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ORIGINAL ARTICLE

Case Control Study

Blood tests for prediction of deep endometriosis: A case-control study

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Author contributions: Chen ZY participated in the design of this study, drafted the manuscript, and performed the statistical analysis; Zhang LF, Zhang YQ, Zhou Y, and Li XY carried out the study and collected data; Huang XF participated in the design of this study and made critical revision related to the important intellectual content of the manuscript; All authors read and approved the final manuscript.

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Abstract

BACKGROUND

Deep endometriosis (DE) is the most aggressive subtype of endometriosis. The diagnosis may be challenging, and no biomarkers that can discriminate women with DE from those without DE have been developed.

AIM

To evaluate the role of blood hemostatic parameters and inflammatory indices in the prediction of DE.

METHODS

This case-control study was performed at the Women's Hospital, Zhejiang University School of Medicine between January 2015 and December 2016. Women with DE and women with benign gynecologic disease (control group) eligible for gynecological surgery were enrolled. Routine plasma hemostatic parameters and inflammatory indices were obtained before surgery. Univariate and multivariate analysis were performed. Receiver operating characteristic (ROC) curves were generated, and areas under the curve (AUC) were calculated to assess the predictive values of the selected parameters.

RESULTS

A total of 126 women were enrolled, including 31 with DE and 95 controls. Plasma fibrinogen (Fg, $P < 0.01$), international normalized ratio ($P < 0.05$), and C-reactive protein levels ($P < 0.01$) were significantly higher in women with DE compared with controls. Plasma hemoglobin (HB) levels ($P < 0.05$) and shortened thrombin time ($P < 0.05$) were significantly lower in women with DE than in controls. Plasma Fg levels [adjusted OR (aOR) 2.12, 95%confidence interval (CI): 1.31-3.75] and plasma HB levels (aOR 0.48, 95%CI: 0.29-0.78) were significantly associated with DE (both $P < 0.05$). ROC analysis showed that the diagnostic value of Fg or HB alone for DE was limited. The AUC of the combination of both

Data sharing statement: Statistical code, and data set available from the corresponding author at (email: huangxiufeng@zju.edu.cn). Participants gave informed consent for data sharing but the presented data are anonymized and risk of identification is low.

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markers as a dual marker index was 0.773 with improved sensitivity (67.7%) and specificity (78.9%) at cutoffs of 3.09 g/L and 126 g/L, respectively.

CONCLUSION
The combination of Fg and HB was a reliable predictor of DE. A larger study is needed to confirm the findings.

Key Words: Deep endometriosis; Diagnosis; Fibrinogen; Hemoglobin; Inflammation

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Core Tip: Deep endometriosis (DE) is the most aggressive subtype of endometriosis. Prompt diagnosis of DE is challenging, and developing new approaches for DE prediction before surgical intervention is of key importance for controlling the disease. Herein, we performed a case-control study to evaluate the role of plasma hemostatic parameters and inflammatory indices in predicting DE. Our results revealed that the combination of fibrinogen and hemoglobin had a good predictive value for DE before surgical intervention.

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INTRODUCTION

Endometriosis, which is characterized by the presence of endometrial glands and stroma at ectopic sites, affects approximately 10% of women of reproductive age. Up to 80% of women with endometriosis suffer from chronic pain, and up to 50% of women suffer from infertility. Endometriosis-related productivity loss and decreased quality of life lead to a heavy economic burden[1]. Endometriosis can be classified as superficial endometriosis (SUP), ovarian endometrioma (OMA), and deep endometriosis (DE)[2]. DE is the most aggressive of the three subtypes that constitute endometriosis. It is defined as an endometriotic lesion penetrating a depth of > 5 mm and showing aggressive behavior[3]. It can affect the uterosacral ligaments, parametrium, bladder, and bowel. Patients with DE usually present with severe pelvic pain and low fertility. The heterogeneity of the disease makes the diagnosis of DE a clinical challenge[4-6] that may be delayed for more than 8 years[7]. Accidental intraoperative diagnosis of DE is also common. DE often requires surgical therapy, and a high incidence of surgical morbidity of DE has been reported[8]. Therefore, developing new approaches for predicting DE before surgery is of crucial importance.

In previous years, symptoms and clinical history, pelvic examination, blood tests, transvaginal ultrasound, and magnetic resonance imaging (MRI) have been proposed for the preoperative prediction of endometriosis[9-13]. However, the clinical presentation of DE tends to vary. Some women experience severe pain, while others remain asymptomatic[10-11]. Pelvic examination results and the accuracy of ultrasound or MRI diagnosis can significantly vary in relation to the location of DE[13], and assessment by vaginal examination or image diagnosis depends on the level of expertise. The benefit of blood test prediction of deep endometriosis would have the advantages of being noninvasive, no exposure to harmful radiation, rapid reporting, and low cost. Several studies have explored the predictive value of blood biomarkers such as serum CA-125 in DE[11-12]. Low sensitivity and specificity reduce the value of serum CA-125 as a single test in the diagnosis of DE. In fact, a reliable noninvasive marker for preoperative diagnosis of this disease has not yet been introduced.

The most widely accepted etiologic mechanism of endometriosis is retrograde menstruation resulting in ectopic implantation of endometrium in the pelvic cavity. The ectopic implanted endometrium can lead to recurrent bleeding, subsequent repeated tissue injury, and inflammation[14]. Endometriosis has also been associated with increased activation of the coagulation system and fibrinolysis system, and

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elevated plasma fibrinogen (Fg) levels, shortened thrombin time (TT), shortened activated partial thromboplastin time (APTT), shortened prothrombin time (PT), and increased expression of urokinase-type plasminogen activator and plasminogen activator inhibitors[15-19]. The data indicate that women with endometriosis might have a potential hypercoagulable state. Additionally, a high concentration of proinflammatory cytokines was reported in women with endometriosis[20-21]. Nevertheless, whether these routine hemostatic parameters and inflammatory indices have any predictive value in terms of preoperative diagnosis of DE has not yet been determined. This study was conducted to assess whether DE could be identified by routine hematological parameters before surgery. The study objectives were to estimate the predictive values of routine hemostatic parameters and inflammatory indices for DE.

MATERIALS AND METHODS

Study subjects

A case-control study was performed at the Women's Hospital, Zhejiang University School of Medicine between January 2015 and December 2016. Approval for this study was obtained from the Institutional Ethics Committee at Women's Hospital School of Medicine, Zhejiang University (IRB-20200049-R). Data were retrospectively retrieved from an electronic database. Inclusion criteria for the DE group were: (1) 18 to 40 years of age[13]; and (2) DE defined as endometriotic lesions that infiltrated the uterosacral ligaments by > 5 mm and muscularis propria (bladder, intestine, ureters). Lesions were confirmed by pathology. Patients with DE who simultaneously had SUP or OMA were also included[2,14]. Exclusion criteria for the DE group were: (1) A history of abnormal uterine bleeding in the previous 3 mo; (2) A history of acute inflammation, suspected infectious disease, malignancy, metabolic diseases, and autoimmune disease in the previous 3 mo; (3) Pregnancy; (4) Hormonal therapy, including oral contraceptives, gonadotropin-releasing hormone analogs, or any other hormonal treatment, antithrombotic and hemostatic agents, and herbal compounds during the previous 3 mo; (5) Medical emergencies; and (6) With non-fasting lipid profiles.

Women between 18 and 40 years of age with surgical treatment at the same time for benign gynecologic diseases, including benign ovarian tumors, tubal infertility, cervical intraepithelial neoplasia, and intrauterine adhesion, but without any evidence of endometriosis, were recruited as controls. Detailed histories, thorough physical examinations of the abdominal-pelvic cavity, and sonography screening were performed by designated experts. The exclusion criteria were the same as for the DE group. Women to be enrolled in the controls with suspected endometriosis presenting dysmenorrhea or tenderness in the pelvic cavity or were also excluded.

During the study period, 698 patients with endometriosis were scheduled for surgery in the general gynecology department. However, 667 women were excluded because they did not meet the selection criteria, 154 who were > 40 years of age, 251 with non-fasted blood collection, 138 with no surgical treatment, with hormonal treatment, or complicated by other diseases, 124 with pathologically proven endometriosis but not DE phenotype. The remaining 170 eligible women without endometriosis were enrolled; 75 cases were excluded, 30 because of suspected endometriosis, 21 with no surgical treatment, and 24 complicated by inflammatory, or metabolic, or autoimmune diseases.

Blood collection and laboratory methods

All participants had routine peripheral blood tests before surgery. Blood samples with ethylenediaminetetraacetic acid (EDTA) as the anticoagulant were used to obtain a complete blood count, platelet count, HB level, neutrophil count, and lymphocyte count with a, autoanalyzer (Beckman, Coulter LH750). Coagulative parameters, including PT, TT, APTT, and Fg were determined with an automatic blood coagulation analyzer (STAGO, Evolution ISTA-R-IV, Germany). The neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), international normalized ratio (INR), platelet distribution width, neutrophil number, lymphocyte number, and mean platelet volume were also calculated. Considering crosstalk between lipid metabolism and coagulation function, serum lipid profiles including total cholesterol, total triglycerides, high-density lipoprotein, and low-density lipoprotein were tested and measured by enzymatic colorimetric assay after an overnight fast of 12 h. C-reactive protein (CRP) levels were simultaneously determined. The blood samples without EDTA were centrifuged at 3500 *g*, and serum supernatants were collected. CRP levels

were assayed in fresh serum using an immunoturbidimetric assay (Abbott, Architect C16000). Intra- and interassay coefficients of variation for all measurements were 5% and 10%, respectively.

Statistical analysis

Continuous data were reported as means ± SD for normally distributed variables, and variables that were not normally distributed were reported as medians and range. Between-group differences of variables with a normal distribution were tested by analysis of variance and Student's *t*-test. For variables with a non-normal distribution, differences were compared with Kruskal–Wallis and Wilcoxon tests. Categorical variables were reported as *n* (%), and the χ^2-square test was used to compare the distribution across different groups. Stepwise logistic regression was used to assess the association of hemostatic profiles with the presence of DE. All indices of interest such as age, body mass index (BMI), history of delivery and abortion, inflammatory indices, and serum lipid profiles that could cause a confounding bias were entered into the initial model as potential risk factors with SLE = 0.05 and SLS = 0.10. The final model was built using all significant variables in the multivariate analysis. Receiver operating characteristic (ROC) curves were constructed, and the area under curves was calculated to determine the predictive power of the independent risk factors. The statistical analysis were conducted with SAS, version 9.4 (SAS Institute, Cary, NC, United States). *P* values < 0.05 were considered statistically significant.

RESULTS

Subject characteristics

A total of 126 women were enrolled in this study, 31 with DE and 95 without DE (Figure 1). The indications for surgery in the DE patients were a pelvic mass, history of infertility, pelvic pain with failed analgesics. DE involved the uterosacral ligament in 26 (83.9%) patients, the colorectal septum in two (6.5%), the ureter in one (3.2%), and the sigmoid in two (6.5%). Adenomyosis was suspected in 13 women with no uterine fibroids on transvaginal ultrasound. The indications for surgery in controls were benign ovarian tumors and tubal infertility (54 cases), cervical intraepithelial neoplasia (28 cases), and intrauterine adhesion (13 cases). Baseline clinical characteristics are shown in Table 1. There were no differences in age, BMI, parity, abortion, and lipid profiles between the study and the control groups.

Differences in hemostatic profiles and inflammatory indices between patients with and without DE

Plasma Fg ($P < 0.01$), INR ($P < 0.05$), and CRP levels ($P < 0.01$) of women with DE were significantly higher than those in controls. Plasma HB levels ($P < 0.05$) and TT ($P < 0.05$) of women with DE were significantly lower than those in controls. Differences between the other hematological parameters in the two groups were not significant (Table 2).

Multivariate analysis of hemostatic parameters and inflammatory indices

Multivariate analysis (Table 3) showed that plasma Fg levels [odds ratio (OR) 1.67, 95%CI: 1.13-2.46], PT (OR 1.63, 95%CI: 1.12-2.38), plasma HB levels (OR 0.63, 95%CI: 0.42-0.92), and TT (OR 0.69, 95%CI: 0.48-0.99) were significantly associated with the presence of DE (all $P < 0.05$). No relationships between the other hematological parameters and the presence of DE were found. APTT, INR, NLR, and PLR were not included in the multivariable logistic models, considering that they overlapped with other parameters.

After adjusting for potentially confounding factors including age, BMI, history of delivery and abortion, and serum lipid profiles, plasma Fg levels [adjusted OR (aOR) 2.12, 95%CI: 1.31-3.75] and plasma HB levels (aOR 0.48, 95%CI: 0.29-0.78) remained significantly associated with the presence of DE (both $P < 0.05$, Table 4). The relationship between PT/TT and DE was no longer significant.

Predictive performance of Fg and HB for DE detection

The predictive performance of Fg and HB for DE was investigated using ROC analysis. The area under the curve (AUC) of Fg was 0.639 (95%CI: 0.524-0.755, sensitivity = 58.1%, specificity = 70.5%), and that of HB was 0.664 (95%CI: 0.552-0.776, sensitivity = 64.5%, specificity = 62.1%) for the diagnosis of DE. The AUC of the combination of

Table 1 Baseline clinical characteristics and serum lipid profiles of participants

Variable	Control group (*n* = 95)	DE (*n* = 31)	*P* value
Age (yr), mean ± SD	31.57 ± 5.03	32.10 ± 5.13	0.61
BMI (kg/m^2), mean ± SD	21.37 ± 2.67	20.36 ± 2.17	0.06
Parity, *n* (%)			0.41
0	35 (71.43)	14 (28.57)	
≥ 1	60 (77.92)	17 (22.08)	
Abortion, *n* (%)			0.90
0	50 (75.76)	16 (24.24)	
1	18 (72.00)	7 (28.00)	
≥ 2	27 (77.14)	8 (22.86)	
TG (mmol/L), median (Q1-Q3)	0.80 (0.64-1.12)	0.81 (0.57-0.99)	0.33
TC (mmol/L), median (Q1-Q3)	4.27 (3.80-4.82)	4.09 (3.80-4.77)	0.80
HDL (mmol/L), median (Q1-Q3)	1.32 (1.14-1.59)	1.39 (1.19-1.55)	0.70
LDL (mmol/L), median (Q1-Q3)	2.16 (1.83-2.60)	2.16 (1.81-2.69)	0.98

Data are mean ± SD for normally distributed variables, medians (Q1-Q3) for variables without a normal distribution, and *n* (%) for categories variables. BMI: Body mass index, DE: Deep endometriosis; HDL: High-density lipoprotein; LDL: Low-density lipoprotein; TC: Total cholesterol; TG: Total triglycerides.

Table 2 Hemostatic parameters and inflammation indices of participants with or without deep endometriosis

Variable	Controls (*n* = 95)	DE (*n* = 31)	*P* value
PT (s)	12.91 ± 0.61	13.11 ± 0.59	0.11
INR	1.01 (0.98-1.04)	1.05 (1.00-1.07)	0.03
APTT (s)	36.11 ± 3.16	36.84 ± 3.18	0.27
TT (s)	15.56 ± 0.61	15.29 ± 0.56	0.03
Fg (g/L)	2.83 (2.53-3.14)	3.09 (2.73-3.97)	0.01
PLT (10^9/L)	228.00 (185.00-258.00)	235.00 (212.00-262.00)	0.32
HB (g/L)	130.00 (124.00-136.00)	126.00 (115.00-130.00)	0.02
WN (10^9/L)	3.90 (3.00-4.80)	3.30 (2.80-4.10)	0.27
WL (10^9/L)	1.65 (1.30-2.00)	1.60 (1.30-1.80)	0.34
MPV (fL)	8.60 (7.90-9.70)	8.40 (7.80-8.90)	0.23
PCT (%)	0.19 (0.17-0.22)	0.20 (0.18-0.23)	0.21
NLR	2.16 (1.59-3.20)	2.31 (1.58-2.78)	0.86
PLR	130.00 (108.82-180.00)	154.71 (128.95-179.09)	0.08
CRP (mg/L)	12.91 ± 0.61	13.11 ± 0.59	0.01

Data are mean ± SD for normally distributed variables and medians (Q1-Q3) for abnormal variables without a normal distribution. APTT: Activated partial thromboplastin time; CRP: C-reactive protein Fg: Fibrinogen; HB: Hemoglobin; INR: International standardized ratio; MPV: Mean platelet volume; NLR: Neutrophil-to-lymphocyte ratio; PCT: Platelet distribution width; PLR: Platelet-to-lymphocyte ratio; PLT: Platelet count; PT: Prothrombin time; TT: Thrombin time; WL: Lymphocyte number; WN: Neutrophil number.

both markers was 0.773 with improved sensitivity (67.7%) and specificity (78.9%) at a cutoff of 3.09 (g/L) and 126 (g/L), respectively (Table 4, Figure 2). The combination of both markers as a dual marker index significantly improved the diagnostic accuracy.

Table 3 Unadjusted association of hemostatic parameters and inflammation indices with deep endometriosis by logistical regression

Variables	β (SE)	*P* value	OR (95%CI)
PT	0.49 (0.19)	0.01	1.63 (1.12, 2.38)
Fg	0.51 (0.20)	0.01	1.67 (1.13, 2.46)
TT	−0.38 (0.19)	0.04	0.69 (0.48, 0.99)
PLT	0.23 (0.19)	0.24	1.26 (0.86, 1.83)
HB	−0.47 (0.20)	0.02	0.63 (0.42, 0.92)
WN	−0.22 (0.19)	0.25	0.81 (0.56, 1.16)
WL	−0.17 (0.19)	0.37	0.85 (0.59, 1.22)
MPV	−0.22 (0.18)	0.24	0.81 (0.56, 1.15)
PCT	0.24 (0.18)	0.18	1.27 (0.89, 1.8)
CRP	−0.19 (0.20)	0.34	0.82 (0.55, 1.22)

CI: Confidence interval; CRP: C-reactive protein; Fg: Fibrinogen; HB: Hemoglobin; MPV: Mean platelet volume; OR: Odds ratio; PCT: Platelet distribution width; PLT: Platelet count; PT: Prothrombin time; SE: Standard error; TT: Thrombin time; WL: Lymphocyte number; WN: Neutrophil number.

Table 4 Stepwise logistical regression analysis and receiver operating characteristic analysis for deep endometriosis, hemostatic parameters, and inflammatory indices

Variable	OR (95%CI)	Sensitivity	Specificity	AUC (95%CI)	Cutoff value
Fg	2.12 (1.31, 3.75)[a]	0.581	0.705	0.639 (0.524, 0.755)[a]	3.04
HB	0.48 (0.29, 0.78)[a]	0.645	0.621	0.664 (0.552, 0.776)[a]	128
Fg + HB	-	0.677	0.789	0.773 (0.677, 0.868)[a]	3.09 + 126

[a]*P* < 0.05. Age, BMI, history of delivery and abortion, and serum lipid profiles were entered into the stepwise regression model with SLE = 0.05, SLS = 0.10. AUC: Area under the curve; CI: Confidence interval; Fg: Fibrinogen; HB: Hemoglobin; OR: Odds ratio.

DISCUSSION

This study examined the predictive values of hemostatic parameters and inflammatory indices for DE. Our data suggest that the combination of Fg and HB levels could be used as a reliable predictor of DE. To the best of our knowledge, this is the first report that evaluated hemostatic parameters and inflammatory indices for the prediction of DE. Fg is a known coagulation factor associated with hypercoagulation. As an acute-phase reaction and a hemostatic parameter, Fg has an important role in coagulation, inflammation, and the maintenance of hemostasis[22-23]. Fg is also a marker of inflammation and a major determinant of thrombosis and hemorheology[24]. In this study, we found elevated Fg levels in DE patients, which is consistent with previous findings [15-16].

Increasing evidence shows that pathophysiological changes in endometriosis have features in common with those observed during tissue injury and repair (TIAR)[3,25-26]. TIAR process may contribute to the development of endometriosis. The coagulation and fibrinolytic systems have important roles in TIAR[27]. An increase in plasma Fg is more likely caused by recurrent bleeding in the ectopic implantation of the endometrium and the impairment of the fibrinolytic system in endometriosis. Elevated Fg levels may reflect hemorheological disorders, a potential hypercoagulable status, and subclinical systemic inflammation in endometriosis.

In this study, a shortened TT was found in women with DE, which is in line with previous studies[16-17]. TT reflects anticoagulation, and a shortened TT indicates hypo-fibrinolysis. In this study, an inverse relationship between TT and DE was initially detected by multivariate analysis. After adjusting for confounding factors, the association was no longer significant. Moreover, no differences in APTT and TT were found between the DE and the control groups.

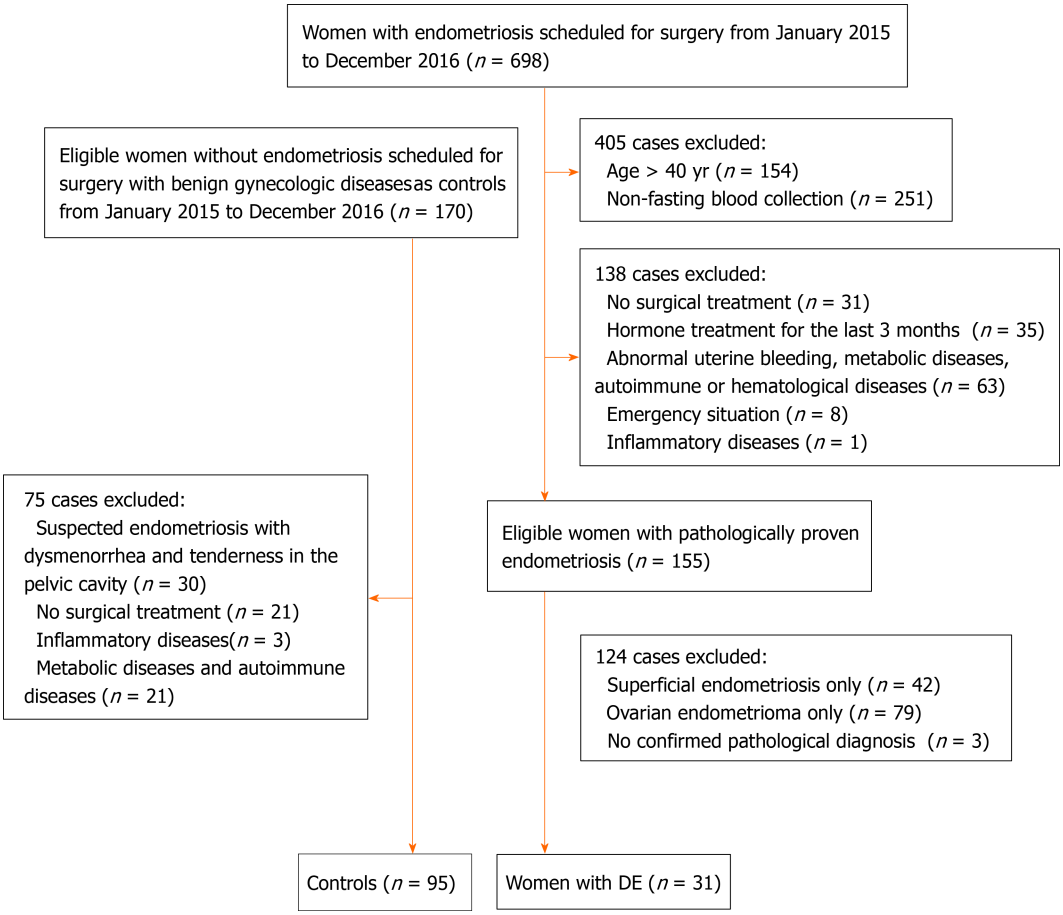

Figure 1 Flowchart of enrollment. DE: Deep endometriosis.

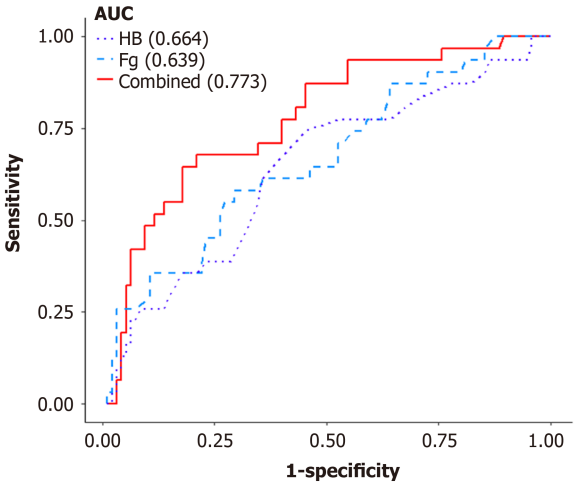

Figure 2 Receiver operating characteristic curves for fibrinogen and hemoglobin alone or their combination in the diagnosis of deep endometriosis. AUC: Area under the curve; Fg: Fibrinogen; HB: Hemoglobin.

Decreased plasma HB levels were identified in women with DE in this study, which is in line with the findings in women with OMA[28-29]. Moreover, our results revealed an inverse relationship between plasma HB levels and the presence of DE. An inverse association between severity of endometriosis and plasma HB levels was reported in another study[30]. The exact cause of low plasma HB levels in patients with endometriosis is not clear. It may be associated with erythrocyte regulation of iron metabolism disorders or chronic systemic inflammation[31-32]. Low plasma HB levels may be associated with hypoxia, which has been reported to facilitating endometriosis development[33]. Further studies are required to investigate how HB contributes to

the development of DE.

Serum CA-125 antigen is the most frequently used biomarker in the diagnosis of endometriosis in clinic practice[11,34-35]. Santulli *et al*[36] reported that serum CA-125 antigen was significantly associated with the severity and the penetration depth of DE; but it is not widely used in the diagnosis of DE. In this study, we found that either plasma Fg levels alone or plasma HB levels were not powerful enough to predict DE. A good predictive value for DE was obtained when plasma Fg levels were combined with HB levels. The AUC of the combination was 0.773, and the specificity was 78.9% at cutoffs of 3.09 g/L and 126 g/L. Ding *et al*[37] investigated the predictive role of Fg for endometriosis and found that the combination of Fg and serum CA-125 had good predictive power for OMA. They showed that Fg had potential predictive value for endometriosis, which is consistent with our results. Our model for predicting DE with the use of plasma Fg and HB may have clinical implications. Using this model, patients suspected of DE should undergo a thorough preoperative assessment through pelvic examination and pelvic imaging to detect DE nodules. Nonetheless, further studies for optimized predictive tools for DE are warranted.

Endometriosis is associated with an inflammatory response. In this study, increased CRP levels were found in the DE group, and there the difference in NLR between women with or without DE was not significant. The results of the value of inflammatory indices such as CRP and NLR in endometriosis in previous studies are not consistent[29,37-38]. This inconsistency may be associated with a different course, subtypes, and sample sizes used in those studies. In this study, multivariate analysis did not identify any association between CRP and NLR and the presence of DE.

Low HB levels could be caused by other bleeding disorders such as adenomyosis and uterine fibroids. In this study, 13 patients in the DE group had suspected adenomyosis with no uterine fibroids. Nonetheless, they did not complain of abnormal menstrual bleeding, and the HB levels were still within the normal range. Thus, the decreased HB levels of the DE group could not be attributed to concomitant adenomyosis. In addition, the coexistence of adenomyosis and endometriosis is well known[39]. We could not exclude the women with both DE and adenomyosis from the DE group in this study.

Our study has several limitations. First, the size of the DE group was relatively small. The low incidence of DE and strict criteria imposed in this study limited the enrollment. Additionally, this is the first study that evaluated the predictive role of hemostatic parameters for DE, and one of the aims of this study was to inspire future larger investigations. Second, as we did not include cases with only SUP or OMA subtypes, the results may not be applicable for all patients with endometriosis. Finally, there was no ideal control group for studying plasma Fg levels in DE. Our control group consisted of women with surgery for benign gynecological conditions, which permitted a thorough assessment of DE. However, some of the conditions, such as tubal infertility or ovarian cysts, might be associated with altered plasma levels.

In addition to the limitations, the following strengths should also be pointed out. First, the results of Fg/HB and the presence of DE were consistent in both univariate and multivariate analysis. Second, we for adjusted those confounding factors to eliminate possible effects on coagulation function and inflammatory response, which could make the predictive value of Fg and HB more reliable. In addition, these effects were not investigated in the previous relevant studies on endometriosis.

The study findings support the routine combination of Fg and HB as an essential part of the preoperative assessment of patients with suspected DE. The model can be adopted for use in clinical practice. Furthermore, this study suggests that an altered coagulation system may have key involvement in the development of endometriosis. The results also suggested that patients with DE may have a potential hypercoagulable state. Further studies are required to determine the anticoagulant therapy for these patients.

CONCLUSION

A combination of Fg and HB could be used in routine clinical practice as a reliable predictor of DE before surgical intervention. Future studies with larger samples are needed to verify the findings and to investigate how Fg and HB contribute to the development of endometriosis, particularly DE.

ARTICLE HIGHLIGHTS

Research background

Deep endometriosis (DE) is the most aggressive subtype of the disease. The diagnosis of DE is challenging. No biomarkers have been identified for discriminating women with DE from those without DE.

Research motivation

Developing new approaches for predicting DE before surgery is of crucial importance. It is unclear whether DE could be identified by routine hematological evaluation before surgery.

Research objectives

To evaluate the role of blood hemostatic parameters and inflammatory indices in the prediction of DE before surgical intervention.

Research methods

A case-control study investigated the value of routine plasma hemostatic parameters and inflammatory indices in women with DE and without endometriosis. Univariate analysis and multivariate analysis following adjustment for potential confounding factors were performed. Receiver operating characteristic curves were generated, and the areas under the curve was calculated to assess the predictive values of the selected parameters.

Research results

Elevated plasma fibrinogen (Fg) and decreased hemoglobin (HB) levels were found in women with DE compared with controls. Plasma Fg and HB levels were significantly associated with DE after adjusting for potential confounding factors. The diagnostic value of Fg or HB alone for DE detection before surgical intervention was limited, but the combination of Fg and HB had good predictive value for DE.

Research conclusions

It suggested that the combination of Fg and HB levels could be used as a reliable predictor of DE. Based on the model, a thorough assessment is recommended for suspected patients with DE.

Research perspectives

Further studies are required to investigate how Fg and HB contribute to the development of endometriosis, particularly DE.

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REFERENCES

1 **Simoens S**, Dunselman G, Dirksen C, Hummelshoj L, Bokor A, Brandes I, Brodszky V, Canis M, Colombo GL, DeLeire T, Falcone T, Graham B, Halis G, Horne A, Kanj O, Kjer JJ, Kristensen J, Lebovic D, Mueller M, Vigano P, Wullschleger M, D'Hooghe T. The burden of endometriosis: costs and quality of life of women with endometriosis and treated in referral centres. *Hum Reprod* 2012; **27**: 1292-1299 [PMID: 22422778 DOI: 10.1093/humrep/des073]

2 **Johnson NP**, Hummelshoj L, Adamson GD, Keckstein J, Taylor HS, Abrao MS, Bush D, Kiesel L, Tamimi R, Sharpe-Timms KL, Rombauts L, Giudice LC; World Endometriosis Society Sao Paulo Consortium. World Endometriosis Society consensus on the classification of endometriosis. *Hum Reprod* 2017; **32**: 315-324 [PMID: 27920089 DOI: 10.1093/humrep/dew293]

3 **Gordts S**, Koninckx P, Brosens I. Pathogenesis of deep endometriosis. *Fertil Steril* 2017; **108**: 872-885.e1 [PMID: 29100623 DOI: 10.1016/j.fertnstert.2017.08.036]

4 **Agarwal SK**, Chapron C, Giudice LC, Laufer MR, Leyland N, Missmer SA, Singh SS, Taylor HS. Clinical diagnosis of endometriosis: a call to action. *Am J Obstet Gynecol* 2019; **220**: 354.e1-354.e12 [PMID: 30625295 DOI: 10.1016/j.ajog.2018.12.039]

5 **Abrão MS**, Petraglia F, Falcone T, Keckstein J, Osuga Y, Chapron C. Deep endometriosis infiltrating the recto-sigmoid: critical factors to consider before management. *Hum Reprod Update* 2015; **21**: 329-339 [PMID: 25618908 DOI: 10.1093/humupd/dmv003]

6 **Poupon C**, Owen C, Arfi A, Cohen J, Bendifallah S, Daraï E. Nomogram predicting the likelihood of complications after surgery for deep endometriosis without bowel involvement. *Eur J Obstet Gynecol Reprod Biol X* 2019; **3**: 100028 [PMID: 31403118 DOI: 10.1016/j.eurox.2019.100028]

7 **Ghai V**, Jan H, Shakir F, Haines P, Kent A. Diagnostic delay for superficial and deep endometriosis in the United Kingdom. *J Obstet Gynaecol* 2020; **40**: 83-89 [PMID: 31328629 DOI: 10.1080/01443615.2019.1603217]

8 **Roman H**, Bubenheim M, Huet E, Bridoux V, Zacharopoulou C, Daraï E, Collinet P, Tuech JJ. Conservative surgery *vs* colorectal resection in deep endometriosis infiltrating the rectum: a randomized trial. *Hum Reprod* 2018; **33**: 47-57 [PMID: 29194531 DOI: 10.1093/humrep/dex336]

9 **Bazot M**, Daraï E. Diagnosis of deep endometriosis: clinical examination, ultrasonography, magnetic resonance imaging, and other techniques. *Fertil Steril* 2017; **108**: 886-894 [PMID: 29202963 DOI: 10.1016/j.fertnstert.2017.10.026]

10 **Nnoaham KE**, Hummelshoj L, Kennedy SH, Jenkinson C, Zondervan KT; World Endometriosis Research Foundation Women's Health Symptom Survey Consortium. Developing symptom-based predictive models of endometriosis as a clinical screening tool: results from a multicenter study. *Fertil Steril* 2012; **98**: 692-701.e5 [PMID: 22657249 DOI: 10.1016/j.fertnstert.2012.04.022]

11 **Nisenblat V**, Bossuyt PM, Shaikh R, Farquhar C, Jordan V, Scheffers CS, Mol BW, Johnson N, Hull ML. Blood biomarkers for the non-invasive diagnosis of endometriosis. *Cochrane Database Syst Rev* 2016; CD012179 [PMID: 27132058 DOI: 10.1002/14651858.CD012179]

12 **Oliveira MAP**, Raymundo TS, Soares LC, Pereira TRD, Demôro AVE. How to Use CA-125 More Effectively in the Diagnosis of Deep Endometriosis. *Biomed Res Int* 2017; **2017**: 9857196 [PMID: 28660213 DOI: 10.1155/2017/9857196]

13 **Guerriero S**, Ajossa S, Minguez JA, Jurado M, Mais V, Melis GB, Alcazar JL. Accuracy of transvaginal ultrasound for diagnosis of deep endometriosis in uterosacral ligaments, rectovaginal septum, vagina and bladder: systematic review and meta-analysis. *Ultrasound Obstet Gynecol* 2015; **46**: 534-545 [PMID: 26250349 DOI: 10.1002/uog.15667]

14 **Laux-Biehlmann A**, d'Hooghe T, Zollner TM. Menstruation pulls the trigger for inflammation and pain in endometriosis. *Trends Pharmacol Sci* 2015; **36**: 270-276 [PMID: 25899467 DOI: 10.1016/j.tips.2015.03.004]

15 **Wu Q**, Ding D, Liu X, Guo SW. Evidence for a Hypercoagulable State in Women With Ovarian Endometriomas. *Reprod Sci* 2015; **22**: 1107-1114 [PMID: 25701841 DOI: 10.1177/1933719115572478]

16 **Ding D**, Liu X, Guo SW. Further Evidence for Hypercoagulability in Women With Ovarian Endometriomas. *Reprod Sci* 2018; **25**: 1540-1548 [PMID: 30244655 DOI: 10.1177/1933719118799195]

17 **Viganò P**, Ottolina J, Sarais V, Rebonato G, Somigliana E, Candiani M. Coagulation Status in Women With Endometriosis. *Reprod Sci* 2018; **25**: 559-565 [PMID: 28681683 DOI: 10.1177/1933719117718273]

18 **Alotaibi FT**, Peng B, Klausen C, Lee AF, Abdelkareem AO, Orr NL, Noga H, Bedaiwy MA, Yong PJ. Plasminogen activator inhibitor-1 (PAI-1) expression in endometriosis. *PLoS One* 2019; **14**: e0219064 [PMID: 31315131 DOI: 10.1371/journal.pone.0219064]

19 **Braza-Boïls A**, Marí-Alexandre J, Gilabert J, Sánchez-Izquierdo D, España F, Estellés A, Gilabert-Estellés J. MicroRNA expression profile in endometriosis: its relation to angiogenesis and fibrinolytic factors. *Hum Reprod* 2014; **29**: 978-988 [PMID: 24608518 DOI: 10.1093/humrep/deu019]

20 **García-Gómez E**, Vázquez-Martínez ER, Reyes-Mayoral C, Cruz-Orozco OP, Camacho-Arroyo I, Cerbón M. Regulation of Inflammation Pathways and Inflammasome by Sex Steroid Hormones in Endometriosis. *Front Endocrinol (Lausanne)* 2019; **10**: 935 [PMID: 32063886 DOI: 10.3389/fendo.2019.00935]

21 **Zhou J**, Chern BSM, Barton-Smith P, Phoon JWL, Tan TY, Viardot-Foucault V, Ku CW, Tan HH, Chan JKY, Lee YH. Peritoneal Fluid Cytokines Reveal New Insights of Endometriosis Subphenotypes. *Int J Mol Sci* 2020; **21** [PMID: 32429215 DOI: 10.3390/ijms21103515]

22 **Vilar R**, Fish RJ, Casini A, Neerman-Arbez M. Fibrin(ogen) in human disease: both friend and foe. *Haematologica* 2020; **105**: 284-296 [PMID: 31949010 DOI: 10.3324/haematol.2019.236901]

23 **Olumuyiwa-Akeredolu OO**, Page MJ, Soma P, Pretorius E. Platelets: emerging facilitators of cellular crosstalk in rheumatoid arthritis. *Nat Rev Rheumatol* 2019; **15**: 237-248 [PMID: 30824879 DOI: 10.1038/s41584-019-0187-9]

24 **Luyendyk JP**, Schoenecker JG, Flick MJ. The multifaceted role of fibrinogen in tissue injury and inflammation. *Blood* 2019; **133**: 511-520 [PMID: 30523120 DOI: 10.1182/blood-2018-07-818211]

25 **Leyendecker G**, Wildt L, Mall G. The pathophysiology of endometriosis and adenomyosis: tissue injury and repair. *Arch Gynecol Obstet* 2009; **280**: 529-538 [PMID: 19644696 DOI: 10.1007/s00404-009-1191-0]

26 **Capobianco A**, Cottone L, Monno A, Manfredi AA, Rovere-Querini P. The peritoneum: healing, immunity, and diseases. *J Pathol* 2017; **243**: 137-147 [PMID: 28722107 DOI: 10.1002/path.4942]

27 **Opneja A**, Kapoor S, Stavrou EX. Contribution of platelets, the coagulation and fibrinolytic systems to cutaneous wound healing. *Thromb Res* 2019; **179**: 56-63 [PMID: 31078121 DOI: 10.1016/j.thromres.2019.05.001]

28 **Moini A**, Ghanaat M, Hosseini R, Rastad H, Hosseini L. Evaluating hematological parameters in women with endometriosis. *J Obstet Gynaecol* 2021; 1-6 [PMID: 33459084 DOI: 10.1080/01443615.2020.1845634]

29 **Tokmak A**, Yildirim G, Öztaş E, Akar S, Erkenekli K, Gülşen P, Yilmaz N, Uğur M. Use of Neutrophil-to-Lymphocyte Ratio Combined With CA-125 to Distinguish Endometriomas From Other Benign Ovarian Cysts. *Reprod Sci* 2016; **23**: 795-802 [PMID: 26692541 DOI: 10.1177/1933719115620494]

30 **Kim SK**, Park JY, Jee BC, Suh CS, Kim SH. Association of the neutrophil-to-lymphocyte ratio and CA 125 with the endometriosis score. *Clin Exp Reprod Med* 2014; **41**: 151-157 [PMID: 25599037 DOI: 10.5653/cerm.2014.41.4.151]

31 **Defrère S**, González-Ramos R, Lousse JC, Colette S, Donnez O, Donnez J, Van Langendonckt A. Insights into iron and nuclear factor-kappa B (NF-kappaB) involvement in chronic inflammatory processes in peritoneal endometriosis. *Histol Histopathol* 2011; **26**: 1083-1092 [PMID: 21692040 DOI: 10.14670/HH-26.1083]

32 **González-Ramos R**, Defrère S, Devoto L. Nuclear factor-kappaB: a main regulator of inflammation and cell survival in endometriosis pathophysiology. *Fertil Steril* 2012; **98**: 520-528 [PMID: 22771029 DOI: 10.1016/j.fertnstert.2012.06.021]

33 **Wu MH**, Hsiao KY, Tsai SJ. Hypoxia: The force of endometriosis. *J Obstet Gynaecol Res* 2019; **45**: 532-541 [PMID: 30618168 DOI: 10.1111/jog.13900]

34 **O DF**, Fassbender A, Van Bree R, Laenen A, Peterse DP, Vanhie A, Waelkens E, D'Hooghe TM. Technical Verification and Assessment of Independent Validation of Biomarker Models for Endometriosis. *Biomed Res Int* 2019; **2019**: 3673060 [PMID: 31428634 DOI: 10.1155/2019/3673060]

35 **Baggio S**, Zecchin A, Pomini P, Zanconato G, Genna M, Motton M, Montemezzi S, Franchi M. The Role of Computed Tomography Colonography in Detecting Bowel Involvement in Women With Deep Infiltrating Endometriosis: Comparison With Clinical History, Serum Ca125, and Transvaginal Sonography. *J Comput Assist Tomogr* 2016; **40**: 886-891 [PMID: 27841773 DOI: 10.1097/RCT.0000000000000447]

36 **Santulli P**, Streuli I, Melonio I, Marcellin L, M'Baye M, Bititi A, Borghese B, Lafay Pillet MC, Chapron C. Increased serum cancer antigen-125 is a marker for severity of deep endometriosis. *J Minim Invasive Gynecol* 2015; **22**: 275-284 [PMID: 25446542 DOI: 10.1016/j.jmig.2014.10.013]

37 **Ding S**, Lin Q, Zhu T, Li T, Zhu L, Wang J, Zhang X. Is there a correlation between inflammatory markers and coagulation parameters in women with advanced ovarian endometriosis? *BMC Womens Health* 2019; **19**: 169 [PMID: 31888633 DOI: 10.1186/s12905-019-0860-9]

38 **Thubert T**, Santulli P, Marcellin L, Menard S, M'Baye M, Streuli I, Borghese B, de Ziegler D, Chapron C. Measurement of hs-CRP is irrelevant to diagnose and stage endometriosis: prospective study of 834 patients. *Am J Obstet Gynecol* 2014; **210**: 533.e1-533.e10 [PMID: 24440563 DOI: 10.1016/j.ajog.2014.01.022]

39 **Maruyama S**, Imanaka S, Nagayasu M, Kimura M, Kobayashi H. Relationship between adenomyosis and endometriosis; Different phenotypes of a single disease? *Eur J Obstet Gynecol Reprod Biol* 2020; **253**: 191-197 [PMID: 32877772 DOI: 10.1016/j.ejogrb.2020.08.019]

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