Proceedings of the Scientific Meeting of the International Medical Society of Paraplegia in Jerusalem on 6 November 1968 at Hadassah Medical Centre

PART I (*contd.*)
(including discussions)

AFTERNOON SESSION

SECONDARY VERTEBRAL DEFORMITIES IN CHILDHOOD AND ADOLESCENCE

ABSTRACT

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THIS is a report of 60 paraplegic patients who sustained their paraplegia either in early childhood or as young adults under the age of 16. Twenty-one were of traumatic origin, very often without fractures, 19 as a result of transverse myelitis or arachnoiditis, 10 following tumours and 9 due to congenital malformation. Some of the latter patients also sustained injuries in addition to their malformation (Table I).

TABLE I

Infantile Paraplegia up to the Age of 16

Aetiology

Trauma, with or without fracture	21 (35%) para, 14; tetra, 7
Myelitis—arachnoiditis	19
Tumors	10
Malformative and congenital paraplegia	9
Others	1
	60

With regard to the type of spinal deformity, scoliosis was the most frequent in the cases of myelitis, tumours and malformation. Kyphosis, hyperlordosis and kyphoscoliosis were found frequently in the same individual. Twenty patients did not have spinal deformities (Table 2).

Deformities developed more frequently before the age of 12 than after. In the older age-group, there were 19 deformities amongst 29 patients, while in the younger age-group 35 deformities were found in 31 patients.

The results of these deformities are: disturbance of the sitting balance, limitation of independence, development of pressure sores over ischium and posterior part of the trochanter minor, due to faulty positioning, as well as respiratory and cardio-vascular deficiency. They also may interfere with schooling and education.

TABLE II

Deformities of the Spine according to the Aetiology

Etiology	Scoliosis	Kyphosis	Lordosis
Trauma (21) .	5	7	2
Myelitis (19) .	8	2	3
Tumors (10) .	6	4	2
Malformations ((9) .	6	5	0
Others (1) .	1	0	0
60	26	18	7

In certain types of hyperlordosis with forward tilting of the pelvis, the anatomical arrangement of the bladder may be altered and compression of the kidney with haematuria and pain as a result of compression of the kidney between the ribs and corset on the one side and the scoliosis on the other may occur.

In evaluating the different causes leading to deformity of the spine, the following distinction can be made:

(1) The younger the patient when sustaining paraplegia the greater the chance of spinal deformity.
(2) The level of the cord lesion is very important. In paraplegia below T12, abdominal, back and paravertebral muscles are still intact, preventing deformity.
(3) Surgical procedures on the spine themselves may cause spinal deformities, as well as radiotherapy. It seems that laminectomy causes more frequently kyphosis, whereas rib resection and spinal osteotomy usually result in scoliosis.
(4) Early treatment and the quality of nursing and especially physiotherapy have a very important influence in this matter.
(5) Disturbance of muscle balance at trunk level and articular changes resulting in ectopic ossification have an unfavourable effect.

In discussing the treatment of spinal deformity, one has to distinguish between preventive and corrective treatment.

With regard to prevention, great care has to be taken before the paralysed child is allowed to sit up and especially to stand. X-rays of the spine in various directions have to be taken and stiffness of muscles has to be watched, as is done in polio patients. Secondly, clinical check-ups, including muscle and articular

testing, are necessary. Thirdly, pelvic tilting in sitting position must be prevented. Furthermore, it is necessary to develop the intact paravertebral muscles as much as possible. Lastly, the sitting position of the child should progress gradually with a well-fitting corset, which will be necessary for the sitting and standing positions.

When the deformity is established, we use the same treatment as for poliomyelitis and idiopathic deformities. For a long time, we have been very reluctant to use corrective plaster of Paris in spinal cord patients, as can be imagined. However, finally, we have not found another way to prevent or limit the aggravation

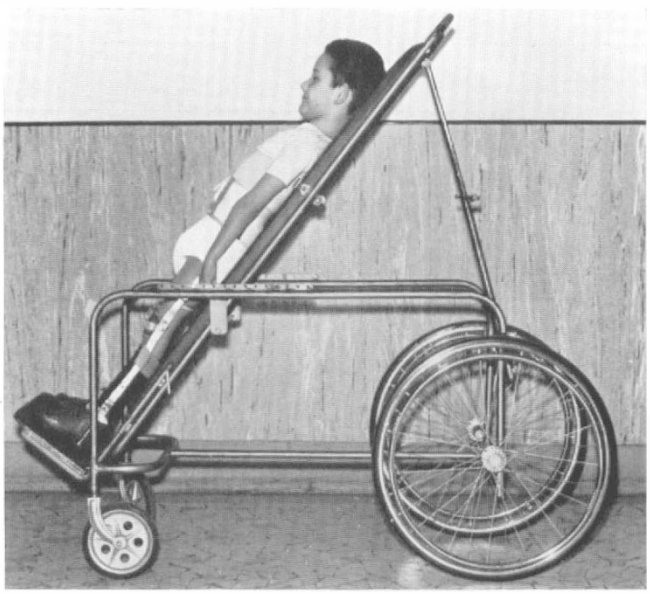


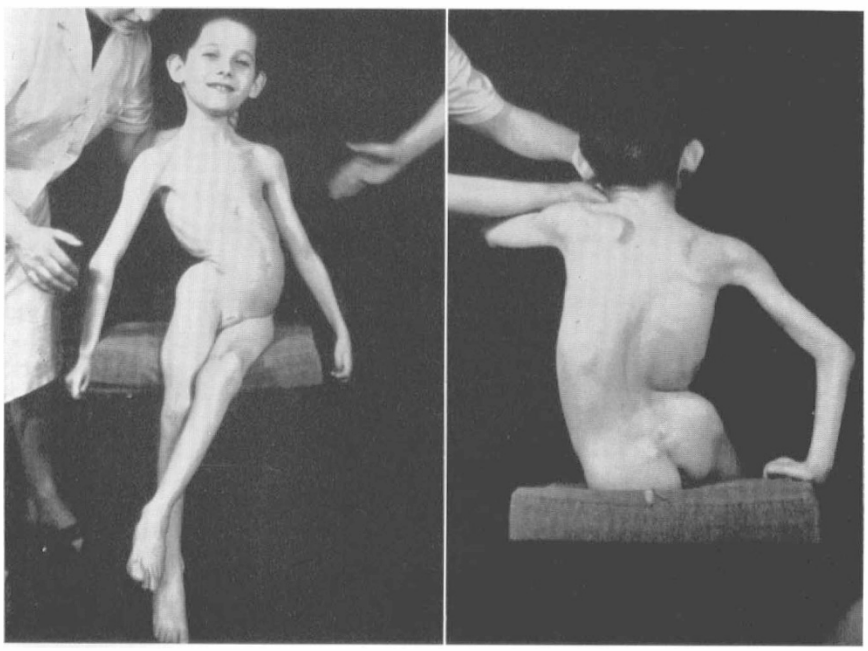
FIG. 1

Tilting table to enable upright position of a child suffering from spinal deformity as a result of incomplete spastic tetraplegia.

of deformities. Now, we are using the plaster of Paris, changing the child's position every three hours, taking off the jersey between the skin and the plaster of Paris, at first daily then every other day, and we have not run into trouble, except initially in one case. However, in certain cases, it is absolutely necessary, *before making the plaster*, to decrease the spasm by the use of Valium or by alcohol injection at the level of the motor points, or even by certain surgical procedures either on muscles or nerves. In a few cases, the treatment by plaster of Paris must be completed by bone graft. When this is necessary, the Harrington technique seems to us to be a good solution.

Lastly, the treatment of these deformities means limitation of the sitting position until the child's growth ends or until consolidation is achieved by a graft. Our patients are always allowed to stand for at least one hour, to sit for one hour at least for toilet, because the independence of a child must be preserved much more than the

degree of independence of a grown-up. Later, the child either stands, with an apparatus if one is necessary, or he lies in supine position on a tilting table, the tilting of which may be changed from horizontal up to 70° (Fig. 1). This system decreases the strain on the spine, makes education easier and allows the patient to be in touch with the surrounding world in a more normal way than being constantly lying supine. Instead of a tilting bed, a tilting board fixed on four wheels may be used, called 'wheelchair-type relax'.



A B

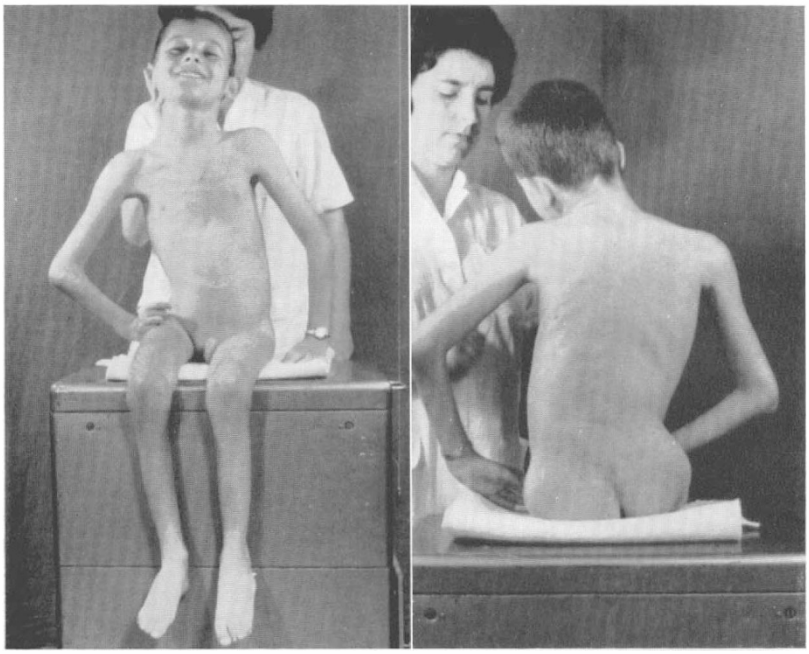
FIG. 2

A and B, Profound spinal deformity due to preponderance of spasticity of the right side in a boy with an incomplete spastic tetraplegia below C6.

This paper was illustrated by a number of tables, X-rays and photographs. The following cases may serve as illustrations of this paper:

CASE 1. A 12-year-old boy with incomplete spastic tetraplegia below C6 resulting in profound spinal deformity due to preponderance of spasticity of the right side. The treatment consisted in intramuscular injections of diluted alcohol combined with myotomy. As a result of the treatment a considerable improvement followed which enabled the boy to sit straight and this position is maintained by a special corset. Figure 2, A and B shows the boy's condition before treatment. Figures 3, A and B, and 4, A and B show the condition after treatment.

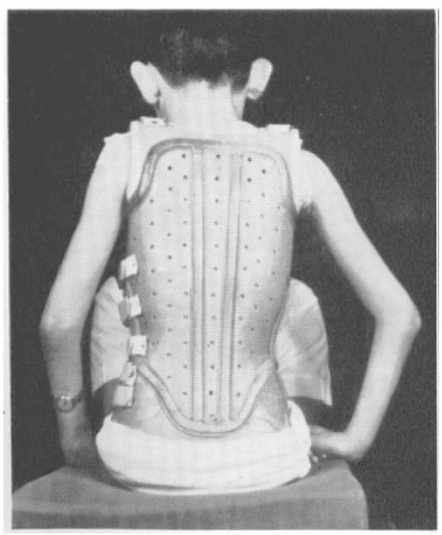
CASE 2. A 16-year old girl with complete spastic paraplegia below T2 due to sympathico-blastoma who was operated upon 12 years ago. In due course she developed



A B

FIG. 3

A and B, Considerable improvement of spinal deformity and posture.



A

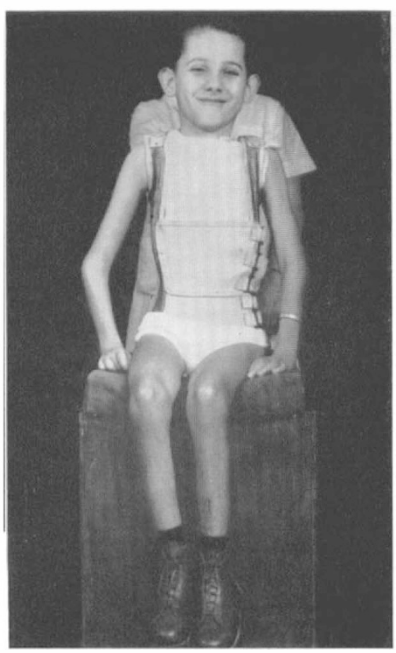


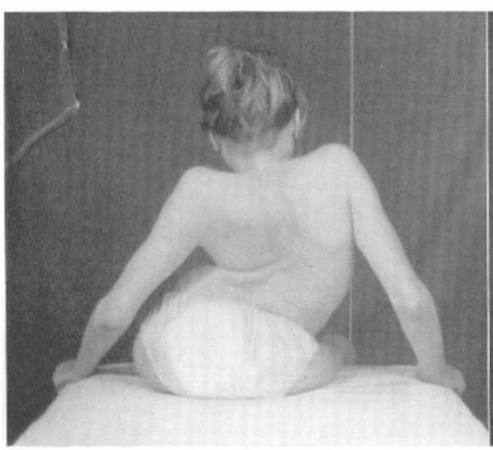
FIG. 4

A and B, Straight posture maintained by a special corset.

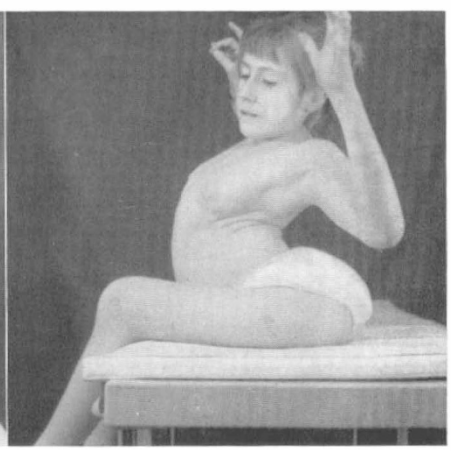
FIG. 5

A, B, and C, Grotesque deformity of vertebral column and trunk in 16-year-old girl with complete spastic paraplegia below T2.

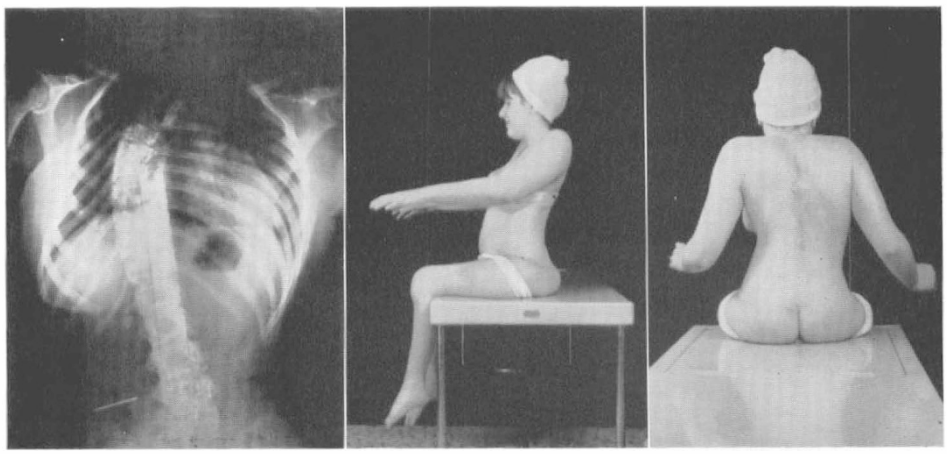
A



B



C



A B C

FIG. 6

A, B and C, Same patient three years after spinal grafting shows a most remarkable improvement of spinal deformity and posture.

a grotesque deformity of the spine and trunk with postural collapse, as shown in Figures 5, A, B and C. This patient underwent surgical treatment by spinal grafting and made a most remarkable improvement following this operation, as shown in Figure 6, A, B and C.

EVALUATION OF LATE SPINAL DEFORMITIES WITH FRACTURE-DISLOCATIONS OF THE DORSAL AND LUMBAR SPINE IN PARAPLEGICS

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PROBLEM AND INTRODUCTION

THE purpose of this clinical study was to determine which deformities of the dorsal and lumbar spine produced by fractures and dislocations were important. These deformities were to be considered in regard to return of spinal cord and nerve root function, as well as the effect of the deformities on sitting and walking as well as disabling back pain. Of special concern was the identification of deformities which proved to be progressive. On the basis of such a study, one would like to be able to predict which fracture dislocations of the spine should be relocated and which should be stabilized by fusion and by which operative method.

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