Abnormalities of the First and Second Stages of Labor

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Abnormalities of the first and second stages of labor refer, for the most part, to abnormal progression of labor. Abnormal labor progression includes the clinical terms of “dystocia,” “slow progress in labor,” “dysfunctional labor,” “failure to progress,” and “cephalopelvic disproportion.” Dystocia is the most common clinical problem a clinician must confront during labor, and efforts to prevent or correct dystocia account for most labor interventions. In the United States, dystocia is the most common indication (30%) for primary cesarean delivery (CD), and accounts for as many as 68% of unplanned, vertex CDs. Because most repeat CDs follow a first CD for dystocia, approximately 60% of all CDs are related to this diagnosis [1]. Despite this frequency and clinical importance, there is inconsistency among practitioners regarding the diagnosis, management, and criteria for intervention for labor abnormalities.

This article discusses the risk factors, diagnoses, management options, and outcomes of the various categories of labor abnormalities, and provides an evidence-based approach where one exists. The article concentrates on the term, healthy woman carrying a singleton, vertex, normally grown fetus with no anomalies.

**Diagnosis and terminology**

Dystocia (literally: ἄνυξ, abnormal or difficult, and τόκος, labor or delivery, in ancient Greek) is characterized by slow progress or (eventual) arrest of labor. When
it results in a CD, the diagnosis is usually described as cephalopelvic disproportion (CPD) or failure to progress. Originally, CPD described obstructed labors occurring as a result of pelvic contracture caused by rickets. Fortunately today, true pelvic contracture is rare and CPD is a subjective diagnosis based on a clinical suspicion that the baby is either too large or malpositioned, or the pelvis too small for a vaginal delivery or both. As opposed to its original use, the current term CPD does not imply a permanent condition, because over two thirds of women diagnosed with CPD in the index pregnancy go on to deliver even larger infants vaginally in subsequent pregnancies if vaginal birth is attempted [2]. Unless CPD is proved by appropriate pelvimetry, the authors believe the term CPD should be abandoned.

Failure to progress is a more general term that refers to both the absence of progressive cervical dilatation or progressive fetal descent. Although not all the factors leading to failure to progress are recognized, failure to progress can be the result of true CPD (passenger or passage); ineffectual uterine activity; or ineffective maternal expulsive efforts (power). Dystocia often involves combinations of these factors. The current incidence of dystocia is unknown, because it is dependent on both the definition of abnormal progress in labor (which itself is dependent on the criteria used to define normal labor), and is composed of both dystocia that results in CD and dystocia that results in vaginal delivery. What is clear is that dystocia resulting in CD is overdiagnosed [3].

In 2000, Gifford et al [1] found that 24% of CDs for lack of progress were performed in the latent phase (American College of Obstetricians and Gynecologists [ACOG] criteria), and that 73% of women who had CD before 4 cm had not exceeded Friedman’s [4] limits of a prolonged latent phase. In addition, the second stage of labor was not prolonged in 36% in women whose CD was performed for dystocia at 10 cm.

Ideally, the first step in properly evaluating and managing labor abnormalities is a generally acceptable and clinically meaningful identification of the point at which labor becomes abnormal. The next step would provide a timely intervention, which would be continued until a second clearly defined end point is reached. At this point the patient would either be delivered vaginally or by CD. Unfortunately, such clear-cut guidelines do not exist and the clinician is faced with a wide array of definitions and opinions that may or may not be applicable to his or her patient population. Nevertheless, the next sections summarize the current understanding of labor abnormalities and provide some evidence-based approaches to their management for each stage and phase of labor.

**Abnormalities of the first stage**

The first stage of labor begins with the onset of labor and ends at complete cervical dilatation. It is divided into a latent, early phase, followed by an active phase. Abnormalities of the first stage of labor have been reported in 8% to
11% of women in labor [4,5]. Sheiner et al [6] studied 92,918 term, singleton, vertex pregnancies, and found that independent risk factors for CD for failure to progress were induction, maternal age greater than 35, fetal weight greater than 4 kg, hypertensive disorders, hydramnios, and fertility treatment. Women who were nulliparous or had premature rupture of membranes had a 3.8-fold chance of CD for failure to progress than those without those risk factors. Although there were significantly higher rates of low Apgar scores at 1 and 5 minutes in the failure-to-progress group compared with controls (18.2% versus 2.1% and 1.3% versus 0.2%, respectively), perinatal mortality rates did not differ.

**Latent phase disorders**

*Defining the beginning of labor*

Friedman [4] defined the beginning of the latent phase (the onset of labor) as the time at which the mother recognizes regular contractions. This definition is overly inclusive because pregnant women may perceive painful contractions at any time in pregnancy, especially near term. If a more strict definition of labor, such as painful contractions associated with cervical change (effacement and dilatation), is used, a similar problem is encountered because effacement and dilatation may occur even before labor begins. Hendricks et al [7] observed cervical changes over the last 4 weeks of pregnancy (prelabor) in 303 women, and noted a mean dilatation of 1.8 cm in nulliparous women and 2.2 cm in multiparous women with 60% to 70% cervical effacement in the last few days before delivery.

Many studies regarding the timing of labor interventions define the onset of labor as the time when the patient is admitted to the labor floor [5,7,8]. This works well when there are strict criteria for admission to the labor unit, such as those promulgated by the National Maternity Hospital in Dublin for active management of labor [9]. Their criteria include painful contractions at term associated with any one of the following: ruptured membranes, bloody show, or complete effacement. Beginning of labor is defined as admission, and all management and interventions are based on this starting point.

In contrast, in the United States, most clinicians admit patients in labor based on the degree of discomfort associated with contractions or the extent of dilatation. *Williams Obstetrics* states that with intact membranes and painful contractions, a cervical dilatation of at least 3 to 4 cm can be used to confirm labor and can serve as a convenient starting point for labor management [3]. This means that labor cannot be reliably determined until most if not all the latent phase has been completed. This sentiment is echoed in the ACOG bulletin on dystocia (2003), which avoids discussing the latent phase entirely and “focuses on labor subsequent to entering the active phase…” [10]. This leaves the clini-
cian with no current diagnostic guidelines for the latent phase. Most clinicians continue to use Friedman’s [4] original classification system.

Friedman [4] defined one abnormality of the latent phase: a prolonged latent phase (≥20 hours in nulliparas and ≥14 hours in multiparas between onset of labor and active phase). An arrest of the latent phase implies the woman is not yet in labor. The term “false labor” has often been used in this situation, but the gradual physiologic process by which the uterus and cervix prepare for labor is better termed “prelabor.”

Friedman [4] noted the association between prolonged latent phase and early or excessive sedation, early epidural, and unfavorable cervix at the onset of labor. His studies suggested that a prolonged latent phase did not predict subsequent labor abnormalities or increase perinatal mortality. This was disputed by Chemlow et al [11]. In a study of 10,979 women, patients with prolonged latent phase of labor (defined as ≥12 hours in nulliparous and ≥6 hours in multiparous patients) were at increased risk for other labor abnormalities, CD, low Apgar scores, need for neonatal resuscitation, and febrile morbidity and blood loss. These risks persisted even when controlling for other labor abnormalities, parity, epidural use, meconium, and prolonged rupture of membranes. What is not clear from this study is whether increased or premature intervention contributed to these outcomes.

There are two practical resolutions to the problem of defining when labor begins. The first is to consider the diagnosis of labor as the beginning of the active phase (or admission), and anything before that as prelabor. The second is to use the patient’s own perception of when labor began. The clinical importance of these definitions is obvious and the outcome of labor may depend on the timing of specific interventions. It is far more important to correctly diagnose active labor than to mistakenly diagnose a prolonged latent phase (as opposed to prelabor). Although what seems to be a prolonged latent phase (but may actually be prelabor) may be tiring and frustrating to the patient and her caregiver, it poses little immediate risk for the mother and her fetus. As noted previously, 16% to 40% of CD’s for dystocia were performed before the onset of the active phase [1,12].

Unengaged head at presentation

Several studies have evaluated nulliparous women who present in labor with unengaged (above 0 station) or floating fetal heads (at or above −3 station) [13–16]. Contrary to the generally held belief that most nulliparas present in labor with engaged fetal heads, the fetal head is unengaged in over 70% of nulliparous in both the latent and at the onset of active phase [13,16]. These women have somewhat longer second stages but no greater risk for oxytocin use, instrumental delivery, or shoulder dystocia [14]. Although the risk for CD for abnormal progress of labor was highest (approximate fourfold risk) in those women with a floating head compared with those at lower stations, the highest absolute rate
for CD was 34%, and most women (over 80%) achieved a vaginal delivery [16]. In one study, there were no vaginal deliveries in the group with a persistently floating head at 7 cm [14]. The authors suggest that clinicians should try not to admit women to the hospital before the vertex has descended to at least −2 station, if possible.

**Policy of delayed admission**

A policy of delayed admission may help to avoid premature and unnecessary intervention in women with prolonged latent phase. A number of investigators have found that when women in early labor (before 3 cm dilatation) are admitted to the hospital, they tend to experience longer average labors, increased number of interventions, and more complications of labor [17,18]. In 1998, McNiven et al [17] performed a randomized trial of early versus delayed admission in 209 low-risk nulliparous women in spontaneous labor. Women with regular contractions randomized to early assessment (delayed admission) were not admitted if cervical dilatation was less than 3 cm, whereas those in the control group (direct admission) were. Those in the delayed admission group had significantly less oxytocin use (40% versus 23%); epidural use (90% versus 79%); and shorter durations of labor in the hospital (13.5 versus 8.3 hours) and second stage (95 versus 77 minutes). There were no significant differences in CD or neonatal outcomes.

In 2001, Holmes et al [19] studied the relationship between cervical dilatation at initial evaluation and the risk of CD in 3220 women with vertex singleton pregnancies at term with intact membranes. All patients delivered within 36 hours of initial evaluation. Although the overall rates of CD were low, in nulliparas the odds of a CD were 2.6 times higher (95% CI 1.49–4.61) in patients presenting less than 3 cm compared with those greater than or equal to 4 cm; in multiparas the odds were 4.7 times higher (95% CI 2.64–8.49). The use of oxytocin and epidural was also increased in women presenting earlier. Interestingly, the authors state that the rate of CD was not significantly different for nulliparas or multiparas who were allowed to go home compared with those who were admitted immediately. However, analysis of the data by the journal editor revealed that, when all patients were combined, those with deferred admission had an odds ratio for CD of 0.64 (95% CI 0.42–0.97) (ie, about a one third reduction in risk of CD) [20]. The authors concluded that women who present early are somehow different than those who present later, and that the reason they present early (anxiety, pain, or need for support) may represent “intrinsic maternal or obstetrical characteristics” that in themselves may be responsible for increased medical interventions. Even if this were so, delaying admission whenever possible seems to be beneficial and has not been shown to have adverse effects. Additional indirect benefits include the use of less hospital resources and, of more importance to each laboring woman, fewer patients on labor and delivery competing for nursing and physician attention.
Management of prolonged latent phase

Some women in early labor are seen repetitively over a few days or occasionally even longer for persistent or intermittent contractions, yet their cervical examination reveals little change. These patients are a challenge from both a medical and psychologic perspective. These women, and their partners, are often exhausted and frustrated, and are worried that something is wrong. At these times, it is difficult for those caring for them to make objective, evidence-based clinical decisions.

Friedman versus active management

Friedman [4], using criteria of regular contractions as the onset of labor, recommended intervention if the active phase had not begun after 20 hours in nulliparas and 14 hours in multiparas. The two options for management he suggested for prolonged latent phase are standard approaches used by many clinicians today despite the fact that there are no randomized controlled trials supporting their use.

The first is therapeutic sedation with 10 to 20 mg of morphine sulfate, with a repeat dose if the patient is still awake and uncomfortable. The second option is oxytocin augmentation. Friedman believed both options were equally safe and effective, but preferred sedation because it allowed the patient to rest before the onset of the active phase and ruled out prelabor. After sedation, 85% of women awoke in active labor; 10% stopped contracting (prelabor); and 5% resumed their previous pattern and required oxytocin [4,21].

In 1980 an alternative approach used at the National Maternity Hospital in Dublin was described by O’Driscoll and Meagher [9]. They believed that allowing women 20 hours of latent phase before intervention resulted in unnecessary and avoidable maternal frustration and exhaustion. Their labor management protocol (confined to nulliparas) is referred to as the “active management of labor.” It uses standardized admission and an intervention protocol to deliver all patients within 12 hours. It was originally devised to shorten labor, not to decrease CD rates. Their criteria for the diagnosis of labor in active management are painful uterine contractions, plus either complete cervical effacement, ruptured membranes, or bloody show. With these criteria, several studies have confirmed some shortening of labor and a decrease in maternal infection, but slight or no change in CD rates [22]. Other interventions (among several) of active management of labor include delayed admission, early amniotomy, oxytocin, and continuous labor support. Their efficacy should be evaluated separately.

Amniotomy

A Cochran Review of the effect of early amniotomy have shown significant reductions in the duration of the first stage of labor (by 60–120 minutes); less risk
of slow labor in the active phase; and less need for oxytocin augmentation [23]. There was also a trend toward increased CD for fetal heart rate abnormalities, and increased number of fetal heart rate abnormalities per hour in the early amniotomy group. The authors of this Cochrane Review state that this trend should “… temper our enthusiasm for a policy of routine early amniotomy as an isolated intervention [and that] these effects would likely be attenuated by fetal blood sampling [and by] amnioinfusion.” They conclude that, based on current evidence, amniotomy should be reserved for labors that are progressing slowly. Suggestions for preventing, or if unsuccessful, managing prolonged latent phase in women with intact membranes are shown in Box 1.

**Box 1. Management of prolonged latent phase**

- Avoid early admission to the labor and deliver unit. Admit only if cervix ≥3 cm dilated or 100% effaced. Before labor, during prenatal care, counsel the patient appropriately regarding the benefits of this approach. (Level A-I)
- Diagnosis of a prolonged latent phase is subjective, but can be based on Friedman’s criteria (≥20 hours in nulliparas and 14 hours in multiparas between onset of labor and active phase).
- Evaluate patients individually to assess their level of fatigue and need for support. (Level C-III)
- If the mother is doing well and there is a reassuring fetal status, keep patients at home as long as possible and encourage adequate fluid intake and small frequent meals. Have the patient return if there is bloody show or membrane rupture or a perceived change in the strength or frequency of contractions. Even if there is no change in the patient’s symptoms, set a specific time to periodically re-evaluate the patient’s status. (Level C-III)
- For those patients who need rest, a sleep medication (zolpidem, 5–10 mg orally) may be given to take at home, or they may be admitted for morphine sedation (15–20 mg). (Level C-III)
- If the patient’s cervix is ≥3 cm or 100% effaced, offer admission with active management. Oxytocin should be started and titrated to achieve contractions every 2 to 3 minutes. Early amniotomy is optional, either with oxytocin or as an alternative to oxytocin. Amniotomy is usually best delayed until cervix is ≥2 cm dilated and station is ≤2, especially if the vertex is not well applied to the cervix. (Level B-I)
Women with premature rupture of membranes should probably be augmented if they are not contracting every 2 to 3 minutes and demonstrating cervical change [24].

Active phase disorders

Disorders of the active phase are common and can be seen in up to 25% of nulliparous labors and in 15% of labors in multiparas [25]. Progress of active labor is usually assessed with vaginal examinations every 2 to 3 hours (try to keep to less than seven to eight examinations total). Given the high interobserver variability of digital cervical examinations, cervical examination by vaginal ultrasound has been advocated for assessment of the adequacy of labor. One study has demonstrated that the extent of cervical shortening seen on ultrasound during contractions is significantly greater in the normal latent and active phases of labor than in the prolonged latent phase, protracted active phase, and prelabor [26]. More research is needed before clinical use can be recommended.

Beginning of the active phase

The beginning of the active phase can be defined retrospectively by an increasing rate of cervical dilatation compared with the latent phase, but this is not useful clinically. Many studies have confirmed that an abrupt increase in the slope of digital cervical dilatation is usually seen by the time the cervix reaches between 3 and 4 cm [4,7,27]. The current ACOG bulletin on dystocia (2003) uses 3 to 4 cm to define onset of the active phase, and Williams Obstetrics states that, in the presence of uterine contractions, 3 to 4 cm “...reliably represents the threshold for active labor.” As per the preceding discussion regarding the variability of the latent phase, many refer to latent phase as “prodromal” labor and the active phase as “labor” [3,10].

Normal progression

Recent studies have also shown that Freidman’s pattern and rates of progression in labor, and his recommendations for intervention, are not applicable to today’s laboring women who usually receive epidurals for labor [8,27–31]. In a normal nulliparous labor, the mean normal duration of the active phase (from about 4–10 cm) has been shown to be fairly consistent at about 4 hours. Compared with Friedman’s population (which included patients with breech presentation, twins, oxytocin, heavy sedation, and a high rate of forceps delivery), recent studies have demonstrated a longer (slower) active phase, and a longer second stage without increased maternal or infant morbidity [28,30,31]. These important differences were highlighted by Zhang et al [31].

As can be seen in Table 1, there is a wide variation in the normal or acceptable rates of dilatation. It is very important to remember that the fifth percentile
### Table 1
Comparison of studies on length of labor depending on patient characteristics

<table>
<thead>
<tr>
<th></th>
<th>Friedman</th>
<th></th>
<th>Rouse</th>
<th></th>
<th>Albers</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Nulliparas</td>
<td>Multiparas</td>
<td>Zhang</td>
<td>Nulliparas</td>
<td>Multiparas</td>
<td>Nulliparas</td>
</tr>
<tr>
<td>Epidural or caudal</td>
<td>8%</td>
<td>8%</td>
<td>48%</td>
<td>84%</td>
<td>96%</td>
<td>0%</td>
</tr>
<tr>
<td>Oxytocin</td>
<td>9%</td>
<td>9%</td>
<td>50%</td>
<td>63%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>Low forceps or vacuum</td>
<td>51%</td>
<td>13%</td>
<td></td>
<td></td>
<td></td>
<td>0%</td>
</tr>
<tr>
<td>Midforceps or Cesarean Section</td>
<td>6%</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
<td>0%</td>
</tr>
<tr>
<td>Breech</td>
<td>4%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
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<tr>
<td>First stage (active phase)</td>
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<tr>
<td>Time from 4 to 10 cm (mean hours)</td>
<td>2.5</td>
<td>—</td>
<td>5.5</td>
<td>—</td>
<td>—</td>
<td>7.7</td>
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<tr>
<td>Minimum rate (fifth percentile) of dilatation at ≥4 cm (cm/h)</td>
<td>1.2</td>
<td>1.5</td>
<td>0.3–0.8</td>
<td>0.7</td>
<td>0.5</td>
<td>0.5</td>
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<tr>
<td>Maximal duration (hours)</td>
<td>12</td>
<td>6</td>
<td>—</td>
<td>—</td>
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<tr>
<td>Second stage</td>
<td></td>
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<td></td>
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<tr>
<td>Descent from +1 to +3</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Maximum (hours)</td>
<td>1 cm/h</td>
<td>2 cm/h</td>
<td></td>
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<tr>
<td>Maximal duration (hours)</td>
<td>2.5</td>
<td>1</td>
<td>3.5</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

All maximums = 95 percentile

*Data from references [4,28,30,31,40].*
represents the minimum normal rate. In the study by Zhang et al [31], in which half the patients received oxytocin augmentation, the absence of cervical change for more than 2 hours was not uncommon before 7 cm, and in many patients, the rate of cervical dilatation was never more than 1 cm per hour, yet all patients delivered vaginally.

An interesting and important exception to the rates of dilatation noted previously is in the grand multipara (≥ para 5). In a recent multicenter study in over 1000 grand multiparas, it was determined that the latent phase is slower and longer, whereas the active phase is no faster than women of lower parity [32]. In fact, the latent phase in a grand multipara resembles that of nulliparas until 4 cm, and continues until approximately 6 cm, when the active phase finally begins, and then accelerates at the same rate of multiparas of lower parity.

Other means to assess adequacy of active phase

Partogram

Although used routinely and recommended in several European countries, including Ireland and Great Britain, there is limited evidence to demonstrate the benefit of using a partogram to evaluate labor.

Malposition assessment

In 1999, Ponkey et al [33] analyzed over 6400 deliveries comparing labor with a persistent occiput posterior with those who delivered occiput anterior. They found a rate of occiput posterior of 7.2% in nulliparas, compared with 4% in multiparas. All complications studied, except for endometritis, were more common in the occiput posterior group. Even more dramatic was the finding that only 26% of nulliparas and only 57% of multiparas with a persistent occiput posterior had a spontaneous vaginal delivery. There was no difference in 5-minute Apgar scores between the two groups. Because of this increase in complications with persistent occiput posterior position in labor, and because the accuracy of this diagnosis is fairly poor by vaginal digital examination, ultrasound examination for fetal position has been recommended [34].

Disorders of the active phase

The disorders of the active phase have been divided into a number of overlapping categories by various investigators. The three major categories are:

1. Protracted or prolonged active phase, also called primary dysfunctional labor
2. Arrest of dilatation or descent, also called secondary arrest
3. Combined disorder
A protracted active phase means that, after entering what should be the active phase (3–4 cm), the rate of cervical dilatation is slow. This is defined statistically as less than the fifth percentile. Arrest of dilatation assumes labor was progressing normally at the beginning of the active phase, but that subsequently there was complete cessation of dilatation for a period of at least 2 hours. In a combined disorder, slow progress precedes the arrest of dilatation [35].

The most common cause of a protracted active phase in nulliparas is inadequate uterine activity, whereas in multiparas it is CPD caused by malposition [35]. Friedman [4] found that factors that contributed to disorders of the active phase were fetal malposition, conduction analgesia, and CPD. He recommended expectant management for protraction disorders, and oxytocin for arrest disorders (if CPD was excluded by x-ray pelvimetry or clinical examination). He further stated that 45% of patients with arrest disorders have CPD requiring a CD, but once CPD is excluded, 80% can achieve a vaginal delivery with oxytocin augmentation. Recent data suggest that abnormal active phase progression, often leading to CD, can be preceded by nonreassuring fetal heart patterns in the presence normal fetal oxymetry [36]. Long-term follow-up of 5- to 6-year-old infants delivered after a prolonged active phase or an arrest disorder does not show an increase in the risk of neurologic abnormalities [37].

Management of active phase disorders

Box 2 presents a summary of management of active phase disorders.

Oxytocin

Currently, ACOG recommends that oxytocin be considered for all protraction and arrest disorders with the goal of achieving “minimally effective uterine activity” while avoiding hyperstimulation. This is usually achieved with a minimum of three and a maximum of five contractions in 10 minutes as long as there is associated cervical change. If an intrauterine pressure catheter is used (although this is not required), a minimal goal of 200 Montevideo units (the sum of the increase over baseline, in millimeters of mercury, of all contractions within 10 minutes) is sufficient. Furthermore, before resorting to CD in the first stage of labor, ACOG recommends that two criteria be met: 1) latent phase is completed (cervix ≥ 4 cm), and 2) a uterine contraction pattern of greater than or equal to 200 Montevideo units per 10 minutes present for greater than 2 hours without cervical change [10].

Amniotomy

A randomized trial showed that the addition of amniotomy to oxytocin in women with active phase arrest and intact membranes did not result in a statistically shorter labor (only 44 minutes shorter) or reduce the rate of CD, but
it did increase rate of maternal infection [38]. But another trial in 459 women randomized to elective amniotomy or amniotomy only for specific indications demonstrated that the elective amniotomy group needed less oxytocin (36% versus 76%) and had a shorter active phase by 81 minutes [10,39]. Although there were more variable decelerations in the elective amniotomy group, there was no difference in nonreassuring fetal heart rate changes or operative deliveries. The investigators noted more variable decelerations during the active phase in the elective amniotomy group, but no difference in nonreassuring fetal heart rate changes or operative deliveries.

**Adequate time**

Recent work on active phase disorders by Rouse et al [40,41] in 1999 and 2001 has incorporated the slower labor curves of the more recent studies, and has been included in the most recent ACOG bulletin [10]. He and his colleagues applied a stringent protocol to treat progression disorders in 542 patients who were greater than or equal to 4 cm dilated and who were progressing at less than 1 cm in 2 hours. An intrauterine pressure catheter was used to achieve a contraction pattern of greater than or equal to 200 Montevideo units for at least

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**Box 2. Management of active phase disorders**

- Cervix must be at least 4 cm dilated to diagnose active phase disorder (Level A II-3)
- Oxytocin to achieve three to five contractions every 10 minutes, or contractions every 2 to 3 minutes (Level A II-1)
- Option of intrauterine pressure catheter to document adequate strength of contractions, which is defined as 200 Montevideo units for at least 2 hours (Level B II-2)
- Amniotomy should be performed if rupture of membranes has not already occurred, before entertaining the diagnosis of failure to progress (Level B III)
- At least 4 hours of adequate contractions, as defined by the frequency described previously, of which at least 2 hours with adequate intrauterine pressure catheter–proved strength, must elapse before abnormal active phase progression is entertained (Level A I)
- Even after 4 hours of abnormal progression, active labor (in a nullipara with no uterine scars) can be continued up to 6 to 8 hours with good chances of vaginal delivery as long as fetal monitoring is reassuring and there is evidence of some progress (Level A-1)
4 hours before performing a CD. If the average pattern was less than 200 Montevideo units, they waited 6 hours before resorting to CD. With the use of this protocol, these investigators achieved a 92% vaginal delivery rate. Most women who showed no progress at 2 or even 4 hours after oxytocin initiation eventually delivered vaginally. Of the 126 women who had no progress after 2 hours of oxytocin augmentation, 101 (80%) ultimately achieved a vaginal delivery. The only adverse effect of continuing oxytocin was an increase in maternal infection [41].

**Intrapartum strategies to reduce the risk of dystocia**

A number of additional, general labor strategies have been studied in an effort to reduce the risk of dystocia (Box 3). These include ambulation, maternal position in labor, continuous support, hydration, and judicious anesthesia.

*Ambulation*

Laboring women, especially in early labor, often ask to ambulate. Some older studies have shown that ambulation results in shorter labors and less need for oxytocin, analgesia, and operative deliveries [42]. A recent study on over 1000 women failed to show any differences in these outcomes [43]. There was also no difference in the frequency of CD. It seems that ambulation is neither harmful nor helpful, and that laboring women should be permitted to use whatever position is most comfortable.

*Maternal position*

The upright or erect position, either by squatting or standing, has been associated with several advantages compared with the supine or lithotomy position.

**Box 3. Intrapartum strategies to reduce the risk of dystocia**

*Shown to decrease risk*

- Continuous support (Level A I)
- Maternal erect position (Level B I)
- Judicious use of regional anesthesia (Level B I)
- Adequate hydration (Level B I)

*Not shown to decrease risk*

- Ambulation (Level A I)
These include reductions in second-stage duration, assisted deliveries, episiotomies, severe pain during second stage, and less nonreassuring fetal testing. Second-degree perineal tears and blood loss greater than 500 mL may be slightly increased by this position. Once counseled regarding these findings, women should be encouraged to give birth in the position they find most comfortable.

Continuous labor support

Continuous support during labor is of great emotional and psychologic importance to laboring women. Even if it did not provide measurable benefits in terms of medical outcomes, it is still a valuable practice for the overall well-being of women in labor. Studies have shown significant benefits of continuous support. A Cochrane systematic review of over 12,000 women in 15 trials concluded that women who receive continuous support are less likely to have intrapartum analgesia, operative delivery, and more likely to be satisfied with their childbirth experience [44]. They also noted that greater benefits were observed when continuous intrapartum support was provided by someone other than a member of the hospital staff, and when it began early in labor. There should be medical and political efforts not only to promote continuing support of laboring women by a doula or equivalent, but also to provide resources for its universal implementation.

Hydration

In 2000, Garite et al [45] published the only randomized trial of hydration in labor. A group of 195 nulliparous women were randomized to receive crystalloids at either 125 or 250 mL/h. Women in the 250 mL/h group had fewer labors over 12 hours (13% versus 26% \( P = .047 \)), and trends toward less oxytocin use and lower CD rate. No conclusions regarding the appropriate volume or rate of fluid administration can be drawn from this study, but it should alert the clinician to the potential effects of inadequate hydration on the course of labor.

Regional anesthesia

Epidural use has long been thought to be associated with abnormalities of all stages of labor. The most recent Cochrane review of 11 randomized trials supported the relationship between epidural analgesia and longer first and second stages of labor, oxytocin use, incidence of fetal malposition, and operative vaginal delivery [46]. The CD rate for dystocia was not increased. The authors suggest that women should be counseled appropriately, including discussion of these deleterious effects, before agreeing to an epidural. As ACOG states, all women in labor should be offered the option of epidural anesthesia [10].
Second stage of labor (arrest of descent)

Descent and rotation are the primary labor processes in the second stage (Box 4). A large study by Fraser et al found that risk factors for a “difficult delivery” in nulliparas in the second stage of labor were abnormal fetal position; high fetal station at full dilatation (above –2 station); advanced maternal age (>35 years); and maternal height less than 160 cm [47,47a]. Epidural use was also associated with a difficult delivery, but only if it was placed before 3 cm or after 5 cm. If the interval between epidural placement and full dilatation was ≥6 hours there was a fourfold risk of difficult delivery. Using the best statistical predictors in a multivariable model, these authors only achieved a positive predictive value of 58%. This means that 42% of those with the same combination of risk factors did not have a difficult delivery, and that difficult second stage is hard to predict [47].

Adequate time

ACOG defines a prolonged second stage as follows: in nulliparas–3 hours with epidural, 2 hours without an epidural; in multiparas–2 hours with epidural, 1 hour without an epidural [10]. As with dilatation, recent studies have documented slower rates of descent than did Friedman [8,27–29]. Zhang et al found that in

<table>
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<th>Box 4. Management of second stage</th>
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<td>• Allow adequate time. Conservative suggestions are:</td>
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<tr>
<td>In nulliparas: 3 hours with epidural, 2 hours without an epidural</td>
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<tr>
<td>In multiparas: 2 hours with epidural, 1 hour without an epidural</td>
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<td>If there are no signs of infection (maternal or fetal), no maternal exhaustion, and reassuring fetal testing, labor can be allowed to continue beyond these limits as long as some progress has been made. (Level B II-3)</td>
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<td>• Pushing should start as soon as complete dilatation has been detected, unless the fetus is malpositioned (eg, occiput posterior), or the epidural so dense that the woman has no urge to push. (Level B I)</td>
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<tr>
<td>• Delayed pushing has been associated with longer second stage, with the consequent increased maternal and fetal-neonatal infection risk, and with lower neonatal pH. The laboring patient who opts for delayed pushing should be made aware of these risks. (Level B I)</td>
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nulliparas it can take up to 3 hours to go from +1 station to +3 station, and require an additional 30 minutes to deliver [31].

Traditionally in nulliparas, a 2-hour rule was used as the upper limit of the second stage, and was the point at which operative delivery was recommended. Although there is no definite source for this rule, some believe its origins are related to a study by Hellman and Prystowsky [48] in 1952, which showed increased adverse perinatal and maternal outcomes in women whose second stage exceeded 2 hours [21]. Even earlier, in the 1903 edition of *Williams Obstetrics*, forceps were recommended if the second stage lasted more than 2 hours [3]. The increased morbidities seen in the 1952 study may be related to the aggressive and unnecessary use of operative delivery rather than a direct effect of the length of the second stage. In fact, a number of more recent studies have clearly demonstrated that, as long as there is no evidence of nonreassuring heart rate patterns, and difficult or traumatic operative deliveries are not performed, there is no relationship between the length of the second stage and perinatal outcome [21,49,50].

Because of a series of spinal injuries in infants delivered with forceps to shorten the second stage, Menticoglou et al [49] examined the relationship between length of the second stage and perinatal outcome in over 6000 women. They found that between 0 and 2 hours of the second stage, the probability of admission to the neonatal intensive care unit for a 5-minute Apgar score less than 7 or a low arterial pH was very low, although it increased from 0.36% to 1.24%. Even from 2 to 5 hours of second stage, this risk remained remarkably stable. In addition, these investigators found no significant relationship between the duration of second stage and a low 5-minute Apgar score, neonatal seizures, or overall neonatal intensive care unit admissions.

The authors conclude that “...well grown fetuses who are not compromised during the first stage of labor ...and are carefully monitored during the second stage seldom get into trouble from asphyxia, even when the second stage is prolonged.” In addition, they emphasize the need to avoid traumatic forceps or vacuum deliveries just because an arbitrary time has past. Finally they note that the probability of a vaginal delivery decreases progressively after 3 hours. The decision to allow labor to continue past this point must be based on evidence of continued progress of descent or rotation (ie, from occiput posterior to anterior) [49].

Another study by Myles and Santolaya [50] in 2003 supported the findings noted by Menticoglou et al and showed that over 80% of women with a second stage over 2 hours deliver vaginally, with over 65% delivering vaginally even if the second stage lasted over 4 hours. These delivery rates are similar to those noted by Menticoglou et al [49]. Once again, neonatal morbidities (neonatal intensive care unit admission, Apgar score at 5 minutes <7, arterial pH <7.2) were not increased in infants delivered after 4 hours even when compared with those delivered before 2 hours, but maternal morbidity did increase proportionally with the length of the second stage. Risk factors for a prolonged second stage, aside from parity, included epidural analgesia, diabetes, macrosomia, pre-eclampsia, and chorioamnionitis. Interestingly, diabetes was still a risk factor
even when controlling for macrosomia, and the risk related to chorioamnionitis
was significant only in term patients.

Delayed pushing

Another labor strategy, delayed pushing (awaiting the urge to push, or delay
pushing for 1–2 hours after full dilatation) in women with epidurals, has also
been examined. A large randomized multicenter trial by Fraser et al found
delayed pushing reduced the risk of difficult deliveries (relative risk 0.79; 95% CI
0.66–0.95), but increased the risk of a low cord arterial pH less than 7.10
(relative risk 2.45, 95% CI 1.35–4.43), although the overall score for neonatal
morbidity was not increased [47a,52]. Maternal fever was increased in the
delayed pushing group, but there was no increase in postpartum febrile morbidity
or neonatal sepsis. Approximately 22 women would have to be advised to delay
pushing to prevent a single difficult delivery. Women with a transverse to
posterior fetal position at full dilatation were most likely to benefit from delayed
pushing. In this group, the number needed to treat to prevent a single difficult
delivery is approximately eight. Women whose fetal station is above +2 are also
likely to benefit (number needed to treat is 17) [52].

In two recent randomized controlled trials, one showed no reduction in dura-
tion of pushing with delaying pushing, whereas the other did show a reduction
[51,52]. In the study by Hansen et al [52], the duration of the second stage was
longer in the delayed pushing group, but they had shorter durations of pushing,
fewer decelerations, and primiparous women reported less fatigue. Plunkett et al
[51] did not find any reduction in the duration of pushing. These authors
attributed this to the lower dose of epidural analgesia in their study compared
with that of Fraser et al. The average delay in pushing in the Plunkett study was
only 10 minutes.

As these authors suggest, women receiving lower doses of anesthetic, with
less motor blockade, may not benefit from the effect of delayed pushing because
the urge to push is only delayed a short time compared with women without
epidurals. Furthermore, no differences were noted in either study in cord pH,
Apgar scores, perineal injury, operative vaginal delivery, or endometritis [51].
It is reasonable to conclude that delayed pushing may be of benefit for the
subgroup of women who have more dense epidurals with no urge to push, and
those with fetal malposition. Apart from these women, delayed pushing should
not be encouraged outside research studies, because it has been associated with
longer second stage, with the consequent increased risk of maternal and fetal-
neonatal infection, and with lower neonatal pH.

Summary

Abnormalities of the first and second stage of labor are common. Aside from
the recommendations of Rouse et al to allow longer oxytocin augmentation in the
active phase, there are currently no evidence-based, uniform definitions or
guidelines for the management of abnormal labor [21,38,40,41,53]. Based on
the work of various investigators and the authors’ own experience, this article
summarizes the important considerations and management options for the various
phases of labor. The principles of the management of labor can be traced to the
etymology of the word “obstetrics,” which comes from the Latin “ob,” in front
of or near, and “stare,” to stay or stand. Obstetrics still involves staying near the
laboring woman. If the ultimate goal is to allow a safe vaginal delivery for both
mother and fetus, clinicians need to remember that patience (eg, to give adequate
time to allow normal progression of labor) is their best ally.

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