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ORIGINAL ARTICLE

Clinical and psychometric features of psychiatric patients after a suicide attempt in relation with menstrual cycle phases

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Abstract

There is evidence that frequency of suicide attempts of fertile women is related to the menstrual cycle phases, while the influence of hormonal and psychiatric features has been hypothesized. This study aims to explore the distribution and possible differences in clinical characteristics of women who attempted suicide in relation to menstrual cycle. Seventy fertile female psychiatric patients, hospitalized in psychiatric department after a suicide attempt, were studied. Depression was assessed using Beck Depression Inventory, suicide intent with the Suicide Intent Scale, and aggression using the Buss–Perry Aggression Questionnaire. A profile of psychopathology was obtained by using Symptom Check List SCL-90-R. Attempts were more frequent during the last 4 days of luteal phase and during the 4 days of menses, with 59% of attempts to occur during these 8 days. Patterns of number of attempts and cycle phase were similar for subgroups regarding diagnosis, violent/non-violent mode of suicide attempt, and one or repeated attempts. Although attempts were unequally distributed during the cycle, none of the psychiatric features assessed in the present study were related to the higher frequency of attempts during premenstrual/menstrual days, indicating the need to include additional aspects of suicidal behavior in future studies.

Keywords Suicide attempt · Menstrual cycle · Depression · Suicide intent · Aggression · Violence

Introduction

Suicidal behavior is a multifactorial health problem of global dimension. Suicide accounts for 1.4% of all deaths worldwide, making it the seventeenth leading cause of death among men and women and the second leading cause of death between the ages of 15–29 years for the year 2015 (WHO 2017). Suicide attempts have been estimated to be almost 20 times more than suicides, and their rates across different continents and countries are significantly higher in females compared to males with very few exceptions (Wasserman 2016). Although the pathophysiology of suicidality is systematically investigated in the context of stress–diathesis model in relation to neurotransmitters, mainly serotonin, lipid metabolism, and stress system (HPA axis), a possible role of sex hormones is less studied.

Menstrual cycle characterizes the hormonal changes that occur during the regular function of female reproductive system and constitutes a cyclic pattern which is mediated by feedback mechanisms involving ovaries and hypothalamic–pituitary system (Messinis et al. 2014). It is argued that clinically significant physical and psychiatric symptoms associated with the cyclicity of estradiol and progesterone levels affect up to 12% of women (Hofmeister and Bodden 2016). The incidence of suicide attempts in women has been found to variate during the menstrual cycle, and a possible association of circulating sex hormone levels to suicidal behavior has been investigated. Baca-Garcia et al. (2010) have systematically studied this hypothesis and suggest that low levels of estrogen and progesterone may increase the risk for suicide attempt in fertile women during menses. Indeed, increased frequency of suicide attempts has been mentioned to appear in the first week of the cycle, especially during menses (Baca-Garcia et al. 2003; Baca-Garcia et al. 1998; Dalton 1959; Fourestié et al. 1986; Tonks et al. 1968) or premenstrually

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(Glass et al. 1971; Janowsky et al. 1967; Tonks et al. 1968). However, certain studies did not show a significant association between menstrual cycle phases and the occurrence of the attempts (Ekeberg et al. 1986; Pallis and Holding 1976).

In a review of 44 studies of suicidal behavior (suicide ideation, suicide attempts, suicide) and menstrual cycle (23 studies included suicide attempts), Saunders and Hawton (2006) reported that late luteal and follicular phases are overrepresented between individuals who attempted suicide, indicating a certain positive association between menstrual cycle and suicide attempts, a finding confirmed by 15 studies (Baca-Garcia et al. 2010). Furthermore, in that review, the most usual methodological problems were highlighted; those included selection of the sample according to the outcome of the suicidal behavior, exclusion criteria (pregnancy, hormone therapy, irregular cycles, amenorrhea, and menopause), the difficulty of women to report the day of the cycle, and the determination of the menstrual phase in which the suicide attempt occurred given the fact that a variety of factors could influence the menstrual cycle duration such as pharmacological interventions and stressors.

The majority of studies that have investigated the relationship between suicide attempt and menstrual cycle have included women who were evaluated after being treated at Emergency Wards, and thus, it is not specified whether they were hospitalized in the psychiatric clinic (Baca-Garcia et al. 2004; Baca-Garcia et al. 2010; Caykoylu et al. 2004; Zengin et al. 2015). Furthermore, there is a paucity of studies to evaluate the clinical and psychometric characteristics of attempted suicide of women with regard to their cycle.

In this study, we aimed to evaluate the association of menstrual cycle with suicide attempts among fertile female psychiatric patients hospitalized in psychiatric department after a suicide attempt. Patients who are hospitalized in a psychiatric clinic after a suicide attempt have in general increased suicide risk and usually present elevated psychopathology. Therefore, studying this subgroup of individuals who attempt suicide has significant clinical interest with a view to developing focused and specialized interventions. Furthermore, we explored possible differences in clinical characteristics of women who attempted suicide in different phases of the cycle such as psychiatric diagnosis, depressive symptomatology, suicide intent, mode of attempt (violent/non-violent attempt), and history of previous attempts.

Material and methods

Seventy fertile females in the age range of 18 to 52 years (mean age, 35.5; standard deviation, SD = 8.9) who were admitted to the Psychiatric Clinic of "Attikon" General Hospital in Athens after a suicide attempt were included in the study. Suicide attempt was defined as "every self-directed injurious act with at least some intent to end one's own life" (Mann 2003a). The study protocol was approved by the Ethics Committee of the Hospital, and informed consent was obtained from all individual participants included in the study.

Exclusion criteria were age less than 18 years, irregularity of the cycle, use of oral contraceptives, hysterectomy, amenorrhea, menopause, or premenopause.

The menstrual cycle was considered regular when its duration between the cycles was 28 ± 5 days (Baca-Garcia et al. 1998). In our sample, the reported day of the cycle at admission in the psychiatric clinic was maximum 28 days.

Psychiatric diagnoses were established according to DSM-5. Twenty-eight subjects received a diagnosis of major depressive disorder (MDD), 13 of bipolar disorder, 14 of psychosis, and 15 of personality disorder or adjustment disorder. Depression was assessed using Beck Depression Inventory (BDI) (Beck et al. 1961), suicide intent using the Suicide Intent Scale (Beck et al. 1974), and aggression using the Aggression Questionnaire (Buss and Perry 1992). A more detailed profile of psychopathology was obtained by using Symptom Check List-90-R (SCL-90-R) (Derogatis 1977). We highlight the Global Severity Index (GSI) that is an indicator of the current level of the disorder considering both the number of symptoms and the intensity of the perceived distress as well as the Positive Symptom Distress Index (PSDI) that reflects symptom intensity. Criteria of Träskman et al. (1981) were used to categorize attempts as violent or non-violent. Moreover, all patients provided information regarding their menstrual cycle and the day of their cycle in which they attempted suicide was recorded.

A blood sample was taken for measurement of hormone levels at 08:00 within 72 h after suicide attempt or if patients were primarily hospitalized in the intensive care unit, within 48 h following transfer in the psychiatric ward. The sample was taken in EDTA; plasma was separated by centrifugation and stored at − 30 °C until estimations. Hormone levels were assessed using the radioimmunoassay kits of DIA source ImmunoAssays SA, Belgium. We do not report hormone levels because the blood sample was taken not at the day of attempt, but when patients were in psychiatric wards after they were treated in other departments of the hospital. Mean time elapsed between attempt and blood sampling was 3.0 (SD = 2.4) days, and median time was 2 days. For 13 cases, time was 4 days or more (range 4–13). The estimation of progesterone helped to confirm the reported cycle phase in many cases, while Luteinizing Hormone (LH) and Follicle Stimulating Hormone (FSH) helped to confirm that the participants were not menopausal, both hormone levels being in all cases below 20 mIU/ml (LH 4.98 ± 3.45, range 1.16–16.4; FSH 4.86 ± 2.23, range 1.78–12.7).

According to the literature, premenstrual (late luteal)/menses phases were frequently reported to be characterized by higher incidence of suicide attempts compared to the other

phases of the cycle among fertile women. We, thus, searched for differentiations between clinical profiles of patients who attempted to die by suicide during several phases of the menstrual cycle (Dalton 1959). Therefore, we divided the menstrual cycle into seven phases (each with 4 days duration: 1–4, 5–8, 9–12, 13–16, 17–20, 21–24, 25–28 days), as was done in the study of Dalton (1959). Moreover, we built two subgroups according to the cycle day of the attempt, one for menses/premenstrual days (1–4 and 25–28 days) and another for cycle days 5–24.

Statistical analyses

Descriptive statistics are presented as mean, standard deviation (*M,* SD). The significance of differences for the psychometric measurements was examined performing analysis of variance (ANOVA). The statistical significance level was set at $p < 0.05$.

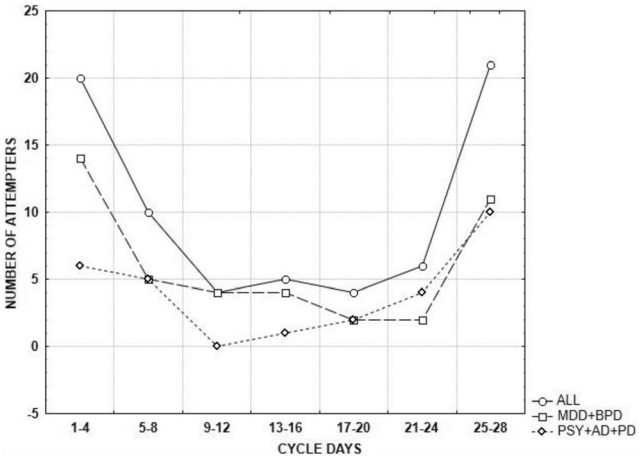

Fig. 1 The distribution of suicide attempts during the menstrual cycle of 70 fertile female psychiatric patients in relation to the psychiatric diagnosis (All total number of patients, MDD + BPD major depressive disorder and bipolar disorder, PSY + AD + PD psychosis and personality disorder and adjustment disorder)

Results

Clinical data of psychiatric fertile female patients who attempted suicide according to diagnosis, violent or non-violent mode of attempt, and history of previous attempts are shown in Table 1. The distribution of suicide attempts during the cycle is presented in Fig. 1. Especially, 20 women (28.57%) attempted suicide during the first phase of the cycle (days 1 to 4), 10 women (14.29%) during the second phase (days 5 to 8), 4 women (5.71%) during the third phase (days 9 to 12), 5 women (7.14%) during the fourth phase (days 13 to 16), 4 women (5.71%) during the fifth phase (days 17 to 20), 6 women (8.57%) during the sixth phase (days 21 to 24), and 21 women (30%) during the seventh phase of the cycle (days 25 to 28).

The number of patients who attempted suicide using non-violent or violent methods as well as the number of patients with one or more attempts in their history in relation to day of menstrual cycle are provided in Figs. 2 and 3, respectively. Figures 1, 2, and 3 show a similar distribution of number of attempters during phases of the menstrual cycle regarding diagnosis, mode of attempt, and number of attempts.

Table 1 Clinical data of psychiatric female suicide attempters of reproductive age

Group	Number	Age		BDI		SIS		AQ		GSI	
		M	SD	*M*	SD	*M*	SD	*M*	SD	*M*	SD
Diagnosis											
All	70	35.5	8.9	28	12	12	6	83	22	1.70	0.79
MDD	28	35.3	8.7	32	9	13	7	85	21	1.86	0.56
BPD	13	43.0	5.9	31	7	14	7	84	31	1.86	0.76
PSY	14	35.1	8.1	22	10	11	5	81	20	1.53	0.72
AD + PD	15	30.0	8.5	24	16	8	4	82	21	1.43	1.15
Mode of attempt											
Non-violent	50	35.6	9.7	27	11	11	6	84	23	1.61	0.76
Violent	20	35.3	7.0	30	12	14	6	82	21	1.92	0.84
Number of attempts											
One	34	32.7	7.7	24	12	11	6	81	19	1.51	0.72
More	36	38.3	9.2	32	9	13	6	85	25	1.88	0.82

MDD major depressive disorder, *BPD* bipolar disorder, *PSY* psychosis, *AD* adjustment disorder, *PD* personality disorder, *BDI* Beck Depression Inventory, *SIS* Suicide Intent Scale, *AQ* Aggression Questionnaire, *GSI* Global Severity Score of SCL-90

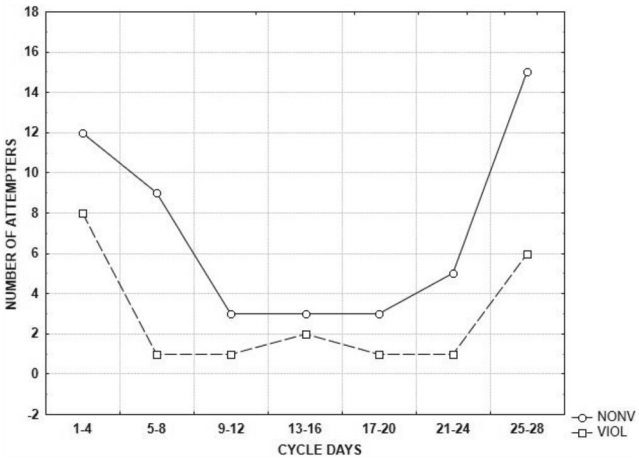

Fig. 2 The distribution of suicide attempts during the menstrual cycle of 70 fertile female psychiatric patients in relation to the mode of attempt (NONV non-violent, VIOL violent)

The possible difference between the expected number of suicide attempts and the observed categorized in two subgroups according to the cycle day on attempt was also explored. For the 70 participants of the study, 10 attempts are expected every 4 days of the cycle, corresponding to 20 for the subgroup 1–4/25–28 days and to 50 for the subgroup 5–24 days. The observed cases were 41 suicide attempts in the first subgroup (1–4/25–28 days) and 29 in the second subgroup (5–24 days), with the difference being highly significant (chi square = 12.81, $p = .0003$).

No significant differences in clinical profile were found between the two subgroups of attempters according to the cycle day (Table 2). Especially, the two subgroups of attempters did not show significant differences in Suicide Intent Scale (SIS) ($p = .32$), BDI ($p = .33$), AQ ($p = .22$), and its subscales, or in any of the SCL-90-R subscales. Significant difference was found only for PSDI (positive symptom distress index, $p = .015$).

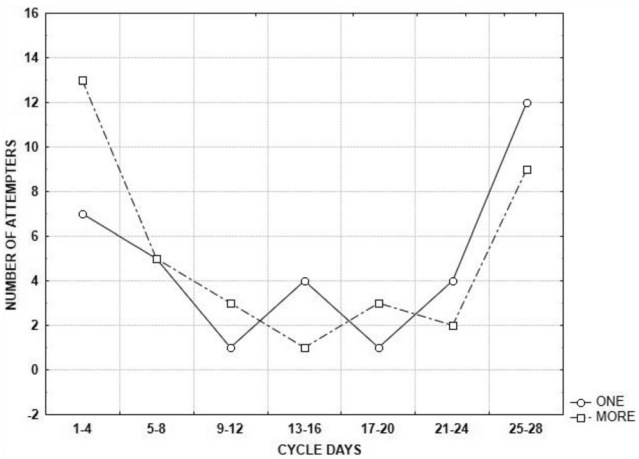

Fig. 3 The distribution of suicide attempts during the menstrual cycle of 70 fertile female psychiatric patients in relation to the number of attempts (ONE no previous attempts, MORE one or more attempts at the past)

Discussion and conclusion

In our study, more than expected suicide attempts were observed in females during menses and premenstruum. Attempts were more frequent during the first 4 days of the cycle (menses, 20 cases, 29%, expected 7%) and in the premenstrual phase (late luteal phase, days 24–28, 21 cases, 30%, expected 7%) in accordance with previous findings (Dalton 1959). It is noteworthy that, as well as in Dalton's study (1959), this pattern of the exacerbation of suicide attempts during menses and premenstruum concerns patients admitted to a psychiatric ward after the suicide attempt. In that study, the author argued that menstruation and premenstruum are characterized by suicide attempts needing admission to a psychiatric clinic (53% of overall attempts during the cycle). Baca-García et al. (2003) noticed that the probability for a fertile woman to commit a suicide attempt during menses was 1.68 times higher than the overall probability for fertile woman. Premenstruum was associated with increased risk of suicide attempts in susceptible women (defined as those with more severe past medical and gynaecologic histories and more sexual and marital problems), indicating that vulnerability has a significant role and menstruation acts as a trigger in certain patients (Glass et al. 1971; Tonks et al. 1968).

There is a great concern about intervention strategies in patients with repeated suicide attempts (Sinclair et al. 2011). Very few studies have examined the relationship between repeated self-destructive behavior and the menstrual cycle. Menses have been associated with increased frequency of self-cutting in women who repeat this act in order to deal with their feelings, without the intent to die (Rosenthal et al. 1972; Saunders and Hawton 2006).

The higher frequency of suicide attempts during certain phases of the menstrual cycle leads us to hypothesize possible higher suicide intent in these attempters. However, patients who attempted suicide, subgrouped according to the phase of the cycle as previously described, did not differ in severity of suicide intent, depression, aggression, or general psychophathology as assessed by the psychometric scales administered. Pallis and Holding (1976) found that suicide attempts during premenstrual week had a significantly higher suicide intent compared with attempts occurred in other phases of the cycle, while no other variables were found to be different (age, marital status, severity of depression, premenstrual symptom). Baca-García et al. (2010) noticed that high-suicide intent score (SIS > 14) was found in a higher number (36%) of women who attempted suicide during menses compared to women who attempted suicide during follicular, mid-cycle, and luteal phases (24%).

Table 2 Clinical data of female suicide attempters categorized in two groups according to cycle day of attempt

Variable	Cycle day of attempt					
	1–4 or 25–28 ($N = 41$)		5–24 ($N = 29$)		F (1, 68)	p-value
	M	SD	M	SD		
Age	36.0	8.5	35.0	5.5	0.25	.62
SIS	12.8	6.1	11.3	5.8	1.00	.32
BDI	29.4	11.9	26.7	11.3	0.95	.33
AQ	87.6	25.92	80.21	22.64	1.52	.22
AQ, physical	20.12	8.60	19.69	8.71	0.04	.84
AQ, verbal	14.41	5.12	13.86	5.21	0.19	.66
AQ, hostility	8.44	6.55	7.86	6.33	1.57	.22
AQ, anger	25.27	16.27	21.31	5.84	1.59	.22
SCL-90, GSI	1.81	0.80	1.55	0.77	1.95	.17
SCL-90, PSDI	2.65	0.69	2.24	0.65	6.26	.015

SIS Suicide Intent Scale, *BDI* Beck Depression Inventory, *AQ* Aggression Questionnaire, *GSI* Global Severity Score, *PSDI* Positive Symptom Distress Index

Depression is a well-established risk factor for suicidal behavior (Bernal et al. 2007). Some authors proposed that mood disturbance might appear in certain phases of the menstrual cycle (during menses or premenstrual), but no firm conclusions can be drawn since this relationship has not been replicated in other studies (Saunders and Hawton 2006). In the present study, no significant differences were found in depressive symptomatology between individuals who attempted suicide during menstrual/premenstrual phases or in other phases of the cycle, indicating that the significant excess of the attempts cannot be related to the emotional burden of the attempters. Caykoylu et al. (2004) administered the Hamilton Depression Rating Scale (HDRS) to female attempters admitted in the emergency ward after a suicide attempt and did not find any significant differences between the scores of women who attempted suicide in different phases of the cycle (Caykoylu et al. 2004). It has been argued that menses have an increased risk for suicide attempt; nevertheless, this association does not seem to be influenced by clinical variables such as depression, impulsivity, and lethality (Baca-Garcia et al. 2003).

Psychometric evaluations were used in the study, that is, the administration of Beck Depression Questionnaire, Aggression Questionnaire, and Suicide Intent Scale were not able to identify factors that distinguish the two groups of attempters namely those who attempted at the days 0–4/25–28 or days 5–24 of the menstrual cycle. Global Severity Index (GSI) of the SCL-90 did not differ between the two groups ($p = .12$). However, a statistically significant difference emerged in Positive Symptom Distress Index (PSDI), an indicator of symptom intensity. Although in this study, suicidal women during menses/premenstruum do not present higher levels of psychopathology than the others, they seem to experience more severe symptoms.

Aggression has been systematically described to be related with suicidal behavior in both genders indicating a component of diathesis in stress–diathesis model (Mann 2003b). Recent studies identified certain aspects of aggressive behavior in suicidal males and females. In females, suicidality is proposed to be linked with non-impulsive aggression (Dalca et al. 2013) and hostility (Sadeh et al. 2011). Therefore, we explored possible differences in aggression (severity and forms of aggression) between fertile women who attempted suicide across the menstrual cycle. Total aggression and its dimensions (physical, verbal aggression, anger, and hostility) did not differ between suicide attempts that occurred in different phases of the cycle.

It is suggested that the underlying mechanisms of this possible association between suicide attempts and hypoestrogenic/low progesterone phases of the menstrual cycle are linked with the neuromodulatory effects of estrogens. It seems that decreased levels of estrogens are associated with alterations in serotoninergic and dopaminergic activity, neurotransmitters which are implicated in suicidality's biological pathways (Mann 1998; Saunders and Hawton 2006). Premenstrual low progesterone levels are described to trigger inflammatory process, initially with intracellular events and subsequently with the production of pro-inflammatory agents (Evans and Salamonsen 2012). Suicidality has been proposed to be related at least in part with immunological dysregulation (Brundin et al. 2015).

The identification of the fertile women's characteristics that are at a greater risk for suicide in certain phases of the menstrual cycle could promote more sophisticated intervention strategies in these patients' population.

Certain limitations of this study should be mentioned. A limitation of the study is that we have not measured hormone levels of the attempters for the day of attempt, since the blood

sample was taken a few days later. Thus, we cannot report levels of estradiol and progesterone, since there are great fluctuations of their levels during cycle days. Furthermore, we did not include assessment of premenstrual syndrome in the design. Indeed, in a large sample of women aged 18–40 years, those with premenstrual syndrome/premenstrual dysphoric disorder were found to have more non-fatal suicidal behaviors compared to women with no premenstrual symptoms (Pilver et al. 2013; Saunders and Hawton 2006).

In conclusion, in this study, we report an abnormal distribution of suicide attempts during the menstrual cycle in psychiatric patients. A higher incidence of attempts was observed during menses and premenstruum (late luteal phase) compared to suicide attempts occurred in other phases of the cycle. Similar distributions were found for subgroups of attempters categorized according to diagnosis, violent/non-violent attempt, or one/repeated attempts. Moreover, there were no significant associations of cycle phase with psychometric features (general psychopathology, depressive symptomatology, suicide intent, and aggression). However, during menses and premenstruum, suicide attempts were associated with higher levels of perceived symptom intensity compared to suicide attempts that occurred in other phases of the cycle.

Compliance with ethical standards

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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