Reducing Inductions: Lack of Justification to Induce for "Postdates"

by Judy Slome Cohain

Abstract: If no error is made in data entry, the conception date for IVF pregnancies is either correct or the day before conception. Non-IVF pregnancies, using all dating methods, get an estimated due date accurate to within 2–4 weeks. About 10% of non-induced, non-IVF deliveries take place at ≥2 weeks after estimated due date. This is reduced to <1% if pregnancy is defined as 284 days. Stillbirth is a low risk at ≥42 weeks. Postterm pregnancy results in a 99.95% risk of a healthy baby in Europe, 99.90% in the US. No prenatal test decreases postterm perinatal mortality. Elective induction or cesarean section at 41 weeks has not been shown to lower perinatal mortality compared to expectant management. The evidence justifying postdates induction are indirect observational studies that observed high rates of induction and cesarean section at 41 weeks in certain hospitals to occur serendipitously with nationwide decreases in stillbirth from 3/1000 to 2/1000, which could be accounted for by many other factors. Drawbacks of routine induction include: a 13% increase in premature births between 34–36 weeks, no improvement in perinatal mortality, no documented decrease in stillbirths (except in low-level studies), no research showing safety as regards immediate and long term brain function, 5% increase in the elective cesarean rate, a possible increase in brachial palsy, no decrease in meconium aspiration syndrome and two to three times more maternal deaths or near misses from amniotic fluid embolism.

Causes of Postterm Pregnancy

The cascade of hormones needed to start labor is not fully understood, therefore making it impossible to know why labor starts or does not start. "Postterm" pregnancy is caused by:

1. Inability to know when conception took place.
2. Defining pregnancy as 40 weeks from last menstrual period (LMP) instead of 284 days. Among accurately dated IVF pregnancies, if ≥284 days were used to define postterm, instead of ≥280 days, in the absence of induction, postterm pregnancies would account for less than 1% of pregnancies (Sladkevicius et al. 2005).
3. Fear of giving birth.

IVF Pregnancies Are the Only Pregnancies with Accurate Dating

IVF considers ovulation to be the day that mature oocytes are retrieved from the mother by surgery just prior to ovulation. Fertilization happens within 18 hours. Other than IVF, ultrasound and all other methods of dating are only accurate to within 30 days. When specialists, blind to conception date, did ultrasounds on

CHART 1

Unexplained stillbirth rates, including diabetics, but excluding previous caesareans, toxemia, antepartum hemorrhage, uterine ruptures, placenta previa, placental abruption and car accidents, in each week per 1000 undelivered fetuses at the beginning of the week in Scotland, using best data source, 1985–1998 (Smith, Pell and Dobbie 2003).

Weeks	Stillbirth/1000 Undelivered	Weeks	After Previous C-Section
38	1 in 5900	38	1 in 2200
39	1 in 6350	39	1 in 2800
40	1 in 3600	40	1 in 1900
41+0	1 in 3750	41+0	1 in 1700
42+0	1 in 2100	42+0	1 in 315

167 IVF pregnancies between 12 and 14 weeks, they were only able to estimate the age of the pregnancies within -15 days and +14 days of the actual due date (Sladkevicius et al. 2005). Ultrasound is inaccurate for dating because:

1. Symmetrically large or small fetuses do not fit the norm.
2. Ultrasound reference values are not accurate (Lynch and Zhang 2007).
3. Fetal position affects measurement. Crown-rump length (CRL) measurements are strongly dependent on the fetal position. Biparietal diameter (BPD) measurements are considered by many to be more reliable than CRL, sometimes producing dates within a range of -8 or +8 days from the real date of IVF pregnancies (Sladkevicius et al. 2005).
4. User error, experience, motivation and talent.
5. Data entry errors.

Ultrasound for dating pregnancies has not decreased the rate of postterm pregnancy. The 1980 edition of *Williams Obstetrics*, published before the widespread use of labor induction for postdates, states that 10% of pregnancies persist for 42 weeks or more. In a large study done with the intent to reduce postterm pregnancy using ultrasound, the postterm rate was reduced to 2.5% (Lynch and Zhang 2007). However, in a 2010 study from Sweden using a population of over 1,175,000 singleton births from gestational week ≥37, for which 95% had first trimester ultrasounds, 9% of pregnancies persisted for 42 weeks or more (Roos et al. 2010).

In a study of 17,000 Finnish women from 1993–1998 trying to prove the usefulness of ultrasound dating between weeks 8 and 16, after eliminating those who underwent induction for postdates, 10% of women who were certain of their LMP went postterm. When two days were added to the length of pregnancy from LMP, only 6% of deliveries were postterm (Taipale and Hiilesmaa 2001). This is one of the few studies that also looked at outcomes, and found no increase in perinatal mortality among postterm births.

Ultrasound dating does not lower postterm or perinatal mortality. Due to the possibility of adverse effects, in the absence of improved outcomes, the policies of the Food and Drug Administration, Society of Obstetricians and Gynaecolo-

gists of Canada (SOGC), The American Academy of Family Practitioners and the American Congress of Obstetricians and Gynecologists (ACOG) all state that prenatal ultrasound should not be offered or used routinely due to the potential for "adverse effects" (Marinac-Dabic, Krulewitch and Moore 2002; Bly and Van den Hof 2005; AAFP 2010; ACOG 2009). Replacing routine ultrasound dating by adding four days to the due date from LMP at 37 weeks, so as not to increase prematurity by four days, may eliminate most postterm pregnancies with no compromise to the health of the fetus by side effects of ultrasound.

Does Intervention to Prevent Postterm Improve Outcomes?

Many believe that inducing delivery will improve the outcomes of rare problems such as anencephaly, ichthyosis and extrauterine pregnancy, as well as the more common problems of stillbirth, pregnancies in which tests suggest the presence of macrosomia, oligohydramnios or placental insufficiency, and meconium aspiration. However, inducing delivery is not supported in these circumstances.

Rare Disorders

Extrauterine pregnancy has never been documented to survive to postterm. Anencephaly (1/200,000) may be associated with postterm delivery but prenatal diagnosis does not improve outcomes. A rare disease, ichthyosis, was thought to be associated with postterm; however, ichthyosis has now been identified as a genetic group of keratinization disorders that deliver prematurely (Klar et al. 2009).

Stillbirth

The most feared outcome of pregnancy is death. Stillbirth is fetal death from 20 weeks on and occurs in 1/150 pregnancies (Reddy et al. 2006). If the mother is nulliparous, obese, over 35 years old or black, her risk of stillbirth is about 1/100 (Reddy et al. 2006). If the fetus is suffering from intrauterine growth restriction (IUGR), or if the mother is preeclamptic or diabetic, then the risk of stillbirth is higher than 1/100. If she has had a previous cesarean, her risk of unexplained stillbirth after 39 weeks doubles from 1/1000 to 1/500 (Smith, Pell and Dobbie 2003). Women over 35, primiparous women and obese women are not only marginally more at risk for stillbirth but, for unrelated reasons, happen to have more postterm pregnancies (Roos et al. 2010). However, induction of all women over 35, primparous women and obese women has not been shown to lower stillbirth rates or improve outcomes.

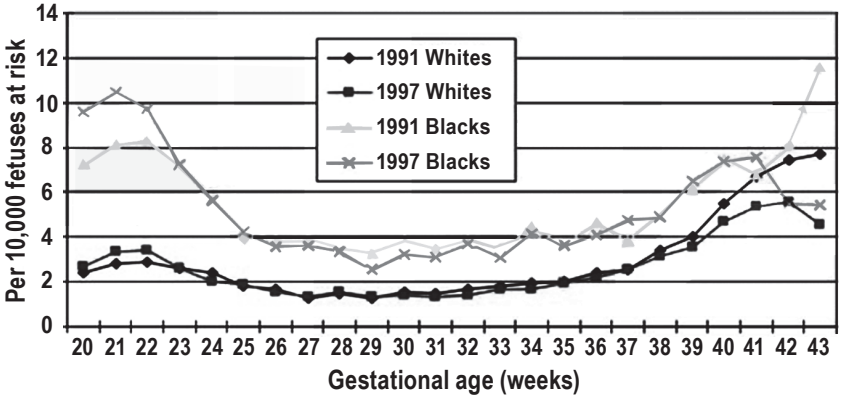
Does stillbirth increase significantly after 42 weeks? Yes. However, induction of labor has not been shown to significantly decrease stillbirth or overall perinatal mortality. After 40 weeks, stillbirth happens at a rate of 1/3600 women, including diabetics with no previous cesareans. When women with previous cesareans are included, the stillbirth rate after 40 weeks is 1/2000 pregnancies (Smith, Pell and Dobbie 2003). The rate of stillbirth among the 10% of pregnancies that go beyond 42 weeks is about 1/1000.

With 10% of pregnancies continuing past 42 weeks, postterm pregnancies are common. Two thousand women would have to be treated to prevent one stillbirth at 41 weeks and the treatment would have to be one that does not increase perinatal mortality itself. Would inducing 2000 women at 41 weeks prevent one stillbirth? So far, there is a lack of quality evidence to indicate that this is the

case. Two reviews found no significant difference in perinatal mortality including stillbirths between induction and expectant management groups (Sanchez-Ramos 2003; Gülmezoglu and Crowther 2006). Systematic induction before 42 weeks has not been shown to lower the perinatal mortality or stillbirth rates (Zeitlin et al. 2007). There is no high-quality research clearly supporting induction at 41 weeks. Elective cesarean at term has three times the perinatal mortality of vaginal birth (MacDorman et al. 2007) and elective induction has been shown to increase cesarean rates by 5% (Lowe 2007). If the mother has another pregnancy, cesarean doubles the risk of stillbirth during the next pregnancy, at or after 39 weeks (Smith, Pell and Dobbie 2003).

Four indirect observational studies suggest that induction before 42 weeks might lower stillbirth rates in postterm pregnancies. Three of the four are authored by M.E. Hannah, whose breech review changed breech protocol to routine cesarean, and whose "data gives rise to serious concerns as far as study design, methods, and conclusions. In a substantial number of cases, there was a lack of adherence to the inclusion criteria. There was a large interinstitutional variation of standard of care; inadequate methods of antepartum and intrapartum fetal assessment were used, and a large proportion of women were recruited during active labor. In many instances of planned vaginal delivery, there was no attendance of a clinician with adequate expertise" (Glezerman 2006). When given an opportunity to answer these concerns, Hannah refused (Ross and Hannah 2006). Hannah's articles promoting induction for postterm linked two things that may not be related: the stillbirth rates in Canada as a whole and the induction rates reported at two Canadian hospitals close to where she lived, in five individual counties, from 1980–1995 (Sue-A-Quan et al. 1999). She did not examine perinatal mortality rates as a whole during the period. Stillbirth rates went down from 3/1000 to 2/1000. This could have been the result of many factors, such as greater availability of abortion on demand, better prenatal care, improved nutrition, and/or less smoking. During the 15-year study period, induction rates increased or decreased at different rates in each place, but in general increased from 12% to

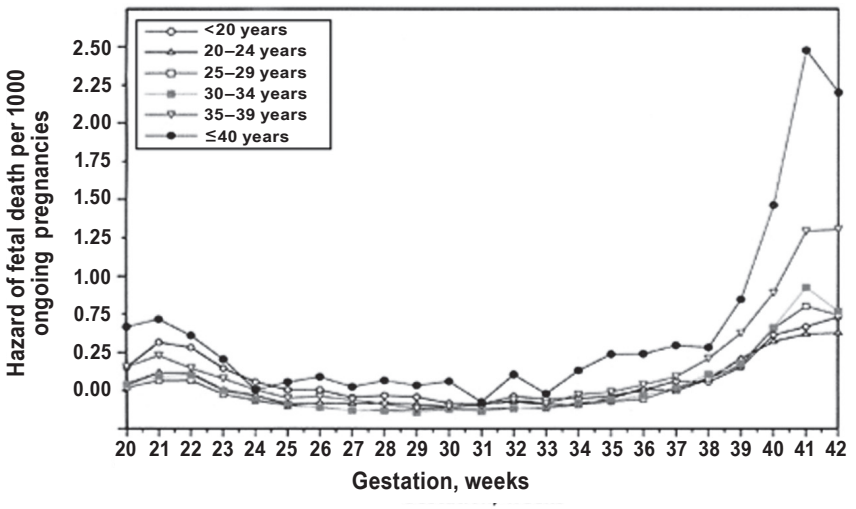
FIGURE 1
Total stillbirth rates in the US in 1997 (Yuan et al. 2005).



Figures and charts provided by author

FIGURE 2

Stillbirth rates by age of mother from US Vital Statistics (Reddy et al. 2006). The graph may look convincing but remember that there were only 21 stillbirths among 1640 births to mothers over 40.



16%. Cesarean rates also increased. It is not made clear by how much; only small samples of cesarean rates at 40 and 41 weeks in the years 1986, 1992 and 1995 are given (Sue-A-Quan et al. 1999). All three Hannah studies compare induction in one place to stillbirth rates at different places during the same period. The studies neglect to report overall perinatal mortality, a possible outcome of increased inductions and cesareans, and withhold data that might weaken an already weak argument.

The fourth study is by a group of five Canadian academics who chose to study US (not Canadian) birth certificate data from 1991–1997 (Yuan et al. 2005). Birth certificate data is known to be unreliable due to underreporting. The birth certificate data shows no indication of why labor induction was used and the authors admit the data includes inductions for an already dead fetus and for a fetus that was already compromised. Therefore, the outcomes of actual inductions were not reviewed at all. Like the other studies, this study compares stillbirth rates (not perinatal mortality) to approximate induction rates during a six-year period in which induction increased from 10% to 20%.

These authors admit that it is impossible to conclude anything definitive or conclusive about induction since so many factors could lower the stillbirth rate. Nevertheless, the studies cited above are the evidence used to justify the protocol of induction at 41 weeks.

As much as we would like a prenatal test and subsequent intervention that would prevent stillbirth and improve perinatal mortality, there is none. Inducing for postdates has risks and no benefits. Risk screening and prenatal tests have many false positive results and the majority of adverse outcomes occur in the

larger population of women identified as low-risk. "There is no effective screening test that has clearly shown a reduction in stillbirth rates in the general population" (Smith and Fretts 2007; Haws et al. 2009). Tests that do not decrease stillbirth and perinatal mortality compared to control group (Haws et al. 2009) are:

- Fetal movement counting
- Routine ultrasound scanning
- Doppler velocimetry
- Detection and management of maternal diabetes mellitus
- Antenatal fetal heart rate monitoring using cardiotocography
- Fetal biophysical profile test scoring (BPP)
- Vibroacoustic stimulation
- Amniotic fluid volume assessment (AFI)
- Home vs. hospital-based bed rest and monitoring in high-risk pregnancy
- In-hospital fetal surveillance unit
- Use of the partograph during labor
- Cardiotocography during labor with or without pulse oximetry

Macrosomia

In addition to higher stillbirth rates, another justification for inducing labor before a pregnancy goes postterm seems based on the fact that the healthy fetus continues to gain weight in utero and larger babies may suffer damage on the way out. The 2011 Cochrane Review found three trials involving 372 women rigorous enough to draw conclusions. The evidence shows that induction of labor for suspected fetal macrosomia in non-diabetic women has not been shown to alter the risk of maternal or neonatal morbidity (Irion and Boulvain 2011).

In countries with relatively low induction rates of 15% (Denmark and Sweden), where 8% of births take place ≥42 weeks, 4% of babies weigh 4500 g or more at birth. In countries like Austria and Belgium, where 40% of pregnancies are induced, only 0.5% of births take place ≥42 weeks, and 1% of babies weigh 4500 g or more at birth (Zeitlin et al. 2007). Induction seems to result in lower birth weights but has not been shown to improve newborn outcomes.

According to a 2010 review, shoulder dystocia is associated with temporary or permanent damage from obstetrical brachial plexus palsy (OBPP), but the majority of OBPP cases are not associated with macrosomia, have no identifiable risk factors and are relatively unpredictable (Doumouchtsis and Arulkumaran 2010). Brachial palsy occurs more frequently in induced labors. This is thought to be a result of pressure put on an impacted posterior shoulder during the first stage of labor. The use of a vacuum and forceps are also risk factors for shoulder dystocia. The incidence of OBPP is similar in assisted vaginal deliveries of non-diabetic women and spontaneous vaginal deliveries in diabetic women (Doumouchtsis and Arulkumaran 2010). There is no perfectly accurate way to predict birth weight and half the cases of shoulder dystocia in the aforementioned review happened with birth weights of less than 4000 g.

Cesareans, at one time, were thought to prevent OBPP. Yet, despite greatly increased rates of cesarean, the incidence of OBPP has remained the same. This suggests that OBPP may happen in utero or during the first stage of labor. One to four percent of OBPP cases accompany cesarean surgery and half occur without

shoulder dystocia. Twenty percent of permanent OBPP cases are not associated with shoulder dystocia. Infants delivered by caesarean section have a lower risk of brachial plexus injury; 500 caesarean deliveries would have to be performed to prevent one case of OBPP. More experienced practitioners have a lower incidence of OBPP because the risks may be less if there is no panic, pressure on the fundus, lateral traction or pivoting of the head at the neck or rotational movement of the head in an attempt to rotate the shoulders.

Placental Insufficiency

When the baby keeps growing, this is evidence that the placenta is functioning well, which indicates that the fetus should be able to tolerate spontaneous labor. Where the baby is thought to have stopped or slowed down its growing, a genetic defect is suspected.

Placental dysfunction can take place at any time during pregnancy and is suspected to be the main cause of miscarriage at every week of pregnancy. Simple, consecutive measurement of the height of the uterine fundus by the same caregiver has been shown effective at picking up the fetus that is not gaining weight and is small-for-dates. If pregnancy is viewed holistically, abdominal measurements facilitate a relationship between a woman and her baby, and educate couples about nutrition, which contributes to better outcomes. When a fetus is suspected to be small-for-dates, the antenatal care provider should focus on behavioral, social and environmental influences that could be mitigated, including smoking and poor nutrition. Induction has not been shown to improve outcomes because diagnosis of IUGR is often wrong.

Photo provided by Lora Denton

Oligohydramnios

Babies born with oligohydramnios diagnosed at birth may have poorer outcomes, but inducing because the Amniotic Fluid Index (AFI) is low has never been shown to prevent poor outcomes. "Not enough water seen on the ultrasound" is not justification for induction. The AFI is a measure of the length of the two

CHART 2

Stillbirth rates in each week per 1000 undelivered fetuses at the beginning of the week and rate of neonatal deaths per 1000 live births in Denmark, Finland, Netherlands, Sweden, and Ireland in 2000 including previous c-section (Zeitlin et al. 2007).

Weeks	Stillbirth/1000 Undelivered	Neonatal Deaths/1000 Live Births
37	0.34 (1/3000)	2.68
38	0.40 (1/2500)	0.49
39	0.54 (1/1800)	0.87
40	0.79 (1/1300)	0.66
41	1.24 (1/800)	0.86
42	1.58 (1/600)	1.33

largest pockets of amniotic fluid, divided by two. Research comparing AFI in the summer and winter has proven that the amount of amniotic fluid directly reflects the amount of fluid the mother is drinking, and how much she is sweating (Feldman et al. 2009).

In a 2004 study, scientist failed to find poor outcomes associated with an AFI of 5 cm or less, measured within seven days of delivery in the third trimester (Driggers et al. 2004). They found no difference in umbilical arterial pH or base excess, even in small-for-gestational-age (SGA) infants, including those with suspected placental insufficiency. There was no difference in the number of SGA neonates, 5-minute Apgar <7, respiratory distress syndrome, necrotizing enterocolitis or neurologic morbidity from matched controls with normal AFI. "Amniotic fluid stems from the baby's urine, and the urine results from good blood flow, so if we see low fluid, the assumption is that there is not good blood flow and the fetus is compromised. This study shows the amniotic fluid index is not as good as we thought, and there is no reason to deliver the baby early if other tests are normal" (Driggers et al. 2004).

In a prospective study of 3050 pregnancies, AFI failed to predict lack of fetal well-being and had "no prognostic significance" (Locatelli et al. 2004). A systematic review of the literature found that "the use of the amniotic fluid index increases the rate of diagnosis of oligohydramnios and the rate of induction of labor without improvement in peripartum outcomes" (Nabhan and Abdelmoula 2008). A 2007 article found that single deepest pocket (SDP) measurement, like the AFI, lacks predictive power and is as useless as AFI (Magann et al. 2007).

Meconium Aspiration

In addition to worrying about higher birth weights and placental insufficiency, women are told they need to be induced at 41 weeks to decrease the risk of meconium aspiration. However, research has revealed that meconium is not the cause of meconium aspiration. Meconium aspiration syndrome (MAS) was named because meconium is found below the vocal cords. Meconium aspiration syndrome presents as respiratory distress (tachypnea), a prolonged expiratory phase and hypoxia. A 2009 review of randomized control (RTC) trials found

pulmonary hypertension and asphyxia, not the presence of meconium, to be the important risk factors for MAS (Vain et al. 2009). It is likely that perinatal distress and aspiration of meconium occur earlier in the pregnancy, not at birth, which is why suctioning or cesarean delivery does not improve outcomes. Universal intrapartum suction of infants with meconium stained amniotic fluid has proven useless. Instead, endotracheal intubation and suctioning are currently recommended only for nonvigorous infants. Respiratory failure in infants with MAS is initially treated with mechanical ventilation and surfactant administration.

Suctioning of the hypopharynx is not a risk-free procedure. Potential complications include delay in the delivery of the infant and onset of resuscitation efforts, damage to the mouth and hypopharynx and cardiac arrhythmias secondary to vagal stimulation. A 2009 study concluded, "Routine suctioning is more likely to cause harm than good and should therefore be abandoned as a routine procedure" (Vain et al. 2009). A 2009 systematic review (1966–2007) suggests elective induction of labor at and after 41 weeks of gestation is associated with a decreased risk of meconium stained amniotic fluid, but the lack of quality studies shows a lack of evidence that this translates into better outcomes. Therefore, more research is required before induction can be justified (Caughey et al. 2009).

Drawbacks of Elective Induction for Postterm

United States statistics show a 13% increase in premature singleton births for the years 1991–2006, the increase occurring among births between 34–36 weeks, with no change in the earlier weeks of prematurity (MacDorman et al. 2010). During this period the cesarean delivery rate for singleton preterm births increased 47% and the rate of induced labor doubled, from 8% to 16%, suggesting "that the increase in the preterm birth rate was related to increases in obstetrical interventions" without any improvement in US infant and fetal mortality rates (MacDorman, Declercq and Zhang 2010).

CHART 3

Total American Stillbirth Rates for 1997 (Yuan et al. 2005).

Weeks	Stillbirth/1000 Undelivered
37	1/1400
38	1/1250
39	1/1000
40	1/800
41	1/750
42	1/900

Two respected British doctors have published reviews exposing the lack of evidence supporting induction between 41 and 42 weeks. Hollis summarizes the evidence, writing, "The induction of labour between 41 and 42 weeks is a very crude strategy for reducing term and post-term stillbirth rates. Although the risk of fetal death is increased after 42 weeks, many more fetuses die in utero between 37 and 42 weeks than die in the post-term period. It appears that smaller term fetuses run a far greater risk than their larger counterparts, and that current methods of antepartum assessment of the term fetus are still inadequate" (Hollis 2002).

Difficulty in identifying at-risk fetuses is what has led to routine inductions and better methods are needed (Ahmed and Versi 1993). Without proof of improved fetal outcomes, is it justifiable to put the mother at increased risk? Consider this case, of a typical, routine induction: a 40-year-old woman with an unremarkable

obstetric or medical history admitted at 41+ weeks for induction due to reduced fetal movement; fetal head down; estimated fetal weight 3600 g; cervix not effaced or dilated. The woman was induced with prostaglandin E (PGE), two doses over 16 hours. Epidural analgesia was administered. At 7 cm, membranes were artificially ruptured. Ten minutes later the cervix was fully dilated and the patient started pushing. Respiratory distress appeared and the patient was ventilated and intubated, then died of amniotic fluid embolism (Chanimov et al. 2008).

The rate of amniotic fluid embolism (AFE) is increasing from previous rates of 1/120,000 and occurred in 1/50,000 births from 2005–2007 in the United Kingdom (Knight et al. 2010). Among the 60 cases of AFE reported, half were labor inductions. A 2010 Australian study found the same recent increase in AFE associated with induction (Roberts et al. 2010).

What Authentic Postdates Look Like: A Case Study

A woman traumatized by three previous vacuum deliveries at term, with birth weights around 2500 g consulted with me once by phone in the 14th week of her fourth pregnancy. When she was 44 weeks pregnant, she called again and asked me to check the fetus to see if it was all right. I told her she was 44 weeks but she insisted that she had given me the wrong due date at first contact.

I went to her house and did a nonstress test, which was reactive and reassuring. The next day, she called to request that I check to see if she was ready to go to the hospital. When I arrived an hour later, she was crowning. She delivered a 2500 g baby 15 minutes later. The baby had apgars of 10, 10 and nursed well. The baby's skin presented as if peeling in long half-centimeter wide, 2 mm deep strips on her arms and legs. It was a cold winter day. The house had space heaters but, a day later, the baby's temperature dropped to 35.5°C and respirations slowed down. The mother called an ambulance; the baby was warmed in the hospital and today is a perfectly healthy school-aged child.

Judging by the hypothermia and the skin peeling in thick strips (not just dry and peeling), this baby probably was truly postterm. The mother reported having had contractions for a month. It seems consistent with her history that she was afraid to allow herself to go into labor if it meant going to a hospital again until she found someone willing to serve her at home.

First births are known to deliver on average at 41 weeks and may be delayed due to fear of delivery. As this case serves to illustrate, some postterm births may be due to the mother having no satisfactory place to deliver or person she trusts to assist with her delivery. This suggests that women lacking a caregiver they trust or conditions they consider favorable to delivery may be more likely to deliver postterm.

References:

AAFP. 2010. "Cesarean Delivery in Family Medicine (Position Paper)." Accessed January 2, 2011. www.aafp.org/online/en/home/policy/policies/u/ultrasonography.html.

ACOG. 2009. Practice Bulletin No. 101: Ultrasonography in Pregnancy. *Obstet Gynecol* 113 (2): 451–61.

Ahmed, AI, and E Versi. 1993. "Prolonged pregnancy." *Curr Opin Obstet Gynecol* 5 (5): 669–74.

Bly, S, and MC Van den Hof. 2005. Diagnostic Imaging Committee, Society of Obstetricians and Gynaecologists of Canada. "Obstetric ultrasound biological effects and safety." *J Obstet Gynaecol Can* 6:572–80.

Caughey, AB, V Sundaram, AJ Kaimal et al. 2009. "Maternal and neonatal outcomes of elective induction of labor." *Evid Rep Technol Assess* (Full Rep) 176:1–257.

Chanimov M, I Ben-Shlomo, B Chayen et al. 2008. "Amniotic fluid embolism: a plea for better brain protection." *Isr Med Assoc J* 10 (2): 154–55.

Doumouchtsis, SK, and S Arulkumaran. 2010. "Is it possible to reduce obstetrical brachial plexus palsy by optimal management of shoulder dystocia?" *Ann N Y Acad Sci* 1205 (1): 135–43.
Driggers, RW, CJ Holcroft, KJ Blakemore and EM Graham. 2004. "An amniotic fluid index < or =5 cm within 7 days of delivery in the third trimester is not associated with decreasing umbilical arterial pH and base excess." *J Perinatol* 24 (2): 72–76.
Feldman I, M Friger, A Wiznitzer et al. 2009. "Is oligohydramnios more common during the summer season?" *Arch Gynecol Obstet* 280 (1): 3–6.
Glezerman, M. 2006. "Five years to the term breech trial: the rise and fall of a randomized controlled trial." *Am J Obstet Gynecol* 194 (1): 20–25.
Gülmezoglu, AM, CA Crowther and P Middleton. 2006. "Induction of labour for improving birth outcomes for women at or beyond term." *Cochrane Database Syst Rev* 4:CD004945. doi: 10.1002/14651858.CD004945.pub2.
Haws, RA, MY Yakoob, T Soomro et al. 2009. "Reducing stillbirths: screening and monitoring during pregnancy and labour." *BMC Pregnancy Childbirth* 9 (suppl) 1:S5. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2679411/pdf/1471-2393-9-S1-S5.pdf.
Hollis, B. 2002. "Prolonged pregnancy." *Curr Opin Obstet Gynecol*. 14 (2): 203–07.
Irion, O, and M Boulvain. 2000. "Induction of labour for suspected fetal macrosomia." *Cochrane Database Syst Rev* 2:CD000938, 45.
Klar, J, M Schweiger, R Zimmerman et al. 2009 "Mutations in the fatty acid transport protein 4 gene cause the ichthyosis prematurity syndrome." *Am J Hum Genet* 85 (2): 24–53.
Knight, M, D Tuffnell, P Brocklehurst et al. 2010. UK Obstetric Surveillance System. "Incidence and risk factors for amniotic-fluid embolism." *Obstet Gynecol* 115 (5): 910–17.
Locatelli, A, A Zagarella, L Toso et al. 2004. "Serial assessment of amniotic fluid index in uncomplicated term pregnancies: prognostic value of amniotic fluid reduction." *J Matern Fetal Neonatal Med* 15 (4): 233–36.
Lowe, NK. 2007. "A review of factors associated with dystocia and cesarean section in nulliparous women." *J Midwifery Wom Heal* 52 (3): 216–28.
Lynch, CD, and J Zhang 2007. "The research implications of the selection of a gestational age estimation method." *Paediatr Perinat Epidemiol* 21 (suppl) 2:86–96.
MacDorman, MF, E Declercq and J Zhang. 2010. "Obstetrical intervention and the singleton preterm birth rate in the United States from 1991–2006." *Am J Public Health* 100 (11): 2241–47.
MacDorman, MF, E Declercq, F Menacker et al. 2007. "Neonatal mortality for low-risk women by method of delivery." *Birth* 34 (1): 101–02.
Magann, EF, SP Chauhan, DA Doherty et al. 2007. "The evidence for abandoning the amniotic fluid index in favor of the single deepest pocket." *Am J Perinatol* 9:549–55. http://www.ncbi.nlm.nih.gov/pubmed/17909990.
Marinac-Dabic, D, CJ Krulewitch and RM Moore Jr. 2002. Center for Devices and Radiological Health, Food and Drug Administration. "The safety of prenatal ultrasound exposure in human studies." *Epidemiology* May 13 (suppl) 3:S19–22.
Nabhan, AF, and YA Abdelmoula. 2008. "Amniotic fluid index versus single deepest vertical pocket as a screening test for preventing adverse pregnancy outcome." *Cochrane Database Syst* Rev 3:CD006593.
Reddy, UM, CW Ko and M Willinger. 2006. "Maternal age and the risk of stillbirth throughout pregnancy in the United States." *Am J Obstet Gynecol* 195:764.
Roberts, C, C Algert, M Knight et al. 2010. "Amniotic fluid embolism in an Australian population-based cohort." *BJOG* 117 (11): 1417–21.
Roos, N, L Sahlin, G Ekman-Ordeberg et al. 2010. "Maternal risk factors for post term pregnancy and cesarean delivery following labor induction." *Acta Obstet Gynecol Scand* 89 (8): 1003–10.
Ross, S, and M Hannah. 2006. Term Breech Trial Steering Committee. Interpretation of the Term Breech Trial findings." *Am J Obstet Gynecol*. 195 (6): 1873.
Sanchez-Ramos, L, F Olivier, I Delke and AM Kaunitz. 2003 "Labor induction versus expectant management for postterm pregnancies: a systematic review with meta-analysis. *Obstet Gynecol* 101:1312–18.
Sladkevicius, P, S Saltvedt, H Almström et al. 2005. "Ultrasound dating at 12–14 weeks of gestation. A prospective cross-validation of established dating formulae in in-vitro fertilized pregnancies." *Ultrasound Obstet Gynecol* 26 (5): 504–11.
Smith, GC, and RC Fretts. 2007. "Stillbirth." *Lancet* 370 (9600): 1715–25.
Smith, GC, JP Pell and R Dobbie. 2003. "Caesarean section and risk of unexplained stillbirth in subsequent pregnancy." *Lancet* 362 (9398): 1779-84.
Sue-A-Quan, AK, ME Hannah, MM Cohen et al. 1999. "Effect of labour induction on rates of stillbirth and cesarean section in post-term pregnancies." *CMAJ* 160:1145–49.
Taipale, P, and V Hiilesmaa. 2001. "Predicting delivery date by ultrasound and last menstrual period in early gestation." *Obstet Gynecol* 97:189–94.
Vain, NE, EG Szyld, LM Prudent et al. "What (not) to do at and after delivery? Prevention and management of meconium aspiration syndrome." *Early Hum Dev* 85 (10): 621–66.
Yuan, H, RW Platt, L Morin et al. 2005. "Fetal deaths in the United States 1997 vs 1991." *Am J Obstet Gynecol* 193:489–95.
Zeitlin, J, B Blondel, S Alexander et al. 2007. "Variation in rates of post term birth in Europe: reality or artifact?" *BJOG* 114:1097–103.