BJA

CLINICAL INVESTIGATION

Association between mode of anaesthesia and severe maternal morbidity during admission for scheduled Caesarean delivery: a nationwide population-based study in Japan, 2010–2013

H. Abe[1], M. Sumitani[2,*], K. Uchida[1], T. Ikeda[1], H. Matsui[3], K. Fushimi[4], H. Yasunaga[3] and Y. Yamada[1]

[1]Department of Anesthesiology and Pain Relief Center, The University of Tokyo Hospital, 7-3-1 Hongo, Bunkyo-ku, Tokyo, Japan, [2]Department of Pain and Palliative Medicine, The University of Tokyo Hospital, 7-3-1 Hongo, Bunkyo-ku, Tokyo, Japan, [3]Department of Clinical Epidemiology and Health Economics, School of Public Health, The University of Tokyo Hospital, 7-3-1 Hongo, Bunkyo-ku, Tokyo, Japan and [4]Department of Health Policy and Informatics, Tokyo Medical and Dental University, 1-5-45 Yushima, Bunkyo-ku, Tokyo, Japan

*Corresponding author. E-mail: SUMITANIM-ANE@h.u-tokyo.ac.jp.

Abstract

Background: Although the incidence of maternal mortality during Caesarean delivery remains very low, the rate of severe maternal morbidity is increasing. Improvements in obstetric anaesthetic practice have resulted in a dramatic reduction in the risk of maternal death from general anaesthesia. Less clear is whether the risk of severe maternal morbidity differs according to mode of anaesthesia for women undergoing Caesarean delivery. We analysed the association between the mode of anaesthesia and severe maternal morbidity during Caesarean delivery using a nationally representative inpatient database.

Methods: We identified 89 225 women undergoing scheduled Caesarean delivery from the Diagnosis Procedure Combination database in Japan, 2010–2013. We defined severe maternal morbidity as the presence of any life-threatening complications and identified women with severe maternal morbidity from the database. Propensity score-matched analysis was carried out to compare the odds of severe maternal morbidity between women who underwent general vs neuraxial anaesthesia.

Results: Of 89 225 women, 10 058 received general anaesthesia and 79 167 received neuraxial anaesthesia. In the propensity score-matched analysis with 10 046 pairs, a higher incidence of severe maternal morbidity was observed among patients receiving general (2.00%) rather than neuraxial anaesthesia (0.76%). The odds ratio of severe maternal morbidity was 2.68 (95% CI, 1.97–3.64) among women receiving general compared with neuraxial anaesthesia.

Conclusions: For scheduled Caesarean delivery, general anaesthesia compared with neuraxial anaesthesia is associated with greater odds for severe maternal morbidity. However, we should be cautious with interpretation of these findings because they may be explained by confounding indications.

Editors key points

- Maternal mortality is now low in developed countries, but there is limited data on morbidity.
- Using a healthcare database, the impact of mode of anaesthesia on maternal morbidity was explored.
- Propensity score matched analysis found increased maternal morbidity in patients undergoing general anaesthesia.
- Further research is needed in this area to confirm this, accounting for potential confounders.

In the 1970s and 1980s, anaesthesia was one of the major risk factors for maternal deaths during Caesarean delivery.[1,2] In the 1990s, pregnant women who underwent Caesarean delivery with general anaesthesia had a higher risk of maternal mortality than did those with neuraxial anaesthesia; major causes of deaths from general anaesthesia were maternal hypoxia secondary to failed intubation, hypoventilation, aspiration, or other severe respiratory morbidity.[3] Developments and improvements in anaesthetic monitoring and airway devices, as well as updated guidelines for difficult airway management, have reduced the risk of the airway problems during general anaesthesia in pregnant women.[4,5] As a result, the risk ratio of maternal mortality between general and neuraxial anaesthesia after Caesarean delivery decreased from 16.7 [95% confidence interval (CI), 12.9—21.8] (from 1985 to 1990) to 1.7 (95% CI, 0.6—4.6) (from 1997 to 2002) in the United States.[3,6]

Recently, severe maternal morbidity has gained interest as an important quality indicator of obstetric care because maternal mortality remains extremely low in developed counties, and even in the largest datasets, studies focusing on maternal mortality do not provide sufficient case numbers for analysis.[7] Although not yet universally defined, the indicators of severe maternal morbidity commonly include postpartum haemorrhage, disseminated intravascular coagulation, shock, sepsis, cardiac dysfunction, respiratory dysfunction, pulmonary embolism, cerebrovascular disorders, and neurological problems.[8,9] Based on data from a population-wide study in the United States, rates of severe maternal morbidity have increased in recent years.[10] For example, the rate of severe maternal morbidity has increased from 0.74% to 1.29% between years 1998—1999 and 2008—2009 in the United States. Among women requiring delivery hospitalization, the main driver for the increase in the rate of severe maternal morbidity is blood transfusion, a key indicator for severe postpartum haemorrhage.[10,11] Less clear is whether, among those undergoing Caesarean delivery, mode of anaesthesia influences the risks of major haemorrhage and severe maternal morbidity. The suppressive effect of anaesthetic agents on uterine muscle contraction in pregnant humans and activation of platelet receptor related to platelet aggregation was demonstrated *in vitro*, which might increase the risk of major haemorrhage among women undergoing Caesarean delivery under general anaesthesia.[12,13] A prior study for total hip arthroplasty demonstrated that general anaesthesia was associated with a higher incidence of deep surgical site infection, cardiovascular complications, and respiratory complications compared to neuraxial anaesthesia, although simple comparison would be impossible because of differences of characteristics of patients and procedures.[14] The practice guideline for obstetric anaesthesia by the American Society of Anesthesiologists empirically recommends neuraxial anaesthesia in preference to general anaesthesia for most Caesarean deliveries to minimize the risk of anaesthesia-related adverse events.[15] However, whether anaesthetic techniques can influence the incidence of severe maternal morbidity remains unclear.

In the present study, we hypothesized that the mode of anaesthesia is related to severe maternal morbidity during admission for Caesarean delivery. We analysed the association between the mode of anaesthesia and severe maternal morbidity during Caesarean delivery using a Japanese inpatient database with the aim of expanding knowledge of clinical factors contributing towards severe maternal morbidity.

Methods

Data sources and approval

The institutional review board and ethics committee of The University of Tokyo approved this study. The data in the Diagnosis Procedure Combination database were thoroughly de-identified. Given the anonymous nature of the data, the requirement for informed consent was waived.

The Diagnosis Procedure Combination database is a Japanese case-mix system similar to the diagnosis-related groups in Medicare in the United States. This patient classification system was originally launched in 2002 by the Ministry of Health, Labour and Welfare of Japan and is linked to a Japanese lump-sum payment system. The key objectives of the Diagnosis Procedure Combination system are to implement a standardized electronic claims system and to provide transparency of hospital performance.[16—18] In 2012, the database included data on approximately 7 million inpatients from 1057 participating hospitals, representing approximately 50% of acute-care hospitalisations throughout Japan.[19] The database included the following data: hospital identifier, hospital location, and hospital type (academic or non-academic); patient age, height, and weight; diagnosis and comorbidities on admission; and complications that occurred after admission recorded as text data in the Japanese language and by International Classification of Diseases, 10th Revision (ICD-10)