Estimating the risk of adverse birth outcomes in pregnant women undergoing non-obstetric surgery using routinely collected NHS data: an observational study

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Declared competing interests of authors: Paul Aylin reports grants and other from Dr Foster (company has included an analysis of weekend mortality in previous 'Hospital Guide' and have paid travel expenses to biannual conference on Global Comparators in Healthcare), outside the submitted work. Alex Bottle reports that The Dr Foster Unit at Imperial College London, where he is based, is part-funded by Dr Foster Intelligence, a private health-care information company (wholly owned by Telstra Corporation Ltd).

Published October 2016
DOI: 10.3310/hsdr04290

Scientific summary

Birth outcomes in women undergoing surgery

Health Services and Delivery Research 2016; Vol. 4: No. 29
DOI: 10.3310/hsdr04290

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Background

This study began as a result of questions posed by pregnant women who were scheduled to have cancer surgery during their pregnancy. Women wanted to know the risks of surgery to pregnancy, including the risks of a spontaneous abortion, stillbirth and premature delivery. However, there is limited available evidence quantifying these risks. Furthermore, of the evidence that is available, none relates directly to NHS outcomes and there are no current NHS guidelines regarding non-obstetric surgery in pregnant women.

Objectives

Our main objectives were to:

1. carry out a descriptive analysis of the data, describing counts of each adverse outcome by year, maternal age, procedure type, socioeconomic status and trimester of pregnancy
2. estimate the risk of each adverse outcome in women who have had surgery and compare this with the risks in those women who have not had surgery
3. estimate the risk associated with common procedure groups.

Methods

Hospital Episode Statistics (HES) is an administrative database that includes records of all patient admissions and day cases in all English NHS hospital trusts. We analysed HES maternity data collected between 2002–3 and 2011–12, and identified women who underwent non-obstetric surgery while pregnant.

The study outcomes were based on mothers' records (spontaneous abortion, preterm delivery, caesarean delivery, maternal death and long inpatient stays) and infants' records (stillbirth and low birthweight).

We used the adjusted odds ratio obtained directly from the logistic regression model to estimate the relative risk (RR) of each adverse birth outcome in pregnancies in which non-obstetric surgery was carried out compared with pregnancies with no record of surgery.

We used the logistic regression model to estimate marginal probabilities of each outcome of interest. This allowed us to compare outcomes between two populations whose only difference was in the exposure, permitting us to estimate adjusted RR, attributable risk and the number of operations associated with one additional adverse birth outcome [number needed to harm (NNH)]. Confidence intervals (CIs) for each measure of effect were estimated using the non-parametric bootstrap method. The end points of 95% CIs were defined as the 2.5th and 97.5th percentiles measured across the bootstrap samples.

Results

A total of 6,486,280 pregnancies were identified in the period April 2002 to March 2012. Spontaneous abortions accounted for 5.8% of all pregnancies. The number of maternal deaths following spontaneous abortion or delivery was very small and corresponded to a rate of 4 per 100,000 pregnancies. Among our cohort, 7.5% of deliveries ended in preterm birth and 23.9% ended in elective or emergency caesarean section. We identified 47,628 (0.7%) women who had non-obstetric surgery during their pregnancy. The most common surgical group was abdominal (26.2%), followed by dental (11.3%), nail and skin

(10.0%), musculoskeletal (9.6%), and ear, nose and throat (ENT) (6.4%). There were 3062 cases of appendectomy and 1306 cases of cholecystectomy.

After adjusting for potential confounders, we found that pregnant women who underwent non-obstetric surgery had a higher risk of adverse birth outcomes than those women who did not have surgery. The RR for spontaneous abortion was 1.13 (95% CI 1.09 to 1.17); for preterm delivery was 1.43 (95% CI 1.39 to 1.47); for maternal death was 4.72 (95% CI 2.61 to 8.52); for caesarean section was 1.21 (95% CI 1.19 to 1.23); for long inpatient stay was 1.22 (95% CI 1.19 to 1.25); for stillbirth was 1.64 (95% CI 1.50 to 1.81); and for low birthweight was 1.49 (95% CI 1.44 to 1.54). For NNHs, we estimated that, for every 143 pregnancies in which a surgical procedure was carried out, there was one associated additional spontaneous abortion; for every 287 procedures there was one associated additional stillbirth; for every 31 procedures there was one associated additional preterm delivery; for every 25 procedures there was one associated additional caesarean section; for every 50 procedures there was one associated additional long inpatient stay; for every 39 procedures there was one associated additional low-birthweight baby; and for every 7692 procedures there was one associated additional maternal death.

The additional risk of having an adverse birth outcome associated with abdominal surgery was higher than for women who did not have surgery during their pregnancy. Abdominal surgery during pregnancy was associated with an increase in the risk of spontaneous abortion and caesarean delivery of 5.0 percentage points.

We found that musculoskeletal, ENT, breast or dental procedures during pregnancy were associated with higher risks of some adverse birth outcomes.

Limitations

We have no means of disentangling the effect of the surgery from the effect of the underlying condition itself. Many spontaneous abortions will not be associated with a hospital admission and, therefore, will not be included in our analysis. A spontaneous abortion may be more likely to be reported if it occurs during the same hospital admission as the procedure, and this could account for the increased risk associated with surgery during pregnancy. Key data items that are necessary to determine parity, gestational age, birthweight and stillbirth are missing.

Conclusions

This is the first study to report the risk of adverse birth outcomes following non-obstetric surgery during pregnancy across NHS hospitals in England. We have no means of disentangling the effect of the surgery from the effect of the underlying condition itself. We found that non-obstetric surgery during pregnancy was associated with a significantly higher risk of all the outcomes we looked at, although, because of data completeness issues and the potential for ascertainment bias, we have some reservations over the findings associated with spontaneous abortion. The overall attributable risk of an adverse birth outcome in women who underwent surgery during pregnancy compared with women who did not was generally low.

Our observational study can never attribute a causal relationship between surgery and adverse birth outcomes. However, we believe that our findings and, in particular, the NNHs improve on previous research, utilise a more recent and larger data set based on UK practice and are useful reference points for any discussion of risk with prospective patients.

Future work

Further research is needed to evaluate the impact of non-obstetric surgery on the baby (e.g. neonatal intensive care unit admission, prolonged length of neonatal stay, neonatal death) and could be assessed by linking the maternal and baby records within the HES database. The use of large clinical databases, such as EuroKing Maternity systems (www.euroking.com/), linked to the HES database could be usefully exploited for this purpose.

Funding

Funding for this study was provided by the Health Services and Delivery Research programme of the National Institute for Health Research.

Health Services and Delivery Research

ISSN 2050-4349 (Print)

ISSN 2050-4357 (Online)

This journal is a member of and subscribes to the principles of the Committee on Publication Ethics (COPE) (www.publicationethics.org/).

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This report

The research reported in this issue of the journal was funded by the HS&DR programme or one of its preceding programmes as project number 12/209/59. The contractual start date was in April 2014. The final report began editorial review in April 2015 and was accepted for publication in January 2016. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The HS&DR editors and production house have tried to ensure the accuracy of the authors' report and would like to thank the reviewers for their constructive comments on the final report document. However, they do not accept liability for damages or losses arising from material published in this report.

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