

From Sophies Minde, Oslo University Orthopaedic Hospital.
(Head: Professor dr. med. Ivar Alvik).

SCOLIOSIS

A Method for Fusion with Early Mobilization of the Patient

By

IVAR ALVIK

The aim of the operative treatment of the increasing scoliotic curve is to stop the progression of the curve, to prevent further secondary deformation, to improve the stabilization and the whole physical fitness of the patient, and if possible, to correct as much as advisable the curve itself.

On account of these indications and because of the drawbacks of the ordinary methods for fusion with the long lasting immobilization in a heavy plaster jacket confined to bed for many months, partly also because of the inconvenience by operating through a window in the plaster jacket, and also because of the shortage of orthopaedic beds in our country, we started ten years ago to develop our own method for fusion of the increasing scoliotic curve.

The main principles in this method are:

1. The curve is first mobilized as much as possible by means of physiotherapy consisting of bending and stretching the curve in the same way as treating a contracture. Especially important is the stretching of the muscles and the soft tissue on the concave side of the curve.
2. Having obtained the best possible mobilization of the curve a plaster jacket is applied with the patient in standing position in a gallow with suspension and side traction.
3. Further correction is obtained by means of ordinary wedging of the jacket. I admit that it may be impossible to obtain the same correction as by using a turnbucklejacket. But I don't think it is advisable to press the correction beyond a reasonable force. The rebending power of a curve corrected too much in this way is so strong that no ossifica-

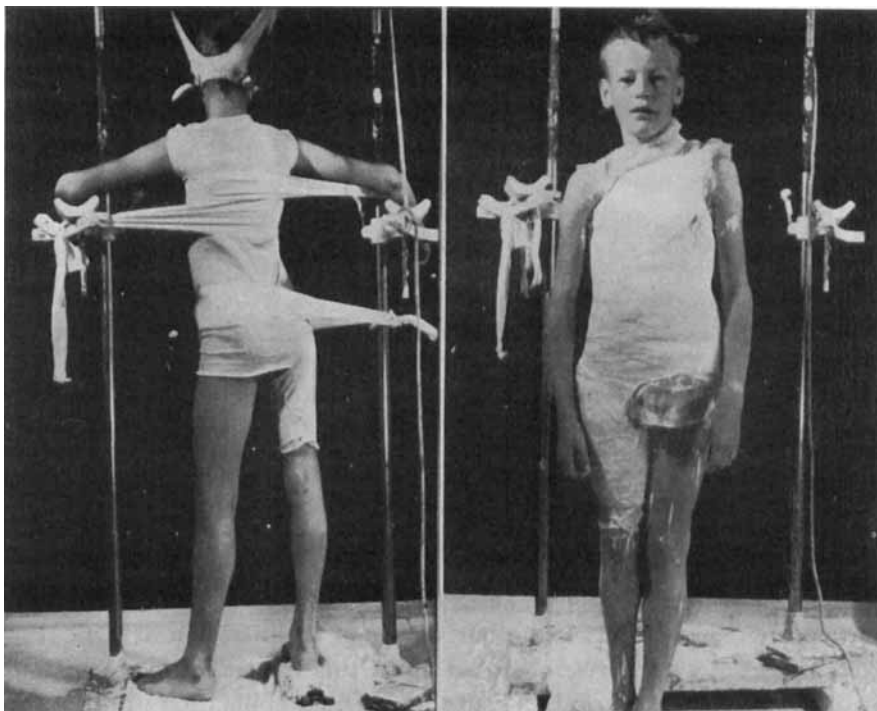


Fig. 1.

Fig. 2.

Fig. 1. The patient placed in the gallow in standing position with suspension and side-traction

Fig. 2. The plaster jacket applied in the position shown in Fig. 1.

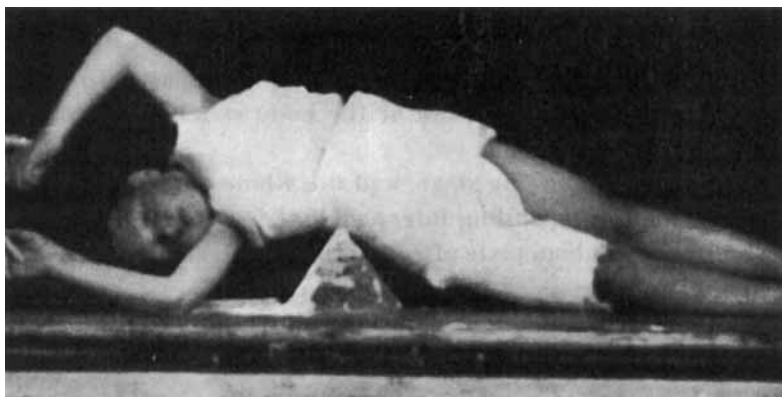


Fig. 3.

Wedging of the plaster jacket for further correction of the curve.

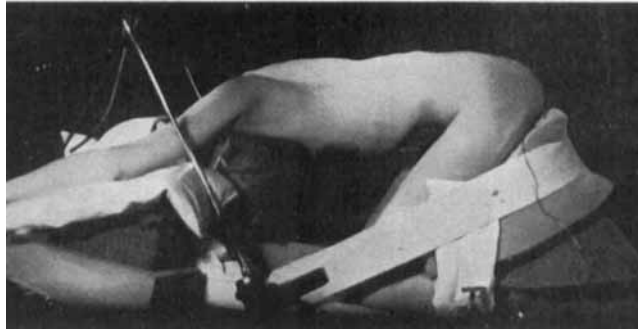


Fig. 4.

For operation (fusion) the patient is placed on the operating table in the so-called Knee-Elbow position.

tion and no newformed bone can stand it. The consequence is development of pseudarthrosis after removal of the postoperative plaster jacket.

4. The corrected plaster jacket is carried for several weeks or months and is often changed after another seance of mobilization of the curve.

In cases not going to be operated upon, this treatment may continue until the increasing period has subsided. The mobilization and the following corrected plaster jacket may also sometimes precede the treatment with Meellwakey brace.

5. Before the fusion the plaster jacket is removed giving access to the operating field without any hindrance.

6. The operation is performed in the so-called *knee-elbow position*. This position is convenient for the surgeon and facilitates the operation. The bleeding is also minimal in this position compared to the usual prone position with more or less of the body weight pressing on the abdominal wall.

The fusion is done in one stage, and the whole curve is included the fused area. The corresponding intervertebral joints are resected.

To obtain a broad boneplate after the fusion the soft tissue is stripped well off to both sides.

A large amount of bone-bank bone is used as chips, usually more than half a liter for each fusion.

7. After the operation the patient is placed back in bed without any plaster jacket and without any corrective spine support.

8. The patient is usually let out of bed the third or fourth day after the operation without any spine support.

9. As soon as the patient is able to stand in the gallow for at least 20 min., he is replaced there with suspension and side traction as before the operation, and another plaster jacket is applied in the same way as previously. This is done about 14 days after the operation, sometimes a little later, but has to be done before the new formed bone is going to be calcified. The procedure is surprisingly well tolerated, and further correction of the curve is also this time obtained by means of ordinary wedging of the jacket. The corrective force used by the wedging should not be greater than the corresponding force used before the operation.

10. With this plaster jacket the patient is sent home, can walk around, attend school and maintain activity.

11. The plaster jacket is worn for 9 months, some times a little longer. After removal of the jacket, an X-ray control is taken in standing position, one exposure with weightbearing (the weight of the body) and another in suspension, in the same way as before the operation. A similar control is taken half a year after removal of the postoperative plaster jacket, and once a year later.

TABLE 1
*Scoliotic patients treated by means of fusion at Sophies Minde, Oslo University
Orthopaedic Hospital from 1952 to 1960.*
Number 152

	Females 103	Males 49
<i>Etiologi</i>		
Poliomyelitis	95	(71 right and 24 left)
Idiopathic	52	(44 right and 8 left)
Congenital	5	(2 right and 3 left)

From 1952 till 1960 152 patients have been treated with fusion of the scoliotic curve at Sophies Minde, Oslo University Orthopaedic Hospital. The first few cases were treated with correction in the turnbucklejacket and operation through a window in the jacket. All the others were treated in accordance to the described method of correction and fusion.

In the course of the first years in this period 20 of the youngest patients were treated with hemilateral fusion. The fusion in these cases was carried out just on the convex side of the curve, assuming that the

curve during further growth would correct itself. We found also such a correction in the following years in 8 cases. We found, however, in 10 of the cases with hemilateral fusion a considerable increase of the curve after the fusion. In 5 of them the cause of the impairment was a pseudarthrosis, and the cause in the other was probably that the new formed bone in these young individuals was too weak and too soft to stand the pressure of the force causing the scoliosis. All the patient with hemilateral fusion were under the age of 11 years at operation.

The few cases treated with turnbucklejacket and fusion through the window in the jacket, and the cases treated with hemilateral fusion are included in this material. 9 cases over the age of 18 years treated with fusion of extensive scoliotic curve because of pain and dorsal insufficiency are also included.

Complications: We do not have any death postoperatively. We have not had any serious infection either, but a few cases have had a serous sinus lasted for some weeks not interfering with the final result. Rather frequently a postoperative hematoma has to be aspirated preventing a sinus.

The follow-up examination shows 4 deaths in the course of the first three years after the operation. All of them were poliocases with pronounced respiratory paralysis, and all of them died of diseases in the respiratory system. At that time we did not have opportunity to perform the same elaborate respiratory and cardiac analysis before the operation as later on, excluding cases with a developing cor pulmonale. It is, however, impossible from this material to draw any conclusion concerning the mortality rate among fused and not fused poliopaticents with increasing scoliotic curves.

TABLE 2
Age at operation.

4 years	1 case	14 years	32 cases
5 years	1 case	15 years	24 cases
6 years	1 case	16 years	13 cases
7 years	3 cases	17 years	8 cases
8 years	3 cases	18 years	3 cases
9 years	5 cases	19 years	3 cases
10 years	5 cases	20 years	1 case
11 years	7 cases	21-25 years	3 cases
12 years	14 cases	over 25 years	2 cases
13 years	23 cases		
152 cases			

TABLE 3
Number of vertebrae included in the fusion.

4 vertebrae fused in 1 case	10 vertebrae fused in 19 cases
5 vertebrae fused in 3 cases	11 vertebrae fused in 11 cases
6 vertebrae fused in 4 cases	12 vertebrae fused in 26 cases
7 vertebrae fused in 7 cases	13 vertebrae fused in 31 cases
8 vertebrae fused in 3 cases	14 vertebrae fused in 28 cases
9 vertebrae fused in 12 cases	15 vertebrae fused in 7 cases
152 cases	

TABLE 4
Observation time.

1.5-2 years	44
2-3 years	55
3-4 years	20
4-5 years	16
5-6 years	11
146	

TABLE 5
Follow-up.

Follow-up examined	146
Dead postoperatively	0
Dead later on *	4
Refused follow-up examination	2
152	

- * 1 dead of bronchopneumonia 2 months after the operation.
 1 dead of Asiasyke (probably bronchopneumonia) 1 year after op.
 1 dead of bronchopneumonia 1 year after the op.
 1 dead of pneumonia 3 years after the operation.
 They were all poliocases with pronounced respiratory paralysis.

Table 2 shows that the fusion usually has been performed at the age of 13-15 years, and Table 3 shows that in most cases the number of fused vertebrae were from 12 to 14.

More or less correction is obtained in about 80 % compared to the curve before operation. This is the final result estimated at the later controls, and is not referring to the correction just after removal of the postoperative plaster jacket.

TABLE 6

Final result of 146 fused scoliosis in accordance to correction of the curve.

Correction obtained	116:	79.5 %
Unchanged (+ — 2 degrees)	10:	6.8 %
Curve increased (9 pseudarthrosis)	20:	13.7 %
		146: 100.0 %

TABLE 7

Final obtained correction measured in degrees.

Under 6 degrees	9 cases	26-30 degrees	12 cases
6-10 degrees	22 cases	31-35 degrees	7 cases
11-15 degrees	27 cases	36-40 degrees	4 cases
16-20 degrees	18 cases	41-45 degrees	2 cases
21-25 degrees	14 cases	46-50 degrees	1 case
			116 cases

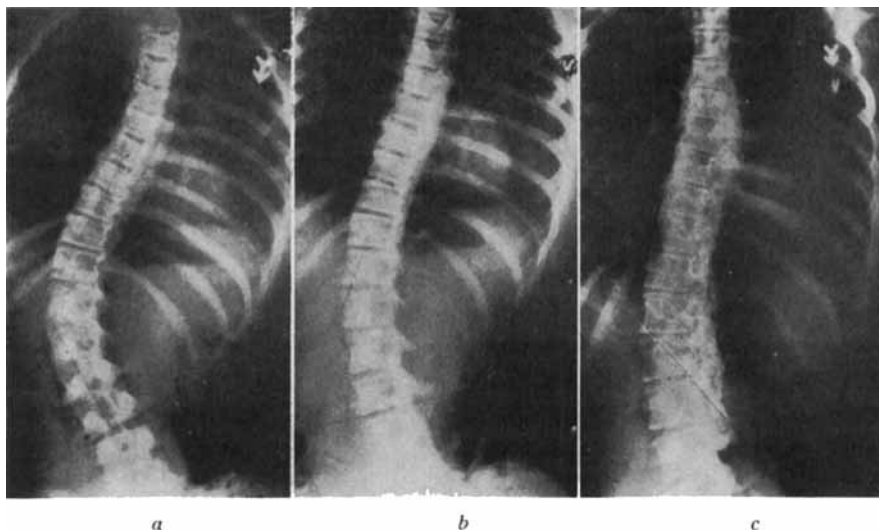
It is evident that in most cases some of the correction is lost after removal of the postoperative plaster jacket. There is, however, no loss at all in 39 cases, and a loss of less than 5 degrees in 45 cases. The average loss of correction after removal the postoperative plaster jacket is 6.3 degrees included 9 cases of pseudarthrosis. (Pseudarthrosis rate: 6.2 %).

TABLE 8

Changing of the curve from the time when the plaster jacket was removed (9 months after the operation) till the follow-up examination.

Decreased (further correction)	11 cases
Unchanged	28 cases
Increased curve: (loss of correction)	
0- 5 degrees	45 cases
6-10 degrees	29 cases
11-15 degrees	11 cases
16-20 degrees	6 cases
over 20 degrees	15 cases (9 pseud-arthrosis)
145 cases	

Average loss of obtained correction from removing the plaster jacket till follow-up examination = 6.3 degrees.

*Fig. 5.*

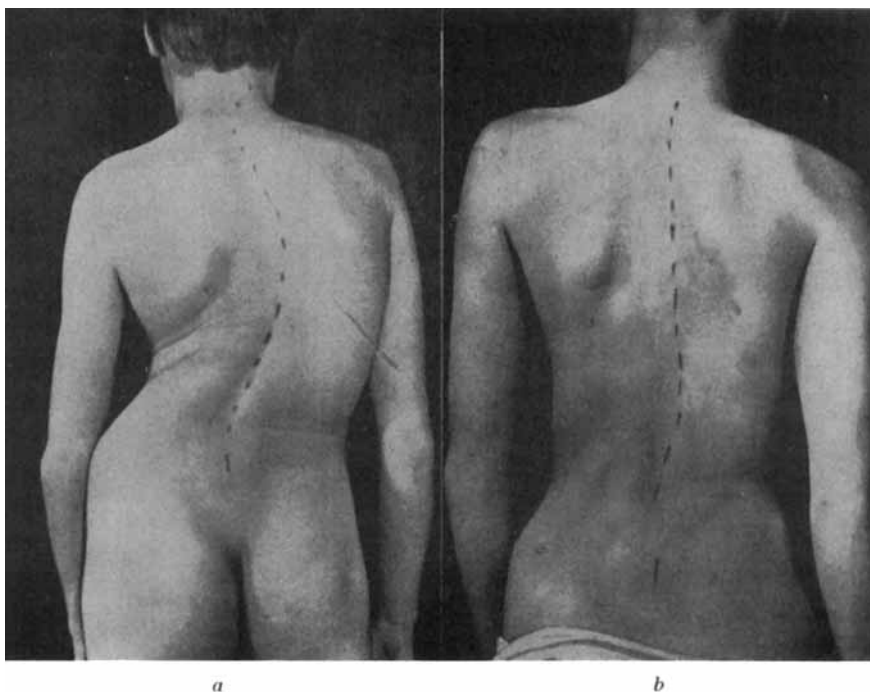
- a) The spine in standing position with body weightbearing.
- b) The same spine in standing position suspended after mobilizing.
- c) The same spine after fusion.

Fig. 5a shows a scoliotic spine on the X-ray film in standing position with body weightbearing, b) the same spine in standing position and suspended after mobilizing, and c) the same spine in standing position after fusion.

S U M M A R Y

The first step in the surgical treatment of the scoliotic curve is forcible mobilization by means of physiotherapy. After that a corrective plaster jacket is applied in standing position with suspension and side traction, and the jacket is further corrected by means of ordinary wedging. For fusion the plasterjacket is removed, the patient is placed on the operating table in the so-called "Knee-Elbow position", and returned to bed without any kind of spine support. The patient is let out of bed in the course of the first three or four days after the operation, and a new corrective plaster jacket is applied in the standing position with suspension and side traction as soon as the patient can stand in the gallow, usually about 14 days after operation. With this jacket he is sent home, to school and activity for 9 months.

The number of fused vertebrae were usually from 12 to 14, all in one

*Fig. 6.*

- a) The patient before treatment.
b) After fusion.

seance. More or less permanent correction of the curve is obtained in 80 %. The pseudarthrosis rate has been 6.2 %. The average loss of correction after removal of the postoperative plaster jacket has been 6.3 degrees (including the pseudarthroses). There has been no loss at all in 39 out of 152 cases.

RESUME

Le premier pas dans le traitement chirurgical de la courbure scolio-tique est la mobilisation forcée au moyen de la physiothérapie. Après cela on utilise un corset plâtré correctif, mis en place en position verticale avec suspension et traction de côté, le corset étant corrigé plus tard par les moyens ordinaires de feutrage. Pour opérer la fusion, le corset plâtré est retiré, le malade est placé sur la table d'opération dans la position dite « genou-coude » et il est replacé dans son lit sans aucune sorte de soutien de la colonne vertébrale. Le malade est sorti du lit au

bout de trois ou quatre jours après l'opération et un nouveau corset plâtré correctif est mis en place en position verticale avec suspension et traction de côté dès que le malade peut supporter la bretele, en général 14 jours après l'opération. Muni du corset, il est renvoyé à la maison, il peut retourner à l'école ou reprendre son activité pour une période de neuf mois.

Habituellement, le nombre des vertèbres fusionnées a été de 12 à 14, toutes dans la même séance. Une correction plus ou moins permanente de la courbure a été obtenue dans 80 % des cas. Le taux de la pseudarthrose a été de 6,2 %. La perte moyenne de correction après que le corset plâtré post-opératoire ait été retiré a été de 6,3 degrés (y compris la pseudarthrose). Dans 39 des 152 cas, il n'y a pas eu de perte du tout.

ZUSAMMENFASSUNG

Der erste Schritt in der chirurgischen Behandlung der skoliotischen Krümmung ist die wirksame Mobilisierung mittels Physiotherapie. Danach wird ein korrigierendes Gipsmieder in stehender Stellung unter Suspension und Seitenzug angelegt und das Mieder wird weiterhin mittels der geläufigen Anbringung von Keilen korrigiert. Für die operative Versteifung wird das Gipskorsett entfernt, der Patient wird auf den Operationstisch in die sogenannte „Knie-Ellbogenlage“ gebracht und ohne irgendeine Art der Wirbelsäulenunterstützung ins Bett zurückgelegt. Im Verlaufe der ersten drei oder vier Tage nach der Operation wird der Patient aus dem Bett geführt und ein neues, korrigierendes Gipskorsett wird in stehender Stellung unter Suspension und Seitenzug sobald der Patient im Galgen stehen kann, gewöhnlich ungefähr 14 Tage nach der Operation angelegt. Mit diesem Mieder wird er für 9 Monate nach Hause, zur Schule und zur gewöhnlichen Beschäftigung entlassen.

Die Zahl der versteiften Wirbel betrug meist 12 bis 14 in einer Sitzung. Mehr oder weniger dauernde Korrektur der Krümmung wird in 80 % erhalten. Pseudarthrosen traten in 6,2 % auf. Der durchschnittliche Verlust an Korrektur nach Entfernung des Gipsmieders war 6,3 Grade (einschliesslich der Pseudarthrosen). In 39 von 152 Fällen kam es zu keinerlei Verminderung der Korrektur.