

## SONOGRAPHIC EVALUATION OF HIP EFFUSION IN CHILDREN

### Improved visualization with the hip in extension and abduction

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#### Abstract

**Purpose:** To assess the difference in the sonographic appearance of hip effusions when the hip was placed in the extended and abducted position as compared to a neutral position.

**Material and Methods:** Twenty-one consecutive children (aged 2–14 years) with hip pain or limping were examined for hip effusions by means of ultrasound. The capsule-femoral-neck distance, the presence of joint fluid, and the shape of the anterior capsule were compared in hips in slight extension and abduction with those in hips in a neutral position.

**Results:** Of the 11 positive hip effusions, the maximal distance between the capsule and femoral neck was significantly larger ( $p<0.005$ ) in the extended and abducted hip position than in the neutral hip position, with a mean difference of 1.6 mm. Convex bulging of the anterior capsule was more confidently diagnosed in 3 hip effusions in the extended and abducted hip, and better visualization of fluid between the capsule and femoral neck was achieved in 4 joints in this posture.

**Conclusion:** The study demonstrated an improvement in the sonographic detection of hip effusion in the extended and abducted position compared to the neutral position.

**Key words:** Hip, ultrasonography; diseases, arthritis; paediatrics.

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Ultrasonography (US) can be considered the best non-invasive technique for the detection and follow-up of hip effusion (1, 3, 4). False-positive results are considered rare (8). The high sensitivity of US in detecting small amounts of articular fluid has also been confirmed by intra-articular injection in cadaveric hips (3). The sensitivity of ultrasound in diagnosing hip effusion *in vivo*, however, has not been established. It has been suggested that false-negative US of hip effusion might result when the examination of the hip is performed in a flexed position (4). Others have suggested a better demonstration of small effusions if there is slight flexion and internal rotation of the hip (2). The purpose of

this study was to assess the difference in the appearance of hip effusions when the hip was placed in the extended and abducted position as compared to a neutral position.

#### Material and Methods

Twenty-one consecutive children (aged between 2 and 14 years) with hip pain or limping were examined by means of US. High resolution 5-MHz or 7.5-MHz transducers (Aloka 650) were used. The examinations were made in the supine position. Each child was first examined with the hip in the neutral position, in which the back of the thigh

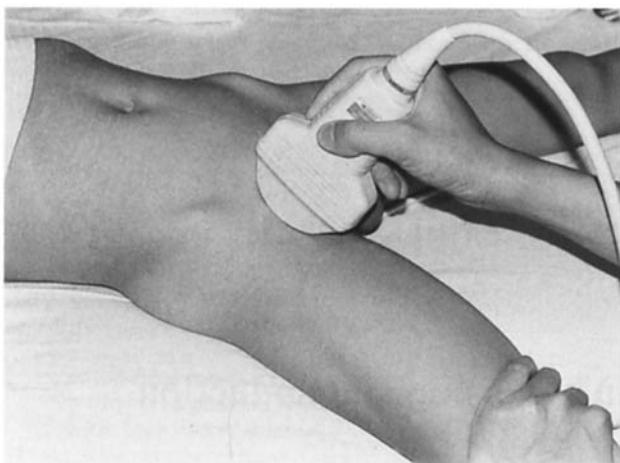


Fig. 1. Manoeuvre for obtaining the extended and abducted hip positioning of the right hip.

rested on the examination bed. The transducer was placed with an anterior approach to obtain a sectional image orientated along the axis of the femoral neck. The capsule-femoral-neck distance, the presence of joint fluid, and the shape of the anterior capsule were noted. The child's hip was then abducted so that the mid-thigh rested against the edge of the examination bed. A downward pushing force from the examiner's left hand on the lower thigh was applied to create passive extension of the hip – using the edge of the examination bed as a fulcrum (Fig. 1).

For the left hip, the examiner sat on the other side of the examination bed and the left hand was used for the pushing manoeuvre with the right hand holding the transducer over the left hip region. The same section along the axis of the femoral neck was obtained with the same parameters and observations regarding hip effusions as in the neutral position. The findings in the two different positions were compared.

As a control, the capsule-femoral-neck distance in 20 hips in 10 children (aged 3–9, mean 6.5 years) with no hip symptoms was studied with the same examination method.

### Results

Hip effusions were detected in 11 hips in 9 of the 21 children studied. There were 7 boys and 2 girls (aged 3–11 years, mean 6.9 years) with the final diagnosis of transient synovitis ( $n=7$ ), chronic inflammatory arthritis ( $n=1$ ), and bacterial arthritis ( $n=1$ ). The capsule-femoral-neck distance in these 11 hip joints was compared with that in the control group (Table). Adoption of the extended-abducted position

in the hip resulted in a significant increase in the capsule-femoral-neck distance compared with that in the neutral position in the diseased hips ( $p<0.005$ ). The capsule-femoral-neck distance also increased significantly when the normal hip was extended and abducted in the control group ( $p<0.05$ ) but the magnitude of this normal increase was much less than that in the diseased hips. Comparison of the differences in capsule-femoral-neck distance with the hip in the neutral versus extended-abducted position between the diseased and normal hips also showed a highly significant difference ( $p<0.001$ ). This indicated that the presence of joint effusion accentuated the increase of capsule-femoral-neck distance with the hip in extension and abduction.

On subjective assessment, bulging convexity of the anterior capsule was seen in 10 diseased hips in the extended-abducted position compared to 7 in the neutral position. Better visualization of the fluid col-

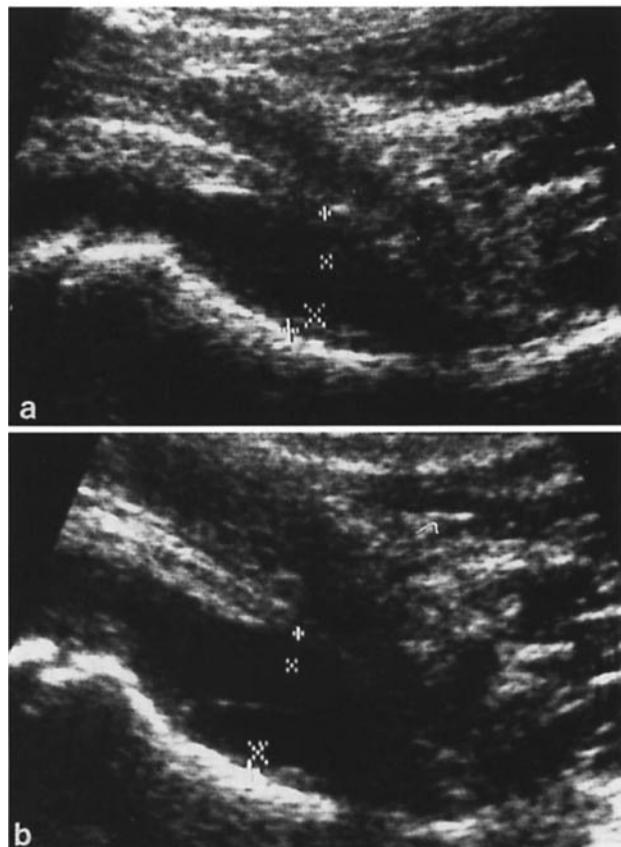


Fig. 2. Parasagittal image of the right hip in an 11-year-old boy presenting with hip pain. a) Neutral position. The width of effusion between the calipers (x-X) was 4 mm. The capsule-femoral-neck distance between the calipers (+---+) was 10 mm. b) The same hip in extension-abduction shows a larger volume of fluid in the anterior recess, and the width of effusion between the calipers (x-X) was 8 mm. There was a greater degree of capsular convexity, and the capsule-femoral-neck distance (+---+) increased to 13 mm.

**Table**

*Mean capsule-femoral-neck distance in diseased and normal hips in the neutral and the extended-abducted positions*

	Neutral hip	Extended and abducted hip
Diseased hips	6.7 mm 1SD=2.0	8.3 mm 1SD=2.4
Controls	5.1 mm SD=0.6	5.4 mm SD=0.7

lection within the joint was shown in 4 diseased hips in the extended-abducted position. Examination in the extended-abducted posture thus gave better subjective and objective results (Fig. 2).

### Discussion

The present study demonstrated an improvement in the detection of hip effusion in the extended and abducted hip position compared to the neutral hip position. This improvement is probably due to the difference in intracapsular pressure in the two positions.

Intracapsular pressure increases with the volume of joint fluid. Joint fluid under pressure tends to collect in the most compliant potential space under least pressure. The anterior femoral recess is probably one such space in the hip joint, which explains the high sensitivity of ultrasound in the detection of effusion by means of the anterior approach.

It has been shown that the intracapsular pressure in patients with transient synovitis is highly dependent on the position of the hip joint (6, 7). Intracapsular pressure was shown to be higher in the extended hip position than in the flexed hip position (5-7). With low intracapsular pressure (which may occur with a small amount of hip effusion or with hip flexion), joint fluid may be distributed to other areas than the anterior recess amenable to US detection. When the hip is placed in an extended position, the higher intracapsular pressure will force the joint effusion into the more compliant anterior recess which will be more readily detected, as demonstrated in our study results. The decrease in anterior

capsular tension with hip extension may be the underlying mechanism of the increase in compliance of the anterior recess with hip extension.

We do not know whether hip abduction will give higher intracapsular pressure and thus contribute to better detection in hip effusion. We have found that examination in the combined extension and abduction posture is easier and requires less manipulation than in extension alone.

We do not recommend this positioning as a routine since the hip extension will cause more pain in an already painful hip, probably as a result of a further rise in intracapsular pressure. There is also a theoretical risk of compromising hip vascular perfusion because of a concomitant increase in intracapsular pressure. The examination manoeuvre should therefore be adopted only when the diagnosis of hip effusion is uncertain in the neutral hip position or when US-guided aspiration of hip effusion is undertaken and the examination time needs to be kept to a minimum.

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