Original Article

Cervical spinal canal stenosis first presenting after spinal cord injury due to minor trauma: An insight into the value of preventive decompression

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ABSTRACT

Purpose: Patients with pre-existing cervical spinal canal stenosis (CSCS) may have minimal or no symptoms. However, performing preventive decompression is controversial as the incidence of CSCS leading to severe cord injury is unknown. Hence, this study aims to revisit the threshold for surgery in “silent” CSCS by reviewing the neurologic outcomes of patients with undiagnosed CSCS who sustained a cervical spinal cord injury (CSCI).

Methods: Two groups of subjects were recruited for analysis. Firstly, patients with trauma-induced CSCI without fracture or dislocation were included. Pre-existing CSCS was diagnosed by MRI measurements. The second group consisted of asymptomatic subjects recruited from the general population who also had MRIs performed. Canal sizes were compared between this control group and the patient group. Within the patient group, neurological assessments and outcomes by Frankel classification were performed in patients treated surgically or conservatively.

Results: 32 patients with CSCS were recruited. The mean spinal canal sagittal diameter (disc-level) of all CSCS cases was 5.3 ± 1.4 mm (1.3–8.2). In comparison, the diameter was 10.5 ± 1.7 mm (6.6–14.6) in the 47 asymptomatic individuals recruited from the general population. Decompression was performed in 17 patients and conservative treatment in 15. Mean follow-up was 19.3 ± 17.0 months (6–84). At the final follow-up, 3 patients (9.3%) returned to their pre-injury Frankel grade, whereas 26 patients (83.3%) lost one or more neurological grade. Three patients (9.3%) died.

Conclusions: Majority of patients with “silent” CSCS who sustained cervical cord injuries did not return to their pre-injury neurological status. All of these subjects have pre-existing canal stenosis hence the risk of cord injury. Given the poor neurological outcome of CSCS, a lower threshold for surgery could be indicated to avoid these disastrous injuries. However, before making any conclusive recommendation we must first identify the prevalence of “silent” CSCS in the general population and the risk of developing spinal cord injury with more prospective population-based studies.

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1. Introduction

Magnetic resonance imaging (MRI) is commonly used to assess a variety of symptoms ranging from nonspecific neck pain to hand numbness without neurological deficits. It is not uncommon for these MRI studies to reveal incidental cervical spinal canal stenosis (CSCS) with varying degrees of cord compression in patients who show few or no neurological symptoms [1]. Such a condition can be referred to as “silent” CSCS. Due to the pre-existing narrowing, the spinal cord is more susceptible to injury. Previous reports have suggested that these patients are at increased risk of cervical spinal cord injury (CSCI) from minor trauma, such as a fall or flexion-extension injuries from a motor vehicle collision [2,3]. At present, it is controversial whether these patients require prophylactic or early decompression surgery. Some surgeons
recommend prophylactic decompression surgery to prevent potential catastrophic spinal cord injuries [4,5]. However since the actual incidence of cord injury with background of CSCS is unknown in the general population, it is difficult to discern whether this approach is of benefit to patients. Moreover, despite the increased risk of CSCI in these patients, the extent of neurological damage they may suffer and the degree to which they can recover is unclear.

Hence, the aim of this study is to assess whether the neurological injuries suffered by patients with silent CSCS presenting with CSCI can recover or not. This study also aims to gain some insight into the value of early surgery in patients with silent CSCS by analyzing their pre-injury status and discuss whether minor neurological deficits in CSCS should be managed more proactively.

2. Materials and methods

This was a retrospective study of all patients admitted to our hospital for CSCI resulting from cervical trauma from January 2005 to December 2011. This study was ethically approved by a local institutional review board. All patients with CSCI and CSCS and at least one-year post-injury (unless unable to make the one-year follow-up due to death) follow-up were included. Patients with concomitant fracture or dislocation of the cervical spine or major head injury, missing medical records or absent MRIs were excluded. Patients with fracture or dislocation were excluded because of the inability to properly measure the canal size at injury on MRI. Details regarding age, gender, follow-up period, type of trauma and pattern of cord injury were recorded. The pre-injury status of the subject was confirmed by the descriptions in the medical notes as well as a follow-up interview whenever possible. MRI measurements, neurological status and treatment offered were also reported.

2.1. MRI measurements and control group

In this study CSCS was defined as a complete anterior and posterior cerebrospinal fluid effacement with deformation of the cord contour at the level of interest or a T2 signal lengthening within the spinal cord on MRI [1,6] (Fig. 1). We measured the anteroposterior (AP) diameter at the most stenotic level in all patients on the mid-sagittal T2 MRI (Fig. 2). Measurements were taken from a line drawn perpendicular from the posterior longitudinal ligament at the most prominent disc bulge to the posterior elements at the corresponding level. All patients recruited were unaware they had CSCS until they had their first MRI performed on admission after the injury. None of the patients had pre-existing myelopathic symptoms that required medical consultation. A control group was recruited from the general population to compare the canal sizes with our patient group. For this purpose, an open recruitment of sex- and age-matched subjects without any neurological symptoms from the general population via an advertisement by our University was performed. Subjects underwent MRIs with the measurements of the AP canal diameter of the disc-level for comparison. The AP canal diameters at the narrowest disc-level between patient and control groups were performed to determine whether patients CSCI generally had narrower canal diameters and whether “silent” CSCS existed in the general population.

2.2. Neurological classification

The neurological status was classified according to the Frankel grading which was the grading used by our institution. This was graded for the pre-injury status, neurological examination on admission and at the final follow-up [7].

2.3. Treatment options

Patients were managed with surgery or observation. At our institution, conservative treatment consisted of a period of observation for at least 1–2 weeks after diagnosis. No therapeutic intervention was given as long as the patient showed continuous neurological improvement. When improvement reached a plateau, the risks and benefits of the available surgical options based on the patient’s residual neurological deficit were discussed with the patient and family. Our center did not routinely use corticosteroid treatment.

2.4. Statistical analysis

The \( \chi^2 \) test was used to analyze the difference in Frankel grade between those who underwent conservative treatment and those who underwent decompression surgery. In addition, we used the Mann–Whitney U test to compare the demographic data of the 2 treatment groups and to determine any differences between the patient and control groups with regards to the mean narrowest AP canal diameter at disc-level. Significance was defined as \( p < 0.05 \). Statistical analyses were performed using SPSS software (version 17.0, IBM, Chicago, USA).

3. Results

Out of the 61 patients recruited within the study period, 20 were excluded due to concomitant cervical column fracture or...
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