

# THE INDICATIONS FOR AND RESULTS OF THE EXCISION OF LUMBAR INTERVERTEBRAL DISC PROTRUSIONS : A REVIEW OF 500 CASES

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THE DIAGNOSIS OF protrusion of a lumbar intervertebral disc is readily made in the majority of patients by a careful clinical examination and the study of skiagrams of the lumbo-sacral region. The essential problem is not diagnosis but in deciding upon the correct treatment in each case. The natural history of lumbago and sciatica has not been altered by the discovery of their common cause, and the tendency for spontaneous and frequently rapid recovery to take place remains as strong as it has been down the centuries. Rest during the stage of acute symptoms and later exercises for the lumbar muscles and joints forms the correct treatment in the majority of patients. Only when an adequate trial of such measures fails to bring relief should surgery be considered. It is, therefore, clear that any discussion of the relative merits of conservative and surgical treatment is profitless, since surgery should be reserved for cases in which other measures fail. The series of 500 surgically treated cases considered here represents but a small proportion of the cases seen in the out-patient department in which a clinical diagnosis of protruded lumbar intervertebral disc has been made. It is difficult to determine what proportion of patients with the lesion require operative treatment, and there are probably considerable variations depending in particular upon the surgeon concerned. However, before a patient attends a neurosurgical clinic he will have passed through the hands of a general practitioner and often, in addition, a general physician, a neurologist or an orthopædic surgeon, and in this way many of the milder cases are filtered off and are, therefore, not seen by the neurosurgeon. Of the patients who, after such a process of filtration, are referred to the neurosurgical out-patient clinic at St. Bartholomew's Hospital, less than 20 per cent. are subjected to operative treatment. The only absolute indication for operation is the sudden development of severe neurological disturbance as a result of involvement of the cauda equina by a large protrusion. This clear indication for surgery was present in 2 per cent. of our cases and in the remainder of the cases in the series the operative indications were relative. These relative indications are the severity of the pain, its duration and the frequency

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of recurring attacks. The severity of the pain is assessed from the history, the tension signs and the disability which it causes. Where these suggest that the emotional accompaniment of pain is excessive and indicate that the symptom is one of discomfort or aching rather than pain, operation is avoided. As regards duration of symptoms it is usually decided not to operate when these are of less than three months standing. However, where pain is intense, this arbitrary minimum period of conservative treatment may be shortened, and where short-lived acute attacks of pain recur frequently, operation will sometimes be carried out.

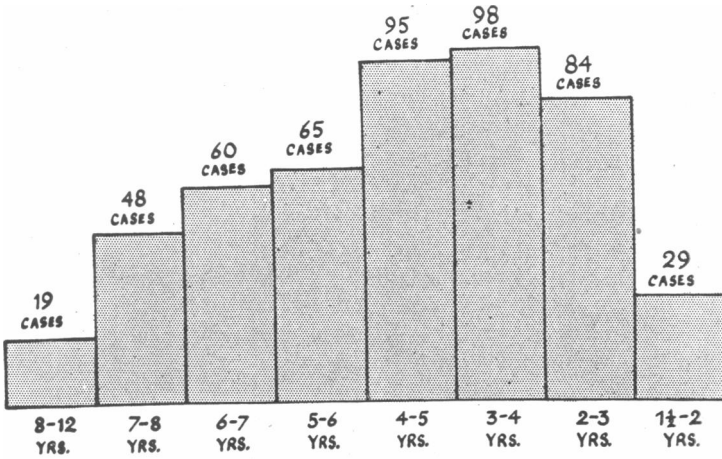
Before considering the results of the surgical treatment, reference must be made to certain important previously published follow-up studies. Poppen reviewed a series of 400 cases in 1945. These represented 8 per cent. of the patients with low back and sciatic pain entering the Lahey Clinic over a 10-year period. Of these, 65 per cent. were completely relieved of their symptoms, 30 per cent. were improved, and 5 per cent. not benefited by the operation. In 60 per cent. backache made the patient unfit for heavy lifting. In 1945 Grant reviewed a series of 200 cases with an average post-operative follow-up period of three years. In this group 63 per cent. were completely relieved, 29 per cent. were improved and 8 per cent. unimproved or worse. Grant considers that the more definite the operative findings the better the result. In 1948 Waris reviewed the late results in 374 cases with a 1.5 year period of post-operative observation. Of these 41 per cent. were completely relieved, 50 per cent. were improved, 6 per cent. were unchanged and 1 per cent. were worse after operation. In 1949 Spurling and Grantham published a follow-up study of 327 cases. 40 per cent. were cured and in a further 39 per cent. the result was satisfactory. In 21 per cent. the result was either a partial success or a failure. These results were obtained by a group of highly skilled workers. The results of surgery in groups of patients injured in industry and operated upon by a number of different surgeons, are less impressive. Thus Marble and Bishop (1945) reviewed a series of 496 cases taken from the files of an industrial insurance office. Ninety-two of these cases were subjected to operation. The result was regarded as excellent, with return to work within six months, in 37 per cent., and was fair in 10 per cent. In 53 per cent. the patient remained disabled after 12 months. Thus in less than 50 per cent. of cases was the result satisfactory and it is noted that, in over 25 per cent. of the cases submitted to operation, no protrusion was found. Aitken and Bradford (1947) review a series of 170 case records of similar origin. There were five post-operative deaths in the group (2.9 per cent.). The result was excellent or good in three per cent. of cases and was fair in 25 per cent. In 45 per cent. of cases, however, the patients were either unchanged or worse after operation. Further, in almost 28 per cent. of cases a second operation was done. Thus the results of surgery, in a group of cases treated at many different clinics and in which the question of compensation arises, are far from satisfactory.

Turning now to the consideration of the results of surgery in the present series, it must be stressed that since the disturbances which lumbar intervertebral disc protrusions occasion are essentially subjective the assessment of results presents difficulty. The first requisite is a knowledge of the individual patient so that fair comparison of his pre-operative and post-operative condition can be made. In this series every patient was examined before and after operation—frequently repeatedly—by the author, and all the operations were performed by him—except when he assisted his registrar. Secondly, the results of operation must be considered against a background of the indications which lead to it. If pain of short duration and low intensity has been accepted as indications for surgery it is clear that even mild post-operative symptoms must be regarded as evidence that the operation has been a partial or complete failure. On the other hand where operation has been reserved for patients whose pain has been severe and prolonged or frequently recurring, with a resulting gross disability, it is clear that mild post-operative symptoms are of much less significance for the patient and surgeon. It has already been stressed that in the present series the indications for operation were such as to exclude all patients with mild symptoms and little disability.

Thirdly, it is necessary, particularly if different published follow-up series are to be compared, to have detailed information concerning the type of operative and post-operative treatment. In the present series the operation was limited to relieving the affected nerve fibres from compressing and stretching forces. In only two cases was a posterior rhizotomy performed, and in no case was a spinal fusion carried out. In all except the earlier cases in the series the patient has been got out of bed on the eighth post-operative day and commences spinal exercises on the tenth day. A feature of these exercises is flexion and the patient is discharged flexing to the toes at the end of the third week after operation. All cases are advised to continue these exercises indefinitely. In the literature details of post-operative treatment receive relatively little consideration. One important matter which arises, however, is the value of spinal fusion performed after excision of the protrusion. There has been an increasing tendency towards this procedure and figures are now becoming available which assist in deciding upon its value. Rovig (1949) has carefully reviewed 100 cases of verified protrusion, followed for from 7-12 years after operation. In 43 of 46 patients in which spinal fusion was not done, there was back discomfort in varying degree, acute lumbago occurring in 15 and sciatic pain in seven. In a second group of 54 patients on whom a spinal fusion was done, 50 were symptom free and there was but one case of acute lumbago and four of recurrent sciatica. These figures suggest that spinal fusion, added to the disc excision, has very material advantages. Mixer and Barr (1941) review their results in a series of 94 cases, followed up for 18 months. In 61 of these patients the protrusion had been excised and in a second group of

33 patients a spinal fusion had been performed in addition. They report that as regards the lower limb pain 69 per cent. of the unfused group and 91 per cent. of the fused group were completely relieved. As regards back pain in the unfused cases, 52 per cent. were free from this; 38 per cent. had much pain or weakness, and the remaining cases (10 per cent.) had more severe weakness or pain. In the fused cases 73 per cent. had normal backs, and 21 per cent. mild symptoms, 6 per cent. having more severe symptoms. These results again suggest advantages in combining fusion with excision of the disc protrusion. However, Echols (1949) reviews a series of 109 cases with an average follow-up period of 5.5 years on whom simple excision of the protrusion (without fusion) was done. 91 per cent. of these patients were considered to have done well, having no more than minor complaints, referable to the back and leg, and being fully employed. He, therefore, concludes that the results of simple excision in carefully selected cases are so satisfactory that fusion is contra-indicated except in special circumstances. Spurling and Grantham (1949) consider that the results of simple removal of the disc protrusion are so satisfactory that spinal fusion is contra-indicated at the primary operation and should be performed as a secondary procedure, where persistence of symptoms warrants additional surgery. In the series of industrial cases already referred to, spinal fusion did not improve the results. Thus, in the Marble and Bishop series, fusion was followed by an excellent result in only four cases, a fair result in one case and a poor or bad result in 23 cases. Aitken and Bradford's review likewise lends no support to those who claim that fusion greatly improves the results of intervertebral disc surgery. Further, in 22 per cent. of the cases in their series in which a spinal fusion was attempted, the operation did not achieve its object. The case for spinal fusion in the treatment of lumbar disc protrusions has, therefore, not yet been convincingly made. The series of Mixter and Barr and of Rovig are small and the cases in the former followed for but a short time after operation. The results of fusion in larger series must be awaited before a final assessment of its value may be made. It must be remembered that spinal fusion increases the magnitude of the operation and the duration of the patient's stay in hospital. Fourthly, to assess adequately the results of operation a sufficiently large series of cases must be reviewed, and these must have been followed after operation for an adequate period. In Table 1 the time interval between operation and the autumn of 1949 (when the figures were made out) is shown. Thus, 127 operations had been done more than six years previously, and 237 more than four years previously. In only 29 cases of the series had the post-operative period been as short as 1½ to two years. Had it been possible to maintain contact with every patient this table would also indicate the duration of the period of post-operative observation. Unfortunately this ideal was not attained—perhaps in part because of war time conditions. Thus civilian patients changed their addresses and were lost sight of. In the case of the large

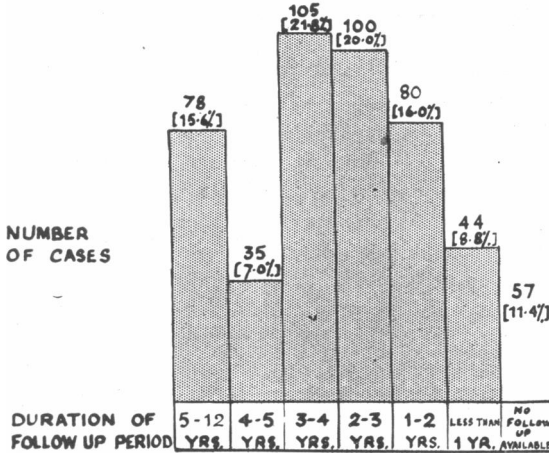
HUNTERIAN LECTURE



TIME INTERVAL SINCE OPERATION IN THE CASES IN THE SERIES.

TABLE I

TIME INTERVAL BETWEEN OPERATION AND FINAL FOLLOW UP EXAMINATION



1. 113 CASES FOLLOWED FOR OVER 4 YEARS  
[25.6% OF CASES FOLLOWED UP]
2. 218 CASES FOLLOWED FOR OVER 3 YEARS  
[49.5% OF CASES FOLLOWED UP]
3. 318 CASES FOLLOWED FOR OVER 2 YEARS  
[72.2% OF CASES FOLLOWED UP]

TABLE II

number of Service patients the follow-up was even more difficult—especially since, included amongst them, were members of the French, Dutch, Polish and other allied forces serving in England. Details of the follow-up achieved are shown in Table 2. Thus one-quarter of the patients were followed for four or more years after operation, one-half for three or more years, and almost three-quarters for two or more years.

The results of the analysis of the follow-up examinations must be considered from several points of view. Firstly, the incidence of crural and lumbar pain post-operatively must be noted—Table 3. All cases complaining of such symptoms after convalescence from operation are included in this table. Thus in 46.5 per cent. of cases there were no symptoms referable to the disc lesion and in 53.5 per cent. some such symptoms were present. As regards crural pain this was completely relieved in 77.6 per cent. but 22.5 per cent. have had some lower limb pain post-operatively. It was persistent in only 8 cases (1.8 per cent.) in the series, and in the great majority it was slight and transient. It seems possible that scarring in and around the extradural nerve is at times responsible for this lower limb pain, but the possibility of small recurrent protrusions, not producing symptoms of sufficient intensity to indicate re-exploration, does exist. Low back pain was completely relieved in 60 per cent. of the patients, but 40 per cent. had some lumbar pain after operation. Of the 177 patients with post-operative lumbar pain, in only 11 (6.2 per cent.) was this symptom either severe or persistent. In the majority it was no more than a mild weakness or discomfort following exertion.

Secondly, the results may be considered from a subjective viewpoint, and the patient's own opinion of the effectiveness of the procedure is given in Table 4. The terms used in this classification require explanation. "Cured" implies a complete absence of symptoms apart from premenstrual backache, or mild aching in the back or leg, resulting from climatic alterations. "Much improved" implies that the patient is well satisfied with the result, but develops backache after heavy exertion, or has had one or more transient attacks of acute back pain—sometimes spreading to the leg. There may also be persisting muscular weakness as a residuum of a severe pre-operative motor deficit. It will be seen that classified in this way over 92 per cent. of the patients may be regarded as either cured or much improved. "Improved" implies persistent or recurring back or leg pain but of reduced severity, and not such as to indicate re-operation to search for a recurrent protrusion. The three patients "unchanged" by operation are later referred to as incapacitated and the probable reason for the poor result indicated.

A third aspect of the results concerns the patient's post-operative working capacity. It should be pointed out that when our patients are discharged from hospital they are advised to avoid all unnecessary back strains. Thus a girl contemplating a career in nursing is counselled against such a course, or a young man whose work entails repeated

heavy back strain is advised to seek some other occupation. However, in the majority of patients one would be reluctant to advise such change of occupation because of the financial anxiety to which it would so often give rise. Caution and the avoidance of unnecessary back strain is probably the only advice one can give to most patients, and it is of interest that, among the series, there are many patients doing the heaviest manual labour and others who play county rugby football and hockey, minor counties cricket and amateur league association football. The results from the standpoint of work are shown in Table 5. As would be expected, the vast majority of patients return to full work. Three patients remained incapacitated, one because of long-standing severe osteo-arthritis of the spine, and the other two probably because of an overlying neurosis.

Fourthly, the effect of operation upon the physical signs must be considered—Table 6. As regards the spinal signs, deformity disappears in most cases with the exception of a diminution in the lumbar lordosis, which frequently persists. Local tenderness likewise disappears. Movement of full range is usually restored, though frequently it would seem that full flexion is obtained by a compensatory increase in movement at the hip and upper lumbar joints—the affected region of the spine remaining rigid. The tension signs likewise disappear in the great majority so that straight leg raising and femoral nerve stretching produce no more than a tightening in the posterior crural muscles, or the quadriceps. Persistent, though usually not significant, neurological disturbance is frequently seen, however. It is considered that the incidence of these abnormal neurological signs is almost certainly greater than is shown in Table 6, since in the course of routine follow-up examinations the slighter signs will frequently pass unnoticed. Reduction or absence of one or more tendon reflexes—in particular the ankle jerk—is the most common abnormality and was seen in over 60 per cent. of the cases. A definite area of reduced cutaneous sensibility was found in 30 per cent. Persisting disturbance of motor function was the least common neurological abnormality at the follow-up examination. Hypotonia and atrophy was seen in 8.4 per cent. of the cases. This was usually of slight degree, and except in the case of upper lumbar disc protrusions, when the quadriceps was involved, affected the muscles innervated by the fifth lumbar and upper sacral roots—glutei, hamstrings and the muscles below the knee. It is probable that a mild degree of atrophy in the peronei and dorsiflexor muscles of the ankle and toes will frequently pass unnoticed as will also atrophy of the intrinsic muscles of the foot. Persistent weakness was seen in 6.5 per cent. of the cases followed up. This may involve any of the muscle groups above mentioned in which atrophy occurs. Thus; examples of weakness of abduction and extension of the hip (glutei), extension of the knee (quadriceps), plantar flexion of the ankle (gastrocnemius and solus), dorsiflexion and eversion of the ankle (peronei and extensor muscle group) and the intrinsic muscles of the foot, have all been encountered. The most frequently weakened

movements were, however, dorsiflexion of the hallux or lateral toes or, less commonly, plantar flexion of these digits. It would appear that muscles of relatively small mass at the periphery of the limb supplied by the affected anterior root or roots are especially liable to be weakened. This residual weakness was for the most part slight. The five patients in the series who developed a severe paraparesis in association with massive

**RESULTS OF OPERATION**

TABLE 3

**1. Effect of operation on patients' symptoms :—**

(i) No symptoms referable to intervertebral disc lesion ..	206 cases	46.5%
(ii) CRURAL PAIN—		
Complete absence .. .. .	344 cases	77.6%
Present in some degree .. .. .	99 cases	22.4%
(a) Slight and transient .. .. .	85 cases	
(b) Severe and transient .. .. .	6 cases	
(c) Persistent .. .. .	8 cases	
(iii) LUMBAR PAIN—		
Complete absence .. .. .	266 cases	60.0%
Present in some degree .. .. .	177 cases	40.0%
(a) Slight on exertion .. .. .	166 cases	
(b) Severe on exertion .. .. .	5 cases	
(c) Persistent .. .. .	6 cases	
(iv) No follow-up examination made .. .. .	57 cases	11.4%

TABLE 4

**2. A subjective analysis of the results :—**

(i) Cured .. .. .	269 cases	60.72%
(ii) Much improved .. .. .	140 cases	31.60%
(iii) Improved .. .. .	21 cases	4.74%
(iv) Unchanged .. .. .	3 cases	0.67%
(v) Recurrence (Proven) .. .. .	10 cases	2.25%
TOTAL .. .. .	443 cases	99.98%

TABLE 5

**3. Effect on working capacity :—**

(i) Full .. .. .	411 cases	92.8%
(ii) Reduced .. .. .	29 cases	6.5%
(iii) Incapacitated .. .. .	3 cases	0.7%
TOTAL .. .. .	443 cases	100.0%

TABLE 6

**4. Effect of operation on physical signs :—**

(i) Spinal signs	} Markedly reduced or absent in over 80% of cases		
(ii) Tension signs			
(iii) Neurological signs (as determined at re-examination in 378 cases)—			
(a) Persistent motor disturbance (Hypotonia and atrophy only 32; muscle weakness 25) .. .. .	57 cases	15.0%	
(b) Persistent sensory disturbance .. .. .	114 cases	30.0%	
(c) Persistent reflex disturbance .. .. .	234 cases	62.0%	



disc protrusions made, on the whole, a good motor recovery, the rate of which appeared to depend upon whether compression or trauma had been responsible for the cauda equina disturbance. In two of these patients severe weakness of dorsiflexion and eversion of one ankle has persisted and it is noteworthy that there have been a few other cases in the series presenting with an isolated paralysis of the same movements. At operation in this latter group a large protrusion, particularly related to one extradural nerve, was found. Recovery of motor function did not occur following the removal of the protrusion.

The particular frequency of persistent alteration in the tendon reflexes is perhaps due to the fact that these reflexes are dependent upon the integrity of both motor and sensory fibres. Even where the loss of either type of fibre is insufficient to produce demonstrable motor or sensory disturbance, their combined loss may cause reflex disturbance. It must further be remembered that the large fibres in the posterior nerve roots which subserve proprioceptive sensibility are those which are most vulnerable in the presence of a compression force. As regards reduced cutaneous sensibility, since an intervertebral disc protrusion injures the posterior nerve root fibres central to their ganglion cells, if this injury is of such severity as to lead to fibre degeneration, the resulting sensory deficit will be persistent, there being no regeneration of the portions of these root fibres within the spinal cord. It has been noted that paralysis of dorsiflexion of the ankle and toes and of eversion of the foot on one side may persist after the removal of a massive central protrusion producing a cauda equina syndrome. It may also persist after the excision of a large laterally placed protrusion, whose effects appear to be largely confined to the extradural nerve. In both types of case there is almost certainly injury to both the intradural nerve roots and the extradural nerve at the level of the protrusion. Perhaps the tension within the latter nerve renders it particularly vulnerable and the severe lesion produced in the extradural nerve may play an important part in the production of the paralysis under discussion.

The frequency of the post-operative recurrence of intervertebral disc protrusion varies in the reports of different authors. Thus Waris re-operated on two per cent. of the cases in his series; Spurling and Grantham re-operated in 5.5 per cent. Echols suggests that the recurrence rate may be in the neighbourhood of 10 per cent., and Falconer has re-operated upon 14 per cent. of his cases. It must be remembered that only a proportion of patients with persistent or recurrent post-operative pain will be submitted to a second operation. The same problem in assessing the severity of the symptoms exists here as existed before the primary operation, and there will be a natural reluctance to submit the patient to multiple operations. In the present series recurrent symptoms of such severity as to indicate re-operation occurred in 10 patients. Of these all were cured by the second operation, which usually revealed a recurrent protrusion in the same position as that previously

excised. In three of the 10 cases this was not so ; in one of these, protrusion of an adjacent disc had occurred ; in another, protrusion of the same disc, but on the opposite side, and in the third, adhesions only were found, and bound the extradural nerve to the scarred posterior common ligament—division of the adhesions and a posterior rhizotomy relieving the symptoms.

### CONCLUSIONS

In the course of this study several points have become clear to us. In the first place excision of a lumbar intervertebral disc protrusion is required in but a small proportion of the cases with this lesion. Secondly, when operation is reserved for cases which require it, the results from the point of view of the patient's symptoms and signs are highly satisfactory. Thus, as regards lumbar and crural pain, in less than one per cent. of the cases were these symptoms not improved by the operation, and in 92 per cent. they were either completely removed or greatly diminished. The physical signs were likewise benefited. The spinal and tension signs largely disappeared, but, when the injury to nerve roots had been severe, persistent neurological disturbance was seen. This usually took the form of a diminished or absent tendon jerk or an area of reduced cutaneous sensibility, but occasionally a well-marked pre-operative motor deficit persisted after operation. The risks of operation are small. Thus two patients in the series died after operation—a case mortality of 0.4 per cent. A further 118 patients have had lumbar disc protrusions excised up to the end of 1949 without mortality so that the case mortality for 618 cases is 0.32 per cent. Post-operative complications were infrequent and in only one case in the series was any increase in lower limb weakness noted after operation. Finally, in only 10 cases of the series (two per cent.) did post-operative symptoms, of such severity as to indicate re-operation, appear. In each of these patients a second operation brought relief which has continued up to the present. Clearly with the passage of time an increase in the incidence of post-operative recurrence may be noted. However, since some of the cases in the series have been followed up for over 12 years it is considered unlikely that the incidence of severe recurrence of symptoms will be greatly in excess of the figure of two per cent. already mentioned.

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