OSTEOGENESIS IMPERFECTA

Definition and prevalence

Osteogenesis imperfecta (OI) is a congenital hereditary disorder, in which there is increased bone fragility, muscle weakness, dental problems, spine curvature, breathing problems, triangular face shape, etc. Other names include Lobstein disease, blue sclera syndrome, brittle bone disease and others. The prevalence of OI is about 1 per 20 000 live born infants. However, mild forms of the disease often go unrecognised, so the actual incidence is likely to be higher. Both males and females are equally affected.

Etiology

Osteogenesis imperfecta congenita is caused by a mutation of the type 1 pro-collagen gene (COL1A1 and COL1A2). Type I collagen is important for the bone, fascia, cornea, sclera, meninges and skin formation. It constitutes approximately 30% of body weight.

Clinical picture

The onset of the disease varies – in mild forms of the disease no fractures are observed until old age is reached. In severe clinical forms, intra-uterine fractures might be present. Most cases of the disease are due to a newly emerged mutation.

Clinical features usually vary according to disease type but they might also vary within the same family:

- Type I (mild form) – there are no deformations of long bones. Sclerae are white or blue. The number of fractures ranges from 1-2 to 60 throughout life time. They are more frequent in childhood. Patients' stature is usually unaffected. Dentinogenesis imperfecta (disorder of dental formation) might be present. Deafness and scoliosis might be present as well. Patients' physical activity is diminished.
- Type II (very severe form) – it is usually lethal. Sclerae are blue. There is a characteristic facial dysmorphism – small nose and lower jaw. Intra-uterine fractures are seen in all patients – affecting the scull, long bones, ribs and vertebrae. Rib fractures, pulmonary hypoplasia, malformations or CNS hemorrhage are usually the cause of lethality.
- Type III (severe from) – it is characterised by loose joints, muscular weakness, chronic intermittent bone pains and deformations of the scull, usually due to early fractures. Face is frequently triangular with frontal bossing. Patients' mobility and functioning are affected. There is dentinogenesis imperfecta. The color of sclera varies. Intra-uterine fractures are frequent. Deformation of extremities is progressive and leads to their shortening. Kypho-scoliosis results in respiratory compromise.
- Type IV (moderately severe form) – the onset of fractures is usually in childhood. Intra-uterine fractures are present as well. Long bones are deformed.
- There are other types of OI, but they occur very infrequently and most are considered subtypes of the moderately severe form (type IV).

Genetic counseling

Osteogenesis imperfecta is an inherited disorder. It is due to either autosomal dominant mutation or to a newly emerged mutation. There are family cases and autosomal recessive mode of inheritance as well. Prenatal diagnosis is possible by chorion villus sampling and DNA analysis. Intra-uterine long bone and rib fractures are diagnosed by US in the 15-18th week of gestation.

Treatment

Treatment is symptomatic and patients' monitoring requires a team of specialists.

So far, there is no unanimous agreement on the biphosphonates, which are used to treat osteoporosis and may increase the strength and density of bones in OI. Nutrition is important – it should be rich in calories, calcium and vitamin D.

In more severe cases the use of metal braces or even surgery may be considered to increase bone strength, to correct deformities and to reduce risk of fractures. Reconstructive surgery may be beneficial for overall mobility.

Despite prevention and treatment, fractures occur. Most of them heal quickly, but prolonged immobilisation of the patient after surgery should be avoided.

Rehabilitation and follow-up care

Management of children and infants OI poses difficult decisions for pediatricians, orthopedists, and physiatrists. Physical therapy has a major place in the overall care of these patients and most of them benefit from physical activity programmes. Properly prescribed based on the specific strengths and needs of each child, they demonstrate positive outcomes in posture and stamina.

Treatment plans should promote and maintain optimal function. They should include early intervention, muscle strengthening, aerobic conditioning, and, when possible, protected ambulation. Infancy offers many opportunities to develop strength and avoid some of the deformities, such as torticollis, that are often seen in children with OI. Positioning is critical to avoid contracture and malformation. It is important not to leave a child with OI in a fixed position, either recumbent or sitting, for long periods. Immobilisation reduces lean muscle mass and cardiovascular fitness, and it causes bone density to decline rapidly. Postfracture therapy is necessary to reduce the effects of immobilization on bone density and strength. Swimming and water therapy are highly recommended.

A comprehensive rehabilitation programme results in a high level of functional activity for children with OI with an acceptable level of risk for fracture. Involvement in school and social activities complements the psychological side of this process.

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