Orthopaedics & Traumatology: Surgery & Research (2010) 96S, S10—S16

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WORKSHOPS OF THE SOTO (2009 RENNES). SYMPOSIUM: THE LUMBAR-PELVIC-FEMORAL COMPLEX

The lumbar-pelvic-femoral complex: applications in hip pathology

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KEYWORDS
Osteoarthritis of the hip;
Congenital dislocation of the hip;
Pelvic tilt

Summary Everyday clinical practice frequently leads us to suspect a close relationship between the lumbar spine and the hip-joints. Sagittal balance fundamentally expresses a postural strategy mobilizing the dynamic structure of the lumbar-pelvic-femoral complex in an authentic balance by which obligatory coupled movements transmit stresses in a single structure, the spine, to the two-part structure of the lower limbs, and vice-versa. Flexion contracture is a frequent hip pathology, but congenital dislocation and ankylosis of the hip have the greatest impact on the spine, due to excessive mechanical strain and/or spinal malalignment, which is initially supple but becomes fixed. Clinical analysis, backed up if necessary by infiltration tests and imaging, guides indications for surgical management. These considerations suggest a general attitude that considers not just the hip itself, for which the patient is consulting, but the lumbar-pelvic-femoral complex as a whole (and also the knee) before undertaking total hip replacement. Femoro-acetabular impingement is a recently described pathology associating morphological hip-joint abnormality and labral and joint cartilage lesions, leading to early osteoarthritis of the hip. Abnormal spinal or pelvic parameters have not been found associated with femoro-acetabular impingement. Congenital pelvic tilt is a benign and often overlooked pathology in children. Supra- and infra-pelvic pelvic tilt in childhood palsy raises the difficult strategic issue of how to get these children in their wheelchair with a well-balanced spine over a straight pelvis and frontally and sagittally balanced hips.

Introduction

Everyday clinical practice frequently leads us to suspect a close relationship between the lumbar spine and the hip-joints.

Sagittal balance fundamentally expresses a postural strategy mobilizing the dynamic structure of the lumbar-

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doi:10.1016/j.otsr.2010.03.007

pelvic-femoral complex in an authentic balance by which obligatory coupled movements transmit stresses in a single structure, the spine, to the two-part structure of the lower limbs, and vice-versa.

The lumbar-pelvic-femoral complex should be taken into account in managing hip pathology in adults and children.

The present study focuses first on the impact of hip deformity on the spine, then the difficulties of arthrodesis and management of congenital hip dislocation (CHD). Is femoro-acetabular impingement relevant to spinal imbalance?

In children, the issues are, on the one hand, benign congenital asymmetric pelvis with infantile scoliosis and, on the other, the difficulty of managing pelvic tilt in childhood palsy.

Adult incidence of hip-joint pathology and spinal impact

The spinal impact of hip-joint pathology is well-known, but not always well analyzed or taken into account.

Kerboull et al., in a number of studies [1,2,3] reported improvement in spinal symptoms following total replacement of stable [2] and unstable [3] hips.

Hip flexion contracture

Flexion contracture occurs frequently in evolved hip pathology, impairing the backward step and causing a compensatory anterior tilt of the pelvis to align the limb with the ground in the stance phase. The anteversion increases the sacral slope and induces lumbar hyperlordosis which more or less completely opposes forward flexion of the trunk [4]. The hyperlordosis thrusts the disks and joint capsules into the canal. Hip flexion contracture may thus decompensate pre-existing lumbar disc arthritis. When the hip is symptomatic, total hip replacement (THR) is indicated and should improve spinal symptoms, on condition that the THR eliminates the flexion contracture.

In THR, the anterior capsule should be largely released or resected, and lower limb lengthening, which would hinder correction of the flexion contracture, must be avoided.

Ankylosis and arthrodesis

Ankylosis and arthrodesis are sequels of osteoarthritis, often infectious, and/or of a previous arthrodesis.

The hip itself is pain-free, but the ankylosis puts excessive strain on the lumbar spine, always sagittally (in flexion/extension, to compensate for the loss of this movement in the hip) and possibly also frontally (in lateral inclination) and horizontally (in rotation). Faulty ankylosis may further cause infra-pelvic pelvic tilt, causing compensatory spinal malalignment, which is initially reducible but may become fixed (creating a supra-pelvic pelvic tilt).

These two phenomena explain spinal pain and the development of lumbar disk arthritis. The spinal impact of ankylosis is especially rapid and severe when the hip is blocked in a faulty position [1,5], whereas ankylosis in correct position is much better tolerated and does not impact other joints until after some 20 years' evolution [6,7].

Ankylosis can be categorized [1] as:

- in correct position (flexion 15/20°, adduction 0/5°, external rotation 0/5°):
  - unipodal stance is stable,
  - in walking, the forward step induces retroversion of the pelvis with lumbar cyphosis, and the backward step induces anteversion of the pelvis with lumbar lordosis, without pelvic or spinal rotation;
- in faulty frontal position:
  - in adduction: the ipsilateral lower limb appears ''shorter'', there is pelvic tilt (contralateral hip in abduction) and ipsilateral inclination of the spine,
  - in abduction: the ipsilateral lower limb appears ''longer'', there is pelvic tilt (contralateral hip in adduction) and contralateral inclination of the spine,
  - in flexion: the extension of the hip required for the backward step induces anterior flexion of the trunk, which can only be compensated by lumbar hyperlordosis, beyond a certain degree of flexion in ankylosis:
    - backward step amplitude is reduced (as of 30°) then abolished (as of 50°) [1],
    - anterior flexion of the trunk is unavoidable during the backward step,
  - in rotation: the patient has to pivot the pelvis around the healthy hip for the flexion plane of the knee to be parallel to the direction of gait; the pelvis is tilted with respect to the direction of gait, spinal rotation counter to the pelvic rotation is required to keep the shoulders facing forwards.

THR can improve spinal symptoms, especially if the spine is not yet arthritic, the hip recovers sufficient stability and the gain in mobility is enough to significantly reduce the preoperative strain on the spine. In case of pelvic tilt with spinal malalignment, straightness can only be restored if the spine remains supple and there is no residual faulty position of the hip postoperatively, as sometimes reported in severe faulty ankylosis [8].

Hamadouche et al. [2] reported results of 45 THRs for ankylosis or arthrodesis in 45 patients with a mean age of 55.8 years (range: 28—80 years). Mean duration of ankylosis was 36 years (range: 3—65 years) and mean FU 8.5 years (range: 5—21 years). Mean postoperative flexion was $88 \pm 23°$ (range: 30—130°), comparable to other reports (87° for Kilgus et al. [8], and 78° for Arlaud et al. [9]) and function was satisfactory in 91% of cases (more frequently than in other reports [8,9,10]). Patients must be informed of the risk of residual limp, detracting from the spinal result. Thirty-seven of the patients had preoperative spinal pain, which reduced in intensity in 21 cases (60%), remained unchanged in 14 and worsened in one scoliotic patient (who underwent arthrodesis at 6 years post-THR).

Reikeräs et al. [11], in a series of 55 cases, found moderate or medium improvement in lumbar pain in 26 patients; two showed aggravation. Kilgus et al. [8] reported that 25 of a series of 41 cases had lumbar pain, which resolved entirely or almost entirely in 20 cases.

Congenital hip dislocation (CHD)

There are three types of CHD [1], depending on the position of the head of the femur with respect to the paleo-