Prior cesarean, failure to progress in labor, and fetal distress are three of the most common indications for cesarean delivery in the United States, accounting for 35 percent, 30 percent, and 8 percent of cesareans, respectively (Shearer, 1993). Because the majority of cesareans performed will be for at least one of these three indications, we chose to develop quality indicators involving each, where sufficient data were available. The development of the specific indicators was based on four main sources of data. We used these resources to establish quality indicators that were clinically important, and that were based on evidence in the literature:

1) The document published by the American College of Obstetricians and Gynecologists (ACOG) in 1994, “Quality Assessment and Improvement in Obstetrics and Gynecology.” This document contains several “criteria sets” whose purpose is to “…identify a threshold below which most physicians would agree that the care may be substandard and above which there may be several levels of acceptable care.” Although these criteria represent a generally agreed upon standard, the process by which they were arrived at is not explicitly discussed.

2) Technical Bulletins and Committee opinions, periodically published by ACOG as educational aids to the practicing physician. These are “prepared by an expert or panel of experts, based on both scientific literature and personal expertise. Each document is reviewed and approved by the committee responsible for its development. Second, an oversight committee within ACOG performs a thorough review. Third, the ACOG executive board which represents all regions of the nation reviews it and grants final approval.”
3) Since these ACOG publications are developed through an informal consensus process, we performed a literature search using MEDLINE to review each of the included topics.

4) The text, *Effective Care in Pregnancy and Childbirth* (Crowther et al., 1989; Enkin, 1989; Enkin et al., 1989; Grant, 1989; and Keirse, 1989; in Chalmers et al., 1989). This text contains meta-analyses of most known randomized trials in the field of obstetrics.

**IMPORTANCE**

The rate of cesarean delivery has increased from 5.5 percent in 1970, to 23.5 percent in 1991. Cesareans account for nearly one million of the four million births that occur annually in the United States, making it the most commonly performed major surgical procedure (Center for Disease Control [CDC], 1993). While the cesarean delivery rate has leveled since 1988 (CDC, 1993), questions remain about the appropriate use of cesarean delivery for many indications. These questions are motivated by several observations. First, the United States has higher rates of infant mortality than many developed countries in which cesarean rates are less than half of those in the U.S. (Notzon et al., 1987; CDC, 1993). Second, there is considerable variation in the use of cesareans between regions of the United States (CDC, 1993), and from hospital to hospital (Shiono et al., 1987). This variation does not appear to be explained by differences in clinical risk factors, since nonclinical factors such as hospital ownership, hospital teaching status, payment source, and volume of deliveries have also been shown to influence the rate of cesarean births (Stafford, 1991; King and Lahiri, 1994). All of these observations suggest that factors other than the health benefit to mother or infant may influence the decision to perform cesarean delivery.

Physician and hospital charges for cesarean delivery in 1991 were $7286, 66 percent higher than the charges of $4720 for vaginal delivery. The additional charge for cesarean delivery includes $611 for physician fees and $2495 for hospital charges (CDC, 1993). The CDC has estimated that a savings of one billion dollars would have occurred in 1991 if the
Cesarean delivery rate had been 15 per 100 births (U.S. Department of Health and Human Services [DHHS], 1990), rather than the actual 23.5 per 100 (CDC, 1993). With 3.9 million births annually in the United States, a 1 percent drop in the cesarean rate could reduce annual medical charges by an estimated $170 million (Keeler and Brodie, 1993).

Cesarean births require on average two additional days of hospitalization when compared to vaginal deliveries, and in some states women are given two weeks’ extra disability payment following cesarean delivery (Keeler and Brodie, 1993). In addition, cesarean birth poses increased risks of morbidity for the mother when compared to vaginal birth. The most common complications following cesarean delivery are infectious (endometritis and urinary tract infection), but more serious complications such as excessive blood loss, venous thrombosis, damage to internal organs, anesthetic complications and death are also more common following cesarean birth (VanTuinen and Wolfe, 1992).

The decision to perform a cesarean involves calculating the trade-offs between risk and benefit to both mother and fetus simultaneously. While cesarean delivery may be more morbid for the mother, it is often perceived as being the safest route of delivery for the infant (Feldman and Freiman, 1985). Ideally, information about risks and benefits to both mother and infant, at least in the most common clinical situations, would be available to assist decisionmaking. However, in many cases such information does not exist (Gifford, 1995).

PRIOR CESAREAN DELIVERY

IMPORTANCE

Traditional obstetric practice dictated that women who had one cesarean should have all subsequent births by cesarean. This was due to the perceived risk of uterine rupture during labor, with subsequent maternal hemorrhage and possible fetal death. Repeat cesarean deliveries have accounted for 48 percent of the rise in cesareans between 1980 and 1985 (Taffel et al., 1987), and are currently the
leading indication for cesarean delivery. In 1980, a NIH Consensus Development Conference on Cesarean Childbirth reviewed the topic and concluded that “...a proper selection of cases should permit a safe trial of labor and vaginal delivery for women who have had a previous low-segment transverse cesarean delivery” (NIH Consensus Statement, 1981). ACOG has subsequently published a committee opinion (1994) stating that “... in the absence of a contraindication, a woman with one previous cesarean delivery with a lower uterine segment incision should be counseled and encouraged to undergo a trial of labor in her current pregnancy.” Despite these recommendations in 1991, less than 25 percent of women with prior cesareans currently have vaginal births (CDC, 1993).

EFFICACY AND/OR EFFECTIVENESS OF INTERVENTIONS

Treatment with Repeat Cesarean vs. Trial of Labor

There have been no randomized trials of a trial of labor vs. elective cesarean delivery for women with prior cesareans. However, a summary of seven cohort studies (Enkin, 1989, in Chalmers et al., 1989) showed that 80 percent (range 60 to 85 percent) of women who attempt a vaginal birth after cesarean will be successful. The same summary found that the maternal morbidity following elective cesarean exceeds that which follows a trial of labor. The incidence of uterine rupture or dehiscence in the review ranged from 0.5-3.3 percent in the trial of labor groups, and from 0.5-2.0 percent in the elective repeat cesarean groups. Overall, dehiscences or ruptures occurred in 1.5 percent of the women who had elective cesareans, and in 0.8 percent of the women with a trial of labor. Febrile morbidity was more common in the women who had elective cesarean delivery than in those who had a trial of labor. There are no data to suggest a benefit in infant outcomes following elective repeat cesarean delivery. Iatrogenic prematurity and respiratory distress can be the result of cesarean delivery scheduled and performed prior to term (because of inaccurate estimates of gestational age). No estimate of the frequency with which this currently occurs is available.

Data from managed care settings are sparser, but also raise the question about the utility of elective repeat cesareans. One recently-
published prospective cohort study of 7229 patients in a Health
Maintenance Organization examined outcomes following a trial of labor
(n=5022) vs. elective cesarean delivery (n=2207) (Flamm et al., 1994).
The success rate of a trial of labor ranged from 70 to 82 percent among
ten hospitals. The rate of uterine rupture was 0.8 percent in the trial
of labor group, and was not reported in the elective cesarean group.
There were no maternal or infant deaths related to uterine rupture in
either group. The elective cesarean groups had significantly longer
hospital stays (85 hours vs. 57 hours, p=.0001), more transfusions (1.72
percent vs. 0.72 percent, p=.0001), more postpartum fever (16.4 percent
vs. 12.7 percent, p=.0001). Hysterectomy was rare and not significantly
different between the two groups (0.27 percent vs. 0.12 percent, p=.21).
The trial of labor group had more infants with five minute Apgar scores
<7 (1.48 percent vs. 0.68 percent, p=.004). There were no perinatal or
maternal deaths related to uterine rupture in either group. One
maternal death occurred in the trial of labor group, as the result of an
anesthetic complication during emergency cesarean delivery.

It is important to note that the risk of uterine rupture during or
prior to labor following a prior cesarean depends on the type of uterine
scar which is present. For women with a prior transverse lower segment
incision, the risk of uterine rupture during a trial of labor appears to
be much less than the risk with a vertical uterine incision (Enkin,
1989, in Chalmers et al., 1989). The decision about whether or not to
undergo a trial of labor is therefore dependent on knowledge of the
previous type of uterine scar. The vast majority of women in the U.S.
are eligible to have a trial of labor because vertical incisions are
used so infrequently (Flamm et al., 1994).

In summary, both NIH and ACOG have endorsed the safety and efficacy
of a trial of labor following one prior transverse lower segment
cesarean section. No randomized trials on the topic exist, but multiple
observational studies have given consistent results showing:

1) The majority of women who attempt a vaginal birth after
cesarean will be successful.

2) There is excessive maternal morbidity and no improvement in
infant health with elective repeat cesarean delivery.
3) When the type of uterine scar is a classical or vertical scar, the rate of uterine rupture is higher, and elective repeat cesarean should be done.

4) The cost of routine elective repeat cesarean exceeds that of a trial of labor, both because of higher physician fees and longer hospital stays, and because of the increased maternal morbidity of cesarean delivery.
### Recommended Quality Indicators for Prior Cesarean Delivery

The following criteria apply to all women admitted for labor and delivery.

#### Treatment

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Quality of evidence</th>
<th>Literature</th>
<th>Benefits</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. For women who have delivered by cesarean, the type of uterine incision used (transverse lower segment or vertical) should be noted in the medical record.</td>
<td>III</td>
<td>Enkin, 1989, in Chalmers et al., 1989</td>
<td>Prevent uterine rupture in future pregnancies.</td>
<td>Decisions about future method of delivery are dependent on the availability of this information. This indicator is indirectly suggested by data on differential rupture rates in previous vertical versus transverse cesareans. Documentation of the type of incision at the time of delivery will provide the most accurate measure of the risk associated with a future trial of labor, reducing the risk of adverse outcomes.</td>
</tr>
<tr>
<td>2. For women with a cesarean delivery in a prior pregnancy, the number and type of previous uterine scar(s) should be noted in the current delivery medical record. (If this information is not available, an attempt to locate it should be documented in the chart.)</td>
<td>II-2</td>
<td>Enkin, 1989, in Chalmers et al., 1989</td>
<td>Prevent uterine rupture during labor. Reduce morbidity by avoiding cesarean delivery.*</td>
<td>Allows for the most appropriate mode of delivery in the current pregnancy to be chosen, reducing the risk of adverse outcomes.</td>
</tr>
<tr>
<td>3. Women with one prior transverse lower segment cesarean should undergo a trial of labor unless another indication for cesarean delivery is present.</td>
<td>II-2</td>
<td>Enkin, 1989, in Chalmers et al., 1989; Flamm et al., 1994</td>
<td>Reduce morbidity by avoiding cesarean delivery.*</td>
<td>A trial of labor means that the subject should have regular painful uterine contractions that result in cervical dilation or descent of the fetal presenting part. No difference in fetal outcomes has been shown for repeat cesarean versus trial of labor, but maternal morbidity is reduced with a trial of labor. Approximately 70% of women who attempt a trial of labor after cesarean will deliver vaginally.</td>
</tr>
<tr>
<td>4. Women with a prior vertical cesarean should have a scheduled repeat cesarean delivery.</td>
<td>II-2</td>
<td>Enkin, 1989, in Chalmers et al., 1989</td>
<td>Prevent uterine rupture.</td>
<td>The percentage of women with a vertical incision is low, but in these women there will be a decreased risk of catastrophic uterine rupture with a planned cesarean. Risks are minimal with a small number of women receiving unnecessary cesareans. Although spontaneous labor may unexpectedly ensue prior to the date of the planned cesarean, a cesarean should be carried out as soon as the woman presents in labor. No trial of vaginal delivery should occur.</td>
</tr>
</tbody>
</table>

*Morbidity is primarily for the mother, with increased risk of transfusion, fever, infection and prolonged recovery time.
Quality of Evidence Codes:

I: RCT
II-1: Nonrandomized controlled trials
II-2: Cohort or case analysis
II-3: Multiple time series
III: Opinions or descriptive studies
CESAREAN DELIVERY FOR FAILURE TO PROGRESS IN LABOR

IMPORTANCE

Disorders of the progress of labor, or “failure to progress in labor” can be caused by disproportion in the size of the fetal head and the maternal pelvis or ineffective uterine contractions. These disorders sometimes fall under the heading of “dystocia,” a broad term used to describe a heterogeneous group of labor abnormalities. Some authors have suggested that the diagnosis of dystocia in first pregnancies is primarily responsible for the increase in cesareans seen in the United States, since primary cesareans for dystocia have usually been followed by repeat cesareans for “prior cesarean” (Boylan and Frankowski, 1986). Three times as many women are diagnosed with dystocia now than were so diagnosed in 1970 (VanTuinen and Wolfe, 1992), but the reasons for the increased use of this diagnosis are unknown. Both the NIH Consensus Development Conference on Cesarean Childbirth (1981) and the Canadian National Consensus Conference on Aspects of Cesarean Birth (1986) pointed to the increasing use of this diagnosis as an area for concern, and formulated recommendations regarding the diagnosis. Subsequently, ACOG developed a “criteria set” involving the diagnosis of failure to progress in labor which specifies criteria to be met before assigning the diagnosis and actions to be taken prior to carrying out a cesarean delivery (ACOG, 1994).

EFFICACY AND/OR EFFECTIVENESS OF INTERVENTIONS

Diagnosis

The diagnosis of dystocia can be made in either the first or second stage of labor. The course of labor is generally described by three stages (Figure 6.1). The first stage begins with the onset of labor and continues until complete cervical dilatation (10 cm) is reached. The second stage of labor begins at the time of complete dilatation and ends with complete expulsion of the fetus. The third stage of labor lasts from the delivery of the fetus until expulsion of the placenta. The
first stage of labor is divided into two phases, the latent phase and the active phase. During the latent phase, contractions are often less strong and more irregular than during the active phase, and the rate of cervical dilatation is much slower.

<table>
<thead>
<tr>
<th>Contractions begin</th>
<th>3-4 cm dilatation</th>
<th>10 cm dilatation</th>
<th>Delivery of newborn</th>
<th>Delivery of placenta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latent Phase</td>
<td>Active Phase</td>
<td>First Stage</td>
<td>Second Stage</td>
<td>Third Stage</td>
</tr>
</tbody>
</table>

Figure 6.1 – Standard Terminology Describing the Course of Labor

During the latent phase of labor, change in cervical dilatation is slow with a mean of 7 hours to reach a dilatation of 2.0 to 2.5 cm. At 3 to 4 cm of cervical dilatation, the active phase of labor is entered, and the rate of cervical dilatation increases to 1.0 to 3.0 cm per hour (Crowther et al., 1989, in Chalmers et al., 1989). The second stage of labor begins when the laboring woman has reached 10 cm of cervical dilatation, and ends with delivery of the infant. Controversy remains regarding the definition of abnormal progress in labor, and its effects on the mother and infant. According to ACOG, the rate of cervical dilatation in the active phase below which progress should be considered “abnormal” is 1.5 cm per hour for multiparas or 1.2 cm per hour for nulliparas, based on the observations by Friedman (ACOG Technical Bulletin, No. 137, 1989). The Canadian consensus panel (1989) has suggested that progress of less than 0.5 cm per hour warrants a diagnosis of dystocia. The protocol of the “active management of labor” (O’Driscoll et al., 1984; Lopez-Zeno et al., 1992) uses a threshold of 1 cm per hour. These commonly used definitions for abnormal labor progress have been based on means and standard deviations derived from observing large numbers of labors (Friedman, 1989), and not necessarily on the outcomes of such labors. It is implicit in all of these
definitions of abnormal progress that a series (at least two) of cervical exams is necessary in order to establish a lack of progress.

Although there is no consensus about the specific definition of poor progress in labor, there is one aspect of this diagnosis on which there is no disagreement in the literature. Both the ACOG (1994) and the Canadian consensus panel (1986) agree and have specified in their recommendations that before the diagnosis of "dystocia" can be entertained, a woman should have entered the active phase of labor (defined as a cervical dilatation of at least 3 cm in a nullipara and 4 cm in a multipara). This criterion is also used by those who advocate the active management of labor approach (O’Driscoll et al., 1984; Lopez-Zeno et al., 1992). Because the rate of cervical dilatation in the latent phase is known to be much slower than that in the active phase of labor, the same rate of progress is not to be expected. Although a prolonged latent phase may be associated with later labor abnormalities (Chelmow et al., 1993), there is no evidence and no consensus that cesarean delivery for lack of progress in the latent phase, no matter how slow the progress, is of any benefit to the mother or infant in the absence of another indication for cesarean. Despite this, there is evidence from both Canada and the United States that the diagnosis of dystocia is used frequently prior to the establishment of active labor (Stewart et al., 1990).

**Treatment**

Treatment options once the diagnosis of dystocia is made include continued observation, oxytocin, amniotomy, ambulation or cesarean delivery. The most effective of these treatments for poor progress in labor has not been well-established (ACOG, 1994; Canadian Consensus Conference Report, 1986; Keirse, 1989, in Chalmers et al., 1989). Amniotomy has been shown to shorten the length of labor in nulliparous women and to decrease the incidence of subsequent dystocia (Fraser et al., 1993), but there are no trials of the efficacy of amniotomy alone as a treatment for pre-existing dystocia. A randomized trial of the so-called "active management of labor," which involves early amniotomy, frequent cervical exams and oxytocin treatment when the rate of cervical
dilatation in active labor is less than 1 cm per hour, was published in 1992 (Lopez-Zeno et al., 1992). After controlling for confounding variables, this therapy resulted in a decrease in cesarean delivery (OR 0.57, 95 percent CI 0.36-0.95) which was statistically significant. Labors were also shorter in the treatment than in the control group. It is not clear which element or combination of elements in the active management protocol contributes to the reduction in cesarean use. Keirse (1989, in Chalmers et al., 1989) summarizes the results of four studies of oxytocin treatment for poor progress in labor, only one of which showed an increase in the rate of cervical dilatation in treatment vs. control women. In two of the four trials, ambulation resulted in the same increase in cervical dilatation as treatment with oxytocin.

ACOG (1994) has stated that cesarean delivery should be used to treat these disorders only when "...there has been no change in either dilatation of the cervix or descent of the presenting part after at least 2 hours of active labor following completion of the latent phase" (the two hour time period appears to be derived from consensus and not from outcomes data). This recommendation is based on the observation that "...95 percent of women will have three to five contractions every 10 minutes that are each greater than 25 mm Hg above baseline." Thus, they suggest that it is reasonable to proceed to cesarean delivery when a laboring woman has met this norm and still has had no change in cervical dilatation or descent of the presenting part over a period of two hours. The Canadian consensus panel (1986) did not make a specific time recommendation about when to proceed to cesarean delivery. Both groups specify that other therapeutic interventions such as amniotomy or oxytocin should be used in an attempt to correct the problem before resorting to cesarean delivery.
## RECOMMENDED QUALITY INDICATORS FOR CESAREAN DELIVERY FOR FAILURE TO PROGRESS IN LABOR

The following criteria apply to all women admitted for labor and delivery.

### Diagnosis

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Quality of evidence</th>
<th>Literature</th>
<th>Benefits</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. When the diagnosis of failure to progress in labor is made, a woman</td>
<td>III</td>
<td>AGOG, 1994; Canadian Consensus</td>
<td>Reduce morbidity by avoiding cesarean section delivery.*</td>
<td>Reduces the number of unnecessary cesarean deliveries because the diagnosis of failure to progress in labor is not applicable in the latent phase. Unlike the active phase, there are no accepted standards for dilatation during the latent phase. Risks are minimal. Other terms for failure to progress are: &quot;cephalopelvic disproportion,&quot; &quot;protracted or prolonged active phase,&quot; &quot;protracted or prolonged first stage,&quot; &quot;feto-pelvic disproportion,&quot; and &quot;arrest of dilatation.&quot; The active phase of labor is defined as a cervical dilatation of 3 cm for nulliparas and 4 cm for multiparas.</td>
</tr>
<tr>
<td>should be in the active phase of labor.</td>
<td>Conference Report, 1986</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. When the diagnosis of failure to progress in labor is made, at least</td>
<td>III</td>
<td>ACOG, 1994; Canadian Consensus</td>
<td>Reduce morbidity by avoiding cesarean section delivery.*</td>
<td>This is implicit in recommendations that the observation of progress over time is necessary to establish the diagnosis. Repeat exams increase the accuracy of diagnosis since the lack of a change over time is necessary to assess the progression of labor and helps reduce the likelihood of an unnecessary cesarean delivery. Risks are minimal.</td>
</tr>
<tr>
<td>two exams of cervical dilatation separated in time by at least 2 hours</td>
<td>Conference Report, 1986</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>should have been done and recorded in the medical record.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Treatment

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Quality of evidence</th>
<th>Literature</th>
<th>Benefits</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Before a cesarean delivery is used to treat failure to progress in labor, at least one of the following therapeutic interventions should have been tried after the time of the diagnosis of FTP: 1) Amniotomy 2) Oxytocin 3) Ambulation</td>
<td>III</td>
<td>ACOG, 1994; Canadian Consensus Conference Report, 1986</td>
<td>Reduce morbidity by avoiding cesarean section delivery.*</td>
<td>There is no clear evidence that any one of these interventions is more effective than the others in treating failure to progress in labor. These measures should result in a shorter length of labor. May lead to a decrease in the cesarean delivery rate with certain protocols. Risk is minimal.</td>
</tr>
</tbody>
</table>

*Morbidity is mainly for the mother, with increased risk of transfusion, fever, infection and prolonged recovery time.

**Quality of Evidence Codes:**

I: RCT  
II-1: Nonrandomized controlled trials  
II-2: Cohort or case analysis  
II-3: Multiple time series  
III: Opinions or descriptive studies
FETAL DISTRESS/NON-REASSURING FETAL STATUS AND INTRAPARTUM FETAL HEART RATE MONITORING

IMPORTANCE

Cesarean deliveries for “fetal distress” account for about 10 percent of all cesareans. The incidence of this diagnosis increased dramatically during the 1980s, from 1.2 percent of all deliveries in 1980 to 6.3 percent in 1989 (VanTuinen and Wolfe, 1992). This increase coincided with the increase in use of electronic fetal monitoring (EFM), a technology which was adopted and enjoyed widespread use prior to extensive study in randomized trials. The goal of electronic fetal heart rate monitoring is to detect changes in the fetal heart rate that are indicative of fetal hypoxia (commonly known as “fetal distress” or “non-reassuring fetal status”), and that might eventually lead to either permanent neurologic injury or death.

EFFICACY AND/OR EFFECTIVENESS OF INTERVENTIONS

Diagnosis

The development of procedures such as EFM to screen for fetal distress, has been made difficult by the lack of a “gold standard” against which they can be assessed. Initially, Apgar scores were used to determine the presence or absence of “true” distress, but they have been shown to correlate poorly with other morbidity measures and with long-term outcomes (Sykes et al., 1982). Measurement of fetal acid-base status, either intrapartum with scalp blood sampling, or after birth with cord blood, gives a better idea of the metabolic status of the infant, but is still not a highly reliable predictor of long-term infant morbidity or mortality (Clark and Paul, 1985). Inter- and intra-observer reliability of EFM interpretation is poor. In one study, four obstetricians were asked to read 50 different EFM tracings. Only 11 of the 50 tracings were assessed in the same way (“need for immediate delivery“) by all four physicians. Twenty-one percent of the tracings
were interpreted differently by individual obstetricians when reassessed two months later (Nielsen et al., 1987).

At least 10 randomized controlled trials have been published comparing routine electronic fetal monitoring in labor to either selective monitoring of high-risk pregnancies (Leveno et al., 1986) or to intermittent auscultation of the fetal heart rate (periodically listening to the fetal heart rate with either a stethoscope or Doppler device) by a nurse or midwife (Haverkamp, 1976; Renou, 1976; Kelso et al., 1978; Wood et al., 1981; Neldam, 1986; MacDonald et al., 1985; Luthy et al., 1987; Vintzileos, 1993). Meta-analysis revealed that routine electronic fetal heart rate monitoring increased the risk of cesarean delivery for “fetal distress,” maternal infection and general anesthesia (Grant, 1989, in Chalmers et al., 1989). EFM did not decrease perinatal deaths, but did decrease the incidence of neonatal seizures, though the long-term benefits of this reduction in neonatal seizures are unclear (MacDonald et al., 1985). EFM may be more effective in certain subgroups.

The Dublin randomized trial of intrapartum fetal heart rate monitoring randomized over 12,000 women to either continuous EFM or intermittent auscultation. This study, which used fetal scalp sampling to document the presence or absence of fetal acidemia in conjunction with EFM, found no overall increase in cesarean deliveries with EFM (OR 1.10, 95 percent CI 0.88-1.38), but a significant increase in cesareans for fetal distress (OR 2.37, 95 percent CI 1.22-4.6). In this study, perinatal deaths were not different between the two groups, but the incidence of neonatal seizures was lower in the EFM group (OR 0.46, 95 percent CI 0.25-0.87). Retrospective re-analysis of the data from this trial showed the increase in neonatal seizures to be only among those infants where labor was induced, augmented or prolonged (Grant, 1989, in Chalmers et al., 1989). A randomized trial of 34,995 pregnancies in Dallas, Texas, compared routine EFM to EFM only in high-risk pregnancies. In this trial, there was no difference in neonatal seizures (OR 1.16, 95 percent CI 0.78-1.73) or perinatal death (OR 0.87, 95 percent CI 0.73-1.02) between the two groups. These findings have led to the suggestion that EFM is effective in preventing adverse infant
outcomes in high-risk pregnancies, but has no beneficial fetal effects in pregnancies not at high risk for intrapartum distress.

The ACOG considers continuous electronic monitoring and intermittent auscultation to be equivalent methods for monitoring a fetus in labor (ACOG Technical Bulletin, No. 132, 1989), but notes that staffing limitations may limit the option for auscultation in many institutions. They do not make a distinction as to the type of monitoring that should be used for high-risk vs. low-risk pregnancies, nor do they suggest criteria for differentiating between those two subgroups. The auscultation regimen used in the randomized trials is every 15 minutes in the first stage and every 5 minutes in the second stage, requiring 1:1 nursing care. ACOG suggests that in low-risk pregnancies the heart rate should be monitored every 30 minutes in the first stage, and every 15 minutes in the second stage, although they acknowledge there are no data supporting this as the optimal time interval. In contrast to the ACOG recommendations, the U.S. Preventive Services Task Force (1989) recommends that “fetal heart rate should be measured by auscultation on all women in labor to detect signs of fetal distress. Electronic fetal monitoring should not be performed routinely on all women in labor. It should be reserved for pregnancies at increased risk for fetal distress.” The Canadian Task Force on the periodic health exam has advised against routine electronic fetal monitoring in normal pregnancies, and states that the data are currently insufficient to recommend universal electronic monitoring in high-risk pregnancies (Anderson and Allison, 1990, in Goldbloom and Lawrence, 1990).
### RECOMMENDED QUALITY INDICATORS FOR CESAREAN DELIVERY FOR FETAL DISTRESS

The following criteria apply to all women admitted for labor and delivery.

#### Diagnosis

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Quality of evidence</th>
<th>Literature</th>
<th>Benefits</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fetuses should be monitored during active labor. The forms of monitoring are: 1) intermittent auscultation with a stethoscope or doppler device; or 2) continuous electronic fetal monitoring (EFM).</td>
<td>III</td>
<td>Grant, 1989, in Chalmers et al., 1989</td>
<td>Decrease fetal morbidity and mortality.*</td>
<td>There are no trials comparing absence of fetal monitoring to monitoring during labor since there is general consensus that some form of monitoring is necessary. Active labor begins at 4 cm of cervical dilatation.</td>
</tr>
</tbody>
</table>

*Morbidity includes anoxia, seizures, and long-term neurologic damage.

#### Quality of Evidence Codes:

I: RCT
II-1: Nonrandomized controlled trials
II-2: Cohort or case analysis
II-3: Multiple time series
III: Opinions or descriptive studies
PROPHYLACTIC ANTIBIOTICS FOR CESAREAN DELIVERY

IMPORTANCE

Post-partum infection is a common complication of cesarean delivery (Gibbs, 1985). Fever, endometritis, and more serious infections such as wound infection, sepsis and septic pelvic thrombophlebitis are all more likely to occur after cesarean delivery than after vaginal delivery (Enkin et al., 1989, in Chalmers et al., 1989). The prevalence of specific types of infection is not well understood because of varying definitions applied in the literature (Enkin et al., 1989, in Chalmers et al., 1989); however, estimates of endometritis range from 12 to 95 percent following cesarean delivery, depending on the patient population under study. Other infections may occur in as many as 25 percent of women delivered by cesarean (Gibbs, 1985).

EFFICACY AND/OR EFFECTIVENESS OF INTERVENTIONS

Prevention

Prophylactic antibiotics for the prevention of post-cesarean infectious morbidity have been extensively studied. Enkin et al. (1989, in Chalmers et al., 1989) summarized the results of over 90 controlled trials that examined the effect of prophylactic antibiotics in cesarean delivery (Table 6.1). A meta-analysis of 43 controlled trials showed that the odds ratio of serious infection (defined as septicemia, pelvic abscess, general peritonitis or serious wound infection) was 0.24 (95 percent CI 0.18-0.32) when use of prophylactic antibiotics was compared to no treatment. A similar effect was seen with post-partum endometritis, where an analysis of 44 studies gave an odds ratio of 0.25 (95 percent CI 0.22-0.29) when prophylactic antibiotics were compared to no treatment. A summary of 42 studies of the effects of prophylactic antibiotics on wound infection showed an odds ratio of 0.35 (95 percent CI 0.28-0.44).

While the risk of post-operative infection following cesarean is greater for emergency deliveries than for elective ones, prophylactic
antibiotics have also been shown in a meta-analysis of a subset of the above studies to reduce both endometritis (OR 0.23; 95 percent CI 0.13-0.42) and wound infection (OR 0.10; 95 percent CI 0.03-0.36) following elective cesarean delivery (Enkin et al., 1989, in Chalmers et al., 1989).

Table 6.1
Effect of Prophylactic Antibiotics on Post-Cesarean Infection

<table>
<thead>
<tr>
<th>Type of Infection</th>
<th>Wound infection</th>
<th>Endometritis</th>
<th>Other serious infection*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All cesareans</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OR</td>
<td>0.35</td>
<td>0.25</td>
<td>0.24</td>
</tr>
<tr>
<td>95% CI</td>
<td>0.28-0.44</td>
<td>0.22-0.29</td>
<td>0.18-0.32</td>
</tr>
<tr>
<td>No. studies</td>
<td>42</td>
<td>44</td>
<td>43</td>
</tr>
<tr>
<td>N</td>
<td>5372</td>
<td>5661</td>
<td>5777</td>
</tr>
<tr>
<td>Experi/Control</td>
<td>3036/2441</td>
<td>3235/2545</td>
<td>3323/2605</td>
</tr>
<tr>
<td><strong>Elective cesareans</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OR</td>
<td>0.10</td>
<td>0.23</td>
<td>NA</td>
</tr>
<tr>
<td>95% CI</td>
<td>0.03-0.36</td>
<td>0.13-0.42</td>
<td>NA</td>
</tr>
<tr>
<td>No. studies</td>
<td>5</td>
<td>11</td>
<td>NA</td>
</tr>
<tr>
<td>N</td>
<td>164</td>
<td>425</td>
<td>NA</td>
</tr>
<tr>
<td>Experi/Control</td>
<td>86/78</td>
<td>241/214</td>
<td>NA</td>
</tr>
</tbody>
</table>

*This includes septicemia, pelvic abscess, general peritonitis or cases specified by the authors as serious wound infections. NA=not available, expt=experimental (antibiotic) group.


Penicillins, cephalosporins, metronidazole, and combinations of clindamycin plus gentamycin have all been studied for use in prophylaxis. There does not appear to be a clear advantage of any one of these antibiotics over the others (Gibbs, 1985; Enkin et al., 1995). There is some evidence that the combination of penicillin plus aminoglycoside may reduce febrile morbidity to a greater extent than penicillin alone, however the increased risk of nephrotoxicity and ototoxicity with aminoglycosides should be considered. Shorter courses of antibiotic prophylaxis appear to be less effective than longer courses in reducing febrile morbidity, but there is no agreed upon
duration of prophylaxis that maximizes benefits in reducing infection and minimizes antibiotic toxicity and cost. Even single-dose therapy results in significant reductions in infectious outcomes (Enkin et al., 1995).

Potential adverse consequences of routine antibiotic prophylaxis include diarrhea, development of resistant strains, and allergic and/or toxic reactions to the antibiotic administration. The prevalence of such reactions is not well known, although there have been no reports of serious maternal side effects of antibiotic prophylaxis for cesarean delivery. The reported prevalence of mild drug reactions such as rash is less than 1 percent; however, this may be an underestimation due to under-reporting in the studies cited above (Enkin et al., 1989, in Chalmers et al., 1989). Antibiotics administered to the mother prior to the delivery of the infant can result in transfer of the medication to the fetus. This can lead to diagnostic interventions to rule out sepsis in the newborn which are costly and distressing to parents and infant. The available evidence suggests that antibiotics administered after cord clamping are just as effective as those administered pre-operatively in preventing post-operative infection (Enkin et al., 1989, in Chalmers et al., 1989).

Risk factors for infection following cesarean delivery include prolonged labor, prolonged rupture of membranes, internal monitoring, multiple vaginal exams during labor, obesity and low socioeconomic status (Gibbs, 1985; Enkin et al., 1989, in Chalmers et al., 1989). The data reviewed by Enkin (1989) suggest that prophylactic administration of antibiotics should be routine policy, except in the rare case where the prevalence of post-operative infection in an institution is low without the use of prophylaxis.
**RECOMMENDED QUALITY INDICATORS FOR ANTIBIOTIC PROPHYLAXIS FOR CESAREAN DELIVERY**

The following criteria apply to all women who deliver by cesarean.

**Prophylactic Antibiotics for Cesarean Delivery**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Quality of evidence</th>
<th>Literature</th>
<th>Benefits</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Women who give birth by cesarean should receive at least one dose of antibiotic prophylaxis.</td>
<td>I</td>
<td>Enkin et al., 1989, in Chalmers et al., 1989</td>
<td>Reduce endometritis. Reduce wound infection.</td>
<td>Routine prophylaxis with antibiotics results in reduction in endometritis (OR=0.23) and wound infection (OR=0.10). Side effects of antibiotics include rash and GI upset as well as a small risk of anaphylaxis.</td>
</tr>
<tr>
<td>2. Prophylactic antibiotic regimens should include one of the following: broad spectrum penicillins, broad spectrum cephalosporins, or metronidazole.</td>
<td>I</td>
<td>Enkin et al., 1989, in Chalmers et al., 1989; Enkin et al., 1995</td>
<td>Reduce endometritis. Reduce wound infection.</td>
<td>These drugs have been shown to be effective in lowering febrile morbidity and the incidence of wound infection in cesarean delivery. Categories of antibiotics other than these have not been studied and should not be used for prophylaxis.</td>
</tr>
<tr>
<td>3. Aminoglycosides should not be used, alone or in combination, for antibiotic prophylaxis.</td>
<td>III</td>
<td>Enkin et al., 1989, in Chalmers et al., 1989; Gibbs, 1985</td>
<td>Prevent oto- and nephro-toxicity.</td>
<td>There is no evidence that any additional benefit confirmed by adding aminoglycosides to the prophylactic regimen outweighs the added risk of oto- and nephro-toxicity.</td>
</tr>
<tr>
<td>4. Prophylactic antibiotics should be administered after the umbilical cord is clamped.</td>
<td>II</td>
<td>Enkin et al., 1989, in Chalmers et al., 1989; Gibbs, 1985</td>
<td>Prevent unnecessary transfer of medication to fetus.</td>
<td>Administering antibiotics after cord clamping avoids transfer of medication to the fetus and interventions to rule out sepsis in an infant “treated” with antibiotics prior to delivery are avoided. Antibiotic effectiveness is still maintained. When chorioamnionitis is present prior to delivery, antibiotic therapy is therapeutic as opposed to prophylactic. Institution of antibiotics prior to delivery of the infant in these cases may be appropriate.</td>
</tr>
</tbody>
</table>

**Quality of Evidence Codes:**

I: RCT  
II-1: Nonrandomized controlled trials  
II-2: Cohort or case analysis  
II-3: Multiple time series  
III: Opinions or descriptive studies
REFERENCES - CESAREAN DELIVERY


Enkin M. 1989. Labour and delivery following previous caesarean section. In Effective Care in Pregnancy and Childbirth. Volume 2:


