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Clinical study

Lumbar discectomy and the diabetic patient: incidence and outcome

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Summary Medical records of 363 patients who had a diagnosis of lumbar disc disease and were managed by a posterior approach lumbar discectomy over a 7 year period were reviewed: 33 patients had a preoperative diagnosis of diabetes, an incidence in this patient population of 9.1%. The results for these 33 patients who had a diagnosis of diabetes mellitus were compared with those of 33 age and sex matched nondiabetic (control) patients who had a similar operative approach. Twenty-five of the diabetic and 28 of the control patients were available for long term follow up. The results were positive (good to excellent) for 24 of the 28 (86%) control patients and 15 of the 25 (60%) diabetic patients. Seven of the 25 (28%) diabetic patients had reoperation for recurrent disc herniation at the same level following the initial procedure compared with one of the 28 (3.5%) control patients. © 2001 Harcourt Publishers Ltd

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INTRODUCTION

Outcome and success following lumbar disc surgery is dependent on initial patient selection[1,2] and reviews of poor outcome emphasize the significance of patient selection.[3] To our knowledge, there are two articles in the literature that investigate the results of operations on the lumbar spine in patients who have diabetes mellitus. In the paper by Simpson et al.[1] the results for 62 patients who had a diagnosis of diabetes mellitus and lumbar disc disease or spinal stenosis were compared with those for 62 age and sex-matched non-diabetic patients. In their study, diabetic patients had high rates of postoperative infection and prolonged hospitalization compared with the rates for the control group. Long term results were excellent or good for 39% of the patients who had diabetes mellitus and 95% of the nondiabetic patients.

Given a significant variation in postoperative results based on a preoperative diagnosis of diabetes mellitus, our study was conducted to investigate in more detail the lumbar discectomy subgroup. It was our aim to clarify the incidence of diabetes in the lumbar discectomy population and to compare postoperative quality of life (QOL) results of posterior lumbar discectomy in patients who have diabetes mellitus (DM) against nondiabetic (nonDM) controls.

The belief is that outcomes after spinal procedures in the diabetic patient are unpredictable.[2] This study was conducted to help make outcomes following the commonly performed procedure of lumbar discectomy more ‘predictable’ and so to provide accurate information to the diabetic patient in the preoperative workup phase.

MATERIALS AND METHODS

From January 1992 to December 1998, a total of 363 patients were admitted to our institution with a preoperative diagnosis of lumbar disc degeneration and clinical indications for lumbar discectomy. All patients were managed surgically via a posterior approach. All patients had clinical and radiological changes consistent with herniated lumbar disc and had failed to improve after conservative management. The operative approach used varied from microdiscectomy to laminectomy depending on the surgeons’ preference and radiological findings. A microsurgical approach was used in 45% of patients in our study group, *n*=53. Early mobilisation is encouraged and formal in-patient physiotherapy provided to all patients. The data on perioperative findings were evaluated by means of a review of the hospital records and it was confirmed that all patients in the study were operated for disc lesions and nerve root impingement.

Thirty-three patients in this group had a preoperative diagnosis of DM in conjunction to their disc disease. The results for the 33 diabetic patients were compared with those of 33 age and sex matched nonDM control group. A total of 53 patients, 25 DM and 28 non-DM were available for long term followup and both groups were assessed with a devised non-standardized quality of life (QOL) Likert scale type[4] questionnaire. This yielded a follow-up rate of 80.3%, *n*=66.

Of *n*=66, 11 patients were lost to followup. Two patients, both diabetic, did not wish to be included in the study. Two patients had died of causes unrelated to the operation. Although the records of the remaining 7 patients were reviewed, their results were not included as the QOL questionnaire could not be completed.

Details elicited from the patient’s notes were age, time since operation, reoperation, type and duration of diabetes mellitus. The questionnaire was completed by either phone interview or at time of followup consultation.

All patients were asked a series of questions including: 1) persistence or relief of their radicular pain; 2) content with life; 3) ability to return to work or level of activity greater than before surgery; and 4) activities of daily living. A discussion to assess if 5) the patient would have the procedure repeated if radicular type symptoms were to affect them from disc pathology at another spinal level; and 6) a statement of recommendation of the operation to others was sought. The patient was required to comment on two statements at completion of the interview: 7) ‘I regret having this operation’ and 8) ‘I feel life is more comfortable/enjoyable

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Table 1 Operation repeated vs diabetes status

	No-reop	Reoper	Total
Non DM	27	1	28
DM	18	7	25
Total	45	8	53

P=.025.
Fishers exact test (18) of association (*P*<0.05): there is a significant association between DM & reoperation.

Table 2 Comparison of mean QOL scores vs diabetic status

	n	Mean	ST dev	SE mean
DM	25	0.31	1.21	0.24
Non DM	28	1.116	0.790	0.15

P=0.0072 (*P*<0.001); DF=40.
Student's independent *t*-test for comparison of means.
The nonDM QOL score is significantly better than the QOL mean of the DM group.

after the operation'. All responses in the interview were graded from a 'strongly agree' response to 'strongly disagree'. A numerical figure was given to each response, grading a score of +2 for 'strongly agree' and –2 for 'strongly disagree.'

To assess the quality of life changes, the aggregate subset scores from the questionnaire were compared for the diabetic and control group by means of a two sample independent *t*-test[5] (Table 1). A Fisher's exact test[6] was used to examine the predictability of reoperation based on a preoperative diagnosis of diabetes (Table 2).

RESULTS

Of the 363 patients who were operated on for lumbar disc protrusion, 33 had a preoperative diagnosis of diabetes mellitus. The incidence of diabetes in The Canberra Hospital lumbar discectomy population was 9.1%, compared with less than 2.9% for the Canberra area general population.[7] Our review of the literature has not found previous reports on incidence of diabetes in a lumbar discectomy subgroup population.

Of the 33 diabetic patients, 6 were not available for followup. Of the remaining 27 patients, 2 did not wish to be interviewed or included in the study. Of the 33 age and sex matched nonDM control group, 7 were unavailable for followup. There was one Workers Compensation claimant in the control group and none in the DM group. There was no statistical difference between the mean ages of the DM group (mean 66 years, range 24–82 years) and the nonDM group (mean 64 years, range 23–82 years). There was no statistical difference in gender proportions between the DM group (76% female) and the nonDM (71% female).

The relationship of age to post-operative outcome for both groups was examined with a *t*-test. There was no statistical difference to outcome scores based on patients' age as $P>0.05$ ($P=0.343$). The mean ages in our study are similar to those of recent studies on lumbar spine surgery in the diabetic population.[1,8]

In the DM group, 22 (88%) patients were type II or mature onset diabetics, 2 were type I insulin dependent and I patient was an insulin dependent diabetic secondary to long term high dose corticosteroid usage. Since there were only two patients with type I diabetes, it was not appropriate to treat them separately in a statistical analysis. The average HbA1C of the diabetic group at the time of the operation was 6.9% (normal = 4.5–6.0), *n*=25.

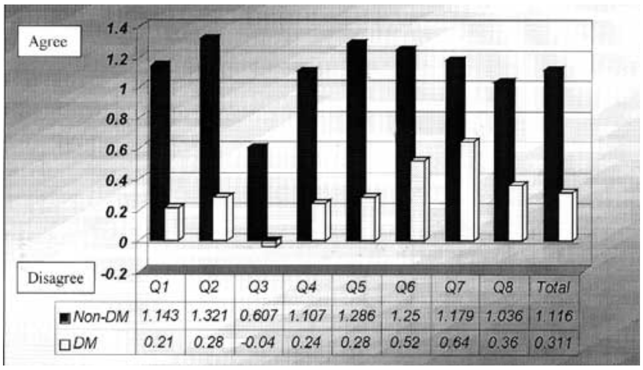

Fig. 1 Aggregate QOL mean scores key: Q1: less pain than before operation? Q2: Feel content/happier with life? Q3: Return to work? Q4: Has lifestyle improved? Q5: Recommend operation to others? Q6: Would you have the operation again? Q7: 'I regret having this operation' Q8: Activities of daily living more enjoyable.

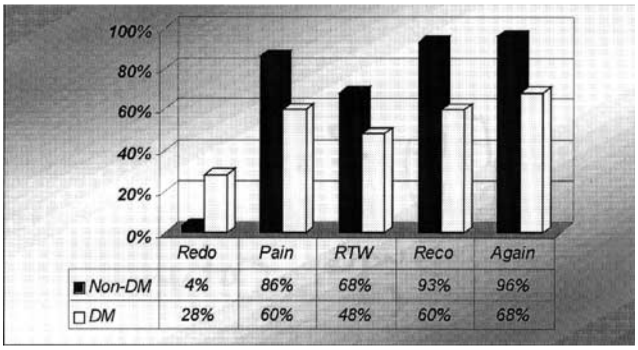

Fig. 2 Proportion of affirmative answers to health status questions. Key: Redo: rate of reoperation; Pain: less pain than before operation; RTW: return to work; Reco: recommend operation to others; Again: would you have the operation again.

An aggregate score for each of the eight categories in the QOL questionnaire was calculated (Fig. 1). A score of +2 correlates with a positive outcome and –2 with a negative outcome, on the Likert scale. This demonstrates that the average outcome for the DM group (+0.31, standard deviation 1.21) was statistically different (worse) than the mean average results for the nonDM control group (+1.17, standard deviation 0.79)—Student's t-test, $P<0.01$ (see Table 1). Sub analysis of the individual QOL questions revealed that the outcome for all 8 categories was worse for the DM group than for the nonDM control group (Fig. 1).

A greater proportion of nonDM patients state that they were in less pain following the procedure (86% vs 60% for the DM group), and the analysis reveals that of those nonDM patients who improved, they were more likely to have a score closer to +2 (favourable outcome). The QOL score for this question was +1.14 for the control group and +0.21 for the DM group. Although 86% of the control group stated they were in less pain following the procedure, 96% stated they would consider surgery again if the same problem occurred at a different spinal level. Sixty-eight per cent of the DM group stated they would have a further procedure despite a 60% improvement in postoperative pain scores. One could assume from this data that the discectomy patient has post-operative improvement in other facets of their daily life and not just their pain control. Patients were asked to comment if they would recommend the operation to others with an identical problem. Sixty percent of the DM group stated they would give a positive recommendation to proceed with surgery compared with 93% for the control group.

The rate of a recurrent disc herniation following lumbar discectomy is stated in the literature at approximately 5%. In the control group, only 1 patient of 28 was reoperated for a recurrent disc protrusion (3.5%). The DM group had a very high rate of recurrent disc protrusion with 7 of 25 patients (28%) having a redo discectomy. A Fisher's Exact Test on reoperation was performed and reveals that in our patient population, there is a strong relationship between diabetes and reoperation, $P<0.05$ (see Table 2).

Question 7 was a 'reverse' question intended to highlight patients who were providing a standard response and not appropriately attending to questions and reply. The patient was asked to respond to the statement 'I regret having this operation'. A score of –2 equated with a 'strongly disagree' response, that is, a favourable response. On the graph B included, the score was reversed so as to adhere with the trend of the other questions. Again, the outcome score indicates that the control group fared better that the DM group, with a QOL score of +1.25 compared with +0.64 (Fig. 1).

Table 3 Table of means for nonDM and all other DM groups

Level	*n*	Mean	ST dev
0	28	1.1161	0.7898
1	2	1.6875	0.4419
2	22	0.1534	1.2002
3	1	1.0000	0.0000

Pooled ST dev = 0.9823.

DISCUSSION

Two of the diabetic patients did not wish to be included in the study as they had poor outcomes following surgery. If these two additional diabetic patients were included, the results of a *positive outcome* following surgery would have been even worse than the stated figure of 60% in the diabetic group. In addition, the control group included one Workers Compensation patient. This male had a poor outcome following surgery. If this patient was excluded from the study on the basis of a Workers Compensation claim, the *positive outcome* result in the control group would have improved.

Our study is the second in the recent literature that supports the findings of poor results following lumbar spine surgery on the diabetic patient, with our study focusing on lumbar disc surgery. The overall positive outcome in our study for the diabetic group was 60% compared with the result of 39% in the article by Simpson. Their diabetic group had a subtotal of 20 patients following lumbar discectomy for herniated disc. In this group of 20 patients, only 7 (35%) patients responded with a good–excellent outcome following surgery and 30% with a poor response. In the nondiabetic group, 32 of 33 (97%) patients had a good–excellent result following lumbar discectomy. There is, however, one article in the literature that reports a minimal effect from DM in the postoperative lumbar spine patient. Cinotti[8] reviewed 25 diabetic and 25 nondiabetic patients who had undergone decompression for lumbar spinal stenosis. The outcome of surgery was similarly successful in the two groups. Mistaken preoperative diagnosis was the cause of failure in three diabetic patients: two with diabetic neuropathy and one with diabetic angiopathy.

Many articles have discussed the potential predictors of outcome following lumbar disc surgery. A recent publication by Graver et al.[3] of a 7 year followup of 122 patients reveals that preoperative psychological distress and impaired fibrinolytic activity were predictors of poor outcome. As with our study, age was not a predictor of outcome. Graver et al. did not examine diabetes as a separate predictor of outcome following lumbar disc surgery as our study has done.

In a study of 428 patients following surgery for lumbar canal stenosis, the results suggest that comorbidity of diabetes is associated with a poor outcome.[9] In a study of 3289 surgically treated lumbar disc patients and 4025 nonoperative patients, identifying complications from codiagnoses, the complication rates were significantly correlated with the postoperative length of stay and with the risk factors of obesity, hypertension and diabetes.[10]

The precise mechanism for the production of radicular pain secondary to lumbar disc disease is unclear. The possibilities are direct mechanical impingement of a nerve root, vascular alteration of the nerve root or an inflammatory stimulus from the herniated lumbar disc material. Given that an adequate decompression of a nerve root is achieved during discectomy, the issue of why the diabetic nerve root does not respond following a decompressive procedure is yet to be examined.

Although it is postulated that an inflammatory stimulus of herniated lumbar disc is responsible for sciatic pain and radiculopathy,[11] the clinical relevance of histologically defined inflammatory infiltrates is not confirmed.[12] In a prospective study of 44 patients, it was concluded that there is no statistically significant correlation between macrophage infiltrates in herniated lumbar disc specimens and obtained data on preoperative pain and neurological status.

From our results the rate of reoperation in the diabetic population was unacceptably high at 28%, compared with the control group at 3.5%. The issue of the high rate of recurrence in the diabetic patient warrants further investigation. Robinson et al.[13] in a study to characterise the analytic profile of proteoglycans in intervertebral discs of nondiabetic and diabetic subjects, states that discs in patients with diabetes have proteoglycans with lower buoyant density and undersulfated glycosaminoglycan. This may lead to increased susceptibility to disc prolapse in diabetic patients. Our study supports this, with 9.1% of patients in our review group undergoing lumbar discectomy having diabetes mellitus. The findings show that discs from normal nondiabetic subjects have 15 times the rate of 35 Sulfate incorporation into glycosaminoglycan molecules than do discs of diabetic patients. The proteoglycans of diabetic patients are banded at a lower buoyant density, indicating a lowered glycosylation rate and a lower number of sugar side chains per core protein.

The issue of mis-diagnosis has been discussed as a reason for poor outcome following lumbar spine surgery.[1,9] Diabetic polyneuropathy is a complex disease of progressive nerve fibre loss. Microangiopathic and metabolic disturbances are considered to be responsible for the development of the various forms of diabetic polyneuropathy. Diabetic involvement of the spinal nerve roots is a poorly recognized complication of diabetes mellitus and diabetic polyradiculopathy simulating lumbar disc disease is a distinctive entity, as discussed by Hirsh.[14] Such involvement can closely simulate more common spinal diseases and thus lead to inappropriate therapy.[14,15] Electrodiagnostic and radiological studies should be used to differentiate between the two conditions.[16]

Another possibility for poor outcome in the diabetic group may be related to bone stock of the lumbar vertebrae. It is known that patients with long-standing diabetes mellitus have significantly lower bone mineral density than healthy controls.[17] These changes with resulting endplate and facet joint degeneration may result in pain sources that are not relieved following a decompressive procedure.

The two patients with juvenile onset diabetes had a mean insulin usage of 38 years. Although their results were excellent, with a mean QOL score of +1.69 (Table 3), it is difficult to draw conclusions with only 2 patients. We recommend a larger study, or a meta-analysis of this subgroup for further investigation.

Of note is the relatively high proportion of females (73.5%) in our investigation group. Women have been shown to have a poorer outcome than men following lumbar discecomy,[1] although the reason is not understood.

Our results demonstrate that QOL indicators are significantly lower in the DM group as compared with the control group. This study reinforces that DM patients who have lumbar disc disease cannot be expected to have the same results as nonDM patients with similar lumbar disc disease. The implications of this study are relevant to the consent process and legal issues related to poor outcome following lumbar discectomy. We recommend an adequate discussion with the diabetic patient in the preoperative phase, noting the results are below the literature figures of 85–95% success.

In conclusion, the diabetic patient has a poorer outcome following lumbar discectomy than nondiabetic controls. Although other pathological processes may be concurrent, such as obesity and hypertension, our study provides evidence that QOL outcome scores are significantly worse in the diabetic patient (P<0.01). The rates of reoperation and prolonged hospitalisation are significantly higher in the diabetic patient. We recommend that the preoperative evaluation of the diabetic patient should exclude other causes of radicular pain or weakness, and the consent process include a realistic discussion on outcome.

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