Belfast Health and Social Care Trust

Central Cord Syndrome:

Does early surgical intervention improve neurological outcome

Ciara Stevenson, Jonathan Warnock, Suzanne Maguire, Niall Eames

Department of Trauma and Orthopaedic Surgery, Royal Victoria Hospital, Belfast, United Kingdom

Introduction

Central Cord Syndrome (CCS) is the most common incomplete acute spinal cord injury. First described by Schneider in 1954[1]: “It is characterized by disproportionately more motor impairment of the upper than the lower extremities, bladder dysfunction, usually urinary retention, and varying degrees of sensory loss below the level of the lesion”[2].

The elderly male populations are most commonly affected following a simple fall with neck hyperextension in a pre-existing stenotic canal. However younger patients can be affected following high-energy trauma or those with congenital cervical stenosis.

Schneider et al advocated conservative management because the natural history of this condition is to improve neurology rapidly in the early stages; surgery is therefore unnecessary and even detrimental.

Since this initial review it has been reported that many conservatively managed patients experience late-onset neurological deterioration and only 60% remained functional despite a period of initial improvement[3]. With developments in knowledge of the biomechanics of the cervical spine, asepsis and microsurgical techniques there have been a number of limited and retrospective studies showing favourable results for surgical intervention and early decompression.

It was therefore our aim in this study to review the management and outcomes of patients with central cord syndrome in Northern Ireland in 1 year.

Methods

A retrospective chart review was performed on all patients admitted to the Royal Victoria Hospital in Belfast with a diagnosis of central Cord Syndrome from April 2011 to April 2012. Information gathered included demographics, mechanism of injury, length of hospital stay and functional status.

27 patients with traumatic central cord syndrome were identified. In all, motor deficit was more pronounced in the upper limbs and there was variable sensory loss. MRI confirmed signal change within the spinal cord. 5 patients were managed conservatively and 22 with surgical decompression. Unfortunately one of the surgical patients passed away prior to follow-up due to gastric lymphoma and therefore was excluded from the study. The American Spinal Injury Association (ASIA) motor and sensory scores were obtained in the operative group from the time of injury, pre-operatively, post-operatively and at follow-up. The ASIA scores were collected at time of injury, day 10 and at follow-up in the conservative group. Follow-up for both groups was at 6 months.

Penrod et al[4] suggests that outcome is better in patients under 50 years of age, and we therefore grouped patients by age in the surgical group. Group 1 consisted of 7 patients with a mean age of 42.8 years (<50), group 2 of 6 with a mean age of 57 years (50-70) and group 3 of 8 patients with a mean age of 77 years (>70).

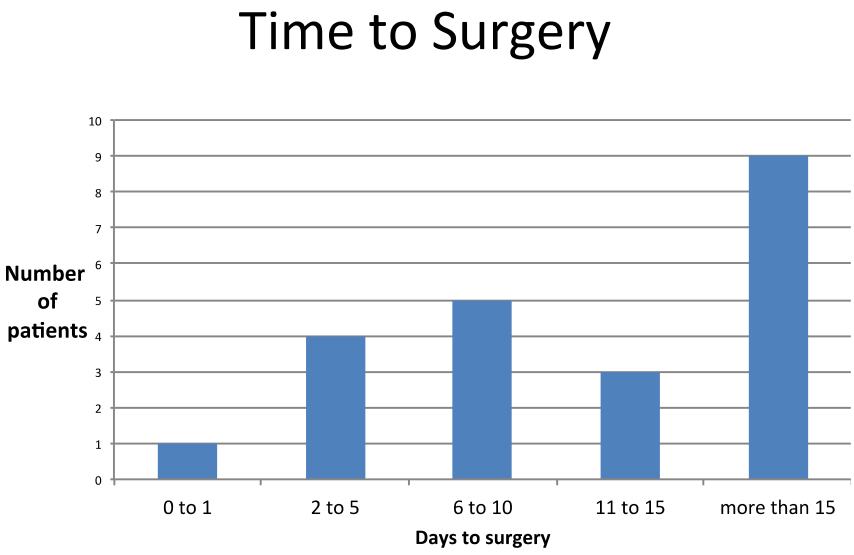
Results

In keeping with the literature, 85% of all patients in this study were male and the most common mechanism of injury across all age groups was a simple fall with neck hyperextension.

Mechanism of injury for three groups

Group (age)	**1 (<50)**	**2 (50-70)**	**3 (>70)**
Simple Fall	5	5	7
Farming accident	1	0	1
Sports trauma	1	1	0
Total	**7**	**6**	**8**

The majority of these patients waited more than 10 days for surgical intervention.

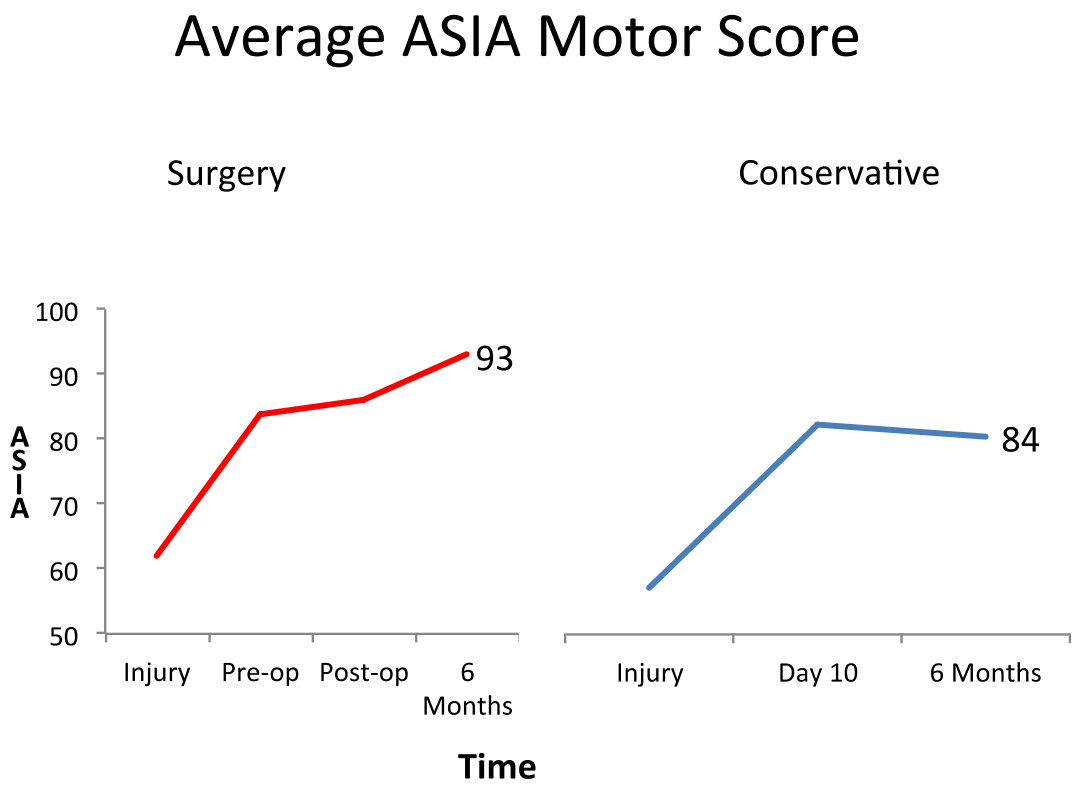


Outcome in surgical and conservative groups

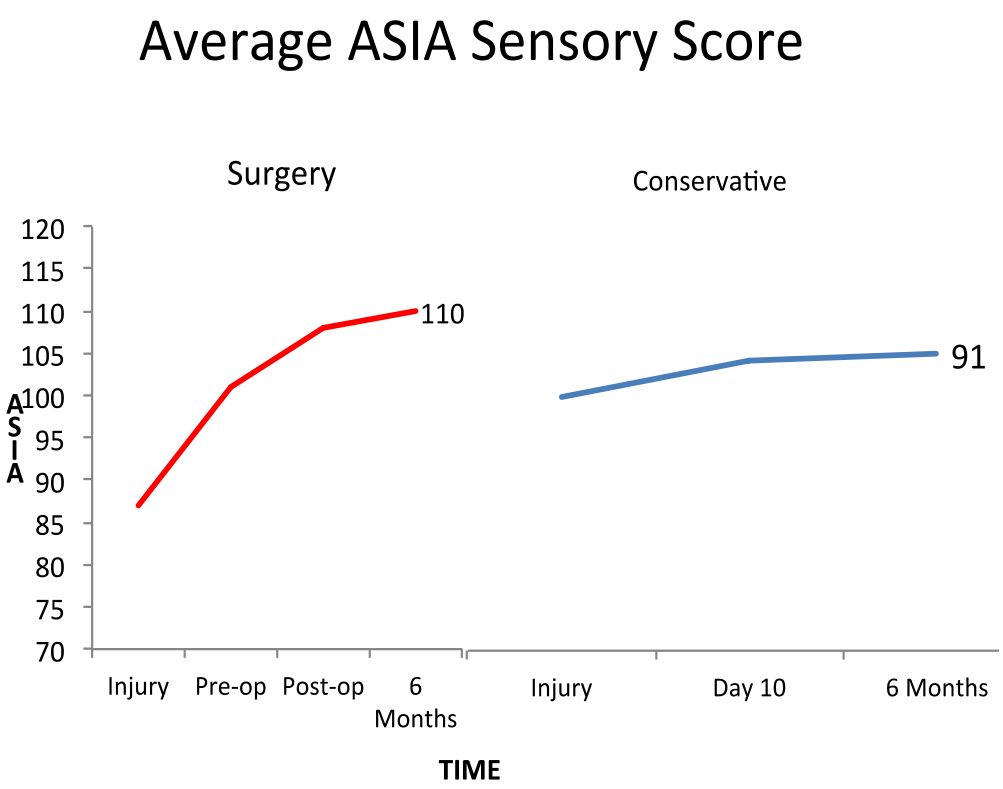
The average ASIA motor score in the surgical cohort improved from injury, pre-operatively, post-operatively and at follow up from 51, 81, 83 and 93 respectively.

Average Asia motor score in conservative patients improved from time of injury to day 10 from 57 to 86 however at follow up fell to 84

Patients in both conservative and surgical groups demonstrate a rapid initial neurological recovery. Patients that undergo surgery continue to improve their neurological status compared with the conservative cohort who deteriorates with time. This is in keeping with the findings of Bosch et al.



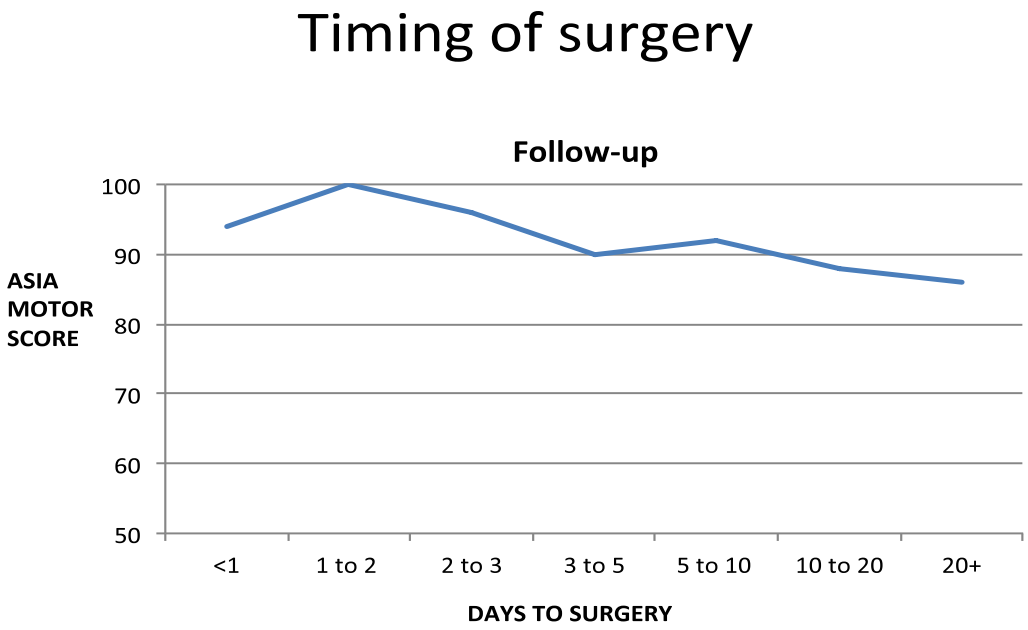
The average ASIA sensory score in the surgical cohort improved from injury, pre-operatively, post-operatively and at follow up from 87, 101, 108 and 110 respectively. Average Asia sensory score in conservative patients also improved from time of injury to day 10 from 85 to 90 and then to 91 at follow-up but this appears to be at a slower rate.



Timing of surgical intervention

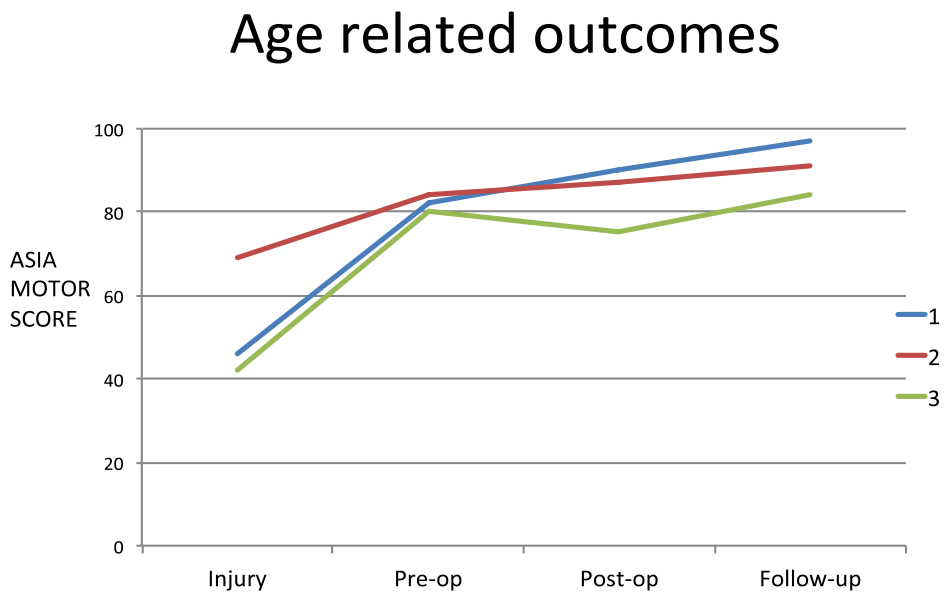
Patients operated on or less than 48hrs have ultimately better ASIA motor scores at follow-up and there is a progressive deterioration the longer the delay to surgery as demonstrated.

Timing of surgery (days)	Average ASIA motor score			
	Injury	Pre-op	Post-op	Follow-up
<1	0	81	90	94
1-2	90	100	100	100
2-3	48	48	62	96
3-5	93	92	84	90
5-10	59	84	84	92
10-20	30	81	81	88
20+	46	80	83	86



Outcome related to age

In the surgical cohort at time of discharge, 86% of patients in group 1 (<50) were mobile unaided with normal bladder and bowel function compared with 67% in-group 2 (50-70) and 38% in group 3(>70). This study supports Penrod and Newey's [5] findings that patients under the age of 50years have ultimately better ASIA motor scores and therefore the ability to regain functional independence.



Group 1 (<50yrs) have improved motor scores at follow-up

Discussion

The classic paper on Central Cord Syndrome by Schneider et al in 1954 described the aetiology and natural history of this condition. He concluded that surgery was unnecessary and even harmful. This set a trend in the subsequent literature for these patients to be managed conservatively and it was only when Bosch and his colleagues evaluated the long-term neurological status of these patients was it suggested that their management could be improved. Analysis of the initial study by Schneider finds that he initially advocated a surgical approach for the treatment of central cord syndrome but unfortunately two patients received no benefit and one of these awoke quadriplegic. The remaining six patients in his study were therefore managed conservatively. Since then dramatic improvements have been made in spinal surgery, from knowledge of biomechanics and spinal stability to improvements in microsurgical techniques and asepsis. Recent studies such as Lenehan et al[6] in 2012 have highlighted the benefits of early decompression and stabilization. In 2002 Guest et al[7] reported that early surgery (<24hrs) is safe and cost-effective compared with late surgery. Chen[8] et al in 2009 claim that surgical intervention can be safely undertaken in patients with traumatic central cord syndrome. Despite many recent studies demonstrating the benefits of stabilization in preventing the 'second hit' described by Ludwig et al[9], timing and selection remains unclear and to date there is no prospective randomized control trial to guide clinicians.

Our study is limited in that it is retrospective and based on few numbers. Nevertheless it did agree with the natural history of

Discussion continued

central cord syndrome as previously described in that the majority of patients are elderly males presenting following a simple fall with neck hyperextension. It has confirmed that the majority of recovery does happen pre-operatively and that the younger cohort has better outcomes. This study also suggests that early surgical intervention (less than 48hrs) will produce improved motor and sensory ASIA scores at follow-up. For those patients operated on late perhaps the role of surgery is to prevent further neurological deterioration. Further research in this field is required.

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Declaration

None of the authors has any potential conflicts of interest