

## CASE SERIES

# Behçet's Disease and Pregnancy: A Retrospective Case-control Study

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**Background:** Behçet's disease (BD) is a rare chronic multisystemic vasculitis of unknown etiology. It is usually diagnosed between the 2<sup>nd</sup> and 4<sup>th</sup> decades of life, so its association with pregnancy is not unusual. This study aims to characterize the evolution of pregnancy in a group of pregnant women with BD and the impact of this pathology in embryo-fetal morbidity. **Methods:** A retrospective case-control study included 49 pregnancies in women suffering from BD, followed in our institution. Pregnancy outcomes were compared with a control group of healthy pregnant women. Two controls per case were randomly selected. Statistical analysis used SPSS 25.0, and a *p*-value of 0.05 was considered statistically significant. **Results:** Forty-nine pregnancies were included in 27 patients with BD. BD exacerbation occurred in 32.6% of the pregnancies. There were no significant statistical differences between the two groups regarding the rate of preterm delivery, gestational diabetes, and preeclampsia (*p*>0.05). In the BD group, we found a higher rate of miscarriage (24.5%) and fetal growth restriction (FGR, 13.3%, *p*<0.05). In the study group, 13 (32.5%) of the pregnant patients did not need treatment. The cesarean rate was significantly higher in the BD group (43.2% vs 20.4% in the control group, *p*<0.05), and there were no significant differences in median gestational age at the time of delivery (*p*>0.05). The birth weight of newborns did not differ significantly between the groups. There was no association of BD with maternal morbidity and neonatal complications. **Conclusion:** In this study, the majority of pregnant with BD did not present clinical exacerbation of their pathology. However, BD may have an adverse influence on pregnancy outcomes. FGR and miscarriage rates were significantly higher in the study group.

## INTRODUCTION

Behçet's Disease (BD) is a chronic multisystemic inflammatory disorder, characterized by recurrent oral and genital ulcers, uveitis, arthritis, and skin lesions (erythema nodosum). This systemic vasculitis was first described in 1937 [1-3], and it may involve both the arteries and veins, but venous involvement is more frequent [3]. BD etiology is not entirely understood; however, it

is known that an immunogenetic predisposition linked to HLA-B51 immunophenotypes in the presence of specific extrinsic agents may trigger an immune vasculitis that characterizes this syndrome [1,3-5]. This disease is seen worldwide, but it has important regional variations, and it is more common in the Middle East and the Mediterranean regions [3,4]. The highest incidence of the disease is found in Turkey [3].

The diagnosis of BD is based on clinical criteria [3].

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Abbreviations: BD, Behçet's disease; FGR, fetal growth restriction; ACOG, American College of Obstetricians and Gynecologists; SPSS, Statistical Packages for Social Sciences; GD, Gestational diabetes.

Keywords: Autoimmune disease, Behçet's disease, pregnancy outcomes, fetal outcomes

BD is often diagnosed between the 2<sup>nd</sup> and 4<sup>th</sup> decades of life [6,7], so its association with pregnancy is not unusual. It is important to understand the association between pregnancy and BD. Data report that the course of this disease improves or remains stable during pregnancy [4]. However, the current studies to evaluate the BD courses during pregnancy are limited and conflicting. Concerning pregnancy outcomes, no increase in pregnancy complications has been observed in some studies [6,7], although some authors report a higher rate of maternal and fetal complications, like a miscarriage in these patients [2,5]. This study aims to characterize the evolution of pregnancy in a group of pregnant women with BD, as well as the impact of this pathology on embryo-fetal morbidity.

## MATERIALS AND METHODS

This descriptive and retrospective case-control study included 49 pregnancies in 27 patients with BD, with antenatal follow-up, deliveries, and puerperium in our institution, between January 2002 and 31 December 2019. BD was diagnosed according to the International Study Group's criteria for Behçet's Disease 1990 [8], all the pregnant patients in the study meet these criteria.

Two controls per case were randomly selected from healthy women with singleton pregnancies who attended the same hospital and during the same period. The control group included 89 pregnant women with antenatal care and delivery in our institution.

The primary outcome was defined as the influence of pregnancy on the risk of BD flares, and the secondary outcome was BD's effect on pregnancy and fetal morbidity. We evaluated: age at BD diagnosis, illness duration, clinical manifestations, treatment, obstetric history (gestational age at delivery, cesarean delivery, neonate birth weight, and Apgar score), obstetric outcomes (preterm delivery, preeclampsia, gestational diabetes mellitus, fetal growth restriction, miscarriage), and disease activity during pregnancy and puerperium.

Preterm delivery was defined by the American College of Obstetricians and Gynecologists (ACOG) criteria (2019) as a labor that occurs before 37 weeks of pregnancy. Preeclampsia was defined according to ACOG criteria (2019) as systolic blood pressure  $\geq 140$  mmHg or diastolic blood pressure  $\geq 90$  mmHg on two occasions at least 4 hours apart after 20 weeks of gestation and proteinuria (defined as urinary excretion of 300 mg or more in a 24-hour urine collection or protein/creatinine ratio of 0.3 mg/dL or more or dipstick reading of 2+) or in the absence of proteinuria, new-onset hypertension with new onset of target organ damage (platelet count less than 100,000/uL, serum creatinine concentration greater than 1.1 mg/dL or doubling of the serum creatinine concentration in the absence of other renal diseases, elevated blood concen-

trations of liver transaminases to twice the upper limit of normal concentration, severe persistent right upper quadrant or epigastric pain and not accounted for by alternative diagnoses, pulmonary edema or new-onset headache unresponsive to medical treatment and not accounted for by alternative diagnoses or visual disturbances). Gestational diabetes (GD) was defined according to the Portuguese Endocrinology Society's recommendations and the International Association of Diabetes and Pregnancy Study Groups (IADPSG) criteria since 2011, before 2010 GD diagnosis was made according to the American Diabetes Association criteria with the use of O'Sullivan test. Fetal growth restriction (FGR) was defined as an estimated fetal weight below the 3<sup>rd</sup> percentile or below the 10<sup>th</sup> percentile associated with fetal Doppler alterations. Stillbirth as fetal deaths after 24 weeks of gestation. Miscarriage is defined by ACOG criteria (2018) as a nonviable, intrauterine pregnancy with either an empty gestational sac or a gestational sac containing an embryo or fetus without fetal heart activity within the first 12 6/7 weeks of gestation. Disease exacerbation was defined as the occurrence of new symptoms and worsening of preexisting symptoms that required a change in the treatment strategy during pregnancy.

## STATISTICAL ANALYSIS

Statistical analysis used Statistical Packages for Social Sciences (SPSS) software, version 25.0 (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.). Categorical variables are presented as frequencies and percentages and continuous variables as means and standard deviations. The denominator used in the analyses of maternal outcomes, stillbirths, and live births was all pregnancies; for other fetal outcomes, all live births were used as the denominator. The Kolmogorov-Smirnov test or skewness and kurtosis were used to confirm normal distribution. The independent samples t-test was used for comparative analysis between the Behçet's group and control group. All reported P values are two-tailed, with a P-value of 0.05 indicating statistical significance.

The study was approved by our Centre ethics committee (reference number 2019.136 (116-DEFI/120-CE)). All data were stored and handled anonymously.

## RESULTS

The study included a total of 49 pregnancies in 27 women with BD. Demographic and BD patient characterization is present in Table 1. BD was diagnosed at the mean age of  $26.4 \pm 5.9$  years, and the median duration of the disease before pregnancy was 4.0 (7.0) years. The nulliparity rate was 63.3%. The rate of miscarriages in

**Table 1. Characteristics of the Patients with Behçet's Disease**

	Behçet's Disease (n=49)
Age at BD diagnosis <sup>a</sup> (years) mean (±SD)	26.4±5.9
Duration of disease <sup>a</sup> (years) - median (IQR)	4.0 (7.0)
Age at pregnancy <sup>a</sup> (years) - mean (±SD)	32.4±4.9
Nulliparity - n (%)	31 (63.3)
Miscarriage story	
1 - n (%)	12 (24.5)
2 - n (%)	6 (12.2)
Disease activity during pregnancy <sup>a</sup>	
remission - n (%)	29 (67.4)
exacerbation - n (%)	14 (32.6)
Disease activity during puerperium <sup>a</sup>	9 (25.7)
Symptoms in patients during pregnancy <sup>a</sup>	
oral ulcers - n (%)	8 (17.8)
genital ulcers - n (%)	4 (8.9)
skin involvement - n (%)	3 (6.7)
ocular involvement - n (%)	1 (2.2)
joint involvement - n (%)	2 (4.4)
neurological manifestation - n (%)	3 (6.7)
No treatment <sup>a</sup> - n (%)	13 (30.0)
Medication during pregnancy <sup>a</sup>	
prednisolone - n (%)	12 (30.0)
azathioprine - n (%)	1 (2.5)
infliximab - n (%)	1 (2.5)
LMWH - n (%)	8 (20.0)
cycloporine - n (%)	1 (2.5)
aspirin - n (%)	26 (65.0)

SD - Standard deviation, IQR - Interquartile Range, LMWH - low-molecular-weight heparin. <sup>a</sup>5 missing values for age at BD diagnosis; 13 missing values at the duration of disease; 6 missing values for age at pregnancy; 6 missing values for disease activity during pregnancy; 2 missing values for disease activity during puerperium; 4 missing values for symptoms in patients during pregnancy; 9 missing values for no treatment; 9 missing values for medication during pregnancy.

BD was 24.5%.

The most frequent clinical manifestations were oral ulcerations (17.8%). Other signs of clinical exacerbation were found: genital ulcers (8.9%), skin involvement (6.7%), arthritis (4.4%), uveitis (2.2%), and neurological manifestation (6.7%) (the clinical manifestations of BD are listed in Table 1).

Thirteen (30.0%) of the pregnant patients did not need treatment. Prednisolone was used in twelve patients (30.0%), azathioprine in one patient (2.5%) as infliximab (2.5%) and cyclosporine (2.5%), and twenty-six (65.0%) used aspirin (Table 1).

BD was in remission during pregnancy in 29 (67.4%) cases, and 14 (32.6%) experienced exacerbation during

pregnancy (Table 1).

Some pregnancy complications in the BD group were observed: 12 cases of miscarriage (24.5%), 4 cases of FGR (13.3%), and 2 cases of GD (6.1%). We did not observe any case of preeclampsia (Table 2).

The mean gestational age at birth was 38.1 (SD 1.7) weeks. Birth rates before 34 and 37 weeks of gestation were 3.0% and 9.2%, respectively. The mean birth weight was 2947.3 (SD 508.9) grams, and low birth weight was found in 5 (15.2%) cases (Table 2).

Table 2 shows the pregnancy data of patients with BD and the control group. There were no significant statistical differences between the two groups regarding the rate of preterm delivery ( $p = 0.347$ ), GD ( $p = 0.729$ ), and

**Table 2. Pregnancy Data of Patients with Behçet's Disease and Control Group**

	Behçet's Disease (n= 49)	Control group (n= 98)	P value <sup>a</sup>
Age at pregnancy <sup>b</sup> (years) mean ± SD	32.4±4.9	31.6±6.4	0.424
Nuliparity - n (%)	18 (36.7)	68 (69.4)	<0.001
Gestation age at birth <sup>b</sup> (week) mean±SD	38.1 (1.7)	38.4 (1.8)	0.583
Gestation age at birth <37 - n (%)	3 (9.1)	11 (11.2)	0.347
Pregnancy outcomes			
Miscarriage - n (%)	12 (24.5)	0	<0.001
FGR - n (%)	4 (13.3)	1 (1.0)	0.011
GD - n (%)	2 (6.1)	9 (9.2)	0.729
Preeclampsia <sup>b</sup> - n (%)	0	3 (3.1)	0.553
Birth weight <sup>b</sup> (gr) mean ± SD	2947.3 (508.9)	3105.2 (414.6)	0.143
low (<2500) n (%)	5 (15.2)	6 (6.1)	
normal (2500-4000) n (%)	28 (84.8)	92 (93.9)	
Cesarean <sup>c</sup> - n (%)	16 (43.2)	20 (20.4)	0.007
Perinatal mortality - n (%)	0	1	-

SD - Standard deviation, FGR - fetal growth restriction, GD - Gestational diabetes mellitus. <sup>a</sup>P value of independent samples t-test. <sup>b</sup>6 missing values for age at pregnancy in Behçet's group; 6 missing values for pregnancy outcomes - preeclampsia in Behçet's group; excluding patients with miscarriage and 4 missing values for gestational age at birth and for birth weight in Behçet's group; 17 missing values for birth weight in Behçet's group. <sup>c</sup>excluding patients with miscarriage.

pre-eclampsia ( $p = 0.553$ ).

The maternal outcome of pregnancy, miscarriage, and FGR differed significantly between the studied groups. In the pregnant group with BD, we found a higher rate of miscarriage and FGR ( $p = 0.011$ ) than in controls. The cesarean rate was higher in the BD group ( $p = 0.007$ ), and there were no significant statistical differences in median gestational age at the time of delivery ( $p = 0.583$ ).

The mean birth weight of newborns pregnant with BD and the control group were 2947.3 grams and 3105.2 grams, respectively. There were no significant differences between the birth weight of newborns ( $p = 0.143$ ). No perinatal deaths were observed in the BD group.

## DISCUSSION

This study compared 49 pregnancies in 27 women with BD with 98 pregnancies in a healthy control group. BD is a systemic vasculitis commonly diagnosed during the reproductive years, the mean age of BD diagnosis was 26.4±5.9 years, which is consistent with the published data [1]. Oral and genital ulcerations (17.8% and 8.9%, respectively) were the most frequent complications, as previously described [4,9]. In this study, the BD pregnant group has higher miscarriage and FGR rates than healthy controls. However, the current literature about the influence of BD on pregnancy and its impact on the course of BD is limited and unclear. Table 3 summarizes the clinical manifestations and pregnancy outcomes of all the data

referenced in the discussion.

There are conflicting data about the influence of pregnancy on BD. Previous studies have reported more incidence of disease remission than exacerbations during pregnancy. Marsal et al. [7] observed a flare of the disease in only 2 of 23 patients, and pregnancy did not significantly affect the BD. Jadaon et al. [5] reported that remissions were substantially higher (almost five times) than exacerbations. In the studies of Iskender et al. [6], Orgul et al. [10], Uzun et al. [11], and Hamza et al. [12], remission of symptoms was observed in most BD patients during pregnancy. Similarly, in the series of Noel et al. [1], flare rate was significantly lower during pregnancy than during the nonobstetric period. However, some authors report a higher rate of flares during pregnancy in BD patients. Bang et al. [13] found an exacerbation rate of 66.7% (18 patients), and in a study conducted by Gul et al. [14] with 16 pregnancies, they report nine cases of exacerbations and seven cases of remissions. In this study, approximately 67% of the patients had remission of disease activity during pregnancy. The majority of manifestations during pregnancy were oral and genital ulceration. These findings were in concordance with the reported published studies [1,11,13].

Previous reports suggest that improvements in BD behavior during pregnancy may be associated with hormone-dependent immunomodulation characteristics of pregnancy due to the significant increase of progesterone and estrogen levels. These hormones may induce an an-

**Table 3. Behçet's Disease Course During Pregnancy According to Some Published Studies**

Author (ref)	Patients (# of pregnancies)	Clinical manifestations (n)	Disease activity n(%)	Outcome during pregnancy				
				Miscarriage n(%)	FGR n(%)	Preeclampsia n(%)	Preterm delivery n(%)	Cesarean delivery n(%)
Noel et al. [1]	46(76)*	Aphthous ulcers (46) Genital ulcer (32) Skin lesions (5) Ocular involvement (31) Joint involvement (24)	Remission 49 (64.5) Exacerbation 27 (35.5)	5 (6.6)	-	-	-	3 (3.9)
Jadaon et al. [5]	31(77)**	Uveitis (5) Arthritis (3) Oral/genital ulcer (17) Vascular involvement (1) Skin lesions (1)	Remission 54 (70.12) Exacerbation 12 (15.58)	16 (20.8)	Did not differ between the study and control groups	-	1 (1.2)	9 (14.8)
Iskender et al. [6]	24(49)	n=24 Oral/genital ulcer (8) Eye inflammation (1) Neurologic manifestation (1)	n=24 Remission 14 (58.3) Exacerbation 2 (8.3)	The rates of miscarriage (16.3), FGR, preeclampsia and cesarean did not differ between the study and control groups.	6 (14.6)	17	-	0 (0)
Marsal et al. [7]*	10(25)	Oral/genital ulcer (1) Vascular manifestations (1)	Remission - Exacerbation 2	1 (4)	-	-	1 (4)	0 (0)
Orgul et al. [10]	26(66)	-	Remission 60 (90.9) Exacerbation 6 (9.1)	16 (24.2)	-	2 (3)	12 (24)	-
Uzun et al. [11]	28(44)	Oral/genital ulcer (4) Eye inflammation (1) Arthritis (1) Skin lesions (3) Three symptoms (oral ulcers, genital ulcers and eye inflammations or arthritis) (2) Four symptoms (oral ulcers, genital ulcers, eye inflammations and arthritis) (1)	Remission 23 (52.3) Exacerbation 12 (27.3)	3	-	-	-	-

No maternal or fetal complications were observed.

Hamza et al. [12]	8(21)	Oral/genital ulcer (16) Uveitis (2) Erythema nodosum (6)	Remission (12) Exacerbation (9)	-	-	-	-
Bang et al. [13]	27(27)	Oral/genital ulcer (5) Skin lesions (1) Three symptoms (oral ulcers, genital ulcers and skin) (2) Two symptoms (oral ulcers or genital ulcers or skin or uveitis) (8)	Remission 9 (33.3) Exacerbation 18 (66.7)	-	-	-	-
Gul et al. [14]	16(16)	-	Remission 7 Exacerbation 9	No complicated pregnancy	-	-	-
Lee et al. [15]	144(144)	-	-	-	4.86%	6.25%	12.5%
							40.97%
							Higher incidence of preterm birth
							Higher incidence of cesarean

\* Included also 9 BD patients diagnosed during pregnancy or the first 3 months postpartum. \*\* Just pregnancies in BD patients already diagnosed.

ti-inflammatory pathway in patients with BD [1,6,10,15]. Lee et al. [15] report that alpha-fetoprotein and human chorionic gonadotropin may also contribute to this immunosuppression observed during pregnancy.

In a systematic review of the literature about the effects of BD on pregnancy outcome, Ben-Chetrit et al. [16] report the rate of complications ranges between 4% and 20% of pregnancies. Iskender et al. [6] compare their study group (BD pregnant) with a healthy control group and report pregnancy outcomes similar between the groups (preeclampsia, miscarriage, preterm delivery, and cesarean delivery rates). Marsal et al. [7] did not find an association between BD patients with maternal and fetal complications (miscarriage, perinatal death, etc.). Uzun et al. [11] reported that BD is not associated with adverse obstetric problems, such as preeclampsia and FGR. In this study, the occurrence of maternal-fetal complications have been reported in patients with BD, but no significant differences in the incidence of preeclampsia and preterm delivery between groups were found. However, in contrast to Iskender et al. [6] and Marsal et al. [7], we found a higher rate of miscarriage and FGR in BD pregnant patients than in the healthy control group. This finding may be associated with the presence of vasculitic lesions in the placenta as reported by some authors [2,5]. Increased rates of miscarriage also have been previously reported by Jadaon et al. [5], who propose that the vasculitic process underlying BD and hypercoagulability during pregnancy in BD patients could explain the increase of miscarriage in these patients. The dysfunction of endothelial cells and the presence of antiendothelial cell antibodies in BD patients is associated with increased pregnancy complications [5]. Noel et al. [1] observed a significant association between history of vascular involvement and the risk of obstetric complications (miscarriage and cesarean deliveries) and defend that the reason for it can be associated with default in trophoblast implantation [1].

Previous studies [6,10,15] report an increased preterm labor rate in patients with BD. In this study, there were no significant differences in gestational age at birth between groups.

We observed that the cesarean rate was higher in the BD group. In studies conducted by Jadaon et al. [5] and Lee et al. [15], the results were similar. The higher cesarean rate in our study may be explained by a higher rate of FGR, which is an independent risk factor for cesarean delivery. On the other hand, a possible higher incidence of placental dysfunction at the end of pregnancy, secondary to Behçet's, that may be linked to fetal distress during labor. These possible explanations need future studies. They found that newborns' birth weight was not different between groups, which was concordant with the present study. We observed no cases of maternal or fetal deaths in the BD group.

The present study is noteworthy for several reasons. This study is the first to compare maternal and fetal outcomes between pregnant women with and without BD in a Portuguese cohort. The present study included a single-center sample of BD patients, which adds homogeneity and guarantees technical rigor to the patients' follow-up reducing missing data for any of these patients.

Nevertheless, this study has some limitations. The reduced number of cases and the retrospective analysis represent the most important limitations which justify inherent biases, including selection bias and information bias. Also, the clinical records lacked some relevant demographic details, which may be confounding factors in the present study.

However, our study is about a rare disease. This study brings more information about the reciprocal influence of BD and pregnancy for the medical community. On the other hand, in our study, the sample size was able to provide statistical significance for diverse variables.

## CONCLUSION

In conclusion, most women with BD did not present clinical exacerbation of their pathology during pregnancy, and in some cases, pregnancy improved the course of the disease. These findings are consistent with other studies and support the theory of pregnancy-induced disease remission. However, it seems that BD may have an adverse influence on pregnancy outcomes. FGR and miscarriage rates were significantly higher in the study group. Nonetheless, there were no differences in the rate of preeclampsia, preterm delivery, or embryo-fetal severe morbidity and mortality. Therefore, a trained multidisciplinary team with a specific surveillance protocol should follow pregnancy in BD patients.

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