

## Induction at 41 weeks increases the risk of caesarean section in a hospital with a low rate of caesarean sections

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**Objective:** To analyse the impact of a change in the management of prolonged pregnancies from inducing labour at 42<sup>+0</sup> to induction at 41<sup>0-6</sup>. **Design:** Retrospective cohort study. **Methods:** Analysis of 3563 single pregnancies with cephalic presentation of  $\geq 41$  weeks of gestation delivered in Cruces University Hospital (Spain). Two cohorts were compared corresponding to before and after the change in the policy on induction. **Main outcome measures:** Induction rate, vaginal delivery rate, newborn morbidity and mortality. **Results:** The overall rate of caesarean sections in the patients included in the study was 12.8% (19.5% among those induced and 8.4% among those in whom the onset of labour has been spontaneous). The caesarean section rate in cohorts 41<sup>0-6</sup> and 42<sup>+0</sup> were 14.1% and 11.4%, respectively ( $p = 0.01$ ). Though there were more newborns with umbilical cord blood pH < 7.10 in cohort 41<sup>0-6</sup> than in the other group (8.7% versus 4.5%;  $p < 0.01$ ), no significant differences were found between cohorts in 5-min Apgar score < 7, number of admissions to the neonatal care unit or perinatal mortality. **Conclusion:** The induction of labour during week 41 in prolonged pregnancies may increase the rate of caesarean sections in hospitals with low rates of caesarean sections.

**Keywords:** Caesarean section, induced, labour, pregnancy, pregnancy outcome, prolonged, stillbirth

### Introduction

The main professional societies for Obstetricians and Gynaecologists recommend inducing labour to avoid prolonged pregnancy at week 41 [1–3] as opposed to expectant management, namely, waiting until week 42. These recommendations are based on the results of several scientific studies [4–8] reporting that induction of labour at week 41 reduced perinatal mortality without increasing the rates of caesarean sections. Our centre, following these recommendations, changed its protocol for management of pregnancies that go beyond their due date, bringing forward the time of induction from week 42 to week 41. The objective of this study was to analyse the impact of this change in the management of such long pregnancies on the type of delivery and perinatal outcomes.

### Materials and methods

This is a retrospective cohort study of 3563 singleton pregnancies with cephalic presentations delivered at  $\geq 41$  weeks in Cruces

University Hospital between January 2008 and December 2010. Pregnancy dating was based on the date of the last period and adjusted according to ultrasound measurements, as appropriate. There were no cases of hypertensive disease or growth restriction because these conditions will end at 40<sup>+0</sup>. Gestational diabetes with good metabolic control with diet and without any complications is the only situation in which pregnancy can continue beyond 40 weeks, finishing the rest of gestational diabetes at 40<sup>+0</sup>. Labour was induced at week 42<sup>+0</sup> until July 2009, when the protocol was changed to induce labour during week 41. Two cohorts were compared, the first one of 1775 pregnant women admitted between January 2008 and June 2009 (cohort 42) and the second one of 1847 women admitted between July 2009 and December 2010 (cohort 41). Patients were assessed on admission using the Bishop score and cardiotocography. If the Bishop score was < 5, cervical ripening was achieved using a sustained-release prostaglandin E2 insert (Proppess®, Ferring, Madrid, Spain) for 24 h or until the Bishop score increased to  $\geq 6$ . If the Bishop score was  $\geq 6$  on admission, oxytocin stimulation was started straight away. During labour, the foetus was monitored with continuous cardiotocography. If the trace suggested deterioration in foetal well-being, biochemical monitoring was performed using samples of blood taken from the foetal scalp.

The following variables associated with labour were analysed: the rate of caesarean section, of instrumental delivery and of inductions and the corresponding reasons, foetal morbidity (number of newborns with umbilical cord blood pH < 7.10, with 5-minute Apgar score < 7, and admitted to the neonatal care unit) and perinatal mortality. Data were obtained from the database of births at the hospital in which all these variables are record at the time of the delivery. Statistical analysis was carried out using the SPSS version 17 (SPSS Inc., Chicago, IL, USA) software and statistical significance was set at  $p < 0.05$ .

### Results

Table I lists the descriptive data with regards to the two cohorts. As can be observed, there are no statistically significant differences between the cohorts, except with respect to the number of weeks of gestation at delivery. During the period in which the policy was to induce labour at week 42 (cohort 42), 75.9% of the women gave birth during week 41 and 24.1% during week 42. In the other group (cohort 41), when inductions were carried out during week 41, 94.6% of the women delivered during that week and 5.4% during week 42.

Table I. Description of the two cohorts.

	Cohort 42 (n = 1746)	Cohort 41 (n = 1817)	<i>p</i>
Mean age of pregnant women	32.78 ± 4.61	32.77 ± 4.49	0.93
< 21	19 (1.1%)	20 (1.1%)	0.58
21–35	1228 (70.3%)	1306 (71.9%)	
> 35	491 (27.0%)	499 (28.6%)	
Week of gestation at delivery			< 0.01
41	1325 (75.9%)	1718 (94.6%)	
42	421 (24.1%)	99 (5.4%)	
Parity			0.47
First (primipara)	1100 (63.0%)	1173 (64.6%)	
Second delivery	560 (32.1%)	549 (30.2%)	
Third delivery or more	86 (4.9%)	95 (5.2%)	
Prior caesarean section	91 (5.2%)	107 (5.9%)	0.37
Gestational diabetes	22 (1.3%)	29 (1.6%)	0.39

Table II. Data concerning the induction of labour.

	Cohort 42 (n = 1746)	Cohort 41 (n = 1817)	<i>p</i>
Spontaneous onset of labour	1240/1746 (71.0%)	913/1817 (50.2%)	< 0.01
Inductions	506/1746 (29.0%)	904/1817 (49.8%)	
Cause of induction			
To avoid prolonged pregnancy	260/506 (51.4%)	533/904 (58.9%)	< 0.01
Premature membrane rupture	165/506 (32.6%)	232/904 (25.7%)	< 0.01
Others	81/506 (16.0%)	139/904 (15.4%)	0.75
Stained amniotic fluid	493/1746 (28.2%)	447/1817 (24.6%)	0.01
Intrapartum fever	189/1746 (10.8%)	292/1817 (16.1%)	< 0.01
Intrapartum scalp pH	103/1746 (5.9%)	80/1817 (4.4%)	< 0.05
Intrapartum scalp pH < 7.20	15/103 (14.6%)	17/80 (21.3%)	0.23

Table II shows the data relating to the induction of labour. In cohorts 42 and 41, the percentages of cases in which labour was induced were 29.0% and 49.8%, respectively ( $p < 0.01$ ). More women in cohort 41 had intrapartum fever, while there were more cases of meconium-stained amniotic fluid and needing for biochemical monitoring in cohort 42. We did not find any significant differences between the cohorts in the number of cases of pH < 7.20 in blood taken from foetal scalp.

The overall percentage of caesarean sections among the women included in the study was 12.8% (456/3563): 19.5% when labour had been induced (275/1410) and 8.4% when the onset of labour had been spontaneous (181/2153). The rates of caesarean sections in the groups 41 and 42 were 14.1% and 11.4%, respectively ( $p = 0.01$ ). Among the subgroups of women who had been induced and those in whom the onset of labour had been spontaneous, we did not find any significant difference between the cohorts in the prevalence of caesarean sections or in the number of normal or instrumental deliveries (Table III).

Table IV lists data on perinatal outcomes. We found that there were more newborns with umbilical cord pH < 7.10 in cohort 41 than in the other group (8.7% versus 4.5%;  $p < 0.01$ ), but did not detect any significant difference in the percentage of cases with a 5-min Apgar score of < 7, in the percentage of admissions to the neonatal care unit or in perinatal mortality. There were seven perinatal deaths in cohort 42: four occurring before birth, one during the first 24 h of life and two in the first 7 days. The infant who died in the first 24 h of life was born at week 41<sup>3</sup> and died due to respiratory depression after severe bradycardia during

Table III. Data concerning the delivery.

Delivery	Cohort 42 (n = 1746)	Cohort 41 (n = 1817)	<i>p</i>
Caesarean section	199/1746 (11.4%)	257/1817 (14.1%)	0.01
Induction	100/506 (19.8%)	175/904 (19.4%)	0.85
Spontaneous	99/1240 (8.0%)	82/913 (9.0%)	0.15
Normal	1098/1746 (62.9%)	1103/1817 (60.7%)	0.18
Induction	262/506 (51.8%)	471/904 (52.1%)	0.90
Spontaneous	836/1240 (67.4%)	632/913 (69.2%)	0.37
Instrumental	449/1746 (25.7%)	457/1817 (25.2%)	0.69
Induction	144/506 (28.5%)	258/904 (28.5%)	0.97
Spontaneous	305/1240 (24.6%)	199/913 (21.8%)	0.12

Table IV. Data concerning perinatal outcomes.

	Cohort 42 (n = 1746)	Cohort 41 (n = 1817)	<i>p</i>
Mean weight at birth	3516 ± 442	3530 ± 426	0.33
Weight > 4.500 g	38/1746 (2.2%)	35/1817 (1.9%)	0.59
5-min Apgar < 7	19/1746 (1.1%)	18/1817 (1.0%)	0.77
pH < 7.10	79/1746 (4.5%)	158/1817 (8.7%)	< 0.01
Admission to neonatal care unit	33/1746 (1.9%)	37/1817 (2.0%)	0.75
Mortality	7/1746 (4.0‰)	3/1817 (1.6‰)	0.18

labour, while in both the infants, who died in the first week of life, the cause of death was severe congenital heart defects. There were three deaths in cohort 41, one case before labour and two in the first 28 days of life, both of these due to severe congenital malformations (foetal heart defects and a diaphragmatic hernia).

## Discussion

In recent years, the main scientific societies have recommended that labour be induced after 41 weeks [1–3]. These recommendations are based on the results of published studies indicating that this approach to management decreases perinatal mortality without increasing the rate of caesarean sections [5–8].

The hospital, following these recommendations, changed its protocol for the management of pregnancies that go beyond their due date moving the time of induction from week 42<sup>0</sup> to week 41. The objective of this study was to analyse the impact of this change on the type of delivery and perinatal outcomes. For this, the results from two periods of time were compared: one during which the policy was to induce labour at week 42 and the other when labour was to be induced during week 41. In contrast with other studies [5–8], a statistically significant increase was found in the rate of caesarean sections when labour was induced during week 41 (11.4% versus 14.1%;  $p < 0.01$ ). This increase is attributable to the fact that in the cohort 41 there were more inductions than in cohort 42 (49.8% versus 29.0%;  $p < 0.01$ ), as a consequence of the bringing forward the labour. The overall percentage of caesarean sections when labour had been induced was 19.5%, in contrast to just 8.4% among cases of spontaneous onset of labour; accordingly, there was a higher prevalence of caesarean sections in cohort 41, as more of the women had induced labour.

Recently published studies have indicated that the percentage of caesarean sections is very similar under expectant management and induction of labour, so a protocol that increases the number of inductions should not have an effect on the rate of caesarean sections. Specifically, a multicentre Canadian study including 3407 pregnancies had 21.2% of caesarean sections after inducing labour compared to 24.4% among those managed expectantly [8].

Similarly, the meta-analysis of Sanchez-Ramos et al [9], analysing the results of 16 studies (6588 pregnancies in total) found a prevalence of caesarean sections of 20.1% in induced labour compared to 22.0% under expectant management.

By contrast, during the years of study, the hospital, a tertiary referral centre, had an overall percentage of 11.6% caesarean sections for singleton pregnancies. This rate is one of the lowest in Spain, where the mean rate is 22.3% [10]. Therefore in a hospital such as the authors, where the rate of caesarean sections under expectant management is lower than when labour is induced, it is logical that a change that increases the number inductions will tend to increase the number of caesareans. Specifically, adopting a protocol to induce labour during week 41 has led to an increase in the rate of caesarean sections in this group of patients from 11.4% to 14.1%.

Pavinic et al. [11] also found a significant increase in the rate of caesarean sections, from 16.6% when the protocol followed considered inducing labour at week 42 to 25.4% when the induction was brought forward to week 41. This research group estimated that for every 1000 inductions of labour in week 41, one case of foetal death is prevented.

On the other hand, in the systematic review carried out by Caughey et al. [4], based on 11 randomised clinical trials and 25 observational studies, it was concluded that the risk of caesarean sections seemed to be the same or lower among women whose labour is induced and those under expectant management. Further, in a Cochrane review [7], the rate of caesarean sections was lower in pregnant women induced at week 41 (OR 0.58 IC95% 0.34–0.99), probably attributable to a fall in the number of caesarean sections performed due to foetal distress when labour was induced [8].

Cardiotocography produces a high rate of false positive cases, so complementing foetal monitoring with other more specific tests may help to lower the rates of caesarean sections carried out due to foetal distress. Previous studies suggest that biochemical monitoring using foetal scalp blood sample decreases the number of false positive cases when using cardiotocography [12,13]. In this study, it was observed that in cohort 42 foetal scalp blood was taken on more occasions (5.9% versus 4.4%,  $p < 0.05$ ), but there were no significant difference between the cohorts in the number of infants found to have scalp blood pH  $< 7.20$  (14.6% versus 21.3%,  $p = 0.23$ ).

It has been reported that foetal morbidity and mortality is higher in post-term deliveries than among deliveries at term [14], and similarly there is an increase in the risk of perinatal mortality in pregnancies lasting 41 weeks or longer compared to pregnancies at term [15] (OR 1.37 IC95% 1.08–1.73). When the data are analysed week-by-week, this increase is higher when the gestation is longer. Specifically, during week 41 the mortality has been found to be 1‰ [16], while mortality can reach 4‰ during week 42 [17].

In the analysis, no statistically significant difference was found in perinatal outcomes: there were three cases of foetal death in the group induced during week 41 compared to seven deaths in the group induced at week 42, although the sample size of the study was not sufficiently large to be able to draw strong conclusion with regards to this clinical variable.

In short, the results indicate that in pregnancies that progress beyond their due date inducing labour during week 41 may

increase the rate of caesarean sections in hospitals where overall this rate is low.

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Details of ethics approval are not required for this type of study in the authors' institution.

**Declaration of Interest:** The authors report no conflicts of interest.

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