

Research Article

# Gestational Length: How long is too long?

Ginsberg NA<sup>1,\*</sup>, Levine EM<sup>1</sup>, Locher S<sup>1</sup>

<sup>1</sup>Department of Obstetrics and Gynecology, Advocate Illinois Masonic Medical Center, USA

<sup>2</sup>Department of Obstetrics and Gynecology, Northwestern University Medical Center, USA

\*Corresponding author: Norman Ginsberg, Department of Obstetrics and Gynecology, Advocate Illinois Masonic Medical Center, 30 N Michigan Ave, Chicago, Illinois, 60602, USA, Tel: 773-296-5254; Fax: 773-296-7205; Email: cvsguy1@aol.com

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## Abstract

**Objective:** We hypothesize that delivery at 39 to 40 6/7th weeks may be safer for the mother and child than delivery past that gestational age.

**Study design:** A proprietary perinatal database was queried from January 1, 1992 through December 31, 2011. Only singleton pregnancies without a history of cesarean were included. Patients were grouped according to the gestational age at birth, for 39 weeks, 40 weeks and 41 weeks gestation. These groups were further divided by either induction or spontaneous labor. Delivery method, birth weight Apgar score, gestational age, fetal demise and Neonatal Intensive Care Unit (NICU) admission were all recorded. Statistical analysis with a P value <.05 was calculated.

**Results:** Live births of 33,454 pregnancies were evaluated. The cesarean rate was 22% less in the 39th and 40th week gestation groups compared to the 41st week gestation group (p<.001).

**Conclusion:** Delivery between 39 to 40 6/7 weeks will significantly reduce the primary cesarean rate and will have a long term effect on the overall cesarean rate.

**Keywords:** Cesarean rate; Gestational age; Induction of labor; Stillbirth

## Introduction

The rate of cesarean delivery has climbed over the past decade, which has raised interest in whatever impact can be made by obstetricians to address this. Naturally, the best way to reduce today's high cesarean rate would be to avoid the first cesarean that inevitably leads to repeat cesarean deliveries [1]. Evidence exists that there may be a fetal gestational age at which delivery may optimally occur, so as to minimize the risk of fetal and maternal morbidity and mortality. While spontaneous delivery may seem to be an ideal modality, there may be an appropriate time to induce labor to achieve delivery. Early term delivery (<39 weeks of gestation) [2] has been associated with significant neonatal complications, as has post-term deliveries (≥ 42 weeks of gestation), and there continues to be a need to minimize those types of deliveries [3]. The authors hypothesize that delivery at 39 or 40 weeks of gestation may result in a better outcome for mother and child than delivery at 41 weeks and beyond.

## Materials and Methods

A proprietary Structured Query Language (SQL) perinatal database was used to obtain perinatal data from the point of care, from January 1, 1992 through December 31, 2011 at Advocate Illinois Masonic Medical Center (AIMMC). This database matched both obstetrical and neonatal outcome of all babies born at the medical center, and is continually monitored for accuracy using multiple data sources. For this retrospective investigation, the dataset used only included singleton pregnancies without any history of prior cesarean deliveries. The analysis of these data concentrated on those patients who delivered during the 39<sup>th</sup>, 40<sup>th</sup> and 41<sup>st</sup> weeks of gestation. It was further partitioned between those deliveries for which labor was induced, and those that were not, which included spontaneous labors and primary elective cesarean deliveries.

The parity, type of delivery, birth weight, Apgar scores and assessment of the Estimated Gestational Age (EGA) at presentation in labor were noted for each delivery, as well as if labor was induced, at those described gestational ages. The EGA was determined by the delivery date minus the first day of bleeding of the Last Menstrual Period (LMP) as reported by the parturient at presentation to Labor

and Delivery, and confirmed by the prenatal record having been received from the office of the respective obstetrician. The gestational age at delivery was alternatively assigned according to the Estimated Date of Delivery (EDD) based on early sonography performed during the pregnancy and recorded on that prenatal record. The incidence of induction of labor (IOL) and the Neonatal Intensive Care Unit (NICU) admission rates were determined.

Dichotomous and categorical variables were analyzed with Chi-square or Fisher Exact tests and continuous data were analyzed with independent samples t-test or one-way ANOVA to identify the significance of differences between defined groups. This investigation was approved by the Advocate Investigational Review Board.

## Results

The demographic description of those included in this investigation is described in Table I. One can see that it included a large Hispanic population (59%), depicting the racial make-up of the population studied as being one mostly of color. The difference of the parity status at delivery between the 39-40 and 41 week gestation groups is consistent with the known greater likelihood of multiparous patients presenting in spontaneous labor earlier than those who are nulliparous [4]. The payer for the majority of the patients in our population was private, more than public (75% private), and it appears that Medicaid patients were more likely to deliver in the earlier time period.

There were a total of 14,651 live births in the 39 week group, 13,171 in the 40 week group and 5,632 in the 41<sup>st</sup> week of gestation group. We found a significant difference in cesarean rate between the 39<sup>th</sup> week group and 41<sup>st</sup> week group, as well as between the 40<sup>th</sup> week and 41<sup>st</sup> week group (Table II), regardless of whether or not labor was induced (p < .0001, likelihood ratios of 63.2 and 52.8 respectively). There was a significantly lower incidence of cesarean in those that were induced at 39 weeks of gestation compared to 40 and 41 weeks of gestation (p<0.001 with likelihood ratios of 31 and 17.4 respectively). The mean birth weights of the population studied increased in each gestational age category. The prenatal Bishop scores were not available for analysis.

**Table 1:** Demographic Description of Population Studied.

	39-40 weeks	41 weeks	p
Average Age at Delivery	27	27	NS
Race of Parturients			
Caucasian	28 %	28 %	NS
African-American	7 %	7 %	NS
Hispanic	58 %	59 %	NS
Asian	4 %	4 %	NS
Other	2 %	2 %	NS
Parity at Delivery			
Nulliparous	44 %	53 %	< .01
Payer			
Public	23 %	21 %	.02

**Table 2:** AIMMC Deliveries/Births (Singleton pregnancies without any history of prior cesarean delivery) 1992-2011.

	≥ 39 <sup>0</sup> and < 41 wks.		p	≥ 41 <sup>0</sup> and < 42 wks.	
	Induced	Spont		Induced	Spont
Total	4,903	22,952		1,921	3,711
Live Births	4,889	22,933		1,919	3,711
	27,822			5,632	
NICU Admissions (%)	408 (8.3 %)	1,438 (6.3 %)	NS	186 (9.7%)	241 (6.5%)
Apgar5 < 7 (%)	42 (0.9 %)	149 (0.6%)	NS	17 (0.9%)	30 (0.8%)
Cesarean Deliveries	1,117 (23 %)	3,475 (15.2 %)	Induced = .001	524 (27.3 %)	668 (18.0 %)
Primary CD Rate (%)	16.5 %		< .001	21.2%	

Spont = Spontaneous

NICU = Neonatal Intensive Care Unit

CD = Cesarean Delivery

NS = Not significant

Though, the timeframe of this study may be considered long (20 years of collected perinatal data), the statistical analyses that were performed showed no significant difference between what was calculated for this period of time (1992-2011) versus the calculation of cesarean delivery rates for the most recent 10 year period (2001-2010). Hence, the 1992-2011 (20 years) timeframe was ultimately selected for this investigation, as greater power could be achieved with these numbers.

Since the cost of healthcare delivery is pertinent to the investigation presented here, a comparison of the cost of the average vaginal delivery with that of a cesarean delivery was performed. We averaged the reimbursement from all of the payers, both public and private, according to the type of delivery, and irrespective of the length of stay, or any associated internal cost discrepancies between the delivery types. This comparison was done for only the past year, given the possibly vast cost changes that may have occurred during the timeframe of this investigation. For the calendar year of 2011, the average hospital reimbursement for a vaginal delivery was \$6,117, and \$9,898 for a cesarean delivery (a difference of \$3,781).

We further analyzed the difference in cost between IOL and spontaneous vaginal delivery, not distinguishing between the possible

differences in cesarean rate, which is known to impact the cost differential. This computed cost difference for the calendar year of 2012 was identified as \$576, primarily from the difference in length of stay (LOS). This may be relevant for any paradigm in which IOL is considered.

## Comment

The best time to deliver the fetus is often a complex problem where both maternal and fetal concerns need to be considered. Despite the recent strides in neonatal care, it has been shown that near term delivery is associated with adverse outcomes for the newborn, and should only be considered when the benefits outweigh the risks [5]. Additionally, it is well known that post-dates pregnancies are at risk for cesarean delivery and unexpected complications, such as stillbirth, with even appropriate surveillance [6]. For this reason, present day management encourages delivery before 42 weeks of gestation. We considered the evidence that supports delivery even prior to 41 weeks of gestation, including the maternal and fetal concerns, and our own clinical data that we have collected.

Cesarean delivery has become a significant issue, now that the enthusiasm for vaginal trial of labor after cesarean is waning. The risks and long-term consequences of cesarean are well known and need no elaboration [7,8]. Obviously, the best way to reduce the need for repeat cesareans is to reduce the need for the first one. Our data clearly show that the risk for cesarean is increased in the 41<sup>st</sup> week of gestation compared to 39 and 40 weeks of gestation. According to the data we reviewed, the risk of cesarean at 39 or 40 weeks of gestation (whether induced or not), is less than that for women spontaneously delivering at 41 weeks gestation. While this retrospective analysis is compelling, the conclusions need to be supported from a prospective randomized trial that has the intention to treat at 39 weeks of gestation verses expectant management to 41 plus weeks. Because this retrospective data has been so strong, there is now an ongoing NIH trial to specifically answer if this conclusion is indeed valid. The results will be available within several years.

Hannah and colleagues from Canada reported in the New England Journal of Medicine about a randomized control trial involving 3,407 women with uncomplicated pregnancies of 41 or more weeks of gestation [9]. These women were randomly assigned to undergo induction of labor or have serial antenatal monitoring until spontaneous labor ensued, unless there was evidence of fetal or maternal compromise, in which case labor was induced or cesarean was performed. In the induction group of 1,701 women, 360 (21.2%) underwent cesareans, compared with 418 (24.5%) of the 1,706 in the monitored group (P= 0.03). They concluded that in post-term pregnancy, induction results in a lower cesarean rate than serial antenatal monitoring. Many felt that a randomized trial of this sort would be impossible to reproduce in the United States. A recent Cochrane review suggested that induction at 41 weeks results in improved perinatal outcomes without increasing the cesarean delivery rate [10].

Kamail investigated the cost-effectiveness of elective induction of labor at 41 weeks in nulliparous women [11]. The cohort dataset included a cesarean rate of 27% in women induced at 41 weeks of gestation. They estimated that given a live birth incidence of 4.1 million deliveries in the United States in 2005, there would be about

200,000 nulliparous women that would remain undelivered by 41 weeks. Health benefits were measured in quality-adjusted life years (QALYs). They calculated \$10,945 as the cost per QALY. The results of this described induction of labor incidence therefore represented an incremental gain of 6,565 QALYs for the theoretic 200,000 women (or nearly \$72 million), a clear cost-effectiveness argument.

The cesarean delivery rate for our data collected in 1995 and that for 2010 parallels what can be seen nationally, as reported by the National Center for Health Statistics [12,13]. Our data demonstrates a 22% reduction in the cesarean rate when deliveries occurred before 41 0/7 weeks of gestation (16.5% vs. 21.2%), as compared to after 41 0/7 weeks of gestation. Such a reduction in the cesarean rate should reduce the number of repeat cesareans by a similar percentage, if examined over a period of time. The overall effect of concentrating deliveries to this time frame could realize a considerable reduction of cesareans performed in our present setting. The authors recognize that this is an unrealistic goal, but an effort to move more patients to this time period, when clinically reasonable to do so, could realize much of this impact.

In the United States, there were 4,131,019 live births in 2009, and Solheim reported that 32.9% (1,359,105 patients) underwent a cesarean delivery [14]. The simple measure of delivering everyone at 39 to 40 weeks could potentially reduce the number of cesareans by 271,821 patients in the country, according to the demonstration of our single hospital's collected data. It can be further suggested that applying this cesarean rate reduction to an earlier scheduled (induced) delivery, per our data analysis, may cost \$576 for each possible induction of those patients expected to still be pregnant at 40 [6] weeks of gestation (or 16.8% of that national pregnant population). Applying these numbers to the national birth data of 2009, there would be an expenditure of 400 Million dollars for IOL ( $0.168 * 4,131,019 * \$576$ ) versus the saved expenditure of 1.1 Billion dollars ( $0.22 * 1,359,105 * \$3,781$ ), as a result of reducing the number of cesarean deliveries. Naturally, these economic arguments are no match for the related economic and health costs associated with the possible reduced incidence of major surgery for delivery.

Fetal/perinatal concerns are pertinent to determining the optimal length of gestation, in addition to the maternal morbidities associated with cesarean delivery. Certainly, the incidence of stillbirth at a later gestational age might be avoided if delivery occurs earlier (e.g. before 41<sup>st</sup> weeks). The issue of stillbirth was addressed by Fretts, describing its incidence, the accidents it stems from, and its potential avoidance [15]. Yuan et al found a 20% reduction in stillbirth with increased induction of labor, from 13% to 20% [16]. The perinatal morbidity and mortality addressed with later gestation was also addressed in other networks as well [17]. Mandujano et al looked at the cumulative effect of stillbirth in pregnancy according to gestational age, and found that the incidence of stillbirth was lowest at 40 weeks of gestation [18]. It appears that the literature supports delivery before 41 weeks, to be in the child's best interest.

## Conclusion

This study supports the contention that delivery at 39 to 40 weeks is more likely to end in vaginal delivery than at 41 weeks of gestation. The demographics described in our population are somewhat dissimilar to the average American population. Despite this

dissimilarity, our findings are consistent with the medical literature, with regard to the optimal timing of delivery, and our findings are therefore generalizable. Our findings are further supported by several other large studies, both randomized and retrospective, and there appears to be a growing consensus of the conclusion offered here [19,20]. While mother and fetus can safely be delivered at 41 or more weeks, there is enough strong and compelling evidence to suggest that a concerted effort should be made to effect delivery by 41 0/7 weeks, if clinically reasonable to do so. It does not appear that induction of labor would increase the rate of cesarean delivery, regardless of parity [21-24]. From our data, late term deliveries (41 0/7 weeks of gestation and beyond), appear to increase the risk of cesarean delivery, whether or not labor is induced ( $p < 0.001$ ). Adherence to the paradigm presented here may serve to reduce our current overall cesarean delivery rate.

This study is limited by virtue of the fact that it is a retrospective observational study. The conclusions of this study are meant to stimulate a prospective study to see if the same conclusions can be reached. Until such a study is concluded, best clinical practice should be used in managing pregnancies with an open mind to the possible benefit of earlier delivery.

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