Chapter 117
Osteogenesis Imperfecta

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Description

Osteogenesis Imperfecta (OI) is one of the most common skeletal dysplasias named by Lobstein in 1835 who was one of the first to correctly understand the aetiology of the condition. It is a generalized disease of connective tissue comprising pathologic changes in all tissues in which type 1 collagen is an important constituent (e.g., bone, ligament, dentin, and sclera). The basic defect is one of a qualitative or quantitative reduction in type 1 collagen for which mutations in genes encoding type 1 collagen are responsible. In 1979, Sillence and others devised a classification scheme that divides osteogenesis imperfecta into four types (two additional types have subsequently been added). Features of osteogenesis imperfecta vary not only between types but within each type as well. Patients with OI may correlate with some, but not all, of the clinical features [1–4]. The several types of Osteogenesis Imperfecta include the following features:

Type 1

- The most mild and common (50 %) type
- Autosomal dominant inheritance
- Collagen is of normal quality but is produced in insufficient quantities
- Bones predisposed to fracture with most fractures occurring before puberty
- Loose joints and muscle weakness
- The Sclera of eyes usually have a blue tint
- Triangular face
- Tendency toward spinal curvature

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- Brittle teeth possible
- Hearing loss possible, often beginning in early 20s or 30s

Type 2

- The most severe form of osteogenesis imperfecta
- It results from new dominant mutations to type 1 collagen genes
- Collagen is not of a sufficient quality or quantity
- Frequently lethal at or shortly after birth, often due to respiratory problems
- Numerous fractures and severe bone deformity
- Small stature with underdeveloped lungs

Type 3

- The most severe form in people who survive the perinatal period
- It results from new dominant mutations to type 1 collagen genes
- Enough collagen is made but it is defective and improperly formed
- Fractures are often present at birth. X-rays may reveal healed fractures that occurred before birth
- Short stature
- The Sclera of eyes usually have a blue tint
- Triangular face, Spinal curvature
- Loose joints and poor muscle development in arms and legs
- Brittle teeth possible
- Respiratory problems possible
- Barrel-shaped rib cage
- Hearing loss possible

Type 4

- It is between type I and type III in severity
- Collagen quantity is sufficient but is not of a high enough quality and improperly formed
- Bones fracture easily, most before puberty
- Shorter than average stature
- Barrel-shaped rib cage
- Triangular face
- Sclera are white or near-white (normal in colour)
- Hearing loss possible
- Tendency toward spinal curvature
- Brittle teeth possible

Type 5

- Similar to Type IV in appearance and symptoms of OI
- Dominant inheritance pattern
- Large hypertrophic calluses at fracture or surgical procedure sites
- Calcification of the interosseous membrane between the radius and ulna restricts forearm rotation and may cause dislocation of the radial head
- Bone has a “mesh-like” appearance when viewed under the microscope

Type 6

- Extremely rare type
- Moderate in severity and similar in appearance and symptoms to Type IV
- Normal Sclera
- Teeth not affected
- Alkaline Phosphatase slightly elevated
- It is distinguished by a characteristic "fish-scale" mineralization defect seen in biopsied bone

Treatment Strategy

Since osteogenesis imperfecta is a genetic condition, it has no specific cure. Traditionally surgical correction of deformities, physiotherapy, and the use of orthotic support and devices to assist mobility are the primary means of treatment. Due to the improved understanding of the molecular mechanisms of osteogenesis imperfecta the recent years, medical treatments (e.g. Bisphosphonates) aiming at increasing bone mass and strength gain popularity whereas surgery is reserved for functional improvement [5–10].

Osteogenesis imperfecta			
Classification	Meta-analysis	Systematic review	Cochrane library
All groups	Risedronate in adults with OI type I results in modest but significant increases in BMD at lumbar spine, and decreased bone turnover. However, this may be insufficient to make a clinically significant difference to fracture incidence [10]	Bisphosphonate treatment in children with OI, improves BMD but does not eliminate fracture risk and is not a cure for this disease [8]	Oral or intravenous bisphosphonates increase BMD in children and adults with OI. These were not shown to be different in their ability to increase BMD; it is unclear whether either treatment decreases fractures [7]

Osteogenesis Imperfecta is most frequently confused with child abuse and neglect [9]
OI Osteogenesis Imperfecta, *BMD* bone mineral density

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