OBJECTIVE: To quantify adverse neonatal and maternal outcomes associated with elective term delivery at less than 39 completed weeks of gestation.

STUDY DESIGN: Prospective observational study conducted in 27 hospitals over the course of 3 months in 2007.

RESULTS: Of 17,794 deliveries, 14,955 (84%) occurred at 37 weeks or greater. Of term deliveries, 6562 (44%) were planned, rather than spontaneous. Among the planned deliveries, 4645 (71%) were purely elective; 17.8% of infants delivered electively without medical indication at 37-38 weeks and 8% of those delivered electively at 38-39 weeks required admission to a newborn special care unit for an average of 4.5 days, compared with 4.6% of infants delivered at 39 weeks or beyond (P < .001). Cesarean delivery rate in women undergoing induction of labor was not influenced by gestational age but was highly influenced by initial cervical dilatation and parity, ranging from 0% for parous women induced at 5 cm or greater to 50% for nulliparous women at 0 cm.

CONCLUSION: Elective delivery before 39 weeks' gestation is associated with significant neonatal morbidity. Initial cervical dilatation is highly correlated with cesarean delivery among women undergoing induction of labor in both nulliparous and parous women. Elective delivery before 39 completed weeks' gestation is inappropriate. Women contemplating elective induction at or beyond 39 weeks' gestation with an unfavorable cervix should be counseled regarding an increased rate of cesarean delivery.

Key words: elective delivery, induction of labor, repeat cesarean delivery.

Table 1: Elective delivery and neonatal outcome

<table>
<thead>
<tr>
<th>Variable</th>
<th>37 wk</th>
<th>38 wk</th>
<th>39+ wk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elective inductions</td>
<td>112</td>
<td>678</td>
<td>2004</td>
</tr>
<tr>
<td>NICU admissions</td>
<td>17</td>
<td>44</td>
<td>61</td>
</tr>
<tr>
<td>%</td>
<td>15.2</td>
<td>7.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Elective repeat cesarean</td>
<td>105</td>
<td>696</td>
<td>776</td>
</tr>
<tr>
<td>NICU admissions</td>
<td>21</td>
<td>58</td>
<td>62</td>
</tr>
<tr>
<td>%</td>
<td>20.0</td>
<td>8.3</td>
<td>8.0</td>
</tr>
<tr>
<td>Elective primary cesareans</td>
<td>24</td>
<td>97</td>
<td>153</td>
</tr>
<tr>
<td>NICU admissions</td>
<td>5</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td>%</td>
<td>20.8</td>
<td>16.5</td>
<td>7.8</td>
</tr>
<tr>
<td>Total elective deliveries</td>
<td>241</td>
<td>1471</td>
<td>2933</td>
</tr>
<tr>
<td>NICU admissions</td>
<td>43</td>
<td>118</td>
<td>135</td>
</tr>
<tr>
<td>%</td>
<td>17.8</td>
<td>8.0</td>
<td>4.6</td>
</tr>
</tbody>
</table>

NICU: neonatal intensive care unit; NS, nonsignificant.
Statistical analysis represents a comparison of each gestational age to the subsequent gestational age category.
*For 37 + 38 wk elective primary cesarean vs 39+ wk elective primary cesarean, P = .002.


Results

Twenty-seven hospitals in 14 states (Colorado, Florida, Georgia, Kansas, Kentucky, Louisiana, Nevada, New Hampshire, Oklahoma, South Carolina, Tennessee, Texas, Utah, and Virginia) participated. Thirteen hospitals had annual delivery volumes of <2000, 9 facilities had annual delivery volumes between 2000-4000, and 5 hospitals had annual delivery volumes > 4000. Total patient delivery volume in these 27 facilities during this 3-month period was 17,794.

Of 17,794 total deliveries, 14,955 (84%) occurred at term, that is, 37 weeks or greater. Of term deliveries, 6562 (44%) were planned, rather than spontaneous. Among the planned deliveries, 4645 (71%) were elective. Indications for the nonelective planned deliveries were as follows: 41 weeks or greater (6%), hypertension (6%), large for gestational age/macrosomia (6%), diabetes (4%), oligohydramnios (2%), IUGR (1%), abnormal antepartum testing (1%), and other (3%). Among deliveries for hyper-

tension, patients in 15 of 27 facilities (56%) had neither a mean admission systolic pressure > 140 mm Hg nor a mean admission diastolic pressure > 90 mm Hg. In only 3 of 27 facilities, was the mean admission systolic pressure > 145 mm Hg, and in only 1 of 27 facilities was the mean admission diastolic pressure > 90 mm Hg.

Sixteen percent of all deliveries (2794 deliveries) were elective inductions of labor at term (range, 8-40%). Four facilities had elective term induction rates of <10%, 15 had rates of 10-20%, and 8 had elective term induction rates > 20%. Two hundred seventy-four women (1.5%) underwent elective primary cesarean delivery at term (range, 0-5%). Only 2 facilities had an elective primary cesarean rate > 2%.

Among patients undergoing induction of labor, 72% were induced primarily with oxytocin, 15% with a prostaglandin E2-containing agent, 8% with misoprostol, and 4% with amniotomy. For elective deliveries, neonatal outcome is expressed as a function of gestational age. For elective deliveries, neonatal outcome is expressed as a function of gestational age in the Table. Seventy percent of the infants requiring transfer to a special care unit were initially admitted to that unit; 30% of such infants were transferred later to such a unit. Of 2797 infants, 270 (9.7%) electively delivered at term required admission to a special care unit, compared with 252 of 3783 infants (6.6%) undergoing indicated planned term delivery (P < .001). The mean duration of special care stay for infants admitted to a special care unit after elective delivery was 4.6 ± 5.9 days.

Cesarean delivery rate in women undergoing planned induction of labor was not heavily influenced by gestational age; cesarean rates of 13.9%, 10.0%, and 13.5% were seen for women induced at 37, 38, and 39+ weeks, respectively. However, cesarean delivery rate was highly influenced by initial cervical dilation in both nulliparous and parous women (Figure). The mean length of labor (start of induction to delivery) for women undergoing elective term induction of labor was 13.6 ± 7.9 hours for nulliparous women and 8.2 ± 5.0 hours for parous women.
Previous publications suggest that the population in the United States as a whole.\(^9,10\) We have clearly demonstrated increased neonatal morbidity for infants delivered at both 37 and 38 weeks, compared with those delivered at 39 weeks and beyond. Our practice of “rounding down” for the purposes of data analysis, as described previously, would tend to underestimate the degree of morbidity for any gestational age (ie, a newborn infant at 37 weeks 6 days would be expected to have less morbidity than 1 at 37 weeks 0 days, but outcomes for both groups are reported as “37 weeks”). In a similar manner, for purposes of statistical analysis, we accepted as valid any stated indication for delivery. These biases would lead to an underestimation both of the frequency and neonatal complication rates associated with elective term delivery. Short-term complications associated with intensive care admission in infants in this gestational age range are thoroughly described and have been demonstrated to be overwhelmingly respiratory in origin.\(^13-16\)

For over 2 decades, the American College of Obstetricians and Gynecologists (ACOG) has advocated the restriction of elective term delivery to women with a confirmed gestational age of at least 39 weeks.\(^17,18\) Our data support the ongoing validity and importance of these recommendations, as well as the fact that they are disregarded in at least 10% of all deliveries. Noncompliance with these recommendations appears to represent a classic example of the “normalization of deviance,” a term used to describe an unsound practice that continues because of anecdotally derived favorable experience.\(^19\) In the case of the elective, term pre-39 week induction, several things are clear. First, most infants delivered even at 37 weeks do not require special newborn care. Second, our observation that about one-third of such infants requiring special care are not immediately transferred to a special care unit from the labor suite suggests many obstetricians may not be aware of such transfers. This observation also suggests that any analysis of term or near-term neonatal infants that tabulates only initial special care admissions will underestimate the true morbidity seen in this group. Third, because gestational age-related adverse outcome in this group is, for the most part, confined to short-term morbidity, rather than long-term injury or death, long-term patient dissatisfaction is unlikely to be brought to the attention of the obstetrician. Finally, the above numerical analysis demonstrates that such morbidity could never be statistically demonstrated within the experience of any single obstetrician, group of obstetricians, or, in most cases, even an individual facility.

We observed a mean labor time of 14.5 hours in nulliparous women undergoing planned induction and 8.7 hours in parous women. This compares with 10-11 and 6-7 hours, for nulliparous and parous women in a recent series that included both induced and spontaneous labors.\(^20\) This observation has important implications with respect to resource utilization, an important issue, because labor and delivery ranks behind only cardiovascular care in terms of total cost in the United States.\(^21\)

Our data are not uniformly negative in terms of implications for elective delivery. Indeed, it would appear that for the parous woman with a favorable cervix at 39 weeks, induction of labor carries a rate of primary cesarean far lower than seen in the general population, with no increase in neonatal morbidity. Caughey and Musci\(^4\) also observed a nadir in both neonatal morbidity and cesarean delivery rate for all infants born at 39 weeks’ gestation. Although the nature of our dataset does not allow the definitive conclusion that such women have a lower rate of primary cesarean delivery if induced at 39 weeks than if allowed to labor spontaneously, these data would suggest that elective induction at 39 weeks in parous women with a favorable cervix remains an appropriate option.
Elective primary cesarean at term represented only 1-2% of all deliveries over the study interval, although wide regional variation was seen. Because current standard of care allows a woman to choose elective primary cesarean delivery (an option with a 100% chance of cesarean), we cannot rationally argue against a standard that would allow induction of labor in a nulliparous woman with an undilated cervix (an option with a 50% chance of cesarean), assuming appropriate informed consent has been obtained. However, because health care costs would be incrementally higher both in women undergoing elective primary cesarean delivery and elective induction at term with an unfavorable cervix, both approaches represent suboptimal resource use that should be seriously considered by payers.22-24

Our data demonstrate increased neonatal morbidity associated with elective delivery before 39 weeks’ gestation. This practice should be curtailed in accordance with ACOG guidelines. We are in the process of implementing strict protocols to end this practice within our health care system. An increased rate of cesarean delivery is also seen in women undergoing elective induction of labor with an unfavorable cervix. Induction of such women must be accompanied by appropriate informed consent regarding the risks of cesarean delivery.

Finally, the graduated pattern of neonatal morbidity seen in 37- and 38-week deliveries, compared with those at 39 weeks and beyond, coupled with similar data regarding morbidity in the near-term infant (34-36 weeks), suggests that the use of the designations “term” to refer to a gestation that has reached 37 weeks 0 days and “preterm” to those at 36 weeks 6 days and below is anachronistic. Such a designation has no basis in maternal or fetal physiology and potentially leads to inappropriate care by suggesting to the clinician and patient that 37 weeks 0 days represents a valid physiologic threshold. One may extend this principle to the use of the descriptor postterm, because neonatal morbidity has been shown to increase incrementally beyond 39 weeks’ gestation as well.4,25,26 The use of these older terms may lead to both inappropriate attempts to prolong pregnancy in the presence of certain complications before 37 weeks, inappropriate elective delivery beyond this point in time, and an underappreciation of the well-defined risks of allowing pregnancy to proceed beyond 39 weeks.4,26 Given the near universal use of early ultrasound to establish or confirm fetal age, such a discontinuous classification of gestational age is no longer helpful. We suggest that both risks and appropriate management approaches in obstetrics should be precisely defined in terms of the gestational ages at which these risks have been demonstrated or management approaches have been validated.

REFERENCES