Nontraumatic Spinal Cord Injury: An Italian Survey

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Objective: To describe the demographic and clinical characteristics and the clinical course of patients with nontraumatic spinal cord injury (SCI).

Design: A multicenter prospective study.

Setting: Thirty-two rehabilitation centers in several Italian regions.

Participants: Patients with nontraumatic SCI (N=330) on first admission (February 1, 1997–January 31, 1999) to rehabilitation centers.

Interventions: Not applicable.

Main Outcome Measures: Indicators of rehabilitation process quality were efficient bladder and bowel management. The indicator of neurologic recovery was improvement in American Spinal Injury Association Impairment Scale (AIS) level at discharge. The indicator of rehabilitation outcome was return home. Length of stay (LOS) was also measured as an indicator of the care process.

Results: Of the 330 patients, 30% exhibited an improvement in AIS classification at discharge, and 73% returned home. In multivariate analysis, a longer LOS was associated with vascular etiology, complete lesions, residence outside the district of the rehabilitation center, and presence of clinical complications. Neurologic improvement was related to incompleteness of the lesion and longer LOS. Factors predicting a return home were married status, incompleteness of lesion, clinical improvement, efficient bowel and bladder management, absence of pressure ulcers, and longer LOS.

Conclusions: Patients showed long waiting times between diagnosis and initiation of rehabilitation, a good chance of improvement on the AIS, and low rates of home returns.

Key Words: Neurologic disorders; Rehabilitation; Spinal cord injuries.

THE DIAGNOSIS of nontraumatic spinal cord injury (SCI) is a crucial aspect in the epidemiologic study of this pathology. The spinal cord can be affected by many diseases. Patients with nontraumatic SCI are treated by physicians with different specializations (internal medicine, surgery, physical medicine and rehabilitation), adding to the difficulty with epidemiologic studies. In general, spinal cord units mainly treat patients with SCI of traumatic origin. Studies of nontraumatic SCI are rare.

Although Kurtzke[1] reported an annual incidence of nontraumatic SCI of 8 per 100,000, he stressed that his data might be incomplete and not fully representative. A Spanish retrospective study,[2] based on questionnaires completed at home, reported a lower incidence: .51 per 100,000. Another retrospective study,[3] based on data recorded for the entire population of Fiji, reported an incidence of .87 per 100,000, which is also lower than Kurtzke's finding. Biering-Sørensen et al[4] reported 92 cases of nontraumatic SCI during 10 years in Denmark (24.3% of the whole case series) but, because of lack of information, were unable to estimate the actual incidence. In a retrospective Dutch study, Schönherr et al[5] reported an incidence of .16 SCIs per 100,000, and 52% of these subjects were affected by nontraumatic SCI. Schönherr also expressed concern that the data may not have been entirely reliable.

Data from different case series show significant variability in the rate of traumatic and nontraumatic SCI—a variability that depends on geographic location, on the type of care department, on the physician's diagnostic skills, and on people's health expectations.

In older studies, the rate ranges from 30%[6] to 80%.[7] In a long-duration observational study[6] (1950–1979) of subjects with nontraumatic SCI, these lesions are reported to account for an increasing proportion of total SCIs (from 15% to 45%). More recent studies[3-5,8-10] report different findings, from 20% to 52%. The etiology of nontraumatic SCI is frequently described.[2-4,6,8,10,11] Infectious causes are more frequent in developing countries, whereas neoplastic causes are more frequently reported in the western world.

Italian data are available only from retrospective studies, which use different methods of data collection and different inclusion criteria. In a large case series,[12] which recruited subjects from 7 centers, nontraumatic SCI cases accounted for 26.1% of the total sample; in a regional study in Italy,[13] based on discharge diagnosis codes, nontraumatic SCIs accounted for 42.8% of all SCIs.

The Italian Epidemiological Spinal Cord Lesion Study Group (Gruppo Italiano Studio Epidemiologico Mielolesioni [GISEM]), established in 1996, gathered prospective data on all patients with SCI[14,15] admitted to rehabilitation wards. The aim of our article was to describe the data relating to demographic variables, clinical characteristics, and the clinical course of patients with nontraumatic SCI admitted to the GISEM study.

METHODS

From February 1, 1997 to January 31, 1999, GISEM recruited all patients with nontraumatic SCI admitted to 32 Italian centers involved in SCI rehabilitation who had agreed to take part in the study. Thirty-seven centers are members of GISEM, but 5 were excluded from this part of the study

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because their patients received only a brief treatment in the acute phase of their disease.

All persons consecutively admitted with clinical signs of SCI, both complete and incomplete, localized at any level, were included in the study, with no restrictions placed on age, nationality, or disease duration. Each center supplied the etiologic diagnosis and classified nontraumatic SCIs into the following 5 categories: inflammatory and infectious, vascular, primary neoplastic, osteodegenerative disorders, and other.

Patients with SCI due to multiple sclerosis, spinal cord metastasis, degenerative central nervous system diseases, and hereditary or congenital diseases were excluded. Patients with traumatic SCI were excluded from this part of the study. This article describes patients at their initial rehabilitation after diagnosis.

This study was approved by the local ethics committees, and all participating subjects were required to give their consent before inclusion.

Data were recorded using a simple, computerized, multiple-choice (EpiInfo, version 6.0[a]), 80-item form. The following information was gathered for each subject: personal and demographic details; cause of SCI; time since diagnosis; neurologic examinations at the time of hospital admission, during rehabilitation, and before discharge, with particular emphasis placed on neurologic status; American Spinal Injury Association Impairment Scale[16] (AIS) levels; and complications. Discharge destination was also recorded.

The indicators of rehabilitation process quality were efficient bladder management (ie, voluntary micturition, Valsalva maneuver, micturition with reflex maneuvers as soprapubic percussion or self-catheterization) and efficient bowel management (defined as the normal management of bowel functions without help from caregivers). Length of stay (LOS) was also measured as an indicator of the care process. The indicator of neurologic recovery was improvement in AIS level (an increase, at discharge, of at least 1 grade on the scale above the grade recorded on admission), and the indicator of rehabilitation outcome was return to home.

Data were collected in each center and forwarded every 3 months to the coordinating center, where they were pooled in a single data file. The precision of all data included in this file was verified periodically. A scientific committee met every 6 months to check the trend of the study.

The strength and direction of associations between 2 variables (without taking into account potential confounding by other variables) were determined by using univariate analysis with odds ratios (OR) and their 95% confidence intervals (CIs) and statistical significance with P less than .05 (χ^2 test, Kolmogorov-Smirnov) for discrete variables and by parametric (Student t test, Fisher F test, analysis of variance [ANOVA], correlation indices) and nonparametric tests (Kruskal-Wallis test, median test, Mann-Whitney U test) for continuous variables. Multivariate analysis models, accounting for all available extraneous confounding prognostic variables, were evaluated by means of multivariate regression analyses (ANOVA for continuous variables, stepwise logistic regression for dichotomous variables). Statistical analysis was performed using the SPSS, version 6.l.3[b]; EpiInfo, version 6.0; and CIA, version 2.0[c] packages.

RESULTS

Descriptive Analysis

During 2 years, GISEM gathered data on 330 patients with nontraumatic SCI (209 men, 121 women) from their first admission to a rehabilitation center.

The male to female ratio was 1.7:1, and the mean age at diagnosis was 55.2 years (median, 58y); no lesion level–related difference emerged from these data.

In 7 cases (2.1%), the level and the completeness of the lesion were not reported; therefore, table 1 refers to 323 persons. Neoplastic and vascular causes were most frequent (≈25%). A cervical lesion was detected in 72 cases (22.3%), which was complete in 12 (16.7%) and incomplete in 60 (83.3%). A thoracolumbar lesion was detected in 251 cases (77.7%), complete in 67 (26.6%) (table 1).

On admission, AIS grade C was the level most frequently found (n=120, 36.4%); while completeness of the lesion (grade A) was found in 24.2% (table 2).

Migration for rehabilitation, involving patients living in a district other than that of the hospital, was observed in 52 subjects (16.1%). The median interval between diagnosis and rehabilitation admission was 60.9 days; this interval was longer in the cases of complete (55.5d) than in incomplete lesions (37.5d), although the difference was not statistically significant.

Pressure ulcers were present on admission in 65 cases (19.7%); other complications were rare, but at least 1 complication was present on admission in 94 cases (28.5%). Complications during hospitalization were urologic in 26 (7.9%), respiratory in 18 (5.5%), and associated with deep vein thrombosis (DVT) in 11 cases (3.3%) (fig 1).

Mean LOS was 73.5 days (median, 57d; range, 2–413d); the longest mean LOS (107.9d) was for complete cervical lesions ($P<.0026$) (table 1).

In 99 cases, (30.0%), AIS grades at discharge showed improvement compared with grades recorded at admission, 217 cases (65.8%) were unchanged, and 7 cases (2.1%) showed deterioration (table 2).

On discharge, pressure ulcers were detectable in 29 patients (8.8%). Efficient bladder and bowel management was attained by 224 subjects (67.9%) and by 213 subjects (64.5%), respectively. Fecal incontinence was present in 40 patients (12.1%). A total of 241 patients returned home (73.0%), 69 were transferred to another hospital (20.6%), and 11 were transferred to a nursing home (3.4%).

Inferential Analysis

Quality of the rehabilitation process. LOS was longer for men (mean, 77.9d; median, 58d) than for women (mean, 66.2d; median, 55d), although the difference was not statistically significant. Median LOS differed ($P<.01$) according to cause (it was longer [82d] for vascular patients) and to the completeness of the lesion (it was longer for patients with complete [85.5d] than for those with incomplete [54d] lesions) ($P<.0049$). AIS grade B at admission was related to a longer LOS ($P<.00001$). Residence outside the rehabilitation center district was also related to a longer LOS (81d vs 55d; $P<.0l6$). The presence of at least 1 complication on admission, such as pressure ulcers ($P<.003$) or DVT ($P<.014$), was related to a longer LOS (79.5d vs 49.5d; $P<.009$). At least 1 complication ($P<.04$) and DVT during rehabilitation ($P<.03$) prolonged LOS. In the multivariate analysis, longer LOS was associated with poorer AIS level, complete lesions, and presence of DVT at admission.

Efficient bladder management correlated with male sex (OR=6.25; 95% CI, 2.9–12.5); incompleteness of lesion (OR=.31 for complete lesions; 95% CI, .17–.54); younger mean age ($P<.009$); absence of complications at admission (OR=.32 for at least 1 complication; 95% CI, .18–.55), especially pressure ulcers (OR=.35; 95% CI, .19–.65) and urologic (OR=.35; 95% CI, .14–.86) and respiratory (OR=.31; 95%

Table 1: Characteristics of 323 First Admissions by Lesion Level (7 unknown, 2.1%)

	Cervical Incomplete	Cervical Complete	Dorso-Lumbar Incomplete	Dorso-L23 Lumbar Complete	Total	%
Age (y)						
Mean	57.5	50.0	55.5	53.3	55	
Median	61.0	55.0	58.0	57.0	58	
Domicile, n (%)						
Same district as center	51 (85)	9 (75)	155 (84.2)	53 (79.1)	268	83.0
Other district	9 (15)	3 (25)	28 (15.2)	12 (17.9)	52	16.1
Unknown			1 (0.5)	2 (3.0)	3	0.9
Etiology, n (%)						
Inflammatory	8 (13.3)	8 (66.7)	36 (19.6)	11 (16.4)	63	19.5
Vascular	7 (11.7)	1 (8.3)	48 (26.1)	25 (37.3)	81	25.1
Neoplastic	9 (15.0)	1 (8.3)	54 (29.3)	17 (25.4)	81	25.1
Degenerative	25 (41.7)	1 (8.3)	28 (15.2)	6 (9.0)	60	18.6
Other	11 (18.3)	1 (8.3)	18 (9.8)	8 (11.9)	38	11.8
Onset to admission interval						
Mean ± SD	59.1±53.9	85.4±71.9	63.6±65.5	67.1±52	64.4	
Median	40.0	69.0	36.0	53.5	60.9	
LOS (d)						
Mean ± SD	64.5±48.3	107.9±110.2	70.4±55.8	85.9±55.8	73.5	
Median	47.5	68.0	56.5	87.0	57	
Destination after discharge, n (%)						
Other hospital	11 (18.3)	6 (50)	33 (18.0)	18 (26.8)	68	21.1
Nursing home	5 (8.4)		1 (0.5)	4 (6.0)	10	3.1
Home	42 (70.0)	6 (50)	145 (79.6)	42 (62.7)	235	72.8
Other	2 (3.3)		3 (1.6)		5	1.5
Unknown			2 (0.3)	3 (4.5)	5	1.5

Abbreviation: SD, standard deviation.

CI, .10–.94) complications. Absence of complications during the rehabilitation period (OR=.29 for presence; 95% CI, .16–.5), in particular respiratory (OR=.18; 95% CI, .04–0.7) and urologic (OR=.37; 95% CI, .15–.94) complications, correlated with better bladder management.

Efficient bowel management correlated with lesion incompleteness, younger age, and absence of complications at admission. Presence of at least 1 complication at admission (OR=.32; 95% CI, .18–.55) and during hospitalization (OR=.28; 95% CI, .16–.49) was the major negative factor. A strong clinical correlation was found between bowel and bladder management (OR=24.4; 95% CI, 12.5–48.2) and between bowel management and clinical AIS improvement (OR=5; 95% CI, 1.9–6.7).

Rehabilitation outcome. Improvement at discharge was related to lesion incompleteness (OR=.17 for complete lesions; 95% CI, .06–.39) and to longer LOS (median LOS, 75d for improved cases; median LOS, 51d for unimproved cases).

Nearly three quarters (73%) of the patients went home after discharge (2.4% to a specially adapted house). About one fifth were transferred to other hospitals for specialized rehabilitation or as a result of complications. Only 3.3% were admitted to nursing homes. A longer LOS (median, 61.5d vs 48.5d) (P=.004), married status (OR=3.1; 95% CI, 1.8–5.4), incomplete lesion (OR=.51 for complete lesion; 95% CI, .29–.92), "improvement" on the AIS (OR=3; 95% CI, 1.5–6.1), absence of pressure ulcers (OR=0.1; 95% CI, .04–.26), and efficient bladder (OR=9.9; 95% CI, 5.4–18.4) and bowel (OR=9.1; 95% CI, 5–16.8) management were all factors predicting a return home.

Table 2: AIS Grade on Admission and at Discharge for 330 First-Admission Nontraumatic SCI Patients

	Discharge						
	A	B	C	D	E	NK	Total
Admission							
A	69	2	4	1	—	4	80
B	2	18	5	10	—	1	36
C	1	2	47	68	2	—	120
D	—	—	2	81	7	1	91
E	—	—	—	—	2	—	2
NK	—	—	—	—		1	1
Total	72	22	58	160	11	7	330

Abbreviation: NK, not known.

DISCUSSION

Few articles dealing specifically with subjects having nontraumatic SCI are available. The samples considered are often very small, and, even in larger series, there is usually a mixture of nontraumatic SCI and traumatic SCI. In these cases, descriptions and statistical analyses focus mainly on traumatic lesions.

Case reports on nontraumatic lesions do exist, but only 1 has included etiology.[17] Our study considers one of the largest samples of patients with nontraumatic SCI described to date and uses prospective collection of data.

As noted by others,[4,5] it is difficult to obtain accurate records on nontraumatic spinal cord lesions. The percentage of nontraumatic SCI reported varies greatly. Our finding (33%) is lower than those in some studies (range, 46%–73%),[3,5,18] is similar to findings of others (range, 30%–39%),[2,6,10,19] and is higher than those of others (range, 20%–24%).[4,8] This lack of homogeneity can be explained by the fact that hospital departments are organized differently in different countries. Some

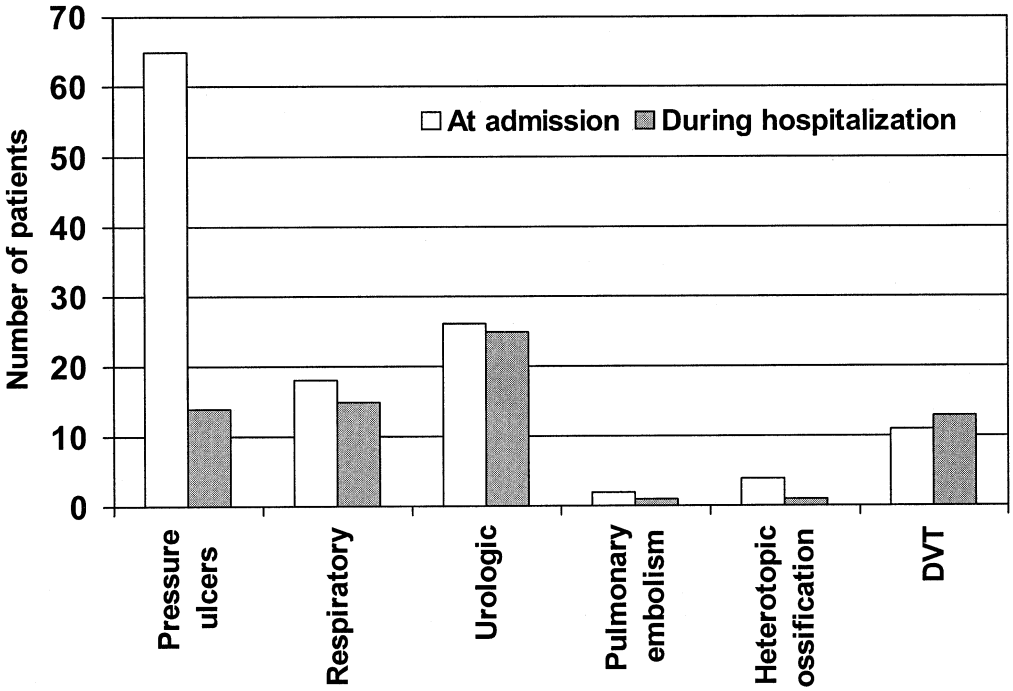

Fig 1. Complications at admission and during hospitalization.

centers are involved mainly with patients affected by traumatic SCI, whereas others, working in collaboration with neurologic and neurosurgical departments, admit many patients with nontraumatic SCI, especially of neoplastic origin.

In Italy, there are few SCI rehabilitation centers. Those taking part in this study, which are mainly concerned with the treatment of spinal cord trauma, are probably among the best organized and equipped. Patients with nontraumatic SCI, on the other hand, can also be admitted to less highly specialized rehabilitation units. Our results may therefore underestimate the true percentage of nontraumatic SCIs.

According to the scientific literature, the mean age of nontraumatic SCI patients is markedly higher than that of patients with traumatic lesions,[3,5,10] a difference that, as reported by many,[2-5,18] becomes less marked in the sixth decade of life.

As far as the etiology of nontraumatic SCI is concerned, there is very little homogeneity in the literature: data gathering centers (which differ in type and in their social, economic, and geographic setting) show a prevalence of neoplastic,[2,8] infectious,[3,6] or degenerative causes.[4,10,11] This variation is exacerbated by lack of consistent diagnostic criteria and can be explained by the small sample sizes. Our data show a high number of neoplastic lesions, with a percentage (25.1%) that is similar to the values reported by some (range, 23.9%–26.0%)[4,6,10,11] and is lower than those reported by others (range, 34.0%–45.9%).[2,8,9,18] The percentage of infectious and inflammatory causes (19.5%) is similar to that found by Garcia-Reneses[2] (18.6%) and Biering-Sørensen[4] and colleagues (17.4%), but is lower than the percentages found by others (range, 25.0%–32.3%).[3,6,8,11] As far as pathology due to degenerative changes is concerned, our result (18.6%) is similar to that previously reported by Watson (19.1%),[6] but lower than those of Biering-Sørensen,[4] Murray,[18] and Ogunniyi[11] (≈30%) and colleagues and lower than that of McKinley et al (53.5%).[10] Finally, our percentage of vascular lesions (25.l%) is considerably higher than values reported in the literature (range, 8.1%–19.8%).[2,4,6,8,10]

Few data are available on the latency between diagnosis and rehabilitation admission or on rehabilitation LOS. Meinecke,[8] in a study using a mixed traumatic and nontraumatic sample, reported "a long waiting time" for 19 hospital admissions in the cases of nontraumatic patients. McKinley et al[10] provide analytical data on the acute and rehabilitation phases, and their results differ considerably from those of our study. The acute diagnostic and therapeutic phase was 4 times shorter than the one we recorded (12.6d vs 64.4d), and rehabilitation LOS was significantly shorter (28d vs 73.5d). In an Italian multicenter study,[12] the interval between diagnosis and admission was more than 5 months.

A long interval between diagnosis and admission for rehabilitative treatment brings to light organizational difficulties within the Italian health service and communication problems between departments. This is particularly evident for patients residing in areas outside those in which the rehabilitation center is located. Indeed, health policy makers are urged to consider the problems related to longer LOS in patients living far from rehabilitation hospitals.

Only 30% of our sample showed an AIS improvement at discharge, and this seems to be related to the specific nature of nontraumatic pathologies, which are often progressive. It is difficult to compare our finding on the percentage of patients exhibiting an improved AIS level on discharge with those of other studies. We were able to find data from 1 study on neurologic change in 8 patients with nontraumatic SCI, and even these data were presented together with data from subjects with traumatic lesion.[3] The percentage of cases showing an improvement reported in this study was similar to our finding (31.4%).

CONCLUSIONS

The probability of returning home at discharge was only 73.0%; in particular, 1 in 5 patients needs to continue treatment in another hospital. This can be perceived either as a problem

related to the disease's severity or to the poor organization of the health care system.

Another interesting finding of our study is the increased probability of clinical improvement after a longer hospital stay. This finding is strengthened by the similar positive correlation found between LOS and the probability of returning home after discharge. It is not clear how this finding should be interpreted. It could be that the hospitalization of subjects tending to show an improvement is prolonged, but this finding could also be seen as the positive outcome of a longer period of rehabilitative treatment. LOS data available in other European countries are restricted to patients with traumatic-type lesions, whereas the data for North America[10] are less detailed than those of our study. This may be attributable to different approaches to the management of patients with nontraumatic SCI.

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Suppliers

a. Centers for Disease Control and Prevention, Division of Public Health Surveillance and Informatics, Epidemiology Program Office, 4770 Buford Hwy NE (Mail Stop K-74), Atlanta, GA 30341-3717.
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