The Effect of Idiopathic Scoliosis on Natural Delivery and Use of Epidural Anesthesia: A Matched Cohort Study

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INTRODUCTION:

Idiopathic scoliosis (IS) is a common spine condition that is more prevalent in females. It is unclear whether IS, with or without posterior spinal instrumentation and fusion (PSIF), influences rates of Caesarean section (CS) and epidural anesthesia (EA) at the time of delivery.

METHODS:

We retrospectively identified all patients aged 18 to 35 years old who delivered in our integrated health system during a five-year period. These 1,810 patients were compared to a control cohort of 1,810 non-IS patients, with the cohorts matched for maternal age, number of breech presentations, and number of prior Caesarean deliveries. Body mass index (BMI), race/ethnicity, maternal gravida and para, and all delivery details were documented for each patient. Obstetrical factors expected to increase the risk of CS were also noted on all patients and were included in statistical analysis.

$\chi 2$ analysis and Poisson regression analysis with robust error variance were carried out to determine significant differences ($p < 0.05$) in rates and relative risk (RR) of CS and EA for pregnant women with vs. without scoliosis. RR for CS and EA was also calculated for the operative IS versus nonsurgical IS group, as well as for the nonsurgical scoliosis group versus the control (i.e., no scoliosis) group. Subgroup analysis was done on the PSIF group to assess for differences in rates of CS and EA based on fusion level, specifically comparing the group of patients with distal fusion level L3 and above to those at L4 or distal.

RESULTS:

Five percent (88) of women in the IS cohort had previously undergone PSIF. Compared to the control cohort, the IS cohort had significantly fewer obese patients and more patients of normal BMI ($p < 0.0001$). Significant differences in racial composition existed between groups, as the IS cohort had more Black and White patients and fewer Hispanic patients than the control cohort ($p < 0.0001$).

$\chi 2$ analysis between IS and control group showed that the IS cohort had significantly higher rates of EA than the control group (63.8% vs. 58.8%, $p = 0.0024$). When including PSIF patients in the IS group, differences between groups were just above statistical significance ($p = 0.068$, 23.4% CS rate in IS vs. 26% control). However, after excluding PSIF patients from the IS group, there were significantly lower rates of CS ($p = 0.048$, 23.2% vs. 26% control) and higher rates of EA ($p = 0.0002$) in the nonsurgical IS group compared to the control group. Within just the scoliosis patient cohort, $\chi 2$ analysis demonstrated a markedly lower EA rate in the PSIF vs. non-PSIF group (39.8% vs. 65%, $p < 0.0001$), but no significant difference in CS between the 2 groups ($p = 0.26$). The PSIF subgroup analysis showed that the proximal fusion group ($n = 67$) had a higher rate of CS (31.3% vs. 21.1%, $p = 0.38$) and of EA (41.8% vs. 31.6%, $p = 0.42$) compared to the distal fusion group ($n = 19$), but the differences were not statistically significant.

Poisson regression analysis with relative risk (RR) assessment with 95% confidence intervals (CI) supported the aforementioned findings. Compared to the control cohort, the IS cohort had a decreased relative risk of CS of 0.90 (95% CI 0.81-1.00, $p = 0.05$) and an increased RR of EA of 1.08 (95% CI 1.02-1.13, $p = 0.004$). This 10% decreased RR of having a C section and 8% increased RR of having epidural analgesia in the scoliosis cohort held true when the PSIF group was excluded from the analysis. Regression analysis of PSIF showed that, for all patients, PSIF patients had a 37% decreased RR of EA (CI 0.49-0.81, $p=0.0003$) and, when assessing just the scoliosis group alone, the PSIF patients had a 66% decreased RR of EA compared to all scoliosis patients (RR 0.34, 95% CI 0.21-0.53, $p = <0.0001$). PSIF patients had no significant difference in CS relative risk in all analysis. In keeping with the chi-square analysis of the PSIF subgroup, there were no significant differences in RR of CS or EA rate between the proximal and distal fusion groups.

DISCUSSION AND CONCLUSION:

This study demonstrates that young women with IS may be reassured that, without PSIF, they will not have deceased rates of EA or increased rates of CS at the time of childbirth compared to patients without IS. In fact, our data revealed a 10% lower risk of cesarean delivery and an 8% increased likelihood of EA at delivery in IS patients compared to the control cohort. Rate of cesarean delivery was not significantly altered by having PSIF, but in all analyses, PSIF patient did have a significantly lower chance of receiving EA, both compared to all other pregnant women (37% decreased RR) and compared to the nonsurgical IS group (66% decreased RR). While the distal fusion group did have a 10% decreased likelihood of having a cesarean delivery and of receiving EA, these differences were not statistically significant, likely due to the small number of participants in these groups.

The literature indicates that decision making surrounding epidural anesthesia and cesarean section is complex and these decisions are influenced by many factors. Our regression analysis controlled for almost all of the obstetric and physical

patient variables (i.e., BMI, maternal age, number of breech presentations, and other physical and obstetric features). However, some other demographic and socioeconomic variables known to impact rate of CS and EA were not included, such as household income, educational level, and specific geographic region, among others. We theorize that the IS cohort's increased familiarity with the medical system, as a result of years of regular visits for their spine, may have contributed significantly to the higher rate of EA and decreased rate of CS. Further research must be done to examine how other demographic and socioeconomic factors influence the delivery experience of patients with IS.