

Post-Burn Roentgenographic Study of the Foot in Children

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Abstract

Foot burns in a pediatric patient require special consideration. In deep burns of III-IV degree in children, covering 5% and more of the body surface, that cause the development of burn disease, most patients develop osteoporosis of uniform, spotted and reparative type. 79 patients aged 14 years and younger underwent X-ray examination at the Burn department of RSCUMA and the Samarkand Inter-Regional Burn Centre. X-ray method is the main in recognition and study of the pathology of bones and cartilages of the foot and ankle joint. In prolonged treatment of burn disease premature degenerative changes of joint, subluxations, ankylosis and calcification in para-articular soft tissues were observed. The early surgical treatment of burnt foot deformation leads to definite positive changes in bones.

Keywords: Foot burns; Pathology; Pediatric patient; Pain; Osteoporosis

Introduction

Foot burns in a pediatric patient require special consideration [1-3]. Although the feet involve only a small percentage of the total body surface area (3.5%), they play an important role in daily life because of their motion and weight-bearing function and the short and long-term morbidity is incalculable in terms of pain, functional impairment and financial loss [4,5].

It is necessary to mention that foot burns children mostly occur in Central Asia since many indigenous people still use the ancient means of heating called 'Sandal' during the winter months [6]. In deep burns of III-IV degree in children, covering 5% and more of the body surface, that cause the development of burn disease, most patients develop osteoporosis of uniform, spotted and reparative type. In prolonged treatment of burn disease premature degenerative changes of joint, subluxations, ankylosis and calcification in para-articular soft tissues were observed. [7,8]. X-ray method is the main in recognition and study of the pathology of bones and cartilages of the foot and ankle joint.

Material and Results

A total of 79 patients aged 14 years and younger underwent X-ray examination at the Burn department of RSCUMA and the Samarkand Inter-Regional Burn Centre. All observed changes in bones and joint in the foot area in patients with burns were put together to form clinical X-ray working scheme. We attributed the changes due to direct action of high temperature to the group of primary disturbances of the 18 (22, 79%) patients and burn complication on foot and their consequences to the group of secondary disturbances of 61 (77, 21%) patients.

The causes of patients burns were: sandal burn at 60 patients (75, 95%), flame burns at 12 (15, 19%), electrical burns at 7 (8, 86%).

We have examined by means of X-ray 79 patients with heavy 153 of feet. Of all cases, 52 were old contractures persisting for 1-5 years, while 27 were contractures that had 6 to 10 years. The marked deformities of bone-ankle joint changes were observed at 23 patients, with changes in the form and slow growth of bones in foot ankle with its valgus or varus deformities. Contractures of the 1st and 2nd degrees were observed in 9 cases, of the 3rd degree in 42 cases, and of the 4th degree in 18 cases. The distribution of patients with different kinds of X-Ray of bone changes is presented in Table 1.

The most characteristic structural changes of bone tissue were osteoporosis (28, 10%). Particularly common trophic disturbances manifest osteoporosis. It is clearly marked in patients with painful syndrome, with long closing burn wound in the foot area.

In case of osteoporosis we observed the dystrophic changes, of hypertrophic character at 26 patients (60, 47%) and diffusion type at 17 (39, 53%) cases. The compensatory reconstruction of foot bone was seen at hypertrophical form of osteoporosis. As the foot was always kept in the position of maximal loading the marked reformation of bone observed foremetatarsus (trabecula) is massive, thickened and situated in longitudinal direction. The picture of the bone substance was large-looped with some light cavity areas, but the most vividly seen changes were in heel bone. Rough and compact bone beam in heel bone were situated fan-shaped and very rare they split at the background and were connected with compact cortical plate, and that causes the increase of loading on heel bone.

Foot osteolysis was observed at 28 (18, 30%) cases. The structural changes and resolution of some bones (or parts) of foot has been the result of neurodystrophic process in bone tissue. Osteogenesis disturbances are revealed by X-ray examination in patients in a year on the burnt foot. Osteolysis in toe phalanges is revealed by X-ray examination at the IV week after the burn. At first disappearance of the closing plates of nail phalanges tuberosity is revealed. The X-ray radiography has shown the absence of nail and middle phalanges of II-III-IV toes at 14 (50,0%) cases, at 8 (28,57%) patients the process took I toes and at 6 (21,43%) – it took the head of IV-V metatarsus bones and the area of the heel bone.

The numbers of patients treated	Character of changes						
	Osteoporosis	Osteolysis	Under-development	Osteoarthropathia	Strain and sprains	Arthrosis	Ankylosis
79	43	28	17	14	39	7	5
153 (100%)	28 (10%)	18 (30%)	11 (11%)	9 (15%)	25 (49%)	4 (58%)	3 (27%)

Table 1: The distribution of patients with different kinds of X-Ray of bone changes is presented.

The under-development of foot toes was seen at 17 (11, 11%) of cases. This was observed at heavy foot deformations, when the ends of metatarsus bones were displaced to the back, perforating the skin and provoking ulceration. The X-ray radiography showed the remains of bones, which lost their form and were connected into one conglomeration, which were locked as deformed and derogated stump.

Osteoarthropathia in the foot was seen at 14 (9, 15%) cases. The X-ray radiography showed the swell and deformation of the joint outline surface, clearing of bone structure on the base of thinness and reduction of bone in size. At 8 cases there was the sharpened end of metatarsus bones. These changes were followed by osteolysis of foot toes phalanxes. At 6 cases the foot had the crescent-shaped form.

Strains and sprains of foot toes were observed at 39 (25, 49%) cases, mainly, at deformations of the foot III-IV degree. X-ray study clarity the relationship of bones in the joint and reveals changes in the soft tissues and articular margins of bones. The powerful, cicatricial heaviness or solid areas tightening the joints of joined bones were clearly seen. The radiography had shown the sharp changes (breach) and swell of joint ends at metatarsus bones and the main toes phalanxes. The phalanxes were underdeveloped and sharply deformed. At sole dislocation of toes the metatarsus bones were raised to the back and its longitudinal slit was somehow extended.

The degenerative-dystrophic injuries in foot joints is in the basis of Arthrosis. At 7(4, 58%) patients we examined the arthrosis case. We have observed the osteoporotic reconstruction in epiphysis, which lessens the bone's firmness, as a result of it loading leads to deformation and breach of congruence of foot joint area, clinically characterized by statistic foot deformation.

The foot ankylosis is a heavy injury of tissue with drawing the elements of junction ligamentous or bone-joint apparatus (at 5 cases) into inflammatory or necrobiotic process. In the area of ankylosed joint we can see the heavy foot deformation with predominance of wide and united cicatricious process. The foot ankylosis is often seen at sole flexion (bend).

Discussion

At present, despite the pronounced progress in the prevention and treatment of burns during childhood, burns still remain one of the

leading causes of trauma and disability in children, particularly in young children.

The problem of X-ray examination is to recognize these changes in time to control their dynamics and contribute to successful treatment of burn victims. The roentgenologic changes at burns were in detail in works of some authors. In deep burns of III-IV degree in children, covering 5% and more of the body surface, that cause the development of burn disease, most patients develop osteoporosis of uniform, spotted and reparative type. In prolonged treatment of burn disease premature degenerative changes of joint, subluxations, ankylosis and calcification in para-articular soft tissues were observed. In childhood and adolescence disturbance of osteogenesis is noted. The degree of manifestation of the revealed changes in the area of the foot and ankle joint depended on the depth of the burn as well as the methods of treatment and duration of existence of wound surfaces and scar contractures. Timely detection of marked changes in the area of the foot gives opportunity to undertake a number of preventive measures and administer more efficient treatment.

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