



## Risk factors for ectopic pregnancy in women with planned pregnancy: a case–control study



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### ABSTRACT

**Objective:** To explore the risk factors for ectopic pregnancy (EP) in women with planned pregnancy. **Study design:** This case–control study was conducted in women with planned pregnancy and included 900 women diagnosed with EP (case group) and 889 women with intrauterine pregnancy (IUP) as the control group matched in terms of age and gestational week. Socio-demographic characteristics, reproductive history, gynecological and surgical history, previous contraceptive use, and history of infertility were compared between the two groups. Blood samples were collected from all the participants to detect serum chlamydia trachomatis (CT) IgG antibody. The odds ratio (OR) with its 95% confidential interval (CI) of each variable was calculated by univariable conditional logistic regression analysis. Factors significantly different between both groups, as revealed by univariable analysis, were entered into a multivariable logistic regression model by stepwise selection.

**Results:** The risk of EP was associated with previous adnexal surgery (adjusted OR = 3.99, 95% CI: 2.40–6.63), uncertainty of previous pelvic inflammatory disease (adjusted OR = 6.89, 95% CI: 3.29–14.41), and positive CT IgG serology (adjusted OR = 5.26, 95% CI: 3.94–7.04). A history of infertility including tubal infertility (adjusted OR = 3.62, 95% CI: 1.52–8.63), non-tubal infertility (adjusted OR = 3.34, 95% CI: 1.60–6.93), and *in vitro* fertilization (IVF) treatment (adjusted OR = 5.96, 95% CI: 1.68–21.21) were correlated with the risk of EP. Women who had previously used condoms were less likely to have EP during the current cycle (adjusted OR = 0.27, 95% CI: 0.21–0.36).

**Conclusions:** Besides well-acknowledged risk factors for EP, attention should be paid to women with planned pregnancy who have a history of infertility and/or IVF treatment, to prevent complications from EP.

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### Introduction

Ectopic pregnancy (EP) is the leading cause of maternal mortality in the first trimester of pregnancy [1]. Approximately 1–2% of all naturally conceived pregnancies end up with EP [2]. In the past decades, the occurrence of EP has been on the rise in many countries [3,4].

In the general female population, the widely accepted risk factors for EP include tubal damage resulting from pelvic infection (e.g. chlamydia trachomatis, CT) or previous adnexal surgery, smoking, and *in vitro* fertilization (IVF) [2,5]. These risk factors are not necessarily independent of one another, and the risk of EP varies among different populations [5]. Fertility intention might have an impact on pregnancy outcome [6]. Women not planning to become pregnant often resort to a variety of contraceptive methods, most of which could prevent unwanted pregnancy (intrauterine or ectopic), but if contraception fails, some contraceptive methods, like intrauterine device (IUD) and oral contraceptive pills (OCs), could potentially increase the EP risk according to the results of a meta-analysis [7]. Women with planned pregnancy include a certain population of females with a history of infertility and/or assisted reproduction technologies

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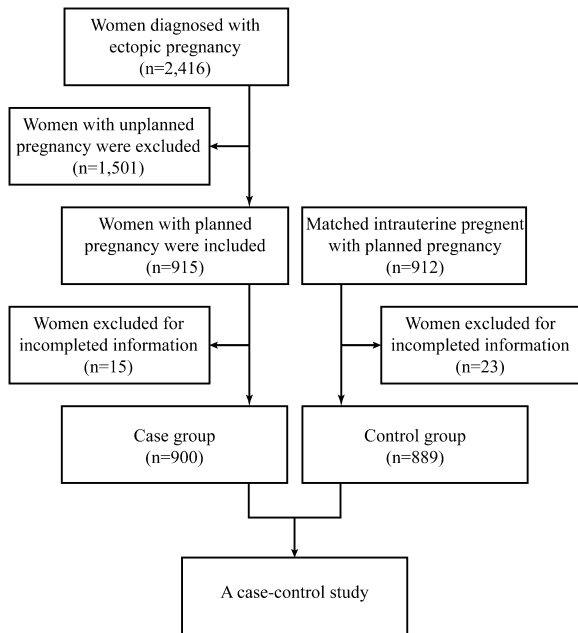


Fig. 1. Recruitment profile of the study.

(ART). Whether or not the EP risk factors are different in women with planned pregnancy from those in the general female population has not been determined. We therefore conducted this case control study to explore the risk factors for EP in women with planned pregnancy.

## Materials and methods

### Ethical considerations

This study was approved by Institutional Review Board and was conducted at the International Peace Maternity and Child Health Hospital in Shanghai, China. Written informed consent was obtained from women before recruitment.

### Participants and methods

The study was conducted during a period from September 2010 to April 2013. According to the American College of Obstetricians and Gynecologists Practice Bulletin [8], the diagnosis and location of pregnancy were confirmed at operation for EP patients who received surgical treatment. The EP diagnosis was confirmed by a combination of tests, including serum  $\beta$ -hCG level and transvaginal ultrasonography, for patients who received medical treatment. All the women diagnosed with EP by the unified diagnosis criteria at our prenatal care center were asked if their pregnancies were planned. Women with planned pregnancy were then recruited into the case group (EP group). During the same study period, women presenting at our prenatal care center with planned intrauterine pregnancy (IUP) were recruited as the control group (IUP group). The two groups were matched in terms of age ( $\pm 5$  years) and gestational age ( $\pm 7$  days).

An investigator who was blind to the group of participants was responsible for data collection by questionnaire. To ensure a high completion rate, the questionnaire was filled out by the investigator during interview. The information collected for each participant included sociodemographic characteristics,

Table 1  
Sociodemographic characteristics of women with planned pregnancy (ectopic vs. intrauterine).

	EP <i>n</i> <sup>a</sup> (%)	IUP <i>n</i> <sup>a</sup> (%)	OR	95% CI	<i>p</i> -Value
Age (year)					0.29
≤19 (youngest 17)	1 (0.11)	1 (0.11)	1.08	[0.07, 17.29]	
20–29	446 (49.56)	481 (54.11)	Reference		
30–39	441 (49.00)	396 (44.54)	1.20	[0.99, 1.45]	
≥40 (eldest 43)	12 (1.33)	11 (1.24)	1.18	[0.51, 2.69]	
Marital status					0.93
Married	872 (96.89)	862 (96.96)	Reference		
Unmarried	28 (3.11)	27 (3.04)	1.03	[0.60, 1.75]	
Educational attainment					<10 <sup>-3</sup> <sup>b</sup>
University or above	467 (52.53)	612 (68.84)	Reference		
High school	107 (12.04)	92 (10.35)	1.52	[1.12, 2.07]	
Middle school	66 (7.42)	54 (6.07)	1.60	[1.10, 2.34]	
Primary school or lower	260 (29.25)	131 (14.74)	2.60	[2.04, 3.31]	
Occupation					<10 <sup>-3</sup>
Employed	627 (69.90)	729 (82.09)	Reference		
Self-employed	106 (11.82)	61 (6.87)	2.02	[1.45, 2.82]	
Unemployed	164 (18.28)	98 (11.04)	1.95	[1.48, 2.55]	
Individual annual income (¥)					<10 <sup>-3</sup> <sup>b</sup>
>100,000	244 (27.70)	270 (30.44)	Reference		
50,000–100,000	237 (26.90)	330 (37.20)	0.80	[0.63, 1.01]	
<50,000	400 (45.40)	287 (32.36)	1.54	[1.23, 1.94]	
Active tobacco smoker <sup>c</sup>					<10 <sup>-3</sup> <sup>b</sup>
Never	815 (92.30)	838 (95.77)	Reference		
Lighter smoker	49 (5.55)	30 (3.34)	1.68	[1.06, 2.67]	
Heavy smoker	19 (2.15)	7 (0.80)	2.79	[1.17, 6.67]	
Exposure to passive smoking <sup>c</sup>					<10 <sup>-3</sup> <sup>b</sup>
Never	504 (56.88)	611 (69.27)	Reference		
Occasionally	29 (3.27)	22 (2.49)	1.60	[0.91, 2.82]	
Frequently	353 (39.84)	249 (28.23)	1.72	[1.41, 2.10]	

EP: ectopic pregnancy; IUP: intrauterine pregnancy; OR: odds ratio; CI: confidence interval.

<sup>a</sup> The sum does not necessarily equal the sample size for all the variables because of missing data (occupation: 3 in cases and 1 in controls; individual annual income: 19 in cases and 2 in controls; active tobacco smoker: 17 in cases and 14 in controls; exposure to passive smoking: 14 in cases and 7 in controls).

<sup>b</sup> The *p* value of the test for trend is given.

<sup>c</sup> Light smoker and occasional exposure to passive smoking: smoking less than 1 cigarette per day; heavy smoker and frequent exposure to passive smoking: smoking more than 1 cigarette per day for a minimum of 6 months.

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