

Racial and ethnic disparities in the surgical management of tubal ectopic pregnancy

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Objective: To evaluate racial and ethnic disparities in the surgical management of ectopic pregnancy over time.

Design: Retrospective cohort study.

Setting: None.

Patient(s): Surgically-managed cases of patients with tubal ectopic pregnancy within the American College of Surgeons National Surgical Quality Improvement Program database between 2010 and 2019.

Intervention(s): None.

Main outcome measure(s): Surgical approach (laparoscopic compared with open) and procedure (salpingectomy compared with salpingostomy/other).

Result(s): Of 7791 patients undergoing surgical management of tubal ectopic pregnancy, 21.8% identified as Hispanic, 24.5% as Black, 9.4% as Asian/other, and 44.3% as White. Use of laparoscopy increased 1.3% per year from 81.4% in 2010 to 91.0% in 2019 (95% confidence interval [CI], 0.010–0.016). Odds of undergoing laparoscopic surgery were lower in Black (adjusted odds ratio [aOR] 0.52; 95% CI, 0.45–0.61) and Hispanic patients (aOR 0.52; 95% CI, 0.44–0.61) compared with White patients and remained similar over time. The use of salpingectomy increased by 1.1% per year from 80.6% in 2010 to 94.7% in 2019 (95% CI, 0.009–0.014). Odds of undergoing salpingectomy were higher among Black (aOR 1.78, 95% CI 1.43–2.23) and Hispanic patients (aOR 1.54; 95% CI, 1.24–1.93) and lower among Asian patients (aOR 0.73, 95% CI, 0.56–0.95) compared with White patients. These ratios remained similar for Black and Asian patients over time.

Conclusion(s): Despite the increased use of laparoscopy and salpingectomy in the surgical management of ectopic pregnancy over time, Black and Hispanic patients remain less likely to undergo minimally invasive surgery and more likely to undergo salpingectomy compared with White patients. (Fertil Steril Rep® 2022; ■: ■–■. ©2022 by American Society for Reproductive Medicine.)

Key Words: Racial disparity, ethnic disparity, gynecologic surgery, minimally invasive surgery, ectopic pregnancy

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Ectopic pregnancy occurs in 1.5%–2% of all gestations, with the vast majority located within the fallopian tube (1, 2). Tubal ectopic pregnancy can be managed expectantly, medically, or surgically (1). When surgical management is elected, laparoscopy is preferred as it is associated with shorter operative time, less intraoperative blood loss, and lower cost (1, 2). Laparoscopy can be safely

performed for ectopic pregnancy even in the setting of hemoperitoneum, reserving laparotomy for cases of inadequate visualization or hemodynamic instability (2, 3).

Surgical management of tubal ectopic pregnancy can involve salpingectomy or salpingostomy. The choice of procedure depends on multiple factors, including fertility preferences, condition of the fallopian tube, and

ability to achieve hemostasis. Although there is no clear consensus on the comparative fertility outcomes after salpingectomy or salpingostomy, randomized controlled trials demonstrate similar rates of subsequent intrauterine versus ectopic pregnancy after either procedure (4).

Racial and ethnic disparities in gynecologic surgery have been previously identified, with Black and Hispanic patients less likely to undergo minimally invasive surgery than White patients (5–8). Black patients are also more likely to undergo salpingectomy and experience severe morbidity related to ectopic pregnancy than White patients (9–11). Previous studies examining disparities in the surgical management

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TABLE 1

Demographic characteristics of all patients undergoing surgical management of tubal ectopic pregnancy (2010–2019).

Demographic	Total n = 7791 (%)	Laparoscopic n = 6667 (%)	Open n = 1124 (%)	P Value ^a	Salpingectomy n = 7074 (%)	Salpingostomy n = 717 (%)	P Value ^b
Race				<.001			<.001
White	3,451 (44.3)	3,081 (46.2)	370 (32.9)		3,081 (43.6)	370 (51.6)	
Black	1,905 (24.5)	1,548 (23.2)	357 (31.8)		1,782 (25.2)	123 (17.2)	
Hispanic	1,700 (21.8)	1,375 (20.6)	325 (28.9)		1,576 (22.3)	124 (17.3)	
Asian/other	735 (9.4)	663 (9.9)	72 (6.4)		635 (9.0)	100 (14.0)	
Age (y)	30 (26–34)	30 (26–34)	29 (26–34)	.42	30 (26–34)	29 (25–33)	<.001
BMI \geq 30 kg/m ²	2,683 (33.5)	2,024 (33.9)	405 (38.1)	.007	2,248 (35.2)	181 (27.7)	<.001
Diabetes	116 (1.3)	91 (1.4)	10 (0.9)	.19	92 (1.3)	9 (1.3)	.92
Smoking	2,050 (22.4)	1,539 (23.1)	262 (23.3)	.87	1,636 (23.1)	165 (23.0)	.95
Hypertension	225 (2.5)	175 (2.6)	34 (3.0)	.44	187 (2.6)	22 (3.1)	.50
Bleeding disorder	33 (0.4)	27 (0.4)	3 (0.3)	.79	27 (0.4)	3 (0.4)	.75
ASA Class \geq III	1,000 (10.9)	618 (9.3)	180 (16.0)	<.001	755 (10.7)	43 (6.0)	<.001
Transfusion	272 (3.0)	141 (2.1)	83 (7.4)	<.001	212 (3.0)	12 (1.7)	.043
Emergency case	6,925 (75.6)	4,841 (72.6)	896 (79.7)	<.001	5214 (73.7)	523 (72.9)	.66

Note: Data are median (interquartile range) or n (%) unless otherwise specified. BMI, body mass index; ASA Class, American Society of Anesthesiologists Physical Classification System.

^a Comparison between laparoscopic and open groups.

^b Comparison between salpingectomy and salpingostomy groups.

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of ectopic pregnancy have been limited by small sample sizes, abstraction of data from claims-based databases, or analyses over short timescales (11, 12). The objective of this study was to evaluate racial disparities in the surgical management of tubal ectopic pregnancy in a large, diverse, national cohort over a ten-year period. The primary outcome was the surgical approach (laparoscopic compared with open). Given previously identified disparities regarding the performance of tubal-sparing surgery in the management of ectopic pregnancy, a secondary outcome of procedure type (salpingectomy compared with salpingostomy) was also analyzed (11). It was hypothesized that racial and ethnic minority populations would be less likely to undergo minimally invasive surgery and salpingostomy than White patients, with potential dissipation of these disparities over time.

MATERIALS AND METHODS

The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database is a prospectively-collected, validated national surgical database comprised of surgical cases from more than 700 community and participating academic hospitals. Data collection methods for the ACS NSQIP are publicly available and have been detailed in previous publications (13–16). Briefly, trained surgical reviewers at each participating site extract data from electronic medical records (15). The ACS NSQIP enforces annual quality audits to maintain accuracy, precision, and reproducibility among hospital participants, with results consistently showing reliable data and improvements in reliability each year (16). As subjects within the ACS NSQIP database are fully de-identified, the study protocol did not meet the criteria for human subjects research and was deemed exempt by the institutional review board at the University of Pennsylvania.

In this retrospective cohort study, data were abstracted on surgical approach and procedure for patients undergoing

surgical management of ectopic pregnancy from January 1, 2010, to December 31, 2019, using the Current Procedural Terminology (CPT) codes 59120, 59121, 59150, and 59151. In addition, the International Classification of Disease (ICD) 9 (633.1, 633.11, 633.10) and 10 (000.101, 000.102, 000.111, 000.112, 000.1, 000.10, 000.11) codes were used to limit analyses to cases of tubal ectopic pregnancy. The cohort was restricted to patients between the ages of 18 and 50 years. Race and ethnicity were categorized as Hispanic, Black, White, or Asian/Other (including American Indian or Alaskan Native and Native American or Pacific Islander). Race and ethnicity were either self-assigned or assigned by trained clinical reviewers at the time of prospective data collection as directed by the ACS NSQIP guidelines. To assess associations between patient race/ethnicity and surgical approach, cases were categorized into those performed using laparoscopic techniques and those performed using an open abdominal approach. To assess associations between patient race/ethnicity and surgical procedure, cases were categorized into those involving salpingectomy and those not involving salpingectomy.

Data were abstracted on a selected subset of demographic and clinical variables within the ACS NSQIP database that could potentially confound the relationship between patient race and surgical management of tubal ectopic pregnancy. These included patient variables such as obesity (dichotomized as body mass index [BMI] $<$ or \geq 30 kg/m²), diabetes, hypertension requiring medication, history of a bleeding disorder, current smoking status, and American Society of Anesthesiologists (ASA) Physical Status Classification (dichotomized as $<$ or \geq III [patient with a severe systemic disease]). Additional variables related to the surgical procedure, such as emergent status and blood transfusion before surgery, were also included.

Continuous variables were compared using Wilcoxon rank sum tests, and categorical variables were compared using χ^2 and Fisher's exact tests as appropriate. Logistic

regression was performed to evaluate the proportion of cases performed laparoscopically and the proportion of procedures involving salpingectomy within each operative year. Marginal analysis was then used to predict the marginal effect of operative year on surgical approach and procedure. Multivariable logistic regression analyses were used to calculate unadjusted and adjusted odds ratios (aOR) with 95% confidence intervals (CI) comparing Hispanic, Black, and Asian/other patients to White patients regarding the likelihood of undergoing laparoscopic surgery and the likelihood of undergoing salpingectomy. Multivariable models were adjusted for variables noted to be significantly different ($P < .1$) between the 2 relevant groups—ASA Class $> III$, preoperative blood transfusion, and emergency status when comparing laparoscopic with open surgery; age, obesity, ASA Class $\geq III$, and preoperative blood transfusion when comparing cases of salpingectomy with those without salpingectomy. Interaction analyses evaluated the relationship between race/ethnicity and either surgical approach or surgical procedure between the 2 operative time cohorts, defined as 2010–2014 and 2015–2019. All statistical analyses were performed using Stata 16.1.

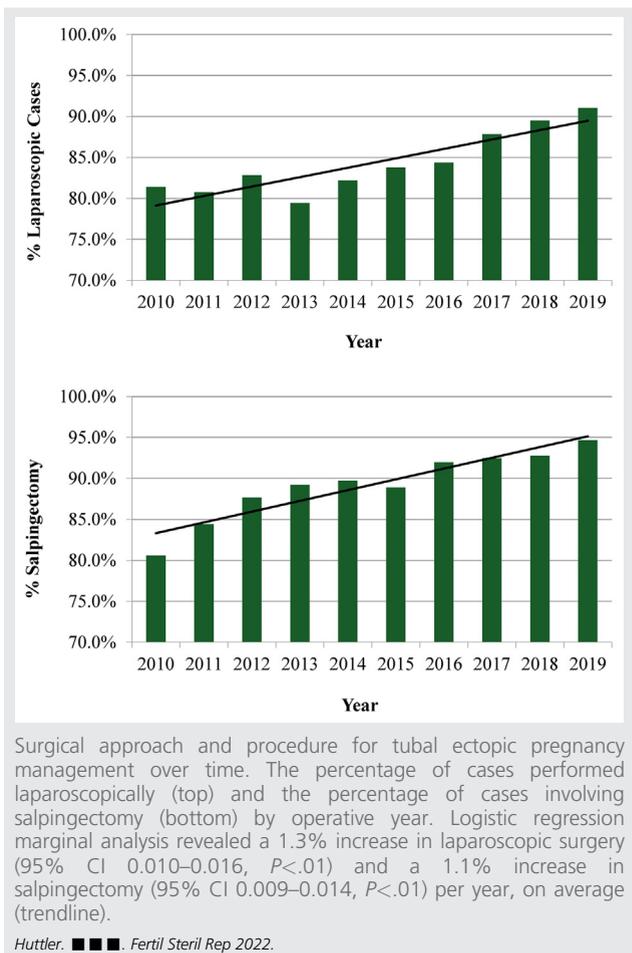
RESULTS

A total of 9164 reproductive-aged patients underwent surgical management of tubal ectopic pregnancy from 2010 to 2019. After excluding 1,189 with unreported race, 7,791 patients remained in the final cohort. Of these, 9.4% identified as Asian or other races ($n = 735$), 21.8% as Hispanic ($n = 1,700$), 24.5% as Black ($n = 1,905$), and 44.3% as White ($n = 3,451$). Most cases were performed laparoscopically ($n = 6,667$, 85.6%) as compared with open ($n = 1,124$, 14.4%). Compared with patients undergoing laparoscopic surgery, those undergoing open surgery were more likely to be obese, be ASA Class $> III$, have received a preoperative blood transfusion, and undergo emergency surgery. Salpingectomy was performed in most cases ($n = 7,074$, 90.8%). Compared with patients who did not undergo salpingectomy, those who underwent salpingectomy were more likely to be younger, obese, ASA Class $> III$, and have received a preoperative blood transfusion (Table 1).

The proportion of procedures performed laparoscopically increased from 81.4% in 2010 to 91.0% in 2019 (Fig. 1). On average, laparoscopic surgery increased by 1.3% per year, and this trend was found to be significant (95% CI, 0.010–0.016, $P < .01$). After adjusting for ASA Class $> III$, preoperative blood transfusion, and emergency status, Black and Hispanic patients were less likely to undergo laparoscopic surgery compared with White patients (Black aOR 0.52, 95% CI 0.45–0.61; Hispanic aOR 0.52, 95% CI 0.44–0.61) (Table 2). Obesity was no longer significant in the multivariable model. When this relationship between surgical approach and race/ethnicity was compared between the 2 operative time cohorts (2010–2014 and 2015–2019) using interaction analysis, there were no significant differences for all racial/ethnic groups (all $P > .05$, Table 2).

The proportion of salpingectomy procedures increased from 80.6% in 2010 to 94.7% in 2019 (Fig. 1). On average,

FIGURE 1



salpingectomy increased by 1.1% per year, and this trend was found to be significant (95% CI 0.009–0.014, $P < .01$). After adjusting for age, obesity, ASA Class $\geq III$, and preoperative blood transfusion, Black and Hispanic patients remained more likely to undergo salpingectomy than White patients (Black aOR 1.78, 95% CI 1.43–2.23; Hispanic aOR 1.54, 95% CI 1.24–1.93), and Asian patients less likely to undergo salpingectomy (aOR 0.73, 95% CI 0.56–0.95) (Table 3). When the relationship between surgical procedure and race/ethnicity was compared between the 2 operative time cohorts using interaction analysis, there were no significant differences for Black and Asian patients (both $P > .05$). In Hispanic patients, the increased odds of undergoing salpingectomy observed in the 2010–2014 cohort were significantly decreased in the 2015–2019 cohort ($P = .044$), at which point they were no longer significantly different compared with the referent group of White patients (Table 3).

DISCUSSION

Despite trends over the last decade toward greater use of laparoscopy and salpingectomy in the surgical management of tubal ectopic pregnancy, Black and Hispanic patients

TABLE 2

Odds ratios for laparoscopic surgery by patient race/ethnicity.

Race/Ethnicity	Unadjusted OR 2010–2019 (95% CI)	Adjusted OR ^a 2010–2019 (95% CI)	Adjusted OR ^a 2010–2014 (95% CI)	Adjusted OR ^a 2015–2019 (95% CI)	Interaction P Value
White	Ref	Ref	Ref	Ref	Ref
Black	0.52 (0.44–0.61)	0.52 (0.45–0.61)	0.51 (0.40–0.65)	0.53 (0.43–0.65)	.83
Hispanic	0.51 (0.43–0.60)	0.52 (0.44–0.61)	0.47 (0.36–0.62)	0.52 (0.42–0.63)	.61
Asian/other	1.10 (0.84–1.44)	1.18 (0.90–1.55)	1.38 (0.89–2.14)	1.06 (0.76–1.50)	.37

OR, odds ratio; Ref, referent.

^a Adjusted for American Society of Anesthesiologists Class \geq III, preoperative blood transfusion, and emergency statusHuttler. ■■■. *Fertil Steril Rep* 2022.

remain significantly less likely to receive minimally invasive surgery and more likely to undergo salpingectomy than their White counterparts. Asian patients are also less likely to undergo salpingectomy.

These findings are consistent with previous studies evaluating racial disparities in gynecologic surgery (5–8, 11, 12), though the underlying etiologies remain unclear. In the present study, the decreased use of laparoscopy in minority patients was not accounted for by ASA classification, preoperative blood transfusion, or emergency status of surgery. It remains possible that clinical variables not captured in the ACS NSQIP database—such as beta human chorionic gonadotropin level or estimated gestational age at the presentation—may confound this relationship. The increased use of salpingectomy among minority patients was similarly not accounted for by age, obesity, ASA classification, or preoperative blood transfusion. Again, patient factors, including parity, fertility desires, coverage for assisted reproduction, gynecologic history and condition of the fallopian tube, and presence of a contralateral fallopian tube, are not captured by the ACS NSQIP; if these differ among racial and ethnic groups they may contribute to observed disparities.

It is perhaps equally plausible that these disparities result from racism within the American health care system. Although the precise impact of a racial bias on medical decision-making remains challenging to quantify, physician prejudice has been identified as a significant contributor to racial disparities in health care (17, 18). For example, erroneous beliefs about intrinsic biologic differences in pain

perception between Black and White individuals held by White medical trainees have resulted in inappropriate and inadequate treatment recommendations for Black patients (19). However, perhaps even more significant than individual biases is the impact of structural racism on differential access to care for minority patients (20, 21). In nongynecologic surgery and internal medicine literature, studies have suggested that Black, Hispanic, and Asian patients are more likely to undergo surgery at low-volume hospitals and seek care with low-volume or nonboard certified physicians who lack consistent access to high-quality resources (22–26). Moreover, claims-based analyses have demonstrated associations between surgical management of ectopic pregnancy, hospital characteristics, and patient insurance status, with Medicaid and uninsured patients found to be 60%–70% less likely to undergo salpingostomy compared with commercially insured patients (11). These factors may contribute to the present study's findings if Black and Hispanic patients disproportionately lacked commercial health insurance or were presented to lower-resourced hospitals. Although the ACS NSQIP database does not capture geographic, hospital, insurance, and provider level data—thus limiting the ability to account for these factors—differences in insurance status or access to care between racial and ethnic groups may represent central manifestations of systemic racism, with disparities in the surgical management of ectopic pregnancy signifying downstream effects.

The strengths of this study include its large sample size, the racial and ethnic diversity of the study population, and the use of a highly-validated clinical database. An additional

TABLE 3

Odds ratios for salpingectomy by patient race/ethnicity.

Race/Ethnicity	Unadjusted OR 2010–2019 (95% CI)	Adjusted OR ^a 2010–2019 (95% CI)	Adjusted OR ^a 2010–2014 (95% CI)	Adjusted OR ^a 2015–2019 (95% CI)	Interaction P Value
White	Ref	Ref	Ref	Ref	Ref
Black	1.73 (1.41–2.15)	1.78 (1.43–2.23)	1.89 (1.35–2.66)	1.73 (1.29–2.33)	.69
Hispanic	1.53 (1.23–1.89)	1.54 (1.24–1.93)	2.09 (1.41–3.10)	1.28 (0.97–1.68)	.044
Asian/other	0.76 (0.60–0.97)	0.73 (0.56–0.95)	0.65 (0.44–0.98)	0.78 (0.55–1.12)	.49

OR, odds ratio; Ref, referent.

^a Adjusted for age, body mass index \geq 30 kg/m², American Society of Anesthesiologists Class \geq III, and preoperative blood transfusionHuttler. ■■■. *Fertil Steril Rep* 2022.

strength is the longitudinal analysis over a ten-year interval which enabled the assessment of previously unevaluated trends over time. This study also has limitations related to its use of retrospective aggregate data. As previously described, the ACS NSQIP database does not capture certain patient, geographic, hospital, and provider level data that may confound the relationship between patient race/ethnicity and surgical management of tubal ectopic pregnancy. Secondly, CPT coding does not distinguish between salpingectomy and oophorectomy for ectopic pregnancy, and there is no CPT code that specifies salpingostomy. Although most surgical cases for tubal ectopic pregnancy that do not involve salpingectomy are likely to represent salpingostomy procedures, some cases of tubal abortions may also be included in this group. As this study uses both ICD-9 and ICD-10 codes, there may also be disruptions in observed rates of tubal pregnancy related to the coding transition, though this should be equally distributed among all patients. Additionally, the cohort of Asian patients included approximately 3% of patients who identified as other races, and the categorical definition of race precluded the assessment of patients who identified as multiple races. Finally, 13.0% of patients were excluded because of missing or unknown race and ethnicity, which may result in inclusion bias.

Additional analyses are necessary to clarify and correct the underlying factors that result in disparate surgical management between racial and ethnic groups. Implementing universal protocols for the management of ectopic pregnancy—akin to those that have demonstrated efficacy in reducing disparities within obstetric care—represents potential interventions to mitigate these inequalities (27).

CONCLUSION

In conclusion, most disparities regarding the surgical approach and procedure type in the surgical management of ectopic pregnancy among minority patients have persisted over the last decade. Many minority patients remain not only disproportionately affected by ectopic pregnancy but also less likely to receive care concordant with established standards. The increased likelihood to undergo salpingectomy seen among Hispanic patients from 2010 to 2014 was the only disparity that did not persist in the 2015–2019 cohort. Although the clinical significance of this finding is unclear given the ambiguity surrounding the most beneficial surgical procedure for tubal ectopic pregnancy, it is reassuring that this disparity dissipated over time. Identifying racial and ethnic disparities in reproductive health care is a requisite first step in establishing interventions to equalize care across all individuals.

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