# Impact of scoliosis on gestational outcome

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## *Abstract*

**Objective:** To demonstrate the impact of scoliosis on pregnancy and gestational outcome.

**Material and Methods:** We retrospectively evaluated gestational outcomes of pregnant women with scoliosis at Hacettepe University Hospital between 2008 and 2018. Cases were grouped according to the presence of previous scoliosis surgery and compared in terms of gestational week at birth, birthweight, rate of neonatal intensive care unit admission, hospitalization during pregnancy, route of delivery, type of anesthesia at labor and postpartum intensive care unit admission rate. Ejection fraction (EF), functional vital capacity (FVC), forced expiratory volume (FEV1) and FEV1/FVC ratio values were also recorded.

**Results:** A total of 23 women were included, of whom 12 (52.2%) had a prior scoliosis surgery. One of the 23 (4.3%) cases was terminated due to respiratory problems, while the remaining 22 cases resulted in deliveries. The median gestational week at birth was 38.2 and the median birth weight was 3150 g. Median (range) maternal height was 143 (80-160) cm while median (range) maternal weight was 51 (35-86) kg. Three (13.6%) were diagnosed with restrictive lung disease. No significant difference was found between operated and non-operated groups in terms of respiratory function test results, cardiac EF and other related demographic and clinical features. Overall cesarean delivery rate was 63.6% (14/22) and cesarean section rate was significantly higher in the operated group (83.3% versus 40%) (p=0.04).

**Conclusion:** Cesarean section rate was increased in this cohort of pregnancies in women with scoliosis and who had previous scoliosis surgery. (J Turk Ger Gynecol Assoc 2023; 24: 241-5)

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## Introduction

Scoliosis is a medical condition in which a the spine has a sideways curve due to a range of etiologies resulting in a change of the normal structure (1). Conventionally, a curvature greater than 10° is defined as scoliosis (1). Idiopathic scoliosis is generally divided into two groups according to onset of the disease, as early and late (2). Late onset, which is also defined as adolescent idiopathic scoliosis, comprises 80-85% of cases (3-5).

The etiology of idiopathic scoliosis is not clear. The etiology of vertebral abnormalities may involve a wide range of factors (6). These include environmental and genetic factors, vitamin deficiency, chemical exposure, medications, abnormalities in growth hormone and melatonin secretion, and impaired connective tissue structure and paraspinal musculature may contribute to the pathogenesis (6-8). A female to male ratio of 3.5:1 was reported and progression of scoliosis was found to be 10 times higher in women than men (9,10). It is known that progression of the curve in scoliosis is associated with growth (11). Therefore, large changes in the degree of scoliosis is not expected in adulthood (12,13). The reported incidence of scoliosis during pregnancy varies from 0.02% to 0.7% (14). Although there are a limited number of studies about pregnancy outcomes of patients with scoliosis, most of the studies did not demonstrate adverse outcomes (14-16).

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However, there are controversial results regarding the effect of pregnancy on the progression of scoliosis. Some studies have suggested that pregnancy causes a progression of scoliosis and some other vertebral changes (17-20). However, many studies have concluded that pregnancy does not lead to increased curvature in scoliosis (16,18,21,22).

The aim of this study was to evaluate the clinical characteristics and gestational outcomes of pregnant women with scoliosis who were followed up at a single center.

## Material and Methods

We retrospectively evaluated the gestational outcomes of pregnant women with scoliosis who were followed up at Hacettepe University Hospital between 2008 and 2018. The required data were extracted from the institutional electronic database.

Demographic characteristics and clinical findings of the patients, such as maternal age, gravidity, parity, number of miscarriages, maternal height and maternal weight were recorded. Echocardiography and respiratory function test results during pregnancy were evaluated in eligible cases. Ejection fraction (EF), functional vital capacity (FVC), forced expiratory volume (FEV1) and FEV1/FVC ratio values were recorded. Gestational week at birth, birthweight, rate of neonatal intensive care unit (NICU) admission, hospitalization during pregnancy, route of delivery, type of anesthesia at labor and postpartum intensive care unit (ICU) admission rate were evaluated.

Patients were divided into two groups according to previous scoliosis surgery. EF and respiratory function tests, hospitalization during pregnancy, route of delivery, gestational week at birth, birth weight and NICU admission rate, type of anesthesia and postpartum ICU admission rate were compared between these two groups.

### Statistical analysis

Statistical analyses were performed with the Statistical Package for the Social Sciences v22 (IBM Inc., Armonk, NY, USA). The Kolmogorov-Smirnov test was used to evaluate the normal distribution of the data. When the data were not normally distributed, median values together with range were used. Mann-Whitney U test was performed for the comparison of median values amongst the groups. Categorical variables were compared using chi-square test. A $p<0.05$ was considered statistically significant.

Written informed consent was obtained from all the patients, and the study was approved by the Institutional Ethics Committee of Hacettepe University (approval number: GO 18/1077-33, date: 20.11.2018).

## Results

The study included 23 pregnant women who were previously diagnosed with scoliosis. The median (range) age was 26 (20-35) years. Only one out of 23 pregnancies resulted in termination of pregnancy (4.3%), while the remaining 22 cases resulted in live deliveries. Scoliosis was classified as thoracic, thoracolumbar or lumbar in 56%, 22% and 22% of the cases, respectively. Median maternal height was 143 (80-160) cm while median maternal weight was 51 (35-86) kg. All the demographic characteristics and clinical findings of the patients are summarized in Table 1. Twelve of the patients (52.2%) had prior scoliosis surgery. The number of previous surgeries was 1, 3, 4, 6 and 9 for 5, 4, 1, 1 and 1 cases, respectively. Median EF value of the patients was 65 (61-70) %. None of the patients were evaluated as having cardiac insufficiency based on their EF values. Median FVC value was 1.96 (0.84-4.30) L, median FEV1 value was 1.79 (0.55-3.39) L and median FEV1/FVC ratio was 85.8 (65.5-92.2). Three (13.6%) patients were diagnosed as having restrictive lung disease. 8 (36.4%) patients required hospitalization during pregnancy. Hospitalization indications were respiratory problems, preterm labor and preeclampsia for 4, 3 and 1 cases, respectively. No significant correlation was found between the route of delivery and whether the scoliosis was thoracic, thoracolumbar, or lumbar. Cesarean delivery rate was 63.6%. Regional or general anesthesia was used in 4 (28.5%) and 10 (71.5%) cases, respectively. Median duration of hospitalization was 4 (2-40) days. Three mothers (13.6%) were admitted to the ICU in the postpartum period due to pneumonia, restrictive lung disease and pericardial effusion. These patients were observed for two days in the ICU. The median gestational week at birth was 38.2 and the median birth weight was 3150 g. The earliest gestational week at birth was 34, while the lowest birth weight was 1600 g. Three newborns were admitted to the NICU due to prematurity (Table 2).

One pregnancy was terminated at the 22$^{nd}$ week of gestation due to maternal respiratory function problems. The patient's height was 80 cm and weight was 35 kg. According to the results of the respiratory function test performed at the 20$^{th}$ week of gestation, the FVC value was 1.05 L, the FEV1 value

**Table 1. Demographic characteristics and clinical findings**

| | **Median (range)** |
|---|---|
| Age, years | 26 (20-35) |
| Gravida | 2 (1-3) |
| Parity | 0 (0-2) |
| Abortions | 0 (0-2) |
| Maternal height (cm) | 143 (80-160) |
| Maternal weight (kg) | 51 (35-86) |

was 0.55 L and the FEV1/FVC ratio was 80%. In this woman echocardiography reported the EF as 60%, and first-degree mitral insufficiency and tricuspid insufficiency were present. There was no cardiac insufficiency. The patient's respiratory problems gradually increased and she was hospitalized at the 22nd gestational week. The patient was referred to the departments of chest diseases and cardiology. After consultation with all involved specialities, termination of pregnancy was performed with the patient's informed consent. Median values for FVC, FEV1, FEV1/FVC, EF, gestational week at birth, birth weight, hospitalization during pregnancy, rates of admission to the NICU, route of delivery, type of anesthesia and postpartum admission to the ICU were comparable between the previous scoliosis surgery and non-surgery groups. There was a significant difference between the two groups in terms of the route of delivery. The rate of cesarean section in the group without previous scoliosis surgery was 40%, while in the group with previous surgical history this rate was 83.3% (p=0.04) (Table 3).

**Table 2. Descriptive characteristics, pregnancy outcomes and neonatal outcomes**

| | **Median (range)** |
|---|---|
| Gestational week at birth | 38.2 (34.3-40.2) |
| Birthweight, g | 3145 (1,600-4,220) |
| **Route of delivery**[¥] | |
| Vaginal delivery[¥] | 8 (36.4) |
| Cesarean section[¥] | 14 (63.6) |
| **Anesthesia**[¥] | |
| Regional[¥] | 4/14 (28.5) |
| General[¥] | 10/14 (71.5) |
| Number of previous scoliosis surgeries | 1 (0-9) |
| **Cardiac findings (n=20)** | |
| Ejection fraction, % | 65 (61-70) |
| Rate of cardiac insufficiency[¥] | 0% |
| **Respiratory findings (n=12)** | |
| FVC | 1.96 (0.84-4.30) |
| FEV1 | 1.79 (0.55-3.39) |
| FEV1/FVC (%) | 85.8 (65.5-92.2) |
| Rate of restrictive lung diseases (n=3)[¥] | 3/22 (13.6) |
| Admissions to intensive care unit[¥] | 3/22 (13.6) |
| Duration of hospitalization | 4 (2-40) |
| Hospitalization during pregnancy[¥] | 8/22 (36.4) |
| Respiratory problems | 4 (18.2) |
| Early pregnancy complications | 3 (13.6) |
| Preeclampsia | 1 (4.6) |

[¥]Data shown as n (%) or n/total n (%), FVC: Functional vital capacity, FEV1: Forced expiratory volume

## Discussion

Idiopathic scoliosis is a three-dimensional spine deformity of unknown etiology (10). It has been reported that scoliosis has no adverse effect on pregnancy, and *vice versa* (16,18,21-23). However, some studies have suggested that pregnancy increases scoliosis curvature (17,19,24).

In a study by Lebel et al. (15), scoliosis was found to be significantly associated with labor induction and increased rates of cesarean deliveries, although it was concluded that scoliosis was not a risk factor for adverse pregnancy outcomes and especially birth dystocia, using multiple logistic regression analysis. Our findings are consistent with the literature. In this study, scoliosis was not associated with adverse pregnancy outcomes.

Cesarean delivery rate was 63.6% in our series. Previous studies also reported cesarean section rates as high as 41% (25). Despite a lack of consensus, the high cesarean rate was mostly associated with the fear of the patients, inadequate pelvic capacity of patients and the necessity for timely planning of the delivery. For these reasons, although scoliosis is not an absolute indication of cesarean section, it may be a facilitating factor.

In a study evaluating 27 pregnancies of 17 scoliosis patients conducted in Hong Kong, it has been shown that the

**Table 3. Comparison of pregnant women with and without previous history of scoliosis surgery**

| | **Previous scoliosis surgery** | **No previous scoliosis surgery** | **p** |
|---|---|---|---|
| FVC (L) | 2.2 | 2.16 | 0.414 |
| FEV1 (L) | 1.97 | 1.88 | 0.710 |
| FEV1/FVC (%) | 85 | 85 | 0.604 |
| EF (%) | 65 | 66.5 | 0.605 |
| Gestational week at birth | 38.2 | 36.2 | 0.566 |
| Birthweight (g) | 2,890 | 2,860 | 0.880 |
| Hospitalization during pregnancy[*] | 5 | 7 | 0.799 |
| Admission to NICU[*] | 3 | 0 | 0.082 |
| **Route of delivery** | | | |
| Cesarean section[*] | 10 | 4 | **0.040** |
| Vaginal delivery[*] | 2 | 6 | |
| **Type of anesthesia** | | | |
| Regional[*] | 2 | 2 | 0.056 |
| General[*] | 8 | 2 | |
| Admission to ICU[*] | 3 | 0 | 0.082 |

[*]Number of cases. FVC: Functional vital capacity, FEV1: Forced expiratory volume, EF: Ejection fraction, NICU: Neonatal intensive care unit, ICU: Intensive care unit

complication rates were similar to the general population (14). In our study, the results were consistent with the general population in terms of pregnancy complications.

In a retrospective study by Chan et al. (16) the rate of obstetric complications including preterm delivery or induced labor were found to be not associated with the severity of scoliosis curve or prior spinal fusion. Furthermore, it was reported that the rate of spinal anesthesia was 70%. In the present study, the rate of caesarean section (63.6%) and general anesthesia (71.5%), which were higher than previously reported. Relevant risk factors, such as anatomic problems and patient anxiety were defined for lower rates of regional anesthesia (26). In a case-matched study, 41 patients who underwent scoliosis surgery were evaluated and it was argued that technical difficulties may be experienced in regional anesthesia (27). Most of the group requiring general anesthesia included patients with lumbar scoliosis and thoracolumbar scoliosis who had a previous history of operation. This rate suggests that spinal anesthesia failure increases in patients with scoliosis surgery and scoliosis involving the lumbar region.

In previous studies, it has been reported that pregnancy may have an effect on back pain of the patients with scoliosis and quality of life after pregnancy despite there being no need for further surgeries related to scoliosis (22,28). Consistent with this, only one of our patients needed orthopedic revision at three years after birth. However, it is not clear whether revision surgery was related to pregnancy.

### Study Limitations

The main strengths of this study were the single center design of the study and the relatively high number of parameters evaluated. The main limitations were the retrospective design and the relatively small number of patients. Further limitations include a lack of information on the effect of pregnancy on scoliosis and orthopedic findings.

### Conclusion

In this study, pregnant women with scoliosis did not have increased rates of adverse pregnancy outcomes, as previously reported. However, previous scoliosis surgery emerged as a risk factor for cesarean section. Further studies with a larger number of patients are needed to confirm these results.

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