

# Rupture risk factors of fallopian tubal pregnancy

**T. Fukami, H. Tsujioka, S. Matsuoka, S. Sorano, A. Tohyama, H. Yamamoto, S. Nakamura, M. Goto, R. Matsuoka, F. Eguchi**

*Department of Obstetrics and Gynecology, ASO Iizuka Hospital, Iizuka, Fukuoka (Japan)*

## Summary

The present authors analyzed patients' backgrounds and pre-surgical findings to clarify the risk factors of rupture of fallopian tubal pregnancy. The surgical findings 113 cases were clearly diagnosed as fallopian tubal pregnancy with or without rupture. Twenty-six cases of fallopian tubal pregnancy were ruptured and 87 cases were not ruptured at the time of operation. The risk factors of fallopian tubal rupture were assessed by Chi-square for independence test and multiple regression analysis. Obesity (BMI over 26), prior birth history, social welfare entitlement, ultrasonography findings of fetal heart movement, and pre-surgical serum beta-hCG level more than 3,000 mIU/ml patient were significantly higher risk in fallopian tubal rupture. Fertility treatment patient were at significantly lower risk for fallopian tubal rupture. Higher beta-hCG levels, especially >3,000 mIU/ml is associated with increased risk of fallopian tubal rupture in ectopic pregnancy.

**Key words:** Ectopic pregnancy; Rupture; Serum beta-subunit human chorionic gonadotropin.

## Introduction

Ectopic pregnancy remains the leading cause of maternal life crisis [1, 2]. About 1% of pregnancies are in an ectopic location with implantation not occurring inside of the womb [3]. Most of ectopic pregnancies (97%) are implanted within the fallopian tube. Recently the serum beta-subunit human chorionic gonadotropin (beta-hCG) levels and transvaginal ultrasound examination have valuable resources for diagnosing ectopic pregnancy. The knowledge of risk factors associated with the rupture of an ectopic pregnancy may be a valuable tool to identify women at risk for this life-threatening condition. The aim of this study was to discover the fallopian tubal rupture risk factors of ectopic pregnancy in surgical cases. The authors analyzed patient backgrounds and pre-surgical findings to clarify the risk factors of rupture of the fallopian tubal pregnancy.

## Materials and Methods

The study group comprised cases of fallopian tubal ectopic pregnancy which were diagnosed in the present hospital from January 2007 to June 2012. On the surgical findings, 113 cases were clearly diagnosed as fallopian tubal pregnancy with or without rupture. The authors classified a ruptured group and an unruptured group. They analyzed patient backgrounds and pre-surgical findings to clarify the risk factors of rupture of fallopian tubal pregnancy. Inclusion criteria were the following: patients diagnosed with fallopian tubal ectopic pregnancy and operated by laparotomy or laparoscopy. Gestational age was calculated according to the last menstrual period at the time of surgery. Exclusion criteria: non-fallopian tubal pregnancy (ovarian, interstitial site). The authors interviewed patients' and recorded their medical histories. They also analyzed serum beta-hCG concentration, fetal heart

beat, and operative findings including intraperitoneal bleeding. The risk factors of fallopian tubal rupture were assessed by Chi-square for independence test and multiple regression analysis. Student's *t*-test, Mann-Whitney-Wilcoxon test for independent samples, Pearson's chi-square, and Fisher's exact test were applied for comparison of groups where appropriate. Multivariate logistic regression analysis was used to identify predictors of the outcome of ectopic pregnancy (variables with a *p* value < 0.05 by univariate analysis were entered into the multivariate analysis). Receiver operating characteristic curves (ROC) was used to test the overall predict accuracy of serum beta-hCG, and results were reported as area under the curve (AUC). All statistical analysis was performed with SPSS for Windows, version 20.0. Statistical significance was defined as *p* < 0.05.

## Results

The surgical findings of 113 cases were clearly diagnosed as fallopian tubal pregnancy with or without rupture. Twenty-six cases of fallopian tubal pregnancy were ruptured and 87 cases were not ruptured. The mean of maternal age was  $29.0 \pm 5.4$  years in unruptured group and  $32.0 \pm 3.9$  years in ruptured group. The mean gestational age was  $7.72 \pm 1.23$  weeks in unruptured group compared with  $7.23 \pm 1.82$  weeks in ruptured group. According to *t*-test, there was no statistical difference between groups. Odds ratios and 95% confidence intervals (CI) for fallopian tube rupture are shown in Table 1. BMI > 26, parity, social welfare entitlement, ultrasonography findings of fetal heart movement, and serum beta-hCG over 3,000 mIU/ml patients were significantly at higher risk for fallopian tubal rupture. Fertility treatment patient were significantly at lower risk for fallopian tubal rupture. Based on the ROC

Table 1. — Odds ratios and 95% confidence intervals for fallopian tube rupture.

	n (%)			
	Ruptured (n=26)	Unruptured (n=87)	Odds ratio	95% CI
Age (years)				
< 30	10 (38.4)	56 (64.4)	1.0	
> 30	16 (61.6)	31 (35.6)	2.9	1.2–7.1
Body mass index				
< 26	17 (65.4)	80 (92.0)	1.0	
> 26	9 (34.6)	7 (8.0)	5.1	1.6–15.8
Parity				
Nullipara	7 (26.9)	47 (54.0)	1.0	
Delivered	19 (73.1)	40 (46.0)	3.2	1.6–15.8
History of pelvic surgery				
No	19 (73.1)	51 (58.6)	1.0	
Yes	7 (26.9)	36 (41.4)	0.5	0.2–1.4
History of STD				
No	23 (88.4)	66 (75.9)	1.0	
Yes	3 (11.6)	21 (24.1)	0.4	0.1–1.5
Habitual smoker				
No	16 (61.6)	42 (48.3)	1.0	
Yes	10 (38.4)	45 (51.7)	0.6	0.2–1.4
Social Welfare				
No	22 (84.6)	85 (97.7)	1.0	
Yes	4 (15.4)	2 (2.3)	7.7	1.3–44.0
Marriage				
No	6 (23.1)	15 (17.2)	1.0	
Yes	20 (76.9)	72 (82.8)	1.4	0.5–4.2
Fertility treatment				
No	26 (100.0)	79 (90.8)	1.0	
Yes	0 (0.0)	8 (9.2)	0.2	0.1–0.4
Fetal heart movement				
No	20 (76.9)	83 (95.4)	1.0	
Yes	6 (23.1)	4 (4.6)	6.2	1.6–24.1

curve (Figure 1), the optimal cutoff value of pre-surgical serum beta-hCG levels as an indicator of risk of fallopian tubal rupture was projected to be 3,475 mIU/ml, which yielded a sensitivity of 62.5 % and a specificity of 57.1%, with the AUC at 0.66 ( $p = 0.045$ ). Amount of surgical bleeding is shown in Figure 2. Surgical bleeding was obviously increased in fallopian tubal rupture group.

## Discussion

Diagnosis of fallopian tubal pregnancy requires immediate treatment to avoid rupture remains and is ultimately an arduous task. The high rupture rates were explained by delayed diagnosis due to lack of diagnostic tools such as transvaginal ultrasound and beta-hCG measurements. The rate of fallopian tubal rupture is acceptable (23%) compared with other reports (18–35%) [4, 5]. The present authors discovered five factors: (BMI > 26, parity, social welfare entitlement, ultrasonography findings of fetal heart movement, and serum beta-hCG over 3,000 mIU/ml) that

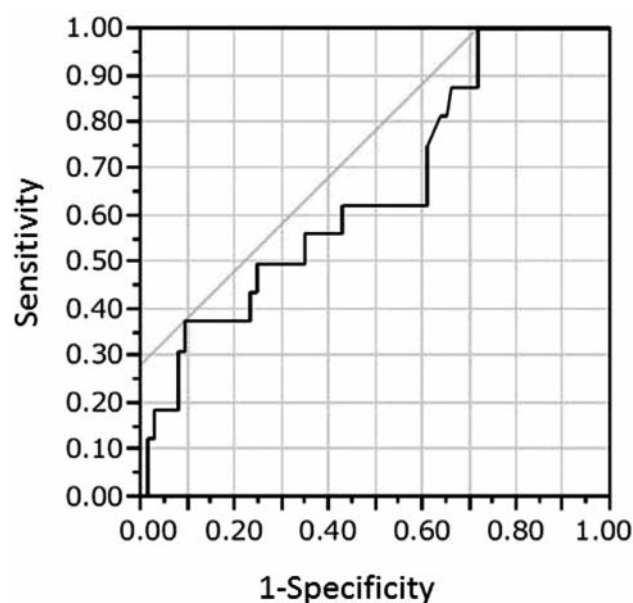


Figure 1. — Evaluation of the summarized serum beta-hCG for predicting fallopian tubal rupture by analysis of receiver operating characteristic (ROC) curve.

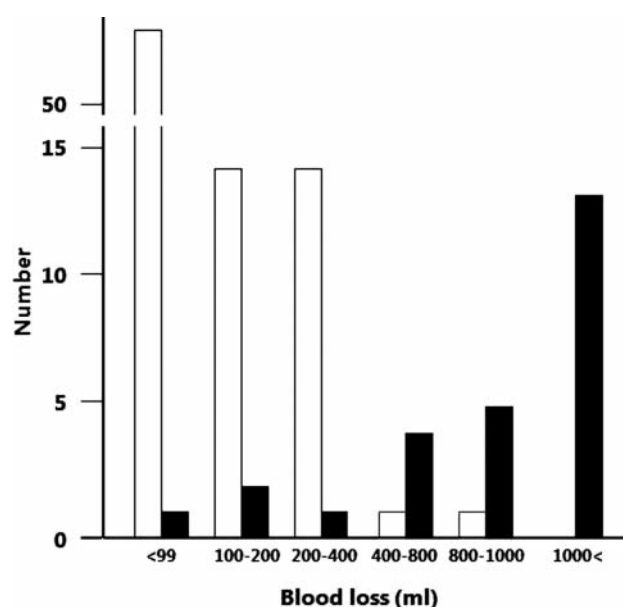


Figure 2. — Amount of bleeding of fallopian tubal pregnancy with/without rupture. ■: ruptured group, □: unruptured group.

increased the risk of fallopian tubal rupture. Subjects with BMI > 26 were at significantly higher risk for fallopian tubal rupture.

The mechanism behind irregular menstrual cycles is related to disturbances in the normal hormonal balance. Normal menstrual cycles correlate with normal cyclic

production of hormones. An increase in body fat percentage also increases circulating estrogen levels in the body. This excess estrogen causes conflicting signals to the ovaries and to the brain, which results in irregular or ovulation from the ovaries. When ovulation is late or absent, abnormal cycles result. Parity was also a factor for significantly higher risk of fallopian tubal rupture. There is some possibility of relating it to uterine endometrium inflammation and scar.

Social welfare entitlement patients were at a significantly higher risk for fallopian tubal rupture. The cause is uncertain, the possibility are low education level, lack of health knowledge, and unsanitary environments.

Fertility treatment patients were at significantly lower risk for fallopian tubal rupture. Because these patients visited hospital earlier than natural pregnant patient regarding their pregnancy, ectopic pregnancies could be diagnosed before rupture. Serum beta-hCG over 3,000 mIU/ml and ultrasonography findings of fetal heart movement presented were related with activity of ectopic pregnancy. Job-Spira *et al.* reported that beta-hCG over 10,000 mIU/ml increased the probability of fallopian tubal rupture [4]. Cacciatore *et al.* managed 71 cases of suspected ectopic pregnancy based upon quantitative serum beta-hCG and vaginal ultrasonography [6]. They selected expectant management when the beta-hCG was less than 1,000 mIU/ml. Trio *et al.* successful expectant management about the initial beta-hCG was less than 1,000 mIU/ml in 112 cases ectopic pregnancy [7]. Ylostalo *et al.* proposed another management of beta-hCG. They calculated percentage by the initial value for beta-hCG and the 48-hour beta-hCG [8]. More than 2% decrease in value had a possibility of unruptured prognosis. The present authors suggest that a serum beta-hCG level of more than 3,000 mIU/ml and ultrasonography findings of fetal heart movement presented in fallopian tubal pregnancy were risk factors for rupture and they needed to decide the surgical procedure. However, it must be kept in mind that fallopian tubal rupture can occur even with lower levels of serum beta-hCG.

## Conclusion

There is a dispute regarding the risk factors leading to rupture in fallopian tubal pregnancy. According to the present study, higher beta-hCG levels, especially > 3,000 mIU/ml was associated with increased risk of fallopian tubal rupture in ectopic pregnancy. Patients presenting with these findings can be warned about the risk of rupture and surgical management can be planned according to these risk factors.

## Acknowledgements

The authors acknowledge Hidenobu Koga for assistance with statistics analysis.

## References

- [1] Goksedef B.P., Kef S., Akca A., Bayik R.N., Cetin A.: "Risk factors for rupture in fallopian tubal ectopic pregnancy: definition of the clinical findings". *Eur. J. Obstet. Gynecol. Reprod. Biol.*, 2011, 154, 96-99.
- [2] Berg C.J., Callaghan W.M., Syverson C., Henderson Z.: "Pregnancy-related mortality in the United States, 1998 to 2005". *Obstet. Gynecol.*, 2010, 116, 1302.
- [3] Saraiya M., Berg C.J., Shulman H., Green C.A., Atrash H.K.: "Estimates of the annual number of clinically recognized pregnancies in the United States, 1981-1991". *Am. J. Epidemiol.*, 1999, 149, 1025.
- [4] Job-Spira N., Fernandez H., Bouyer J., Pouly J.L., Germain E., Coste J.: "Ruptured fallopian tubal ectopic pregnancy: risk factors and reproductive outcome: results of a population-based study in France". *Am. J. Obstet. Gynecol.*, 1999, 180, 938.
- [5] Saxon D., Falcone T., Mascha E.J., Marino T., Yao M., Tulandi T.: "A study of ruptured fallopian tubal ectopic pregnancy". *Obstet. Gynecol.*, 1997, 90, 46.
- [6] Cacciatore B., Korhonen J., Stenman U.H., Ylostalo P.: "Transvaginal sonography and serum hCG in monitoring of presumed ectopic pregnancies selected for expectant management". *Ultrasound. Obstet. Gynecol.*, 1995, 5, 297.
- [7] Trio D., Strobelt N., Picciolo C., Lapinski R.H., Ghidini A.: "Prognostic factors for successful expectant management of ectopic pregnancy". *Fertil. Steril.*, 1995, 63, 469.
- [8] Ylostalo P., Cacciatore B., Sjoberg J., Kaariainen M., Tenhunen A., Stenman U.H.: "Expectant management of ectopic pregnancy". *Obstet. Gynecol.*, 1992, 80, 345.

Address reprint requests to:  
T. FUKAMI, M.D., PhD  
Department of Obstetrics and Gynecology  
ASO Iizuka Hospital  
3-83 Yoshio-machi, Iizuka  
Fukuoka 820-8505 (Japan)  
e-mail: fukami1975@msn.com