Pre-anaesthetic assessment of coagulation abnormalities in obstetric patients: usefulness, timing and clinical implications

L. SIMON, T. M. SANTI, P. SACQUIN AND J. HAMZA

Summary
The usefulness and optimal timing of laboratory coagulation tests before obstetric extradural analgesia are controversial. Moreover, the significance of mild coagulation abnormalities during pregnancy remains unclear. We have assessed the reliability of coagulation tests performed several weeks before delivery as predictors of coagulation abnormalities during labour. Platelet count, plasma fibrinogen concentration, prothrombin time (PT) and activated partial thromboplastin time (aPTT) were sampled in 797 women during the ninth month of pregnancy and checked during labour. Platelet count was less than 100 x 10^9 litre^{-1} for 11 women during labour. Only three had been detected by the first sample. Platelet count less than 100 x 10^9 litre^{-1} or fibrinogen concentration less than 2.9 g litre^{-1} during labour were associated with an increase in the incidence of postpartum haemorrhage (odds ratio = 19.7). We conclude that a platelet count several weeks before delivery was not reliable in predicting thrombocytopenia during labour and that women with mild coagulation abnormalities in early labour may need special attention regarding the risk of postpartum haemorrhage, (Br. J. Anaesth. 1997; 78: 678–683).

Key words

In a recent survey of 435 French obstetric units,1 most anaesthetists advocated laboratory coagulation tests before extradural analgesia for labour. In this study, coagulation tests were performed during the ninth month of pregnancy in 74% of obstetric units surveyed. They included prothrombin time (PT), activated partial thromboplastin time (aPTT) and platelet count in almost all cases- Although haemostasis disorders seem to increase the risk of extradural haematoma,2 the usefulness of laboratory coagulation screening tests is still debatable.3 However, platelet count can decrease during pregnancy4 and the incidence of thrombocytopenia has been shown to increase during labour.5 The significance of this thrombocytopenia remains unclear and determination of a safe lower platelet count limit before performing extradural analgesia is still controversial. Many anaesthetists avoid extradural analgesia if platelet count is less than 100 x 10^9 litre^{-1},6-8 but this limit has no supporting data.9 Another difficulty in coagulation assessment is the choice of when to perform it. Haemostasis disorders can appear late in pregnancy. Therefore, a medical history, physical examination and laboratory testing may be inadequate in detecting these haemostasis disorders if they are performed too early.10 In addition, no relationship between mild coagulation abnormalities during pregnancy and haemorrhagic complications during extradural analgesia11 or delivery12 have yet been established.

Therefore, we designed a prospective study to evaluate the accuracy of laboratory coagulation tests performed during the ninth month of pregnancy to predict coagulation abnormalities during labour. We also examined the incidence of these coagulation abnormalities during labour and their relationship with post-partum haemorrhage (PPH).

Patients and methods
This prospective surveillance study was performed between 1 June 1995 and 31 December 1995. During this period, we studied all women with a singleton pregnancy who came into the labour ward for delivery. As the study was an anonymous survey of haematological and clinical variables, hospital Ethics Committee approval was not required. Inclusion criteria were: pre-anaesthetic clinical assessment during the ninth month of pregnancy, physical status ASA I or II, and term = 36 and <42 weeks at the time of delivery. We excluded all women with a medical history known to be associated with haemostasis disorders, such as von Willebrand disease, diabetes mellitus, idiopathic thrombocytopenic purpura or lupus erythematosus. We also excluded women receiving anticoagulant therapy and parturients admitted for elective Caesarean section.
STUDY DESIGN

The first blood sample (BS 1) for laboratory coagulation tests was obtained in each parturient during the ninth month of pregnancy, usually just after pre-anaesthetic clinical assessment. Platelet count, PT, aPTT and plasma fibrinogen concentration were determined in each sample. When the women entered the labour ward for delivery, a second blood sample (BS 2) was obtained for the same tests via a 16-gauge i.v. cannula just before the start of a basal infusion of Ringer's lactate solution. Age, parity, medical and obstetric history, and gestational age (GA) were obtained by an anaesthetist, who enquired again of any previous history of bleeding. He also noted on the anaesthetic chart all recent antepartum medical complications such as pre-eclampsia, sepsis or placenta praevia. Each abnormal coagulation test result was checked systematically in a new sample. Moreover, thrombocytopenia (platelet count <100 × 10^9 litre⁻¹) was confirmed by examination of the stained peripheral blood film to exclude platelet clumping. BS 2 was always available before the decision to proceed with extradural analgesia. If indicated, extradural analgesia was provided for labour in each parturient whose platelet count was more than 100 × 10^9 litre⁻¹ at BS 2.

When the women left the labour ward, the route of delivery (vaginal delivery or Caesarean section) and the occurrence of PPH were noted. Only significant haemorrhages were considered. These were defined as clinically severe bleeding requiring volume expansion and manual uterine exploration, associated with either blood transfusion or a significant decrease (≥2 g dl⁻¹) in haemoglobin concentration, or both, within 24 h post-partum.

We compared for each parturient the results of BS 1 and BS 2, and we calculated the changes in platelet count (%) and fibrinogen concentration (g litre⁻¹) between the two periods. Then we examined mean (SD) platelet count and fibrinogen concentration in BS 2. Values less than the lower threshold of the corresponding 95% confidence limits (value = mean value – 1.96 SD) for one or both variables, or with a PT <70% or an aPTT >40 s (normal 30 s) were classified as "coagulation abnormalities". We compared the incidence of severe PPH in this group and in the other women.

STATISTICAL ANALYSIS

Results are expressed as mean (SD). For quantitative data, statistical analysis was performed using analysis of variance for repeated measures. When overall differences were detected, individual comparisons between groups were performed by Student's t test with Bonferroni's correction. Fisher's exact test was used to compare nominal data.

Results

We studied 835 parturients: 797 were included in the results and statistical analyses, and 38 were excluded. The characteristics of these 38 patients in the labour ward are shown in table 1. Mean delay between BS 1 and BS 2 was 17 (9) days (always less than 30 days).

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Information on 38 women excluded from the study. Reasons for exclusion are indicated</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>38</td>
</tr>
<tr>
<td>Age (yr) (mean (range))</td>
<td>30.9 (24–43)</td>
</tr>
<tr>
<td>Gestational age (weeks) mean (SD))</td>
<td>38.2 (2.4)</td>
</tr>
<tr>
<td>Reasons for exclusion in labour ward</td>
<td></td>
</tr>
<tr>
<td>Placenta praevia</td>
<td>8</td>
</tr>
<tr>
<td>Placenta abruptio</td>
<td>2</td>
</tr>
<tr>
<td>Fever ≥38.5°C or sepsis syndrome</td>
<td>6</td>
</tr>
<tr>
<td>BS 2 not available</td>
<td>10</td>
</tr>
<tr>
<td>Low molecular weight heparin therapy</td>
<td>3</td>
</tr>
<tr>
<td>Hypertension and/or pre-eclampsia</td>
<td>9</td>
</tr>
</tbody>
</table>

Figure 1 Variations (in absolute value) in platelet count between the two samples, BS 1 and BS 2, for each woman. These variations (Y axis) in function of the BS 1 value for platelet count (X axis) are shown. Mean variation (∆) and 95% confidence limits (---) for these variations are also indicated.

Figure 2 Variations (in absolute value) in platelet count between the two samples, BS 1 and BS 2, for women who had a platelet count less than 100 × 10^9 litre⁻¹ (mean value – 1.96 SD at BS 2) in either one or both samples. The shaded area indicates the area below 100 × 10^9 litre⁻¹.
were, respectively, 216 (54) × 10⁹ litre⁻¹ (extremes 88–538) and 206 (54) × 10⁹ litre⁻¹ (extremes 48–415). From BS 1 to BS 2, platelet count was variable and unpredictable in all women (fig. 1).

The lower threshold of the 95% confidence limit for platelet count was 100 × 10⁹ litre⁻¹ (BS 2 mean value ± 1.96 SD). Four women were thrombocytopenic (<100 × 10⁹ litre⁻¹) at BS 1. For one patient, platelet count increased to 132 × 10⁹ litre⁻¹ at BS 2, whereas for the others, platelet count at BS 2 remained less than 100 × 10⁹ litre⁻¹. Thrombocytopenia (<100 × 10⁹ litre⁻¹) appeared in eight other women at BS 2. Therefore, a total of 11 women had platelet counts less than 100 × 10⁹ litre⁻¹ at BS 2. All of these parturients had platelet counts less than 160 × 10⁹ litre⁻¹ at BS 1 (fig. 2). Mean variation between the two samples was −26 (20)% for these 11 thrombocytopenic patients whereas it was −3.7 (14)% in the overall population.

PT, aPTT AND PLASMA FIBRINOGEN CONCENTRATION

There were no abnormal values for PT or aPTT in either BS 1 or BS 2. Mean values for fibrinogen concentrations in BS 1 and BS 2 were, respectively, 4.6 (0.8) g litre⁻¹ (extremes 2.0–7.6) and 4.8 (1.0) g litre⁻¹ (extremes 2.1–9.0). The lower threshold of the 95% confidence limit for plasma fibrinogen concentration was 2.9 g litre⁻¹ (BS 2 mean value −1.96 × SD). Thirteen parturients had fibrinogen concentrations less than 2.9 g litre⁻¹ at BS 1. Twenty-six parturients had fibrinogen concentrations less than 2.9 g litre⁻¹ at BS 2. For these women, the variation in fibrinogen concentration from BS 1 to BS 2 was −1.23 (0.88) g litre⁻¹, whereas it was +0.18 (0.84) g litre⁻¹ in the overall population. As observed with platelet count, BS 1 was not reliable in detecting women with fibrinogen concentrations less than 2.9 g litre⁻¹ at BS 2 (fig. 3).

COAGULATION DISORDERS IN EARLY LABOUR AND PPH

The mode of delivery was vaginal for 677 women and a Caesarean section was performed in the other 120. Among the 677 who had a vaginal delivery, 46 had significant PPH (table 2) and all occurred in patients asymptomatic for haemostasis disorders before delivery. They were all considered as clinically significant haemorrhages requiring volume expansion (Ringer’s solution, blood transfusion, or both) and manual uterine exploration. In two patients, hysterectomy was necessary to stop massive haemorrhage. Mean

---

**Table 2** Number of patients and main clinical characteristics of women who had Caesarean section or vaginal delivery with or without post-partum haemorrhage (PPH). *P*<0.05 vs value in women who had vaginal delivery with no PPH (Student’s t test)

<table>
<thead>
<tr>
<th></th>
<th>Caesarean sections</th>
<th>Vaginal delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PPH</td>
<td>No PPH</td>
</tr>
<tr>
<td><strong>n</strong></td>
<td>120</td>
<td>46</td>
</tr>
<tr>
<td><strong>Age (yr) (mean (range))</strong></td>
<td>32.7 (21–45)</td>
<td>30.9 (21–41)</td>
</tr>
<tr>
<td><strong>Gestational age (weeks)</strong></td>
<td>39.3 (1.5)</td>
<td>39.8 (1.2)</td>
</tr>
<tr>
<td><strong>Haematology values in labour ward (BS 2) (mean (SD))</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Platelet count (×10⁹ litre⁻¹)</td>
<td>206 (61)</td>
<td>185 (59)*</td>
</tr>
<tr>
<td>Fibrinogen level (g litre⁻¹)</td>
<td>5.0 (0.9)</td>
<td>4.3 (1.3)*</td>
</tr>
</tbody>
</table>

---

**Table 3** Sensitivity specificity, positive and negative predictive values of fibrinogen concentration <2.9 g litre⁻¹, at either BS 1 or BS 2, predicting occurrence of PPH

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
<th>Positive predictive value (%)</th>
<th>Negative predictive value (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fibrinogen &lt;2.9 g litre⁻¹ at BS 1</td>
<td>4.3</td>
<td>98.4</td>
<td>16.6</td>
<td>93.4</td>
</tr>
<tr>
<td>BS 2</td>
<td>19.6</td>
<td>97.8</td>
<td>39.1</td>
<td>94.3</td>
</tr>
</tbody>
</table>
marked increase in platelet reactivity during pregnancy. On the other hand, some authors have described decreased platelet activation during pregnancy and suggested the presence of a plasma factor that selectively inhibits prostaglandin-dependent activation. Therefore, it remains difficult in clinical practice to define precisely the clotting capacities of a woman with a mild gestational thrombocytopenia.

The risk of spinal haematoma has been estimated to be approximately 1 in 150 000 after extradural analgesia. Even if the risk of this complication is increased in patients with a low platelet count, it is difficult to define the safe lower threshold for platelet count. The haematological definition of thrombocytopenia is a platelet count less than 150 × 10^9 litre⁻¹. The lower limit of 100 × 10^9 litre⁻¹ for platelet count, often judged as “safe” to perform extradural analgesia, has no supporting data. In the absence of any other coagulation disorder, some authors would prefer to lower this limit to 80 × 10^9 litre⁻¹. Nevertheless, some authors do not systematically observe the platelet count before extradural analgesia. Rolbin and colleagues estimated that in their institution approximately 5000 thrombocytopenic parturients have benefitted from extradural analgesia over a 30-yr period without any spinal haematomas. The same team has reported the case of uncomplicated extradural analgesia in an asymptomatic parturient whose platelet count was 2 × 10^9 litre⁻¹ immediately after delivery.

Whatever the significance of these low platelet counts and the acceptable limit, one remaining problem is the choice of the appropriate time to perform a platelet count. Indeed, some authors found a decrease in mean platelet count whereas others reported no change in platelet count during pregnancy. Many anaesthetists consider it sensible to obtain the results of coagulation tests several weeks before extradural analgesia. However, our study showed that the result of this nine month platelet count was useless in predicting platelet count less than 100 × 10^9 litre⁻¹ during labour.

**Figure 4** Incidence of post-partum haemorrhage (PPH) in women with platelet counts or fibrinogen concentrations at BS 2 less than 100 × 10^9 litre⁻¹ and 2.9 g litre⁻¹, respectively. The incidence was significantly different compared with the rate observed in women with both platelet count and fibrinogen concentrations greater than these thresholds (***P<0.01; Fischer’s exact test). Rates are indicated in percent (Y axis) and absolute values.
The nature of the other laboratory tests which are useful before extradural analgesia and their lower “safe value” are still debatable. Coagulation tests such as PT and aPTT measurements have not been studied extensively in obstetric patients but they seem to be less useful for early detection of haemostasis disorders during labour. Indeed, these tests were always normal in our study. Therefore, we believe that these tests should no longer be performed in clinically normal parturients before extradural analgesia.

Fibrinogen concentration increases physiologically during pregnancy. A safe lower limit for plasma fibrinogen concentration has not been evaluated, while the safe laboratory lower limit defined for the general population may not be appropriate for pregnant women. Nevertheless, we had to define a lower limit of normality for both of these variables. Therefore, all values for either platelet count or fibrinogen concentration at BS 2 which were below the lower threshold of the corresponding 95% confidence limit were considered as abnormal.

Our study has shown that significant PPH were more frequent when platelet count or fibrinogen concentration, or both, were low in early labour. In previous studies, this association has not been recognized as a significant factor associated with PPH. The significance of the relationship between these mild coagulation abnormalities and the occurrence of PPH is not clear. During pregnancy, biological changes occur such as an increase in many clotting factor concentrations and placental synthesis of plasminogen activator inhibitor. Early in pregnancy, intravascular fibrin deposition can be found in the uteroplacental circulation. This reflects local chronic intravascular coagulation which induces local fibrinolysis. These biological changes are associated with mechanical factors that limit the risk of bleeding, such as structural changes in the spiral arteries and myometrial contractions. These physiological changes must prepare the pregnant woman for delivery and placental separation and the inherent risk of haemorrhage. In case of failure of the mechanical protective mechanisms, there is an increased need for haemostatic components such as fibrinogen and platelets. We may hypothesize that in such situations there is inadequate compensation which is reflected in a low platelet count and a low fibrinogen plasma concentration. Combs, Murphy and Laros showed that the main clinical variables related to the risk of PPH were prolonged labour and factors associated with uterine atony. If impaired uterine contractility occurred in patients with a low platelet count and fibrinogen concentration, local coagulation factors may not ensure good haemostasis and therefore, at the time of delivery, an increased incidence of PPH could occur. This hypothesis of a relationship between obstetric factors and mild coagulation abnormalities may explain the occurrence of PPH, but this will require further studies.

In clinical practice, detection of coagulation abnormalities, and especially detection of thrombocytopenia, may be important in the management of the obstetric patient. Nevertheless, unhelpful coagulation tests should be avoided. Our results demonstrated that coagulation tests performed several weeks before labour should be abandoned and that PT and aPTT are unnecessary in clinically normal parturients.

References

