THE UNSTABLE HIP AND MID-LUMBAR MYELOMENINGOCELE

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We reviewed 55 patients with mid-lumbar myelomeningocele (L3 and L4) first seen over a 17-year period from 1970 to 1986 and followed up for an average of ten years. We assessed a number of factors which might affect hip stability and ability to walk, recording the natural history of clinical and radiological hip deformity.

Two-thirds of the hips had become dislocated or subluxed by the end of the first year of life, involving 86% of hips in patients with an L3 level and 45% of those with an L4 level. All the hips that developed instability secondary to muscle imbalance did so within the first year. The neurological level was the most significant determinant of walking ability: all patients with L4 neurological levels could walk but only one-third of those with L3 lesions could do so. Hip stability, intelligence quotient and fixed deformity did not influence walking ability.

Since Sharrard described his posterolateral iliopsoas transfer in 1964, the management of hip stability in myelomeningocele patients has been the subject of discussion. The neurological level of the lesion is considered to be the most important factor in determining the walking ability of the patient (Hoffer et al 1973; De Souza and Carroll 1976; Feiwell, Sakai and Blatt 1978; Huff and Ramsey 1978; Asher and Olson 1983; Stillwell and Menelaus 1983; Samuelsson and Skoog 1988), and it is agreed that those with lesions above L3 have no potential to walk and will derive no benefit from relocation of dislocated hips. For patients with mid-lumbar myelomeningocele (L3 and L4) some authors advocate attempts at hip stabilisation (Lindseth 1976; Asher and Olson 1983; Lee and Carroll 1985), but others have found no improvement and have reported successful reduction of hip dislocation in only 30% to 60% of cases (Barden, Meyer and Stelling 1975; Feiwell et al 1978; Jackson, Padgett and Donovan 1979; Bazih and Gross 1981; Samuelsson and Skoog 1988).

The imprecise definition of the neurological level in some reports makes assessment of results difficult. The

four levels of Hoffer et al (1973) and the five levels of Sharrard (1964) do not clearly differentiate between knee extension power (quadriceps) and knee flexion (medial hamstrings). In our study we have accordingly defined the two mid-lumbar levels (L3 and L4) within the six-level system of Lindseth (1976). The natural history of the hips in each group has been determined as well as the prognosis for ambulation. The influence of hip stability, deformity, spasticity, and intelligence on walking ability were assessed.

MATERIALS AND METHODS

We undertook a retrospective study at the spinal defects clinic of the Red Cross Children's Hospital for the period 1970 to 1986. Patients less than four years old were excluded, as their walking status could not yet be assessed. During this period, 55 patients (30% of the total who attended the clinic) presented with mid-lumbar neurological myelomeningocele. Four died before the end of the study, leaving 51 patients of whom 38 were examined by the authors. The average follow-up was 10.2 years (4 to 19).

A patient recorded as having an L3 level had quadriceps power of MRC grade 3 or more and medial hamstrings less than grade 3. A patient with L4 level had quadriceps power of MRC grade 3 or more and medial hamstrings of grade 3 or more. Medial hamstring power was measured by the patient's ability to extend the hip while prone with the leg straight. In patients with asymmetrical levels the more distal lesion was used to define the neurological level. No patient had any function of tibialis anterior or the hip abductors. There were 24 L3 and 14 L4 lesions.

We recorded fixed flexion deformities of more than

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10° and noted the presence of deformity of the spine, knee, ankle or foot. The presence of spasticity in the lower limb was also documented.

Intelligence was rated as severely retarded if the intelligence quotient was less than 30; moderately retarded if it was between 30 and 50; mildly retarded, but trainable, between 50 and 70; and normal (educable) if above 70 (Hoffer et al 1973).

Walking ability was defined using the criteria of Hoffer et al (1973). For the purposes of this study we regarded only community walkers as having useful ambulatory function (Stillwell and Menelaus 1983).

Standing anteroposterior radiographs of the pelvis were used to assess the stability of the hips; dislocated or subluxed hips were considered to be unstable. Sitting or standing radiographs of the spine were used to assess spinal deformity.

The age at which the patient walked, the orthoses used, and the various surgical procedures performed were all noted. The natural histories of the hips were followed clinically and radiographically in those patients who had adequate records from birth.

RESULTS

Neurological level and walking status. The walking status of 35 patients and the status of their hips at review are given in Table I.

Three patients (all L3 level) aged four years, four years four months and five years were excluded. They had all recently achieved standing in above-knee calipers and their eventual walking status was uncertain. The average age at which walking was achieved was three years eight months (two years six months to five years six months). The L4-level patients walked on average six months earlier than L3 patients (three years six months as opposed to four years one month). No patient has subsequently deteriorated to lose the ability to walk.

Three patients had asymmetrical levels L4/3, L4/3 and L3/2; they were categorised according to the more distal level.

Fixed flexion deformity. The relationship between fixed flexion of the hip and walking ability is detailed in Table II.

Flexion deformity averaged 25° (range 10° to 60°) in 28 hips. No hips had fixed adduction or abduction deformity. There were very few spinal deformities: only three patients had an associated scoliosis.

Natural history of hip instability. The clinical records and radiographs of 24 patients were adequate to assess the natural history of the hips from birth (Table III). The dislocation was unilateral in 12 cases. Instability of the hip was twice as frequent in patients with L3 neurological level.

Of the hips that were stable at one year, only one subsequently dislocated, at ten years, due to increasing pelvic obliquity secondary to scoliosis.

Table I. Walking ability and hip stability in 35 patients (67 hips)* with mid-lumbar myelomeningocele, by number (*per cent*)

Neurological level			
L3	Walker 7 (33)	Unstable	10 (71)
		Stable	4 (29)
	Non-walker 14 (67)	Unstable	13 (48)
		Stable	14 (52)
L4	Walker 14 (100)	Unstable	10 (39)
		Stable	16 (61)

*three hips excluded because of a higher asymmetrical level

Table II. Walking ability and fixed flexion deformity of the hip in 35 patients (67 hips) with mid-lumbar myelomeningocele, by number (*per cent*)

Neurological level		Fixed flexion	
		Present	Absent
L3	Walker	10 (71)	4 (29)
	Non-walker	14 (52)	13 (48)
L4	Walker	3 (12)	23 (88)

Surgical procedures. Many surgical procedures were performed on these children (Table IV) but only 14 of the 43 hips operated on had a stable reduction at the time of the review.

Intelligence quotient. Every patient had an intelligence quotient of at least 50 (Table V). All the patients with an L4 level were walkers, irrespective of their intelligence.

Spasticity. Spasticity was present in the lower limbs of five patients. All had L3 neurological levels and were non-walkers.

Orthoses. All ambulant patients used bilateral elbow crutches and below-knee orthoses.

DISCUSSION

Walking ability and hip stability. Walking ability was not influenced by hip stability but by the level of the neurological lesion. In our experience the walking potential of patients with a level above L3 is minimal while practically all the patients with L5 and sacral levels are able to walk.

All of our patients with an L4 level could walk, whether the hip was stable or not. Only a third of those with an L3 level walked, and the majority of these had an unstable hip. This accords with the findings of Feiwel et al (1978) and Bazih and Gross (1981). We believe that the better walking potential of patients with an L4 level is due to the preserved medial hamstrings which can actively extend the hip. Waters et al (1974) have shown that the hamstrings account for almost one-third of the total hip extensor strength. The patient's ability to extend

Table III. Hip instability at one year in 24 patients with mid-lumbar myelomeningocele (one patient had asymmetrical levels), by number (per cent)

Neurological level	Stable	Unstable
L3	4 (14)	25 (86)
L4	11 (58)	8 (42)
Total	15 (31)	33 (69)

Table IV. Surgical procedures undertaken on 43 hips in 38 children with mid-lumbar myelomeningocele

	Number
Adductor and psoas release	41
Open reduction and capsulorrhaphy	14
Mustard procedure	2
Sharrard procedure	3
Varus derotation osteotomy	26
Pemberton osteotomy	1
Salter osteotomy	1
Chiari osteotomy	3
Miscellaneous	6

Table V. Intelligence quotient (IQ) and walking ability

Neurological level	IQ	Non-walker	Walker
L3	50 to 70	6	2
	> 70	8	5
L4	50 to 70	0	2
	> 70	0	12

the hip against gravity with the leg straight is therefore a very appropriate test for inclusion in the L4 group.

Stillwell and Menelaus (1984) reported the clinical impression that the gait was more stable after iliopsoas transfer but Feiwell et al (1978) recorded no improvement after reduction of a dislocated hip or muscle transfer. Six of the 12 patients in our study with unilaterally unstable hips were able to walk and the Trendelenburg type of gait was similar on both sides. The lurching is probably due to weakness of the abductors and not to instability of the hip.

It has been postulated that an unstable hip will result in painful arthritis, but long-term studies of up to 40 years have not shown this to be a problem (Samuelsson and Skoog 1988).

Natural history. The hips of the patients with an L4 level were half as likely (42% risk) to develop instability as

were those in patients with an L3 level (86% risk). Previously, Carroll and Sharrard (1972) were the only authors to describe the natural history of hip instability in myelomeningocele. The L3-L4 level in the five-level classification of Sharrard differs from the L3 and L4 levels in the six-level Lindseth classification which we have used. Carroll and Sharrard reported a 65% incidence of hip instability at birth and 76.6% at two to three years. In our series 69% of hips had instability by one year, and all patients who developed instability of the hip secondary to muscle imbalance did so within the first year.

Why don't all the hips in patients with an L4 level become unstable, since they lack abductor and extensor (gluteus maximus) power? Possibly they are protected by the extensor power of the hamstrings or by some abductor power too weak to measure. Carroll and Sharrard (1972), in their long-term review of the iliopsoas transfer, had 15 hips with successful results. Eight of these were stable pre-operatively and the operation was performed to prevent late instability. With our present knowledge of the natural history we suggest that these hips would have remained stable without surgery. Similarly, Jackson et al (1979) achieved an overall success rate of 50%, but only 29% success in patients with pre-existing instability.

Fixed deformity. Both Asher and Olson (1973) and Stillwell and Menelaus (1983) reported that hip flexion deformity influenced walking ability, though Samuelsson and Skoog (1988) disagree. Lee and Carroll (1985) advocated stabilising the hip surgically in selected patients with mid-lumbar lesions in order to control flexion deformity. Although we do not advocate leaving flexion deformities untreated, we found that fixed deformity did not influence walking. Patients appeared to compensate by an increased lumbar lordosis. The oldest patient in our series (19 years) was a community walker with fixed flexion deformity of 60° in one hip and 45° in the other.

Spasticity. De Souza and Carroll (1976) in their long-term study found that spasticity did not influence walking potential. However, Samuelsson and Skoog (1988) demonstrated that spasticity caused by syringohydromyelia or an Arnold-Chiari malformation did diminish walking ability. Our five patients with spasticity all had L3 lesions. None was able to walk, but it is difficult to determine if this was due to the spasticity or to the neurological level.

Surgical procedures. In spite of multiple procedures (up to five on one hip) few dislocated hips (32.6%) achieved stability. Although, in retrospect, not all the procedures were appropriate or performed at the correct age, our findings imply that some of this surgery was unnecessary.

Our present policy, when there is hip instability or a flexion deformity of 20° or more, is to perform adductor and psoas tenotomy and anterior obturator neurectomy at six months to one year after birth (Weisl, Fairclough and Jones 1988). These operations are performed simul-

taneously with corrective foot surgery. In the light of our findings, we do not recommend further procedures on the dislocated or subluxed hip in patients with myelomeningocele.

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