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REVIEW OF MECHANISM OF OSSIFICATION IN HUMAN BEINGS

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ABSTRACT

The process of ossification leads to the formation of the bony skeleton in embryos. In later life, another form of ossification occurs until early adulthood. Fibrous membranes and hyaline cartilage forms the embryonic skeleton before week 8 of gestation. After that, bony tissue begins to develop and eventually replaces most of the existing fibrous or cartilage structures. There are two types of Mechanisms of ossification, Endochondral Ossification and Intramembranous Ossification. In endochondral ossification, hyaline cartilage is used for bone construction. While in Intramembranous ossification begins within fibrous connective tissue membranes formed by mesenchymal cells.

Keywords: Ossification, bony skeleton, Fibrous membranes, hyaline cartilage, embryonic skeleton, Endochondral Ossification and Intramembranous Ossification.

INTRODUCTION

The embryo's skeleton comprises of fibrous membranes and hyaline cartilage in the starting phase of embryonic development. After that by the 6^{th} or 7^{th} week of embryonic life, the real process of bone development, ossification starts. There are two ossification pathways: intramembranous ossification and endochondral ossification. Bones formed by both pathways are equivalent regardless of the pathway that forms them.

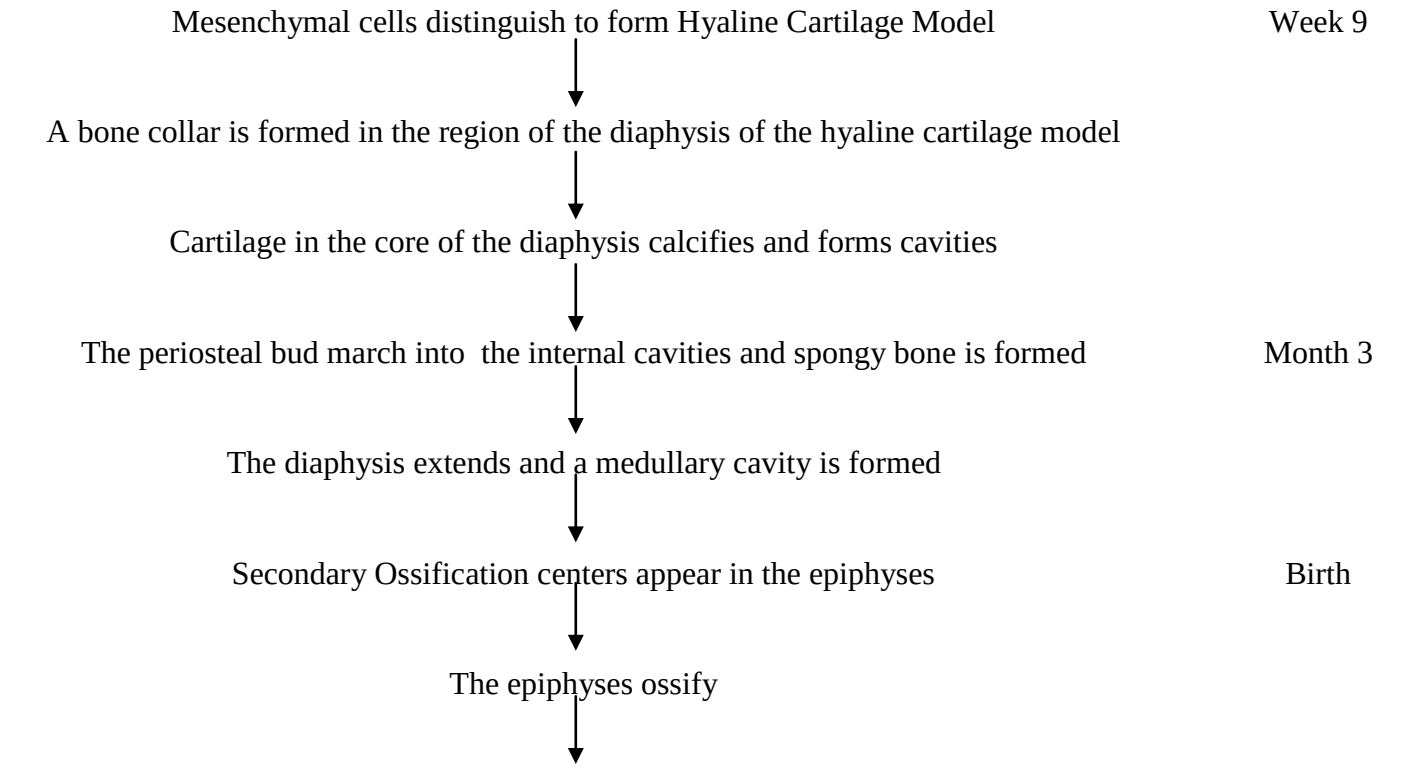
CARTILAGE TEMPLATES

Bone is basically a replacement tissue. It utilizes a representation tissue on which to lay down its mineral matrix. For skeletal development, the most common template is cartilage. During fetal development, a structure is arranged that determines the region of formation of bone. This structure is a flexible, semi-solid matrix produced by chondroblasts and comprise of hyaluronic acid, chondroitin sulfate, collagen fibers, and water. When matrix surrounds and isolates chondroblasts, they are known as chondrocytes. All the way through fetal development and during childhood growth and development, bone forms on the cartilaginous matrix. At the time of birth, a large amount of the cartilage has been reinstated with bone. Some quantity of extra cartilage will be reinstated during childhood, and a little cartilage stays in the adult skeleton.

ENDOCHONDRAL OSSIFICATION

During 2nd month of fetal development, this process utilizes hyaline cartilage for formation of bone. The formation of a long bone characteristically commences in the midpoint of the avascular hyaline cartilage shaft at a section called the primary ossification center. In the beginning, blood vessels gain access to the perichondrium layer of the hyaline cartilage and convert it to a vascularized periosteum. As a result of this, the mesenchymal cells specialize into osteoblasts. The stage is now set for ossification.

ENDOCHONDRAL OSSIFICATION FLOW CHART:



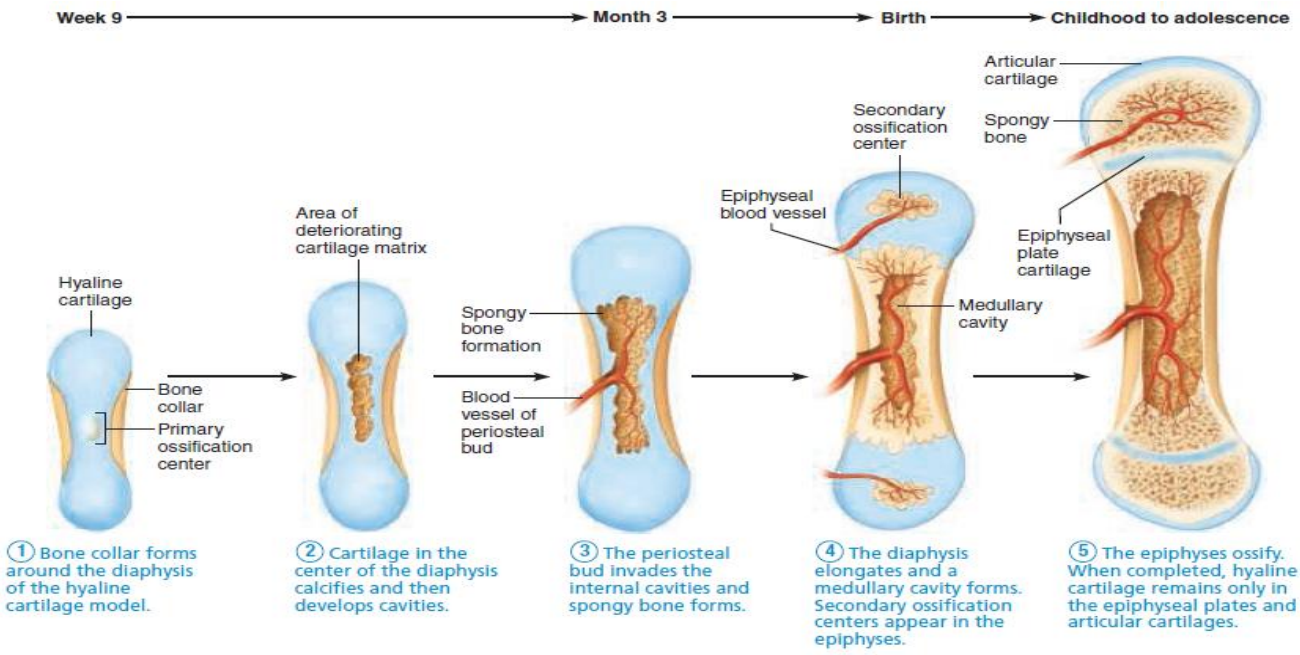


Fig 1 Steps of Endochondral Ossification

INTRAMEMBRANOUS OSSIFICATION: Cranial bones of the skull, the clavicles and most of the flat bones are formed by intramembranous ossification. During 8th week of development, ossification starts within fibrous connective tissue membranes formed by mesenchymal cells. This process involves four major steps:

Ossification centers appear in the fibrous connective tissue membrane: Centrally present mesenchymal cells crowd together and distinguish into osteoblasts, forming an ossification center that produces the first trabeculae of spongy bone.

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Osteoid is secreted within the fibrous membrane and calcifies: Osteoblasts continue to secrete osteoid, which calcifies in a few days. Trapped osteoblasts become osteocytes

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Woven bone and periosteum form: Accumulating osteoid is laid down between embryonic blood vessels in a manner that results in a network (instead of concentric lamellae) of trabeculae called woven bone. Vascularized mesenchyme condenses on the external face of the woven bone and becomes the periosteum.

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Lamellar bone replaces woven bone, just deep to the periosteum (Red marrow appears): Trabeculae just deep to the periosteum thicken. Mature lamellar bone replaces them, forming compact bone plates. Spongy bone, consisting of distinct trabeculae, persists internally and its vascular tissue becomes red marrow

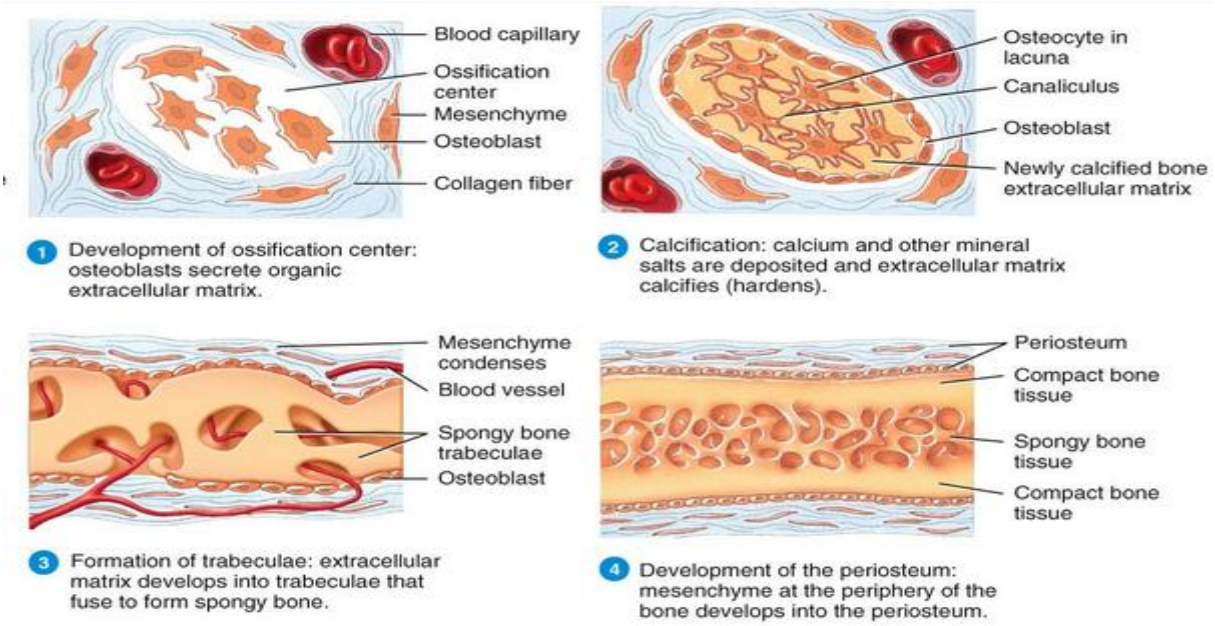

Fig 2 Steps of Intramembranous Ossification

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