# The evidence that shows that stroke and cesarean section are associated needs to be critically reviewed

**TO THE EDITORS:** In the study by Lin et al[1] that was carried out on a retrospective cohort of pregnant women, the authors conclude that cesarean section is a risk factor for the development of stroke; as a consequence, they recommend vaginal delivery to diminish the risk of stroke. However, they did not include confusion variables (such as smoking habits, hypertension, obesity, and diabetes mellitus) as antecedents in the analysis. In addition, patients with cesarean section and vaginal delivery were not similar at the start of the study (Table 1 in the article). These differences were shown before and after the adjustment with multivariable analysis in the group of women with eclampsia/preeclampsia, which is a condition that has biologic plausibility to explain a high incidence of stroke in the first year. Also, the way in which the diagnosis of stroke was done is not clear. Other authors studied the association between conduction anesthesia and stroke incidence[2] and found a relationship with hypertension, instead of conduction anesthesia, in their cohort.

It is not safe for readers to asseverate, just because it appears in the article, that cesarean section increases the risk of stroke when other confusion variables have not been considered, which could explain perfectly a higher incidence of stroke in the group of women with cesarean section. We suggest that the authors carry out a nested case-control study to amplify the dimensions of potential confounders in the analysis, which would support the methods by which their conclusions were drawn. ■

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**REFERENCES**

**1.** Lin SY, Hu CJ, Lin HC. Increased risk of stroke in patients who undergo cesarean section delivery: a nationwide population-based study. Am J Obstet Gynecol 2008;198:391.e1-7.
**2.** Witlin AG, Mattar F, Sibai BM. Postpartum stroke: a twenty-year experience. Am J Obstet Gynecol 2000;183:83-8.

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## REPLY

We appreciate the valuable comments by Eslava-Schmalbach et al on our study showing a higher incidence of postpartum stroke among women having cesarean deliveries.[1] Indeed, clinically credible risk adjustment is difficult for studies based on claims data, because some relevant information may not be available. Initially, we did include hypertension as a confounding variable but found it did not affect the significant relationship between cesarean section and postpartum stroke. Ultimately, we did not include hypertension and diabetes as confounding variables, because claims data tend to seriously underestimate these chronic conditions and because doctors may record only a primary diagnosis at the time of admission, and non–life-threatening conditions may be neglected by patients and health care providers. As stated in the article, our findings could be compromised by these issues.

For 2 reasons, we nonetheless believe cesarean delivery is associated with increased stroke risk. First, although the distribution of potential stroke risk factors among patients delivering vaginally and those receiving medically indicated cesarean delivery would differ,[2] risk factors would not differ significantly between patients who deliver vaginally and those who have cesarean sections *on request*. Yet our data show that maternally requested cesarean deliveries are associated with increased risk for stroke. Furthermore, as mechanisms contributing to the increased risk of postpartum stroke for patients who have cesarean deliveries remain unclear, we did not simply treat cesarean delivery as a surgical procedure per se but took related preconditions into consideration. In conclusion, we proposed that further studies are needed to understand the preconditions or mechanisms contributing to this phenomenon and recommended that greater effort should be directed to developing strategies for reducing cesarean deliveries. ■

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**REFERENCES**

**1.** Lin SY, Hu CJ, Lin HC. Increased risk of stroke in patients who undergo cesarean section delivery: a nationwide population-based study. Am J Obstet Gynecol 2008;198:391.e1-7.
**2.** NIH State-of-the-Science Conference Statement on cesarean delivery on maternal request. NIH Consens State Sci Statements 2006;23:1-29.

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