นิพนธ์ต้นฉบับ

Anterior spinal fusion in the low-back pain ; a clinical and radiological evaluation.

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A report of seventy patients, who had anterior intervertebral disc excision and iliac bone grafting, from the Department of Spinal Disorders, The Robert-Jones and Agnes-Hunt Orthopaedic Hospital, Oswestry, England, and from the Department of Orthopaedic Surgery, Chulalongkorn University Hospital, Bangkok, is presented. The average follow-up period was one and a-half year. The main indications for this operation were chronic lumbar disc diseases such as primary lumbar instability, traumatic disc rupture, degenerative disc with scoliosis, spondylolisthesis and in post-laminectomy patients. The fusion rate in this series was 77.7% and showed good correlation between clinical and radiological results.

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รายงานผู้ป่วยโรคปวดหลังจำนวน 70 ราย ที่ได้รับการผ่าตัดเชื่อมกระดูกสันหลังทางด้านหน้า โดยผ่าตัดเอาหมอนกระดูกออกและใช้กระดูกเชิงกรานมาปลูกเสริม รายงานนี้เป็นผลมาจากการวิจัยร่วมของ แผนก Spinal disorders จากโรงพยาบาล Robert Jones and Agnes Hunt ประเทศอังกฤษ และภาควิชาออร์โทปิดิกส์และเวชศาสตร์ฟื้นฟู คณะแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย ข้อบ่งชี้ในการผ่าตัดผู้ป่วยกลุ่มนี้ได้แก่โรคปวดหลังที่มีสาเหตุจาก Chronic lumbar disc disease เช่น primary lumbar instability, traumatic disc rupture, degenerative disc with scoliosis, spondylolisthesis และ postlaminectomy จากการติดตามผลการผ่าตัดระหว่างหนึ่งปีถึงหนึ่งปีครึ่ง พบว่า มีการเชื่อมติดของกระดูกสันหลังร้อยละ 77.7 และพบว่าในรายผู้ป่วยที่มีกระดูกสันหลังเชื่อมติดกันมีอาการทางโรคปวดหลังดีขึ้น

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The logical management of patients with low back pain with or without sciatica depends upon accurate diagnosis.[1,2,3] The pain syndromes that make the patients disabled and which severely restrict their normal activities need to be sought out carefully. Clinical evaluation which should always include careful history taking, general examination and specification of the area involved will help to give a provisional diagnosis. Specific radiological examinations, such as marker films, lumbar spine series, radiculography, discography, facetography are extremely helpful in confirming the diagnosis[4,2,5,6]. Discussion of the results of clinical and radiological findings between the Orthopaedists and Radiologists is necessary. It will lead to a final diagnosis of the problemed back and then a decision can be made about further necessary treatment.

Excision of the intervertebral disc by an anterior approach and spinal fusion by interbody bone grafting is a method advocated by several surgeons.[1-32] Although the reports of this type of operation diverge strongly concerning the success of the operation, it seems that the technique employed in this particular operation, which varies from one series to another, may play an important role in the final outcome.

This is a preliminary report of a series of patients, who underwent a form of anterior lumbar spinal fusion, from the Department of Spinal Disorders, The Robert – Jones and Agnes – Hunt Orthopaedic Hospital at Oswestry and from the Department of Orthopaedics, Chulalongkorn University Hospital in Bangkok. The study is aimed to assess the radiological rate of fusion and its correlation with clinical results.

Materials and Methods

The series included seventy five patients, (thirty seven males and thirty eight females), who had anterior lumbar fusion immediately after anterior disc excision, using only left iliac cortico-cancellous bone grafts. The average age was 36.4 years (mean age being 36), the youngest was fifteen and the oldest sixty three.

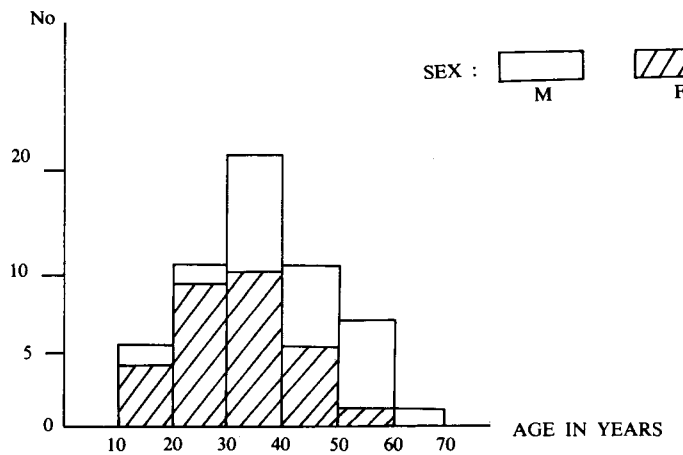

Diagram Age and Sex Distribution

By occupation 34 were classified as labourers, 22 housewives and 19 as sedentary workers. After review, five patients were excluded from the study as there were not enough information available (one became pregnant, two female patients went abroad and two males had not good enough X-rays during the time of analysis).

All the patients selected for this operation were severely disabled, many were crippled and had marked restriction of their normal activities. All these patients underwent detailed history taking, carefull clinical examination and almost all had specific radiological examination as already mentioned. These patients were then discussed in a combined conference between the Orthopaedic surgeons and radiologists to finalize the diagnosis and a decision was then made concerning the extent of anterior lumbar fusion. In many instances, when the problems were very complicated, the nursing staff, psychologists and psychiatrists were also invited to join in the discussion.

The patients were classified according to indications for anterior lumbar fusion (Table I).

Table I.

Group	Indications	No. of Patients
I	Primary intervertebral disc disease[6]	
	- primary lumbar instability	32
	- traumatic disc rupture	7
	- Degenerative disc with scoliosis	4
	- Prolapsed intervertebral disc	3
	- old infective disc	1
II	Post-laminectomy backache[1]	22
III	Spondylolisthesis[3]	6
	TOTAL	**75**

Note : five excluded from study, three in group I, one each in groups II and III

TECHNIQUE OF ANTERIOR LUMBAR FUSION[7,8,9,10,11,12,13,14]

Briefly, a retroperitioneal approach on the left side, as described by Hodgson[15,16,17] et all was performed in all patients. By blunt dissection, structures overlying the lumbar spines were pushed away and retracted by four steinman pins, inserted at vertebral body edges at each associated intervertebral space. Excision of the anterior longitudinal ligament and the intervertebral disc tissues was done as far as the inner surface of the posterior annular ligament. The vertebral end plates were curetted to expose the subchondral bones.

By using a box chisel of standard width, a block of bone was removed from the vertebra. Initially in a group of patients, the cut was high into the vertebral body but only about one-third of the vertebral depth. In a later group of patients, the cut was the opposite, that is, just beyond the vertebral end plate but deep down as far as the posterior annular ligament. Slightly oversized corticocancellous bone graft, all taken from left iliac crests, was then inserted tightly into the prepared area. The wound was closed in layers and a redivac drain put in at the bone graft-donor site. Post-operative care was short and simple. For a one level fusion, the patient was nursed in bed for one to two weeks, after which he was mobilized, supported by a lumbosacral corset. A day or two after mobilization all the patients were put into a plaster-corset which they continue to wear for up to three months. For a two level fusion the immobilization period was longer, usually for two to three weeks, after which the lumbosacral corset was applied, followed by mobilization in a plaster-corset. Some details about the surgery are described as follows :

(1) levels of anterior lumbar fusion were summarized in the following table II.

TABLE II. Showed levels of anterior lumbar fusion

Level	Group I No	Group II No	Group III No	Total No of Patients
L1-2	1	-	-	1
L3-4	1	1	-	2
L4-5	2	1	-	3
L4-5, L5-6	1	-	-	1
L4-5, L5-S1	23	16	2	41
L5-S1	17	3	4	24
L5-6	2	1	-	3
TOTAL				**75**

N.B. L6 = Lumbarization

(2) Time and blood loss.

The time spent on the operation depended on the level and numbers of fusion. In group I, the time varied from ½-2 hours, except for one case which lasted for 3 hours at level L5-6. The blood loss varied from 80-200 cc. In group II, the time varied from 3/4-2½hours and blood loss from 150-500 cc. except in three cases where the blood losses were 800, 1000 and 2000 cc. In group III the time varied from 1-2½hours and the blood loss from 200-600 cc. except in one case where the blood loss was 1400 cc.

(3) Complications

There were very few complications regarding surgery. Only four developed superficial wound infections. Seven had deep vein thrombosis post-operatively but two had had it pre-operatively. There was one jaundice as a result of blood transfusion. In one case, one graft badly slipped from

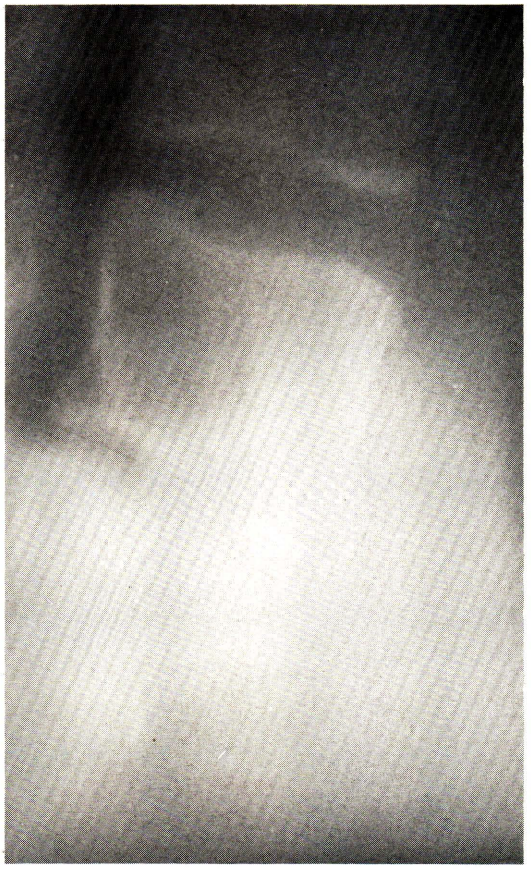

Figure 1 X-rays appearance of solid union of fusion.

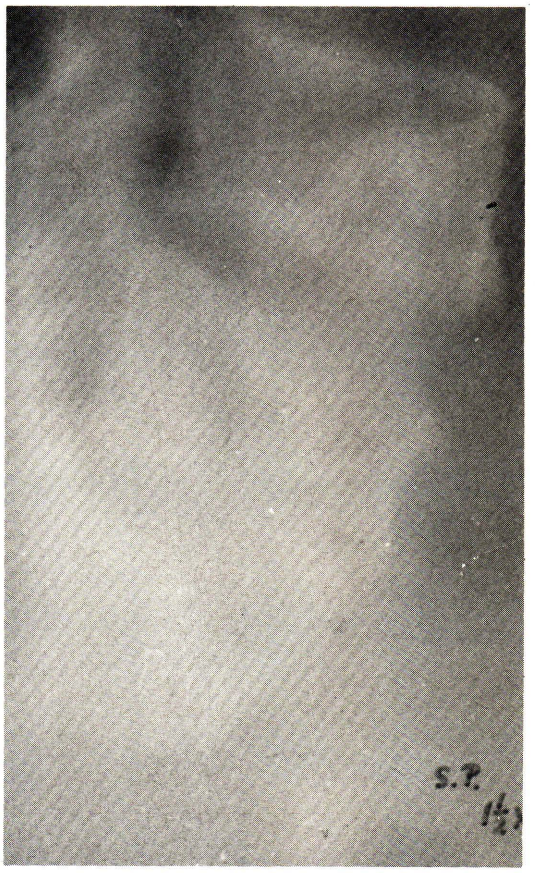

Figure 2 X-rays appearance of delayed union of fusion

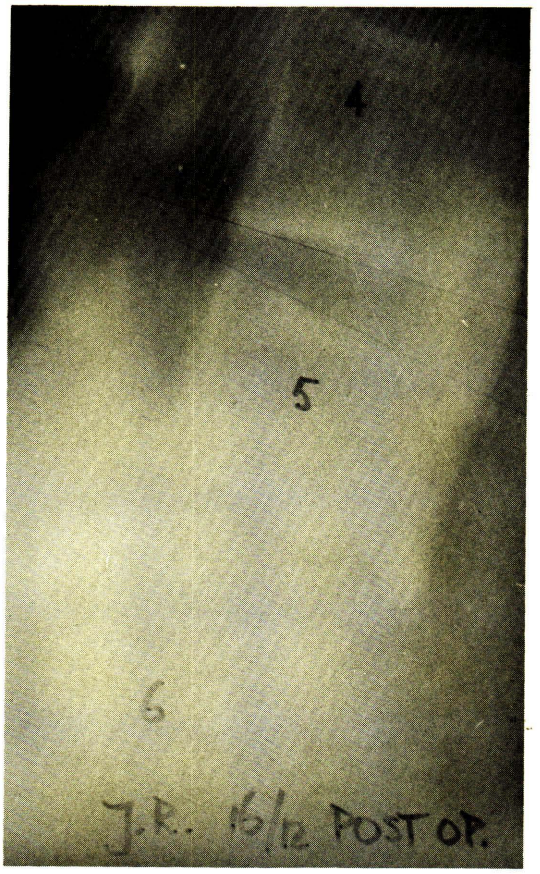

Figure 3 X-rays appearance of mon-union of fusion

the fusion area at L4-5 level which was recognized on the fifth post-operative day and the patient was re-operated on immediately. Many patients developed bladder retention and intestinal ileus for 24-48 hours which were not serious complications. As already mentioned all the donor grafts were taken from the left iliac crest area; most patients suffered from temporary hypoanesthesia of the lateral cutaneous nerve distribution. There was no death and no direct complication from anesthesia, although more than half of the patients had hypotensive type of general anesthesia during surgery. There were four cases of non-union in this series which will be discussed later on.

Results :

Follow-up of the seventy patients (five excluded from analysis) were all done by personal interview and examination by staffs of the department. The average time of follow up was one and a half year. The longest was two years and the shortest one year. As could be seen from the short followup periods, this paper was primarily intended as a preliminary report in which we hoped to draw something from these results.

A. Radiological Results.

Most authors[10,12,18,19,20,21] have commented on the difficulties encountered in the roentgenographic assessment of the presence of bony union with various types of anterior intervertebral fusion. Many[18,20,21] relied on anterio-posterior, lateral, oblique, flexion and extension views of X-rays. Some used tomography. In this series tomography was used routinely in every case at three, six, twelve month intervals, and thereafter the frequency depended upon the state of union. In doubtful cases tomography in flexion and extension views were used. In the interpretation of the roentgenographic appearance stress was mainly placed on the characters of new bone formation and patterns of trabeculation. The table (III) below shows the summation of results of radiological assessment of fusion

As clearly demonstrated in table III, only 20.3% showed fusion at six months after the operation. By the end of the first year after the operation the fusion rate went up to a total of 77.7% There were 18.5% which were still only partially fused and were still fusing at the time of follow up. Only 3.7% had definite evidence of non-union. Considering the individual level of fusion at L5-S1 the fusion rate was 24.6% at six months and 78.4% at the end of the first year, 10.7% still fusing or partially fused. At L4-5 the rates were 11.6%, 69.7% and 25.5% respectively.

B. Clinical results in correlation with radiological findings.

Most authors*[12,13,18,19,20] assess the clinical results in term of pain relief after the operation and the ability to go back to work, in conjunction with clinical examinnation. We also assessed these in the same manner, based upon subjective and objective findings.

Our criteria of assessment were graded thus :-

Good : Relief of pain in the back and lower extremity, either completely or nearly completely. Ability to return to the original employment or fully active in the newly recommended employment. Physical activity not at all or only slightly

TABLE III : Summation of results of radiological assessment of fusion

Time / Level	Group of Patients	1 Level L5-S1	2 Level Fusion		1 Level Floating Fusion*	TOTAL No of Grafts
			L4-5	L5-S1		
Fusion at 6 months	I	5	2	4	1	
	II	1	3	4		22 (20.3%)
	III	2				
Fusion between 6-12 months	I	11	13	11	1	
	II	2	11	8	1	62 (57.4%)
	III	2	1	1		
Partially fused and still fusing between 12-24 months	I		7	4	2	
	II		4	3		(18.5%)
	III					
Non-union between 12-24 months	I		2		1	
					1	4 (3.7%)
	III					
						108 (100%)

N.B. * 2 level fusion means fusion done at two intervertebral disc spaces in the same operation.

* * Floating fusion means fusion done at levels other than L4-5, L5-S1

limited. Occasional analgesic medication required or not at all. Patient's high satisfaction with the operation.

Fair : Partial relief of pain in the back and lower extremity, which should be a lot better than the pre-operative pain. Ability to return to light work or original employment with some limitations. Physical activity limited to a certain degree. Frequent usage of analgesics. Patients still happy with the operation.

Poor : Little or no relief, or sometimes worse pain in the back and lower extremity. Inability to go back to work. Physical activity significantly limited. Constant use of analgesics. Patients not happy with the operation. The results are shown in Table IV.

To simplify these results, if we combine the groups of good and fair patients together as a satisfactory group leaving poor as an unsatisfactory group the picture can be clarified as in table V.

TABLE IV Clinical results in correlation with radiological findings

Radiological Appearance	Groups	No. of Patients	Clinical Grading		
			Good	Fair	Poor
Those showed fusion at end of first year	I II III	25 12 5	17 (68%) 6 (50%) 5 (100%)	6 (24%) 4 (33.3%)	2 (8%) 2 (16.6%)
Those showed partially fused and fusing	I II III	15 8	7 (46.6%) 3 (37.5%)	4 (26.6%) 3 (37.5%)	4 (26.6%) 2 (25%)
Those showed definite non-union	I II III	3 1	1 (25%)		3 (75%) 1 (100%)

TABLE V. Summation of clinical results in correlation with radiological findings.

Radiological Appearance	No. of Patients	Satisfactory	Unsatisfactory
Those fused at one year	42	38 (90.5%)	4 (9.5%)
Those partially fused and still fusion (1-2 yrs)	23	17 (73.9%)	6 (26.0%)
Non-union	5	1 (20%)	4 (80%)

Tables IV and V suggest a good correlation between radiological findings and clinical assessments; 90.5% of patients whose X-rays showed fusion have been graded as satisfactory and 9.5% as unsatisfactory. In those, whose X-rays showed incomplete fusion (partially fused and still fusing), the percentage of satisfaction went down to 73.9%, 26% being dissatisfied. In the non-union group, although the number was small, only one was satisfied with the operation while four out of five were not satisfied. There was no significant difference between groups I and II.

Discussion :

The evidence of bony fusion, complete and incomplete, or non-union should be apparent within the first twelve months after the anterior lumbar spinal fusion. Although the follow-up period in this series was short, a confident interpretation of the preliminary results could be made.

Radiological evidences of fusion was 20.3% at six months' follow up but increased to 77.7% by the end of the first year. There were still 18.5% of cases which had partial fusion but most, if not all of these would eventually accomplish complete fusion. In which case, the overall fusion rate in this series would be well over 90%. This figure resembled those reported by Harmon,[5,6,11,22] Humphries and associates,[13] and Goldner and associates[19] who reported 75% to 96% fusion rates and excellent clinical results. However, this was in contrast to the series from Stauffer and Coventry[20] who reported fusion rate of 56%, Rancy and Adam[23] of 45%, Taylor[24] 44%, Nisbet and James[25] 40%, and Galandruccio and Benton[26] 18%.

In our series, there was a good correlation between clinical and radiological results. In those cases which had radiological fusion, 90.5% of patients obtained good clinical results and only 9.5% were unsatisfied. Of those patients who showed partial fusion in the radiological assessment, 73.9% had satisfactory clinical results, while of those with non-union 80% had unsatisfactory clinical results. The Similar results were reported in Goldner's[19] series which were in contrast to the Stauffer and Coventry[20] series which claimed only 36% good clinical results. Also, Freebody and associates[10] stated that there was no close relationship between non-union and clinical results.

There is still a lot to learn about the problem of low-back pain, and especially about applying anterior lumbar spinal fusion. A scientific and experimental search for an ideal bone graft and an improvement in the operative technique will certainly help to create even better results for this operation.

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