Does pregnancy increase the risk of abdominal hernia recurrence after prepregnancy surgical repair?

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BACKGROUND: By increasing intraabdominal pressure, pregnancy may increase the risk of abdominal hernia recurrence. Current data are limited to studies with small sample size and thus the impact of pregnancy on recurrence is unclear.

OBJECTIVE(S): The objective of this analysis was to evaluate the impact of pregnancy on clinically significant abdominal hernia recurrence in a large multicenter cohort.

STUDY DESIGN: A multiinstitution deidentified electronic health record database, EPM: Explore (Explorys Inc, Cleveland, OH) was utilized to perform a retrospective cohort study of women aged 18–45 years with a history of an abdominal hernia repair from 1999 through 2013. Abdominal hernia was defined to include ventral and incisional hernias, and other types were excluded. The presence or absence of a pregnancy following primary hernia repair was elucidated from the database. Subjects were excluded if a hernia repair occurred during pregnancy. The rate of hernia recurrence, defined as reoperation, was calculated. The association between pregnancy and hernia recurrence was evaluated with logistic regression, both unadjusted and adjusted for diabetes, obesity (body mass index >30 kg/m^2), tobacco abuse, and wound complication at the time of initial hernia repair.

RESULTS: A total of 11,020 women with a history of hernia repair were identified, of whom 840 had a subsequent pregnancy. Overall, 915 women in the cohort had a hernia recurrence (8.3%). Women with a history of pregnancy following primary hernia repair were more likely to have a body mass index >30 kg/m^2, a history of tobacco abuse, and a wound complication at the time of primary repair. In an unadjusted analysis, pregnancy was associated with an increase in the risk of hernia recurrence (13.1% vs 7.1%, odds ratio, 1.96, 95% confidence interval, 1.60–2.42). The association between pregnancy and hernia recurrence was attenuated but persisted after adjusting for confounding factors (adjusted odds ratio, 1.73, 95% confidence interval, 1.40–2.14).

CONCLUSION: Pregnancy is associated with an increased risk of abdominal hernia recurrence after adjusting for confounding factors. The magnitude of this association is likely underestimated, given that the risk of recurrence was defined as reoperation, which captures only the most clinically significant group of recurrences. This information will facilitate counseling for reproductive-aged women planning elective ventral or incisional hernia repair. The risk of recurrence and subsequent reoperation should be balanced against the risk of incarceration and emergent surgery during pregnancy. As such, the desire for future pregnancy and/or contraception should be considered when planning asymptomatic hernia repair for women of reproductive age.

Key words: abdominal hernia, pregnancy, repair, recurrence, ventral hernia

The management of abdominal hernias represents a unique challenge for women of reproductive age. A paucity of data exist regarding treatment strategies and long-term outcomes for the repair of asymptomatic hernias among both pregnant women and nonpregnant reproductive-aged women desiring pregnancy.[1] As such, evidence-based recommendations guiding the timing of repair are lacking.

Traditionally, surgical decision making regarding the repair of asymptomatic hernias in nonpregnant, reproductive-age women has not differed from standard recommendations.[2-4] Theoretically, however, pregnancy may increase the risk of hernia recurrence by increasing intraabdominal pressure and abdominal wall laxity. Conversely, deferring repair until completion of child-bearing assumes the potential for incarceration during pregnancy. Incarcerated hernias in pregnancy are uncommon, accounting for less than 5% of bowel obstructions in pregnancy.[3,5] However, pregnant women with an incarcerated hernia face significantly increased fetal and maternal risks, including emergent surgical repair, anesthesia exposure, hernia rupture, bowel necrosis, sepsis, premature labor, pregnancy loss, or even maternal death.[3,6]

Overall, the recurrence rates for ventral or incisional hernias in contemporary series range up to 15%,[3,7] which is consistent with a 2011 Cochrane metaanalysis of randomized trials, which reported a recurrence rate for ventral and incisional hernias of approximately 5% for both laparoscopic and open repairs.[8] However, the impact of a subsequent pregnancy on the recurrence risk of hernias has not been well characterized. Available evidence is limited to case series with small sample sizes, and no large retrospective series or prospective observational data have been published. Abrahamson and Gorman published the largest case series to date, which were composed of 27 women with a history of ventral hernia repair who subsequently had a pregnancy and term live birth. In this series no cases of recurrence were reported.[9] A recent publication in the *Journal of the American College of Surgeons* stated that "elective postpartum hernia repair provides results similar to the nonpregnant population"; however, this

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publication was a case series with only 12 patients.[4] Therefore, the primary objective of this study was to evaluate the impact of pregnancy on hernia recurrence, with adjustment for confounding factors, in a large cohort of reproductive-age women.

Materials and Methods

A multiinstitution deidentified electronic health record database, EPM: Explore (Explorys Inc, Cleveland, OH), was utilized to perform a retrospective cohort study to assess the impact of pregnancy on ventral and incisional hernia recurrence. EPM: Explore is a commercially available analytics platform that collects and standardizes deidentified data from a variety of health information systems including inpatient and ambulatory electronic health records, billing systems, and laboratory and radiology systems.

The deidentified data from participating health care organizations are collected into a cloud-based data storage grid, which is updated at least once every 24 hours. Each participating health care organization has access to a secure, web-based application that allows for exploration and analysis of population-level data.

At the time of this study, EPM: Explore contained data on more than 50 million patients from 26 integrated health systems and 360 hospitals across the United States.[10] Detailed information on the EPM: Explore platform, data standardization and mapping have been previously published.[11] Studies conducted on the EPM: Explore database are considered exempt by our institutional review board.

All women aged 18−45 years with a history of a primary abdominal hernia repair, defined as either a ventral or incisional hernia, between the years 1999 and 2013 were identified. Given that various hernia subtypes have different baseline recurrence risks,[3] women with other hernia subtypes, such as umbilical, femoral, inguinal, or hiatal, were excluded to prevent conflation or misattribution of risk between subtypes. The presence or absence of a singleton pregnancy following primary repair was elucidated from the database. To exclude spontaneous abortion and early pregnancy loss, a pregnancy event was considered to have occurred only if a women had record of a vaginal, operative vaginal, or cesarean delivery.

Notably, the EPM: Explore platform allows users to place temporality restrictions on and between data fields within a search. For example, to ensure that a pregnancy event occurred after a hernia repair, we restricted our search to vaginal, operative vaginal, or cesarean deliveries occurring at least 12 months from the date of surgery for primary hernia repair. Therefore, although search or exclusion by gestational age is not available within EPM: Explore, the platform provides a sufficient mechanism to accurately identify a cohort of women with a pregnancy resulting in delivery after a primary hernia repair. Women with pregnancy-related primary hernia repairs (occurring during pregnancy or the 6 week postpartum period) were excluded to eliminate women with concomitant exposure.

The presence or absence of a clinically significant hernia recurrence, defined as reoperation, within the first 5 years after primary repair was then abstracted. A 5 year time frame from primary hernia repair was chosen to capture a plausible window in which a pregnancy could have an impact on the risk of hernia recurrence and to reduce confounding by other chronic risk factors. Additional demographic and obstetric data were obtained along with information regarding the presence or absence of risk factors for hernia recurrence including diabetes, obesity (body mass index >30 kg/m^2 prior to hernia repair), tobacco abuse, and a wound complication at the time of initial hernia repair (infection or dehiscence).

Demographic and medical comorbidity data were abstracted from the time of the primary hernia repair. The rate of hernia recurrence was calculated for the entire cohort and for women with and without a history of a pregnancy after primary repair. The association between pregnancy and hernia recurrence was evaluated with a logistic regression, both unadjusted and adjusted for pertinent risk factors.

Risk factors that were significant in the univariable analysis ($P < .1$) were maintained in the final multivariable model. Age was not incorporated in the multivariable model because EPM: Explore reports only categorical age data. Given that prior evidence has not demonstrated an impact of race on the risk of hernia recurrence[12] and that race was essentially dichotomized (white, African American, or other), race was also eliminated from the final multivariate model.

Lastly, because diabetes and obesity are correlated, an interaction variable was added to the final multivariable model. To maintain Health Insurance Portability and Accountability Act−compliant statistical deidentification, EPM: Explore reports population counts rounded to the nearest 10 and does not report sample sizes less than 10.

To determine whether such rounding had an adverse impact on the results, calculations of hat matrix and Pregibon's d-beta were performed to assess for undue influence and leverage, respectively. Categorical variables were assessed using a χ^2 or Fisher exact test as appropriate. Odds ratios with 95% confidence intervals are presented. Data analysis was conducted using STATA version 13.1 (Stata Corp, College Station, TX).

Results

A total of 11,020 women with a history of a hernia repair were identified, of whom 840 had a subsequent pregnancy. Baseline demographic and clinical information, stratified by history of pregnancy after hernia repair, is presented in Table 1. Women with a pregnancy after hernia repair were younger, more likely to be insured by Medicaid, and more likely to have risk factors for hernia recurrence including obesity, tobacco abuse, and wound complication at the time of initial hernia repair.

Overall, 915 women in the cohort had hernia recurrence (8.3%). A univariable analysis of risk factors for hernia recurrence is presented in Table 2. As expected, all other traditional risk factors for hernia recurrence occurred more