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Anal sphincter dysfunction in multiple sclerosis: an observation manometric study

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Abstract: Constipation, obstructed defecation, and fecal incontinence are frequent complaints in multiple sclerosis. The literature on the pathophysiological mechanisms underlying these disorders is scant. Using anorectal manometry, we compared the anorectal function in patients with and without multiple sclerosis.

136 patients referred from our Center for Multiple Sclerosis to the Coloproctology Outpatient Clinic, between January 2005 and December 2011, were enrolled. The patients were divided into four groups: multiple sclerosis patients with constipation (group A); multiple sclerosis patients with fecal incontinence (group B); non-multiple sclerosis patients with constipation (group C); non-multiple sclerosis patients with fecal incontinence (group D). Anorectal manometry was performed to measure: resting anal pressure; maximum squeeze pressure; rectoanal inhibitory reflex; filling pressure and urge pressure. The difference between resting anal pressure before and after maximum squeeze maneuvers was defined as the change in resting anal pressure calculated for each patient.

Results. Group A patients were noted to have greater sphincter hypotonia at rest and during contraction compared with those in group C (p=0.02); the rectal sensitivity threshold was lower in group B than in group D patients (p=0.02). No voluntary postcontraction sphincter relaxation was observed in either group A or group B patients (p=0.891 and p=0.939, respectively).

Conclusions. The decrease in the difference in resting anal pressure before and after maximum squeeze maneuvers suggests post-contraction sphincter spasticity, indicating impaired pelvic floor coordination in multiple sclerosis patients. A knowledge of manometric alterations in such patients may be clinically relevant in the selection of patients for appropriate treatments and for planning targeted rehabilitation therapy.

Keywords: EDSS; Anorectal manometry; Obstructed defecation; Fecal incontinence

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1 Introduction

Anorectal disorders are more common in multiple sclerosis patients than in the age-matched population without multiple sclerosis [1,2]. The underlying pathophysiological mechanisms are not fully understood. Their pathogenesis is multifactorial: neurologic damage; drug therapy; prolonged immobilization in the more disabling forms; anxiety-depression disorder; and spinal disorders [3,4]. Studies on colonic transit time have shown that it is slower in nearly all multiple sclerosis patients [5,6]. The finding of accumulation of markers in the left colon and sigma-rectum suggests that dyschezia is a contributing factor to constipation in multiple sclerosis patients. The hypothesis proposed for pelvic floor dyssynergy is supported by the close association between difficult or irregular bowel movements and urinary retention caused by bladder sphincter dyssynergy [7]. Altered anal sensitivity is found in about 60% of patients with dyssynergic defecation [8]. In a study published in 1996, Chia et al. [9] reported that paradoxical puborectalis contraction is common among multiple sclerosis patients and may partly explain the symptoms of obstructed defecation.

One of the most useful examinations for evaluating pelvic floor dyssynergy is anorectal manometry [10]. However, the literature on manometry in the assessment of anorectal dyssynergy in multiple sclerosis patients is scarce and study results are discordant probably because of the small number of patients involved.

An early study using radiopaque transit markers in 16 multiple sclerosis patients found anal canal hypertonia in those with obstructed defecation and altered filling sensitivity in those with fecal incontinence [5]. A more recent study involving 11 patients found a slight reduction in resting anal and voluntary contraction pressure but a normal sensitivity threshold [8]. A study on 6 patients with multiple sclerosis and fecal incontinence showed a marked reduction in maximum voluntary contraction [11]. A study in a much larger patient sample (n=52) also reported a decrease in maximum voluntary contraction and altered rectoanal inhibition reflex (RIRA) [12]. Jameson et al. found a correlation between manometric anomalies and pudendal nerve motor latency in multiple sclerosis patients with obstructed defecation or fecal incontinence compared to constipated or incontinent controls without multiple sclerosis; the resting anal pressure (RAP) was altered in the multiple sclerosis patients with fecal incontinence, and the maximum squeeze pressure (MSP) was lower in all patients with multiple sclerosis. Pudendal nerve latency was altered in the non-multiple sclerosis patients with fecal incontinence but not in the multiple sclerosis patients, suggesting that anorectal disorders in multiple sclerosis are linked to lesions in the central nervous system [13].

The study population in the current observational study was multiple sclerosis patients referred to the Coloproctology Outpatient Clinic, Department of General Surgery, from the Piedmont Regional Reference Center for Multiple Sclerosis at our hospital. The aim of the study was to evaluate the anorectal manometry data in these patients and compare them with a control group of patients without multiple sclerosis. The differences in manometric values between these two patient subpopulations may shed light on the mechanisms underlying pelvic floor disorders in patients with multiple sclerosis.

2 Material and methods

2.1 Sample selection

Subjects were enrolled from among patients attending the Coloproctology Outpatient Clinic, Department of General Surgery, University of Turin, between 1 January 2005 and 31 December 2011, with a clinical diagnosis of multiple sclerosis [3]. The multiple sclerosis patients were subdivided into two groups: group A was composed of those with constipation and obstructed defecation according to Rome III diagnostic criteria [14] and retention-predominant bowel dysfunction; group B was composed of those with fecal incontinence or defecation urgency. Exclusion criteria were: previous abdominal surgery, except for appendectomy and cholecystectomy, body-mass index >30 ([BMI] weight in kilograms divided by the height in meters squared), heavy smokers, previous pelvic radiotherapy, irritable bowel disease, endometriosis, and muscle and connective tissue diseases.

An equal number of patients, without multiple sclerosis, attending the Coloproctology Outpatient Clinic because of bowel dysfunction (constipation or incontinence) were selected according to the same criteria as the study group. Inclusion criteria were diagnosis of bowel dysfunction: constipation, obstructed defecation, urgent defecation or major or minor fecal incontinence. The patients were subdivided into two groups: group C comprised those with constipation or obstructed defecation or retention-predominant fecal incontinence; group D comprised those with fecal incontinence. These two subgroups constituted the control groups and were matched for type of diagnosis and sex with study groups A and B.

2.2 Variables

All patients underwent clinical examination of the perineum, rectal exploration and rigid rectoscopy. Demographic and clinical data were collected for age, sex, obstetric history, comorbidities, form of multiple sclerosis [15], year of diagnosis, disability level as measured by the Expanded Disability Status Scale (EDSS) [16], and current therapy. In addition, groups A and C were assessed according to the Agachan-Wexner constipation scoring system [17], and groups B and D were assessed according to the Cleveland Clinic Incontinence Scale [18,19].

All patients underwent rectoanal manometry by means of a 8 water perfused channel Dyno Smart manometer, Menfis Medica (Medica S.p.A), Medolla (MO).

The following parameters were measured: resting anal pressure (RAP); maximum squeeze pressure (MSP); rectoanal inhibitory reflex (RAIR); filling pressure and urge pressure; rectal volume. All measurements were performed by a single expert operator (MS).

2.3 Statistical analysis

Descriptive analysis was carried out using common statistical quantities; values are expressed as mean ± standard deviation (SD). Inferential and categorical variables (EDSS scores) were compared using the chi-square test, and the strength of their relationship was estimated by calculating the relative risk (RR). Continuous variables (age, pressure, volume) were compared using two-tailed Student's t test after determining homoscedasticity. In the comparison between categorical and continuous variables, the continuous variables were transformed into dichotomous variables and treated as such. Statistical significance was set at 5%.

Ethical approval: The research related to human use has been complied with all the relevant national regulations, institutional policies and in accordance the tenets of the Helsinki Declaration, and has been approved by the authors' institutional review board or equivalent committee.

Informed consent: Informed consent has been obtained from all individuals included in this study.

3 Results

3.1 Study population

3.1.1 Demographics

In all, 136 patients (68 with and 68 without multiple sclerosis) were included in the study: group A (n=49, mean age 49.6 years); group B (n=19, mean age 46.1 years); group C (n=49, mean age 53.2 years) and group D (n=19, mean age 55.4 years). The percentage of females was 78% in groups A and C and 74% in groups B and D (Table 1).

Student's t test showed that groups A and C overlapped for age (p=0.19), whereas groups B and D did not (p=0.01).

Table 1 reports the demographic and clinical characteristics of the study population.

3.1.2 Multiple sclerosis patients

In group A, 72% of patients had relapsing-remittent multiple sclerosis (RRMS), 24% had secondary-progressive multiple sclerosis (SPMS), 2% had primary-progressive multiple sclerosis (PPMS), and 2% had progressive-remittent multiple sclerosis (PRMS); in group B, 76% had RRMS, 18% had SPMS, 6% had PPMS, and 0% had PRMS. The median year of diagnosis was 1996 for group A and 2000 for group B. The most frequent EDSS score in both groups was 3. Of the four functional systems the EDSS investigated, the pyramidal function score was approximately 2 (range 0-4) in both groups A and B; the difference between the groups was not statistically significant (p=0.85). The median sensitivity score was 1 (mode 0 and range 0-4) in group A and 1 (range 0-2) in group B; the difference between the groups was not statistically significant (p=0.79). The median sphincter function score was 2 (range 0-3) in group A and 1 (range 0-3) in group B, and was similar between the two groups (p=0.58). The median spasticity score was 0 (range 0-3) in group A and 0 (range

Table 1: Patient characteristics.

Mean age - years	
Group A	49.6 ± 12.7
Group B	46.1 ± 9.9
Group C	53.2 ±13.5
Group D	55.4 ± 9.7
Total / number of women (%)	
Group A	49 / 38 (78)
Group B	19 /14 (74)
Group C	49 /38 (78)
Group D	19 /14 (74)
Type of multiple sclerosis (%)	
Group A	72 RRMS; 24 SPMS; 2 PPMS, 2 PRMS
Group B	76 RRMS; 18 SPMS; 6 PPMS; 0 PRMS
EDSS score –pyramidal	**Median (range)**
Group A	2 (0; 4)
Group B	2 (0; 4)
EDSS score –sensory	**Median (range)**
Group A	1 (0; 4)
Group B	1 (0; 2)
EDSS score – bowel and bladder	Median (range)

Table 1 continued: Patient characteristics.

Group A	2 (0; 3)
Group B	1 (0; 3)
EDSS score – spasticity	**Median (range)**
Group A	0 (0; 3)
Group B	0 (0; 2)
Vaginal delivery – percent within group (percentage of breech presentation)	
Group A	37 (47)
Group B	50 (60)
Group C	57 (77)
Group D	63 (79)
Peritoneal abnormalities – no. (%)	
Group A	19 (39)
Group B	4 (21)
Group C	28 (57)
Group D	9 (47)
Urinary-peritoneal abnormalities – no. (%)	
Group A	23 (47)
Group B	12 (63)
Group C	27 (55)
Group D	11 (58)

EDSS denotes Expanded Disability Status Scale; RRMS relapsing-remitting; SPMS secondary-progressive; PPMS primary-progressive; PRMS progressive-relapsing multiple sclerosis.

0-2) in group B; the difference between the two groups was not statistically significant (p=0.28) [Table 1].

3.1.3 Comorbidities

The most common comorbidities were low-back pain (12%) and anxiety-depression (19%) under drug treatment. Because these disorders are often associated with bowel dysfunction, they were analyzed as potential confounders. Analysis showed that their distribution was similar between the groups (low-back pain $\chi^2 = 0.25$, 1 d.f., p=0.38 and psychiatric disorders $\chi^2 = 0.058$, 1 d.f., p=0.19).

3.1.4 Obstetric history

Of the parous women, 37% of those in group A had a vaginal delivery (47% with breech birth), 57% of those in group C (77% with breech birth), 50% of those in group B (60% breech birth), and 63% of those in group D (79% breech birth) [Table 1].

Because episiotomy and laceration during vaginal delivery have been correlated with fecal incontinence [19,20], we tested the distribution of these confounders. Vaginal delivery was more frequent among the women in groups C and D than in groups A and B. Fewer vaginal deliveries were noted in the multiple sclerosis patients (<0.0001, 1 d.f., p<0.001). This may be related to the younger age at delivery in these patients as compared to the women without multiple sclerosis (p=0.001). In general, however, fewer younger women (<40 years of age at delivery) had vaginal delivery (<0.001, 1 d.f., p=0.005). When the two subgroups were stratified according to presence of multiple sclerosis, and then according to age, we observed that age <40 years and multiple sclerosis were predictors for a lower rate of vaginal delivery.

3.1.5 Perineal pathologies

No concomitant morphological alterations (hemorrhoids, fissures, fistula, mucosal prolapse, polyps) were noted in 66% of the multiple sclerosis patients and in 57% of the controls. The two groups were similar for this variable (group A vs. group C $\chi^2 = 0.008$, 1 d.f., p=0.069; group B vs. group D $\chi^2 = 0.01$, 1 d.f., p=0.087).

The proportion of patients with urinary incontinence was greater in group A than in group C ($\chi^2 = 0.001$, 1 d.f., p=0.002) and similar between groups B and D ($\chi^2 = 0.0416$, 1 d.f., p=0.16). None of the non-multiple sclerosis patients made use of self-catheterization, whereas 11 multiple sclerosis patients did and its frequency was similar in groups A and B ($\chi^2 = 0.32$, 1 d.f., p=0.431).

3.2 Manometric profiles

Table 2 reports the manometric measurements recorded in the four patient groups. Figure 1 shows the mean resting anal pressure before and after maximum voluntary contraction and during sustained voluntary contraction.

Resting anal pressure was below the normal range (46-76 mm Hg) in all groups except for group C, which was higher compared to group A (49.8 vs. 40.8 mm Hg, P=0.02), and to groups B and D (37.4 and 31.6 mm Hg, respectively,

Table 2: Manometry values (mm Hg).

	Group A	Group B	Group C	Group D
RAP before MSP	40.8 ±18.6	37.4 ± 16.8	49.8 ± 19.8	31.6 ± 22.9
MSP	99.4 ± 53.5	81.5 ± 48.0	130.0 ± 52.2	97.3 ± 67.5
RAP after MSP	40.7 ± 20.4	37.6 ± 22.8	37.6 ± 16.0	25.4 ± 22.8
ΔRAP	0.2 ± 9.3	-0.2 ± 11.9	12.1 ± 10.4	6.2 ± 10.5
Filling pressure	14.2 ± 9.5	10.3 ± 5.9	13.1 ± 6.4	15.5 ± 7.4
Urge pressure	21.6 ± 13.8	14.2 ± 9.3	20.0 ± 9.5	21.7 ± 8.0
Δ Filling and urge pressure	6.67 ± 8.46	4.72 ± 8.99	7.56 ± 6.27	6.94 ± 5.98

p=0.38). The resting anal pressure was fairly equal in both multiple sclerosis patient groups (p=0.48).

Similarly, the maximum squeeze pressure was below the reference range (203-325 mm Hg in men and 100-231 in women) in all groups except for group C (130.0 mm Hg). Comparison showed a statistically significant difference (p=0.01) only between groups A (99.4 mm Hg) and C, whereas the values for groups A and B and groups B and D were similar (p=0.21 and p=0.41, respectively).

To our knowledge, this is the first study to compare the resting anal pressure measured before and after maximum squeeze and the difference between pre- and post-maximum squeeze pressures. There was a transient reduction in basal sphincter tone after maximum squeeze in group C and D patients but not in group A and B patients. After contraction, the anal pressure measurements were similar for all four groups; however, they started from different resting anal pressure values before the maximum squeeze maneuver. To determine the possible cause, we needed to define an index parameter to account for these differences. For this purpose we calculated the change in resting anal pressure (ΔRAP) by subtracting the value of the resting anal pressure after maximum squeeze (postMSP) from that measured before maximum squeeze (preMSP), where ΔRAP=RAPpreMSP – RAPpostMSP.

A longitudinal analysis was then performed to determine whether the intra-group difference between the two values was statistically significant. There was a significant difference among group C and D patients (p=0.001 and p=0.02, respectively) for the basal anal pressure before and after maximum squeeze, with a reduction in resting anal pressure after maximum squeeze in both groups. No statistically significant difference in resting anal pressure before and after maximum squeeze was observed in the multiple sclerosis patients [Figure 2].

Figure 2 shows the difference in resting anal pressure before and after maximum voluntary contraction in the four patient groups.

The ΔRAP in group A patients was lower than that in group C patients (0.2 vs. 12.1 mm Hg; p=0.01). It was found to be similar in group B and D patients but that may be due to a limited number of patients in each group (-0.2

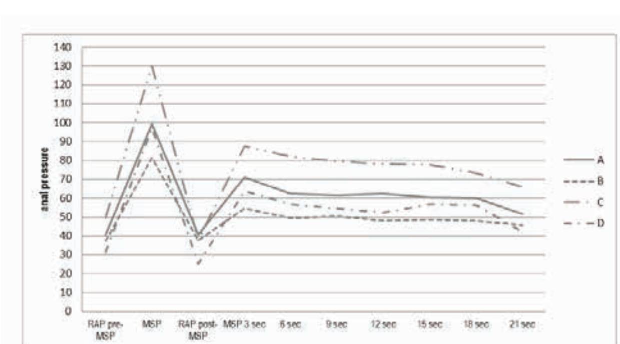

Figure 1: Mean resting anal pressure in mm Hg before (RAP preMSP), during (MSP), after maximum squeeze maneuver (RAP postMSP), and voluntary contraction pressure measured during squeeze maneuver.

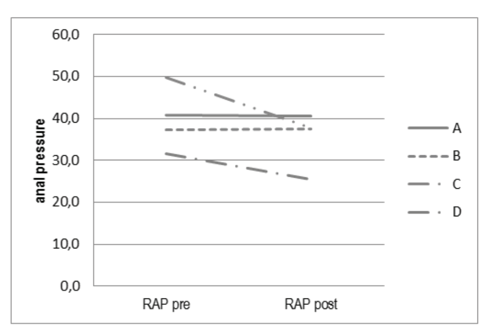

Figure 2: Comparison between resting anal pressure in mm Hg (RAP) measured before and after maximum voluntary contraction in the four patient groups.

vs. 6.2 mm Hg, respectively, p=0.99). Hence, no decline in pressure was seen in the multiple sclerosis patients compared to the controls. However, since this might have been attributable to muscle spasm, we checked whether the ΔRAP differed between patients receiving spasticity medications and those who were not. To do this, the multiple sclerosis patients were subdivided into two groups: one group (n=14) under antispasticity therapy (baclophen, gabapentin, benzodiazepine) and the other group (n=54) was not. The Student's t test showed that the ΔRAP was similar for the two groups (1.5 vs. 0.2 mm Hg; p=0.55).

We then compared the ΔRAP and the EDSS scores for the four functional systems. For statistical purposes, patients with low functional impairment scores (from 0 to 1) were compared to those with high scores (≥2), but no statistically significant difference emerged from this comparison [Table 3].

The duration and intensity of sustained contraction were both normal for the group C patients, whereas in the other groups duration was normal [21] but the range was narrower compared to reference limits (203-325 mm Hg in men and 100-231 mm Hg in women).

The rectal filling sensation threshold (P sens) was normal (5-15 cm H_2O) in all groups except group D where it was higher (15.53 cm H_2O). The pressure threshold required to elicit a sensation of defecation urge (P urge) was slightly below the reference range (15-50 cm H_2O) in group B (14.17 cm H_2O). The rectal pressure threshold for filling and urge was lower in groups A and B compared to the controls (p<0.01). The pressure threshold for urge to defecate was significantly lower in group B and group A patients (p=0.04).

To determine whether small changes in rectal filling could evoke a sensation of defecation urge in some of the groups and whether there were significant between-group differences, we defined a parameter (ΔFU) calculated by subtracting the value for rectal filling sensation from that for defecation urge, where: ΔFU=P urge – P sens. The thresholds for defecation urge and filling sensation were closer in the multiple sclerosis patients (6.67 mm Hg in group A and 4.72 mm Hg in group B; p=0.42). The difference in thresholds was wider in group C (7.56 mm Hg) than in group A, albeit not significantly; no difference was found between groups B and D (p=0.39). Group B patients were noted to have the lowest pressure to elicit rectal filling sensation, whereas group D patients had the highest threshold (Figure 3).

The rectoanal inhibitory reflex (RAIR) was normal in all four groups, except for 2 patients in group C and 1 patient in group B. The comparison showed no statistically significant differences between the groups. Evaluation of RAIR at an arbitrarily selected pressure of 25 cm H_2O showed no statistically significant differences between the four groups.

Table 3: Relation between ΔRAP and functional systems on the EDSS.

Pyramidal Function			
Group	No.	Mean	P value
0-1	16	-3.5 (13.3)	
2-3-4	47	0.19 (8.4)	0.20
Sensory Function			
Group	No.	Medan	
0-1	48	-1.10 (11.06)	
2-3-4	15	0.40 (4.70)	0.60
Spasticity			
Group	No.	Mean	
0-1	56	-0.57 (10.27)	
2-3-4	5	-3.00 (-3.00)	0.61
Bowel and bladder			
Group	No.	Mean	
0-1	35	-0.94 (-0.94)	
2-3-4	28	-0.50 (-0.50)	0.86

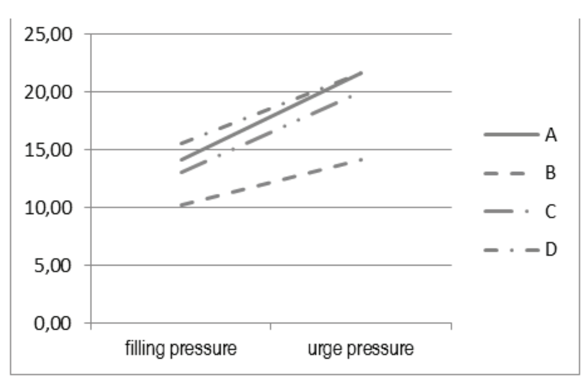

Figure 3: Comparison between sensitivity thresholds required to elicit a sensation of filling and defecation urgency in the four patient groups.

4 Discussion

This study compared manometric characteristics in multiple sclerosis and non-multiple sclerosis patients with perineal disorders. Manometry showed that evacuation difficulties in multiple sclerosis are associated with anorectal alterations that include sphincter muscle weakness and impaired basal and voluntary contraction. In the fecally incontinent patients, rectal hypersensitivity was correlated with defecation urge. The non-multiple sclerosis patients showed no altered change in resting anal pressure before and after maximum squeeze (ΔRAP), indicating that it is typical of multiple sclerosis. No correlations were found between ΔRAP and the characteristics of multiple sclerosis analyzed in this study.

The study has several weaknesses and strengths. One of its limitations is that the preselection of multiple sclerosis patients does not make the sample representative for all patients with multiple sclerosis but only those with anorectal dysfunctions. The cross-sectional study design provides a picture of the situation but not its natural history. Instead, a longitudinal study could yield further information on the course of anorectal dysfunction. Furthermore, the sample size was too small to test for correlations between manometric anomalies and the features of multiple sclerosis, which could be useful in interpreting the data. The paired case-controls were not matched for age, except for the groups with isolated fecal incontinence. The reason for this difference is that, in the general population, fecal incontinence is more prevalent in the elderly, whereas multiple sclerosis tends to affect younger persons [3,22-23].

A notable strength of the study is the comparison between non-multiple sclerosis and multiple sclerosis patients with similar evacuation disorders. This approach may illustrate more clearly the alterations typical of multiple sclerosis. The groups were substantially similar, as confirmed by statistical analysis for confounders.

Among the parous female multiple sclerosis patients, the rate of vaginal deliveries was lower, which seems to be related to their younger age. Whether vaginal delivery has an effect on manometric characteristics, particularly with regard to ΔRAP, requires further study. Vaginal delivery has been associated with a reduction in resting anal pressure and maximum squeeze pressure also in asymptomatic patients [24]. It may be conjectured that if the proportion of vaginal deliveries in the non-multiple sclerosis patients (the control groups) and the multiple sclerosis patients (study group) had been equal, the resting anal pressure before maximum squeeze in the former would have been higher and the ΔRAP would most likely be greater than that recorded. From this we may presume that the ΔRAP in the non-multiple sclerosis patients was underestimated and that the real difference between the ΔRAP in the two otherwise substantially similar groups would have been greater than that found here.

The majority of multiple sclerosis patients (90%) attending a proctological outpatient service present with anorectal dysfunction including retention disorders, fecal incontinence or mixed retention and fecal incontinence. Such disorders are present even in patients with low disability. Constipation and incontinence are equally encountered in patients with various forms of multiple sclerosis and degree of disability.

Clinical examination revealed organic anorectal pathologies in 34% of multiple sclerosis patients with anorectal dysfunction and in 43% of the controls, although the difference between the groups was not statistically significant. Urinary disorders were found in 51% of multiple sclerosis patients and 56% of the controls, suggesting a wide range of perineal alterations. This is in line with previous observations [25,26].

4.1 Resting anal sphincter tone and voluntary contraction

Resting anal muscle tone and voluntary contraction were lower in the multiple sclerosis than in the non-multiple sclerosis patients, irrespective of type of bowel dysfunction. For both these parameters, group C was the only one of the four to show normal values. Groups A, B, and D all had subnormal values and did not differ significantly among each other. This suggests that weakened internal and external sphincter tone in multiple sclerosis patients does not necessarily translate into distinct perineal symptoms, since it may also manifest as either fecal retention or incontinence. Sphincter hypotonia correlated with fecal incontinence. The diminished strength of the external anal sphincter explains the urge to defecate, whereas the diminished strength of the internal sphincter may lead to passive fecal incontinence. The correlation between hypotonic sphincter and retention disorder is less clear.

The data suggest impaired transmission by the sacral parasympathetic fibers responsible for autonomic innervation of the internal anal sphincter and the pudendal nerve, which innervates the external anal sphincter [27].

4.2 Difference in resting anal pressure

The transient decrease in resting anal pressure after maximum squeeze seen in non-multiple sclerosis patients was not observed in the multiple sclerosis patients. To better understand the causes for this discrepancy, which is not mentioned in the literature, we introduced the ΔRAP parameter to calculate the extent of the decrease. In the multiple sclerosis patients, the ΔRAP was significantly lower than that in the controls. This confirmed the lack of internal sphincter relaxation following anal contraction in the multiple sclerosis patients. Unlike what occurs in non-multiple sclerosis patients, the internal anal sphincter does not completely relax in multiple sclerosis patients. We hypothesized that this may be similar to sphincter spasm; however, the comparison between the multiple sclerosis patients receiving and those not receiving antispasticity therapy showed no differences between the two groups.

Comparison between this alteration and disability in the multiple sclerosis patients was performed by comparing the EDSS scores for four functional systems. Correlations were found for pyramidal, sensory, sphincter, and spasticity deficits and the degree of lack of decrease in anal sphincter tone. However, this analysis was based on a small number of patients in subgroups of disability, therefore a larger sample is needed to reveal a statistically significance difference. Figure 2 shows similar trends of ΔRAP for groups A and B and groups C and D. Since there is a significant difference between larger groups, one would expect similar results when comparing less numerous patient groups.

As the comparison between patients with low and high EDSS scores and ΔRAP showed no statistically significant difference, the anomalous manometric values could not be correlated with a specific functional system or with spasticity in particular. It could be hypothesized that such alterations may be attributable to regulatory dysfunction of the mechanisms controlling voluntary and autonomous muscle tone, secondary to altered retrograde sensitive transport and to altered descending motor control in the spine. This would lead to rectoanal dyssynergy, resulting in a lack of relaxation of the anal sphincter after maximum voluntary contraction.

4.3 Prolonged anal contraction

The duration of sustained anal contraction was normal but its intensity was decreased in groups A, B and D. Only in group C were duration and intensity normal. While muscle fatigue is not commonly encountered in multiple sclerosis patients, a deficit in contractile strength of the external anal sphincter can be found. Hence, while elements of anal sphincter fatigue were absent, we did observed hypotonia of the external sphincter in the constipated multiple sclerosis patients and in the incontinent multiple sclerosis and non-multiple sclerosis patients.

4.4 Rectal filling and defecation urge sensitivity thresholds

The rectal filling and defecation urge sensitivity thresholds were normal in groups A and C. The rectal filling sensitivity threshold was above the normal value in group D, which is consistent with mild rectal hyposensitivity. In group B the defecation urge threshold was slightly below the normal range, suggestive of hypersensitivity to rectal filling which could explain the defecation urge that the patients often reported. To determine how close the sensitivity thresholds approximated to one another, we calculated the Δ filling-urge parameter. The thresholds were closer in the multiple sclerosis patients, particularly with regard to fecal incontinence, although the comparison demonstrated no significant differences.

This finding has clinical relevance. Multiple sclerosis patients often complain of the onset of defecation urge immediately after feeling a sensation of having to evacuate, and the urgent need to reach a toilet in time.

4.5 Rectoanal inhibitory reflex

The rectoanal inhibitory reflex was normal in all groups, except for 2 patients in group C and 1 patient in group A. This indicates that the cause underlying the retention disorders in these patients does not appear to be due to impairment of the sacral reflex arc, which is responsible for relaxing the internal anal sphincter and rectal filling [28].

5 Conclusions

This study revealed several manometric differences between patients with and without multiple sclerosis. In the multiple sclerosis patients with fecal incontinence, resting and voluntary anal sphincter contraction pressure was lower, and rectal sensitivity was significantly higher compared to the controls. These elements could explain the fecal incontinence and defecation urge in these patients.

In the multiple sclerosis patients with retention disorder, the sensitivity threshold was normal and sphincter contraction was similar to that in the controls, but the mean resting anal pressure and voluntary contraction pressure were below the normal values. This apparent contradiction between hypotonic sphincter and retention disorder may be explained by impaired muscle coordination in these patients. This hypothesis is supported by the lack of a decrease in anal sphincter tone after contraction in the constipated and incontinent multiple sclerosis patients, as demonstrated by the ΔRAP. The reduced ΔRAP appears to be typical of multiple sclerosis and could be the expression of impaired coordination of the pelvic floor muscles. This alteration may be attributable to regulatory dysfunction of the mechanisms controlling voluntary and autonomous muscle activity. Further study is needed to better understand its pathophysiology and therapeutic implications.

This study also highlights the complexity of anorectal function in multiple sclerosis patients, as demonstrated by manometry. We believe that the data may improve therapeutic response by helping the clinician plan a personalized rehabilitation program for the individual patient.

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