

# Neurogenic Bowel Dysfunction and its Effect on Quality of Life in Patients with Spinal Cord Injury

## Omurilik Yaralanmalı Hastalarda Nörojenik Barsak Disfonksiyonu ve Yaşam Kalitesine Etkisi

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**ABSTRACT Objective:** We aimed to investigate the severity of Neurogenic Bowel Dysfunction (NBD), the association of clinical and demographic characteristics with NBD and the effect of NBD on the Quality of Life (QoL) in patients with Spinal Cord Injury (SCI). **Material and Methods:** The study included 55 patients with SCI. The age, gender, duration of injury, etiology, ambulation level, neurology lesion level and lesion grade of each patient were recorded. NBD was evaluated by the NBD score is composed of 10 questions and the total score is between 0-47. NBD levels were defined as; a score of 0-6 minor for, 7-9 moderate, 10-13 moderate for  $\geq 14$  severe NBD. QoL was evaluated by the Short Form 36 (SF-36). **Results:** Median NBD score was 10 (1-18). Of all patients investigated, 19 (34.5%) had very minor, 6 (10.9%) had minor, 16 (29.1%) had moderate and 14 (25.5%) had severe NBD. NBD scores of the complete patients and patients in non-ambulation group were worse compared to the incomplete patients and patients in functional ambulation group ( $p=0.044$  and  $p=0.002$  respectively). There was no any statistically significant relationship between the 8 subdivisions of SF-36 and NBD. **Conclusion:** Nearly half of the patients with SCI had moderate-severe NBD. NBD was more severe in non-ambulated patients and patients with complete SCI. Contrary to expectations, our study could not show any relation between NBD and QoL. On the other hand, some studies performed on out-patients demonstrated that there is a relationship between NBD and quality of life. As a result, it seems like NBD does not affect QoL of inpatients because of the hospital environment. On the contrary it has a negative effect on the QoL of outpatients in their more social environment.

**Key Words:** Spinal cord injuries; neurogenic bowel; quality of life; rehabilitation

**ÖZET Amaç:** Omurilik yaralanmalı (OY) hastalarda Nörojenik Barsak Disfonksiyonu (NBD) ciddiyetini, klinik-demografik özelliklerin NBD ile ilişkisini ve NBD'nin yaşam kalitesine etkisini araştırmayı amaçladık. **Gereç ve Yöntemler:** Çalışmamıza 55 OY hasta dahil edildi. Yaş, cinsiyet, hastalık süresi, etiyoloji, ambulasyon düzeyi, nörolojik lezyon derecesi ve lezyon seviyesi kaydedildi. Nörojenik barsak disfonksiyonu NBD skoru ile değerlendirildi. NBD skoru 10 sorudan oluşmakta ve total skor 0-47 arasında değişmektedir. NBD derecesi 0-6 çok hafif, 7-9 hafif, 10-13 orta,  $\geq 14$  ciddi NBD olarak tanımlanmıştır. Yaşam kalitesi ise Short Form 36 (SF-36) ile değerlendirildi. **Bulgular:** NBD skoru ortancası 10 (1-18) olarak bulundu. 19 (%34,5) hastada çok hafif, 6 (%10,9) hastada hafif, 16 (%29,1) hastada orta, 14 (%25,5) hastada ise ciddi NBD saptandı. NBD skoru; komplet OY hastalarda inkomplet hastalara göre ve ambule olamayan hastalarda fonksiyonel ambule olabilen hastalara göre istatistiksel olarak anlamlı düzeyde yüksek bulundu ( $p$  değerleri sırasıyla 0,044 ve 0,002). NBD skoru dereceleri ile SF-36'nın 8 alt parametresi arasında istatistiksel olarak anlamlı ilişki saptanmadı. **Sonuç:** OY hastaların yaklaşık yarısında orta-ciddi düzeyde NBD gelişmektedir. Komplet OY ve ambule olamayan OY hastalarda NBD ciddiyeti daha fazladır. Çalışmamız sonucunda beklenenin aksine yaşam kalitesi ile NBD arasında anlamlı bir ilişki saptanmamıştır. Ancak ayaktan hastalarda yapılan bazı çalışmalarda NBD ile yaşam kalitesi arasında ilişki olduğu gösterilmiştir. Bu nedenle yatan hastalarda hastane koşulları nedeniyle NBD'nin yaşam kalitesini önemli bir şekilde etkilemediği, ancak hastane dışındaki daha sosyal yaşamda NBD'nin yaşam kalitesini olumsuz etkilediği düşünülmektedir.

**Anahtar Kelimeler:** Omurilik yaralanmaları; nörojenik barsak; yaşam kalitesi; rehabilitasyon

The life expectancy of patients with spinal cord injury (SCI) increases and participation in social activities becomes more frequent over time with the developments in the field of health. As a result, improving the quality of life (QoL) in SCI population gets more important.<sup>1</sup> In a systematic review investigating the priority of patients with SCI in life and health care, it has been emphasized that improvement in bowel function comes just after the improvement in motor function.<sup>2</sup>

Neurogenic bowel dysfunction (NBD) is; constipation, incontinence and discoordination of defecation according to the loss of neural control. SCI is the most common cause of NBD. NBD is a major cause of morbidity and mortality in SCI and a significant cause of decrease in QoL.<sup>3</sup> The frequency of bowel problems such as constipation, fecal incontinence, abdominal pain and distension, nausea, diarrhea, rectal bleeding and hemorrhoids is 27-62%. Apart from these; gastrointestinal system (GIS) complications such as, gastro-intestinal bleeding, perforation, ileus and intestinal obstruction can also be seen with a frequency of 1.9-11% especially in the first few days following the injury.<sup>4</sup>

In the literature there are only a few studies investigating the effect of NBD on QoL and the association of clinical and demographic characteristics and NBD in SCI.<sup>5-8</sup> So the aim of the present study is to investigate the 1. the severity of NBD, 2. the association of clinical and demographic characteristics and NBD and 3. the effect of NBD on the QoL in patients with SCI.

## MATERIALS AND METHODS

### PATIENTS

Fifty-five patients with SCI, who have been admitted for inpatient rehabilitation to Ankara Physical Medicine and Rehabilitation Training and Research Hospital, were included into the study. Written informed consent forms were obtained from all patients and the study protocol was approved by the Educational Planning and Coordination Committee of Ankara Physical Medicine and Rehabilitation Training and Research Hospi-

tal. Patients who have additional neurological disease except from SCI, and patients with known organic GIS problems or systemic disorders affecting GIS function were excluded. The age, sex, duration of injury, etiology of injury, ambulation level, lesion level (Cervical, thoracic, and lumbar) and lesion grade according to the American Spinal Cord Injury Association (ASIA) Impairment Scale (AIS) classification criteria of each patient were recorded. Ambulation level was grouped as; non-ambulation, therapeutic ambulation and functional ambulation. Patients who are ambulated indoors and outdoors are categorized in functional ambulation, patients who are ambulated indoors only for therapeutic purposes are categorized in therapeutic ambulation and patients who can only stand or are chair/bed bound are categorized in non-ambulation classes.

### EVALUATION OF NBD AND QOL

NBD scores of patients were calculated. NBD includes 10 items as 1. frequency of defecation (0-6 points), 2. time used for each defecation (0-7 points), 3. presence of headache, uneasiness or perspiration during defecation (0-2 points), 4. regular use of tablets against constipation (0-2 points), 5. regular use of drops against constipation (0-2 points), 6. digital stimulation or evacuation of the anorectum (0-6 points), 7. frequency of fecal incontinence (0-13 points), 8. medication against fecal incontinence (0-4 points), 9. flatus incontinence (0-2 points), and 10. perianal skin problems (0-3 points). Total score is between 0-47. NBD levels were defined as; a score of 0-6 very minor, 7-9 minor, 10-13 moderate and  $\geq 14$  severe NBD.<sup>9</sup>

QoL was evaluated by the Short Form 36 (SF-36). SF-36, is divided into 8 health domains: general perception of health (GH) (5 items), physical functioning (PF) (10 items), role limitation due to physical problems (RP) (4 items), role limitation due to emotional problems (RE) (3 items), social functioning (SF) (2 items), bodily pain (BP) (2 items), vitality (VT) (4 items) and mental health (MH) (5 items). For each quality of life domain tested, item scores were coded, summed, and transformed into a scale from 0 (worst) to 100 (best)

using the standard SF-36 scoring algorithms.<sup>10</sup> Turkish validity and reliability of SF-36 was performed by Koçyiğit *et al.*<sup>11</sup>

## STATISTICAL ANALYSIS

Statistical analyses were performed by using SPSS version 11.5 software. The Kolmogorov-Smirnov test was used to determine whether the continuous variable distribution was normal. Descriptive statistics were provided as mean±standard deviation or median (minimum–maximum) for continuous variables while the number of cases and percentages were used for nominal variables. The Mann–Whitney U test was used to determine whether a statistically significant difference was present for continuous or orderable variables not normally distributed. When comparing more than two groups, Kruskal-Wallis test was used for non-

normally distributed numerical variables. Paired comparisons were performed by using Mann Whitney U test with Bonferroni correction. Spearman correlation coefficients were used to evaluate potential relations between the NBD score and the clinical and demographic characteristics of the patients and NBD level and SF-36 components. Power analysis was performed using G Power 3.1.9.2 package and power (1-β) was calculated 0.87 when d (effect size) is 0.4 and α is 0.05. A p value <0.05 was considered statistically significant.

## RESULTS

Demographic and clinical characteristics of the patients were presented in (Table 1). Mean NBD score for SCI patients was 9.1±5.1, and median NBD score was 10 (1-18). Of all patients investigated, 19 (34.5%) had very minor, 6 (10.9%) had minor, 16

**TABLE 1:** Demographic and clinical characteristics of the patients (n=55)

<b>Age (years)</b> mean±SD, median (min-max)	35.6±12.4, 32 (16-60)
<b>Age (years) (n, %)</b> 16-30 / 31-45 / 46-60	25 (45.5%) / 14 (25.5%) / 16 (29.1%)
<b>Sex (n, %)</b> Male / Female	42 (76.4%) / 13 (23.6%)
<b>Disease duration (days)</b> mean±SD, median (min-max)	863±1587, 321 (36-8488)
<b>Disease duration (n, %)</b> 0-3 months / 3-12 months / >12 months	13 (23.6%) / 16 (29.1%) / 26 (47.3%)
<b>Level of lesion (n, %)</b> Cervical / Thoracic / Lumbar	10 (18.2%) / 28 (50.9%) / 17 (30.9%)
<b>Grade of lesion (n, %)</b> AIS A / B / C / D	24 (43.6%) / 11 (20%) / 8 (14.5%) / 12 (21.8%)
<b>Ambulation status (n, %)</b> Not ambulated	8 (14.5%)
Therapeutic ambulated	21 (38.2%)
Functional ambulated	26 (47.3%)
<b>Etiology (n, %)</b> Falling from a height	24 (43.6%)
Motor vehicle accident	13 (23.6%)
Gunshot wound	7 (12.7%)
Crush injury	6 (10.9%)
Non-traumatic	5 (9.1%)

AIS; ASIA (American Spinal Cord Injury Association) Impairment Scale.

(29.1%) had moderate and 14 (25.5%) had severe NBD.

No relationship was found between NBD and age, gender, lesion level, disease duration, and etiology. On the other hand NBD scores of the complete patients and patients in non-ambulation group were worse compared to the incomplete patients and patients in functional ambulation group respectively ( $p=0.044$  and  $p=0.002$  respectively).

There is a weak correlation between NBD score and lesion grade (27.4%) and there is again a weak correlation between NBD score and ambulation level (41%). These results demonstrated that patients with better lesion grade and ambulation level, have less NBD (Table 2). The mean and median values of SF-36 are shown in (Table 3). There were not any statistically significant relationships between the 8 subdivisions of SF-36 and NBD (Table 4).

**TABLE 2:** Comparison of NBD score according to clinical and demographic characteristics of the patients and correlations between them

	NBD score mean±SD, median (min-max)	p	r
<b>Comparison of NBD score according to age (years)</b>			
16-30 years (n=25)	9,1±5,2, 10 (1-16)	*0,541	***0,066
31-45 years (n=14)	8,1±5,1, 8,5 (2-18)		
46-60 years (n=16)	10,1±5,1, 10,5 (1-18)		
<b>Comparison of NBD score according to sex</b>			
Male (n=42)	9,4±5, 10 (1-18)	**0,524	***-0,087
Female (n=13)	8,4±5,6, 8 (1-18)		
<b>Comparison of NBD score according to lesion level</b>			
Cervical (n=10)	5,8±3,7, 4,5 (1-11)	*0,088	***0,214
Thoracic (n=28)	9,9±4,7, 10 (1-18)		
Lumbar (n=17)	9,7±5,8, 10 (2-18)		
<b>Comparison of NBD score according to lesion grade</b>			
AIS A (n=24)	10,8±4,3, 10,5 (2-18)	**0,044	***-0,274
AIS B+C+D (n=31)	7,8±5,3, 7 (1-18)		
<b>Comparison of NBD score according to functional status</b>			
1Not ambulated (n=18)	11,9±3,8, 12 (3-18)	*0,009	
p****(1-3)=0,002	***-0,410		
2Therapeutic ambulated (n=11)	9,1±5,4, 9 (1-16)		
3Functional ambulated (n=26)	7,2±4,9, 6 (1-18)		
<b>Comparison of NBD score according to disease duration</b>			
0-3 months (n=13)	11,5±5,2, 12 (1-18)	*0,148	***-0,217
3-12 months (n=16)	8,5±5,2, 9,5 (2-18)		
>12 months (n=26)	8,3±4,8, 9,5 (1-16)		
<b>Comparison of NBD score according to etiology</b>			
Falling from a height (n=24)	8,3±5,7, 10 (1-17)	*0,247	***-0,070
Motor vehicle accident (n=13)	10,2±4,7, 10 (3-18)		
Gunshot wound (n=7)	11,4±3,9, 11 (6-16)		
Crush injury (n=6)	5,8±3,4, 4,5 (3-10)		
Non-traumatic (n=5)	11,2±4,4, 11 (6-18)		

\*Kruskal Wallis test, \*\*Mann Whitney U test, \*\*\*Spearman correlation test, \*\*\*\*The NBD score and functional status were compared using Kruskal Wallis test, and paired comparisons were made since p was found <0,05 ( $p=0,009$ ), and evaluated using Bonferroni correction, p was found <0,003 ( $p=0,002$ ) (statistically significant) in the comparison between non-ambulated and functional ambulated groups.

NBD; Neurogenic Bowel Dysfunction, AIS; ASIA (American Spinal Cord Injury Association) Impairment Scale.

**TABLE 3:** Short Form 36 domain and component in the patients (n=55)

Short Form 36 domain and component	Mean±SD, median (min-max)
General perception of health	54.9±20,4, 52 (5-100)
Physical functioning	15.8±21,4, 10 (0-90)
Role limitation due to physical problems	13.6±27,6, 0 (0-100)
Role limitation due to emotional problems	63±45,2, 100 (0-100)
Social functioning	42±33,8, 37,5 (0-100)
Bodily pain	55,5±27,1, 62 (0-100)
Vitality	54,6±26,3, 60 (10-100)
Mental health	72,4±20,8, 80 (20-100)

## DISCUSSION

According to our results mean NBD is 9.1 and median is 10. In a study performed by Cameron *et al* (8), median NBD score was found 11.5. In our study moderate-severe NBD is seen in 56.4% of participants. In the literature in two different studies, moderate-severe NBD ratio found was similar to our results (46.9%, 55.6%).<sup>6,12</sup> These results are important for demonstrating that approximately 50% of patients with SCI have moderate-severe NBD. As a result, all patients with SCI should be evaluated carefully for NBD.

Our study showed that patients with complete lesions and patients who are not ambulated have more severe NBD compared with incomplete and ambulated patients respectively. In a similar manner, cervical and thoracic SCI patients and patients with AIS A lesions are more prone to severe NBD compared to lumbar and AIS D patients respectively, according to Liu and colleagues. Moreover, Liu *et al* also showed that disease duration longer than 10 years is associated with more severe NBD too.<sup>12</sup> In another study performed by Özişler *et al*, motor complete patients have critically worse NBD than motor incomplete patients. They have also found a weak negative correlation between disease duration and NBD score.<sup>3</sup> In our study there is no correlation between disease duration and NBD score. The inconsistent results regarding disease duration and NBD severity may be associated with the differences in disease durations in different studies, hence disease duration of patients included were < 1 year in the study by Özişler *et al*, > 1 year in the study by Liu *et al* and mixed approximately 50:50 in our study.

According to the the results of this study; contrary to expectations there have not been found a statistically significant relationship between QoL and NBD. In another study performed by Pardee *et al*

**TABLE 4:** Comparison of the NBD level according to the SF-36 components and correlations between them.

	GH	PF	RP	RE	SF	BP	VT	MH
<b>NBD level</b>	<b>Mean±SD, median (min-max)</b>							
<b>Very minor (n=19)</b>	54±23,1 52 (5-92)	19,5±21,7 15 (0-80)	10,5±21 0 (0-75)	52,6±46,2 66,6 (0-100)	44,1±31,3 37,5 (0-100)	53±25,3 52 (0-84)	53±25 45(15-100)	71,2±19,3 72(40-100)
<b>Minor (n=6)</b>	56±27,8 53 (20-100)	20±28,5 12,5 (0-75)	25±41,8 0 (0-100)	22,2±40,4 0 (0-100)	58,3±34,2 62,5(12,5-100)	63,2±22,8 61 (41-100)	57,5±33,3 75(10-100)	62,6±27 56(36-100)
<b>Moderate (n=16)</b>	57,5±19 61 (20-82)	13,8±26,8 0 (0-90)	18,8±36 0 (0-100)	91,7±25,9 100 (0-100)	36,7±36,1 25 (0-100)	63,7±26,8 64 (10-100)	51,9±25,6 50 (10-90)	76,5±17,3 84(40-100)
<b>Severe (n=14)</b>	52,8±16 51 (25-80)	11,4±8,2 10 (0-25)	7,1±15,3 0 (0-50)	62±46,9 100 (0-100)	38,4±35,2 25 (0-100)	46,4±30,4 41 (10-100)	59±28 62,5(10-95)	73,7±24,1 84(20-100)
<b>p*</b>	0,912	0,120	0,867	0,007***	0,525	0,231	0,864	0,618
<b>r**</b>	-0,037	-0,162	-0,054	0,185	-0,094	-0,074	0,058	0,107
*Kruskal Wallis test, **Spearman correlation test, ***The NBD level and RE were compared using Kruskal Wallis test, and paired comparisons were made since p was found <0,05 (p=0,007), and evaluated using Bonferroni correction, The results from paired comparisons revealed that all p values were >0,00175, and therefore, no statistically significant correlation was found between the NBD level and RE,								

NBD; Neurogenic Bowel Dysfunction, SF 36; Short Form 36, GH; General perception of health, PF; Physical Functioning, RP; Role limitation due to physical problems, RE; Role limitation due to emotional problems, SF; Social Functioning, BP; Bodily Pain, VT; Vitality, MH; Mental Health.

on patients with a disease duration longer than 2 years, QoL was found to be better in patients who are satisfied with bowel management.<sup>5</sup> Liu *et al* found worse results in the physical function subscore of SF-36 in patients with more severe NBD.<sup>6</sup> Similar to our results Cameron and colleagues could not find a relationship between NBD and QoL.<sup>8</sup> Both of the studies showing a correlation between NBD and QoL were performed on outpatients who have a disease duration longer than 1 year. On the other hand Cameron *et al*'s and our studies were performed on inpatients. QoL of inpatients with different clinical characteristics may be similar because of the similar environmental factors during hospitalization. This may be the reason why NBD and QoL seem unrelated according to our results. Moreover, the QoL tool we used is not specific for NBD and may misrepresent NBD for that reason. Studies performed using more specific QoL scales may be helpful.

## CONCLUSION

Nearly half of the patients with SCI have moderate-severe NBD. NBD is more severe in non-ambulated patients and patients with complete SCI. Contrary to expectations, our study could not show any relation between NBD and QoL. On the other hand, some studies performed on outpatients demonstrated that there is a relationship between NBD and quality of life. As a result, it seems like NBD does not affect QoL of inpatients because of the hospital environment. On the contrary it has a negative effect on the QoL of outpatients in their more social environment.

### Conflict of Interest

*Authors declared no conflict of interest or financial support.*

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