

Post-Injury Menstrual Cycle Changes and Hormone Profiles in Women with Acute Spinal Cord Injury

Akut Spinal Kord Yaralanmalı Kadınlarda Menstrual Siklüs Değişiklikleri ve Hormon Profili

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ABSTRACT

Objective: Retrospective, medical record review. To assess the prevalence of post-injury menstrual cycle changes and hormone profiles in women with acute spinal cord injury.

Methods: We obtained and reviewed the medical records of 23 women with acute traumatic spinal cord injury in inpatient rehabilitation units of a tertiary research hospital.

The patients were classified as having normal menstrual cycles (menstrual cycle length between 25-35 days), amenorrhea (no menstrual cycle for more than 90 days), or oligomenorrhea (menstrual cycle length between 36-90 days). The hormone profiles of patients with oligomenorrhea and amenorrhea were tested. These hormone profiles included luteinizing hormone (LH), follicle stimulating hormone (FSH), estradiol, prolactin, and thyroid-stimulating hormone (TSH).

Results: The mean age of the patients was 28.61 ± 9.02 years. Of the 23 women, 15 (65%) demonstrated normal menstrual cycles, and 8 (35%) had menstrual cycle abnormalities. In addition, 7 women had post-injury menstrual cycle abnormalities, 2 had oligomenorrhea, and 5 displayed amenorrhea. The prolactin levels in 6 of the 7 patients with post-injury menstrual cycle abnormalities were higher than normal adult levels. Moreover, the LH levels in 3 of the 6 hyperprolactinemic patients were lower than those found in normal adults. Of the 7 patients with post-injury menstrual cycle disorder, 4 showed high estradiol levels, and 2 exhibited normal estradiol levels.

Conclusion: Hyperprolactinemia and hypothalamic-pituitary-ovarian axis disturbances are associated with post-injury menstrual cycle changes in the view of a small sample size. (*J PMR Sci 2012;15: 69-72*)

Keywords: Spinal cord injury, menstruation, follicle stimulating hormone, luteinizing hormone.

ÖZET

Amaç: Retrospektif, medikal kayıt incelemesi. Akut spinal kord yaralanmalı kadınlarda yaralanma sonrası menstrual siklüs değişikliklerinin prevalansını ve hormon profilini belirlemek.

Yöntemler: 3. basamak araştırma hastanesinin rehabilitasyon ünitelerinden 23 akut travmatik spinal kord yaralanmalı kadının medikal kayıtları incelendi. Hastalar normal menstrual sikluslu (menstrual siklus uzunluğu 25-35 gün), amenoreli (90 günden daha uzun süre menstürasyon olmaması), yada oligomenoreli (menstrual siklus uzunluğu 36-90 gün) olmak üzere gruplandırıldı. Oligomenoreli ve amenoreli hastalarda hormon profili test edildi. Hormon profili luteinizan hormon (LH), folikül stimulan hormon (FSH), estradiol, prolaktin ve tiroid stimulan hormondan (TSH) oluşuyordu.

Bulgular: Hastaların ortalama yaşı $28,61 \pm 9,02$ yıl idi. 23 hastanın 15'inde (%65) normal menstrual siklus, 8'inde (%35) menstrual siklus değişikliği vardı. Yaralanma sonrası menstrual siklus değişikliği olan 7 hastanın 2'sinde oligomenore, 5'inde amenore vardı. Yaralanma sonrası menstrual siklus değişikliği olan 7 hastanın

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6'sında prolaktin düzeyi normal erişkinlerden yüksekti. 6 hiperprolaktinematik hastanın 3'ünde LH düzeyi normal erişkin düzeyinden düşüktü. Yaralanma sonrası menstrual siklus değişikliği olan 7 hastanın 4'ünde estradiol seviyesi yüksek, 2'sinde normaldi.

Sonuçlar: Küçük örneklemlili çalışmamıza göre, hiperprolaktinemi ve hipotalamo-pituiter-ovarian aks bozukluğu yaralanma sonrası menstrual siklus değişiklikleri ile ilişkilidir. *FTR Bil Der 2012;15: 69-72*

Anahtar kelimeler: Spinal kord yaralanması, menstürasyon, folikül stimüle edici hormon, luteinizan hormon

Introduction

Spinal cord injury alters the function of multiple organs and produces severe physical disabilities. Most spinal cord injury patients are male; however, there is a paucity of information regarding the issues related to women with spinal cord injury. Post-injury amenorrhea in women with traumatic spinal cord injury has long been noted, although there have been limited reports on this subject (1-4). Menses are important to a woman; they reinforce her belief in herself as a woman, which in turn can affect her self-esteem (1).

Regular menstruation requires an intact hypothalamic-pituitary-ovarian axis and a normal uterus and outflow tract. A disorder at any of these levels may result in amenorrhea (5). Among the general population amenorrhea is detected 3-5.6% of all females of childbearing age (6,7). But the incidence of post-injury amenorrhea in spinal cord injury women can range between 35-58%, and its duration can range between one to 30 months (1-3). The spontaneous resumption of menstrual periods without hormonal therapy has been reported (2,4). It has been previously reported that ovulatory cycles are common in women with spinal cord injury after the return of menses (8). Given these observations, it is thought that there is no major imbalance of female sex hormones following spinal cord injury. However, low FSH levels and vaginal cytological findings that are compatible with low estrogen stimulation in patients with high spinal cord transection and amenorrhea have been reported (9). Recently, it has been shown that amenorrhea following spinal cord injury is correlated to the level of s-prolactin (10). The aims of this study were to assess the prevalence of post-injury menstrual cycle changes and the hormone profiles of women with acute spinal cord injuries.

Methods

We retrospectively reviewed the medical records of 58 women with acute traumatic spinal cord injury between the ages 17 and 45 years who were hospitalized in the inpatient rehabilitation units of a tertiary research hospital in Turkey. Our inpatient rehabilitation units are freestanding 90- and 24-bed hospitals located at the capital of Turkey; these units receive referrals from across the country and serve as general rehabilitation hospitals. Acute spinal cord injury patients are admitted to our hospitals after acute care has been completed in the general hospitals. The patient who admitted to our hospital within 6 months after the injury were evaluated as acute spinal cord injury. As a part of a systemic evaluation, the menstrual history of women with spinal cord injury is recorded

in our hospitals. The menstrual history records include documentation of any menstrual irregularities before and after the injury, history of any endocrine disorder, breast feeding before the injury, and pregnancy at the time of injury. If the patient exhibited menstrual irregularities after the injury, then the dates of the menstrual bleeding were recorded. The patients were classified as having normal menstrual cycles if their menstrual cycle length was 25-35 days, as having amenorrhea if they had not had a cycle for more than 90 days, and as having oligomenorrhea if they had a cycle length between 36-90 days(11). The test results of serum LH, FSH, estradiol, prolactin, and TSH levels were reported in women with oligomenorrhea and amenorrhea, after the menstrual cycle abnormalities were detected. Each patient's neurological level of injury was determined according to the guidelines of the American Spinal Injury Association. This study was approved by the Başkent University Institutional Review Board.

Results

Of the 58 women with spinal cord injury, 23 (40%) had records of menstrual history that were included in this study. The mean age of the patients was 28.61±9.02 (min 17-max 45) years. Five out of the 23 (21%) subjects had cervical spinal cord injury, 2 with C5 ASIA C and 3 with ASIA A. Ten subjects (44%) exhibited a Spinal cord injury at the thoracic level, which ranged from T4-T11, and all of these injuries were ASIA A. Eight subjects (35%) displayed spinal cord injury at the lumbar level, which ranged from L1-L4, 5 with L1 ASIA A, 1 with L2 ASIA A, 1 with L3 ASIA D, and 1 with L4 ASIA B. The mean follow-up duration was 4.70±3.07 (min 2-max 17) months. Of the 23 women, 15 (65%) had normal menstrual cycles, and 8 (35%) showed menstrual cycle abnormalities. Of the 8 patients with menstrual cycle abnormalities, 1 subject had a history of amenorrhea prior to the injury, 7 had post-injury menstrual cycle abnormalities, 2 had oligomenorrhea, and 5 had amenorrhea. There is no difference in level and completeness of injury of the patients with menstrual cycle changes and without it. All of the patients with post-injury amenorrhea had a gynecological examination at 101.2±11.0 (min 93, max 119) days after the injury. The patients' gynecological examinations were normal. After the gynecological examination, the levels of serum prolactin, LH, FSH, estradiol and TSH were tested. Hormone levels of 2 patients with oligomenorrhea were tested at 12 and 25 days after the menstruation, respectively, when they were re-hospitalized for urinary incontinence. The hormone profiles of the 7 patients with post-injury menstrual cycle abnormalities are shown in Table 1. The prolactin levels in 6 of the 7 patients with

Table 1. The hormone profile, age, injury level and injury-test interval of the seven patients with post-injury menstrual cycle abnormalities

Patient	Age	Level of injury	Prolactin (1.39-24.2 ng/ml)	LH (2-12 m/U/ml)	FSH (1-8 m/U/ml)	Estradiol (25-50 pg/ml)	TSH (0.3-5U/ml)	Injury-test Interval (day)
1	41	L1 ASIA A	16	7	5.2	153	0.5	95
2	25	L1 ASIA A	168	1.51	6.44	44.3	0.79	119
3	34	T4 ASIA A	148	0.82	6.9	67	2.5	94
4	40	C5 ASIA C	96.8	2.94	6.09	70.5	1.5	105
5	32	T4 ASIA A	103	4.48	6.1	49.8	0.68	93
6	33	C6 ASIA A	66.4	0.62	2.21	-	1.79	156
7	40	L1 ASIA A	109	3.64	3.0	105	3.2	350

post-injury menstrual cycle abnormalities were higher than normal adult levels. None of the patients with hyperprolactinemia displayed galactorrhea. The patients' LH levels were lower than normal adult levels in 3 of the 6 hyperprolactinemic patients. Moreover, the FSH and TSH levels were within the normal ranges in all of the patients with post-injury menstrual cycle disorder. Estradiol determination in one of the patients with post-injury menstrual cycle disorder was not performed. Of the 6 patients for whom information was available with post-injury menstrual cycle disorder, 4 subjects exhibited higher estradiol levels, and 2 subjects had normal estradiol levels. Three patients with amenorrhea were medicated with medroxyprogesterone and 2 of the patients were treated with bromocriptin.

Discussion

Amenorrhea in association with galactorrhea and hyperprolactinemia has been reported to occur in women with SCI (12,13). However, it is well known that in women with SCI, post-injury amenorrhea may occur in the absence of galactorrhea, and normal menses with ovulation may spontaneously resume (9). It has also been reported that post-injury menstrual irregularities can occur in SCI patients with normal menses (2). In our study, 7 patients had post-injury menstrual cycle abnormalities: 5 patients demonstrated amenorrhea, and 2 patients showed oligomenorrhea. The oligomenorrheic patients suffered from irregular menses. Like previous study on spinal cord injury (2) in our study level and completeness or incompleteness of lesion played no role on menstrual cycle changes after injury. In addition, of the 7 patients with post-injury menstrual cycle abnormalities, 6 displayed hyperprolactinemia. Previous studies have shown that an elevated level of serum prolactin from any cause will result in anovulation and amenorrhea when the levels are sufficiently elevated (14). Serum prolactin levels in excess of 70-80 ng/ml are commonly associated with anovulation and amenorrhea; however, lower values will interfere with regular cyclic ovulation in many subjects(14). Recently, it has been reported that women

who sustain a SCI during childbearing age are at a higher risk of developing hyperprolactinemia, which is strongly associated with amenorrhea (10).

In our study, in patients with post-injury menstrual cycle disorder, hyperprolactinemia was associated with a low level of LH in 3 subjects. The estradiol levels were normal or higher than normal in these patients. The role of gonadotrophins and ovarian hormones in women with SCI and post-injury amenorrhea has been investigated by Durkan (9). They found that in 6 of 7 women studied, the serum concentration of FSH levels was consistently less than the levels observed in normal adults. The vaginal cytological evaluation of these women was compatible with low estrogen stimulation. The serum concentration of LH was not determined.

Spinal cord injury has an effect on the endocrine system in several ways. In women with chronic spinal cord injury, hypothalamus-pituitary-ovary axes changes, such as high FSH and prolactin levels, and increased LH responses to LH releasing hormone have been reported(3). However, acute stage changes in the hypothalamus-pituitary-ovary axes in women with spinal cord injury have not been studied. A previous study investigating the pituitary-testicular hormonal axes changes in spinal cord-injured male rats noted transient suppression of FSH and LH following spinal cord injury (15). Both serum FSH and LH levels were decreased as early as 3 days after spinal cord transection, and the serum concentrations of FSH and LH were not affected in the sham-operated rats. In addition, the serum FSH levels returned to normal 7 days after transection. In contrast, the serum LH concentration returned to normal by day 14 in T9 animals, although the serum LH concentration remained 40% lower in the L1 animals.

In men with acute SCI, a transient decrease in serum LH and FSH concentrations was reported by Naftchi et al.(16). Paraplegic subjects showed significantly lower serum levels of LH and FSH for 2 weeks after spinal cord trauma; however, after a period of time, these hormones reached normal levels. Similar findings were also found in quadriplegic subjects; however, these patients exhibited a delay of up to 16 weeks before LH concentrations reached normal levels following spinal cord

trauma. Similar to men, women with acute SCI display a transient decrease in serum FSH and LH levels. In our patients, the serum concentrations of FSH, LH and other hormones were measured on only one occasion after the menstrual cycle abnormalities were detected. All of our patients with menstrual cycle abnormalities had normal FSH levels. We believe that the measurement of serum hormone levels was complete after the FSH reached normal levels, although the LH levels were still below normal levels.

The small sample size, short follow-up durations of the patients and retrospective nature of this study limit the generalization of our results. Other potential limitations of our study were that associated injuries can be related with menstrual cycle abnormalities, which were not considered and only the patients with menstrual cycle abnormalities tested for hormone levels. Despite these limitations in our retrospective study, both hyperprolactinemia and low LH levels were detected in women with spinal cord injury with post-injury menstrual cycle abnormalities. The role of gonadotrophins in spinal cord-injured women with post-injury menstrual cycle abnormalities should be analyzed in a longitudinal study.

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