Effect of labour induction on rates of stillbirth and cesarean section in post-term pregnancies

Andrea K. Sue-A-Quan,*† MSc;
Mary E. Hannah,*†‡ MD, CM, MSc;
Marsha M. Cohen,†‡ MSc, MD; Gary A. Foster,† PhD;
Robert M. Liston,§ MB, ChB

Abstract

Background: Meta-analyses of randomized controlled trials suggest that elective induction of labour at 41 weeks' gestation, compared with expectant management with selective labour induction, is associated with fewer perinatal deaths and no increase in the cesarean section rate. The authors studied the changes over time in the rates of labour induction in post-term pregnancies in Canada and examined the effects on the rates of stillbirth and cesarean section.

Methods: Changes in the proportion of total births at 41 weeks' and at 42 or more weeks' gestation, and in the rate of stillbirths at 41 or more weeks' (versus 40 weeks') gestation in Canada between 1980 and 1995 were determined using data from Statistics Canada. Changes in the rates of labour induction and cesarean section were determined using data from hospital and provincial sources.

Results: There was a marked increase in the proportion of births at 41 weeks' gestation (from 11.9% in 1980 to 16.3% in 1995) and a marked decrease in the proportion at 42 or more weeks (from 7.1% in 1980 to 2.9% in 1995). The rate of stillbirths among deliveries at 41 or more weeks' gestation decreased significantly, from 2.8 per 1000 total births in 1980 to 0.9 per 1000 total births in 1995 ($p < 0.001$). The stillbirth rate also decreased significantly among births at 40 weeks' gestation, from 1.8 per 1000 total births in 1980 to 1.1 per 1000 total births in 1995 ($p < 0.001$). The magnitude of the decrease in the stillbirth rate at 41 or more weeks' gestation was greater than that at 40 weeks' gestation ($p < 0.001$). All hospital and provincial sources of data indicated that the rate of labour induction increased significantly between 1980 and 1995 among women delivering at 41 or more weeks' gestation. The associated changes in rates of cesarean section were variable.

Interpretation: Between 1980 and 1995 clinical practice for the management of post-term pregnancy changed in Canada. The increased rate of labour induction at 41 or more weeks' gestation may have contributed to the decreased stillbirth rate but it had no convincing influence either way on the cesarean section rate.

A post-term pregnancy is one that reaches or goes beyond 42 weeks' gestation.[1] An estimated 5% to 10% of all pregnancies will be post-term, the rate depending on the accuracy of pregnancy dating and on the use of labour induction before 42 weeks' gestation.[1,2] Compared with term pregnancies and those delivered at 40 weeks' gestation, post-term pregnancies have been associated with higher perinatal mortality rates and higher rates of induced labour, fetal distress in labour, meconium staining of the amniotic fluid and operative delivery.[3,4]

There have been 2 general approaches to the management of post-term pregnancy: elective induction of labour, and expectant management with serial fetal monitoring and selective labour induction. With the first approach, labour is induced electively when the pregnancy reaches 41 to 42 weeks' gestation. With the latter approach, the pregnancy is monitored closely with serial antenatal assessments of fetal well-being and spontaneous labour is anticipated as long as there are no fetal or maternal problems. If complications develop, labour is induced or ce-

Evidence

Études

From *the Department of Obstetrics and Gynaecology, Sunnybrook & Women's College Health Sciences Centre and University of Toronto, Toronto, Ont.; †the University of Toronto Maternal Infant and Reproductive Health Research Unit, Centre for Research in Women's Health, Toronto, Ont.; ‡the Clinical Epidemiology and Health Care Research Program, University of Toronto; and §the Division of Maternal–Fetal Medicine, Department of Obstetrics and Gynaecology, Dalhousie University, Halifax, NS

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sarean section is undertaken. There is good evidence from randomized controlled trials that a policy of elective labour induction is associated with reduced perinatal mortality, without an increase in the rate of cesarean section.[5–7] On the basis of evidence from these trials, the Society of Obstetricians and Gynaecologists of Canada recommended in 1994,[8] and again in 1997,[9] that women at 41 to 42 weeks' gestation be offered labour induction.

We undertook this study to examine trends over time to determine whether the evidence from randomized controlled trials had been translated into clinical practice and to determine whether outcomes had improved. We hypothesized that if labour was induced more frequently at 41 weeks' gestation than at 40 weeks' gestation we would find over time a greater reduction in the rate of stillbirths and possibly cesarean sections at 41 or more weeks' gestation than at 40 weeks.

Methods

We obtained data from Statistics Canada on the number of live births and stillbirths in Canada between 1980 and 1995 categorized by gestational age at delivery (source: Vital Statistics Database, Statistics Canada). We excluded the data for Newfoundland because they were available only for births from 1990 onward. The small number of births for which gestational age was unknown were also excluded. Data were double entered to ensure accuracy.

We compared changes in the proportion of total births at 37 to 40 weeks' gestation with those at 41 or more weeks' gestation between 1980 and 1995 using logistic regression analysis. We also compared changes over time in the proportion of total births at 41 weeks' gestation with those at 42 or more weeks' gestation. Similarly, the changes in the rates of stillbirth at 41 or more weeks were compared with changes in the rates at 40 weeks' gestation. For the years 1980 and 1995 the stillbirth rate (and 95% confidence interval [CI]) was calculated for each of the gestational ages at delivery, from 37 to 44 weeks. In view of concerns regarding the quality of data from Ontario, we repeated these analyses after excluding data from this province. These analyses yielded results generally consistent with those obtained previously and are not presented.

Since data were not available from Statistics Canada on rates of labour induction and cesarean section, we obtained data on these variables from various hospitals and provinces for as many of the years between 1980 and 1995 as possible. Specifically, data were obtained for births at BC Women's Hospital, Vancouver, and at McMaster University Health Science Centre, Hamilton, Ont., as well as from the following provincial sources: Southern Alberta (the Southern Alberta Perinatal Education Program), Northern/Central Alberta (the Northern/Central Alberta Perinatal Outreach Program), Quebec (the province's ministry of health and social services), Halifax County and all of Nova Scotia (the Atlee Perinatal Database), and Newfoundland (the province's department of health). Data were excluded for the few cases in which information regarding mode of labour onset or delivery was missing. Data were either provided electronically or were double entered to ensure accuracy.

We used logistic regression analysis to compare changes over time in the rates of labour induction and cesarean section among deliveries at 41 or more weeks' gestation with changes in the rates among deliveries at 40 weeks' gestation. We also assessed the changes in these rates after 1991, because evidence from the Canadian Multicentre Postterm Pregnancy Trial[6] and the Cochrane Collaboration review[5] were unavailable before then. The logistic regression analyses modelled the relation between each response variable and 3 explanatory variables: the year of data collection, the gestational age category, and an interaction term between year and gestational age category. A significant interaction term indicates that the response variable changed differentially over time for the 2 gestational age categories. A p value of less than 0.05 was set as the level of statistical significance.

Results

Gestational age at delivery

The proportion of total births at 37 to 40 weeks' gestation decreased from 74.0% in 1980 to 72.6% in 1995; the corresponding proportions for births at 41 or more weeks' gestation were 19.1% in 1980 and 19.2% in 1995 (odds ratio for average decrease per year in proportion of births at 37 to 40 weeks and at 41 or more weeks was 0.99, $p < 0.001$, for both groups). The proportion of births occurring at 41 weeks' gestation increased significantly, from 11.9% in 1980 to 16.3% in 1995 (odds ratio for average increase per year 1.02, $p < 0.001$). In contrast, the proportion of births at 42 or more weeks' gestation decreased significantly, from 7.1% in 1980 to 2.9% in 1995 (odds ratio for average decrease per year 0.95, $p < 0.001$) (Fig. 1).

Stillbirths

The rate of stillbirths decreased significantly among deliveries at 41 or more weeks' gestation, from 2.8 per 1000 total births in 1980 to 0.9 per 1000 total births in 1995 (odds ratio for average decrease per year 0.94, $p < 0.001$). Similarly, the rate decreased among deliveries at 40 weeks' gestation, from 1.8 per 1000 total births in 1980 to 1.1 per 1000 total births in 1995 (odds ratio for average decrease per year 0.96, $p < 0.001$) (Fig. 2). The decrease in the rate at 41 or more weeks was greater than the decrease at 40 weeks ($p < 0.001$). The stillbirth rates were significantly higher in 1980 than in 1995 for deliveries at 37, 38, 39, 40,

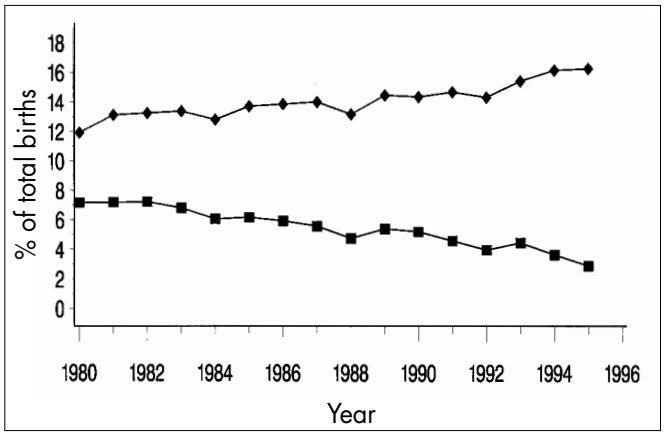

Fig. 1: Proportion of total births at 41 weeks' gestation (◆) and at 42 or more weeks' gestation (■) in Canada between 1980 and 1995.

41, and 42 weeks' gestation (Fig. 3). The rates at 43 and 44 weeks' gestation did not differ significantly between 1980 and 1995 (the 95% CIs on these proportions were wide).

Labour induction and cesarean section

The changes in the rates of labour induction among women delivering at 41 or more weeks' gestation and among those delivering at 40 weeks are given in Table 1. Between 1980 and 1995, the rate among deliveries at 41 or more weeks' gestation increased significantly in all hospitals and provinces studied. In most parts of Canada the rate also increased significantly among deliveries at 40 weeks; at the BC Women's Hospital and in Southern Alberta, Northern/Cen-

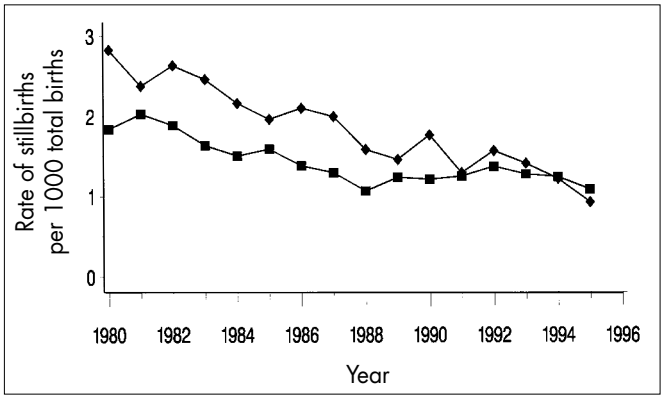

Fig. 2: Rates of stillbirth (per 1000 total births) at 41 or more weeks' gestation (◆) and at 40 weeks' gestation (■) in Canada between 1980 and 1995.

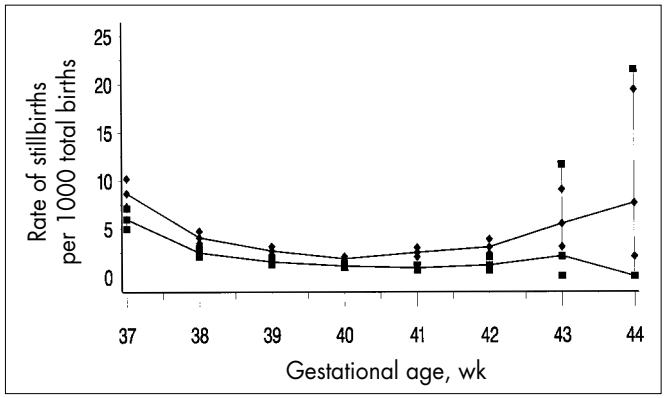

Fig. 3: Rates of stillbirth (per 1000 total births) and 95% confidence intervals by gestational age (from 37 to 44 weeks) in Canada in 1980 (◆, top line) and 1995 (■, bottom line).

Table 1: Changes in rates of labour induction among women delivering at 41 or more weeks' (versus 40 weeks') gestation in various hospitals and provinces in Canada between 1980 and 1995

Source of data*	Year	Rates of labour induction, %		Years compared	Mean annual change in rate of labour induction at ≥ 41 wk		Mean annual change in rate of labour induction at 40 wk		*p* value for difference†
		≥ 41 wk	40 wk		Odds ratio	*p* value	Odds ratio	*p* value	
BC Women's Hospital	1986	12.5	3.8	1986–95	1.24	< 0.001	1.18	< 0.001	< 0.001
	1992	30.4	15.5	1992–95	1.22	< 0.001	1.04	NS	< 0.001
	1995	46.3	16.0						
Southern Alberta	1991	25.0	13.2	1991–95	1.19	< 0.001	1.04	0.007	< 0.001
	1992	27.4	12.7	1992–95	1.19	< 0.001	1.06	0.003	< 0.001
	1995	38.3	14.5						
Northern/Central Alberta	1992	42.4	23.5	1992–95	1.15	< 0.001	1.06	< 0.001	< 0.001
	1995	53.3	27.1						
McMaster University Health Science Centre	1982	19.0	12.8	1982–92	1.05	< 0.001	1.02	NS	NS
	1992	28.2	13.5						
Quebec	1981	22.0	9.9	1981–94	1.07	< 0.001	1.05	< 0.001	< 0.001
	1992	36.3	16.0	1992–94	1.15	< 0.001	1.10	< 0.001	0.013
	1994	42.7	18.7						
Nova Scotia	1988	17.1	9.1	1988–95	1.14	< 0.001	1.11	< 0.001	0.008
	1992	23.0	12.4	1992–95	1.20	< 0.001	1.13	< 0.001	0.031
	1995	34.1	17.1						
Halifax County	1980	14.0	8.3	1980–95	1.08	< 0.001	1.07	< 0.001	NS
	1992	20.5	11.3	1992–95	1.17	< 0.001	1.15	< 0.001	NS
	1995	29.3	16.5						
Newfoundland	1990	33.0	18.0	1990–95	1.18	< 0.001	1.01	NS	< 0.001
	1992	43.1	19.1	1992–95	1.14	< 0.001	1.00	NS	< 0.001
	1995	53.6	19.4						

Note: NS = not statistically significant.
*See Methods for details.
†Expresses significance of difference between the increase in the rate of labour induction at ≥ 41 weeks and the increase in the rate at 40 weeks.

tral Alberta, Quebec and Nova Scotia, the increase for deliveries at 40 weeks was less significant than the increase for deliveries at 41 or more weeks. Among women delivering in Halifax County the increase in the rate of labour induction at 41 or more weeks' gestation was similar to the increase at 40 weeks. After 1991, the rate at 41 or more weeks' gestation increased significantly in all regions (Table 1).

The changes in cesarean section rates between 1980 and 1995 varied across the country (Table 2). Among women delivering at 41 or more weeks' gestation, the rate did not change over time in Southern Alberta or Northern/Central Alberta, at McMaster University Health Science Centre or in Nova Scotia or Newfoundland. Among women delivering at 40 weeks' gestation, the cesarean section rate did not increase over time in these areas, and in Southern Alberta it decreased significantly. Among women delivering at 41 or more weeks' gestation at BC Women's Hospital and in Quebec and Halifax County the cesarean section rate increased, but the increase was confined to the period before 1992. The increase in the rate among women delivering at 41 or more weeks at BC Women's Hospital and in Halifax County did not differ significantly from the increase observed among those delivering at 40 weeks (Table 2). In Quebec, between 1981 and 1994 the increase was slightly greater among women delivering at 41 or more weeks than among those delivering at 40 weeks.

Interpretation

Our study demonstrated an increase in the proportion of total births at 41 weeks' gestation and a decrease in the proportion at 42 or more weeks in Canada between 1980 and 1995. Some of this change may have been due to better dating of pregnancies with more frequent use of ultrasonography early in pregnancy.[10] However, we also found that the rates of labour induction consistently increased over time among women delivering at 41 or more weeks' gestation and that this increase was generally of a greater magnitude than the increase found among women delivering at 40 weeks. Therefore, it seems safe to conclude that much of the observed change over time in the proportion of births by gestational age was due to more frequent use of labour induction at 41 or more weeks' gestation. The continued increase in the rates of labour induction after 1991 may have been due to the new evidence to support this practice,[5,6] and the availability of intracervical and vaginal prostaglandin gels to assist with cervical ripening.

During the study period, the rate of stillbirths decreased among deliveries at 41 or more weeks' gestation. This decrease was greater than that observed among deliveries at 40 weeks, which indicates an association between the increased rate of labour induction at 41 or more weeks' gestation and the falling stillbirth rate among post-term preg-

Table 2: Changes in rates of cesarean section among women delivering at 41 or more weeks' (versus 40 weeks') gestation in various hospitals and provinces in Canada between 1980 and 1995

Source of data	Year	Rate of cesarean section, %		Years compared	Mean annual change in cesarean section rate at ≥ 41 wk		Mean annual change in cesarean section rate at 40 wk		*p* value for difference†
		≥ 41 wk	40 wk		Odds ratio	*p* value	Odds ratio	*p* value	
BC Women's Hospital	1986	18.3	14.1	1986–95	1.04	< 0.001	1.02	0.010	0.061
	1992	24.3	17.7	1992–95	1.01	NS	0.93	0.008	NS
	1995	25.8	15.4						
Southern Alberta	1991	16.4	13.7	1991–95	1.02	NS	0.95	0.001	0.002
	1992	17.2	11.6	1992–95	1.03	NS	0.98	NS	NS
	1995	18.0	10.6						
Northern/Central Alberta	1992	16.5	12.6	1992–95	0.99	NS	0.98	NS	NS
	1995	15.6	11.6						
McMaster University Health Science Centre	1982	17.8	13.9	1982–92	1.01	NS	0.98	NS	NS
	1992	16.3	12.1						
Quebec	1981	14.5	11.5	1981–94	1.01	< 0.001	1.01	< 0.001	0.009
	1992	16.9	12.5	1992–94	0.98	NS	1.00	NS	NS
	1994	16.4	12.6						
Nova Scotia	1988	16.9	15.2	1988–95	0.99	NS	0.99	NS	NS
	1992	16.1	14.4	1992–95	1.01	NS	1.03	NS	NS
	1995	16.5	15.1						
Halifax County	1980	14.0	12.1	1980–95	1.02	< 0.001	1.01	0.013	NS
	1992	18.0	14.3	1992–95	1.01	NS	1.02	NS	NS
	1995	18.4	15.1						
Newfoundland	1990	17.7	15.8	1990–95	0.98	NS	0.98	NS	NS
	1992	18.0	14.4	1992–95	0.98	NS	1.04	NS	NS
	1995	16.8	15.5						

†Expresses significance of difference between the change in the cesarean section rate at ≥ 41 weeks and the change in the rate at 40 weeks.

nancies. This association may be due to an increased use of elective labour induction. Another possible explanation is an increased use of selective labour induction as a result of more frequent and sensitive tests to assess fetal well-being and thus earlier identification of complications. Finally, it is possible that more women at greatest risk for stillbirth are having labour induced before 41 weeks' gestation, thus reducing the likelihood of a stillbirth at a later gestational age. Changes in maternal demographics or health are unlikely to be responsible for our findings because the trend toward having children later in life would have increased, not decreased, the rate of stillbirth,[11] and any changes in maternal health that might have occurred over time would be similar for women delivering at 41 or more weeks and those delivering at 40 weeks.

We found no increase in the rate of cesarean section between 1980 and 1995 among women delivering at 41 or more weeks' gestation in most hospitals and provinces studied. There was no substantial evidence from our study that the increased rate of labour induction at 41 weeks' gestation contributed to any of the increased cesarean section rates observed in post-term and near post-term pregnancies. There are many factors that contribute to the cesarean section rate,[12] and it is possible that the gestational age at which labour begins, the presence of maternal or fetal problems, and the management of labour are more important than whether labour was induced or spontaneous.

In a meta-analysis of 13 randomized or quasi-randomized controlled trials that compared elective labour induction with expectant management and selective labour induction among women at 41 or more weeks' gestation, elective labour induction was found to be associated with a lower risk of perinatal mortality and a lower cesarean section rate than a policy of expectant management and selective labour induction.[5] No evidence for an increased rate of cesarean section was found when the trials were grouped by cervical status, parity, method of labour induction or the baseline rate of cesarean section. In the largest of the trials, the Canadian Multicentre Postterm Pregnancy Trial,[6] the reduced cesarean section rate observed with a policy of elective labour induction was found to be similar among nulliparous and multiparous women, and secondary analyses found this was because elective induction avoided the need to induce labour in the face of maternal and fetal compromise, an approach that was associated with a high rate of cesarean section.[13] Despite this evidence, some clinicians have continued to be concerned that elective labour induction in post-term or nearly post-term pregnancies will increase rather than decrease the need for cesarean section, particularly if the woman is nulliparous or has an unfavourable cervix. There is also some debate as to the effect of this approach on rates of stillbirth. A recent study found that perinatal mortality was not associated with gestational age at birth after controlling for covariates;[14] for post-term pregnancies, the risk factors for perinatal death were maternal age of 35 years or more and small for gestational age at birth.

We recognize that our study has limitations. The data for the rates of labour induction and cesarean section were available only for specific hospitals and provinces. In addition, our findings of associations are not proof of causation. Other factors that change over time may be responsible for the associations found between changes in gestational age at delivery and rates of stillbirth and cesarean section.

In summary, clinical practice for the management of post-term pregnancy changed in Canada between 1980 and 1995. The increased rate of labour induction at 41 or more weeks' gestation may have contributed to the decreased stillbirth rate, but it had no convincing influence either way on the cesarean section rate.

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Correspondence to: *Dr. Mary E. Hannah, University of Toronto Maternal Infant and Reproductive Health Research Unit, Centre for Research in Women's Health, 714–790 Bay St., Toronto ON M5G 1N8; fax 416 351-3771; mary.hannah@utoronto.ca*