

THE INCONGRUOUS HIP

BY

POUL MORVILLE,
M. D.

It is a well known fact that the hip holds a special position in the pathology of the joints on account of the frequent occurrence of deforming affections causing changes in the form of the articular surfaces to such a degree and of such variation as are unknown in any other joint.

It also strikes the observer that while a radiogram of a normal knee-joint, ankle-joint, etc. presents surprisingly constant configurations (the variation in the thickness of the bones apart), the radiogram of the normal hip-joint reveals to the close observer numerous variations in the details: variations in the height and width of the femoral head, in the thickness and length of the collum, in the angle formed by the neck and shaft, etc.

The variations are specially pronounced during the age of growth, and most so before the age of seven. It is really not until after that age that the normal hip shows a fairly constant type in the roentgen picture.

It was *Julius Wolff* who first put forward the doctrine of the functional adaptation of the bones and pointed out the great importance of the functional demands as regards the form and structure of the latter.

The variable picture presented by the socket and head of the femur during first years of childhood makes it natural to assume that the functional demands on this joint are specially severe, or, in other words, that the construction of the joint is

not well adapted to its purpose, which results in an unusual functional transformation of the joint. Possibly it is the upright walk especially that is »unpractical« for the shape of the hip-joint.

If these views hold good as regards the normal hip, it will be easily understood that even a small congenital anomaly in the joint may give rise, later on, to considerable malformations and affections in the hip. Those authors who ascribe many of the mysterious hip affections principally to conditions of anatomical statics would thus seem to be justified in claiming greater attention than has hitherto been accorded them.

*Murk Jansen*¹⁾ is the one who has most consistently advanced such views. He draws attention specially to numerous details, until now quite overlooked in the roentgen picture of the hip, and explains their meaning. Even if one does not always agree with him in his interpretation, one will after a thorough study admit having been, in most instances, confronted with realities of pathological signification, and that he has greatly added to our understanding of the hip affections.

Murk Jansen finds that the principal cause of a series of hip affections lies in the congenitally abnormally flat acetabulum causing incongruence of the articular surfaces. The acetabulum is flat either because its floor is too thick, or because the socket is wider than normal without any corresponding increase of its depth.

In the flat (wide) acetabulum the osseous support of the femoral head will be less solid. Instead of the normal condition, where the socket tightly encloses the greater part of the cartilage-covered caput, which has the same curves as the socket, the relation between the flat acetabulum and the caput may be compared to that between a cup and a saucer. The surface over which there is any osseous contact is considerably diminished, being limited to a small area of the upper lateral part of the femoral head, upon which rests a corresponding part of the »roof« of the acetabulum.

¹⁾ »The Large Brain, the Wide Pelvic Girdle and the Outstanding Number of Hip Anomalies in Man«. Journ. of Bone and Joint Surgery Bd. 9. Nr. 3. 1929.

On account of the flattening of the socket there will be seen in the roentgen picture, in the lower medial part of the joint, a wedge-shaped gap between the acetabulum and the femoral head (marked, in Fig. 1, with a star). While, normally, the body weight is, through the pelvis, transferred to the whole circumference of the femoral head, the whole stress will, in such case, have to be carried by the above mentioned small area of contact. The consequences of these unsatisfactory statics depend on the strength of the bones, which varies very much even in »normal« subjects. Enfeeblement of bone manifests itself first and fore-

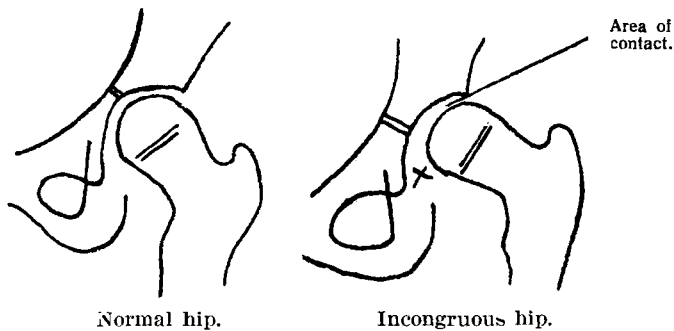


Fig. 1.

most in disturbances in the growth disc, resulting, in the mildest form, in excessive irritability with resulting abnormally rapid growth, in more pronounced cases causing a decrease or irregularity of growth on account of less power of resistance against the pressure. This is observed especially where the growth takes place most rapidly; namely, in the lower femoral epiphysis. Here the static pressure is greatest externally and the growth therefore decreases mostly in the lateral half of the epiphysis, which then gets lower than the mesial half, and the consequence is genu valgum.

In the highest degree of enfeeblement of skeleton the growth in all discs decreases, and we get dwarfism. At the same time, the bones often get so soft that they bend under the influence of the weight, as seen in rachitic children.

The excentric pressure in a hip-joint with flat acetabulum

leads, as seen in Fig. 1, to increased pressure on the caput femoris upwards and laterally, and to decreased pressure downwards and mesially. Thence a decrease of growth laterally, and increased growth mesially. The growth disc turns upwards from its normal position (nearly at a right angle to the axis of the



Fig. 2.

Female, 18 months old. Flat acetabulum with thick floor, lateral position of the head.

femoral neck) towards the horizontal plane. For the femoral neck this means a lengthening of its mesial and a shortening of its lateral half.

In the upper mesial angle of *the femoral neck* a chin-shaped (*M. J.*) eminence develops, which is very characteristic of the incongruous hip. In less serious cases this eminence quite fills out the before mentioned gap downwards in the joint, so that

»the chin« touches the acetabulum. The incongruence is thereby eliminated, as the caput and the mesial part of the collum together form an articular surface corresponding to the flat socket.



Fig. 3.

Same patient 8 years later. Raising and flattening of the epiphysis; the growth disc raised in horizontal position.

Through the upward rotation of the femoral head a portion of its upper part will project beyond the upper acetabular edge. *Calot* considers this peculiarity to be congenital: »subluxation congénitale«. The femoral head gets an upright position on the collum (head-in-neck position).

These changes in the femoral head and neck may thus be

explained through the irregular growth resulting from the excentric pressure on the femoral head. Furthermore, the static forces will, according to *Murk Jansen*, give the femoral neck a tendency to rise in the valgus position.

What effect the congenital flat acetabulum will have on the hip-joint depends partly on the degree of the deformation, partly on the strength of the bones.

In cases of serious disturbances to the growth (rickets), the epiphysis is very sensitive, and the changes described with regard to the form and position of the femoral head will appear

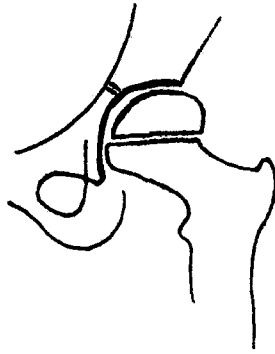


Fig. 4.

The growth disc horizontal. Chin-shaped process mesially on the femoral neck. Broad, flat femoral head extending on the upper surface of the collum and projecting laterally beyond the acetabulum.

in a pronounced degree. Of greater practical importance, however, is the coxa vara caused by the softness of the bone.

In cases of moderate enfeeblement of the skeleton, the femoral neck keeps its form; the result of the incongruence manifests itself in decrease of growth in the lateral part of the femoral epiphysis, resulting in a horizontal growth disc, »chin formation« in the mesial angle of the collum, etc. Fig. 5.

In the mildest degree of enfeeblement of skeleton the growth disc, as already mentioned, is not influenced so strongly by the excentric pressure as to cause deformation (and adaptation) of the femoral head in early childhood; but owing to the still existing incongruence the static forces bring about

the raising already mentioned of the femoral neck in the valgus position.

In individuals with bones of full normal strength the congenital flat acetabulum does not give rise to any of the above mentioned malformations during growth; the bones are able to develop normally in spite of the unfavourable static conditions. On the other hand, the incongruence still remains, and sooner or later the cartilage wears thinner on account of the increased



Fig. 5.
Male, aged six.

pressure on the diminished area of contact, the joint-line gets narrower, the amount of lime salts decreases, the bone becomes plastic, and the femoral head assumes the flat form of a mushroom; in short, *malum coxæ senile*. It must be emphasized, however, that this affection often appears when the patient is about 40 years old or even earlier. It must be clearly distinguished from the arthrosis which is a link in a simple chronic rheumatic affection.

The shape of the femoral end which arises in cases of *moder-*

ate feebleness of growth is, as already mentioned, characterized by a horizontal growth disc, a chin-shaped eminence at the inner angle of the femoral neck, and flattening of the femoral head. The very strong muscles inserted mesially into the femur below the trochanter, the adductors in particular, contribute very largely to keeping the caput in the acetabulum. In the case of a horizontal and »enfeebled« growth disc, this muscle contraction may result in a tendency of the femur to be drawn over mesially in relation to the femoral head. This will cause a dislocation of the femoral head laterally in relation to the neck, which may eventually be furthered by a trauma. According to Murk Jansen, this dislocation of the caput is the initial stage towards the origination of coxa plana (Calvé-Perthe's disease). The dislocation of the femoral head must necessarily result in circulatory disturbances in the latter, leading to the well known changes seen in roentgen pictures of the caput in this disease: rarefaction of lime salts, alternate clearings and density; and on account of the plasticity the femoral head adapts itself to the acetabulum, becomes wide and flat. According to Murk Jansen, the slipping epiphysis proper occurs in cases of flat acetabulum and slight feebleness of growth with development of coxa valga, when this is combined with ante-flexion of the femoral neck.

Murk Jansen gives the following reasons for his hypothesis.

1) An abnormal, strongly flattened socket is a constant phenomenon in cases of congenital hip luxation. It is reasonable to suppose that there are numerous transitional forms between this strongly pronounced malformation and the absolutely normal socket. It is also probable that these transitional forms have a pathological signification.

2) Very often the above mentioned affections appear in several members of the same family.

3) Frequently one finds in the same individual one of the above mentioned affections on one side, and another of them on the other side; i. e. coxa vara and coxa plana, coxa valga and slipping epiphysis, etc. Fig. 6. If one of the above affections

is found on one side, an anatomically normal hip will hardly ever be found on the other.

The thing which to us seems most noteworthy in *M. J.*'s hypothesis is his pointing out of the incongruous hip with the excentric and increased pressure on the lateral half of the femoral head, and the resulting anomalies of growth and form.



Fig. 6.

Male, aged twelve. Flat socket on both sides, most pronounced on left side. Coxa vara on left side, coxa valga on right side.

The *Hüter-Volkman* law, according to which increased pressure causes a local decrease of growth, has previously been appropriated by *Mikulicz* in his explanation of the origination of genu valgum.

Interesting experimental investigations concerning the influence of abnormal pressure on young bones have been made by *Walther Müller*. Resection of the radius in cats caused the ulna to become overburdened, and in the course of 4 weeks the growth disc of the ulna became twice as thick as on the control

side. Roentgenologically as well as histologically the same changes were observed as in rickets. As the calcification and the absorption of the calcified cartilage, which is the qualification for bone formation, ceased, the cartilage layer became thicker. (An interesting example of changes in the epiphysis caused by abnormal stress is given in Fig. 7).

The same changes in the bones may, as we know, be brought about by widely different phenomena, such as thymus extirpation, food deficient in lime and very acid, want of light and air, etc.

From different sides it is now maintained that skeletal changes in rickets, »Spätrhachitis« and osteomalacia are identical, being merely three forms of manifestation of the same bone affection. Their seeming peculiarities are due to the different age at which they make their appearance. Thus, in osteomalacia the scarcity of lime salts is not due to resorption, as formerly believed, but depends on the fact that the bone deposition, which throughout life continues parallelly with the bone resorption, during the disease proceeds abnormally, owing to the failure of the calcification and ossification to take place. The changes are thus in no way specific. *Bauer* sums them up under the name of »calciprival osteopathy«.

Besides the already known changes in the epiphysis, appearing in the above named affections, *Looser* draws attention to some ribbon-shaped transparencies in the roentgen picture, running radially to curved bones. They are often taken for fractures, but are in reality uncalcified membrane bones developed as a reaction against strong mechanical irritation. The latter causes increased lacunary resorption, with which the calcification and bone deposition cannot keep pace. The transparencies are called transformation areas and have been observed by *Looser* in rickets and osteomalacia. *Walther Müller*¹⁾, while making the above mentioned experimental investigations on cats, also produced them in normal bones in cases of great pressure.

Maas expresses the same idea clearly in saying: *Pathological-*

¹⁾ »Die normale und pathologische Physiologie des Knochens«. Leipzig 1924.

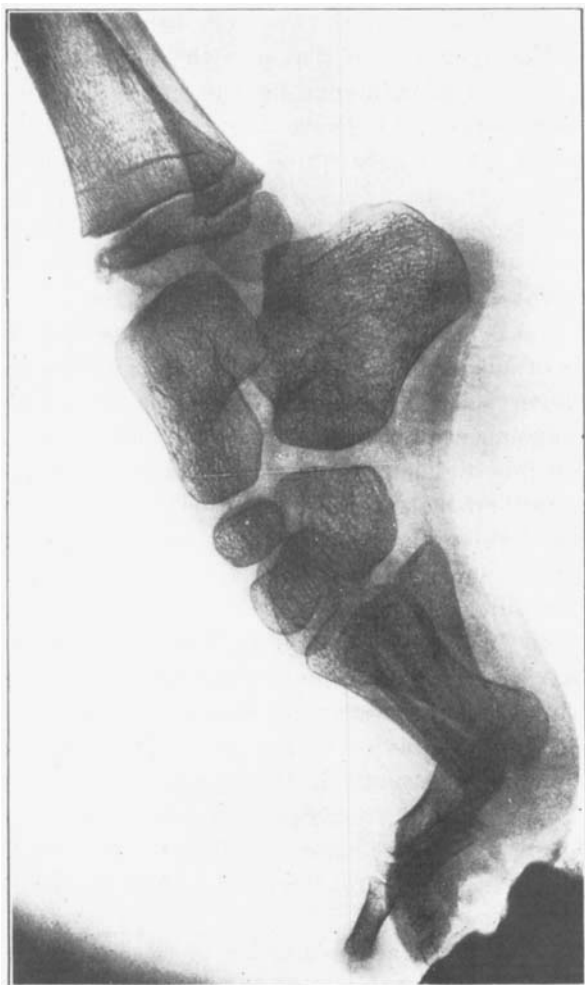


Fig. 7.

Female, aged six. Fixed pes equinus. Example showing the influence of increased pressure on the epiphysis. Strong pressure on the anterior third of the epiphysis of the tibia. The anterior third of the growth disc is broad, but the epiphysis flattened, with small round dark spots.

ly great stress has the same mechanical effect on the growth of sound bones as the physiological stress on soft rachitic bones.

I think that in investigating the consequences of the incongruous hip-joint, the points of view here cited will have to be taken more into consideration than done by *Mark Jansen*.

It should be remembered that also the joint cartilage must be considered as a growth zone for the epiphysis. Histological investigations made by *Fromme* show that in the depth the joint cartilage passes into quite the same structure as the cartilaginous epiphysis.

After the period of growth is ended, the growth elements for the most part disappear, but small quantities of them remain present throughout life in order that the physiological resorption and deposition of bones may be preserved.

In cases of abnormal stress the lacunar resorption increases. The consequences of this will then depend on the ability of the organism to compensate with increased bone deposition. In case it cannot do this, the bone tissue will be more deficient in lime salts, there will be more cartilage and osteoid tissue and, as a result of the greater plasticity of these, successive deformation of the articular surfaces.

When absolutely normal bones do not change their form in spite of incongruence in the hip-joint, I think this is due to the organism having been able to compensate for the greater resorption resulting from the increased pressure. When the pressure increases, owing to heavier weight or hard bodily work, the compensation fails, however. It is natural that the decreasing vitality following with the advance of years, and the physiological involution, especially of regenerative elements of tissue, should also have the same effect, and thus give rise to the development of *malum coxæ senile*.

Thus the most natural explanation of the narrow joint-line will be the involution of the cartilage. The current explanation — cartilage wear — seems more doubtful.

Also *coxa plana*, the hip affection whose pathogenesis has been the object of the most numerous investigations, but which still remains as enigmatic as ever, can be very well explained,

it seems, as a calciprival osteopathy resulting from increased pressure in an incongruous hip.

The roentgenological changes following the advancing dissolution of the nucleus of the epiphysis, the reduction in lime salts and the clearings, absolutely suggest disturbances in the

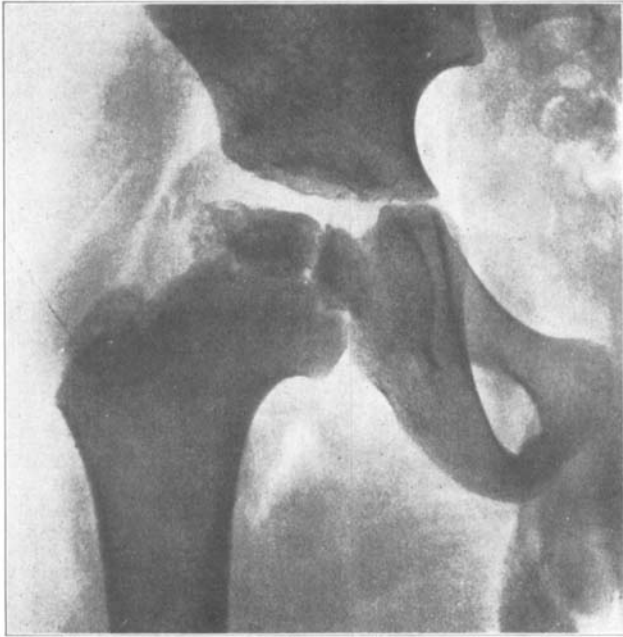


Fig. 8.

Male, aged seven. Coxa plana. Linear clearing simulating fracture.

endochondral ossification. It should be noted that the changes start and get most pronounced in the lateral half of the epiphysis, just where the incongruous hip is exposed to the increased pressure.

The wellknown linear transparencies, of which the one most often occurring divides the epiphysis into a smaller mesial and a larger lateral part, are quite similar to the transformation areas which *Looser*, as already mentioned, found in rachitis and osteomalacia, and *W. Müller* in cases of normal bones ex-

posed to heavy pressure. Also in coxa plana several authors interpret them as fractures in the epiphysis.

It is now generally acknowledged that in the course of a coxa plana changes occur in the acetabulum quite similar to

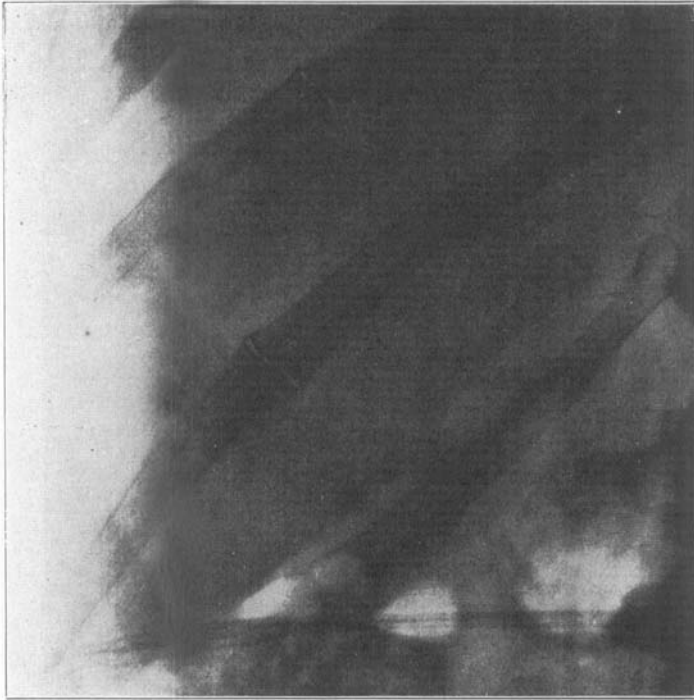


Fig 9.

Female, aged thirty-nine. Osteomalacia. (Obs. Rigshospitalet). Transformation zones in 11th and 10th ribs.

those in the epiphysis. Also these are naturally interpreted as ossification disturbances due to increased pressure on the joint cartilage which, as already mentioned, must be considered as growth zone for the adjacent bones. It is to be observed that *Murk Jansen* denies these acetabular changes; but their presence need not in any way invalidate his conception of the pathological signification of the congenital flat acetabulum. When he maintains that in coxa plana the epiphysis undergoes

complete necrosis on account of its displacement, this can perhaps not be denied in the most serious cases, but the accompanying changes in the collum, and the acetabular affections mentioned, cannot be explained in this way. To me it seems more natural to interpret the changes in all three places as ossification disturbances.

Furthermore, to me there is no doubt that less pronounced



Fig. 10.

Male, aged five. Coxa valga. Large dark spot in the left epiphysis, small similar changes in the lateral part of the epiphysis and the collum near the epiphyseal line.

malformations of the same character as those resulting from coxa plana — the broad, flat head, the short and thick neck — may develop without the more acute, so-called fragmentation stage being necessary as an intermediate link, as has also been pointed out by *Flemming Møller*.

Besides, I have several times observed in coxa valga and other hip affections appearing during childhood slighter degrees of similar changes in the shape and structure of epiphysis, which becomes flatter and broader than normal. Fig. 10. Thus, there

must have been a period of increased bone plasticity, suggesting a disturbance in the ossification resulting from the abnormal pressure in the incongruous hip. It has often been observed that in a dislocated hip there may occur in the epiphysis changes similar to those seen in coxa plana. This, too, suggests ossification disturbances; the normal development and growth of the femoral



Fig. 11.

Female, aged three and a half. Luxatio coxae duplex Reduced 18 months ago. On both sides flat acetabulum with thick floor. On left side »schin« formation. Pronounced structural changes in the epiphysis.

epiphysis taking place only under conditions of physiological stress and pressure. In the case of a one-sided hip dislocation, the nucleus of the epiphysis will always be behind in development as compared with the non-dislocated side. Very often these changes occur both in the acetabulum and in the femoral head after reduction of a dislocated hip-joint, undoubtedly as a consequence of the suddenly changed conditions of pressure.

That circulatory disturbances will be the real consequence of the abnormal pressure conditions cannot be excluded beforehand. In this connection I wish to remind of *P. G. K. Bentzon's* experimental investigations, in which, after alcohol injections around the vessels to the femoral head and neck of rabbits and goats, he in some cases succeeded in producing changes quite similar to those in coxa plana. *Bentzon* believes the bone changes to be due to hyperæmia caused by the alcohol injections. From other sides it is maintained that these injections would lead rather to hypæmia, and *Kassowitz* has produced similar bone changes in a dog's paw by ligating an afferent artery. Thus, also these investigations support the hypothesis of the pathological signification of the flat acetabulum, as it seems reasonable to suppose that an unfavourable functional pressure on a bone hampers the blood supply. The bone tissue which we find in cases of calciprival osteopathy and of irregular endochondral ossification is characterized precisely by the scarcity and irregularity of the blood vessels.

As already mentioned, *Murk Jansen* maintains that *coxa valga* most often develops in patients with a flat acetabulum through the raising of the femoral neck according to the rules of graphical statics.

As we know, coxa valga develops in cases of hemiplegia and after amputations. It can also develop in femoral fractures after a long extension treatment — most frequently, of course, in children. It seems to me that the simplest explanation of these cases is a growth disturbance in connection with changed, abnormal pressure. That coxa valga in an incongruous hip may also have developed owing to growth disturbances caused by abnormal functional pressure cannot, I think, be disregarded beforehand. Especially I find that the picture of coxa valga subluxata, an affection often found in young women, suggests a decreased growth in the lateral half of the femoral neck and increased growth in the mesial half, with the resulting »raising of the femoral neck«. Fig. 12.

While *Murk Jansen's* work on hip affections long remained surprisingly unheeded, *Calot's* views, published much later, at-

tracted, as will be remembered, considerable attention. *Calot* maintains that Calvé-Perthe's disease does not exist, and that

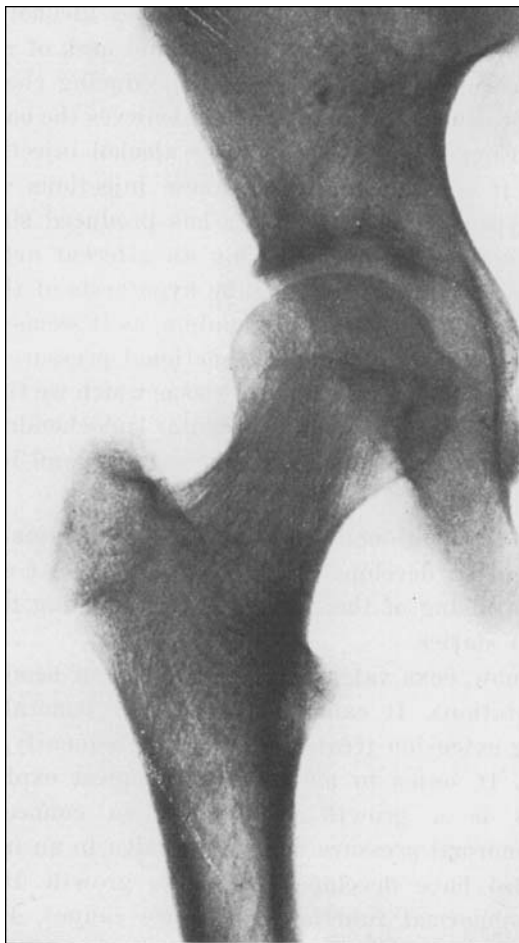


Fig. 12.

Female.

all the cases described under that name are misjudged congenital subluxations. He maintains that this malformation, whose primary cause is a flat acetabulum, is the most im-

portant of all the hip affections, and is the cause both of the so-called Calvé-Perthe's disease and of many other hip affections, especially of *malum coxae senile*.

The abnormalities which he thinks may always be found in a greater or lesser degree in these affections are:

1) In the roentgen picture, the outlines of the acetabulum have the form of a half lemon instead of a half orange as normal.

2) In the flat acetabulum there develops with the years a »double floor«, i. e. a new socket is formed laterally from the original one.

3) The upper outline of the acetabulum, the »roof«, slopes upwards instead of shelving, as normally, following the outline of the spherical head of the femur.

4) The socket encloses only a small part of the femoral head, the greater part of which projects laterally from the acetabulum; the femoral head is subluxated laterally.

Calot, too, thus points out the enormous pathogenetic importance of the congenital flat acetabulum.

Undoubtedly part of the abnormalities which *Calot* considers congenital are sequels appearing much later in life, precisely as suggested by *Murk Jansen's* hypothesis. In one very essential particular I believe, however, that both authors are mistaken. The condition which in the strictest sense corresponds to the »normal hip« — with its deep socket and shelving roof enclosing two thirds of the femoral head — hardly exists in early childhood, usually not before the age of 7 or 8. If *Murk Jansen's* and *Calot's* definitions of a normal hip socket are applied to children under that age, the hip-joint will be abnormal in all children, which does not seem very likely. Investigations on this point have been started. They will hardly shake the principles of *Murk Jansen's* hypothesis, however, but may presumably supplement it and, I hope, correct it on some points. There will probably also be an occasion to discuss the very important clinical consequences of the anatomical conditions in the hip according to the views exposed in this paper.

SUMMARY

A review is given of the hypothesis set forth by *Murk Jansen*: that the congenital flat acetabulum is the cause of various deforming hip affections.

The influence of the abnormal weight distribution — due to the flat acetabulum — upon the growth of the femoral end is discussed in detail.

It is maintained that the affections mentioned are probably to be considered as a consequence of a calciprival osteopathy caused by increased pressure in the anatomically abnormal hip.

It is considered doubtful whether *Murk Jansen's* and *Calot's* views of an anatomically »normal hip« hold good also in children. Investigations on this subject will follow.

RÉSUMÉ

L'auteur expose son point de vue regardant l'hypothèse avancée par Murk Jansen, à savoir que l'acetabulum aplati congénital serait la cause de diverses affections coxales déformantes.

L'auteur discute en détail l'influence de la répartition anormale de la charge — déterminée de la forme aplatie de l'acetabulum — sur la croissance du bout supérieur du fémur. Il est d'avis que les affections en question ne sont probablement qu'une ostéopathie calciprivo causée par une pression augmentée sur les surfaces articulaires de la hanche anormale au point de vue anatomique.

L'auteur n'est pas sûr que les critères de »la hanche anatomiquement normale«, émis par Murk Jansen et Calot puissent s'appliquer aussi quand il est question de très jeunes individus. Il compte publier dans la suite des recherches ultérieures sur ce sujet.

ZUSAMMENFASSUNG

Der Verfasser nimmt zu der von Murk Jansen aufgestellten Hypothese, dass das angeborene flache Acetabulum die Ursache verschiedener deformierenden Hüftleiden ist, Stellung.

Der Einfluss, welchen die durch das flache Acetabulum bedingte abnorme Belastungsverteilung auf das Wachstum des obersten Femurendes ausübt, wird in Einzelheiten besprochen.

Es ist hervorgehoben, dass die besprochenen Affektionen wahrscheinlich als eine mit Kalkschwund verbundenen Osteopathie angesehen werden können, die durch einen erhöhten Druck auf die Gelenksflächen in der anatomisch abnormen Hüfte bedingt ist.

Es muss als zweifelhaft angesehen werden, ob Murk Jansens und Calots Meinung über die anatomisch normale Hüfte sich auf das Kindesalter anwenden lässt. Weitere Untersuchungen über dieses Thema folgen.