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Case Report

Rare Femoral Erosions and Osteoarthrosis of the Knee Associated with Chondrocalcinosis

A Histological Study of this Cortical Remodelling

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Summary. An anatomo-pathological study of four cases of cortical erosions of the femur, radiologically similar to certain cases described in the literature.—These should be considered as a marginal erosive feature of femoropatellar osteoarthrotic remodelling.—The relation of these lesions to a possible nosological entity of "polyarthrosis + chondrocalcinosis" is discussed.

During the past few years, radiologists have observed certain curious grooves of the anterior cortex of the lower end of the femur [1–3, 5, 8, 9]. Reference to these has also been remarked in the literature. In all, they amount to about forty cases.

Of the seven cases which the author has observed personally, four have been the subject of anatomo-pathological studies which are presented here, with particular emphasis on their histology. In cases 1 and 2, a comparison has been made elsewhere of anatomical and radiological features, with more ample clinical information [6, 7].

Observations

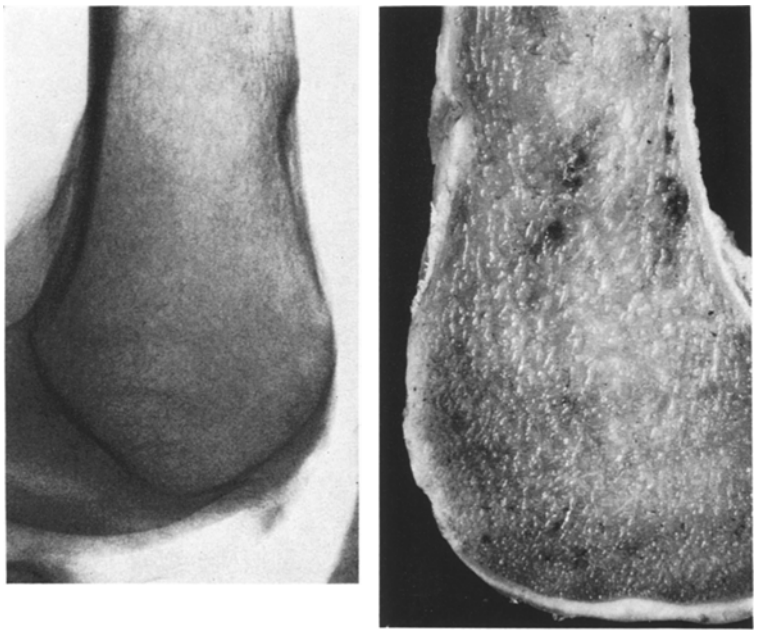
Case 1 (A 1029/68). Woman aged 78 years suffering from severely crippling bilateral osteoarthrosis of the knee for 20 years, who died following an operation for hiatal hernia. There was no information concerning the other articulations but it was known that at one time a diagnosis of rheumatoid arthritis was considered. The sedimentation rate was normal and the latex test negative.

Radiographs showed bilateral gonarthrosis, essentially femoro-patellar, with anterior femoral grooves (Fig. 1a) and meniscal chondrocalcinosis. Diffuse osteoporosis, trapezo-metacarpal osteoarthrosis and a Heberden's node on the left, and L4-L5 vertebral slip were also noted. The shoulders, hips, sacro-iliac joints and pubic symphysis were normal.

Autopsy showed femoro-patellar osteoarthrotic remodelling of both knees with mirror-surface burnishing of the exposed bones (Fig. 1b, 2 and 5). The groove consisted of two elements (Fig. 3 and 4):

— a segment of cortical deformation with well defined limits with respect to the rest of the cortex. Thickening in this segment was due to an old bone remodelling and explained the increase in radiological contrast (Fig. 4b and d). The subjacent bone was osteoporotic, with adipose bone marrow, but no signs of active remodelling.

— mild subperiosteal erosion, not accompanied by inflammation of the soft tissues (Fig. 4b and d). It involved the segment of remodelled cortical bone; above, it was clearly defined with respect to the normal cortex (Fig. 3c); below it was continuous with the burnished surface of the condyle (Fig. 5a). The synovial membrane was for the most part smooth; in contact with the cortical erosion it was umbilicated (with chondrocalcinosis deposits) (Fig. 2). There was no femoro-tibial osteoarthrotic remodelling. Chondrocalcinosis (meniscal, cartilaginous and synovial) was confirmed by histological examination and by x-ray diffraction (demonstration of calcium pyrophosphate crystals).



a b

Fig. 1 a and b. Case 1. Distal end of left femur. a Post mortem radiograph of profile of specimen. Groove on anterior surface of the femur. b Para-median sagittal section. Erosion with angulation of the cortex. On the patellar surface osteosclerotic remodelling of the exposed bone. Lower on the condyle, cartilage layer preserved

particularly of hip and knee joints. No other information. Death was due to pulmonary oedema.

Radiographs showed bilateral osteoarthrosis of the knee, essentially femoro-patellar, with anterior femoral grooves (less well marked than in Case 1) [6, 7] and meniscal chondrocalcinosis. In addition, there were diffuse osteoporosis, acromio-trochitereal osteoarthrosis of the right shoulder, left metacarpo-phalangeal osteoarthrosis and discrete Heberden's nodes on the right. The sacro-iliac joints, feet and hips were normal, apart from some chondrocalcinosis deposits in the hip joints.

Autopsy showed femoro-patellar osteoarthrotic remodelling of both knees similar to that in Case 1 [6,7]. The bilateral grooves corresponded to the same histological lesions: deformation (in this case more incurved than angular) of a segment of remodelled cortex; superficial erosion with little activity, without inflammation of the soft tissues. The subjacent bone was oporotic but otherwise normal.

The synovial membrane appeared to be mainly normal, or in parts slightly velvety, but with adhesion at the eroded area. There was no femoro-tibial osteoarthrotic remodelling. Chondrocalcinosis was confirmed histologically and by x-ray diffraction.

This autopsy also confirmed the existence of the left metacarpo-phalangeal osteoarthrotic remodellings, with chondrocalcinosis.

Case 3 (A 367/72). Woman aged 84 years, diabetic, with inflammatory swelling of the hands (carpal, metacarpo-phalangeal), the feet (metatarso-phalangeal) and of the knees. There was ulnar deviation of the fingers. The latex test was negative. Death was due to bronchopneumonia.

Radiographs showed bilateral femoro-patellar osteoarthrosis with cortical erosion on the left (Fig. 6) and marked femoro-tibial osteoarthrosis on the right. Further radiological findings were: diffuse osteoporosis, osteoarthrosis of the left hip, bilateral gleno-humeral osteoarthrosis

Fig. 2. Case 1. Distal end of left femur. Lateral para-median sagittal slice, anterior view. Above: Normal periosteal femoral surface. Below: Exposed and burnished bone of patellar surface. Middle: Zone of erosion covered by umbilicated synovial membrane, with chondrocalcinosis deposits

with synovial chondromatosis on the left, osteoarthrosis of the wrists with chondrocalcinosis, and a few Heberden's nodes.

Autopsy of the knees showed osteoarthrotic remodelling, femoro-patellar in both and femoro-tibial on the right. On the left, there was a femoral groove histologically similar to those in the previous cases. Here, the osteoarthrotic condyle was not burnished but covered by a thin layer of remodelled cartilage.

Chondrocalcinosis was confirmed on both sides by x-ray diffraction. This autopsy also confirmed the osteoarthrosis of the left hip, the bilateral gleno-humeral osteoarthrosis, radiocarpal and intra-carpal osteoarthrosis on the left and inter-somatic vertebral osteoarthrosis.

Case 4 (A 140/59). Woman aged 83 years. Suffering for some years from "rheumatism" leading gradually to painful deformation and stiffening of all her joints, particularly the two knees. Ulnar deviation of the fingers. No latex test. Death was due to bronchiolitis.

Radiographs showed osteoarthrosis, essentially femoro-patellar, of the left knee (no radiograph of right). The right hand (left hand not radiographed) showed scaphoido-trapezial osteoarthrosis and Heberden's inter-phalangeal osteoarthrosis. Radiographs of the two shoulders were normal.

Autopsy of the left knee showed lateral femoro-tibial and femoro-patellar osteoarthrotic remodelling; the latter with burnishing of the exposed bone and a superior osteophyte. In

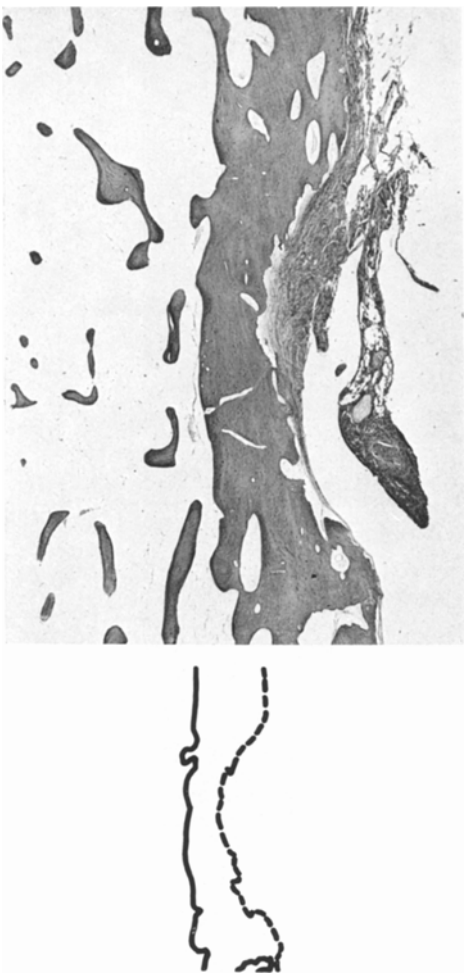


Fig. 3. Topographical histology of the supratrochlear cortex. Case 1. Left femur erosion and slight angulation of a thickened cortex, amplifying the macroscopic and radiological features seen in Fig. 1. The subjacent bone is osteoporotic but shows no abnormal histological remodelling. Fibrous fringe corresponding to an aspecific synovial hyperplasia. Van Gieson, × 11. Diagram: Continuous line = normal surface. Broken line = eroded surface

Fig. 4a—d. Case 1. Detailed histology of the left anterior cortex of the femur. Haematoxylin and Eosin × 80. a Cortex above the eroded zone, covered by fibrous periosteum. No abnormal erosion. b Cortex in the central part of the eroded zone. Lines of suture reflecting former remodelling. Indentation of bony surface; the latter separated from the fibrous periosteum by fibroblastic tissue, no osteoclasts being visible in the plane of this section. c and d The same segments as (a) and (b) respectively, examined under polarized light. In (d), the bone lamellae appear quite clearly to be broken off

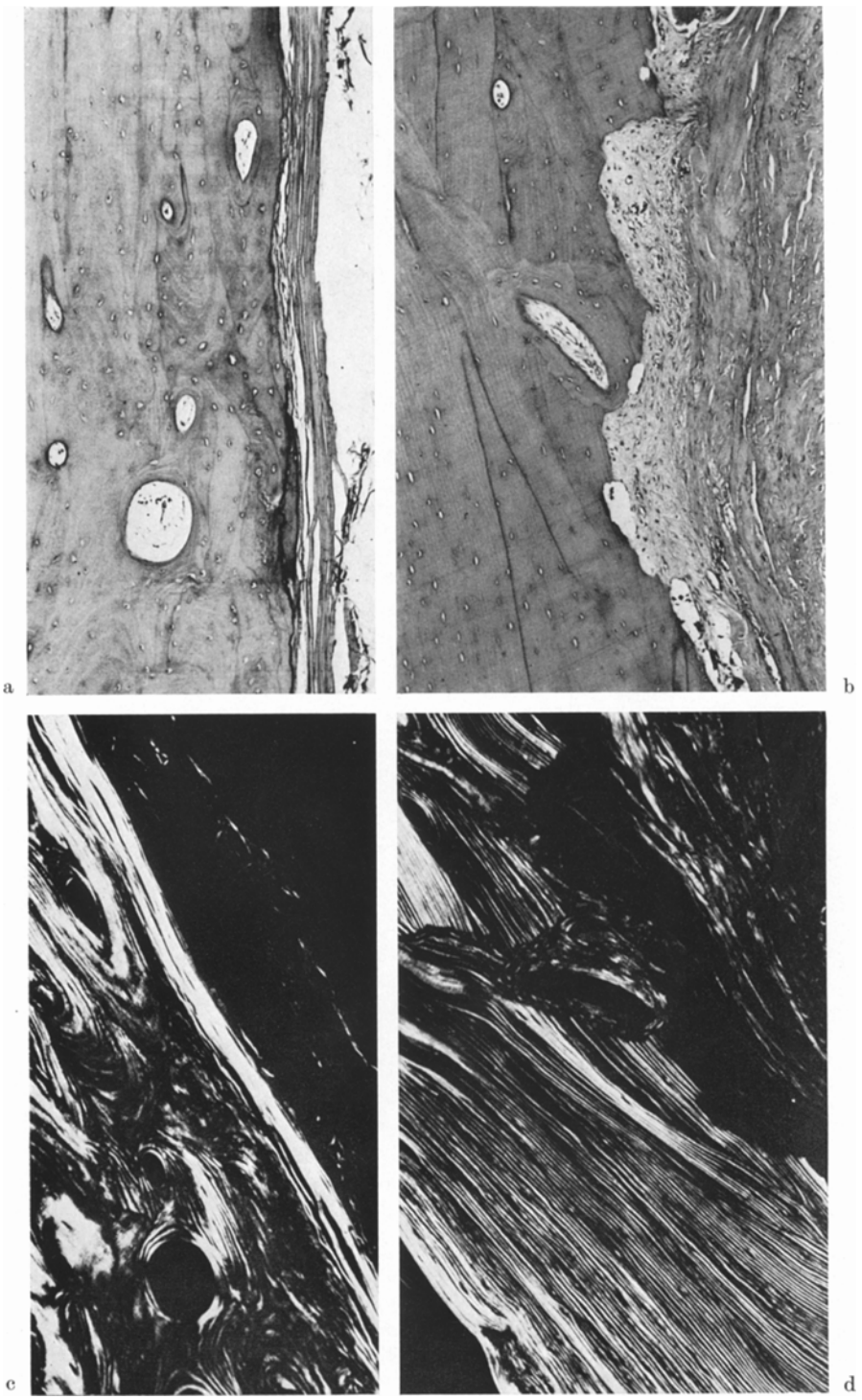


Fig. 4a—d

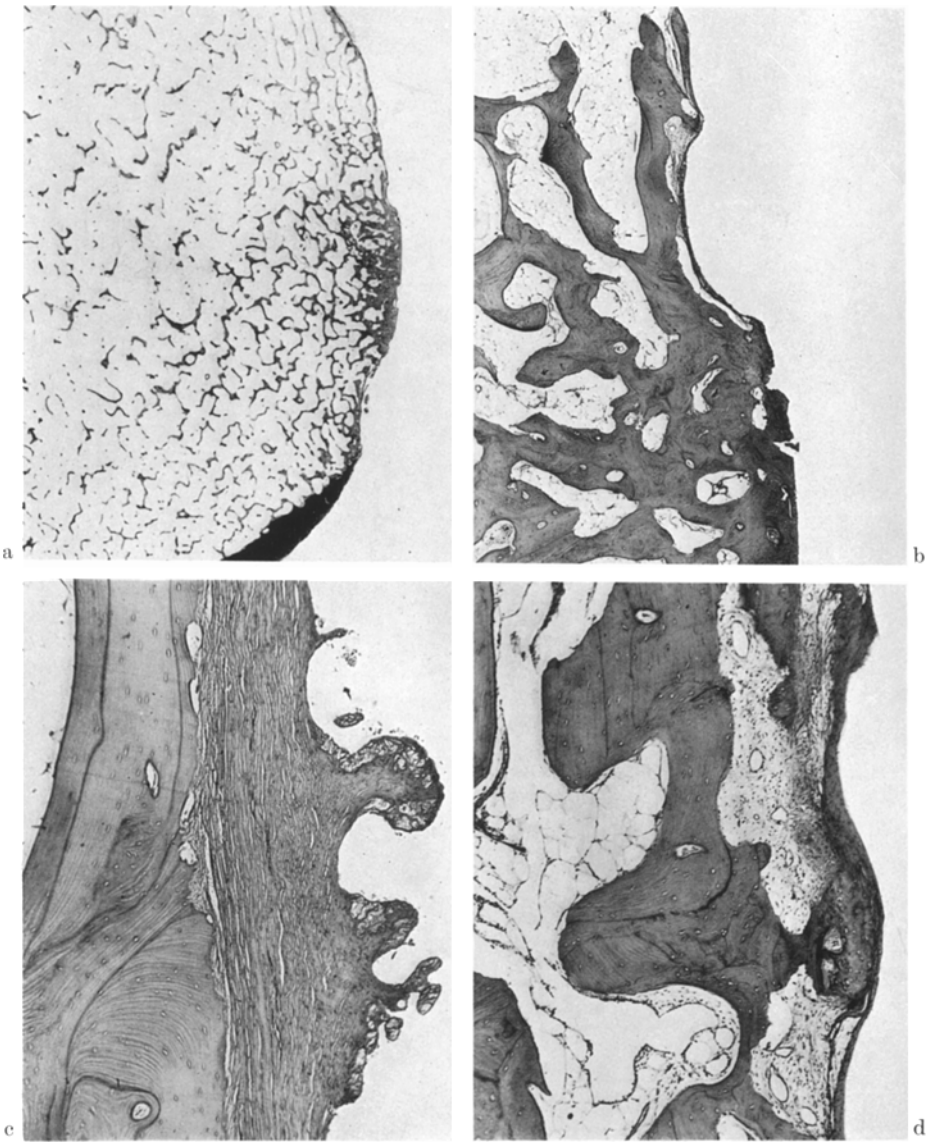
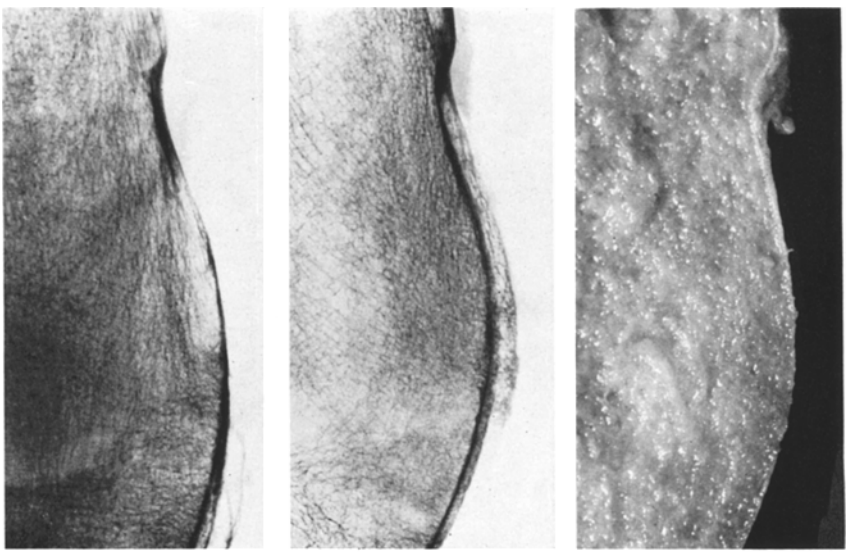


Fig. 5a—d. Case 1. Histology of osteoarthrotic remodelling, left knee. Haematoxylin and Eosin. a Remodelling of bone deprived of its articular cartilage. In continuation of that shown in Fig. 3b, all of the cortex is eroded. Central segment of osteosclerotic burnished bone. Amplifies radiograph and macroscopic aspect shown in Fig. 1. × 2.5. b Upper marginal area of burnished surface mentioned in Fig. 5a. Fibrous pannus covering eroded bone. × 24. c Detail of upper part of Fig. 5a. Cortex, formely remodelled, eroded and covered by fibrous periosteum, continuous with the fibrous pannus of Fig. 5b × 77. d Detail of the lower part of the eroded zone Cortex, formerly remodelled, interrupted by an erosion and flanked by newly formed bone. The fibrous surface layer is a continuation of that shown in Fig. 3b, superior, and in Fig. 5c, inferior. × 59



a b c

Fig. 6. Case 3a—c. Distal end of left femur. Anterior surface of specimen, post mortem. a Radiograph of profile. b Radiograph, oblique ($^3/_4$). Osteosclerotic condylar remodelling. c Para-median sagittal section. Inflexion of the cortex at the level of the cortical groove

spite of the absence of radiological evidence on the few films available, a cortical groove was found presenting the same histological characteristics as in the other cases (Fig. 7). The right knee was not autopsied. The autopsy also revealed an osteoporosis; there was no osteoarthrotic remodelling in either of the shoulders.

In this case, chondrocalcinosis was not evident either from the radiographs or at autopsy; however, as it was based on fragmentary documents, a formal conclusion cannot be drawn.

Discussion

These anatomo-pathological observations eliminate trauma, infection or tumors as causes of the grooves. They cannot be attributed to compression due to effusion, or to the erosion of a pigmented villonodular synovitis. Malformation can also be excluded by the presence of limited but unmistakable bone remodelling, by their integration in the clinical picture, and by their relation to femoro-patellar osteoarthrotic remodelling.

Clinical and Radiological Aspects. These curious grooves are seen in a particular context. The author's personal observations, in conjunction with those found in the literature, indicate that they arise mainly in women over 70 years, suffering from osteoarthrosis of the knee [7]. This osteoarthrosis affects the femoro-patellar articulation in all cases, whereas the femoro-tibial is rarely involved. It is always bilateral even in the rare cases where the groove is found only on one side. They are frequently associated with other osteoarthroses and, although this point is not yet sufficiently documented, suggest an evolution within the framework of a "poly-arthrosis".

Attention is drawn to the presence of chondrocalcinosis in six of the seven cases (the documentation in the seventh case being inconclusive). This association

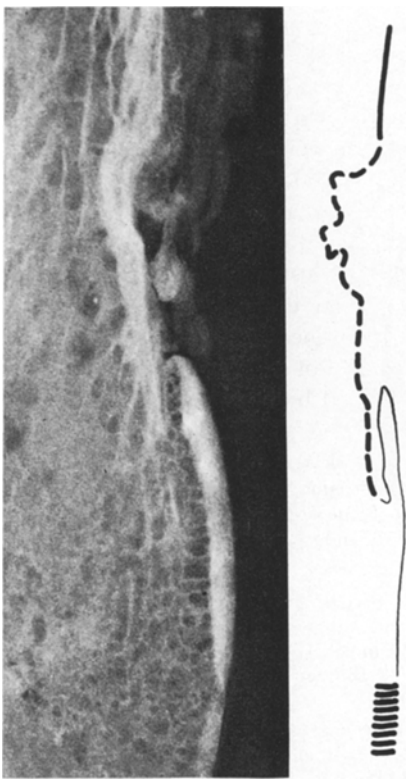


Fig. 7. Case 4. Distal metaphysis of left femur. Haematoxylin and Eosin, × 3,5. Above: anterior cortex, normal. Below: trochlear surface of exposed, burnished bone with an osteophyte above (itself covered by newly formed cartilage). Middle: erosion histologically similar to that in Fig. 4b, with a fringe of synovial membrane in aspecific hyperplasia. Diagram (according the histological aspect): Thick and continuous line = normal bone surface. Thick and broken line = eroded bone surface. Thin line = osteophytic bone surface. Hatched = burnished exposed bone

appears to have escaped notice in most of the literature but has already been pointed out by Ahlgren [1].

Situation in Relation to Femoro-Patellar Osteoarthrotic Remodelling. As all these anatomo-pathological studies have shown, the groove corresponds to the superficial erosion of a remodelled cortical segment which is sharply defined above and in depth, but below is linked to the remodelling of the arthrotic condylar surface.

Thus, it may well be considered as a marginal zone of this osteoarthrotic remodelling which, in certain cases, would not be represented by the usual osteophyte; association of such osteophyte with erosion has, moreover, been described [4] and Case 4 is an example of this. These lesions are therefore quite similar to what would be seen on an osteoarthrotic femoral head where the lateral zone may also, but infrequently, be erosive and not osteophytic.

Conclusions. This erosion implies an abnormal contact of the upper edge of the patella with the femur, which can be observed in certain radiographs [5, 8, 9]. Signs of an old bone remodelling deep in the eroded cortex also reflect the mechanical load imposed by this repeated contact.

As normally there is no convergence of the femur and the patella during extension of the knee, this contact by the upper part of the patella implies a deterioration of the femoro-patellar articular cartilages and a change in the axes of movement; this deterioration does not however provide a full explanation as in many cases of femoro-patellar osteoarthrosis there is no erosion.

In the probability that the existence of "polyarthrosis + chondrocalcinosis", as an entity, could be established, it would be interesting to investigate whether it upsets the internal balance of the knee and leads to femoro-patellar osteoarthrosis, sometimes accompanied by cortical erosions of the femur.

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