Timing of hospital admission in labour: latent versus active phase, mode of birth and intrapartum interventions. A correlational study

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ABSTRACT

Background: Hospitalization of women in latent labour often leads to a cascade of unnecessary intrapartum interventions, to avoid potential disadvantages the recommendation should be to stay at home to improve women's experience and perinatal outcomes.
Aim: The primary aim of this study was to investigate the association between hospital admission diagnosis (latent vs active phase) and mode of birth. The secondary aim was to explore the relationship between hospital admission diagnosis, intrapartum intervention rates and maternal/neonatal outcomes.
Methods: A correlational study was conducted in a large Italian maternity hospital. Data from January 2013 to December 2014 were collected from the hospital electronic records. 1.446 records of low risk women were selected. These were dichotomized into two groups based on admission diagnosis: 'latent phase' or 'active phase' of labour.
Findings: 52.7% of women were admitted in active labour and 47.3% in the latent phase. Women in the latent phase group were more likely to experience a caesarean section or an instrumental birth, artificial rupture of membranes, oxytocin augmentation and epidural analgesia. Admission in the latent phase was associated with higher intrapartum interventions, which were statistically correlated to the mode of birth.
Conclusions: Women admitted in the latent phase were more likely to experience intrapartum interventions, which increase the probability of caesarean section. Maternity services should be organized around women and families needs, providing early labour support, to enable women to feel reassured facilitating their admission in labour to avoid the cascade of intrapartum interventions which increases the risk of caesarean section.

Statement of significance

Problem

A medicalized and a hospital-centred culture of pregnancy and childbirth in Italy as elsewhere, appears to be associated with women being admitted to hospital while in the latent phase of labour.

What is already known

Women hospitalized in the latent phase of labour are more likely to experience unnecessary intrapartum intervention.

What this paper adds

This is the first Italian study to observe that delaying childbearing women's admission until in the active phase of labour may lead to a positive increase in rates of normal labour and birth. Maternity services should be organized around women and families' needs to ensure women receive appropriate support to facilitate their admission in active labour.

1. Introduction

The latent phase of labour, or early labour, can be defined as a period of time, not necessarily continuous, when painful contractions are present and initial cervical changes occur, including cervical effacement and dilation up to 4 cm.[1] The uterine contractions become progressively regular, polarized and coordinated, leading to the next active phase of labour.[2] The latent phase of labour appears to be quite contentious among healthcare professionals worldwide in terms of definition, diagnosis and management.[3,4] According to a number of sources, the duration of early labour ranges from 6–8 h up to 24–36 h.[3,1] Given its extremely variable duration, it is difficult to define a 'normal' or average range of time for this stage of labour.[5,6] Friedman[7] argued that this variability may partially depend on the woman's sensibility to external changes, such as emotions and environment. Contemporary studies of Zhang et al,[8] suggest that the active phase of labour may not start until 5 cm dilation in multiparas and even later in nulliparous. Diagnosing arrest at 4 h without cervical change prior to 6 cm may be premature. International guidelines recommend that the admission to hospital of women in early labour should be delayed by encouraging them to remain home until in active labour; if admitted, healthcare providers should not intervene to modify the length of labour while waiting for its spontaneous onset.[9,1] Jackson et al.[10] and Scotland et al.[11] suggest the introduction of guidelines aimed at discouraging early admissions and unnecessary procedures during labour. Lauzon and Hodnett[12] found that early labour assessment programs deferring the admission of women who are not in established labour may bring benefits to women such as shorter length of stay on labour ward and higher levels of active participation and control during labour and birth. Hospitalization of women in early labour often leads to a cascade of unnecessary interventions[13] when compared to women admitted in active labour: increased rates of oxytocin augmentation, artificial rupture of membranes, analgesia, instrumental birth and caesarean section.[5,14–18]

Despite agreement from maternity care providers, research evidence and international guidelines[1,9] on the benefits of delaying hospitalization during the latent phase, childbearing women often manifest the need for reassurance and support during early labour and may expect to be admitted to hospital, even if not in active labour.[19,20,21] Therefore, the latent phase of labour is recognized as an area of conflict between women and healthcare professionals.[22]

In Italy, maternity care is provided as part of the public service by the Sistema Sanitario Nazionale (SSN), which offers free universal health coverage funded by taxation. No different pathways for low or high risk women are available. Births take place mainly in obstetric units with no options of home visits from SSN by a community or a hospital midwife to women in early labour.[23,24] The medicalized and hospital-centred culture around pregnancy and childbirth appears dominant[25] and, although there are no national research, inappropriate hospitalization in early labour is still quite common.

Furthermore, in Italy there is a lack of research and information about midwifery care, settings and timing of admission during the latent phase which may contribute to intrapartum management and therefore to maternal and neonatal outcomes. This is in contrast with the growing body of international literature around the management of early labour in low risk women[5,17,14,12] highlighting how delaying hospital admission may be protective against unnecessary interventions during labour.

Although the hospital where we conducted the research promotes the normality of childbirth (intrapartum intervention rates in low risk women: epidural analgesia 17%; oxytocin augmentation 11.2%; vacuum assisted delivery 2.3%; caesarean

section 4.3%), we wonder if, even in this context, an early admission contributes to intrapartum interventions.

1.1. Objectives

Given the identified gaps and controversies within the Italian maternity services, the primary aim of this study was to investigate the association between timing of hospital admission in the latent phase vs active phase and mode of birth. The secondary aim was to assess the relationship between timing of hospital admission and intrapartum intervention rates (oxytocin augmentation, artificial rupture of membranes and epidural analgesia) and maternal and neonatal outcomes (post-partum haemorrhage, umbilical cord arterial pH, Apgar score).

2. Methods

2.1. Setting

The study setting was an Obstetric Unit of a large maternity hospital in Northern Italy with approximately 3000 births/year. The Obstetric Unit hosts both low and high-risk women and offers one-to-one midwifery care throughout labour and birth to all women. The current hospital protocol recommends admission and transfer to the Birth Suite of all women found to be in active labour. Latent and active phase diagnostic criteria were defined according to local protocols which differ from the recommendations of international guidelines. The *latent phase* is defined as cervical dilatation ≤2 cm with regular or irregular uterine activity. *Active labour* is defined as cervical dilatation ≥3 cm together with regular uterine activity. A woman with a spontaneous rupture of membranes either in active labour or not, according to the local protocols is immediately hospitalized. After the initial assessment if a woman is not in active labour should be recommended to return home unless there is a maternal request to be admitted. Although this is the recommendation, the management is frequently left to the healthcare professional during the admission assessment, and often the decision is to admit the woman to the Antenatal ward, waiting for the established labour to start.

2.2. Participants

Records of women who gave birth from January 2013 to December 2014 were screened within the electronic birth register to identify low risk women having a hospital admission in the *Latent phase* or in *active labour*. Low risk criteria were: spontaneous labour between 37–42 gestational weeks, single fetus with cephalic presentation and maternal age within 18–45 years. The criteria adopted for the definition of low risk were the same proposed by the World Health Organization (WHO, 2002), modified for maternal age.

Exclusion criteria were: placenta previa or abruption; contra-indications to vaginal birth; pre-eclampsia or eclampsia; previous history of caesarean section; pre-gestational or gestational diabetes; chronic hypertension; preterm birth; previous uterine scar; previous history of obstetric emergencies. Pre labour spontaneous rupture of membranes has been included in the exclusion criteria, due to the management protocol at the study site which recommends immediate admission of any woman with a spontaneous rupture of membranes.

A total of 5.629 maternal records were screened, 2.268 women fulfilled the low risk criteria and did not present any exclusion criteria with the exception of pre labour spontaneous rupture of membranes. A total of 822 women were excluded because of pre labour spontaneous rupture of membranes.

The remaining 1.446 women were categorized depending on admission diagnosis into the *latent phase* group (n = 684) or the *active phase* group (n = 762).

2.3. Variables

The following variables were extracted from the birth register: demographic variables (maternal age at birth and race); obstetric variables (parity, gestational age at birth, previous miscarriage, previous ectopic pregnancy, number of ultrasound exams, pregnancy through medically assisted procreation (MAP), antenatal class attendance) intrapartum variables (mode of birth, intrapartum interventions, centimeters of first cervical dilatation registered in the partogram, length of labour); maternal outcomes (postpartum hemorrhage); neonatal outcomes (Apgar score and pH at 5 min). Parity was dichotomized into "nulliparous" vs "multiparous", gestational age was calculated in weeks, previous miscarriage was dichotomized into "<2" vs "≥2", number of ultrasound SCAN was dichotomized into "<4" vs "≥4". The intrapartum interventions considered were: artificial rupture of membranes (ARM), epidural analgesia and oxytocin augmentation. Length of labour was defined as the time between the first cervical dilatation recorded on the partogram, as the onset of active labour, and the birth. Post-partum hemorrhage defined as blood loss >500 ml at birth. Apgar score and pH at 5 min were dichotomized into "<7" vs "≥7" and "<7.10" vs "≥7.10" respectively.

2.4. Statistical methods

Descriptive statistics were calculated overall and according to hospital admission. Continuous variables were described by mean and standard deviation and compared using T-test, after data transformation, if needed. Categorical variables were described by percentages and compared using Chi-square test. The probability of admission in the latent phase was related to maternal age, parity and antenatal class attendance using a logistic regression model. The relationship between length of labour and admission diagnosis was investigated using a linear regression model adjusted by parity and centimetres of the first vaginal examination registered into the partogram. The probability of receiving each single intrapartum intervention, including caesarean section or vacuum delivery, was related to admission diagnosis in a logistic regression model. The logistic regression model on a single intrapartum intervention as response variable is labelled as 'pragmatic' if it does not include the role of other intrapartum interventions, otherwise the model is labelled as 'enlarged'. Of note, the contrast between enlarged and pragmatic model enables to disentangle the effect that the admission diagnosis has on the risk of a single intrapartum intervention under consideration, and gives the opportunity to understand also how this effect is modulated by other intrapartum interventions (indirect effect). The interventions included in the enlarged statistical model are shown in Table 1. Of note when using ARM as response variable, there are no other intrapartum interventions to be included in the enlarged model as the ARM

is the first procedure to be adopted in case of slow progress in labour. SAS software was used for data management, to check data and to perform the analysis.

2.5. Ethical approval

The study was approved by the local EthicalCommittee of San Gerardo Hospital (n°690, 23/07/2015). Authors and data retrieval assistants attended "Good Clinical Practice" training on ethical and organizational standards in line with which this research was conducted. In terms of gaining consent for data retrospectively collected, we asked all women to sign a general informed consent about management of personal and clinical data for research purposes.

3. Results

3.1. Participants

The eligible 1.446 women were categorized into *latent phase* group (n = 684, 47.3%) and *active phase* group (n = 762, 52.7%).

3.2. Descriptive data

We reported demographic and obstetric characteristics of the sample in Table 2. Data are summarized for the entire sample and the individual admission diagnosis in both groups. We found no significant differences regarding demographic variables, except for maternal age, which increased in the *active phase* group and with parity (46.4% multiparous women in latent phase and 61.6% multiparous women in active labour). The percentage of women who attended antenatal classes was higher in the latent phase group (38.8%) when compared to the active phase group (28.0%). In a logistic regression model considering the latent phase and including maternal age, parity, attendance at antenatal classes, parity showed a protective effect on the probability of admission. (OR = 0.62, 95% CI = (0.46, 0.84) p = 0.002).

Table 3 shows mode of birth, intrapartum interventions and maternal and neonatal outcomes in the whole sample and according to the two admission diagnosis groups.

Regarding the primary end point, mode of birth, 1.341 (92.7%) out of the total 1.446 women had a spontaneous birth, while 48 (3.3%) had a vacuum assisted birth and 57 (4.0%) had a caesarean section. In the *latent phase* group women had a higher risk of caesarean section or an instrumental birth (11.2%) when compared to women admitted in the *active phase* (3.7%). Intrapartum interventions such as ARM, oxytocin augmentation and epidural analgesia were higher in the *latent phase* group compared to the *active phase* group.

3.3. Main results

A multivariate linear regression model on the length of labour showed an average increment of 0.89 h (p-value <0.0001) for the

Table 1
Model response variable and other intrapartum interventions used for the enlarged models.

Model response variable	Other intrapartum interventions included in the enlarged model		
	ARM	Epidural	Oxytocin
ARM		No	No
Epidural	Yes		Yes
Oxytocin	Yes	Yes	
Caesarean section or vacuum assisted delivery	Yes	Yes	Yes

Table 2
Demographic and obstetric characteristics according to the hospital admission diagnosis group.

Variable	Overall n = 1446		Latent phase n = 684 (47.3%)		Active phase n = 762 (52.7%)		*p*-Value
	Mean n	SD %	Mean n	SD %	Mean n	SD %	
Age (years)	32.2	5.0	31.8	5.0	32.6	5.0	0.0031
Caucasian	1234	85.4	582	85.1	652	85.7	0.72
Hispanic	76	5.3	41	6.0	35	4.6	
Asian	61	4.2	28	4,1	33	4.3	
Arab	39	2.7	15	2.2	24	3.2	
African	21	1.5	11	1.6	10	1.3	
Other	14	1.0	7	1.0	7	0.9	
Parity (≥1)	786	54.4	317	46.4	469	61.6	<0.0001
G.A. (weeks)	39,9	1.0	40.0	1.0	39.8	1.1	0.002
Miscarriage (≥2)	57	3.9	24	3.5	33	4.3	0.42
Ectopic pregnancy (≥1)	20	1.4	6	0.9	14	1.8	0.12
US Scan (<4)	404	27.9	195	28.5	209	27.4	0.65
MAP (yes)	29	2.0	14	2.1	15	2.0	0.92
Antenatal classes (yes)#	437	33.1	240	38.8	197	28.0	<0.0001

SD, standard deviation; G.A., gestational age; US, ultrasound; MAP, medically assisted procreation. # = data was available for 618 women in the latent phase group and 704 women in the active phase group.

Table 3
Mode of birth and Intrapartum interventions according to the hospital admission diagnosis group.

Variable	Overall n = 1446		Latent phase n = 684 (47.3%)		Active phase n = 762 (52.7%)		p-Value
Mode of birth	n	%	n	%	n	%	<0.0001
Spontaneous	1341	92.7	607	88.7	734	96.3	
Vacuum assisted	48	3.3	33	4.8	15	2.0	
Caesarean section	57	4.0	44	6.4	13	1.7	
Intrapartum interventions							
ARM (yes)	435	30.1	258	37.7	177	23.2	<0.0001
Oxytocin (yes)	146	10.1	113	16.5	33	4.3	<0.0001
Epidural analgesia (yes)	204	14.1	153	22.4	51	6.7	<0.0001
Episiotomy (yes)[a]	201	15.0	100	16.5	101	13.8	0.1658
Variable	Mean n	SD %	Mean n	SD %	Mean n	SD %	p-Value
Length of labour (hours)	4.19	4.1	5.13	4.4	3.34	3.6	<0.0001
Maternal outcome							
PPH (yes)	49	3.4	30	4.4	19	2.5	0.0471
Neonatal outcome							
Ph (<7.10)	123	8.5	57	8.3	66	8.7	0.8233
APGAR at 5 mins (<7)	4	0.3	2	0.3	2	0.3	0.9138

[a] Calculated on the subsets of women who did not have a c/section; PPH = post partum hemorrhage.

latent phase group. The model was adjusted for both parity (reduction of 3.09 h for multiparous, p-value <0.0001) and cervical dilatation in centimetres at the first vaginal examination registered on the partogram (reduction of −0.56 h for a 1 cm increment, p-value <0.0001). There was a borderline difference in the percentage of maternal post-partum hemorrhage.

In a logistic regression model on the probability of undergoing ARM considering maternal age, parity and antenatal class attendance, a protective effect of parity was observed (OR = 0.62, 95% CI = 0.46, 0.84; p = 0.002).

Using a pragmatic model, the probability of oxytocin augmentation (Table 4) was higher in women admitted during the latent phase (OR = 3.67; 95% CI = 2.43, 5.54; p < 0.0001). The enlarged model, showed the admission diagnosis in the latent phase still remained a risk factor with a lower coefficient, ARM and epidural analgesia were significant risk factors too. This suggested an indirect effect of admission diagnosis in the latent phase, mediated by the role of other intrapartum interventions.

The pragmatic model showed a higher risk of having an epidural analgesia when the admission diagnosis was 'latent phase' (OR = 3.42; 95% CI = 2.41, 4.84; p < 0.0001). In the enlarged model, admission diagnosis in the latent phase was still a risk factor with a lower coefficient, and ARM and oxytocin augmentation were also significant risk factors. This suggested an indirect effect of admission diagnosis in the latent phase, mediated by the role of other intrapartum interventions.

Considering the effect of admission diagnosis on mode of birth, the pragmatic model showed an increased risk of a caesarean section or a vacuum assisted delivery when the admission diagnosis was 'latent phase' (OR = 2.65; 95% CI = 1.68, 4.19; p < 0.0001). In the enlarged model, the admission diagnosis was not significant (although borderline). Epidural analgesia and oxytocin augmentation were highly significant, suggesting an indirect effect of admission diagnosis in the latent phase, mediated by the role of these intrapartum interventions.

Table 4
Pragmatic and Enlarged logistic regression models on the risk of intrapartum interventions and caesarean section or vacuum assisted delivery.

Variable	Pragmatic model			Enlarged model		
	OR	(95% CI)	p-Value	OR	(95% CI)	p-Value
	Oxytocin augmentation			Oxytocin augmentation		
Admission diagnosis	3.67	(2.43;5.54)	<0.0001	1.96	(1.2;3.15)	0.0052
Parity	0.17	(0.11;0.26)	<0.0001	0.38	(0.23;0.64)	0.0002
ARM				2.71	(1.77;4.15)	<0.0001
Epidural analgesia				14.84	(9.50;23.19)	<0.0001
	Epidural analgesia			Epidural analgesia		
Admission diagnosis	3.42	(2.41;4.84)	<0.0001	2.26	(1.52;3.35)	<0.0001
Parity	0.14	(0.09;0.21)	<0.0001	0.20	(0.13;0.31)	<0.0001
ARM				1.92	(1.31;2.80)	0.0008
Oxytociny augmentation				14.67	(9.43;22.83)	<0.0001
	Caesarean section or vacuum assisted delivery			Caesarean section or vacuum assisted delivery		
Admission diagnosis	2.65	(1.68;4.19)	<0.0001	1.62	(0.98;2.66)	0.06
Parity	0.11	(0.06;0.20)	<0.0001	0.19	(0.10;0.35)	<0.0001
ARM				1.11	(0.69;1.77)	0.67
Epidural analgesia				3.09	(1.77;5.38)	<0.0001
Oxytocin augmentation				2.82	(1.60;4.98)	0.00

4. Discussion

4.1. Key results

The findings of the study contribute to raise awareness on timing of admission, management of early labour and how these may be associated with intrapartum intervention rates. Despite local, national and international guidelines recommend to offer individual support and discourage hospital admission of women prior the active labour,[1,8] within this study almost half of the women diagnosed to be in the latent phase (n = 684; 47.3%) were admitted to the Obstetric Unit.

4.2. Interpretation

This study adds to the debate in Italy about the lack of community midwifery services such as home visits and telephone triage, which are important issues in Italy[23]; this often creates a 'vicious circle' leading women to refer to Obstetric Units too early. Maternity services should be organized around women and families' needs by providing early labour support enabling women to be reassured by healthcare professionals, delaying at the same time, their admission to hospital to avoid the cascade of intrapartum interventions highlighted by this study and by the international literature. According to Davey et al.[26] the continuity of care provided through caseload midwifery models may allow midwives to provide personalized and supportive care before admission to hospital. This may result in women feeling more comfortable to remain home slightly longer in early labour facilitating later admissions in active labour. Moreover this study shows that regardless of the context and his childbirth philosophy, timing of admission during labour appears crucial and related to maternal and neonatal outcomes. We think a reflection on the Midwifery care across the entire maternity pathway is needed. The Healthcare Systems should emphasize Midwife-Led continuity Models of Care which provide a continuous support for women and their families from pregnancy to the post-natal period, with benefits for mothers and babies.[27] In line with international research,[5,14–18] our study underlined the undesirable effects of hospital admission for women in early labour, in terms of intrapartum intervention rates and mode of birth, without improving maternal and neonatal outcomes. Although there was no direct correlation between admission diagnosis and mode of birth (p-value 0.06) and early admission was not directly associated with increased caesarean section rates (p-Value 0.0006), an indirect effect of admission in the latent phase on mode of birth was noted, mediated by the role of other intrapartum interventions. Admission in early labour was associated with an increase of intrapartum interventions (artificial rupture of membranes, epidural analgesia, oxytocin augmentation), the correlation between these procedures and mode of birth was statistically significant (p-value <0.0001), explaining the indirect effect mentioned above. This could highlight what is called the "cascade effect"[28]: admission in the latent phase acts as a first step towards consequent interventions, eventually resulting in higher caesarean sections rate. Dahlen et al. in their paper examined the Epigenetic Impact of Childbirth hypothesis. Has been proposed that reduced or elevated levels of cortisol, adrenalin, and oxytocin produced during labour may lead to fetal epigenomic remodelling anomalies, with possible consequent effects on immunity. This argument is complex, but extremely interested for the Midwifery as it underlights the crucial role of the process of labour and birth also on potential long-term consequences.[29]

In this study multiparity seemed to be a protective factor delaying hospital admission; first time mothers may go to hospital earlier than multiparous women because it is their first experience of pain without healthcare professional support at home.[20,30] However, this may be also associated with a shorter duration of the latent phase of labour in multiparous women, when compared to nulliparous ones.[1] Antenatal class attendance was also evaluated and did not appear to be a protective element, showing no association with the delay of hospital admission, which is in accordance with the available evidence.[31]

We should also consider the Italian context and the Obstetric unit where the study has been conducted. Although guidelines define established labour as regular painful contractions and progressive cervical dilatation from 4 cm, in Italy it is still common to start the partogram from a cervical dilatation of 3 cm. Moreover the admission assessment and decision for high and low risk women, is always led by an Obstetrician and it is based only on the cervical dilatation, without considering other maternal signs which would require a longer midwifery assessment. We needed to work with the local protocol and this is the reason why we adopted definitions of the latent and the active phase in contrast with the guidelines and with the recent definition of the active phase by the American College of Obstetricians and Gynaecologists,[32] which considered 6 cm to be the threshold for established labour diagnosis.

4.3. Limitations

Our setting is not representative of all the Italian Obstetric Units, because the one in which we work with has an historical underpinning philosophy of considering childbirth as a normal event, providing one to one midwifery care in established labour, supporting the normal progress of labour and birth. This could explain the very low caesarean section rate of the population considered.

4.4. Clinical implications

To our knowledge this is the first Italian study to investigate the association between hospital admission diagnosis (latent phase vs active phase) and mode of birth, intrapartum intervention rates and maternal/neonatal outcomes. Further research should be conducted in other Italian hospitals to map the range of early labour's and active labour definitions adopted and to evaluate their application in clinical practice. The endpoints investigated through this study should be considered within a larger number of Italian Obstetric Units, in order to generalize findings at national level.

According to the study, delaying childbearing women's hospital admission until in the active phase of labour may lead to a positive increase in normal labour and birth rates, with a consequent reduction in intrapartum interventions and in caesarean section rates. Early labour assessment and triage programs should be designed to ensure women are admitted in active labour; women in the latent phase should receive appropriate support and advice by strengthening community midwifery care, home visiting services[26] and telephone triage systems.[20]

5. Conclusion

The diagnosis of active phase of labour has been described as one of the most important assessments in midwifery care. Women admitted to hospital in early labour had higher probability of experiencing intrapartum interventions. Maternity services should be organized to support women's needs, promoting the normality of childbirth.

Ethical statement

The study was approved by the local Ethical Committee of San Gerardo Hospital (n°690, 23/07/2015). Authors and data retrieval assistants attended "Good Clinical Practice" training on ethical and organizational standards in line with which this research was conducted. In terms of gaining consent for data retrospectively collected, we asked all women to sign a general informed consent about management of personal and clinical data for research purposes.

Conflicts of interest

The authors have stated explicitly that there are no conflicts of interest in connection with this article. The authors alone are responsible for the content and writing of the paper.

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