ABSENCE OF THE LIGAMENT OF HEAD OF FEMUR IN THE HUMAN HIP JOINT

C K Tan, W C Wong

ABSTRACT

The ligament of the head of the femur was studied by dissection in 40 human cadavers, 5 monkeys, 10 cats and 20 rats over a two-year period. Unlike the situation in the monkeys, cats and rats studied, the ligament was not invariably present in humans. It was absent in 4 of the cadavers studied. In 3 of them, the ligament was absent unilaterally. In the remaining 36 cadavers, the ligament was strong in 26 cadavers, weak in 9 and was torn in one. The present findings suggest that although the ligament transmits an artery to the femoral head in the young, it does not appear to have any important mechanised function in maintaining the stability of the hip joint.

Keywords : Ligament, Head of femur

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INTRODUCTION

The presence of an intra-articular ligament in the hip joint, called the *ligament of the head of femur* or *ligamentum teres capitis femoris*, is well documented in all standard textbooks of Anatomy. The ligament is classically described as being an intracapsular and extrasynovial structure which is attached to the fovea capitis of the femoral head at one end and the transverse ligament (which bridges the acetabular notch) or the acetabular margin at its other end. While the attachment of the ligament to the fovea capitis is consistent, its attachment to the acetabulum appears to be variable and descriptions and illustrations vary considerably, e.g. (i) solely to the transverse ligament[1,7,9,10,13,18,23,27], (ii) to the acetabular notch [2,24,32], (iii) to the transverse ligament and the margins of the acetabular notch [4,9,10,15,17,21,22,28,30,31], (iv) to the rim of the acetabulum [9], (v) to transverse ligament and the rim of the acetabulum [5], (vi) the acetabular fossa [3,25], and (vii) to the transverse ligament and acetabular fossa [19]. In some books, however, only cursory mention was made of its presence in the hip joint [5,12,16,26].

However, the absence of this ligament in the human hip joint has been rarely noted [24,28]. Because of the possibility this interesting curiosity, a study of the hip joints of the cadavers in the Dissection Hall of our Department together with a dissection of the joint in monkeys, cats and rats over a two-year period was made. The present paper describes the findings in human cadavers, monkey, cat and rat and discusses their functional implications.

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MATERIAL AND METHODS

The hip joints of 40 cadavers in the Dissection Hall were dissected in the following manner. First, the glutei, adductors and rotators were divided in order to expose the capsule of the joint. The latter was next incised over its anterior, superior and posterior aspects. When the margin of the acetabulum was adequately exposed, its superior rim was nibbled away with bone rongeurs in order to expose the femoral head in its entirety. The latter was then pulled out as far as it would go in order to expose the ligament and photographs were taken. The synovial membrane covering the ligament was then carefully dissected away with a fine scalpel blade. The femoral head was then removed by cutting the ligament close to the fovea capitis and its other attachment to the acetabulum was noted and photographed.

In addition, the hip joints of 5 monkeys, 10 cats and 20 rats were also dissected over the same two-year period as that for the study of human material.

RESULTS

(A) HUMAN MATERIAL

Sex and age of subjects

All the cadavers were more than 60 years of age, the oldest being 73. There were 7 females and 33 males.

The normal ligament

Strength of the ligament. In 36 out of the 40 cadavers studied, the ligament was present bilaterally. In 26 out of these 36 cadavers, the ligament was strong (Fig 1) and presented a great resistance when attempts were made to pull the femoral head out of the acetabular cavity.

Fig 1

Photograph showing the normal ligament in the hip joint when the femoral head is pulled out of the acetabular cavity.

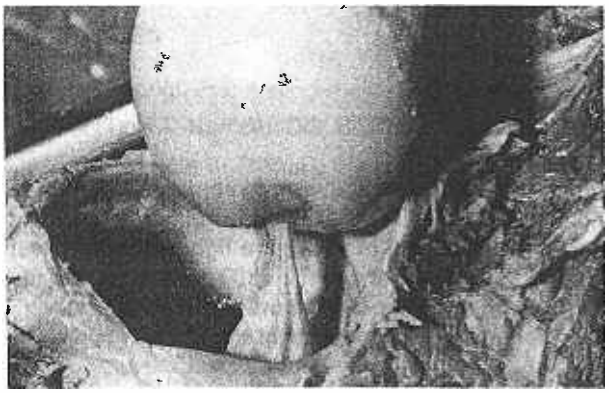


Fig 2

Photograph showing the ligament lying loose in the acetabular cavity without any femoral attachment in one cadaver.

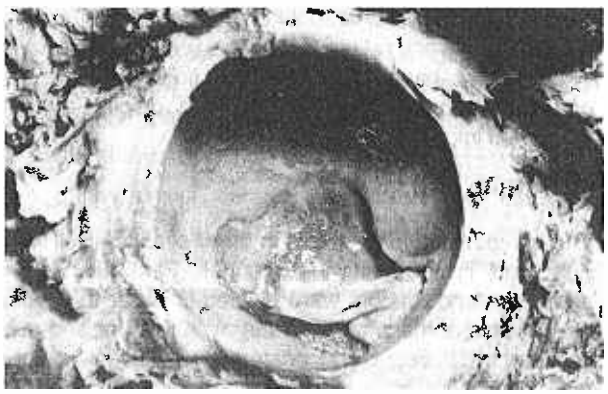


Fig 3

Photograph showing a smooth fovea capitis without any sign of ligamentous attachment

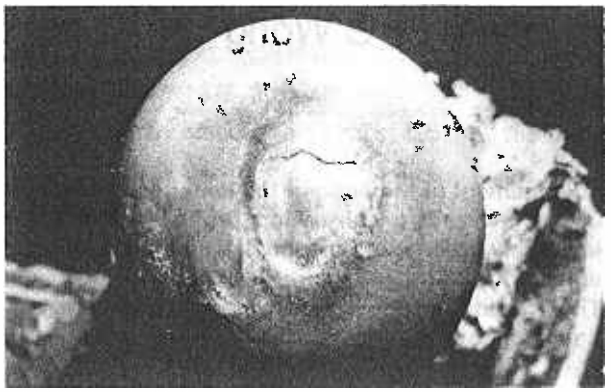
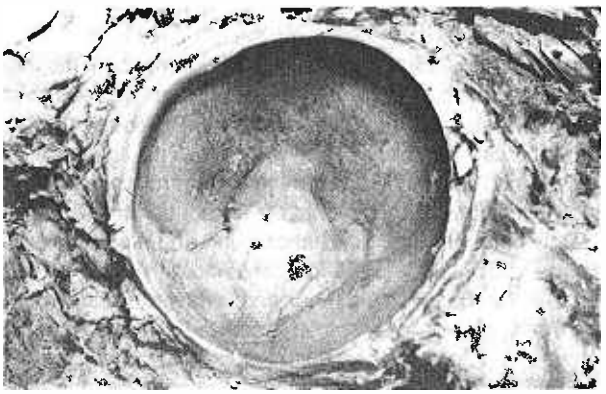


Fig 4

Photograph showing a smooth acetabular cavity without any sign of ligamentous attachment



In one cadaver, the fovea capitis appeared to be smooth but a piece of tissue, which resembled the ligament, was found to be attached to the transverse ligament of the acetabulum at one end while its other end lay free in the acetabular cavity (Fig 2).

In the remaining 9 cadavers, the ligament was easily torn when the femoral head was pulled out of the acetabulum. In 5 of these cadavers, the ligament was thin unilaterally and in 4 of them bilaterally. In 2 of these cases, the ligament appeared to consist of only synovial membrane.

Acetabular attachment. In 6 cadavers, the ligament was attached only to the transverse ligament. In the rest of the cadavers, it was attached to the inner or concave margin of the articular cartilage; in 11 of these cases, the attachment was confined to only the anterior half of the articular margin with a thin extension of the synovial membrane across the pad of fat.

Absence of Ligament

The ligament was missing in 4 of the cadavers studied - in 3 of them, it was totally missing only on one side and in one cadaver, it was missing on both sides. In the 3 cadavers in which the ligament was absent unilaterally, the opposite hip joint had a strong ligament. In all cases, the fovea capitis showed a smooth, irregular pit which looked like a cicatrix (Fig 3). The acetabular margin in these cases was also smooth with no trace whatsoever of any ligamentous attachment (Fig 4) and the gap in the acetabular notch between the transverse ligament and the inner margin of the articular surface of the acetabulum was bridged over by a thin synovial membrane which also covered a pad of fat.

(B) ANIMAL MATERIAL

In all the animals studied, the ligament was exceedingly strong and great force was needed to pull the femoral head out of the acetabulum. It was invariably present in all the hip joints studied.

DISCUSSION

The ligament of the head of the femur has been described as a consistent structure in the hip joint [1,32] and few authors [24,28] have mentioned its possible absence in some people. The present study has shown that this ligament is not invariably present in the human hip joint, being absent in about 10% of subjects studied, although in the monkey, cat and rat, it was found to be invariably present and exceedingly strong.

In the present study, it was found to be absent in 4 out of the 40 cadavers studied-in 3 of them it was absent uilaterally and in one of them bilaterally. In addition, the

ligament was found to be fragile in 9 of the cadavers and in two cadavers, it appeared to be as thin as synovial membrane.

The absence of the ligament in some cadavers and its fragility in others raise questions about its functional importance. The first question which may be asked concerns the role of this ligament in helping to maintain the stability of the hip joint. In man, in whom the ligament has been described as becoming taut when the thigh is semiflexed an adducted [28,31] but relaxed when thigh is abducted [28], opinions seemed to differ regarding its importance although there have been suggestions that it might not have a significant role to play [1,2,8,15,4]. But the fact that it may be absent or very thin in some people seriously questions its role in preventing dislocation of the femoral head from the acetabulum. This variability in the strength of the ligament has been noted previously [23,24,27]. The finding of a loose, presumably torn ligament, in one of the cadavers in the present study without any known clinical evidence of joint dysfunction, further supports the suggestion that this ligament does not have an important mechanical function for the hip joint.

In contrast, in the monkeys, cats and rats dissected in the present study,this ligament was found to be very strong and could not be easily torn by forcefully pulling the femoral head out of the acetabular cavity. This suggests that in these animals, unlike human, the ligament may have an important mechanical role to play. This raises yet another question: whether the presence and strength of this ligament in the hip joint may be related to posture. The findings suggest that the ligament may have functional important in quadripeds, where its presence may be crucial to the stability of the hip joint by virture of its posture, whereas in bipeds its function may be insignificant. This does not appear to have been considered by others previously [1-32].

The absence of the ligament in some human cadavers also raises yet another question, namely, that of the vascular supply to the femoral head [1-4,8,9,11,15,17,19,21,22,28]. It has been traditionally accepted that in the human, the ligament in the young transmits an important artery to the femoral head from the obturator and the medial circumflex branch of the profunda femoris arteries. It is also widely accepted that with increasing age, this supply becomes inadequate and the vascularity of the femoral head is taken over by the retinacular vessels. Crock (6) had made an excellent study of these vessels and had shown that they arose from a vascular ring at the base of the femoral neck. o7 3 This ring is formed by the branches from the lateral and medial femoral circumflex arteries. Its branches give rise to the metaphyseal and epiphyseal branches.

The absence of the ligament in some cadavers suggests that in these subjects it may be congenitally absent. If this is true, then the femoral head of each of these subjects did not have a dual blood supply to begin with and that it had to rely solely on the retinacular vessels for its vascular supply. If this is true, then it suggests that the source of blood supply via the retinacular vessels is more important than from the vessels transmitted via this ligament.

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