification (HO) is a frequent complication in patients with a spinal cord injury (SCI), while the etiology of HO is unknown.

In present study, there was a significant change observed in terms of serum calcium which was significantly increased from 7.83 from baseline to 7.71 at 3 months to 8.96 at the end of 6 months of follow up ($p=0.04$). However other laboratory parameters like serum potassium, serum sodium, HCO₃ and SPo₄ were similar across all the follow up as compared to baseline values. Similar study by S W Kim et al study results showed that AP, P, and Ca by themselves were of little help in the diagnosis of HO. However, the combination of elevated AP and P was significant, especially if both were consistently elevated.⁵⁵ Similar study by Ryu S-R, et al reported serum calcium as 4.2mEq/L (normative range, 4.25.1mEq/L) and ionized calcium was 2.0mEq/L (normative range, 2.02.4mEq/ L) in patients of HO.⁵

6 Conclusion

Present study, there was a significant change observed in terms of serum calcium which was significantly decreased from 7.83 from baseline to 7.71 at 3 months and thereafter to 8.96 at the end of 6 months of follow up ($p=0.04$). However other laboratory parameters like serum potassium, serum sodium, HCO₃ and SPo₄ were similar across all the follow up as compared to baseline values.

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