

EXPERIENCES GAINED FROM
SPONDYLO-SYNDESIS OPERATIONS WITH H-SHAPED
BONE TRANSPLANTATIONS IN THE CASE OF
DEGENERATION OF DISCS IN THE LUMBAR BACK

By

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In cases of disc degeneration in the lumbar back many different operative methods have been employed to bring about spondylosyndesis. Generally speaking, by means of various forms of bone transplantations the aim has been to obtain an osseous conjunction between the arches. Sometimes arthrodesis operations have been performed on the intervertebral joints. Frequently different operative methods have been combined. In more isolated cases an effort has been made with bone transplantations to induce an osseous conjunction between the actual vertebral bodies.

Although a number of statisticians have shown very good results, notably in the case of lumbo-sacral spondylosyndesis (e.g. Lee, King, De Forest Smith), the experience of most orthopedic surgeons seems nevertheless to have been that the result of spondylo-syndesis operations in the lumbar back is quite often not brilliantly successful. It is true that a number of cases recover or become better, but quite often the trouble is found to be almost as pronounced after as before the operation. Some of these failures are due to the fact that no complete osseous consolidation is achieved. Even after the operation some mobility continues to exist in the degenerate disc on account of grafting complications such as pseudo-arthrosis right through the graft, pseudo-arthrosis between graft and arch, resorption to a greater or less extent of the transplanted materials.

In 1943 Breck and Basom published a new operative method with H-shaped bone transplantations taken either from the crista ilei or from the tibia. These pieces of bone are pressed in between the proc.

spin. of the patient who lies in a prone kyphotic position, and so the distance between the proc. spin. is relatively great. When subsequently the back is straightened, the transplantations sit very firmly wedged in between the proc. spin. This operative method has been stated to possess the following advantages. As the transplants keep the vertebral bodies fixed in a reciprocally flexed position the pressure on the rear portion of the disc is lightened, whereby any existing prolapsus of the disc can be reduced. In this way a sUBLUXATION between the vertebrae, which is fairly common in cases of disc degeneration, can be kept reset. Thus a widening of the foramen intervertebrale, through which the nerves pass is gained. Thanks to the firm wedging of the transplanted material between the proc. spin., the patient's stay in bed after the operation can be made relatively short. Finally, this operative method is believed to bring about a relatively secure osseous consolidation. Thus Unander-Scharin, for instance, reports that out of 18 patients on whom this operative method was performed only 1 resulted in a grafting complication.

Since this operative method seemed in theory to have several advantages, and as, moreover, the practical experiences gained from it were apparently favourable, I resolved to test the method.

A series of 61 patients were operated on, but as for various reasons 4 of them were not subsequently given an X-ray examination there remain 57 cases (93 per cent of the series) in which it has been possible to follow the result of the operation.

In 51 of the cases the H-shaped bone transplantation consisted of a piece of the crista ilei—that is to say, mainly of spongy bone—, in 6 of the cases, of a piece of the corticalis of the tibial diaphysis. In addition, bone chips were inserted against the decorticated arches on the one side, and in one case the cartilage in the intervertebral joints was removed. After the operation the patient had to remain in bed in plaster of Paris for 8 weeks. After that the patient was allowed to get up and wear a corset.

In a number of cases, either on one or more previous occasions (15 cases) or concurrently with the spondylo-syndesis operation (15 cases) laminectomy was performed on account of herniation or suspected herniation of the disc. For that purpose a major laminectomy was performed only in a couple of cases involving the removal of an entire arch, whereas in the rest of the cases only a minor laminectomy was carried out entailing the removal of lig. flavum and adjacent edges of the arch.

What I especially looked for upon making a post-examination was a) the frequency of grafting complications and b) the clinical result

in general. In order to ascertain the existence of any grafting complications, X-ray photographs were taken seven months after the operation. For this purpose in each case pictures were also taken of the lumbar back in a maximally flexed and extended position in order to discover whether there was any mobility left in the degenerate disc. The clinical result was investigated 1-2 years after the operation.

TABLE 1

Age	All spondylo-syn- desis operations combined	Mobility in the disc. Grafting complica- tion	Nature of grafting complication		
			through the graft	Graft-arch	Resorption of end of graft
15 years	1	0			
20-29 "	7 (1)	3	2	1 (1)	
30-39 "	26 (2)	8	4	3 (1)	1
49-49 "	20 (2)	5	2	2 (1)	1
50-59 "	3 (1)	2		1 (1)	1
Total	57 (6)	18	8	7 (4)	3

The figure within brackets indicates the number of tibia grafts.

It will be seen from Table 1 that out of all the 57 cases there still remained after the spondylo-syn-
desis operation a certain degree of mobility in the degenerate disc in 18 cases, i.e. in 31 per cent. This occurred relatively often in cases where a tibial graft was used. Of the 6 cases in which a tibial transplantation was performed no less than 4 cases showed some mobility still left in the disc. Of the 51 remaining cases, which were operated on with a transplantation from the crista ilei, there was still some mobility left in the disc in 14 cases, i.e. in 27 per cent of the cases. In all the cases of tibial grafts the complications that caused a certain measure of mobility to remain in the disc consisted of a deficient osseous fixation of the graft on to proc. spin.—i.e. the pseudo-arthrosis graft—proc. spin. In those cases in which crista ilei grafts were used the grafting complication consisted, in the majority of cases (8), of pseudoarthrosis right through the graft and, slightly less frequently, of pseudo-arthrosis graft—proc. spin. (3 cases) or else resorption of one of the grafted ends (3 cases). In other words the crista ilei transplantations appear to have a greater tendency to become firmly attached to the proc. spin. than the tibial grafts. That the former, on the other hand, show with relative frequency resorption right through the graft or resorption of one end of the graft is due, of

course, to the fact that they consist mainly of spongy bone tissue, which is more easily and more rapidly reabsorbed than the hard compact bone tissue in the corticalis of the tibia.

As Table 1 shows, most of the cases of disc degeneration operated upon were within the age groups 30-39 and 40-49.

Some authors have reported very good results particularly in regard to spondylo-syndesis operations L V-S I. Thus, King, who in cases of lumbo-sacral spondylo-syndesis has resorted to arthrodetic operations on the intervertebral joints, involving the fixation of the latter with metal pins + solid bone transplantation and bone chips placed against the arches, records 90 per cent osseous consolidation. Smith, who has used the same operative method, reports equally satisfactory results in connection with spondylo-syndesis L V-S I, but when the spondylo-syndesis also comprised lumbar vertebrae situated higher up, only 50 per cent osseous consolidation was obtained.

TABLE 2

Localisation of the degeneration		No. of spondylosyndesis operations	No. of grafting complications
Multiple disc degenerations	L V - S I	9	2
	L IV - L V	20	5
	L III - L IV	1	1
	L IV - S I	21	8
	L III - L V	3	0
	L III - S I	2	2
	L I - L IV	1	0
		57	18

Table 2 indicates that in spondylo-syndesis L V-S I the grafting complications were at any rate not appreciably less than in spondylo-syndesis L IV-L V. The number of cases where one single disc degeneration was operated on amounted to 30 with 8 grafting complications and the number of multiple disc degenerations was 27 with 10 grafting complications. The number of grafting complications was thus somewhat, though not very much more common, in cases of multiple disc degeneration than in simple degeneration.

Of all these 57 cases the great majority—35—had shown symptoms of disc degeneration more than 3 years prior to the spondylo-syndesis. Five had revealed symptoms for 3 years, 9 for 2 years, 5 for 1 year and 3 for less than 1 year before the operation.

When making an appraisal of the clinical results of the spondylo-syndesis operations those cases in which, concurrently with the spondylo-syndesis, an operation was also performed for herniated disc or disc prolapsus must be kept distinct. The removal of a herniated disc may in itself give freedom from the trouble or even relieve the pains in the back, so that in these cases it is not possible to determine what part the spondylo-syndesis operation has played in the patient's recovery.

In accordance with the findings of the after-examination, the cases have been divided into the following groups: Recovered. Improved and No Improvement. Those cases have been recorded as recovered in which the patients have felt quite free from trouble not only after taking up an easy occupation but even when they have been able without appreciable difficulty to perform work that puts a strain on the back. Among those who have merely shown improvement have been counted only the *markedly* improved cases. A large number of these have not felt any appreciable pain in an easy occupation but could not stand work likely to strain the back. In most cases the subjective trouble consisted mainly in some tendency towards fatigue in the back, so that nearly all the women among the patients were some form of cloth corset.

The uncomplicated cases of disc degeneration—cases, that is to say, which under the spondylo-syndesis operation revealed no signs of herniated disc—numbered 42. Of these, 10 had quite recovered (23 per cent), 22 had only improved (52 per cent) and 10 showed no improvement (23 per cent). Only 1 patient stated that she had become worse. By way of comparison I may mention Unander-Scharin's statistics, in obtaining which several different operative methods were used. In these statistics, 66.25 per cent had fully recovered, 15 per cent had improved and 18.75 per cent showed no improvement. Occasionally the following decision has to be made: in consequence of a disc degeneration a manual labourer becomes unfit for work. Shall he be advised to undergo a spondylo-syndesis operation? According to the experience gained from my material, there is only a relatively small prospect of his back becoming so well after the operation as to enable him to return to his old occupation (only 23 per cent fully recovered).

Further, it is interesting to observe what the clinical result has been in those cases which had previously been operated on for herniated disc once or several times and have subsequently, owing to persistent pain in the back, undergone a spondylo-syndesis operation. Table 3 shows that in these cases the result has been relatively satisfactory and not poor, as might perhaps have been suspected.

TABLE 3

	Recovered	Improved	No improvement
Once previously operated on for prolapsus of disc	5	4	1
Twice do. do.	1	1	—
5 times do. do.	—	—	1
Total	6	5	2

The subjective trouble which a disc degeneration induces is, as a rule, tiredness in the back, pain when moving and aches, which improve after a rest. Sometimes, moreover, there may be another kind of pain, a more persistent aching which goes on night and day and is not relieved by resting. It is generally most pronounced when the patient is lying in bed, and it therefore disturbs sleep at night. This continuous aching pain, when it occurs, is the most troublesome symptom suffered by the patient. I have observed with striking frequency how this persistent aching pain has entirely disappeared after the spondylo-syndesis operation. These patients have considered that, even if they still feel some fatigue and sometimes pain upon moving, such as might quite appreciably limit their capacity for work, they were nevertheless greatly helped by the operation. Among the 42 cases in my material which had merely a disc degeneration and at the same time showed no signs of herniated disc this persistent and pronounced aching pain in the back occurred in ten cases. Of these, 8 became entirely free from this pain after the spondylo-syndesis operation, and only in two of them did it persist after the operation. It seems to me, therefore, that the spondylo-syndesis operations were particularly justified in such cases.

It is also interesting to observe how, in cases of disc degeneration without any sign of herniated disc, sciatic pains are affected by spondylo-syndesis operations. Pains of this sort occurred in 17 cases, and were entirely relieved in 7 cases after the operation, while a marked improvement occurred in 2 cases and the pains remained unchanged in 8 cases.

Agreement between the clinical results and the grafting complications is far from complete. Table 4 shows that, out of the 10 cases of uncomplicated disc degeneration that showed a complete recovery after the spondylo-syndesis operation, 3 had grafting complications. Of the 22 that improved 5 had grafting complications, of the 10 that showed no improvement 6 had grafting complications. Whereas, then, the difference in the frequency of grafting complications among those that fully recovered and those that merely showed some improvement was

very small, the grafting complications among the unimproved cases were clearly on a larger scale than among those whose health was restored or improved.

TABLE 4

	Recovered	Improved	No improvement	
Osseous consolidation.				
No mobility in the disc.	7	17	4	= 28
Grafting complications.				
Mobility in the disc.	3	5	6	= 14
Total	10	22	10	= 42

The reason why a number of cases showed no improvement in spite of a firm osseous bridge being formed between the arches is sometimes that disc degeneration may also occur elsewhere in the lumbar back, though it may not be visible in the X-ray photographs. The question has been discussed whether, as a result of the spondylo-syndesis operation, degeneration can subsequently develop in a superjacent disc owing to an increased functional strain on that disc. Unander-Scharin found, upon examining 80 cases of spondylo-syndesis operation 1-12 years afterwards, that in 7 cases one or more of the immediately superjacent discs showed degeneration, a fact that was not apparent from the X-ray photographs taken at the time of the operation. This, as Unander-Scharin points out, may be due to the fact that the disc degeneration had already existed at the time of the operation although it was not visible in the X-ray picture, or else the degeneration had set in after the operation. Indeed, it happens fairly often that several of the lowest discs in the lumbar back undergo degeneration. I consider it rather unlikely that degeneration of a healthy disc can arise in consequence of a spondylo-syndesis. On the other hand, it is quite conceivable that an already existing state of degeneration in a disc may become further aggravated as a result of increased strain.

As has been pointed out above, there are also a number of cases recorded which, in spite of a grafting complication entailing some residual mobility in the disc, become entirely free from symptoms or else show an improvement. In grafting complications the degree of mobility that still persists in the disc is often quite small. The operation has given rise to some measure of stabilization sufficient to mitigate or to remove the trouble altogether.

As our final judgment on the operative method with the use of H-shaped grafts we may say that neither the post-operative osseous consolidation nor the clinical result in general proves to be any better

than when many other operative methods are used. When H-grafts from the tibial corticalis were used, the frequency of grafting complications was particularly high. The operation using H-shaped bone transplantations quite often led to a satisfactory result with reference to the symptom which sometimes occurs in cases of disc degeneration, viz. that constant back-ache, which is not relieved by resting and is generally most intense when the patient is lying down. Whether this is the case with spondylo-syndesis operations in general, or whether the cause lies in the fact that the H-grafts take the load off the rear part of the disc in a particularly effective manner, I am unable to judge, having no comparative material available and being unable to find in the literature any collated facts throwing light on the subject.

S U M M A R Y

After spondylo-syndesis operations with the use of H-shaped grafts taken from crista ilei + bone chips, grafting complications, combined with a degree of mobility still present in the degenerate disc, developed in 27 per cent of the cases. In a small number of cases H-grafts taken from the corticalis of the tibial diaphysis were used, and in those cases the result was even less satisfactory, viz. no less than 4 grafting complications in 6 cases operated upon. The clinical results were: 23 per cent fully recovered, 52 per cent merely improved and 23 per cent showing no improvement at all—that is to say, certainly no better results than when many other operative methods have been employed. In regard to one symptom, which sometimes occurs in cases of disc degeneration, viz. more or less persistent back-ache unrelieved by resting and most intense when the patient is lying down, the result was, however, particularly favourable. Out of 10 cases suffering from pains of this kind 8 obtained complete relief. The concordance between the clinical result and the grafting complications was far from complete.

R E S U M E

Après des spondylosynthèses à l'aide de greffes osseuses en H de la crête iliaque et de fragments d'os, il s'est développé des complications de greffons avec maintien de la mobilité du disque dégénéré dans 27 % des cas. Dans un petit nombre de cas, on avait utilisé des greffes en H de la corticale de la diaphyse du tibia; le résultat a été alors plus mauvais et on a constaté des complications des greffons dans 4 des 6 cas opérés. Le résultat clinique a été le suivant: 23 % des cas entièrement guéris, 52 % seulement améliorés et 23 % sans amélioration. Par

conséquent, il n'a certainement pas été meilleur que pour beaucoup d'autres méthodes opératoires. En ce qui concerne un symptôme qui se manifeste parfois dans la dégénération des disques, à savoir la douleur sourde presque continuelle dans le dos, qui n'est pas influencée par le repos et est le plus prononcée dans le décubitus dorsal, le résultat a été particulièrement favorable. Sur 10 cas présentant cette sorte de douleur sourde, 8 en ont été entièrement délivrés. La concordance entre le résultat clinique et les complications de greffons a été loin d'être complète.

ZUSAMMENFASSUNG

Nach Spondylosyndesen mit H-förmigen Transplantaten von der christa ilei und Spongiosastückchen entwickelten sich Komplikationen der Knochenspäne mit bleibender Beweglichkeit der degenerierten Bandscheibe in 27 % der Fälle. In einer geringeren Anzahl der Fälle sind H-förmige Transplantate der Schienbeindiaphysenrinde angewandt worden. Dabei wurden die Resultate schlechter, mit nicht weniger als 4 Komplikationen von seiten der Knochenspäne bei 6 operierten Fällen. Das klinische Resultat war: 23 % völlig gut, 52 % nur gebessert, und 23 % nicht gebessert, also sicherlich nicht besser als bei vielen anderen Operationsmethoden. Hinsichtlich eines Symptoms, das sich manchmal bei Scheibendegeneration zeigt, nämlich des fast ununterbrochenen, mahlenden Schmerzes im Rücken, der durch Ruhe nicht beeinflusst wird und bei Bettruhe am ausgeprägtesten ist, war das Resultat besonders günstig. Von 10 Fällen mit derartigem Schmerz wurden 8 völlig davon befreit. Die Übereinstimmung zwischen dem klinischen Resultat und den Komplikationen von seiten der Knochenspäne war bei weitem nicht vollständig.

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