

# Epidemiology of cesarean sections: prolonged pregnancy

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## Summary

The management of prolonged pregnancy is controversial when the cervix is not favourable to induction.

From the results obtained by using topical PgE2 in postterm patients with unfavourable cervix, it is possible to conclude that in those subjects with preliminary cervical modifications (Bishop Score >1) a regular onset of labour and spontaneous delivery were obtained. Conversely a high incidence of failure was shown in those subjects with no cervical maturation (BS=0)..

**Key words:** Prolonged pregnancy; Preinduction; Cesarean section.

## Introduction

Even today diagnosis and treatment of prolonged pregnancy are very controversial issues. From the infancy of obstetrics the concept that delivery should take place "in determinate and opportune time" (Scipione Mercurio, 1596) reveals that the timing of delivery has always been a cardinal feature. Aristotle observed that the period of human gestation varied considerably and prolonged pregnancy was not uncommon.

In 1976 the WHO established that prolonged or post-date pregnancy consisted of gestation lasting over 294 days (42 weeks) from the first day of the last menstruation (International Federation of Gynecology and Obstetrics, FIGO, 1986). Nonetheless there is still uncertainty about the term postmaturity that is often used as a synonym for prolonged pregnancy but in effect describes the status of the fetus. The terms placental postmaturity, dysmaturity and dysfunction refer to a fetus showing clinical signs of intrauterine malnutrition that can manifest at any time during gestation. In the past some authors set the physiologic limit of gestation at the end of week 41 or week 43 of gestation. This discrepancy explains the varying incidence reported in the literature, ranging from 4-14% (mean 10%) at week 42 and 2-7% at week 43.

Actually, the frequency of pregnancies lasting over 42 weeks ranges from 7-12%, and about 4% of these is prolonged to over 43 weeks. In 1958 a study conducted by the National Birthday Trust of Britain on 17,000 births showed that the perinatal mortality rate begins to increase from week 42 of gestation, doubles at week 43 and is 4 to 6 times higher at week 44 with respect to mortality rate at term (Fig. 1). There is no doubt that pregnancy over 42 weeks must be carefully monitored to avoid any fetal risk.

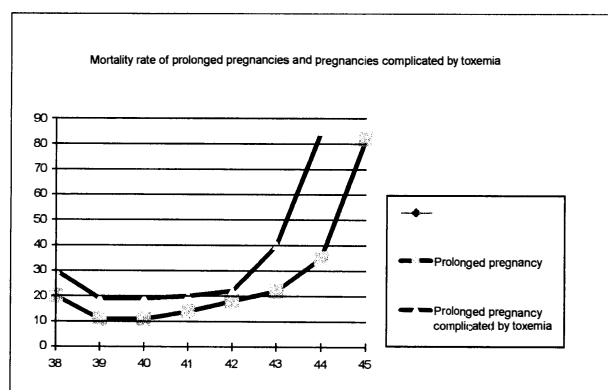
The underlying reasons from erroneous dating in pregnancy are:

- imprecise information on the first day of the last menses (according to Campbell this information is wrong in 40% of cases);
- irregular menstrual cycle;

- poorly controlled diabetes;
- conception occurring immediately after abortion or delivery, during breast feeding or immediately after start of oral contraception;
- metabolic alterations, severe emotional disorders, intake of drugs;
- deficiency of factors that trigger labour on completion of fetoplacental development, placental insufficiency or fetal anomalies (e.g. anencephaly).

Even if the majority of pregnancies considered postterm on the basis of menstrual history were not prolonged, postterm pregnancy exists and is more frequent in the very young or very old nullipara and the old multipara.

Various hypotheses have been suggested to explain the etiopathogenesis of prolonged pregnancy. It has been suggested that hypophyseal-adrenal anomalies in anencephalic infants delay cervical maturation (prelabour), determine contractile protein insufficiency of the uterine muscle fibres and/or inadequate myometrial excitability. However, until more is known about the mechanisms triggering labour, premature labour and prolonged pregnancy will remain unclear.



The so-called postmature syndrome first described by Ballantyne [1] is well known, and is due to metabolic deficiency and deficient placental respiratory functions.

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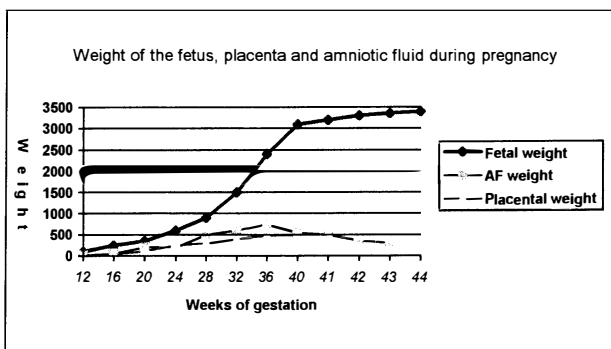
The newborn affected by Clifford's syndrome is larger in build and lighter than the norm, has scant vernix caseosa, desquamated skin, is greyish in colour, has wrinkly skin caused by dehydration, and often scant amniotic fluid stained with meconium.

To date, case history or laboratory findings are not precise enough for the treatment of prolonged pregnancy. The first day of the last menses, the first perception of fetal heartbeat and the movements felt by the mother, and the date of the first positive immunologic pregnancy test can vary by  $\pm$  weeks in terms of accuracy of gestational age. All these elements furnish indications, but only ultrasound performed between week 8 and 18 of gestation allows a sufficiently precise dating of gestational age. Recently, the use of endovaginal probes has revealed biometric parameters capable of establishing a close correlation between gestational age, with about an 1-2 day margin of error. These parameters are:

- crown rump length (CRL);
- mean diameter of the ovular sac and, possibly, the yolk sac;
- biparietal diameter (BPD) between week 12 and 20.

The data reported in the literature imply that the introduction of ultrasound into clinical practice has reduced the incidence of real prolonged pregnancy from 10% to 1% [2]. This is important as the outcome of induced labour for supposed prolonged pregnancy is significantly worse with respect to induced labour where the precise gestational age is known [3].

Assessment of the amniotic fluid (AF) is another meaningful parameter. AF reaches a maximum of 1,000-1,200 ml at 8 weeks' gestation, rapidly drops to about 300 ml at week 42, and even further at 43-44 weeks. Numerous studies have emphasized the importance of quantitative assessment of AF. Phelan [4] showed a correlation between adequate AF volume and the outcome of prolonged pregnancy, the former being the presence of a minimum 2 cm pouch measured by ultrasound. He reported a 2% incidence of cesarean section in patients with normal AF values compared with 16% in those with reduced AF levels. AF assessment often comprises all the components of the biophysical profile, i.e. non-stress test (NST), respiratory and body movements of the fetus, limb stretching, and recently flow-metric examination of the various fetal areas. A normal biophysical profile is generally an optimum index of fetal wellbeing.



It is clear that perinatal mortality and morbidity are caused by events that occur prior to, or during, labour. Hence, the gynaecologist must recognise the fetus at risk in order to prevent disease, and adopt the most suitable diagnostic tools to detect fetal wellbeing in prolonged pregnancy, i.e. biophysical assessment and ultrasonography.

In the management of prolonged pregnancy correct assessment of fetal risk is controversial and is based on four clinical approaches:

- intensive fetal surveillance (monitoring) and waiting;
- pharmacological cervical maturation or preinduction (non-mature cervix);
- induction of labour (mature cervix);
- elective cesarean section.

Although induction of labour was first recommended by Ballantyne & Brown in 1922 to prevent postmaturity, it was not until the 50s' and the advent of more efficacious induction methods that this approach became common practice in prolonged pregnancy. In 1958 Gibberd stated that the choice was between death due to postmaturity or death caused by induction of labour, while a year later Theobald replied that it was a choice between death due to postmaturity or life thanks to induction of labour. Various studies have revealed that unsuccessful induction of labour led to a rise in the incidence of cesarean section [3]. The recent use of prostaglandines to induce labour through pharmacological maturation of the cervix has not significantly increased the percentage of cesarean sections [5, 6]. A controlled randomised and prospective study on 108 women after induced labour at week 41 of gestation or serial monitoring [7] revealed no significant differences in the incidence of cesarean section and perinatal mortality. However, studies on larger series of women are required. Rogers [8] performed a randomised study to assess the incidence of cesarean section in active treatment of labour (200 cases) and no action (waiting) (205 cases), and observed a lower, albeit not statistically different, incidence in the former (active treatment = 7.5%; control = 11.7%;  $p=0.36$ ). The outcome of induced labour and that of no action under strict surveillance has been assessed by numerous authors [5, 9, 10]. A meta-analytic study of 16 clinical trials [11] revealed that the results of elective induction of labour at 41 weeks overlap those observed in the group under surveillance, with the exception of a reduced incidence of AF stained with meconium. It also inferred that prophylactic induction was recommended after 42 weeks' gestation. Meta-analysis of the Canadian multicentric study [12] showed a lower incidence of fetal stress, meconium stained AF, macrosomia and perinatal mortality in the group where labour was induced at weeks 41 to 42. In this study the waiting approach was associated with a greater incidence of cesarean sections (24.5%) than recorded after induced labour (21.2%) due to the higher incidence of fetal stress. In 1995 the same author reported an annual savings of about eight million dollars in the induced labour group.

A retrospective study carried out between 1974 and 1981 at the Dublin National Maternity Hospital on peri-

natal mortality at term (37/41 weeks) and postterm (>42 weeks) pregnancy showed that perinatal mortality was 5.0/1,000 births in the former and 9.4/1,000 in the latter. The study did not include fetal malformations [13].

Indubitably, antenatal fetal monitoring lowers the perinatal mortality of postterm fetuses to rates near those observed in term fetuses [14, 15, 16]. However, it is still not clear which test is the most accurate and reliable in prolonged pregnancy. Gynaecologists agree that the non-stress test (NST) is the simplest, but numerous studies demonstrate the unreliability of this method due to the antenatal and neonatal deaths despite the negative test results [17, 18]. The oxytocin contraction test (OCT) takes longer to perform, and is an efficacious method to prevent perinatal mortality, even if intrapartum mortality remains elevated.

A recent study by Meir [19] on pregnancies over 42 weeks under surveillance analysed the obstetric and perinatal consequences of patients over 42 and 43 weeks. They also studied changes in fetal heart rate after 41 weeks using a computerised CTG. The authors demonstrated increased incidence of operative delivery and macrosomia in the postterm group (26.6% and 21.9%, respectively) compared with the term group (17.51% and 8.3%, respectively). The physiological reduction of FHR variability as gestation progresses must be taken into consideration at the moment of clinical decisions. Meir *et al.* believe that careful antenatal surveillance detects fetuses reaching 42 weeks and over, and therefore reduces perinatal morbidity and mortality to near the currently acceptable level. However, since prolonged pregnancy is at high risk and the single diagnostic methods have low predictive value, integrated monitoring systems performed by experienced operators are required.

It must be pointed out that in pregnancy over 42 weeks the cervix is often immature, and until the 80s' this determined an increment in cesarean sections and morbidity in patients where labour was induced. Hence, the waiting approach associated with intensive monitoring was favoured from week 41 of gestation, and many women went into spontaneous labour during this attending period.

The introduction of prostaglandin gel (PgE2) applications (extramnotic, intracervical, endovaginal) was a breakthrough in the treatment of prolonged pregnancy as it determined preinduction or pharmacological cervical maturation.

The presence of an immature cervix (Bishop score  $\leq 2$ ) can often determine failures in induction and prolonged labour. In fact, a recent meta-analysis of 50 studies underlined that the degree of cervical maturation was an important predictive factor in induction and showed that:

- PgE2 cervix preparation significantly reduced the incidence of failures;
- shortened the induction-delivery time lapse;
- reduced the incidence of operative vaginal deliveries or cesarean sections regardless of the type of PgE2 gel and the application method used [20];
- induced real and proper induction of labour in an elevated percentage of cases.

In 1987 Dyson [21] performed a study in two groups of pregnant postterm women, one group on closely monitored wait (NST and AF monitoring), and the other treated with PgE2 gel cervical maturation followed by induction of labour with oxytocin and/or amniotomy. He observed a significantly lower incidence of fetal distress, aspiration of meconium and cesarean sections in the latter, and Hannah [12] recently confirmed these data.

## Materials and Methods

We studied 152 pregnant women (mean age 16-44 years; gestational  $\geq 42$  weeks) presenting immature cervix (Bishop score  $\leq 4$ ) hospitalised at the Department of Gynaecology and Obstetrics, Cannizzaro Hospital, Catania, Italy between January 1st, 1995 and April 30th, 1996. The series was made up of 122 primipara (80.3%) and 30 pluripara (19.7%). Topical application of PgE2 was used for labour preinduction. The entire series gave informed consent to the study.

*Patient selection criteria were as follows:*

- early ultrasound dating of pregnancy;
- prolonged pregnancy  $\geq 42$  weeks.
- vertex presentation;
- intact membrane;
- single pregnancy;
- fetal biophysical parameters within normal range (cardiographic, ultrasound, flow-metric values).

*Exclusion criteria were:*

- fetus-pelvis disproportion;
- previous hysterectomy;
- maternal pathologies (severe preeclampsia, bronchial asthma, glaucoma, ulcerous colitis).

Classification according to basal BS was as follows:

- 30 cases (19.7%) BS 0;
- 35 cases (23%) BS 1;
- 35 cases (23%) BS 2;
- 37 cases (24.3%) BS 3;
- 15 cases (9.9%) BS 4.

Preinduction was performed by intracervical administration of PgE2 gel (Prepidil gel 0.5 mg - Upjohn).

Treatment was suspended if the following occurred:

- spontaneous rupture of the membrane;
- fetal distress;
- hypertone and/or persistent hyperkinesia with fetal distress;
- preinduction failed whenever BS was  $\leq 4$  after two gel applications.

The mothers were monitored by cardiotocography for at least one hour, and for longer when required, after application of the gel.

The results were assessed on the basis of:

- basal BS;
- number of gel applications;
- frequency of onset of labour or other treatment;
- mean time lapse between start of treatment and delivery;
- failure rate;
- incidence of cesarean sections;
- mean Apgar score at 5 min;
- incidence of side-effects.

Statistical analysis was performed using the Chi square test on the results of the groups having BS 0-1 and BS 2-4.

## Results

The preinduction results are shown in Tables 1, 2, 3 and 4.

Table 1. – No. of gel used and basal BS in the 152 pregnant women where labour was induced.

Bishop score	No. gel		
	1	2	3
0*	13 (43.33%)	10 (33.33%)	7 (23.33%)
1*	24 (68.57%)	8 (22.85%)	3 (8.57%)
2	29 (82.85%)	5 (14.28%)	1 (2.85%)
3	32 (86.48%)	5 (14.28%)	–
4	14 (93.33%)	1 (6.66%)	–

p<0.005.

Table 2. – Results of preinduction using PgE2 gel in 152 post-term pregnant women.

	No.	%
Spontaneous onset of labour	77	50.6
Spontaneous rupture of membranes	52	34.2
Induction of labour	75	49.4
PgE2 gel endovaginal	17	11.2
Amniorexi+oxytocin	58	38.2
Modalities of labour:		
– Spontaneous	127	83.5
– Operative vaginal	2	1.4
– Cesarean section	23	15.1
Apgar Score <7 a 5'	3	1.9

Table 3. – Treatment-delivery time lapse in the 152 pregnant women undergoing preinduction with PgE2 gel.

Hours	No.	%
0-12	72	47.3
12-24	50	32.9
24-36	30	19.8

Table 4. – Indications for cesarean section vs basal BS in the 152 pregnant women undergoing preinduction with PgE2 gel.

BS	Failure	Arrest of descent	FD	Total	%
0*	7	1	3	11	7.2
1*	2	2	4	8	5.3
2	–	1	2	3	2.0
3	–	1	–	1	0.6
4	–	–	–	–	–

FD: fetal distress

p<0.005.

Two applications of gel incremented BS and onset of labour in 141 cases (92.7%), while a third application (failure) was required in 11 (7.3%). Ten of the latter were part of the group with BS=0-1 (Tab. 1). Spontaneous labour started in 77 cases (50.6%), and was due to spontaneous rupture of the membrane in 52 (34.2%). In the cases where BS reached 5-7, induction of labour was achieved by application of vaginal PgE2 gel in 17 cases (11.2%) or treatment with amniotomy plus oxytocin in 58

(38.2%) (Tab. 2). Incidence of spontaneous labour was 83.5%, vaginal operative deliveries 1.4% and cesarean section 15.1%.

The condition of the newborn was satisfactory, Apgar score being <7 at 5 min. in only 3 cases. Only one newborn was transferred to the intensive care unit and was later discharged in good health. Mean birthweight was 3,375 g (range 2,750 - 4,400 g). No systemic maternal side-effects were observed. There were 5 cases (3.3%) of hyperkinesia, and 2 cases (1.3%) of hypertone (hypertonia) that regressed without resort to betamimetic drugs.

Table 3 shows that the time lapse between treatment and delivery was under 24 h in 139 cases (91.5%), within 12 h in 47.4%, and within 36 h only in 8.5%.

Cesarean section was performed in 23 cases because of preinduction failure in 9, for arrest of descent in 7, and fetal distress in 7. Correlation between cesarean section and basal BS revealed that preinduction failure was highest (82.6%) in the group presenting BS 0-1.

## Discussion

Management of prolonged pregnancy is particularly controversial when the status of the cervix does not permit induction as the benefits of reduced potential fetal risks may be outweighed by the risks involved. The results of preinduction of labour in women with immature cervix achieved using topical application of prostaglandins [22, 23, 24] were a breakthrough in the management of cases where fetal or maternal conditions called for delivery.

Our results on the incidence of cesarean section and outcome of the newborn show the efficacy of preinduction and agree with those reported in the literature [20]. A single application of gel increased BS and triggered off spontaneous labour in 43.3% of the group with basal BS 0 and in 93% of those with basal BS 4. A third application of gel was required only in slightly over 30% of the group with basal BS=0-1, and the prevalence of cesarean section due to preinduction failure was highest in this group. The differences (p<0.005) in the number of gel applications required, the time lapse between induction and delivery, the incidence of cesarean section and the preinduction failures between the groups with basal BS 0-1 and BS 2-4 underline that the real problem in the treatment of prolonged pregnancy concerns cases that do not present cervical maturation (BS 0-1).

We recommend induction of labour in cases of pregnancies at week 41 of gestation with BS over 4 and apparent fetal wellbeing because it reduces:

- anxiety and impatience caused by waiting;
- potential risks to the fetus;
- outlay of time and money in intensive monitoring protocols.

Informed consent must be obtained as recently Freeman reported that 40% of the lawsuits filed against gynaecologists involve prolonged pregnancy [25].

## References

- [1] Ballantyne J. W.: "The problem of the postmature infant". *J. Obstet. Gynecol. Br. Emp.*, 1902, 2, 36.
- [2] Boyd M. F., Usber R. H., McClem F. H. *et al.*: "Obstetric consequences of postmaturity". *Am. J. Obstet. Gynecol.*, 1988, 158, 334.
- [3] Gibb D. M. F., Cardozo L. D., Studd J. W. W. *et al.*: "Prolonged pregnancy: is induction of labour indicated? A prospective study". *British Journ. of Obst. Gynec.*, 1982, 89, 292.
- [4] Phelan J. P., Platt L. D., Yen S. Y.: "The role of ultrasound assessment of amniotic fluid volume in the management of the postdate pregnancy". *Am. J. Obstet. Gynecol.*, 1985, 151/3, 304.
- [5] Cardozo L., Fysh J., Pearce J. M.: "Prolonged pregnancy: the management debate". *British Med. Journ.*, 1986, 293, 1059.
- [6] Papageorgiou I., Tsiou C., Minaretzis D.: "Labor characteristics of uncomplicated prolonged pregnancies after induction with intracervical prostaglandin E2 gel versus intravenous oxytocin". *Gynec. Obstet. Invest.*, 1992, 34, 92.
- [7] Herabutya Y., Prasertsawat P. O., Tongyai T.: "Prolonged pregnancy: the management dilemma". *Intern. J. Obstet. Gynecol.*, 1992, 37, 353.
- [8] Rogers R., Gilson G. J., Miller A. C.: "Active management of labor: does it make a difference?". *Am. J. Obstet. Gynecol.*, 1997, 177, 599.
- [9] Witter F. R., Weitz L. M.: "A randomized trial of induction at 42 weeks gestation versus expectant management for postdates pregnancies". *Am. J. Perinatol.*, 1987, 4/3, 206.
- [10] Hannah M. E., Hannah W. J., Hellmann J.: "Efficacy of induced labor vs serial antenatal monitoring in postterm pregnancy". *J. Am. Osteopath. Assoc.*, 1992, 92, 982.
- [11] Crowley P., Elbourne D., Ashurst H.: "Delivery in an obstetric birth chair: a randomized controlled trial". *Br. J. Obstet. Gynaecol.*, 1993, 98/7, 667.
- [12] Hannah M. E., Hannah W. J., Hellmann J.: "Induction of labor as compared with serial antenatal monitoring in post-term pregnancy-a randomised controlled trial". *New England J. Med.*, 1993, 326, 11587.
- [13] Crowley P., O'Herlihy C., Boylan P.: "The value of ultrasound measurement of amniotic fluid volume in the management of prolonged pregnancies". *British J. Obst. Gynec.*, 1984, 91, 444.
- [14] Heden L., Ingemarsson I., Ahlstrom H. *et al.*: "Induction of labor versus conservative management in prolonged pregnancy: controlled study". *Int. J. Feto Maternal. Med.*, 1991, 4, 231.
- [15] Freeman R. K., Garite T. J., Modanlou H. *et al.*: "Postdate pregnancy: utilization of contraction stress testing for primary fetal surveillance". *Am. J. Obstet. Gynecol.*, 1981, 128, 140.
- [16] Johnson J. M., Harman C. R., Lange I. R., Manning F. A.: "Biophysical profile scoring in the management of the post-term pregnancy". *Am. J. Obstet. Gynecol.*, 1986, 154, 269.
- [17] Miyazaki F. S., Miyazaki B. A.: "False reactive nonstress tests in postterm pregnancies". *Am. J. Obstet. Gynecol.*, 1981, 140.
- [18] Fleischer A., Schulman H., Farmakides G. *et al.*: "Antepartum nonstress test and postmature pregnancy". *Obstet. Gynecol.*, 1985, 66, 80.
- [19] Meir Y. J., Bohm P., D'Ottavio G. *et al.*: "La gravidanza oltre il termine: sorveglianza". Atti LXXII Congresso SIGO, 1996.
- [20] Keirse M. J.: "Therapeutic uses of prostaglandins". In: "Prostaglandins Baillier's". *Clinical Obstetrics and Gynecology*. M. G. Elder ed. London, 1992, 6, 787.
- [21] Dyson D. C., Miller P. D., Armstrong M. A.: "Management of prolonged pregnancy: induction of labor versus antepartum fetal testing". *Am. J. Obstet. Gynecol.*, 1987, 156, 928.
- [22] Trofater K. F., Bowers D., Gall S. A.: *Am. J. Obstet. Gynecol.*, 1985, 153, 268.
- [23] Ekman G., Persson P., Ulmstein U.: "Induction of labor in postterm pregnant women". *Int. J. Gynecol. Obstet.*, 1982, 24, 47.
- [24] Calder A. A.: "Methods of induction of labour". In: "Progress in Obstetrics and Gynecology", vol. 3, ed. Studd J. Edinburgh, Churchill Livingstone, 1983.
- [25] Elliott J. P., Flaherty J. F.: "The use of breast stimulation to prevent postdate pregnancy". *Am. J. Obst. Gynecol.*, 1984, 149, 628.

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