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Clinical Study

Driving reaction time before and after surgery for disc herniation in patients with preoperative paresis

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Abstract

BACKGROUND CONTEXT: The effect of many types of surgeries on driving reaction time (DRT) has been reported. Although lumbar disc herniation is one of the most common spinal diseases, the effect on DRT has not been investigated.

PURPOSE: To assess the effect of left- and right-sided pareses caused by lumbar disc herniation on DRT before and after surgery.

STUDY DESIGN: Controlled prospective clinical trial.

PATIENT SAMPLE: Patients undergoing disc surgery.

OUTCOME MEASURES: Impact of paresis caused by lumbar disc herniation and disc surgery on DRT.

METHODS: Forty-two consecutive patients (mean age, 50.3 years) were tested for DRT 1 day before surgery, postoperatively before hospital discharge, and 5 weeks after surgery. Visual analogue scale (VAS) for back and leg pain as well as pain medication and patients' driving frequency were recorded.

RESULTS: Significant improvement of DRT after surgery was seen in patients with left- and right-sided pareses ($p<.005$). For the right-sided paresis group, the preoperative DRT was 761 ms (median, interquartile range [IQR]: 490), 711 ms (median, IQR: 210) immediately postoperatively, and 645 ms (median, IQR: 150) at follow-up (FU). For the left-sided paresis group, DRT was 651 ms (median, IQR: 270) preoperatively, 592 ms (median, IQR: 260) postoperatively, and 569 ms (median, IQR: 140) at FU. Significant differences between right- and left-sided pareses were identified preoperatively and at FU testing ($p<.005$). No correlation was found between VAS for leg or back pain and DRT. Historical control subjects had a DRT of 487 (median, IQR: 116), which differed significantly at all three test times ($p<.001$).

CONCLUSIONS: A significant reduction in DRT in patients with right- and left-sided pareses was found after surgery, indicating a positive effect of surgery. The improvement in DRT seen immediately postoperatively and the lack of a generally accepted threshold for DRT would suggest that for both patient samples, it is safe to continue driving after hospital discharge. However, patients should be informed accordingly.

Keywords: Lumbar disc surgery; Driving reaction time; Paresis; Driving safety; Lumbar disc herniation

Introduction

Various studies have investigated patient outcome, cost analysis, complications, and the ability to return to work or sports after surgery for nucleus pulposus prolapse [1–6]. However, no studies on lumbar disc herniation and driving ability were found. Patients scheduled to undergo surgery commonly inquire about driving after discectomy. Driving reaction time (DRT) is one of the most important factors responsible for driving safety [7,8]. Regarding

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MT and RL contributed equally to this work.

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interventions of the spine, DRT has been investigated after lumbar fusion surgery and after selective nerve root blocks [7,9]. Although one report [7] showed an effect of left- and right-sided radiculopathy on DRT, no publications on neurologic impairment caused by disc herniation and DRT were found. The authors of these studies based their recommendations regarding return to driving on the patient's preoperative data because official recommendations by vehicle authorities recommend a wide range of safe DRT ranging between 700 and 1,500 ms [10–12].

Therefore, the aim of the present study was to analyze the effect of right- and left-sided pareses caused by disc herniation on DRT. Additionally, we hypothesized that on longitudinal comparison, preoperative, postoperative, and follow-up (FU) DRT values would show significant changes in DRT. In addition, we compared the DRT of patients with the DRT of a historical control group.

EVIDENCE & METHODS

Context
Following discectomy, it is unclear when it is safe to return to driving, especially for patients who have some weakness preoperatively.

Contribution
In this study that prospectively studied driving reaction times in patients with HNP and weakness, the authors found that surgery improved reaction times.

Implications
While an exact temporal cut-off for safe reaction times has not yet been determined, the reaction times in this study appear to be close enough to normal historical controls to suggest safe driving in this patient population.
—*The Editors*

Materials and methods

Participants

Forty-nine consecutive patients scheduled for standard posterior sequestrectomy or subtotal discectomy with a paresis caused by lumbar disc herniation were included in the present study. In all patients, magnetic resonance imaging confirmed disc herniation with distinct nerve root compression. The study was limited to patients with a valid driving license.

Of the study patients, 23 had a neurologic deficit in the right leg and 26 in the left leg. Six patients did not complete all examinations and were excluded from the analyses. One patient had a reherniation, one patient suffered from lung cancer, and four patients did not complete the study for personal reasons.

The historical control group consisted of 31 healthy subjects (19 females and 12 males; mean age, 52 years; SD, 7.7 years) with valid driver's license. None of the healthy subjects had any spinal pathology in their medical records (Table 1). The study was approved by the local ethics committee, and all patients gave informed consent before participation.

Procedure

Driving reaction time was tested with a custom-built car simulator (Fig. 1), described and validated in published literature [7,13]. An adjustable car seat was fixed on a frame with hanging pedals mounted on rubber damped pivots. As requested in a previous report [14], the position of the seat, regarding seat inclination, headrest, and seat-pedal distance, was adjustable to simulate the patient's accustomed driving position. An external box, containing the logic gate electronics, a green lamp, and a red lamp, was positioned on a table at a constant distance in front of the car simulator. When the accelerator was fully depressed, the green lamp lit up, indicating that the patient was not driving in a ''ready to brake fashion.'' After an interval of 5-10 seconds, the observer pushed an external trigger, invisible to the patient, which activated the red lamp and the electronic clock. The patients were instructed to apply the brake as quickly as possible with the right leg when the red light

Table 1
Comparison of demographic data and descriptive statistics on DRT of left- and right-sided radiculopathy patients

Variables	Right-sided muscle weakness	Left-sided muscle weakness	Controls
Age, mean (SD) (y)	47.9 (13.6)	52.1 (13.3)	52.0 (7.7)
Female, n	10	8	19
Male, n	10	15	12
Herniation level			
L2–L3	2	1	
L3–L4	2	3	
L4–L5	7	11	
L5–S1	9	8	
Muscle power, n			
2	1	1	
3	14	12	
4	5	10	
DRT pre-op (ms)	761 (491)	651 (275)	487 (116)
DRT post-op (ms)	711 (207)	592 (256)	
DRT FU (ms)	645 (146)	569 (142)	
DRT pre-op			
<700, n (ms)	6	15	
>700, n (ms)	14	7	
DRT post-op			
<700, n (ms)	4	16	
>700, n (ms)	14	6	
DRT FU			
<700, n (ms)	15	18	
>700, n (ms)	5	4	

DRT, driving reaction time; pre-op, preoperative; post-op, postoperative.

Data are presented as median (interquartile range).