Review

Fractures in childhood

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Fractures constitute the 10-15% of all injuries in childhood. Their skeleton presents anatomical and functional differences from the skeleton of adults, thus causing different types of fractures. The purpose of this review study is to identify the types of childhood fractures, their specificities and methods of treatment. Also underlines the necessity of rehabilitation to ensure the health of children as well as the important role of prevention of these on the promotion of children’s health. Children from their small age are more susceptible to developing fractures due to their increased activity and their anatomical structures differ from adults. The difference of the child skeleton from adults is that children’s bones can absorb more energy from the bones of an adult before undergoing deformation and fracture. Fractures of childhood divided into non epiphysis fractures and epiphysis fractures. Due to the anatomical difference in children than adult’s skeleton there are some particularities in their healing and full recovery.

Key words: fractures, childhood, features, treatment.

INTRODUCTION

Bone is consisted of the ground substance and bone cells and surrounded all of the periosteum. The fine structure of the bone is not the same everywhere and its difference depending on the person’s age, the type of bone (wide, long) or the mission of each department. Fractures constitute the 10-15% of all injuries in childhood. The skeleton of the child presents anatomical and functional differences from the skeleton of an adult. These differences have the effect of causing different types of fractures as well as the existence of problems in diagnosis and treatment (Hatzibougias, 2002).

The anatomical peculiarities of the child skeleton include the existence of strong cartilage and periosteum which forms thicker pours with greater speed. The difference of the child skeleton is that children’s bones can absorb more energy from the bones of an adult before undergoing deformation and fracture. This is attributed to their lower comprehensiveness of salt and higher capacity for healing. As the skeleton matures, the bone healing capacities are reduced and the cortex becomes thicker and stronger. The periosteum is an obstacle for closed reduction of a fracture, while helping to stabilize the fracture after reduction (Simoglou et al., 2013).

Literature review

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MATERIAL AND METHOD

The material of the review study was recently articles on the subject, both retrospective and research studies were found mainly in the electronic database Medline and the Association of Greek Academic Libraries (HEAL-Link). Criterion exclusion of articles was the language in addition to Greek and English.

Types of fracture in children

Fractures in childhood divided into non epiphysis fractures and epiphysis fractures. Non epiphysis fractures are divided into: full, compression, as a chloral wood and bending fractures. As complete fractures described those that have fractured both sides of the bone. It is the most common fracture type. Depending on the fracture line may be classified as a spiral, transversely, obliquely or overwhelming (Ferry et al., 1999). The compression fractures in children usually occur in bone metaphysis frequently in the peripheral part of the radius. The compression of the bone may cause compressive fracture which is classified as stable and heals by immobilization over 2-3 weeks. Also common in childhood is the greenstick fracture which breaks one side of the bone and causes bending in the other side. In bending fracture the traumatic curvature of a bone due to the deformation. In this case the bone is angled beyond the limits of deformation but no fracture occurs, so there is no radio graphically visible fracture line (Bekridelis, 1999). Fractures that include the epiphyses are often in childhood. The proportion between the two sexes is 2: 1 (boys - girls) and fractures of the upper limbs occur more frequently than fractures of the lower limbs. The age which the highest frequency observed is the 13 to 14 years for boys and 11 to 12 years for girls. The peripheral part of the radius is the most common location, followed by the peripheral part of the tibia (Paut et al., 1997). The ligaments are often inserted in epiphyses as a result the transmission of traumatic forces is exerted on the end of epiphysis plate. The resistance of the epiphysis plate is enhanced by the shape and the existence of the annulus fibrosis However, the epiphysis plate is not as strong as the metaphysic or diasthesis of the bone. The epiphysis plate is extremely resistant to the extent and lower resistance to twisting and angulations forces (Van der Sluis et al., 1997).

Salter and Harris have classified the injuries of epiphyses in 5 types:
- Type I: is observed separation of the epiphysis through the epiphysis plate
- Type II: the fracture of epiphysis plate includes small part of the metaphysic
- Type III: the fracture of epiphysis plate includes a section of epiphysis and is extended to the joint
- Type IV: the fracture line passes through the metaphysic, the epiphysis plate and epiphysis
- Type V: there is a compression on the epiphysis plate (Sato et al, 2002).

This classification facilitates the determination of prognosis concerning the risk of premature closure of the epiphysis and treating indications. Fractures type I and II are usually treated with closed reduction techniques and do not require absolute straightening. Fractures Type III and IV require anatomical straightening, because there is a displacement of the epiphysis and particular surfaces. Fractures Type V usually is diagnosed late and always cause premature closure of epiphysis (Sato et al., 2002).

Specificities of fractures in childhood

The reconstruction involves the absorption of periosteum combined with formation of new bone tissue. The main factors affect the reconstruction of a fracture is the age of the child, the distance of the fracture from the joint and the relationship of the fracture to the axis of the joint or it’s mobility. The growth potential of the musculoskeletal system provides the basis for the regeneration, as smaller is the child such greater is the possibility of regeneration (Caine et al., 2014). Some epiphysis plates have greater capacity of regeneration from the others. Fractures located near the epiphysis plate have the maximum degree of regeneration, as long as the residual deformation is at the same level with the joint axis of movement. The regeneration of fractures is not effective in displaced fractures, fractures of the diaphysis, fractures presenting rotational deformation and fractures presenting displacement or deformation which is not located on the same level to the axis of the joint. The regeneration capacity decreases significantly as the child reaches a full skeletal maturity (Chevalley et al., 2011).

The overgrowth mainly observed in the long bones, particularly to the femur due to hyperemia caused by the healing of the fracture. The fracture of the femur in children less than 10 years is usually followed by the overgrowth of the femur by 1-3 cm. After the age of 10, the overgrowth is no longer a major problem and is indicated the straightening of the fractured bone (Panagopoulos, 2005). The injuries of epiphysis plates may result in partial or complete closure of epiphysis, leading to shortening or angular deformation of the bone, or both. This disorder depends on fractured bone and the growth capacity of the skeleton. The inhibition of growth usually is observed in the distal femoral epiphysis and in the peripheral and central epiphysis of the tibia. Fractures of the children heal faster than those of the adults. This is due to their growth capacity and thicker metabolically active periosteum. As the big kid or teenager matures, the healing rate slows and reaches those in adults (Chevalley et al., 2011).

Note that the classic metaphysical damages, a long bone fracture type, often associated with abuse. The femur, the humorous and tibia are most commonly long bones which present fractures in abused children. Fractures of the femur in children who do not walk, it is very likely due to abuse compared to children who walk (Agathonos-Georgopoulou, 1998). Multiple fractures at different stages of healing and multiple in different locations skull fractures may indicate abuse (Xatzifotiou, 2005). Therefore this requires detailed
history of injury focusing on whether the injuries described can justify this fracture. If abuse is suspected recommended clinical assessment of the other children of the family (Kikila and Koutelekos, 2011).

Treatment of fracture in childhood

The treatment of fractures can be conservative or surgical. Most fractures in childhood can be treated conservatively by closed methods. To conservative treatment of fractures in childhood included the immobilization with circular plaster or splint (Agathonos-Georgopoulou, 1998). Some types of fractures in childhood have a better prognosis when reduced, with open or closed methods, and treated with internal fixation. The usual indications for the application of internal fixation in children and adults with open epiphyses are: the displaced epiphysis fractures, the displaced intra-particular fractures, unstable fractures, fractures of a child with multiple injuries and open fractures (Xatzifotiou, 2005).

The surgery is not intended to perfectly stable osteosynthesis, but in the achievement and maintenance of the anatomical straightening. So is indicated the simple osteosynthesis using Steinmann needles, Kirschner wires and small nails. Follows immobilization of the fracture usually with a plaster bandage until the satisfactory healing. All internal fixation materials are removed after fracture healing. In some types of fractures in childhood external fixation applies with great success. The main indications of application of external fixation are the open fractures of the pelvis and limbs, particularly those with extensive bone loss, burns and vascular or nerves damages (Kikila and Koutelekos, 2011).

Rehabilitation of fracture in childhood

Restoration is the healing process that aims to help the patient to regain the previous functional condition. The diseases of bones and joints in childhood hold one of the predominant views among children diseases. The early diagnosis is difficult and the examination of the child by an orthopedic is mandatory at least once a year. Infants must undergo this examination two to three times a year, starting from the first month of life (Pagaltos, 2002).

Congenital abnormalities in protein synthesis and the bone metabolism disorders, often leading to abnormal skeletal development. Thus, children are born with deformities of the limbs or acquire them during the development of the skeleton. The correction of these deformations by the Ilizarov method could restore the support and the operational capacity of the limbs. This enables the physical symmetry and harmony of the child (Banousis, 2011).

The Ilizarov method helps to achieve good results in the treatment of children with cerebral palsy, achenondroplasia, in correcting congenital raivoupodias, disorders of the foot limb etc. (Grosomanidou et al., 2002).

The program of rehabilitation for children should begin as early as possible and in any case before the completion of the healing of the fracture. This happens because the immobilization for a long time leads to muscular atrophy, edema and limitation of the track movement of joints (Ilizarov, 1998; Koukourikos et al., 2014). The physiotherapist should immediately begin the mobilization so when the healing is completed, the free joints have full mobility and muscles have maintained as much as possible their strength and elasticity. Also the close cooperation with doctor is essential to address potential complications (Marsh et al., 1997). The rehabilitation program depends upon the type of fracture and the type of treatment (conservative - surgical). The objectives of physiotherapy treatment is to relieve the patient from pain, relax muscle spasm, maintain the track motion of joints, reduce edema, facilitate blood circulation, prevent muscle atrophy and complications and help the respiratory system with special exercises (Roumeliotis, 1993). The state bodies have also the responsibility to provide specific measures in order to facilitate the process of rehabilitation for all the persons and especially for the children with a kind of disability (Tsaloglidou, 2014).

Fracture prevention of childhood

Prevention plays an important role even in the appearance of childhood fracture. Calcium is very important factor for the growth, development and maintenance of strong bones (Al-Sayyad, 2008). Adequate amounts of calcium are necessary for children and adults. Dairy products and especially the cheese are the main source of calcium. There are few times, however, that the consumption of dairy is avoided because of belief, religion or health, as in the case of lactose intolerance. So the alternative calcium sources (such as beans, almonds, sesame seeds and their products, cauliflower, cabbage, small fish eaten along with the bone) can replace the role of dairy in our diet, in combination with vitamin D for better absorption. Vitamin D is produced under our skin and is involved in intestinal absorption and deposition of calcium in the bones. The calcium of dairy is absorbed without the assistance of Vitamin D. In contrast, all other foods containing this precious metal are better eaten with a source of vitamin D (Pantazis, 2001).

Regarding the house that accommodates young children, must be properly configured. So it is necessary to ensure adequate lighting on stairs and in various parts that could be caused an accident. Removal of various carpets, proper drying of the floor and the avoidance of its polishing are necessary steps for young children not to slip. During the bath, the child should be under the supervision of a parent. Moreover, the compliance with driving rules such as safety belt and child seat can protect the child from a serious accident (Dionyssiou et al., 2008).

Especially for fractures due to physical child abuse the early detection of persons designated as vulnerable to the development of "high risk" attitudes, regarding family relationships and parental role and the early support of these groups, prevent most forms of child abuse. Moreover
taking all measures to protect the child's as well as the legal intervention to ensure their safety are objectives of the prevention (Nikodimou, 2008).

CONCLUSION

The difference of the pediatric skeleton is that children's bones can absorb more energy from the bones of an adult before undergoing deformation and fracture. This is attributed to lower levels of salt and in their greatest capacity for healing. Parents need to be more careful with their children not to display various types of fractures. The restoration of fractures in children must be careful, due to their anatomical structure. Complications may stigmatize the rest of their lives. Furthermore, the information of children from their parents about the risk of fractures can reduce their rate. Therefore, it is important to have substantial knowledge in diseases with increased incidence - like fractures - in childhood, both by doctors and nurses for their proper treatment. Nurses are the ones, which undoubtedly can support children and offer generously their nursing training. The nurse with scientific training in combination with the filing of human values through their nursing training. The nurse with scientific training in their anatomical structure. Complications may stigmatize their children not to display various types of fractures. The capacity for the rest of their lives. Further

REFERENCES


