Chapter 7

Quality Improvement Opportunities in Intrapartum Care

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The intrapartum period represents a time of significant risk to both mother and fetus.[1,2] While small in an absolute sense, risks experienced during the peripartum period (for example, fetal neurologic impairment due to prematurity and maternal death from hemorrhage) are relatively large in relation to those experienced at other times during pregnancy or infancy.[1,2] The intrapartum period also represents a time of great opportunity for improving patient outcomes by applying quality improvement principles — process standardization and the use of checklists, teamwork training, crew resource management and evidence-based medicine — to the care of the laboring woman.[3-6]

Interdisciplinary communication and multidisciplinary peer review are essential components of any patient safety program directed at labor and delivery care.

This chapter is not intended as a comprehensive treatise on intrapartum care but to highlight several important areas in current obstetric practice where opportunities for improving outcomes are backed by sound scientific data. Additionally, this chapter underscores the importance of systems change in improving outcomes. For instance, interdisciplinary communication and multidisciplinary peer review are essential components of any patient safety program directed at labor and delivery care.[1,7] To this end, standardized online educational programs, including those directed at fetal heart rate pattern interpretation and the management of shoulder dystocia and postpartum hemorrhage have proven valuable in many facilities. A number of hospitals require successful completion of such educational programs as part of standard credentialing for both physicians and nurses.

Confidential peer review of adverse outcomes is also an essential component of quality improvement and patient safety. Such programs are often made difficult by potential conflicts of interest that exist when the individual undergoing review is either the practice partner or the economic competitor of the reviewers.[1] In addition, attacks on the confidentiality of the peer review process dramatically weaken the effectiveness of such programs and endanger patient safety.

These areas may serve as valuable focal points for individuals, health care facilities and hospital systems aiming to improve the outcomes of pregnancy.

Select Specific Interventions

Timing of elective delivery

For at least 50 years, "term" pregnancy has been defined as one in which 37 to 42 weeks have elapsed since the last menstrual period.[8] Until recently, however, birth outcomes within this 5-week range have received little attention. This issue is of particular importance given our current understanding of the significant short- and long-term morbidity associated with late preterm birth (34 to 36 weeks).[8]

While there are many valid medical and obstetric indications for delivery before 39 weeks of gestation, medical justification for a significant proportion of early deliveries is questionable. Of all births in the United States, 10 to 15 percent are currently performed electively (without identifiable medical or obstetric indication) and before 39 weeks of gestation.[9,10] This includes elective induction of labor and elective primary and repeat cesarean delivery.[9-11] Recent data show that elective delivery prior to 39 weeks of gestation is associated at a minimum with significant short-term morbidity; long-term outcomes in this group, including the type of impaired learning ability and school performance demonstrated in the late preterm infant, have yet to be comprehensively examined.

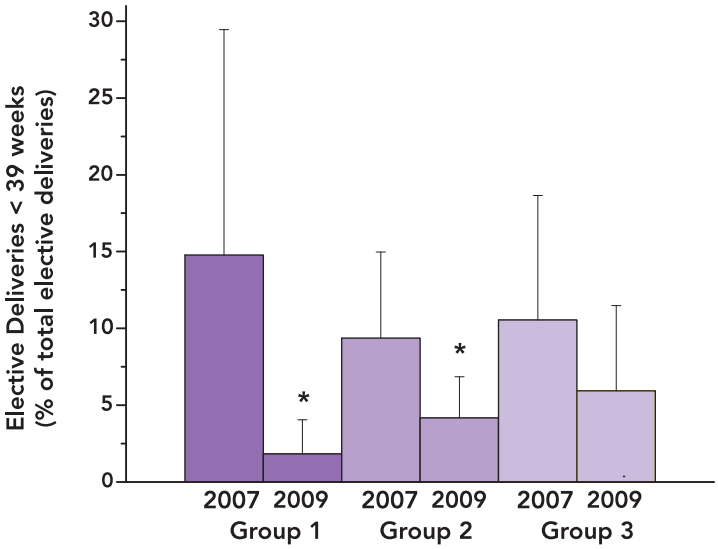
Figure 1 demonstrates newborn intensive care admissions in infants electively delivered at 37, 38 and 39+ weeks of gestation.[9] Neonatal morbidity, as assessed by the need for newborn intensive care, is doubled in infants born electively at 38 to 39 weeks and increased 400 percent in those delivered at 37 to 38 weeks, compared to those delivered at or beyond 39 weeks. Infants born before 39 completed weeks of gestation also have a higher incidence of respiratory distress syndrome and infant death than those delivered later.[9,11]

Confirmation of fetal lung maturity with amniocentesis in order to accomplish elective delivery before 39 weeks probably represents a poor risk/benefit trade-off when elective induction, rather than repeat cesarean, is being considered. Recent data show increased neonatal morbidity with elective delivery prior to 39 weeks even after confirmation of lung maturity.[12] Further, since the rate of primary cesarean associated with induction of labor is directly related to cervical dilatation at the onset of induction, the practice of elective inductions prior to 39 weeks of gestation may also contribute to the rising primary cesarean delivery rate seen in the United States.[9,13] Additional drivers of elective deliveries before 39 weeks include physician convenience and patient expectations.[14]

Given the frequency of elective, early delivery, spontaneous change is unlikely. However, experiences from several institutions suggest that effective medical leadership and the adoption of strict institutional protocols governing the timing of elective delivery could significantly reduce the rate of elective delivery before 39 weeks of gestation to less than 5 percent of deliveries, with a proportional reduction in associated morbidity (Figure 2).[10,15,16] Both the National Quality Forum and The Joint Commission have found these measures important enough to include as quality benchmarks.[17,18] The American College of Obstetricians and Gynecologists also has cautioned against early, elective delivery.[19] The March of Dimes Foundation offers on its website a toolkit for clinicians for use in discouraging elective births before 39 completed weeks of gestation.[20]

Figure 1: Elective Term Delivery and NICU Admission[9]

Figure 2: Elective Deliveries < 39 Weeks[10]



This figure demonstrates the relative effectiveness of various approaches to the reduction of elective delivery prior to 39 weeks gestation. Group 1 consists of facilities in which a departmental policy against this practice was enforced by hospital personnel. Group 2 represents facilities in which a similar departmental policy was only backed by peer review of outliers. Group 3 consists of facilities in which physician education alone was employed. The change in the latter group was not statistically significant.

The safe use of oxytocin

Oxytocin is the drug most commonly associated with preventable adverse events during childbirth and is also the drug most frequently implicated in professional liability claims.[21,22] The Institute for Safe Medical Practice recently designated oxytocin a "high alert medication," bearing a "heightened risk of harm," which warrants "special safeguards to reduce the risk of error."[21]

Protocols for the safe administration and monitoring of oxytocin should be based upon several evidence-based physiologic principles:[21]

- Following any change in dose, oxytocin reaches steady state levels after 30 to 40 minutes.
- There is unpredictable variability in individual response to a given dose.
- Adverse fetal effects of oxytocin are exclusively due to excessive uterine activity, which is dose related.
- Fetal pH reliably falls during labor with uterine contractions more frequent than every 2 to 3 minutes.

From these principles it follows that any general regimen for oxytocin infusion would ideally:

- begin at a low dose (1 to 2 milliunits [mU]/minute);
- increase the dose only after sufficient time has elapsed to allow full evaluation of the effects of the initial dose (30 minutes);
- maintain or decrease the dose once a clinically adequate contraction pattern has been obtained;
- institute a protocol to ensure that fetal and uterine effects of the infusion are carefully and uniformly monitored;[23] and
- include adequate nurse staffing (one registered nurse to one woman receiving oxytocin for labor induction or augmentation).

Alternative infusion protocols utilizing higher doses and more frequent dosing intervals have been proposed and extensively studied.[21] In some cases, such protocols may be carried out without increased morbidity and with shorter labors. However, two meta-analyses have demonstrated increased uterine tachysystole, a lower rate of spontaneous vaginal birth, increased postpartum hemorrhage and increased infection with the use of high- vs. physiologic-dose protocols. In one report, using a protocol in which oxytocin was increased at a rate of 6 mU/min every 20 minutes, labor was shortened, compared to a low-dose protocol. However, uterine tachysystole was seen in half of patients, and cesarean delivery for abnormal fetal heart rate patterns occurred at twice the rate seen with a low-dose regimen.[24]

While no increase in short-term neonatal asphyxial effects was demonstrable in patients experiencing tachysystole and undergoing cesarean delivery for abnormal fetal heart rate patterns in this academic center, the avoidance of near misses is an integral part of current patient safety-based practice. Thus, if patient safety rather than speed of delivery is the primary concern, these data strongly suggest that such high-dose protocols are not ideal for routine use.[21,25]

In some cases, medical or obstetric indications justify a trade-off between the advantages of shortened labor and the risks of high-dose oxytocin protocols. For example, a woman whose well-being is at risk from severe preeclampsia and falling platelet levels may require more aggressive use of oxytocin to hasten delivery.

Simpson and Lyndon have shown that while 80 percent of nurses at the bedside are aware of the correct clinical action in response to uterine tachysystole (i.e., turn down the rate of oxytocin infusion,) this appropriate action occurs only 22.5 percent of the time, and in some instances, the oxytocin actually is increased.[26] The most common cause of discord between the obstetrician and labor nurse is the tendency of the obstetrician not at the patient's bedside to urge the use of oxytocin in a manner that the bedside labor nurse deems unsafe.[21,27]

Uniformity of approach generally is associated with improved performance or outcomes,[1,23,25] and all these considerations suggest the need for a more uniform approach to oxytocin administration and monitoring, particularly within a single institution. As a reasonable addition to uniform low-dose infusion rates, standard, highly specific, checklist-driven protocols focusing on uterine and fetal response to oxytocin may improve neonatal outcomes and reduce the primary cesarean delivery rate for abnormal fetal heart rate patterns[23,25] (see Appendix). Because excessive uterine activity may occasionally be seen with even the most careful clinical care, a "rescue" protocol allowing independent nursing discontinuation of oxytocin and the administration of terbutaline sulfate should be available in every delivery facility.[27]

The cesarean delivery rate

The rise in both primary and repeat cesarean delivery rates over the past several decades is a well-described phenomenon.[28] With the exception of focused protocols to reduce oxytocin-related abnormal fetal heart rate patterns and restrict the practice of elective inductions prior to 39 weeks of gestation, no programs have effectively curbed the ongoing increase in the primary cesarean rate in large populations. While numerous factors contribute to the increase, we believe that the primary contributors are four-fold:

- lack of a tool to detect developing fetal acidemia during labor with a near perfect sensitivity and a high positive predictive value;[29]
- lack of clear national guidelines for diagnosing labor arrest requiring cesarean delivery;[28]
- fear of litigation from failure to perform cesarean delivery;[30] and
- a safety profile for cesarean delivery, which closely approaches that of vaginal birth.[2]

Without any change in the first three factors listed above, we expect to see the cesarean rate remain relatively high in the United States. The cesarean rate is a poor metric for assessing quality of intrapartum care, either individually or institutionally. The ideal rate should be viewed as a secondary parameter that will only be approached as individual components of intrapartum care are perfected.[1]

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Magnesium sulfate for neuroprotection and cerebral palsy

Cerebral palsy most commonly results from prematurity, in-utero infection or other, incompletely understood developmental events unrelated to intrapartum care. However, both intrapartum asphyxia and intracranial hemorrhage may lead to cerebral palsy in previously normal infants.[3]

Scientific and medical organizations dealing with the fetus and newborn now universally accept criteria that support the link between intrapartum asphyxia and cerebral palsy.[3] Appropriate intrapartum care can, in some cases, prevent such events. However, extremely premature infants are at particular risk for the later development of cerebral palsy. Until recently, little was known about effective methods of cerebral palsy prevention in these babies.

We recommend that clinicians consider the administration of magnesium sulfate for neuroprophylaxis in all infants less than 32 weeks of gestation who are at significantly increased risk for preterm delivery.

Several studies, including two meta-analyses, have demonstrated a reduction in cerebral palsy in infants delivered before 32 weeks, who received magnesium sulfate prior to delivery.[31,32] Other types of neurologic dysfunction, including development delay, intellectual impairment, blindness or deafness are not affected. In the animal model, magnesium prevents post-hypoxic brain injury by blocking the excess release of glutamate in the calcium channel.[33] Both fetal and newborn brains appear to be susceptible to glutamate-mediated injury. Magnesium sulfate also has been shown to alter differential expression of the inflammatory mediator IL-1 and reduce neuronal injury in the mouse model.[34]

Various doses, durations of therapy and dosing intervals have been studied, and most seem to demonstrate similar benefit. We recommend that clinicians consider the administration of magnesium sulfate for neuroprophylaxis in all infants less than 32 weeks of gestation who are at significantly increased risk for preterm delivery. Institutions should adhere to one of the available, peer-reviewed, published protocols.[35] While the reduction in rates of cerebral palsy seen with magnesium sulfate administration are important, most studies show a reduction in the absolute magnitude of risk on the order of approximately 2 percent. Thus, it would be scientifically invalid to conclude that cerebral palsy in any individual case would probably have been avoided had magnesium sulfate been administered.

As the authors of one meta-analysis noted, "Further studies are required to clarify how magnesium sulfate works, who should receive it, and how best the treatment should be given. Studies comparing the dose, timing of administration, and whether maintenance magnesium therapy is required and whether it should be repeated are needed."[6] Current recommendations allow the use of various doses and dosing intervals for the administration of magnesium sulfate for neuroprotection, and no specific protocol or set of risk factors can be considered superior to another. We do recommend that institutions develop uniform criteria and protocols for such treatment based upon any one of a number of published approaches.

Brachial plexus impairment

Several large clinical studies document that many cases of brachial plexus impairment, including frank nerve root avulsion, result from unavoidable in-utero processes that also predispose the infant to shoulder dystocia at birth.[36,37] Brachial plexus injury and shoulder dystocia are commonly separate complications with a common origin, namely, fetal-pelvic disproportion during late pregnancy and/or labor. However, some cases of shoulder dystocia may result in brachial plexus injury.

A number of maneuvers are available to the clinician faced with shoulder dystocia. Such maneuvers will generally allow delivery of the infant without brachial plexus injury, excluding those cases described above, in which injury already exists due to the same factors that lead to the shoulder dystocia.

Since shoulder dystocia is both, in an absolute sense, unavoidable and not commonly encountered by the team providing intrapartum care, a uniform team management approach may improve the handling of this emergency. Drills, continuing medical education, interactive online courses and protocols that clarify the duties of each team member are all valuable tools in achieving uniformity of care. We recommend that facilities providing delivery services develop and implement a plan to assure proper team management of shoulder dystocia, utilizing one or more of the above training tools. Accurately documenting the maneuvers utilized and avoided in the management of shoulder dystocia is also essential and could be facilitated by the use of available checklists.

Conclusion and Recommendations

Given the current state of science, evidence-based initiatives to improve intrapartum care appear best suited for:

- introducing facility-based protocols and developing effective medical leadership to eliminate elective birth before 39 completed weeks of gestation and its associated morbidity, while improving patient safety and pregnancy outcomes;
- using standardized, low-dose oxytocin protocols for induction and augmentation of labor;
- implementing unambiguous, uniformly implemented protocols for monitoring oxytocin infusion;
- avoiding inappropriate cesarean deliveries and de-emphasizing cesarean delivery rate as a primary quality indicator;
- adopting protocols for administering magnesium sulfate for neuroprotection in premature infants, modeled after published approaches;
- instituting educational/training methodology designed to enhance team response to obstetric emergencies, including shoulder dystocia and postpartum hemorrhage, to promote clinician understanding of intermediate and abnormal fetal heart rate patterns;
- using available checklists to accurately document the maneuvers utilized and avoided in the management of shoulder dystocia; and
- developing a robust quality improvement program for intrapartum care processes.

Patient safety initiatives based on these principles have resulted in significant improvements in perinatal outcomes in select facilities and hospital systems. Focusing on any of these areas would help individuals and facilities to further improve the outcomes of pregnancy.

Appendix

HCA

HCA Perinatal Safety Initiative

Recommended

Oxytocin "In Use" Checklist for Women with Term Singleton- Babies

"This Oxytocin "In Use" Checklist represents a guideline for care: however, individualized medical care is directed by the physician."

Checklist will be completed every 30 minutes. Oxytocin should be stopped or decreased if the following checklist cannot be completed.

Date and time completed _____

☐ **Fetal Assessment indicates:**

- ☐ At least 1acceleration of 15 bpm x 15 seconds in 30 minutes or adequate variability for 10 of the previous 30 minutes.
- ☐ No more than 1 late deceleration occurred.
- ☐ No more than 2 Variable decelerations exceeding 60 seconds in duration and decreasing greater than 60 bpm from the baseline within the previous 30 minutes.

☐ **Uterine Contractions**

- ☐ No more than 5 uterine contractions in 10 minutes for any 20minute interval
- ☐ No two contractions greater than 120 seconds duration
- ☐ Uterus palpates soft between contractions
- ☐ If IUPC is in place, MVU must calculate less than 300 mm Hg and the baseline resting tone must be less than 25 mm Hg.

***If Oxytocin is stopped the Pre-Oxytocin Checklist will be reviewed before Oxytocin is reinitiated.**

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