Research Article

Sacral examination in spinal cord injury: Is it really needed?

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Objective: To determine if a self-report measure of S4-5 motor and sensory function in patients with chronic SCI accurately predicts sacral examination results.

Design: Prospective, single-blinded self-report survey compared with sacral exam.

Setting: Outpatient SCI clinic.

Participants: 116 patients aged 18+ with chronic SCI > 6 months who have undergone sacral exam.

Interventions: The survey included demographic/clinical and sacral function information such as light touch (LT), pinprick sensation (PP), deep anal pressure (DAP) and voluntary anal contraction (VAC). Survey results and sacral exam were compared and stratified by the patient's American Spinal Cord Injury Association Impairment Scale (AIS) category.

Outcome Measures: Sacral self-report survey, AIS examination.

Results: Mean age was 41.3 ± 14.4 years with majority male (69%) and Caucasian (71.6%). Overall, Positive Predictive Value (PPV) ranged between 48% (VAC) to 73% (DAP) and Negative Predictive Value (NPV) between 92% (VAC) to 100% (LT). AIS-A had NPV of 100% across all categories, and AIS-D had PPV of 100% across all categories.

Conclusion: Patient report of sacral sparing can predict negative sensation in patients with AIS-A and predict positive sensation in persons with AIS-D. Overall, the self-report of sacral sparing of motor and sensory function is not predictive enough to rely on for accurate classification.

Keywords: Spinal cord injury, Sacral, Rectal examination

Introduction

According to the International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI), the sacral exam (including testing sharp/dull discrimination and light touch sensation on both sides of the anal mucocutaneous junction and testing for deep anal pressure and voluntary anal contraction during a digital rectal exam), is a mandatory component to determine 'sacral sparing'.¹ Sacral sparing, determines whether a spinal cord injury (SCI) is classified as neurologically complete or incomplete. This in turn is an important determinant in long term outcomes and prognosis which includes motor recovery,

rehospitalisation, bowel and bladder management, perceived health status, functional independence in self-care and mobility, and social participation.²⁻⁶ However, the rectal exam is also an invasive and unpleasant portion of the exam with possible associated complications of inducing autonomic dysreflexia, rectal trauma or bleeding and possibly stimulating a bowel movement.⁷ Other difficulties associated with the sacral exam includes difficulty with positioning the patient for the examination that often requires additional staff and/or equipment for assistance, availability of trained medical staff to perform the exam, difficulty in assessing in patients with advanced sacral pressure injuries, and patient embarrassment.⁷ This raises the question of whether patient self-report is accurate in determining sacral sparing motor and sensory function to avoid the invasive rectal exam.

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This is particularly relevant in chronic patients with SCI who have had numerous sacral exams over time and may be well aware of their sacral motor and sensory function from repeat testing or be able to report any possible changes that may have occurred since their last examination.⁸

In reviewing the literature, only one previous group has studied the accuracy of self-report in patients (N = 34) with varying levels of injury and severity, including individuals with American Spinal Injury Association Impairment Scale (AIS) A (n = 10), AIS B (n = 11), AIS C (n = 5) and D (n = 8).⁷ The authors reported that for sensory self-report, 82% (n = 23) correctly stated they had sensory function in S4/5 that was corroborated on examination and 83% (n = 5) were consistent with examination when stating they did not have the sensation.⁷ For motor, self-report was less consistent with the examination, with 42.9% of the patients reported motor function having this (a high false positive rate) and 90% correctly stating they did not have (true negative).⁷

The authors concluded, 'People with SCI are reasonably accurate at self-reporting S4-5 sensory and motor function' and stated that in some instances, self-report may be more appropriate to determine sacral sensory and motor function.⁷ However, this report had a number of methodological issues that included a high false positive rate that may be attributed to all questions being asked in the affirmative, sensory questions that were not side of the body specific, and a possible selection bias as 2/3 of the 116 consecutive patients of their SCI outpatient clinic were excluded for lack of participation.^{7,9} Of interest was that 75% of the false positives for motor report were in patients that had level of injury below T10.^{7,9} Some of these methodological issues were published in a letter to the editor in response to the study.⁹

The purpose of this study was to survey patients with chronic SCI, with a neutral based comprehensive survey, to correlate self-report relative to the 'gold standard' of the neurological examination. We hypothesised that patient self-report of S4-5 motor and sensory function is accurate (> 95% in true positive and negatives, with < 5% false positives and negatives) in patients with chronic SCI of all levels of injury. As such, in persons with chronic SCI, patient self-report may be useful in clinical settings if not being recorded as part of a research project.

Methods

Participants

Institutional Review Board approval was obtained before any study procedures were conducted.

Subjects were recruited from an outpatient SCI clinic at two rehabilitation systems. Patients were included if they had a traumatic SCI at least 6 months post injury, have previously undergone rehabilitation such that previous examinations according to the ISNCSC was performed, English speaking, and over the age of 18. All levels of injury were included as well as all AIS grades. Patients were excluded if they had severe cognitive impairment that interfered with the subject understanding the questions based on clinician judgement.

Procedure

This was a prospective, single blinded study. A survey was created that asked study participants to describe the presence or absence of sacral function for light touch (LT), sharp dull discrimination utilising a pin (pin-prick (PP) sensation), deep anal pressure (DAP) and voluntary anal contraction (VAC) using side-specific questions (see [Appendix 1](#)). Demographic data was collected including age, sex, race, level of injury, time since injury, household income and highest level of education. The self-report questions were asked by nursing staff before the patient was seen by the physician in the outpatient setting, and the results of this survey were blinded from the physician who performed the sacral exam (see [Appendix 1](#) for the survey). The sacral exam was performed according to the ISNCSCI as part of the standard of care performed during their regularly scheduled appointment. The sharp/dull discrimination test involved use of a clean safety pin and light touch sensation with a cotton swab on either side of the anal mucocutaneous junction. The digital rectal exam was then performed according to the described Standards. The examiner then documented the results of the exam and remained blinded to the self-report responses. The exam results were extracted from the medical record and recorded on the case report forms.

Statistical analysis

All data were summarised using means and standard deviations or counts and percentages. To determine the extent to which patients could accurately report S4-5 sensory and motor functions, negative and positive predictive values were calculated using the neurological examination as the gold standard. All calculations were performed using SAS 9.4 (Cary, NC).

Results

A sample of 116 patients agreed to participate in the survey and were enrolled into the study at the two sites. [Table 1](#) shows a summary of the patient

Table 1 Summary of patient demographics and injury information.

SCI Patients (N = 116)	
Age at survey	41.3 ± 14.4
Years from injury to survey	8.9 ± 11.5
Male sex	80 (69%)
Race/ethnicity	
White non-hispanic	83 (71.6%)
Black non-hispanic	15 (12.9%)
Hispanic	15 (12.9%)
Other	3 (2.6%)
English language	114 (98.3%)
Education	
9th through 11th grade	6 (5.2%)
High school diploma	44 (37.9%)
Associate's degree	12 (10.3%)
Bachelor's degree	25 (21.6%)
Master's degree	12 (10.3%)
Doctoral degree	5 (4.3%)
Other/unknown	12 (10.3%)
ASIA Impairment Scale (AIS) Grade	
A	63 (54.3%)
B	20 (17.2%)
C	12 (10.3%)
D	21 (18.1%)
Type of paralysis	
Paraplegia	64 (55.2%)
Tetraplegia	52 (44.5%)

demographics and injury information. On average, patients were male (69%), Non-Hispanic White (71.6%) aged 41.3 ± 14.4 years of age. The majority of injuries were paraplegic (55.2%) with a classification of AIS A (54.3%). Although all patients had documented AIS exam, only 38.8% reported never having or unsure if they had the exam.

A summary of responses of the four domains of the self-reported survey and physician exam are described

Table 2 Summary of sacral self-report survey and physician exam portion.

	Self-report	Physician exam
Light touch sensation		
Yes (impaired/intact)	56 (48.3%)	44 (37.6%)
No	53 (45.7%)	72 (62.4%)
I don't know	7 (6%)	
Pin prick sensation		
Yes (impaired/intact)	35 (30.2%)	34 (29.3%)
No	54 (46.6%)	82 (70.7%)
I don't know	27 (23.3%)	
Insertion/ deep anal pressure		
Yes	70 (60.3%)	49 (42.2%)
No	42 (36.2%)	67 (57.8%)
I don't know	4 (3.5%)	
Tighten/ voluntary anal contraction		
Yes	42 (36.2%)	26 (22.4%)
No	61 (52.6%)	90 (77.6%)
I don't know	13 (11.2%)	

in Table 2. Self-reported questions for LT and PP and physician exam questions for LT, PP, DAP, and VAC were combined. If either left or right side had DAP, then the overall response was yes. Conversely, if both sides were absent for DAP, then the overall response was no. VAC was recorded as either present or absent. Within the four domains, several participants indicated that they did not know if they had sacral sensation for some of the self-report questions (3.5% to 23.3%), and were not included in the positive predictive value (PPV) and negative predictive value (NPV) analyses (Table 2).

Table 3 shows a contingency table of the physician exam by the self-report exam for all questions. Table 4 describes the correspondence among the questions in the physician exam and self-report questions. PPV and NPV was described overall, among the level of paralysis, and among AIS classification. Overall, the NPV was accurate across all sacral sparing domains (92% to 100%), however PPV was variable (48% to 73%). This indicates that self-report responses specifying no sensation or contraction were correlated with the physician AIS exam. When comparing the PPV and NPV by AIS classification, we found that NPV was 100% for AIS A across all categories. Additionally, we found that NPV was 100% for LT, DAP, and VAC for AIS B, however PP was variable. For AIS C, we found that NPV was 100% for LT and PP, but was variable for DAP and VAC. Finally, PPV was 100% for AIS D across all categories.

Discussion

This study examined whether a self-report survey on motor and sensory function in chronic SCI was accurate compared to physical exam stratified by injury classification. Notably, those with complete injuries (AIS A) had 100% NPV. This suggests that those who reported no sacral motor/sensory function via survey were correct in relation to the sacral exam. However, those individuals with AIS A that reported sacral motor/sensory function were not correct. Survey results for AIS B and C were variable with PPV and NPV. This is likely due to varying sacral sparing present in these levels of injury. Persons with AIS D injuries who reported having LT, PP, DAP and VAC were congruent with the sacral exam with 100% PPV.

Strengths

This survey addressed limitations from a previous study which attempted to use a self-report measure to assess sacral function.^{7,9} The sample size is large (n = 112)

Table 3 Contingency results of the sacral self-report survey and physician exam.

Physician exam	Self-report							
	Light touch sensation		Pin prick sensation		Deep anal pressure/insertion		Voluntary anal contraction/tighten	
	Yes	No	Yes	No	Yes	No	Yes	No
Overall								
Yes	41	0	24	3	47	2	20	5
No	15	53	11	51	23	40	22	56
AIS classification								
A								
Yes	0	0	0	0	0	0	0	0
No	11	49	4	45	21	38	11	44
B								
Yes	13	0	3	1	17	0	0	0
No	3	2	7	2	2	1	7	9
C								
Yes	7	0	6	0	9	2	2	2
No	1	2	0	3	0	1	4	3
D								
Yes	21	0	15	2	21	0	18	3
No	0	0	0	1	0	0	0	0

Table 4 Correspondence between physician exam results and sacral self-report survey answers.

	Sacral sparing exam											
	Light touch sensation			Pin prick sensation			Deep anal pressure/insertion			Voluntary anal contraction/tighten		
	n	PPV	NPV	n	PPV	NPV	n	PPV	NPV	n	PPV	NPV
Overall	109	73%	100%	89	66%	94%	112	67%	95%	103	48%	92%
AIS classification												
A	60	0%	100%	49	0%	100%	59	0%	100%	55	0%	100%
B	18	81%	100%	13	30%	67%	20	89%	100%	16	0%	100%
C	10	88%	100%	9	100%	100%	12	100%	33%	11	33%	60%
D	21	100%	N/A*	18	100%	33%	21	100%	N/A*	21	100%	0%

*There were no negative cases.

and the questions were in a neutral format so as to not influence positive or negative responses. Finally, we reported PPV and NPV that better describes the accuracy of the self-report exam compared to the physical exam.

Limitations

While we attempted to use language that was easy for the patients to understand, using anatomical terms may still limit full understanding. For example, only 61.2% of surveyed patients reported having previous rectal exams, although documentation confirmed that they did. This finding suggests that patients may not understand the term 'rectal exam.' Additionally, there were several 'I don't know' responses within the survey which may be due to not understanding the terminology used in the survey statements. Another limitation includes the fact the study included only patients with

chronic SCI (> 6 months post-injury) and is not generalisable to acute care. Furthermore, self-reported responses may have differed between different lengths of SCI chronicity.

Conclusion

The results of this study indicate that the physical exam for sacral function should continue to be performed to determine the level of injury and overall prognosis. If needed to defer the exam, self-report of persons with AIS A and D seem to be more reliable than in persons with AIS B and C. We recommend, at the very least, for the incomplete chronic SCI population, to have repeated annual sacral exam.

Disclaimer statements

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Appendix 1. Sacral self-report survey

FOR THE FOLLOWING QUESTIONS, PLEASE NOTE THAT THE ORDER OF THE RESPONSES VARIES.	
Definition for "Pin Prick" – the exam where the clinician pokes an area of the skin with a safety pin/sharp object.	
Picture of rectal/anal area:

1. In your opinion, which of the following is true regarding LIGHT TOUCH sensation on the RIGHT side of your rectal/anal area?	☐ 1 – Yes, I do have light touch on the right side of my rectum/anus. ☐ 2 – No, I do not have light touch on the right side of my rectum/anus. ☐ 9 – I don't know if I have light touch on the right side of my rectum/anus.
2. In your opinion, which of the following is true regarding LIGHT TOUCH sensation on the LEFT side of your rectal area?	☐ 1 – Yes, I do have light touch on the left side of my rectum/anus. ☐ 2 – No, I do not have light touch on the left side of my rectum/anus. ☐ 9 – I don't know if I have light touch on the left side of my rectum/anus.
3. In your opinion, which of the following is true regarding PIN PRICK sensation on the RIGHT side of your rectal/anal area?	☐ 1 – Yes, I do have pin prick sensation on the right side of my rectum/anus. ☐ 2 – No, I do not have pin prick sensation on the right side of my rectum/anus. ☐ 9 – I don't know if I have pin prick sensation on the right side of my rectum/anus.
4. In your opinion, which of the following is true regarding PIN PRICK sensation on the LEFT side of your rectal/anal area?	☐ 1 – Yes, I do have pin prick sensation on the left side of my rectum/anus. ☐ 2 – No, I do not have pin prick sensation on the left side of my rectum/anus. ☐ 9 – I don't know if I have pin prick sensation on the left side of my rectum/anus.
5. In your opinion, which of the following is true regarding sensation of when something is inserted into your rectal/anal area (i.e. suppository or performance of rectal digital stimulation)?	☐ 1 – Yes, I can feel when something is inserted into my rectal/anal area. ☐ 2 – No, I cannot feel when something is inserted into my rectal/anal area. ☐ 9 – I don't know if I can feel when something is inserted into my rectal/anal area.
6. In your opinion, which of the following is true regarding your ability to tighten the muscles of your rectal/anal area as if you are going to hold a bowel movement?	☐ 1 – Yes, I can tighten my muscles around my rectal/anal area as if to hold a bowel movement. ☐ 2 – No, I cannot tighten my muscles around my rectal/anal area as if to hold a bowel movement. ☐ 9 – I don't know if I can tighten my muscles around my rectal/anal area as if to hold a bowel movement.