THE INSERTION OF THE ILIOPSOAS AS A DESIGN FAVOURING LATERAL RATHER THAN MEDIAL ROTATION AT THE HIP JOINT

K Rajendran

ABSTRACT

A study of cadaveric material undertaken to investigate a possible anatomical basis for the nature of rotary influence of the iliopsoas at the hip joint shows that the winding course around the femoral neck with extension of tendon insertion towards the greater trochanter, and the spiralling course of the tendon both appear to be a design for causing external rotation during muscular contraction by a process of unwinding around the neck and untwisting of the spiral tendon under tension.

Keywords: iliopsoas, insertion, hip joint, rotation.

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INTRODUCTION

The iliacus and the psoas major, though morphologically two distinct muscles, have often been considered in combination as the iliopsoas because of a common tendon of insertion and therefore a shared action at the hip joint. Although the primary action of this muscle group as a hip flexor is generally accepted, textbooks of anatomy reveal division of opinion regarding the rotary action. With respect to this action, work done by different authors seems to suggest differing roles for the iliopsoas ranging from internal rotation and external rotation to no significant rotation at all. The present study examines the anatomy of the insertion of the iliopsoas to identify features that may suggest a design in favour of a particular kind of rotation at the hip joint.

MATERIAL AND METHODS

17 hip regions from formalin preserved dissection room cadavers ranging in age from about 55 to 70 were examined. Deep dissection of the gluteal region and upper part of the back of thigh was carried out. The lateral rotators and adductor magnus were removed so as to clearly expose the greater and lesser trochanters and the intertrochanteric crest. The iliopsoas tendon was then identified and cleaned to demonstrate its attachment. In each instance the tendon was also traced forwards to note any change in orientation. Except in cases where the anatomy had been distorted by some previous injury, both sides of every cadaver were included in the study.

OBSERVATIONS

In two of the specimens initially selected, the hip was found to be unsuitable for study on one side because of distorted anatomy possibly from previous injury.

Of the seventeen hips examined the tendon of the iliopsoas showed essentially a similar *course* from the front of the hip joint towards the main insertion on the lesser trochanter. This was spiral in nature such that when traced from front to back, the medial border of the flattened tendon passed posterior to and then slightly lateral to the lateral border (Fig.1). The spiralling towards the insertion was therefore in the direction of medial rotation.

In all the specimens, the main insertion of the tendon was to the medial border i.e. most protruding portion (away from the neck and shaft) of the lesser trochanter and extending to a variable extent to its posterior aspect.

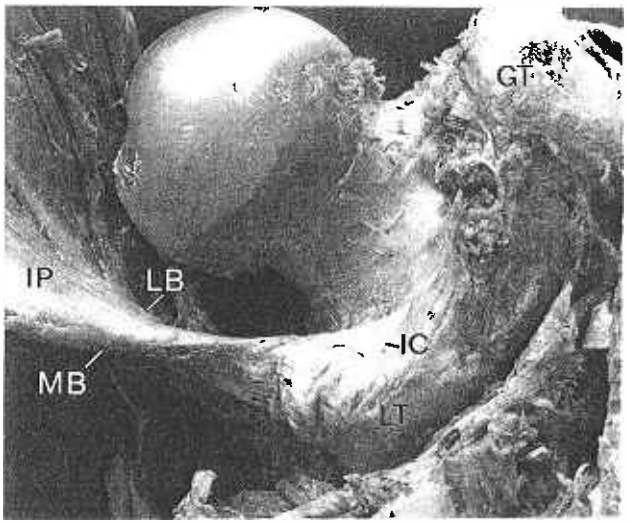

Figure 1: Posterior view of a right hip showing upper end of femur removed from the acetabulum. Orientation of the iliopsoas (IP) is essentially retained in its original form to show its course and insertion. Medial border (MB) of the flattened tendon is shown passing posterior and then lateral to the lateral border (LB) as the tendon spirals towards its main insertion on to lesser trochanter (LT). Portion of the tendom (from its medial border extends along intertrochanteric (IC) crest towards greater trochanter (GT) thus exaggerating the winding course in relation to the femoral neck.

Department of Anatomy
Faculty of Medicine
National University of Singapore
Lower Kent Ridge Road
Singapore 0511

K Rajendran, MBBS (S'pore), FRCS (Edinburg)
Senior Lecturer

Of special interest was the observation of extension of the attachment beyond the lesser trochanter. This was observed in all except one specimen. Three specimens showed a portion of the tendon attached immediately above the trochanter. The remaining thirteen showed the attachment to extend for between one and two centimeters along the intertrochanteric crest, towards the greater trochanter. This extension may be seen as a portion of the tendon winding around the femoral neck (at junction with shaft) in the direction of internal rotation. There were no other findings of note with respect to insertion of the iliopsoas.

DISCUSSION

The primary action of the iliopsoas as flexor at the hip joint is supported by electromyographic studies (Basmajian, 1985) as well as the anatomy of the tendon which passes anterior to the hip joint before reaching the lesser trochanter thereby passing in front of the axis for flexion and extension. Controversy however surrounds the role of the iliopsoas as a rotator at the hip. Textbooks of anatomy describe it variously as a medial (Last, 1978) and a lateral (Gardner, Gray & O'Rahilly 1975, & Kapandji 1983) rotator. Muscle activity has been demonstrated during both medial and lateral rotation (Basmajian, 1958) and in some cases slightly greater activity during lateral rotation (Keagy, Blumlik, & Bergan, 1966). Functional studies in the newborn involving traction on the iliopsoas (McKibbin, 1968) have demonstrated consistent lateral rotation.

The definition of an arbitrary axis for rotation running between the head of the femur and the centre of the femora condyle (McKibbin, 1968) may complicate the understanding of the mechanics of rotation. Unlike in the case of the forearm where the axis for pronation and supination runs between the two joints that control the rotary movement, the lower of the two joints defining the axis of rotation at the hip joint is entirely arbitrary and does not control active rotary movements. Medial rotation for example is described as resulting from a pull by the iliopsoas on the lesser trochanter which lies lateral to this axis (Last, 1978).

If one were to ignore this arbitrary axis of rotation and consider the iliopsoas in relation to the femur, some anatomical features of relevance to rotation become apparent. The tendon of the iliopsoas attaches to the lesser trochanter which protrudes medial to the neck shaft junction. If the trochanter were to serve to improve leverage for efficient rotation then this must be in the lateral direction. The winding course of the tendon to its insertion has been previously described as a possible design for external rotation by a process of unwinding during muscle contraction (McKibbin, 1968). Findings in the present study show this winding course in the majority of cases to proceed even further than the lesser trochanter towards the greater trochanter. Supination of the forearm from the prone position is a comparable situation where the unwinding tendon of the biceps causes lateral rotation of the radius. The final observation of possible relevance to rotary action is the spiralling course (observed in the tendon of the iliopsoas). The direction of the spiral is such that untwisting of this spiral (Haines 1941, Barnett, Davies & MacConaill 1961) in response to tension in the muscle can only result in lateral rotation.

The present study therefore supports the secondary role of the iliopsoas as a lateral rather than a medial rotator at the hip joint on the anatomical basis of being attached to the lesser trochanter which provides leverage for the movement, pursuing a winding course around the femoral neck and demonstrating a spiral both of which are in the direction of medial rotation so that activation of the muscle results in the reverse movement.

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