Nerve palsy after leg lengthening in total replacement arthroplasty for developmental dysplasia of the hip

S. Eggli, S. Hankemayer, M. E. Müller

From the University of Berne, Switzerland

We reviewed 508 consecutive total hip replacements in 370 patients with old developmental dysplasia of the hip, to relate the amount of leg lengthening to the incidence of nerve palsies after operation. There were eight nerve palsies (two femoral, six sciatic), two complete and six incomplete.

We found no statistical correlation between the amount of lengthening and the incidence of nerve damage (p = 0.47), but in seven of the eight hips, the surgeon had rated the intervention as difficult because of previous surgery, severe deformity, a defect of the acetabular roof, or considerable flexion deformity. The correlation between difficulty and nerve palsy was significant (p = 0.041). We conclude that nerve injury is most commonly caused by direct or indirect mechanical trauma and not by limb lengthening on its own.


Received 2 November 1998; Accepted after revision 11 February 1999

The incidence of nerve palsy after primary total hip replacement (THR) has been reported to range from 0.08% to 3.7%. Several studies have confirmed that an important factor is limb lengthening, especially in patients with old developmental dysplasia of the hip (DDH).

We investigated this relationship in 508 consecutive primary THRs for old DDH. In these cases, we attempted to place the centre of rotation at the primary acetabulum to restore the optimal biomechanical situation. This usually required considerable limb lengthening.

Patients and Methods

Between 1965 and 1994, the senior author (MEM) carried out 508 primary THRs (138 bilateral) on 370 patients with old DDH. There were 32 men with a mean age of 52 years (19 to 78) and 338 women with a mean age of 58 years (41 to 78).

In the women the mean body-weight was 59 kg (35 to 88) and mean height 160 cm (143 to 176) and in the men 76 kg (45 to 88) and 171 cm (154 to 180), respectively.

The operation was carried out with the patient supine using a lateral transfemoral approach. Trochanteric osteotomy was utilised 156 times and 157 cases required one or more tenotomies. The iliopsoas tendon was divided in 13 hips, the piriformis tendon in 130, and the adductor tendons in 14. Augmentation of the roof by bone graft was needed in 294 hips using autologous bone in 158 and allograft in 134. All preoperative and postoperative clinical and radiological findings were documented prospectively using computer-readable code sheets. All the clinical examinations were carried out by the senior author.

We investigated correlation with nerve injury at operation in regard to: 1) the age, gender and weight of the patient; 2) limb lengthening, measured radiologically as the distance between the horizontal teardrop line and the tip of the lesser trochanter, with errors of measurement caused by adduction or flexion deformity corrected as described by Eggli et al; 3) the surgeon’s rating of the operation as easy, usual, difficult, very difficult, or having specific problems which influenced the technical course of surgery; 4) the duration of the operation and total blood loss; and 5) the use of a trochanteric osteotomy.

Neurological evaluation was carried out before and after surgery and at follow-up. Nerve palsies were recorded as incomplete or complete and sensory or motor for the femoral, tibial and peroneal parts of the sciatic nerve.

Statistical analysis used one-factor ANOVA-tests for numerical data, and chi-squared tests for categorical data.

Results

The mean follow-up was for 3.5 years (1.2 to 5.7). The hips were divided into groups I to VI depending on the amount of limb lengthening. There were eight nerve pal-
sities in the whole series, three in 183 hips in group I, two in 163 in group II, two in 106 in group III, none in groups IV or V and one in group VI (Fig. 1). There were six sciatic and two femoral palsies. Three of the sciatic lesions affected only the peroneal division and three both the peroneal and tibial divisions. The tibial division was never affected alone.

Two of the nerve injuries were complete (one sciatic, one femoral), three showed only a partial motor deficit (two peroneal, one sciatic) and three showed a partial motor and sensory deficit (one femoral, one sciatic, one peroneal). At the time of review, only the complete sciatic nerve lesion showed no recovery. Both femoral lesions had complete recovery of sensory function and almost normal motor function. Of the six partial lesions three had complete recovery, two partial improvement and one no change.

We found no statistically significant correlation between limb lengthening and nerve injury (chi-squared test; p = 0.47), or with any other patient factors including age (ANOVA p = 0.14), gender (chi-squared test; p = 0.22), weight (ANOVA p = 0.09), previous surgery (chi-squared test, p = 0.071), duration of surgery (ANOVA, p = 0.068), blood loss (ANOVA p = 0.083) or trochanteric osteotomy (chi-squared test, p = 0.133).

However, in patients with nerve injury the surgeon had rated the operation more difficult than in those without nerve damage (chi-squared test, p = 0.041). Specific difficulties which were documented in the hips with a postoperative nerve lesion included flexion contracture needing extensive tenotomies in four, previous hip surgery in five (2 with metal in situ), a major defect of the acetabular roof in three and a complex femoral deformity in two. Sixteen specific difficulties were noted at operation in the eight hips with nerve palsy as against 598 in the 500 with no palsy (Student’s t-test, p = 0.019).

### Discussion

Injury to the femoral or sciatic nerve is a distressing complication after primary THR. The patients often have persisting causalgic pain as well as impaired walking ability. Many factors have been suggested which may increase the risk of neurological damage. These include female gender, the surgical approach, trochanteric wiring, dislocation of the hip during the operation, direct injury by a retractor, the duration of surgery, extrusion of cement, the heat of polymerisation and haematoma. Several reports suggest that the most significant factors in THR for DDH are limb lengthening and a revision operation.

Nerves are quite elastic. Sunderland found that stretching of 20% to 35% was needed to cause a functional nerve injury. Stretching a nerve reduces the cross-sectional area of the fascicles, increases intrafascial pressure and decreases intrafascicular blood flow. Ippolito et al reported that stretching of only 8% produced the first signs of decreased blood supply, and that lengthening of 15% caused an almost complete block. By Laplace’s law, the greater the diameter of the nerve fibres the more susceptible they are to stretching injuries.

Despite this, there is no clear account of a correlation between limb lengthening and nerve injury. Schmalzried et al reported six cases of nerve lesions after lengthening of over 3 cm, and concluded that lengthening does not cause the damage directly, but is a result of indirect compression by prominent osseous or prosthetic parts. Nercessian et al considered that lengthening by 10% of the length of the femur was safe, reporting only one nerve lesion in 66 hips with lengthening of over 2 cm. Edwards et al considered leg lengthening to be a significant risk factor, finding that a mean lengthening of 2.7 cm may damage the peroneal part.

**Fig. 1**

The relationship between total limb lengthening and number of hips with no nerve palsy (grey) and with a palsy (black).
of the sciatic nerve and of 4.4 cm may put the entire sciatic nerve at risk. They concluded that lengthening should be limited to 4 cm. Johanson et al suggested that lengthening was the cause of over 30% of nerve palsies.

The mean lengthening in our series was 2.1 cm with 162 legs being lengthened by 3 cm or more. The eight nerve lesions (1.6%) showed no significant correlation with the amount of lengthening, but for seven of the operations the surgeon classified the procedure as difficult or very difficult. The absolute number of reported specific operative difficulties was significantly increased in the group with nerve palsy. We consider that most nerve lesions are caused by direct or indirect trauma to the nerve during surgery. Lengthening may well make the nerve more susceptible to damage, but is probably not the primary reason for loss of function. Navarro et al agreed and reduced the incidence of nerve lesions by over 50% by paying increased attention to the sciatic nerve. Johanson et al reported two consecutive studies of nerve lesions after THR. The incidence fell from 1% in the first six-year period to 0.3% in the second six years. They considered that this improvement related mainly to the increased experience of the surgeon.

Our findings emphasise the need for accurate preoperative planning in THR which can anticipate major operative complications which put the nerves at risk. Thorough anatomical knowledge and experience are essential, especially in treating old DDH. In certain cases requiring extreme lengthening or with difficult anatomy, we consider that the sciatic nerve should be exposed, so that its tension and position can be monitored.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References