A combined ultrasound and clinical scoring model for the prediction of peripartum complications in pregnancies complicated by placenta previa

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ABSTRACT

Objectives: To generate a combined ultrasound and clinical model predictive for peripartum complications in pregnancies complicated by placenta previa.
Study design: This study included 110 singleton pregnant women with placenta previa delivered by cesarean section (CS) from July 2011 to November 2013. We prospectively collected ultrasound and clinical data before CS and observed the occurrence of blood transfusion, uterine artery embolization and cesarean hysterectomy. We formulated a scoring model including type of previa (0: partials, 2: totalis), lacunae (0: none, 1: 1–3, 2: 4–6, 3: whole), uteroplacental hypervascularity (0: normal, 1: moderate, 2: severe), multiparity (0: no, 1: yes), history of CS (0: none, 1: once, 2: $\geq$ twice) and history of placenta previa (0: no, 1: yes) to predict the risk of peripartum complications.
Results: In our study population, the risk of perioperative transfusion, uterine artery embolization, and cesarean hysterectomy were 26.4, 1.8 and 6.4%, respectively. The type of previa, lacunae, uteroplacental hypervascularity, parity, history of CS, and history of placenta previa were associated with complications in univariable analysis. However, no factor was independently predictive for any complication in exact logistic regression analysis. Using the scoring model, we found that total score significantly correlated with perioperative transfusion, cesarean hysterectomy and composite complication ($p < 0.0001$, Cochrane Armitage test). Notably, all patients with total score $\geq$7 needed cesarean hysterectomy. When total score was $\geq$6, three fourths of patients needed blood transfusion.
Conclusions: This combined scoring model may provide useful information for prediction of peripartum complications in women with placenta previa.

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Introduction

Placenta previa is one of the leading causes of peripartum bleeding. It may cause serious maternal morbidity including massive blood transfusion and cesarean hysterectomy and is even associated with maternal mortality [1]. The risk factors associated with placenta previa are well known as advanced maternal age, increasing parity, prior previa, and prior cesarean section (CS) [2,3]. The incidence of placenta previa is increasing worldwide along with the increase in CS rate [4]. It was noted that advance maternal

age was also contributed to the increase of placental accreta in the United States [5]. In South Korea, maternal age of primigravida steadily increased during the last decades [6] and advanced maternal age seems to substantially contribute to the increased incidence of placenta previa despite the rate of repeated CS decreased [7].

There are several studies reporting ultrasound findings of placenta previa that can predict adherent placenta, which frequently necessitates cesarean hysterectomy due to profuse uterine bleeding [8,9]. These findings include placental lacunae, lack of echolucent area between uterus and placenta, and interruption of bladder wall–uterine interface [10,11]. However, it is also known that CS in placenta previa can be accompanied by profuse uterine bleeding regardless of the presence of adherent placenta [12]. On the contrary, it was reported that ultrasound findings such as placenta lacunae and lack of clear zone are

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frequently observed in placenta previa even without placenta accreta [13]. Therefore, it would be more clinically useful to find out morbid ultrasound findings based on clinical outcomes such as transfusion, uterine artery embolization, and cesarean hysterectomy rather than adherent placenta only. Moreover, maternal clinical factors such as the history of prior CS are fairly valuable predictors of peripartum complications in women with placenta previa. In fact, we and others previously presented the calculated risk of peripartum hysterectomy based on clinical factors including parity, prior history of abortion, and prior history of CS [14,15].

With this background, we planned this study to generate a combined ultrasound and clinical model for the prediction of peripartum complications such as transfusion, uterine artery embolization and cesarean hysterectomy in pregnancies complicated by placenta previa.

Materials and methods

This study analyzed pregnancy outcomes and peripartum complications of 110 singleton pregnant women with placenta previa delivered by CS from July 2011 to November 2013 in our institute. We prospectively collected ultrasound and clinical data of all pregnant women with placenta previa before delivery and observed for the occurrence of peripartum complications including perioperative blood transfusion, uterine artery embolization, cesarean hysterectomy and composite complication (any one of these 3 complications).

The diagnosis of placenta previa was made based on the transvaginal ultrasound performed during the late second and third trimesters of pregnancy. The diagnosis of total and partial placenta previa were made when the internal cervical os was completely or partially covered by the placenta, respectively.

During ultrasound examination, the location and type of previa, lacunae, echolucent area between uterus and placenta, bladder wall–uterine interface and uteroplacental hypervascularity on color Doppler were examined within 2 weeks of CS. The type of placenta was classified as placenta partialis and totalis. The position of placenta was classified as posterior, lateral and anterior. Lacunae within placenta were classified into four grades (from grade 0 to 3) according to previous criteria [16,17] (Fig. 1 A–D). We also evaluated echolucent area between uterus and placenta (intact, absent) [10] (Fig. 1 E and F) and bladder wall–uterine interface (intact, interrupted) [9,10] (Fig. 1 G–H). The vascularity of placenta on color Doppler was classified as normal, moderately increased intraplacental vascularity and severe uteroplacental hypervascularity [18] (Fig. 1 I–K). All ultrasound examinations were done by one of the authors and the specific findings were blinded to operating surgeons.

Clinical factors were classified as follows; age (<35 years, ≥35 years), multiparity (no, yes), history of abortion (no, yes), history of placenta previa (no, yes) and history of CS (0, once, ≥ twice), history of antepartum bleeding (no, yes).

The primary outcome of this study was the occurrence of peripartum complications including blood transfusion, uterine artery embolization and cesarean hysterectomy. Blood transfusion was determined by attending anesthesiologist during CS when there was clinical evidence of inadequate oxygen-carrying capacity or ongoing profuse blood loss. Uterine artery embolization was performed to control moderate uterine bleeding immediately after CS when the vital status of the patient was stable. Cesarean hysterectomy was performed when the vital status of patient was
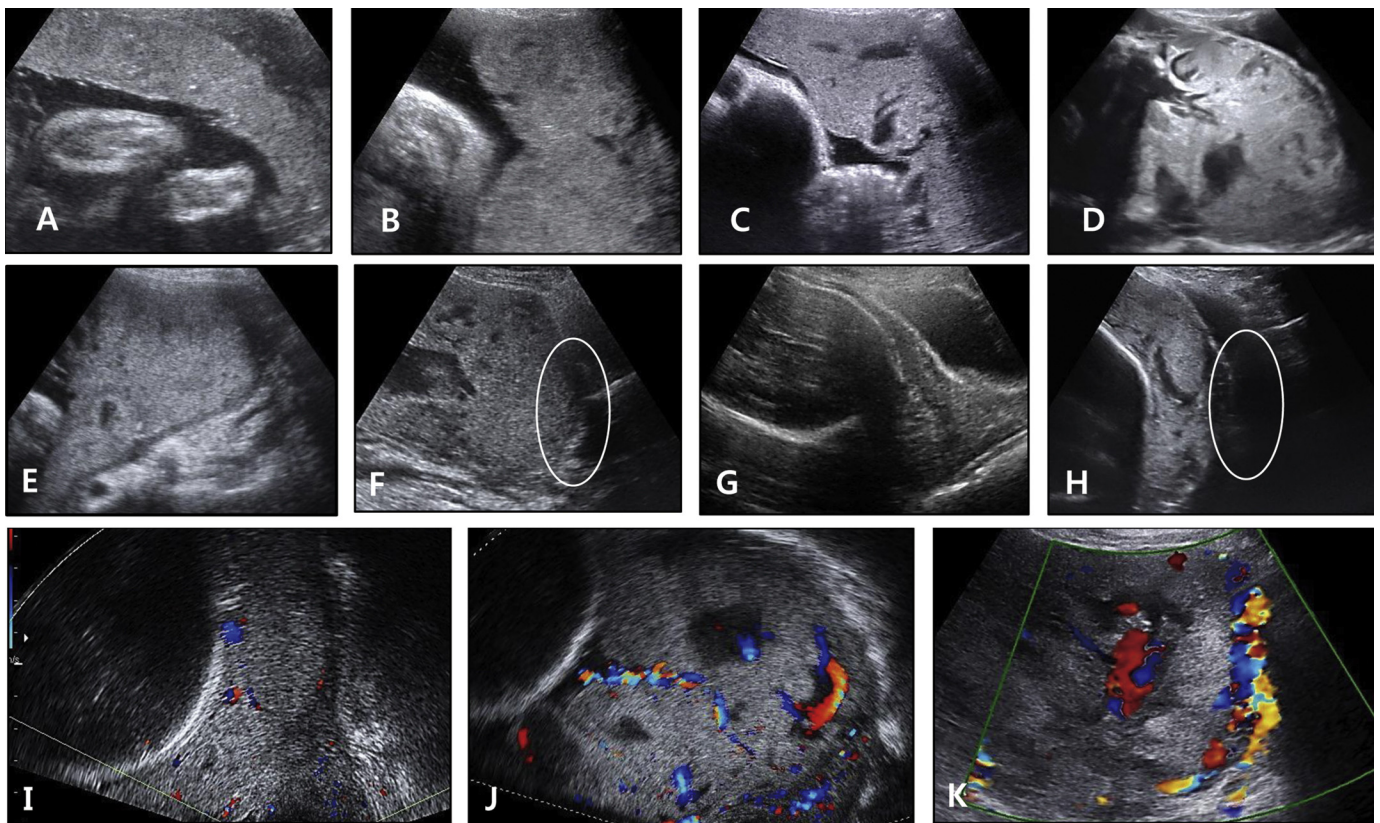

Fig. 1. Classification of ultrasound findings. Lacunae within placenta were classified from Grade 0 to Grade 3 (A–D). Echolucent area between uterus and placenta was classified as intact or absent (E, F) and bladder wall–uterine interface was classified as intact or interrupted (G, H). The vascularity of placenta on color Doppler was classified as normal, moderately increased intraplacental vascularity and severe uteroplacental hypervascularity (I–L).