



The importance of “time to surgery” in the management of lumbar disc herniation in patients without progressive neurological deficits

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Background: Prolonged sciatica symptoms may result in disability and consequently, absence from work for a longer period. Up to 10% of patients may need surgery but it is difficult to predict and determine which of these patients would improve spontaneously in comparison to those who might benefit from discectomy surgery. We aimed to determine if delay in the “time to surgery” (TTS) has any adverse effects on the patient reported outcome measures (PROMs).

Methods: Eighty-seven patients after exclusions were selected consecutively. PROMs were comprised of pre-operative, six weeks and six months post-operative back and leg pain visual analogue scores (VAS) and Oswestry disability index (ODI). The differences between these scores were correlated with TTS. Minimal clinically important difference (MCID) of 30% improvement for ODI scores and 33% for VAS scores from baseline were considered as significant improvement. Patients were grouped into TTS less than 6 months and TTS greater than 6 months from referral to TTS. The longest TTS was 18 months. Statistical analysis was done using JASP (Version 0.14.0) [computer software].

Results: The TTS was on average 22.5 weeks. MCID for the leg pain VAS was achieved in 90.2% patients with TTS <6 months and in 80.8% with TTS ≥6 months. The MCID for ODI was achieved in 60.7% with TTS <6 months and in 42.0% with TTS ≥6 months. The MCID for back pain VAS was achieved in 73.8% with TTS <6 months and in 50.0% of patients with TTS ≥6 months. Those who achieved the MCID in ODI score between the two groups were analysed using chi-square test with P=0.115. Those who achieved the MCID in VAS leg pain score between the two groups were analysed using chi-square test with P=0.227. No statistical difference was found in ODI and VAS for leg for patients with TTS before or after 6 months.

Conclusions: Lumbar discectomies had a positive impact on patient’s pain and function in our local district hospital. Delayed surgery of ≥6 months did not cause statistically significant worse outcomes. In the absence of worsening neurological deficit, it may be the wrong approach to define a value for the TTS.

Keywords: Disc herniation; lumbar discectomy; time to surgery (TTS); minimal clinically important difference (MCID)

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Introduction

It is common knowledge that most sciatic and radicular leg pain caused by lumbar intervertebral disc herniation will settle down spontaneously over a few weeks as the disc hernia resorbs (1,2). Conservative management includes education, combined physical and psychological therapy, pharmacological pain management and injection therapy (selective nerve root block, transforaminal and caudal epidural injections).

Prolonged sciatica symptoms may result in disability and consequently, absence from work for a longer period which may further contribute to the consumption of more healthcare resources (3). It is said that up to 10% of patients may need surgery to excise the lumbar intervertebral disc herniation (4,5) but it remains difficult, if not impossible, to predict and determine which of these patients would improve spontaneously in comparison to those who might benefit from discectomy surgery.

This has led to a widely varying approach to the management of lumbar disc herniation across Western Europe with some centres offering surgery far too early and others avoiding surgery for far too long. Surgeons in The Netherlands performed six times as many lumbar discectomies compared to Scotland, four times the number in England and two times the number in Sweden in the late 90s and early 00s (6).

It is now well accepted that early surgical intervention for patients with persistent symptoms of lumbar disc herniation leads to a favourable functional outcome in terms of pain and disability in the short to median term (7-10). In 2014, Sabnis *et al.* (11) conducted a systematic review, looking to define the optimum “time to surgery” (TTS). They found no consensus on how long conservative treatment should continue for but concluded that a “long duration of preoperative leg pain was found to lead to poor outcome” after surgery. They confirmed that surgery performed within 6 months was associated with a better outcome.

A more recent retrospective review of registry collected data including 372 patients (12) agree that early lumbar discectomy surgery is generally associated with a better functional improvement 1 year postoperatively and suggest an optimum TTS of 14–22 weeks. This is reflected in other reports (13), suggesting that surgery may be considered if 2 months of conservative management is unsuccessful.

The UK National Low Back and Radicular Pain Pathway published in 2017 which is now mandated across the UK

National Health Care recommends TTS of 8–12 weeks in patients with non-tolerable radicular pain and later surgery in patients with symptoms of fluctuating severity. Imaging, however, is to be considered in these patients by the Specialist triage practitioner but not before 12 weeks of the patients receiving “core therapies” (14).

The primary aim of this cohort study was to retrospectively review our British Spine Registry and local data on patients who underwent discectomy surgery for herniated lumbar intervertebral discs. We aim to determine if delay in the TTS had any adverse effects on the patient reported outcome measures (PROMs). Our secondary objective was to establish whether the patients followed the local and national guidelines in terms of TTS and study its effects. We present the following article in accordance with the STROBE reporting checklist (available at <https://jss.amegroups.com/article/view/10.21037/jss-22-68/rc>).

Methods

Study design

This is an observational cohort, retrospective analysis of prospectively collected data gathered from the local and British Spine Registry. Patients who underwent primary discectomy surgery for herniated lumbar disc over a period spanning from January 2013 to August 2019 were selected consecutively. TTS was defined as the time from referral to specialist spinal services to the date of surgery.

Patients included were 25 to 65 years of age, with a diagnosis of symptomatic lumbar disc herniation without progressive neurological deficit, confirmed on a recent magnetic resonance imaging (MRI) scan. The “return to function and work” was extracted from the British Spine Registry satisfaction questionnaire and hospital medical records. Exclusion criteria were patients under the age of 25 and older than 65 years old, patients with a history of previous spinal surgery at the same level and patients with degenerative spinal stenosis. We have also excluded patients with worsening neurological deficit, motor weakness (foot drop) and cauda equina syndrome who required urgent surgery.

Data collection

Data were collected for each patient which incorporated the date of onset of symptoms, date of referral to specialist care and date of surgery. PROMs were

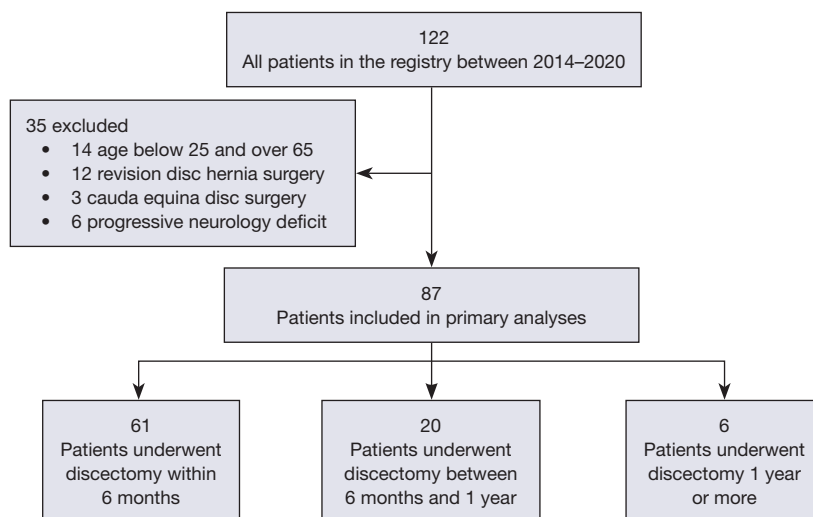


Figure 1 Flowchart demonstrating the flow of patients throughout the analysis.

comprised of pre-operative, six weeks and six months post-operative back and leg pain visual analogue scores (VAS) and Oswestry disability index (ODI). The differences between these scores were correlated with the TTS.

Minimal clinically important difference (MCID) is a well-established means of measuring improvement following an intervention (15), although a single MCID figure has yet to be established for ODI scores (16). For this study, we stated that an MCID of 30% improvement for ODI scores from baseline score to be considered as significant improvement in symptoms. In terms of VAS scores, MCID of 33% decrease in pain has been shown to be a reasonably significant outcome (17). We applied the same generous figure to our study. Adjustments were not made for age, sex, body mass index (BMI), or co-morbidities.

To illustrate the results, patients were divided into two groups: those with TTS less than 6 months and TTS greater than 6 months from referral to the time of surgery. Only 6 patients had their surgery over 12 months from referral, with the longest TTS in our cohort being 18 months. Analysing this group of patients separately would therefore underpower the statistical analysis and increase the risk of a type II error. We therefore combined patients with TTS over 6 months and TTS over 12 months from referral.

Statistical analysis

A sample size power analysis was initially conducted using Satara, Version 16. For ODI with a MCID of 30%, a

minimum of 96 recruits (48 in each group) And for leg pain VAS with a MCID of 33%, a minimum of 76 recruits (38 in each group) would be necessary in this “feasibility study”. Statistical analysis was carried out using JASP (Version 0.14.0 computer software).

Ethical statement

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This study was approved by the North Devon Research and Development Ethics Board (No. NDDH/DRN-3582). Patient consent was prospectively obtained for the data to be collected for the British Spine Registry along with the patient reported outcome data. All patients were anonymised.

Results

A total of 122 patients underwent discectomy surgery for lumbar disc herniation at our small District General Hospital between January 2014 and March 2020. Thirty-five of these patients were excluded (*Figure 1*). The remaining 87 patients had complete data on TTS, ODI and VAS for leg and back pain. The characteristics of the cohort and the overall MCID are detailed in *Table 1*.

The TTS was on average 22.5 weeks, though consisting of a wide range (2 weeks to 1.7 years); 61 patients had surgery within 6 months of referral to specialist spinal services; 26 patients had TTS more than 6 but less than 18 months.

Table 1 Patient characteristics of the included cohort (n=87)

| Characteristic | Values |
|---|-----------|
| Age (years) | 43.9 |
| Male sex | 41 (47.1) |
| Index level | |
| L3-L4 | 2 (2.3) |
| L4-L5 | 40 (46.0) |
| L5-S1 | 45 (51.7) |
| Baseline PROM values | |
| ODI | 54.1 |
| VAS leg pain | 7.5 |
| VAS back pain | 5.0 |
| Postoperative PROM change score | |
| ODI | -30.6 |
| VAS leg pain | -5.7 |
| VAS back pain | -2.5 |
| Achieved MCID in terms of ODI* | 48 (55.2) |
| Achieved MCID in terms of VAS leg pain** | 76 (87.4) |
| Achieved MCID in terms of VAS back pain** | 58 (66.7) |
| Mean TTS (weeks) | 22.5 |

Values are presented as mean or number (%) unless otherwise indicated. *, defined as a $\geq 30\%$ improvement in ODI scores from baseline to the 6-week follow-up; **, defined as a $\geq 33\%$ improvement in VAS leg pain and VAS back pain scores from baseline to the 6-week follow-up. ODI, Oswestry disability index; VAS, visual analogue scores; MCID, minimal clinically important difference; TTS, time to surgery.

As expected, the MCID for the leg pain VAS was achieved in 87.4% of total 87 patients. Of the 61 patients who had TTS of less than 6 months, 90.2% of them achieved MCID for VAS leg pain. Of the 26 patients who had TTS of more than 6 months, only 80.8% of them achieved MCID for VAS leg pain (Table 2).

The MCID for ODI was achieved in 60.7% of patients with TTS of less than 6 months and in 42.0% of patients who had TTS of 6–18 months. The MCID for back pain VAS was achieved in 73.8% of patients had a TTS less than 6 months and in only 50.0% of patients had TTS between 6 to 18 months.

The changes in ODI for patients with TTS below and over 6 months were normally distributed using Shapiro-Wilk Test. An unpaired Student t test showed no statistical

significance ($P=0.135$) in the change score for ODI between the two groups. Cohen's effect size value ($d=0.38$) suggested only a small effect. Those who achieved the MCID in ODI score in the two groups were further analysed using chi-square test with $P=0.115$.

Changes in leg pain VAS was not normally distributed using Shapiro-Wilk Test. A Mann-Whitney U test showed no statistical significance ($P=0.968$) in the change score for leg pain VAS between the two groups. Those who achieved the MCID in leg pain VAS between the two groups were analysed using chi-square test with $P=0.227$. No statistical difference was found in ODI and VAS for leg for patients with TTS before or after 6 months.

Of the 87 patients included in our study, 80 patients were working, and 7 were unemployed pre-operatively. Out of the 57 patients who were working and had their operations before 6 months from referral, 44 patients (77.2%) have restoration of function enough to go back to work 6 weeks after the surgery. Out of the 23 working patients who had their operations between 6–18 months from referral, 17 patients (73.9%) went back to work after 6 weeks (Table 3).

Discussion

It is expected that patients make a significantly quicker improvement in symptoms following surgery in comparison to conservative therapies alone. In both arms of the SPORT randomised control trial (4), patients who received operative treatment and those who received non-operative interventions reported improvement in symptoms over a 2-year follow-up. However, 30% of those crossed over to the surgical arm of the study. The same was seen in the NERVE trial where 21% crossed over to surgery from the randomly assigned to transforaminal epidural steroid injection (18).

Short lived, transient improvement of symptoms following conservative therapy will inevitably delay the decision to proceed to surgical treatment that negatively affect the TTS. In this review, the median time between the onset of symptoms and referral to surgical services was 22 weeks. This can only be explained by the variable response to the conservative therapies in primary care settings. Therefore, "time of referral", rather than onset of symptoms, was used assuming that all patients with such presentation have undergone a trial conservative treatment with variable response.

TTS is a modifiable parameter that has been shown to

Table 2 Summary of the results

| TTS | 0≤n<6 (61 patients) (%) | 6≤n<18 (26 patients) (%) | Total (87 patients) (%) |
|----------------------------|-------------------------|--------------------------|-------------------------|
| MCID in ODI of ≥30% | 37 (60.7) | 11 (42.3) | 48 (55.2) |
| MCID Leg pain VAS of ≥33% | 55 (90.2) | 21 (80.8) | 76 (87.4) |
| MCID Back pain VAS of ≥33% | 45 (73.8) | 13 (50.0) | 58 (66.7) |

TTS, time to surgery; MCID, minimal clinically important difference; ODI, Oswestry disability index; VAS, visual analogue scores.

Table 3 Table demonstrating number of patients who had restoration of normal function

| Time to surgery from time of referral (months) | Number of patients | Pre-operative functioning | | 6 weeks post-operative return to work | | | |
|--|--------------------|---------------------------|------------|---------------------------------------|----|---------|------------|
| | | Working | Unemployed | Yes | No | No data | Unemployed |
| 0≤n<6 | 61 | 57 | 4 | 44 | 2 | 11 | 4 |
| 6≤n<18 | 26 | 23 | 3 | 17 | 0 | 6 | 3 |
| Total | 87 | 80 | 7 | 61 | 2 | 17 | 7 |

influence postoperative morbidity (12). Our results show an average TTS from the referral date to the date of surgery of 22.5 weeks, though consisting of a wide range from 2 weeks to 1.7 years. This by large, seem to be consistent with the National guidelines on the timeline of the management of such pathology and therefore, the current National Lower Back Pain and Radicular Pain pathway seems to be broad enough to provide appropriate guidance for surgical timeframes.

When considering whether delay in TTS had any adverse effects on the PROMs, Peul *et al.* (6) concluded within a sample of 283 patients that early surgery favoured more rapid relief from sciatic pain in comparison to conservative care only. However, overall outcomes were similar for patients in both groups by one year. Siccoli *et al.* (12) concluded in their study of 372 patients that a delay in surgery for lumbar disc herniation was associated with worse patient reported outcomes in terms of functional impairment. They quoted an optimal TTS of between 14 to 22 weeks with surgery beyond this period to be associated with a continuous drop of MCID achievement. However, in this prospective analysis of 87 patients, our results indicate that delay in surgery, does not significantly affect the clinical outcome. Our statistical analysis suggests that there is no statistically significant difference in the generous MCID between patients who had surgery before 6 months and those who had surgery after 6 months. This might well be because of the small sample size.

Leg pain VAS improvement following surgery was more than the improvement in back pain VAS and the ODI.

Relief of leg pain over a 2-year period was also found to be the most significant and consistent following surgery in the SPORT trial (4), MCID for leg pain VAS was more likely in patients who had undergone surgery less than 6 months from referral. This is consistent with the widely accepted trend for better outcome in the early surgery group. However, it is important to note that even at TTS beyond 6 months and up to 18 months, improvement in leg pain was indeed substantial with a statistically significant P value (*Table 3*).

Patient satisfaction would not be complete without a tangible improvement in symptoms, which in this review, was analysed according to the proportion of patients who have restoration of normal function and the ability to return to work. The majority of patients returned to work 6 weeks after surgery irrespective of their TTS, suggesting that performing surgery at any point can have positive outcomes which may indicate that it is the wrong approach to define a value for the TTS.

There are limitations to our research. We analysed a small sample size which was further reduced by a significantly greater number of exclusions than expected which underpowered the study. The data is derived from one small district centre and operation performed by one senior spinal surgeon, although to reduce the selection bias, consecutive patients were recruited. We used ODI as a measure of functional impairment however confounding factors including co-existing disabling pathology like chronic pain, hip or knee arthritis and factors including ethnicity, BMI, and other co-morbidities was not considered

which may influence effectiveness of and recovery after surgery.

Conclusions

This study shows that in our local district hospital, lumbar discectomies had a positive impact on patient's pain and function. In our cohort, delayed TTS of over 6 months and up to 18 months from referral did not cause statistically significant worse outcomes. In the absence of worsening neurological deficit, it may be the wrong approach to define a value for the TTS.

A higher powered RCT using the observations from this and similar studies would be needed to more accurately define the TTS.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at <https://jss.amegroups.com/article/view/10.21037/jss-22-68/rc>

Data Sharing Statement: Available at <https://jss.amegroups.com/article/view/10.21037/jss-22-68/dss>

Peer Review File: Available at <https://jss.amegroups.com/article/view/10.21037/jss-22-68/prf>

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <https://jss.amegroups.com/article/view/10.21037/jss-22-68/coif>). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This study was approved by the North Devon Research and Development Audit Department (No. NDDH/DRN-3582). Patient consent was prospectively obtained for the data to be collected for the British Spine Registry along with the patient reported outcome data. All patients were anonymised.

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