Surgery for Complete Spinal Cord Injury Caused by a Penetrating Mechanism: an Analysis of Functional and Long-term Outcomes from the Spinal Cord Injury Model Systems Database

Michael L Kelly MD; Bryan S Lee MD; Mary Joan Roach PhD; Charles Thomas; Yu-ying Chen PhD

Department of Neurosurgery, Case Western Reserve University School of Medicine, MetroHealth Medical Center, Cleveland, OH, USA; Department of Neurosurgery, Cleveland Clinic, Cleveland, OH, USA; Center for Healthcare Research and Policy, MetroHealth Medical Center, Case Western Reserve University School of Medicine, Cleveland, OH, USA; Department of Physical Medicine and Rehabilitation, University of Alabama at Birmingham School of Medicine, Birmingham, AL, USA.

CNS 2016 ANNUAL MEETING San Diego CALIFORNIA SEPTEMBER 24-28, 2016

Introduction

Surgery for patients with a complete spinal cord injury (CSCI) secondary to a penetrating mechanism (CPSCI) remains controversial. A few studies suggest improved neurological outcome with surgery while many others suggest no benefit. Most studies are limited by small study size and limited follow-up.

Methods

We identified all patients with CPSCI in the Spinal Cord Injury Model Systems database from 1994-2015. CPSCI patients were divided into surgery (SX) and no surgery (NSX) groups. Neurological function was measured according to the International Standards for Neurological Classification of Spinal Cord Injury published by the American Spinal Injury Association (ASIA). SX and NSX groups were then compared for outcomes during hospitalization, acute rehabilitation, and one-year follow-up.

Table 1. Baseline admission characteristics for all complete pSCI patients 1994-2015

	Surgery (n=133)	No Surgery (n=762)	P value
Age (IQR)	24 (20,31)	24 (19,30)	0.4
Gender: Male	117 (88%)	683 (90%)	0.5
AA race	29 (22%)	125 (16%)	0.3
Level of injury			
Cervical	39 (29%)	164 (22%)	**0.001***
Thoracic	58 (44%)	482 (63%)	
Lumbar (T12-L5)	24 (18%)	95 (13%)	
Mechanism			
GSW	129 (97%)	752 (99%)	0.1
Insurance Type			
None	20 (15%)	66 (9%)	**<0.0001***
Private	48 (36%)	468 (61%)	
Government	35 (26%)	150 (20%)	
Education level			
High school or less	111 (84%)	728 (96%)	**0.001***
College	7 (5%)	21 (3%)	
Graduate	1 (0.8%)	2 (0.3%)	
Married	17 (13%)	74 (10%)	0.2

pSCI = penetrating spinal cord injury; IQR = interquartile range; GSW = gun shot wound; *Statistically significant

Results

We identified 895 CPSCI patients, 133 in SX and 762 in NSX group. Age, sex, and race were similar. At hospital admission, more patients in NSX group had injuries at the thoracic level (63% vs. 44%; p=0.001) and had private insurance (61% vs. 36%; p<0.0001). Hospital length of stay (LOS) was increased in SX group (16 days vs. 13 days; p<0.0001) although acute rehab LOS was similar (39 vs. 42; p=0.2). At discharge from rehab median Functional Independence Measure (FIM) motor scores were slightly higher in NSX group (70 vs. 58; p<0.0001), and the percentage of patients with complete injuries remained similar between NSX and SX groups (89% vs. 87%; p=0.8). No difference was observed for duration of mechanical ventilation (p=0.8), rehospitalization (p=0.5), or one year mortality (p=0.1).

Table 2. Complete pSCI Outcomes 1994-2015

	Surgery (n=133)	No Surgery (n=762)	P value
LOS Hospital	19 (11,35)	15 (8,26)	**<0.0001***
LOS Rehab	41 (29,61)	46 (31,71)	0.06
Living at Home at 1 year	89 (67%)	589 (77%)	0.6
FIM Total			
Rehab admission	26 (17,34)	28 (21,36)	0.2
Rehab Discharge	58 (38,72)	70 (53,79)	**<0.0001***
1 year f/u	74 (63,80)	75 (59,81)	0.4
ASIA Complete Injury			
Rehab admission	-	-	-
Rehab Discharge	115 (87%)	681 (89%)	0.8
Mechanical Ventilation			
At Rehab admit	37 (28%)	167 (22%)	0.1
At Rehab discharge	4 (3%)	21 (3%)	0.8
≥1 Readmission at 1 year	34 (26%)	255 (34%)	0.5
Mortality in 1 year	2 (2%)	2 (0.3%)	0.1

LOS = Length of stay; FIM = functional independent measure; ASIA = American Spinal Injury Association; *Statistically significant

Conclusions

Surgery for patients with CPSCI is associated with increased hospital LOS and is not associated with clinically significant improvements in functional outcomes, mechanical ventilation, rehospitalization, or one-year survival.

Learning Objectives

1) Describe the importance of long term functional outcomes for SX and NSX patients with CPSCI.
2) Discuss, in small groups, how these differences in outcomes influence surgical decision-making and prognostication.
3) Identify an effective surgical treatment for patients with CPSCI that accounts for long-term functional outcomes.

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