HETEROTOPIC OSSIFICATION

An Essay

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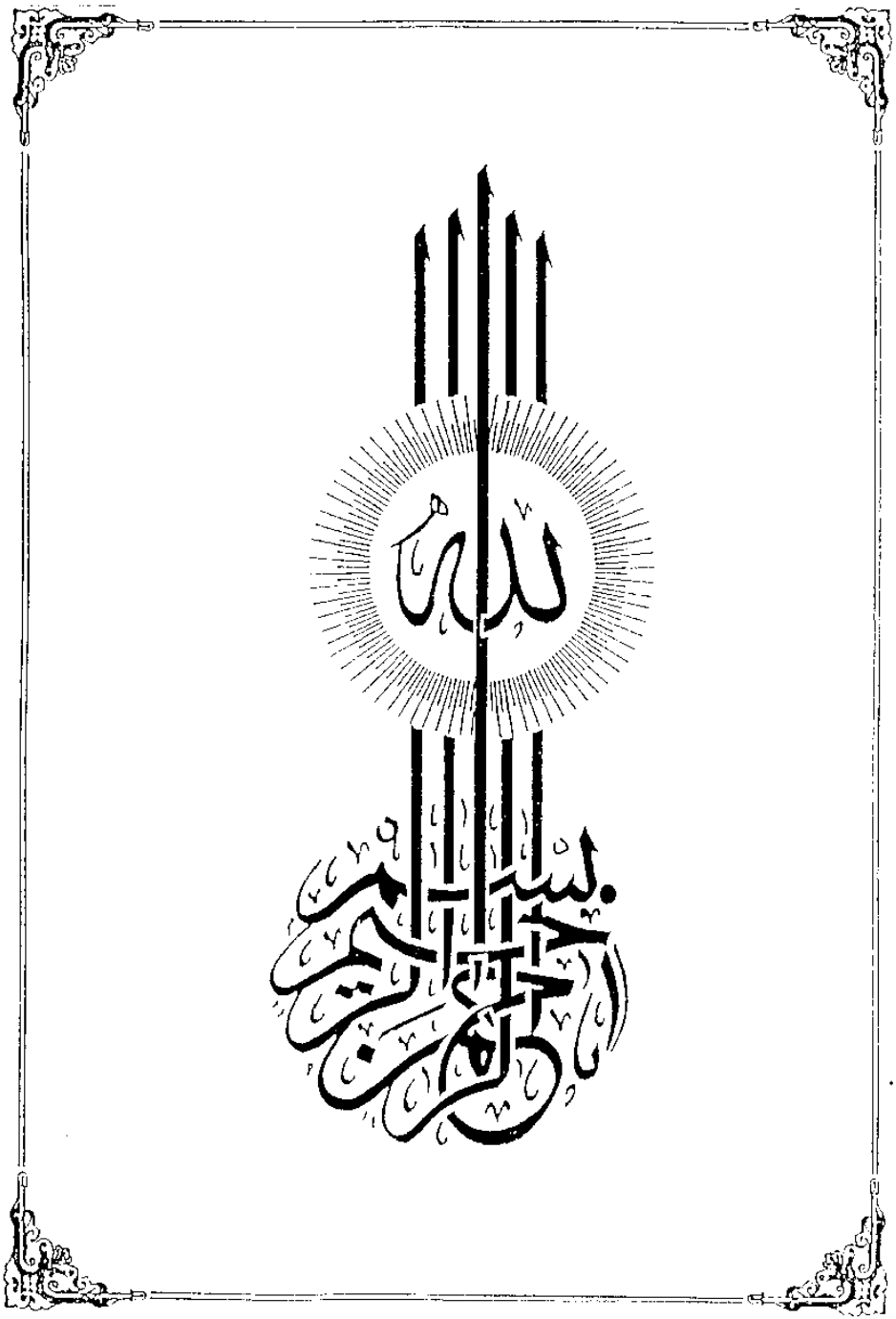
بسم الله الرحمن الرحيم



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"In the name of **ALLAH** most gracious most compassionate".

Praise be to **ALLAH**, who path guided us to this. Never could we have guidance, had it not been for the guidance of **ALLAH**, and prayers and peace be upon the the Imam of the pious, our prophet **MOHAMED** and his kins, companions, followers and callers for his message till the day of judgement.

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LIST OF ABBREVIATIONS

CT	: Computed tomography.
e.g.	: Exampli gralia.
EDTA	: Ethylene diamine tetra-acetic acid.
EHDP	: Disodium etidronate ethane hydroxy diphophoate.
FOP	: Fibrodysplasis ossificans progressiva.
HBF	: Heterotopic bone formation.
HO	: Heterotopic ossification.
MO	: Myositis ossificans.
MOT	: Myositis ossificans traumatica.
MOP	: Myositis ossificans progressiva.
NHO	: Neurogenic heterotopic ossification.
POA	: Paraosteoarthropathy.
THA	: Total hip arthroplasty.
THR	: Total hip replacement.
TMO	: Traumatic myositis ossificans.

CONTENTS

INTRODUCTION

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Heterotopic ossification (HO) is a new bone formation taking place in tissues which normally do not undergo such a process. It is probably a more valid term than myositis ossificans for this condition that may or may not be associated with history of trauma (Zeynel & Ayten, 1985).

Heterotopic ossification occurs in variety of conditions : after musculoskeletal trauma, in neurological disorders, in a congenital disorders, and in metabolic disorders, It differs from more extraosseous calcification in that true bone formation occurs (Jensen et al., 1988).

Aergerter & Kirkpatrick (1975) stated that heterotopic formation of bone usually occurs in the collagenous supportive tissue of the skeletal muscle, in tendons, ligaments, fasciae and apponeurosis.

CLASSIFICATION :

The old classification of myositis ossificans by Noble (1924) was as follows :

(1) M.O. Prgressiva : which occurs early in life, of unknown etiology, characterised by microdactyle and all the skeletal muscles progressively converted into osseous tissues.

(2) M.O Circumscripta : which known as muscular osteomata, with repeated minor trauma, such as Rider's bone.

(3) M.O circumscripta : without history of trauma.

Miller & O'neill (1949) included another type of para articular ossification associated with neurotic lesion (spinal cord lesions) which termed M.O. neurotica in the third group of Noble's classification without history of trauma.

Ackerman (1958) described an "extra-osseous, localized, non-neoplastic formation of bone and cartilage without history of trauma, which was called by Fine & Stout (1956) as psudomalignant osseous tumour of soft tissue"

Nollen and Slooff (1973) stated that heterotopic ossification can be brought under heading of "non-specific ectopic ossification of the locomotor apparatus". These can be divided into :

(1) Ossificatiion in tendons : particularly these of the hip adductors.

(2) Congenital M.O progressiva.

(3) M.O. circumscripta : which includes :

a. Post-traumatic M.O.

b. Paraosteoarthropathies in association of neurological disorders and after burns and tetanus.

c. The ossification around the hip after hip arthroplasty.

Aergerter and kirkpatrick (1975) distinguished two types of heterotopic ossification :

(1) Fibrositis (myositis) ossificans circumscripta : which include :

- Idiopathic type (without trauma).
- 4 % of paraplegics develop heterotopic ossification spontaneously in the region of knee, thigh, and hip.

(2) Myositis ossificans progressiva : a congenital, hereditary and sometimes familial disease in which group after group of muscles, tendons and joint ligaments are involved until the ability for all active movements are lost.

Another classification suggested 4 relatively distinct types of M.O. by Samuelson and Coleman (1976) as follows :

(1) M.O. progressiva.

(2) M.O. traumatica.

(3) Non-traumatic, non progressive form occuring in association with neuromuscular disorders, burns, chronic infections or other systemic diseases.

(4) Non-traumatic, non progressive form occuring in healthy individuals. They reported 4 cases of this type to

support their suggestion.

Ogilivie and Fornasier (1980) suggested the term Pseudomalignant M.O. to describe a circumscribed, proliferative mesenchmal lesions which occurs without history of trauma.

As heterotopic ossification is a more valid term than myositis ossificans. It occurs in varities of conditions and we can classify the HO depending on the hypothesis of Nollen & Sloof (1973), Aergerter & Kirkpatrick (1975) and Samuelson & Coleman (1976) as follows :

A. H.O. associated with history of trauma : as post-traumatic myositis ossificans (Geschicker & Maseritz, 1938; Thorndike, 1940; and Paterson, 1970).

B. Paraosteoarthropathies which includes :

1. Neurogenic heterotopic ossification, associated with neurological disorders (Jensen et al., 1988).
2. Heterotopic ossification associated with burns (Evans, 1966).
3. Heterotopic ossification associated with tetanus (Gun and Young, 1959)

C. Heterotopic ossification after operation as after total hip arthroplasty (T.H.A.) (Nollen and Slooff,1973).

D. Heterotopic ossification without history of trauma :

1. Pseudomalignant M.O. (Oglivie, 1980).

2. M.O. progressiva.

3. Heterotopic ossification associated with metastatic carcinomas (Jeffrey, 1989).

PATHOGENESIS

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The exact aetiology of heterotopic ossification is still obscure, and no much details about the mechanism of causation is known. Many theories and studies were adapted to explain the mechanism of causation of different types of H.O.

A. MYOSITIS OSSIFICANS TRAUMATICA (M.O.T.) :

The exact etiology and pathogenesis is obscur. Many theories and studies were adopted to explain the mechanism of causation.

Dejerine and Ceillier (1919) thought that the detachment of periosteum could explain ossification around the diaphyseal portions of the bone, but it does not explain the intermuscular ossification.

Frejka (1929) published the theory of Leriche which explain the formation of ossification after trauma due to haematoma and oedematous infiltration which leads to embryonic tissue formation which may ossify in cases where a sufficient afflux of lime salts are possible. Such afflux may be caused by inflammatory hyperaemia and trauma.

Mac Ausland, Gartland and Hallock (1953) believed that M.O. is a potential threat in any muscle haemorrhage particularly if the extravasation lies close to bone and closed fascial space. This condition in the quadriceps and

brachialis muscle in particular is prone to develop following direct trauma.

Ackerman (1958) suggest that the periosteum participate to some extent in the process, as quadriceps and brachialis take origin from a plane surface contiguous to the bone over a wide area.

Shroyer (1960) thought that traumatic ossification caused by a rather severe injury such as fracture, dislocation, extensive damage to the capsule or damage to the ligaments and the overlying muscles. Such severe trauma with necrosis of tissues especially muscle, along with haematoma and elevation of the periosteum is classically regarded as being prerequisted for periarticular ossification.

Aegerter and Kirkapatrick (1975) concluded that the cause and mechanism of M.O. is unknown, and it appears to be a chain of events that is initiated by excessive proliferation of cells. They calimed that interstitial haemorrhage is thought to play an important role in the post traumatic type of M.O. . Muscle necrosis may also stimulate this activity. Because the respiratory pigments, haemoglobin and myoglobin are common denominator and might conjecture that the complex protein of these substance may serve as activators possibly as antigenic agents.

Jones (1980) stated that myositis ossificans arising in