Benign Fever Following Vaginal Delivery

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BACKGROUND. In patients with fever following vaginal delivery, physicians must differentiate benign self-resolving fevers from fevers with more serious causes, especially endometritis. To help differentiate these clinical entities, we explored the characteristics and risk factors for benign "single-day" postpartum fever.

METHODS. We conducted a retrospective cohort study of 2137 vaginal deliveries. Patients were randomly selected from the 25,687 vaginal deliveries that took place between 1979 and 1992 at The University of Iowa Hospitals and Clinics. The data were analyzed using odds ratios and multiple logistic regression.

RESULTS. Benign fevers occurred in 3.3% of patients, while endometritis was diagnosed in 1.6%. After controlling for confounding variables, two clinical factors were independently associated with single-day fever: primiparity (odds ratio [OR], 3.4; 95% confidence interval [CI], 2.0 to 5.7) and use of a uterine pressure catheter (OR, 2.4; 95% CI, 1.5 to 3.7). These factors were not associated with endometritis. The first postpartum temperature elevation (≥38.0°C) occurred earlier in patients with single-day fever than in patients with endometritis (4.0 ± 4.6 hours postpartum vs 30.2 ± 27.0 hours postpartum, $P<.001$). The maximum temperature elevation was lower, on average, in patients with single-day fever than in patients with endometritis (38.2° ± 0.2°C vs 38.9° ± 0.6°C, $P<.001$).

CONCLUSIONS. Single-day fever was more likely to occur in primiparous women and in women who were monitored with a uterine pressure catheter. Most women with benign single-day fevers had early low-grade fevers, whereas women with endometritis had higher fevers that occurred later in the postpartum period.

KEY WORDS. Puerperal disorders; fever; puerperal infection; logistic models. *J Fam Pract 1996; 43:146-151.*

Fever in the first 24 hours after delivery often resolves spontaneously and cannot be explained by an identifiable infection.[1,2] The causes of such single-day fevers are unknown, but it has been speculated that they are related to dehydration, lochia block, infusion of fetal protein, or breast engorgement.[3,4] After performing a MEDLINE search (1966 to present) using the terms "puerperal disorders," "fever," and "puerperal infection," we found only two studies addressing single-day fever.[1,2] Little is known about the clinical factors associated with such fevers. Such knowledge might help physicians differentiate between self-limited temperature elevations and more serious infection.

To better characterize single-day fevers, we analyzed data from a previous study, which explored the association between manual removal of the placenta and postpartum endometritis following vaginal delivery.[5] In that study, manual removal of the placenta was a risk factor for endometritis. In this report, we explore two ancillary questions: (1) What clinical risk factors are associated with single-day fevers following vaginal delivery? (2) Can differences in fever characteristics, such as time of onset and maximum postpartum temperature, help distinguish endometritis from benign single-day fever?

METHODS

All 25,687 women who gave birth vaginally at the University of Iowa Hospitals and Clinics between January 1, 1979, and December 31, 1992, were eligible for the study. Using the International Classification of Diseases procedure codes,[6]

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women whose placentas were delivered manually (1421 deliveries, 5.5%) were distinguished from those whose placentas were delivered spontaneously (24,266 deliveries, 94.5%). Using computer-generated random numbers, we selected random samples of 1227 women from the manual-removal group and 1278 women from the spontaneous–placenta-delivery group. We could not obtain four of the requested patient records (two records were lost, one patient refused to release her record, and the hospital administrator would not release one record). Women who gave birth to babies weighing less than 500 g or of less than 20 weeks' gestation were excluded because we suspected that the associations between risk factors and postpartum fevers would be different in these patients. We also excluded women if they received postpartum antibiotics for any reason other than treatment of endometritis. After applying these exclusion criteria, our final study sample included 1052 patients whose placentas had been manually removed and 1085 patients whose placentas had been spontaneously delivered.

We reviewed medical records to determine the time of the first postpartum fever (≥38°C [≥100.4°F]) and the maximum temperature elevation. We also recorded 30 clinical factors potentially associated with these temperature elevations.[1,3,7-9]

Single-day fever was defined as a single fever spike of ≥38°C occurring within the first 24 hours following delivery. A patient could have more than one recorded temperature ≥38°C but not more than one spike; ie, once the temperature started to fall, there could be no reversal of that trend. We excluded patients from this definition if they had an elevated or unknown temperature during labor, if they received postpartum antibiotics for any reason, or if they had a source of infection documented in the physician's progress notes. Postpartum endometritis was recorded if the physician's final impression indicated endometritis as the cause of a postpartum fever ≥38°C. We excluded patients who developed postpartum endometritis following hospital discharge because we focused on the diagnosis of fevers that occurred during hospitalization.

Following delivery, oral temperatures were measured according to an established policy that remained unchanged during the study period. The minimum schedule called for temperature recordings every 4 hours for the first 12 hours postpartum and then three times a day until hospital discharge; however, nurses often measured temperatures more frequently in patients with fevers.

The data were analyzed using Systat Version 5.0 (Systat, Inc, Evanston, Ill). With single-day fever as the outcome, we calculated odds ratios, 95% confidence intervals, and tests of significance (chi-square or Fisher's exact test) for 30 potential risk factors. To determine the independent effects of these factors, we used logistic regression analysis. The logistic regression allowed us to simultaneously control for the potential confounding effects of multiple factors.[10] Using the Wilcoxon rank-sum test, we compared fever characteristics between patients with endometritis and those with single-day fever. The study protocol was approved by the University of Iowa review board for the study of human subjects.

RESULTS

The analysis is based on 2108 patients with a total of 2137 vaginal deliveries (29 women delivered twice). The mean age of the mothers was 24.0 years (± 5.3 years). Approximately one half of the patients (1099, 51.4%) were primiparous, and 285 (13.3%) delivered before 36 weeks' gestation. Most patients (1655, 77.4%) had Medicaid or no insurance. The mean length of stay following delivery was 2.9 days.

Our sample of 2137 patients included 91 (4.3%) who had a single-day fever and 71 (3.3%) who had endometritis during their hospital stays. We adjusted these incidence rates to account for the oversampling of patients whose placentas had been removed manually. These patients comprised 5.5% of the original 25,687 patients. With this weighted adjustment,[11] the estimated incidence of single-day fever and endometritis in a random sample of patients who had vaginal deliveries was 3.3% and 1.6%, respectively.

Because we excluded patients who received antibiotics for reasons other than endometritis, few patients had a postpartum fever attributable to causes other than endometritis or single-day fever. Before excluding these patients, we recorded the cause of fever in the original random sample. Other than endometritis and single-day fever, the causes in this original sample included breast engorgement (9 patients), urinary tract infection (6 patients), transfusion reaction (6 patients), respiratory tract

TABLE 1

Factors Associated with Single-Day Fever in Univariate Analysis (N=2137)

Factor	Incidence of Single-Day Fever: Factor Present* % (n/total)	Incidence of Single-Day Fever: Factor Absent† % (n/total)	Unadjusted Odds Ratio (95% Confidence Interval)
Primiparity	6.6 (72/1099)	1.8 (19/1038)	3.8 (2.2-6.5)
Fetal scalp electrode	5.9 (70/1179)	2.2 (21/958)	2.8 (1.7-4.8)
Uterine pressure catheter	6.7 (58/861)	2.6 (33/1276)	2.7 (1.7-4.3)
Episiotomy	5.0 (81/1629)	2.0 (10/508)	2.6 (1.3-5.4)
Meconium	7.8 (27/345)	3.6 (64/1792)	2.3 (1.4-3.7)
Preeclampsia	8.3 (10/120)	4.0 (81/2017)	2.2 (1.0-4.5)
Use of forceps	6.7 (41/612)	3.3 (50/1525)	2.1 (1.4-3.3)
3rd- or 4th-degree laceration	6.7 (31/462)	3.7 (60/1615)	2.0 (1.2-3.1)
Estimated blood loss >500 mL	6.6 (36/547)	3.5 (55/1590)	2.0 (1.3-3.1)
Uterine exploration	5.3 (60/1132)	3.1 (31/1005)	1.8 (1.1-2.8)
Oxytocin use	6.0 (37/614)	3.5 (54/1523)	1.7 (1.1-2.7)
Manual removal of placenta	5.3 (56/1052)	3.2 (35/1085)	1.7 (1.1-2.7)
Postpartum anemia (Hgb <10 g/dL)	6.2 (27/436)	3.8 (64/1701)	1.7 (1.0-2.7)
Epidural anesthesia	5.7 (39/684)	3.6 (52/1453)	1.6 (1.0-2.5)

*Number of deliveries with single-day fever and factor present divided by all deliveries with factor present.

†Number of deliveries with single-day fever and factor absent divided by all deliveries with factor absent.

NOTE: Factors not associated with single-day fever (P>.05) included diabetes, race, stillbirth, maternal age, socioeconomic status, fetal manipulation, postpartum transfusion, multiple gestation, shoulder dystocia, placenta accreta, gestational age at delivery, duration of ruptured membranes, induction of labor, postpartum tubal ligation, and length of first or second stage of labor.

Hgb denotes hemoglobin.

infection (5 patients), and episiotomy infection (5 patients).

Using univariate analyses, 13 of 30 clinical factors were found to be associated with single-day fever at $P<.05$ (Table 1). The most strongly associated factor was primiparity (odds ratio [OR], 3.8, 95% confidence interval [CI], 2.2 to 6.5).

We tested 24 of the 30 factors for inclusion in a multiple logistic regression model. A variable was tested for inclusion if its P value was less than .25 or if it was associated with postpartum morbidity in previous studies.[3,7-9] Using a stepwise procedure, only variables with $P<.01$ were allowed to remain in the final model. This conservative significance level was chosen to reduce the chance of finding spurious associations, which can occur when many risk factors are considered.[12] The final model included only two independent risk factors for single-day fever: primiparity (adjusted OR, 3.4; 95% CI, 2.0 to 5.7) and use of a uterine pressure catheter (adjusted OR, 2.4; 95% CI, 1.5 to 3.7) (Table 2). We tested the interaction term involving primiparity and uterine pressure catheter, and it was not significant ($P=.7$); hence, the degree of risk from each factor was not affected by the presence of the other.

We were concerned that primiparity might be only a marker for more biologically plausible risk factors, such as long labors or perineal lacerations, which are more common in primiparas. Although these factors were not significantly associated with single-day fever after adjusting for primiparity, it is possible that as a group they might explain most or all of the association between primiparity and single-day fever. To explore this possibility, we fit a logistic regression model with seven variables that were associated with primiparity in our study sample: performance of an episiotomy, third- and fourth-degree lacerations, length of first stage of labor, length of second stage of labor, meconium in the amniotic fluid, uterine pressure catheter, and estimated blood loss >500 mL. When primiparity was added to this model, it continued to be an independent risk factor for single-day fever (OR, 2.8; 95% CI, 1.6 to 4.9).

Manual removal of the placenta approached significance as a risk factor when it was added to the final model presented in Table 2 ($P=.05$; adjusted OR, 1.5; 95% CI, 1.0 to 2.4). However, manual

TABLE 2

Factors Independently Associated with Single-Day Fever in Multivariate Analysis

Factor	Coefficient	Standard Error	*P* Value	Adjusted Odds Ratio (95% Confidence Interval)
Primiparity	1.2187	0.2635	<.001	3.4(2.0-5.7)
Uterine pressure catheter	0.8686	0.2249	<.001	2.4(1.5-3.7)

*Each odds ratio is adjusted for the other factor in the model.

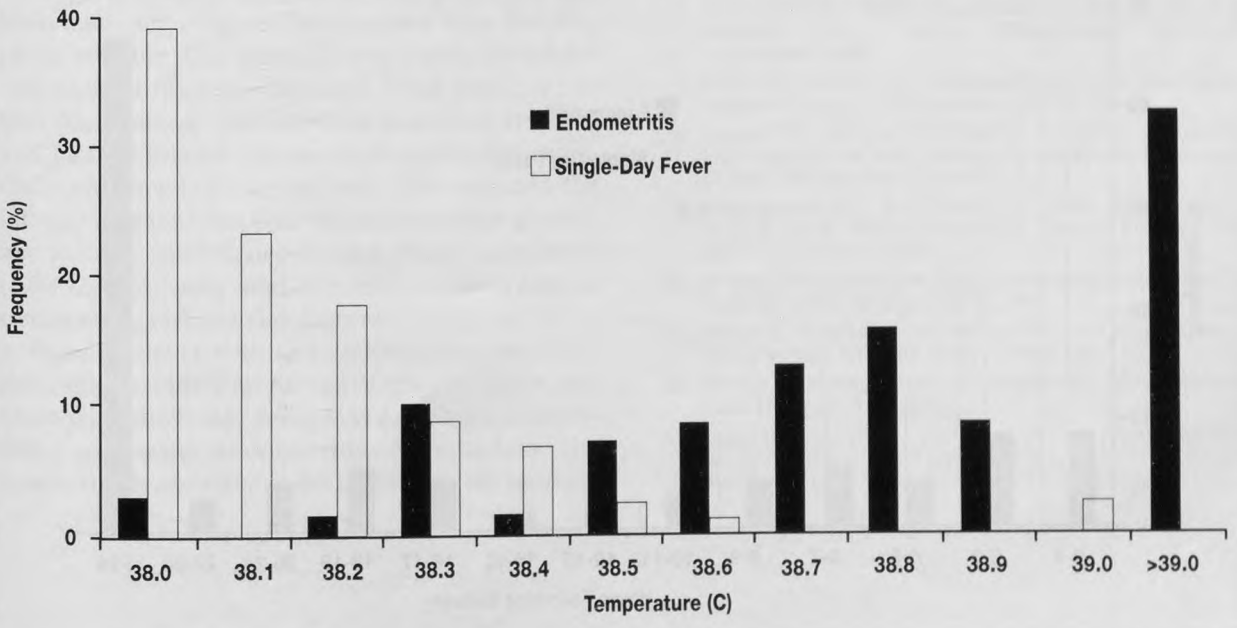
NOTE: Variables tested for inclusion in the stepwise regression: prolonged first stage of labor, prolonged second stage of labor, maternal age <17 years, postpartum transfusion, estimated blood loss >500 mL, uterine pressure catheter, fetal scalp electrode, maternal race, perineal lacerations, episiotomy, meconium staining, postpartum tubal ligation, primiparity, multiple gestation, epidural anesthesia, forceps, oxytocin induction or augmentation, preeclampsia, gestational age <36 weeks, shoulder dystocia, uterine exploration, membrane rupture >24 hours, manual removal of the placenta, postpartum hemoglobin <10 g. In the multivariate analysis, pseudo R^2=.06.

removal of the placenta was not a confounder because, when it was added to the model, the odds ratios for primiparity and the pressure catheter remained essentially the same (3.4 and 2.3, respectively). In addition, we found no interaction between manual removal of the placenta and risk factors in the logistic regression; thus, the relationship between these risk factors and single-day fevers did not depend on the method of placental delivery. To further illustrate this point, we repeated the logistic regression with patients whose placentas were manually removed and those with spontaneous delivery of the placenta weighted according to their prevalence in the study population (5.5% and 94.5%, respectively). In this analysis, both primiparity (OR, 5.1; 95% CI, 2.0 to 12.7) and the intrauterine catheter (OR, 2.2, 95% CI, 1.1 to 4.3) continued to be independently associated with single-day fever.

The maximum temperature in patients with endometritis was significantly higher on average than it was in patients with single-day fever (38.9°± .6°C vs 38.2° ± .2°C, *P*<.001) (Figure 1). Only 3 of 91 patients (3.3%) with single-day fever had maximum

FIGURE 1

Maximum postpartum temperature elevation for benign single-day fever vs endometritis.



temperatures of >38.5°C (>101.3°F). In contrast, 55 of 71 endometritis patients (77.5%) had maximum temperatures exceeding 38.5°C.

The first temperature elevation ≥38.0°C tended to occur earlier, on average, in patients with single-day fever than in patients with endometritis (4.0 ± 4.6 hours postpartum vs 30.2 ± 27.0 hours postpartum, $P<.001$) (Figure 2). This difference is somewhat artificial because we defined single-day fever as occurring within the first 24 hours. If we consider, however, only the patients with endometritis whose first fevers occurred within 24 hours of delivery, the difference persists (4.0 ± 4.6 hours postpartum vs 9.5 ± 7.5 hours postpartum, $P<.001$).

There were 114 patients who had one fever spike ≤38.5°C within the first 24 hours postpartum. Only 8 (7%) of these 114 patients had endometritis, while 88 (77%) had a single-day fever. The remaining 18 patients did not receive postpartum antibiotics and had a variety of stated causes for their fevers, which included continuation of an intrapartum fever (9 patients), "dehydration" (2 patients), episiotomy infection (2 patients), "possible" endometritis without a final impression (2 patients), transfusion reaction (1 patient), upper respiratory tract infection (1 patient), and "too many blankets" (1 patient).

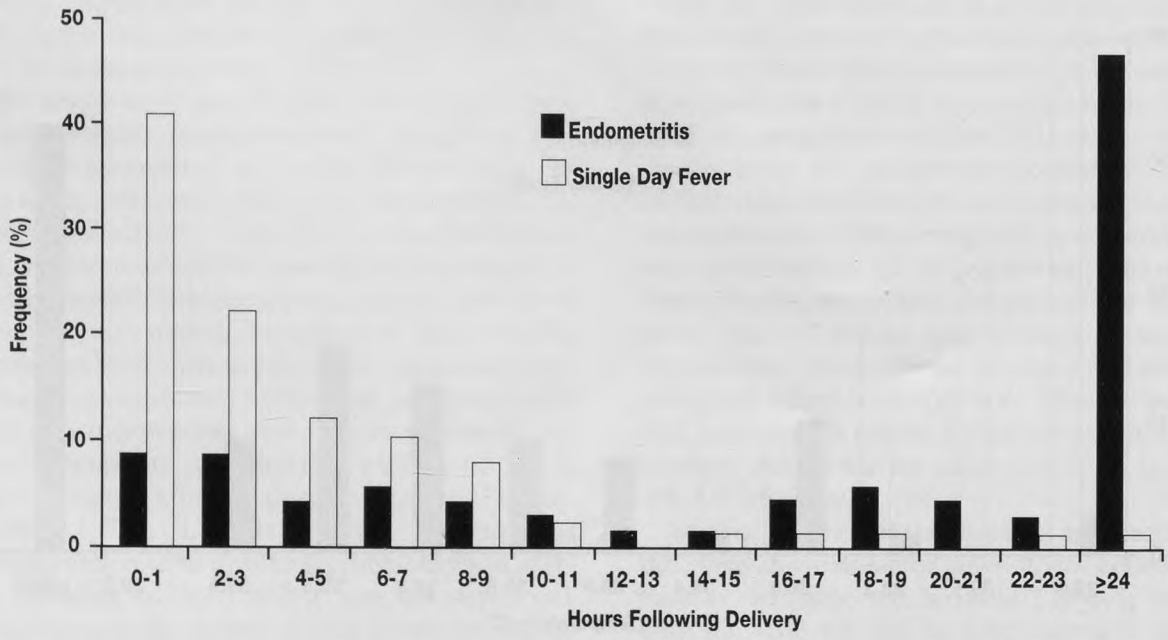
DISCUSSION

In this study, primiparity and the uterine pressure catheter were clinical predictors of benign single-day fever. The associations persisted after adjusting for potential confounders in a multivariate analysis. In contrast, risk factors for endometritis include cesarean delivery, anemia, prolonged rupture of membranes, bacterial vaginosis, manual removal of the placenta, and young maternal age.[3,5,7-9] In a previous analysis of our study patients, we found four risk factors for endometritis following vaginal delivery: maternal age less than 17 years, postpartum anemia, manual removal of the placenta, and ruptured membranes for more than 24 hours before delivery.[5] Neither primiparity nor intrauterine monitoring has been associated with endometritis in studies that have controlled for confounding bias using multivariate analyses.[5,8] In the present study, risk factors for endometritis did not predict single-day fever, and risk factors for single-day fever did not predict endometritis.

Our findings are consistent with those of Gibbs and colleagues,[13] who found that primiparity was associated with asymptomatic postpartum fever. In that study of 60 asymptomatic women with high-

FIGURE 2

Time of first temperature elevation for benign single-day fever vs endometritis.



virulence bacteria in the amniotic fluid, 27 (45%) remained asymptomatic in the puerperium, 16 (27%) developed fever only, and 17 (28%) developed endometritis. Those who developed only fever had a lower mean parity than did those who remained asymptomatic (0.3 vs 1.2, P=.05). Those with endometritis had the same mean parity as those who remained asymptomatic.

The adjusted incidence of single-day fever in our study (3.3%) was similar to the incidence in a series reported by Filker and Monif (3.0%).[1] In that series, the mean highest temperature elevation in patients not requiring antibiotics was the same as the mean highest temperature in our patients who had single-day fever (38.15°C [100.67°F]).

In univariate analyses, intrauterine fetal monitoring is associated with endometritis, but in multivariate analyses, it does not independently predict endometritis.[5,8] In our study, the uterine pressure catheter was an independent predictor of single-day fever.

The underlying cause for the association between single-day fever and primiparity is unknown. We could not explain the association based on clinical variables associated with primiparity, such as length of labor or perineal trauma. Variables not included in our analysis, however, such as noninfectious pyrogens,[13] or pathogenic bacteria in either the vagina[8] or amniotic fluid, might help explain the association.

We oversampled patients whose placentas had been manually removed because we were interested in whether this variable was a risk factor for endometritis or single-day fever. Thus, our ability to find associations with manual placental removal and factors related to manual removal was artificially enhanced. In an analysis that weighted the influence of patients with manual removal according to their prevalence in the study population (5.5%), primiparity and the intrauterine catheter remained significant risk factors.

Some patients who had endometritis may have been misclassified as having single-day fever and some with single-day fever may have been misclassified as having endometritis. Nevertheless, the fevers resolved without antibiotics in all patients who met our definition of single-day fever. Practically speaking, the source of a low-grade fever, which resolves promptly without antibiotics, is of little importance.

Single-day fever is not an important cause of morbidity, but it is important to distinguish this entity from more serious causes of postpartum fever. In our study, most patients with single fever spikes <38.5°C occurring within 24 hours after vaginal delivery had single-day fevers that resolved spontaneously. Patients whose first temperature elevations occurred more than 24 hours postpartum or who had fevers >38.5°C were more likely to require antibiotics for endometritis.

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