

CHANGES IN BONES AND JOINTS RADIOGRAPHICALLY ASCERTAINED IN THE MEMBERS OF THE CZECHOSLOVAK OLYMPIC TEAM

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The achievements of athletes and sportsmen increase every year and records which used to be considered at the limit of human possibilities are constantly exceeded. In all kinds of sports it is possible to observe how speed, force and endurance increase, particularly as a result of the newly introduced training methods. Of particular importance is the fact that sportsmen aspiring at top achievements must undergo a regular training from their youth. When analyzing our material we can see that all members of the Olympic team whom we examined started a regular training between the age of 13 and 20, and in the average around their 16th to 17th year.

The question must be asked how the organism reacts to such constantly increasing demands particularly if these demands are made on an organism which is still developing and not yet completely matured. For this reason a number of works have appeared recently which are concerned with the changes which sport activities cause in the human organism. Particular attention is given to changes in bones and joints. Such studies mostly deal with changes which can be observed only in certain types of sport, analyze them and sometimes point out the possibilities of their prevention (2, 3, 6, 7, 8, 9, 11, 12, 13, 16, 17, 19).

In addition to this a number of papers (1, 2, 8, 10, 13, 19) direct attention also to the mechanism which brings about such changes on bones. Basically, two different views were expressed in the discussion covering this problem. Baetzner's term "Pathology of Function" indicates that, in his view, the stepping up of functions automatically leads to an overloading of the tissue, to its wear and consequent degenerative changes. Baetzner rejects the view that a trauma, or possibly local primary disturbances of tissue, have a joint responsibility for the changes. The opposite position is taken by Knoll who believes that sport activities lead to repeated small traumas, so-called microtraumas, which produce a *locus minoris resistentiae*. In such points of diminished resistance subsequent accidents have a greater effect. In his view the changes in bones and joints, which can be later determined radiographically, represent a healing process after such injuries. This theory is favoured also by Groh, who argues that, even after many years' activity, functional loading of the tissue in normal life and in the sport does not lead to such pressures on joints which could produce degenerative changes.

The third group of authors recognizes the responsibility of both processes and sees the cause of changes in joints and bones both in traumas and in the overloading of the tissue. According to Heiss (1) faulty tactics and an unsuitable manner of training play an important role. It can be seen that no explanation is generally accepted though in recent publications the main emphasis seems to be on the traumatic origin of the changes.

Previous studies dealt mostly in an isolated manner with certain kind of sport, in particular with gymnastics, football, rowing and certain branches of light and heavy athletics [Bláha (3), Jäger (11), Kobbe and Rücker (13), Barth (2), Crasselt (8), Lajko and Kovacz (quoted in 8, 13), Medved and Petrovic (quoted in 8, 13), Querg (16, 17), Landrôt and Kavan (15), Buetti (6) and others].

In our group of athletes we had the opportunity to investigate the effect of different branches of sport and this gives us a certain possibility of comparing how the origin of changes in bones and joints is influenced in different activities. The purpose of our study was also to find what changes are produced by top performances in different types of athletics and sport. We examined those parts of the skeleton where we expected the changes. For this reason a consistent comparison of all types of sport is impossible. Also the limited number of sportsmen in certain groups makes a more general conclusion impossible. Altogether, 85 members of the Czechoslovak Olympic team were examined in the course of the last month prior to their departure for Tokyo. Out of this number 78 were men and 7 women. Men were aged 19 to 34, women 17 to 24.

I. ANALYSIS OF RADIOGRAPHIC FINDINGS ACCORDING TO DIFFERENT ORGANS

Cervical spine was examined in 4 wrestlers. In all four there were degenerative changes. In two cases the findings were classified as degeneration of intervertebral discs of medium to high grade and in the two remaining cases as degeneration of intervertebral discs of low grade. In all four there were also signs of a spondylitis osteo-arthritis (Fig. 1).

Dorsal spine was examined in all members of the team in lateral projection. Findings classified according to type of sport can be seen in Table I.



FIG. 1

Wrestler, 29, an advanced degeneration of intervertebral discs in the lower cervical spine.

It can be seen from this table that normal condition of the dorsal spine was found in less than half of the cases. Almost in one half we found a light to advanced spondylitis osteo-artrtica (Fig. 2), in some cases accompanied by a light to medium advanced degeneration of intervertebral discs. In 14 cases, i.e. in about 16 per cent of all examined, we found wedge-shaped deformities of vertebral bodies accompanied by increased kyphosis. Wedge-shaped deformities of vertebral bodies were evaluated on the one hand as a condition after Scheuermann's disease (Fig. 3), and on the other as post-traumatic deformities of vertebral bodies (Fig. 4). An exact differentiation between these two conditions was often very difficult. None of the sportsmen in whom the wedge-shaped deformities of vertebral body were found reported any injury to his vertebral column and had any complaint which could be related to the dorsal spine. We know from literature (7, 9, 12, 13) that con-

dition after Scheuermann's disease is found often in sportsmen in whom the vertebral column was exposed to increased effort in the period of growth. In our group this condition is concentrated in four types of sport, it is found in volleyball players, rowers, boxers and heavy-weight lifters, in whom such overloading of the vertebral column can be most obviously assumed. In the case of post-traumatic conditions we believe that these represent fatigue fractures of vertebral bodies, also resulting from increased overloading and traumatisation of the vertebral column. The wedge-shaped deformities of vertebral bodies were in most cases small and mostly accompanied by reactive changes on vertebral bodies. When comparing different sports we can see that such wedge-shaped deformities

TABLE I
Roentgenological changes of the dorsal spine

Sport	Number of examinations	Normal	Spondylitis osteo-artrtica		Degeneration of intervertebral disc		Condition after Scheuermann's disease	Post-traumatic changes
			I.	II.	I.	II.		
Light athletics	4	3	1	—	—	—	—	1
Gymnastics-men	8	5	2	1	2	—	—	1
Gymnastics-women	7	4	3	—	—	—	—	—
Wrestling	4	—	—	4	2	1	—	—
Heavy-weight lifting	2	—	2	—	1	—	1	—
Boxing	5	—	5	—	2	—	1	—
Cyclistics	10	9	1	—	—	—	—	—
Rowing	15	5	5	4	3	2	3	1
Football	14	10	3	1	1	—	—	—
Volleyball	13	3	5	2	2	—	3	3
Swimming	3	1	1	1	—	—	—	—
Total	85	40	28	13	13	3	8	6
Per cent	100	47	48		18		16	

TABLE II
Roentgenological changes on the lumbar spine

Sport	Number of examinations	Normal	Scoliosis	Degeneration of intervertebral disc	Spondylitis osteo-artrtica	Post-traumatic wedge-shaped deformity
Gymnastics-men	1	—	—	1	—	1
Heavy-weight lifting	2	1	1	—	—	—
Rowing	15	4	9	1	3	1
Total	18	5	10	2	3	2
Per cent	100	27	55	11	16	11



FIG. 2

Volleyball player, 25, a localized spondylitis osteo-arthritis of the body of T 10; as the change is only local, traumatic origin of the process cannot be excluded.

were found mostly in volleyball players and rowers. Besides these two categories of sportsmen, degenerative changes on the dorsal spine can be found also in wrestlers, boxers and heavy-weight lifters. Least frequent are such deformities in cyclists and light athletes.

The distribution of changes on the lumbar spine is shown in the following table.

The gymnast was examined because he reported pains in the lumbar region. He did not report an accident (Fig. 5). We included this member of the Olympic team into this group because the finding was made when examining his lumbar spine.

No degenerative changes were found in heavy-weight lifters. Rowers had little advanced degenerative changes on their vertebral columns. In the case of one rower, aged 27, we found a small, wedge-shaped disfiguration of bodies of the 2nd and 3rd lumbar vertebrae with uneven covering surfaces. No accident was recorded in his anamnesis.

Scoliosis and rotation of vertebral bodies were relatively frequent, particularly in rowers. In 7 cases

there was dextroscoliosis, in 2 there was sinistroscoliosis. The deviations were mostly small.

Comparing radiographical findings on the dorsal and lumbar spine of rowers we can see that on the dorsal spine degenerative changes appear more than twice as frequently as on lumbar spine. Also wedge-shaped disfiguration of the vertebral bodies were found more frequently on the dorsal spine.

The cause of the relatively frequent changes on the vertebral column is the considerable stress to which intervertebral discs are exposed by the erect posture of the body. Even the effect of the micro-traumas occurring in normal life is manifested on the vertebral column often sooner than on other parts of the skelet (4). It is evident that with every increase in the stress affecting the vertebral column its traumatisation increases also, and this is clearly reflected also in the changes which can be observed. This explains also the greater frequency of degenerative changes and wedge-shaped deformities of vertebral bodies in volleyball players, rowers, wrestlers and boxers, where overloading of the vertebral column is accompanied by the effects of

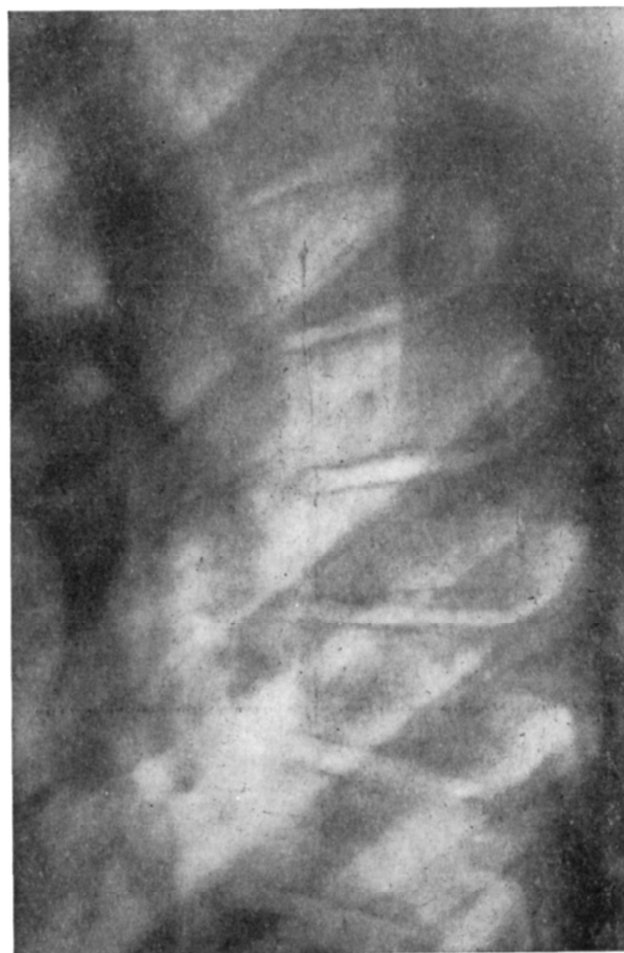


FIG. 3

Boxer, 31, condition after Scheuermann's disease. A wedge-shaped disfiguration of vertebral bodies T 8 and T 9 with signs of spondylitis osteo-arthritis with an increased kyphosis and slightly uneven surfaces.



FIG. 4

Volleyball player, 31, wedge-shaped disfiguration of vertebral bodies T 9 and T 11 with advanced spondylitis osteoarthritis.

sudden applications of force which can produce such changes more easily.

Shoulder joints were examined in wrestlers. In these cases we evaluated degenerative changes in the joint. In the case of one wrestler the finding was normal, in one case there was a mild osteoarthritis, and in two cases the changes in the shoulder joints were more advanced (Fig. 6).

The wrist was examined in 50 members of the team and the findings are recorded in the following table.

Of the pathological findings most frequent were post-traumatic conditions. In most cases these were conditions after fractures and abruptions. It can be seen that particularly gymnasts and volleyball players were affected. The described cyst-like changes were localized 4 times in the scaphoid, where we always found greater cystic formations. These probably represented the condition after microtraumas (4, 5) (Fig. 7 and Fig. 8).

None of the members of the team in whom we found such cystic formations exhibited any clinical symptoms. The larger cysts, particularly in the

TABLE III

Roentgenological changes on the wrist

Sport	Number of examinations	Normal	Post-traumatic changes	Cyst-like changes	Osteoarthritis
Light athletics	1	1	—	—	—
Gymnastics-men	8	4	3	—	1
Gymnastics-women	7	7	—	—	—
Wrestling	4	1	1	2	—
Heavy-weight lifting	2	2	—	—	—
Boxing	5	3	—	2	—
Cyclistics	10	8	1	1	—
Volleyball	13	6	6	1	1
Total	50	32	11	6	2
Per cent	100	64	22	12	4



FIG. 5

Male gymnast, 28, wedge-shaped disfiguration of vertebral body T 12 with strong degeneration of intervertebral disc T 12/L 1.

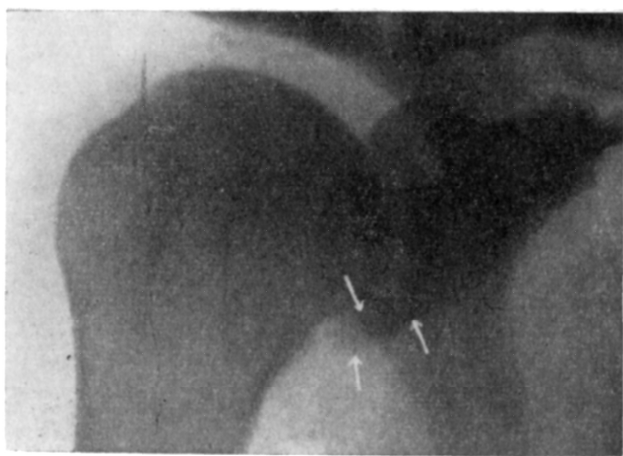


FIG. 6

Wrestler, 29, medium advanced osteo-arthritis of the right shoulder joint. A similar finding was made also on the left side.

scaphoid, represent locus minoris resistentiae. They provide a greater possibility of fracture which can be healed only with a much greater difficulty and which often transforms into pseudoarthrosis.

The case of a carpo-metacarpal osteo-arthritis is illustrated by Fig. 9. The elongation of the posterior edge of the joint surface of the 3rd carpo-metacarpal joint with uneven joint surfaces is evident. The extent of the changes and their localization suggest that these are cases of the post-traumatic condition as in volleyball players this region is greatly stressed and exposed to injuries.

An interesting case can be seen in Fig. 10. In this projection a triangular bone can be seen on the dorsal side of the hand bilaterally between basis of the 3rd metacarpal, os magnum and the trapezoid. This is the so-called os styloideum, an accessory ossicle produced by ossification of surplus cartilage nucleus at the tip of the styloid process of the third metacarpal (K r u p i ě k a). Osteo-arthritic changes more pronounced on the left, can be observed, at the adjoining surfaces of the ossicle and of the corresponding carpo-metacarpal joint. Because of its location this ossicle is easily injured and repeated injuries produce osteo-arthritic changes. The athlete does not suffer from any clinical complaints at present.

The skelet of the metacarpals and of the fingers was examined in volleyball players and boxers. In volleyball players a post-traumatic condition was found in 3 cases and a cyst-like changes in the basis of metacarpal in one case. In one boxer we found a post-traumatic disfiguration of the first phalange of the finger. No other disturbances were found.

Table IV presents the changes found in knee joints.

Osteo-arthritis of the knee joint was found in 18 per cent of cases but exclusively in volleyball and football players; the changes were more advanced in the case of football players (Fig. 11 and 12).

Findings on knee joints show that osteo-arthritic changes are associated with sports in which the possibility of injury to this joint is greatest, but that the considerable functional loading of this joint, as for example in cyclists, does not lead to arthritic changes.

Changes in the ankle joint are recorded in the following table.

The degree of osteo-arthritis of the ankle joint differed from one football player to another, unilateral and bilateral and isolated cases reached a considerable extent and were accompanied by chondromatous changes in the surrounding of the joint. We found them in all football players with the exception of one (the goal keeper). Osteo-arthritis of the ankle joint was also found in half of the gymnasts but in none of the light athletes. This finding shows that the injury is the main cause of such degenerative changes. Other frequent findings in football players and gymnasts were exostoses of the upper surface of the neck of astragalus. These exostoses were mostly bilateral and in dif-

TABLE IV

Roentgenological changes on the knee joints

Sport	Number of examinations	Normal	Osteo-arthritis	Post-traumatic changes
Light athletics	2	2	—	—
Cyclistics	10	9	—	1
Football	14	8	3	4
Volleyball	13	9	4	—
Total	39	28	7	5
Per cent	100	72	18	13

TABLE V

Roentgenological changes of the ankle joints

Sport	Number of examin.		Normal	Osteo-arthritis of the ankle joint	Osteo-arthritis of the astragalo-navicular joint	Exostosis of astragalus	Post-traumatic changes	Os trigonum
Light athletics	4	3	—	—	—	1	—	—
Gymnastics-men	8	2	4	—	—	3	4	1
Football	14	1	13	4	4	8	7	2
Total	26	6	17	4	4	12	11	3
Per cent	100	23	65	15	15	46	42	11

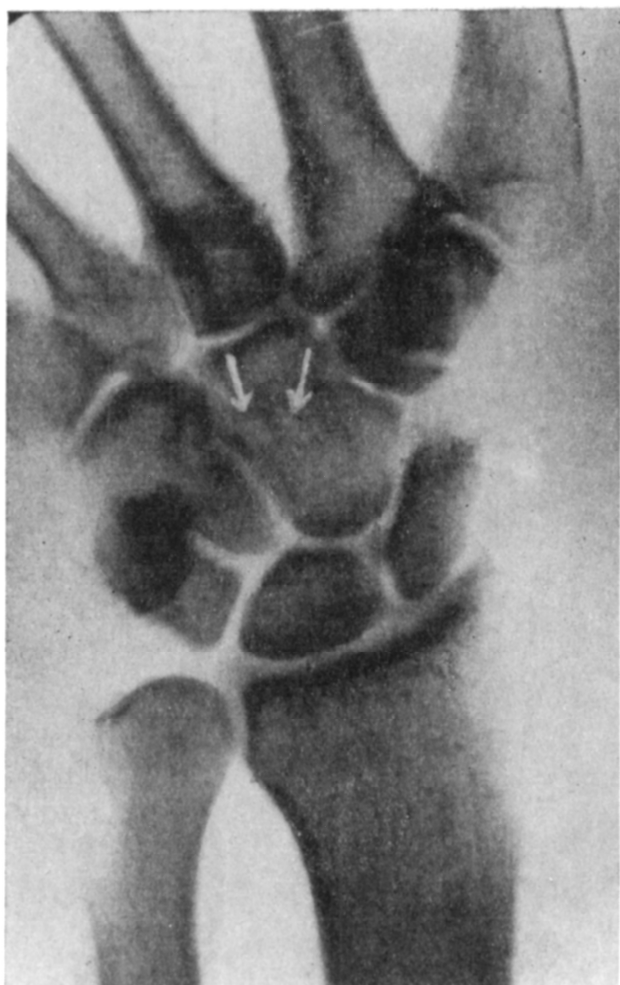


FIG. 7
Wrestler, 29, a cyst in capitatum.

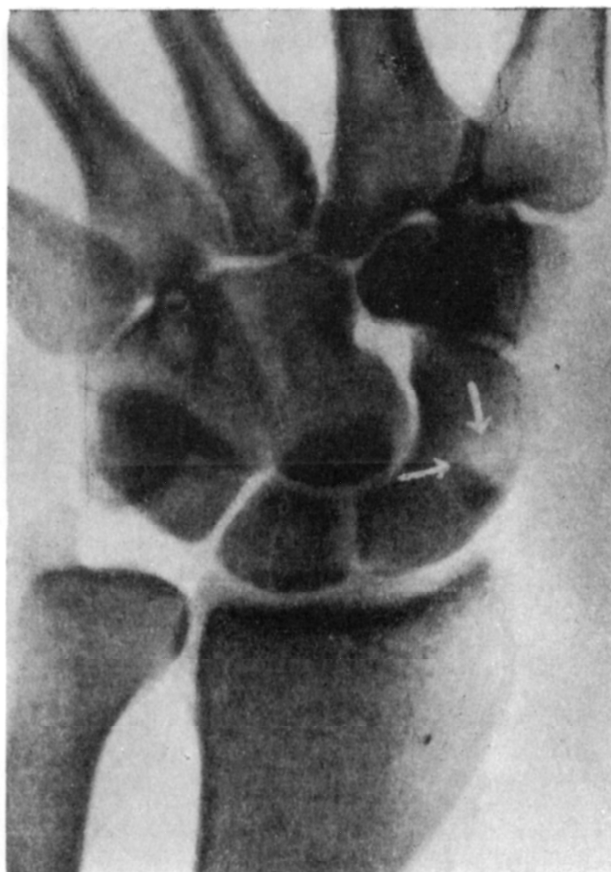


FIG. 8
Boxer, 26, two small cysts in os naviculare

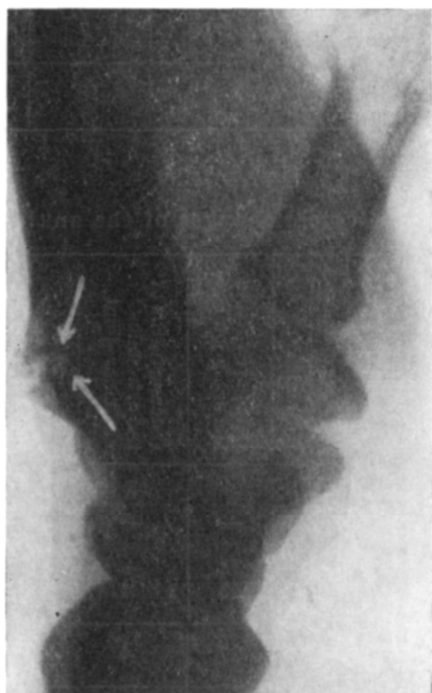


FIG. 9
Volleyball player, 31, carpometacarpal osteo-arthritis.

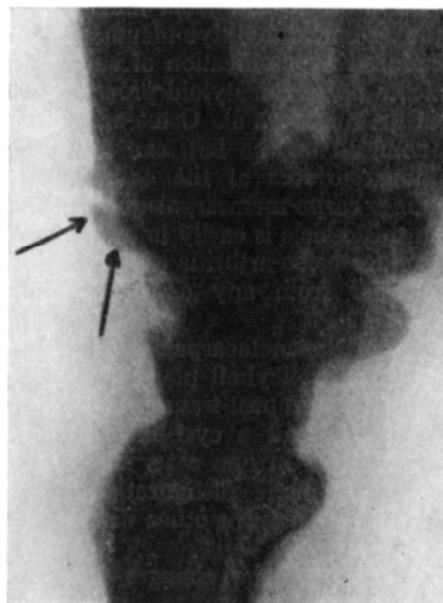


FIG. 10
Male gymnast, 28, os styloideum with osteo-arthritis of connecting surfaces.

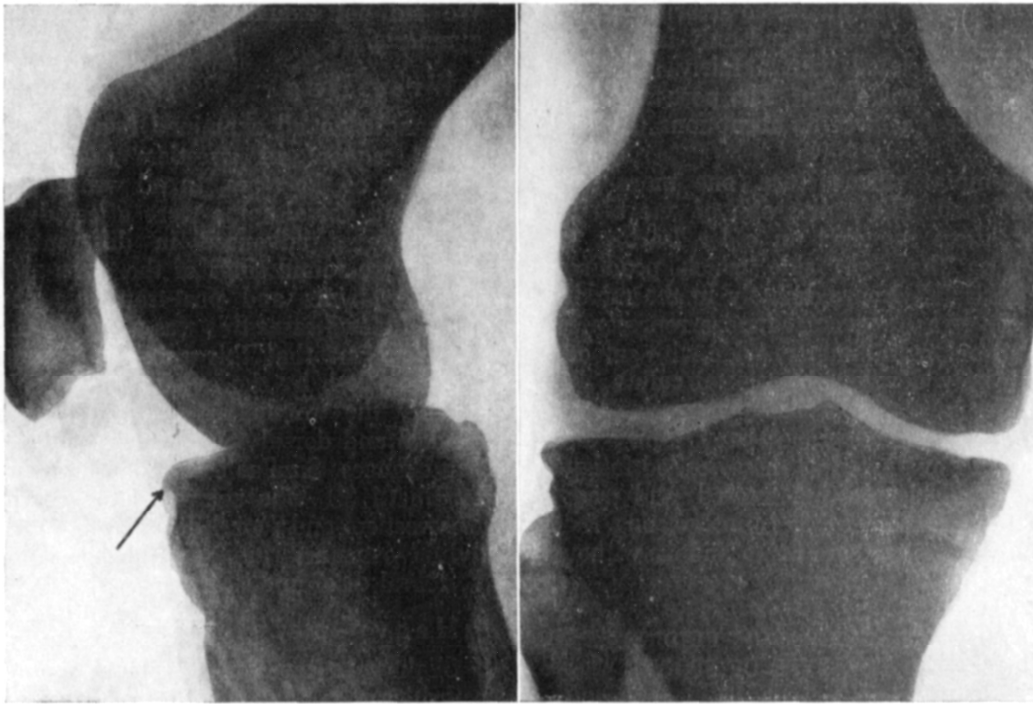


FIG. 11

Football player, 30, medium advanced osteo-arthritis of the right knee joint.

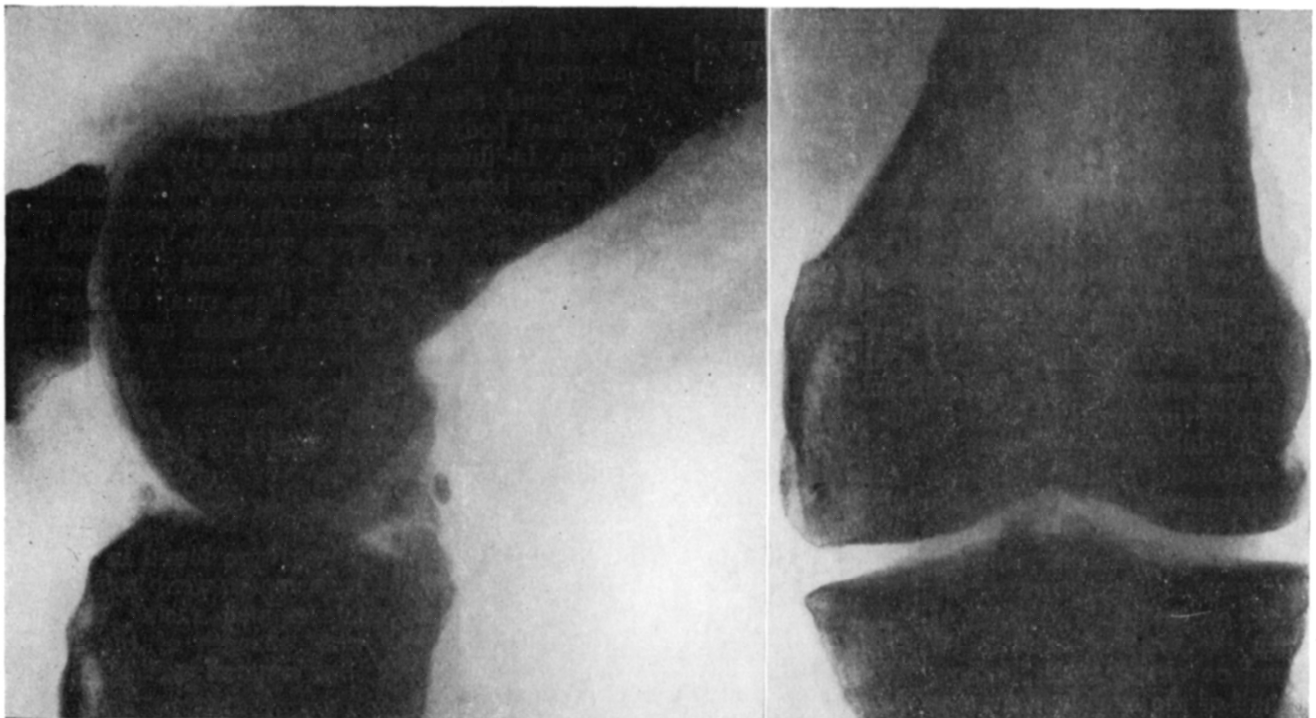


FIG. 12

Football player, 31, condition after a fracture of the lower end of the left femur with an advanced osteo-arthritis of the knee joint and chondromatosis.

ferent stage of development. Osteo-arthritis of the astragalo-navicular joint was found only in football players, mostly associated with a fairly advanced osteo-arthritis of the ankle joint. The post-traumatic changes were after fractures or abruptions (Fig. 13 and Fig. 14).

Ribs. To complete the picture, one more case must be mentioned. The radiograph of one of the heavy-weight lifters revealed an older fracture of the first rib on the right side which produced a pseudoarthrosis (5). Approximately in the middle of the rib there is a transversal fissure represented by clarification of a few millimeters wide with smooth edges and partially developed periosteal callus. The cause of this fracture was probably muscular traction. The athlete does not report any injury and the finding can be evaluated as the so-called fatigue fracture (4, 18) which was not treated, and transformed into pseudoarthrosis. It is interesting that this condition causes no complaint and is without influence on the performance.

II. ANALYSIS OF RADIOGRAPHIC FINDINGS ACCORDING TO THE TYPE OF SPORT

Light athletics

Light athletics were represented in our group by 3 runners (marathon, 1500 m, 400 m), and one walker. No characteristic changes were found in these groups represented only by a very small number of athletes. No pathological findings were made in the case of the runners, but the walker had a mild post-traumatic disfiguration of the vertebral body accompanied by light spondylitis osteo-arthritis of the dorsal spine. With view to the type of sport one can hardly consider this to be connected with it.

Gymnastics

Degenerative changes in the dorsal spine were found in equal proportion in men and women, in less than one half of the cases. The changes were therefore less frequent in gymnasts than would correspond to the average of the entire examined group. Jäger (11), who examined the entire vertebral column of 24 gymnasts, found a smaller number of degenerative changes (he took only the degeneration of intervertebral discs into consideration), but in addition to the changes in the curvature he encountered rather frequent conditions after Scheuermann's disease and spondylolisthesis, which we did not see in our group.

There was a considerable difference between the radiographic findings of wrists of men and women. These are probably a result of the difference between the type of exercise. While in women we found no changes, the findings were normal only in half of the examined men. In 3 cases there were post-traumatic conditions and in one case an osteo-arthritis bases on the accessory ossicle of the styloid process. Frequent changes were found on the ankle joints of men. In 3/4 we found osteo-arthritis of the ankle joint, exostosis of the upper surface of the neck of the astragalus or post-traumatic conditions.

We did not examine the ankle joints of female gymnasts.

Wrestling

Changes on all examined bones and joints were more frequent in wrestlers than in any other members of the team. In all wrestlers the cervical spine and dorsal spine were affected by degenerative changes advanced in different degrees. In 3 cases we found signs of the osteo-arthritis of the shoulder joints and post-traumatic conditions on wrists (in two cases this was a cyst in the scaphoid). It is evident that this sport is exceptionally demanding both by the overloading which it imposes and by the traumatization of certain part of the cervical and dorsal spine which produces degenerative changes. Similar conclusions were reached also by Buetti (6), who examined the cervical spine of 17 wrestlers and found degenerative changes (spondylitis osteo-arthritis and degeneration of intervertebral disc) in 13 cases.

Heavy-weight lifting

Slightly to medium advanced spondylitis osteo-arthritis was found in both heavy-weight lifters, in one case combined with condition after Scheuermann's disease. This shows that the corresponding part of the spinal column was more stressed in both heavy-weight lifters and this resulted in the described changes. The pseudoarthrosis of the first rib was described in the preceding paragraph.

Boxing

Degenerative changes in the dorsal spine were found in all boxers, but their changes were little advanced with one exception, where in addition we found also a wedge-shaped disfiguration of vertebral body evaluated as a post-traumatic condition. In three cases we found cyst-like changes of carpal bones, in two cases cysts of the scaphoid, and in one case minute cysts in os magnum and os pisiforme, which were probably produced by repeated strong impacts by the hand in the course of boxing. In our opinion these small changes in boxers correspond to those which are found in workers handling pneumatic hammers. According to Bláha (4) microscopic changes corresponding to the collapse of trabeculae of spongiosa appear first, later followed by small and larger cyst-like formations of necrotic origin.

Cyclistics

No characteristic changes were found in cyclists and such findings as were made, were isolated. In the group which we examined racing did not produce any pathological changes of the dorsal spine skeleton, wrist or knee joints of cyclists.

Rowing

Comparing the condition of the dorsal and of the lumbar spine of the rowers, we can see that degenerative changes were found twice as often on the dorsal spine than on the lumbar spine. More or less advanced combined degenerative changes

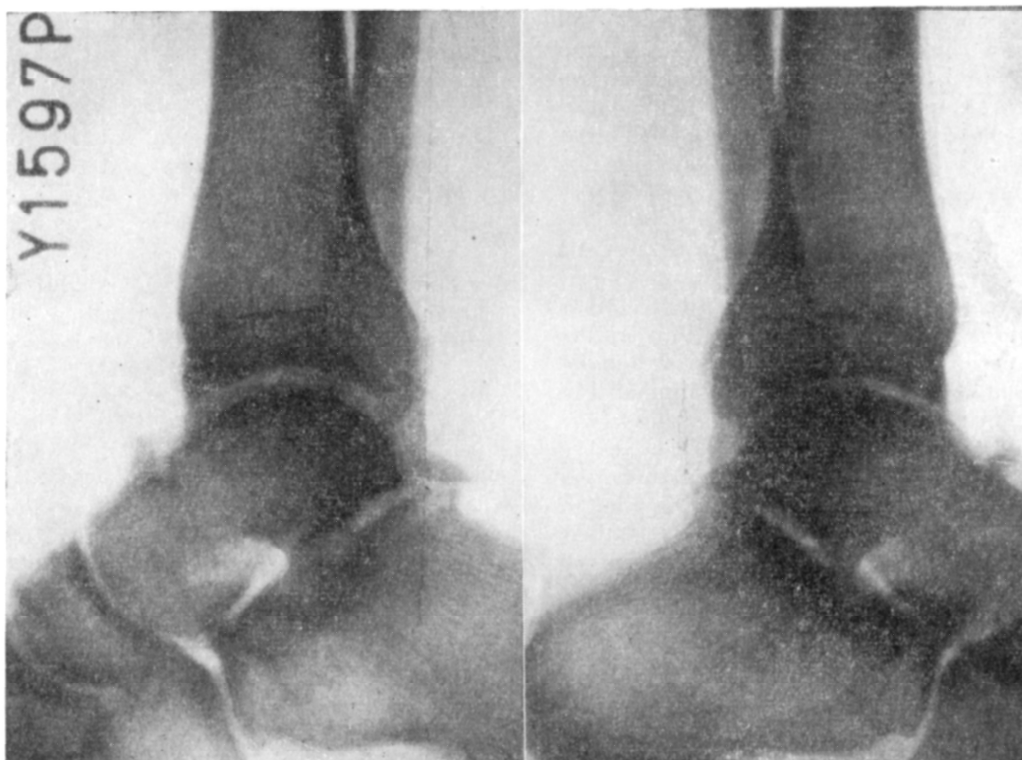


FIG. 13

Male gymnast, 28, osteo-arthritis of ankle joints, exostoses of the upper surface of the astragalus neck, bilaterally.

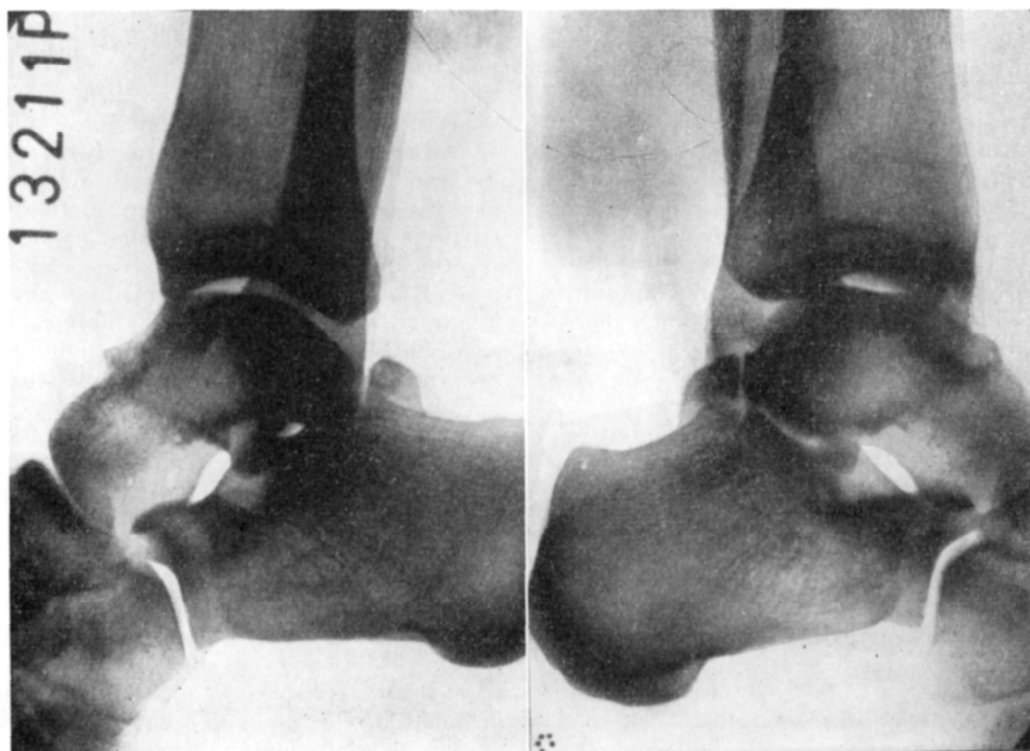


FIG. 14

Football player, 25, arthrosis of ankle joints, greater on the left side, exostoses of the upper surface of the astragalus neck bilaterally, os trigonum bilaterally.

of the dorsal spine were found in two thirds of all examined cases, three times we found a condition after Scheuermann's disease and in 1 case a wedge-shaped disfiguration of the vertebral body interpreted as a post-traumatic condition. On the other hand degenerative changes on the lumbar spine were found in less than one third of cases, once there was a wedge-shaped disfiguration of two vertebral bodies, also interpreted as a post-traumatic condition.

Comparing these findings with the observations made by Querg (16, 17) we can see that in the group which we investigated changes on the spinal column were more frequent. Querg examined 146 rowers, of whom 82 were men. He found degenerative changes in 46.3 per cent of men. The cause of the greater frequency of degenerative changes in the group which we examined may be due to our rowers being older (21—33 years) and to their representing the top-class, which underwent a very intensive training.

F o o t b a l l

Degenerative changes on the dorsal spine were found in less than one third of cases. Osteo-arthritis of the knee joint was present in three cases, post-traumatic conditions of knee joint four times. Comparing with the findings of Bartha (2), who examined 50 football players with 74 per cent of more or less advanced osteo-arthritis of the knee joint, we can see that our group shows a very low incidence of this disease. Osteo-arthritis of the ankle joint, however, were present in all players whom we examined, with the exception of the goal keeper. Fairly frequent were also other changes which are usually described in football players, such as osteo-arthritis of the astragalo-navicular joint which we encountered in somewhat less than one third of cases, and exostosis of the upper surface of the neck of the astragalus were present in more than one half of all cases. Os trigonum was represented twice in our group. A number of studies (Lajko and Kovacz, Medved and Petrovic, Crasselt, Kobbe and others) present an analysis of the condition of ankle joints of football players based on a relatively large number of examinations.

V o l l e y b a l l

The incidence of changes in volleyball players was striking. In particular there were frequent degenerative changes on the dorsal spine and conditions after Scheuermann's disease as well as post-traumatic wedge-shaped deformations of vertebral bodies. Dorsal spine could be described as normal in less than one fourth of all cases. In about one half of the players we found post-traumatic changes on wrists. Osteo-arthritic changes of knee joints were equally frequent in volleyball players as in football players, but less advanced.

This makes it evident that volleyball has an important influence on the development of pathological changes of the skelet, particularly on the dorsal spine. Other frequent post-traumatic changes are on the wrists. When analyzing the anamnesis

of volleyball players we found frequent reports of injuries particularly on hand and ankle joints. The changes observed on the spine are probably connected with the frequent overloading of it and its traumatisation by jumps, falls and fast movements in the course of the game and particularly when jumping.

S w i m m i n g

There were two findings of slightly to medium advanced spondylitis osteo-arthritica on the dorsal spine of swimmers. No other changes were found.

CONCLUSION

This study is concerned with the distribution of pathological changes on bones and joints in connection with different types of sport and athletics. It is based on the examination of athletes and sportsmen who at the time of examination were at the top of their form, and of whom some were awarded Olympic medals shortly afterwards. It is understandable that in all cases this necessitated hard training over several years. It may be assumed that this led also to a greater accumulation of pathological changes, which do not appear with the same frequency when the sport is performed without such high ambitions. This assumption is supported by a comparison with some other studies.

In our view the pathological changes on bones and joints are mainly due to microtraumas. At the same time we do not believe that it is possible to treat the overloading of tissue and injury as two mutually independent events. The chronic overloading of tissue and its fatigue result in a deterioration, so that the tissue is then more prone to microtraumatisation by sudden application of force. In the group which we examined it is evident that the radiological changes can be found mainly in sports where the skelet is stressed by jumps, falls on the upper extremities, sudden movement of the spine and large doses of fortifying exercise accompanied by large intensive loading and stressing. Loading alone without an acute application of force need not necessarily lead to pathological changes even through the training be very extensive; this is evident from the absence of pathological changes on the dorsal spine and knee joints of cyclists in our group.

However, it is probable that on the ground so prepared by overloading also the current influences of the everyday life have a greater effect and that with the progress of time these can lead to corresponding complaints and functional disturbances.

In future a greater attention will have to be paid to this question, particularly in certain types of sport a radiographical examination will have to be included in the preventive measures. Such radiographic examinations will have the aim of finding the initial signs of changes in bones, particularly in the spine. A timely treatment or modification of the training may prevent a deterioration of pathological changes.

Medical control and prevention of excessive overloading and of traumatization of certain parts of the skeleton will have to receive a greater attention when training systems are prepared and actual is training supervised. It appears further that various small injuries, often underrated by athletes and their training instructors alike deserve a much greater attention, because they may mean the beginning of pathological changes in bones. In such cases a timely treatment can prevent a greater damage.

SUMMARY

The members of the Czechoslovak Olympic team, numbering 85, were subjected to radiographical examinations of certain parts of the skeleton. The team included 4 light athletes, 8 male gymnasts, 7 female gymnasts, 4 wrestlers, 2 heavy-weight lifters, 5 boxers, 10 cyclists, 15 rowers, 14 football players, 13 volleyball players and 3 swimmers.

An analysis of the changes found in bones and joints led to the conclusion that the main responsibility for the origin of such changes belongs to so-called microtraumas, which appear particularly in connection with chronic overloading and fatigue of the tissue. Such condition of the tissue is in the first place produced by an incorrectly directed training.

The cervical spine was examined in wrestlers and in all cases more or less advanced changes were found, and diagnosed as degeneration of the intervertebral disc and spondylitis osteo-arthritis.

The dorsal spine was examined in all members of the team in lateral projection. In 53 per cent of cases we found changes in the form of degeneration of intervertebral disc, spondylitis osteo-arthritis or wedge-shaped deformities of vertebral bodies. Most frequent were such changes in wrestlers, volleyball players, rowers and boxers. Wedge-shaped deformities of vertebral bodies were found in 16 per cent of all examined, but they were most frequently in volleyball players and rowers.

The lumbar spine was examined in 18 members of the team (rowers, heavy-weight lifters and 1 male gymnast). The changes found were similar to those observed on the dorsal spine. In rowers changes on the lumbar spine were substantially less frequent than those on the dorsal spine. Also scolioses were more frequent in rowers (they appeared in more than half of the examined cases).

Shoulder joints were examined in wrestlers and in 3 cases there were signs of osteo-arthritis of the shoulder joint in a different degree of progress.

Wrists were examined in 50 members of the team and changes were found in 36 per cent. We found post-traumatic conditions, osteo-arthritis and cyst-like changes in the wrist ossicles, particularly in the scaphoid. The changes were the most frequent in wrestlers, volleyball players, gymnasts and boxers.

The metacarpal skeleton and the skeleton of fingers were examined in volleyball players and boxers.

In 3 volleyball players we found a post-traumatic condition, in 1 case a cyst in the basis of the metacarpal. In 1 boxer we found a post-traumatic deformity of the phalange of the finger.

Knee joints examined in light athletes, cyclists, football players and volleyball players were affected in 28 per cent of cases. We found osteo-arthritis of the knee joint and post-traumatic conditions. Changes were evident particularly in football players and volleyball players.

Ankle joints (examined in light athletes, football players and gymnasts) were affected in 76 per cent of examined cases. We found osteo-arthritis of the ankle and the astragalo-navicular joint, post-traumatic conditions and exostoses of the astragalus. Osteo-arthritis of the ankle joint was established in all football players with the exception of one. Frequent were also post-traumatic conditions and exostoses of the upper surface of the astragalus. Somewhat rarer was osteo-arthritis of the astragalo-navicular joint. In male gymnasts we found osteo-arthritis of the ankle joint and post-traumatic conditions in one half of the examined cases and also exostoses of the upper surface of the astragalus were more frequent.

The examinations demonstrated the connection of pathological changes on bones and joints with certain types of sport and when performed with top results. Most frequent were the changes in certain types of sport and athletics like wrestling, volleyball, rowing, boxing and football. Less frequent were similar changes in cyclists and light athletes.

SOUHRN

U 85 členů československého olympijského družstva bylo provedeno rentgenologické vyšetření některých částí skeletu. Vyšetření byli 4 lehcí atleti, 8 gymnastů, 7 gymnastek, 4 zápasníci, 2 vzpěrači, 5 boxerů, 10 cyklistů, 15 veslařů, 14 hráčů kopané, 13 odbíjenkářů a 3 plavci.

Na podkladě rozboru změn na kostech a kloubech byl vysloven názor, že hlavní podíl na vzniku těchto změn mají úrazy ve formě tzv. mikrotraumat, které se uplatňují zvl. při chronickém přetížení a únavě příslušné tkáně. Tento stav tkání je vyvolán především nesprávně vedeným tréninkem.

Krční páteř byla vyšetřena u zápasníků, u všech byly zjištěny změny ve formě různě pokročilé osteochondrózy, deformující spondylózy či spondylartrózy.

Hrudní páteř jsme vyšetřili u všech závodníků v boční projekci. U 53 % závodníků jsme našli změny ve formě osteochondrózy, deformující spondylózy, případně klínovitě defigurovaných obratlových těl. Nejčastěji byly tyto změny u zápasníků, odbíjenkářů, veslařů a boxerů. Klínovité defigurace obratlových těl jsme našli u 16 % závodníků, především u odbíjenkářů a veslařů.

Bederní páteř byla vyšetřena u 18 závodníků (veslaři, vzpěrači a 1 gymnasta). Zjištěny byly podobné změny jako na hrudní páteři. U veslařů jsme našli změny na bederní páteři podstatně méně

často než na hrudní páteři. U veslařů byly častější i skoliózy — více než v polovině případů.

Ramenní klouby byly vyšetřeny u zápasníků, u 3 byly zjištěny známky různě pokročilé omartózy.

Na zápěstích, které byly vyšetřeny u 50 závodníků, jsme zjistili změny v 36 %. Zjistili jsme zde pouřazové stavy, artrózy a cystická projasnění v zápěstních kůstkách, zvl. v os naviculare. Změny jsme našli nejčastěji u zápasníků, odbíjenkářů, gymnastů a boxerů.

Skelet metakarpů a prstů byl vyšetřen u odbíjenkářů a boxerů. U odbíjenkářů zjištěn 3× pouřazový stav, 1× cysta v bazi metakarpu. U jednoho boxera byla nalezena pouřazová defigurace článku prstu.

Kolenní klouby, které byly vyšetřeny u lehkých atletů, cyklistů, hráčů kopané a odbíjené, byly postiženy v 28 %. Zjištěny byly jednak gonartrozy, jednak pouřazové stavy. Změny byly nalezeny především u hráčů kopané a odbíjené.

Hlezenné klouby (lehčí atleti, hráči kopané a gymnasti) byly postiženy v 76 %. Zjištěny byly artrózy hlezenného a talonavikulárního kloubu, pouřazové stavy a exostózy talu. Artrózy hlezenného kloubu byly zjištěny u všech hráčů mimo jednoho. Časté byly i pouřazové stavy a exostózy horní plochy talu. Poněkud řidší byly talonavikulární artrózy. U gymnastů jsme našli artrózy hlezenného kloubu a pouřazové stavy v polovině případů, rovněž častější byly i exostózy horní plochy talu.

Vyšetření ukázalo vliv některých druhů vrcholného sportu na vznik patologických změn na kostech a kloubech. Nejčastější změny byly zvláště u některých druhů sportu, jako u zápasníků, odbíjenkářů, veslařů, boxerů a hráčů kopané. Nejméně často byli postiženi cyklisté a lehčí atleti.

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