CEOG Clinical and Experimental Obstetrics & Gynecology

Analgesia: effects on the first and second stages of labor

G. Carta[1], A. D'Alfonso[1], V. Franchi[2], P. Catana[1], S. Necozione[3], F. Patacchiola[2]

[1] Department of Obstetrics and Gynecology San Salvatore Hospital in L'Aquila, University of L'Aquila, L'Aquila
[2] Department of Obstetrics and Gynecology Sant'Omero Hospital, University of L'Aquila, L'Aquila
[3] Department of Life, Health and Environmental Sciences, University of L'Aquila, L'Aquila (Italy)

Summary

Background: This controlled observational study aimed at evaluating the effects of epidural analgesia on the first and second stages of delivery in nulliparous women, referred to the birth centers of the Sant'Omero "Val Vibrata" Hospital and the "San Salvatore" Hospital in L'Aquila, selected in accordance with specific inclusion criteria. *Materials and Methods:* Between May 1st, 2012 and April 31st, 2013, 363 patients were enrolled at the birth centres of the "Val Vibrata" Hospital in Sant'Omero (TE) and of the "San Salvatore" Hospital in L'Aquila. 139 patients received epidural analgesia during labor at the "Val Vibrata" Hospital; 224 patients constituted the control group and went through natural delivery without analgesia at the "Val Vibrata" and "San Salvatore" hospitals. *Results:* Dilation time was different in the two groups: in the group with analgesia, the median was 2.30 and 3.35 in the control group. The median expulsion time was 2.05 in the analgesia group and 0.40 in the control group. *Discussion:* The statistical analysis of the study has highlighted the fact the analgesia influences the dilation and expulsion time of labor, confirming on the one hand the clinical evidence, and on the other, adding important results that have not been analyzed by other scientific studies. The results have shown that in nulliparous women, with spontaneous onset of labor, analgesia causes a major reduction in the dilation time of the cervical canal with respect to the control group.

Key words: Epidural analgesia; First stage of delivery; Second stage of delivery; Labor; Dilation.

Introduction

There is evidence in the scientific literature that pain relief in labor is beneficial for both mother and newborn, and conditions have been identified where analgesia is actually an indication [1]. Maternal benefits include reduction in the consumption of O2 and in hyperventilation which prevents metabolic acidosis [2, 3]. In addition, the greater degree of relaxation and of maternal cooperation cause a decrease in the incretion of catecholamines and of stress hormones, and hence an improvement in blood supply to the placenta [4, 5]. Fetal benefits consist above all in improved neonatal outcomes thanks to the abovementioned benefits on placenta circulation [5, 6].

Over the years many scientific studies have focused on various aspects linked to the use of analgesia during labor, such as neonatal outcome and observation of complications, evaluating differences in the use of subarachnoid, epidural or combined analgesia and the incidence of operative delivery [1, 7, 8]. In the past it was deemed that the latter was related to the use of epidural analgesia [2, 9]. So far there has been ample evidence showing that there is no such relationship [1, 10]. As to the possible effects that epidural analgesia has on the stages of delivery, the literature has shown that in most cases the expulsive phase is prolonged [11, 12]. On the contrary, there are no studies confirming the role of analgesia on the dilation phase of labor [13, 11].

This controlled observational study aimed at evaluating the effects of epidural analgesia on the first and second stages of delivery in nulliparous women, referred to the birth centers of the Sant'Omero "Val Vibrata" Hospital and the "San Salvatore" Hospital in L'Aquila, selected in accordance with specific inclusion criteria.

Materials and Methods

Between May 1st, 2012 and April 31st, 2013, 363 patients were enrolled at the birth centres of the "Val Vibrata" Hospital in Sant' Omero, Teramo, and of the "San Salvatore" Hospital in L'Aquila. The study included 139 patients that received epidural analgesia during labor at the "Val Vibrata" Hospital where an anesthesia service is available 24/7; 224 patients constituted the control group and went through natural delivery without analgesia at the "Val Vibrata" and "San Salvatore" hospitals.

This is a controlled observational study. Nulliparous patients with physiological term pregnancy and spontaneous labor were enrolled. The obstetric criteria for exclusion were: operative delivery, cesarian section, twin pregnancy, obstetric maternal disease (gestational hypertension, endocrinopathy, eclampsia, pre-eclampsia, recent hemorrhage, gestational and pre-gestational diabetes), genetic neonatal anomalies or major malformations, anomalous presentation, macrosomias (neonatal weight greater than 4,500 grams, or > 95th percentile for gestational age), use of maternal prescription drugs, uterine anomalies or pathologies, and positive allergy to local anesthesia, and in addition, patients with excessively inhomogeneous results suggestive of measurement errors or of medical conditions of which the patients were not aware.

Revised manuscript accepted for publication June 4, 2015

Table 1. — *Anesthetic administration protocol utilized.*

Cervical dilation (cm)	Position of the head	Initial dose Total volume (ml)	Successive dose Drug and dose	Volume (ml)
2-3	-2/-1	5-10	Ropivacaine 0.10%	20
3-5	-1	15-20	Ropivacaine 0.10% Levobupivacaine 0,0625%	20
> 6		20	Ropivacaine 0.15%-0.20% Levobupivacaine 0.125%	10
Full dilation	-1/0	20		

Table 2. — *Characteristics of patients enrolled in the study (n=363).*

Variable	Average	Std. Dev.	Median
Age	29.84	5.55	30.00
Week	279.41	8.32	280.00
Dilat. time	3.28	1.97	3.10
Exp. time	1.18	1.03	1.05
Apgar 1 min.	8.29	0.62	8.00
Apgar 5 min.	9.40	0.58	9.00
Weight	3262.90	398.91	3250.00
Min. dil.	3.44	1.97	3.17
Min. exp.	1.35	1.02	1.08

Table 3. — *Group A patients (with analgesia, n= 139).*

Variable	Average	Std Dev	Median
Age	29.35	5.64	30.00
Week	278.87	8.68	279.00
Dilat. time	2.88	1.98	2.30
Exp. time	1.83	1.01	2.05
Apgar 1 min.	8.50	0.64	8.00
Apgar 5 min.	9.58	0.54	10.00
Weight	3303.02	400.20	3260.00
Min. dil.	3.04	1.96	2.50
Min. exp.	2.01	0.99	2.08

Table 4. — *Control group N patients (without analgesia, n=224).*

Variable	Average	Std. Dev.	Median
Age	30.15	5.49	31.00
Week	279.75	8.08	280.00
Dilat. time	3.53	1.93	3.35
Exp. time	0.78	0.80	0.40
Apgar 1 min.	8.17	0.57	8.00
Apgar 5 min.	9.29	0.58	9.00
Weight	3238.01	396.97	3240.00
Min. dil.	3.69	1.94	3.58
Min. exp.	0.94	0.81	0.67

Table 5. — *Fisher test in group A (patients with analgesia) and group N (patients without analgesia).*

Frequency *Percentage* *Pct line* *Pct column*	0	1	Total
A	99	40	139
	27.27	*11.02*	*38.29*
	71.22	*28.78*	
	35.23	*48.78*	
N	182	42	224
	50.14	*11.57*	*61.71*
	81.25	*18.75*	
	64.77	*51.22*	
Total	281	82	363
	77.41	*22.59*	*100.00*

The variables taken into account in the study were: maternal age, gestational age, time of dilation of the cervical canal to four cm (moment when the neck of the uterus is centralized and flattened, with the fetal head fixed at least at the upper section, and regular contractions of at least 40 seconds, at which time the first dose of anesthetic is delivered), time of full dilation, time of complete expulsion of the fetus, APGAR scores at one and five minutes after birth, administration of oxytocin, if any, and time when infusion was started, and weight of the newborn.

The anesthetics administration protocol used in the study was the protocol routinely used at the "Fatebenefratelli Villa San Pietro" Hospital in Rome (Table 1).

Statistical analysis

The analysis was carried out in a total sample of 363 patients enrolled in accordance with the inclusion criteria and the variables examined were maternal age, gestational age, time of dilation of the cervical canal to four cm (first administration of the anesthetic), time of total dilation, time of total expulsion of the fetus, APGAR scores at one and five minutes, use or not of oxytocin, time when oxytocin was delivered, and neonatal weight.

The average, median, and standard deviation values were calculated for each variable followed by a second analysis of the previous evaluations separately in the two groups (group n., patients who did not receive analgesia; group A, patients who received analgesia) (Tables 2, 3, 4). All the variables were subjected to the Wilcoxon test (sum of the ranks) and the Kruskal-Wallis test (evaluation of the chi-square) to confirm the reliability of the data. The frequency and the percentage of oxytocin used by the two groups was then evaluated: 28.78% of the women in group A and 18.75% of the women in group N received at least one dose of oxytocin. Data consistency was checked by running the Fisher test (Table 5).

On the basis of the Spearman correlation coefficient, the most significant variables of group A were: age-expulsion time, age-APGAR score at one minute, age-minutes to expulsion, dilation time-gestational weeks, weight-gestational weeks. In group N the most significant variables were: weight-gestational week, minutes to expulsion-dilatation time.

The final analysis with a 95% confidence interval showed that in group N (primiparous women who did not receive analgesia), the odds ratio was 86233 (median value of expulsion time for all 363 enrolled patients): in group N the probability of having an expulsion time < 1.05 increased by 8.6 times. Expulsion time and dilatation time correlated well showing that with a dilation time < 3.10 (median value of the dilation time for all 363 patients enrolled) the probability of having an expulsion time < 1.05 increased by 1.82 times (Table 6).

In group A (women who received analgesia), the odds ratio was 5.6: the probability of a dilation time < 3.10 increased by 5.6 times. Expulsion and dilation times correlated, thus showing that with an expulsion time < 1.05 (median value of the expulsion time

Table 6. — *Spearman's correlation matrix in group N (without analgesia): number of observations: n=224, prob > |r| with H0: Rho = 0.*

	Age	Week	Dilat. time	Exp. time	Apgar 1	Apgar 5	Weight	Min. dil.	Min. exp.
Age	1	0.02459	-0.05782	0.04483	0.02565	-0.0542	0.07448	-0.0578	0.04483
		0.7143	0.3891	0.5044	0.7026	0.4198	0.2670	0.3891	0.5044
Week	0.02459	1	0.06046	0.17236	-0.0191	-0.0101	0.22658	0.06046	0.17238
	0.7143		0.3678	0.0097	0.7759	0.8804	0.0006	0.3678	0.0097
Dilat. time	-0.0578	0.06046	1	0.20185	-0.0802	-0.1405	0.00526	1.00000	0.20185
	0.3891	0.3678		0.0024	0.2320	0.0355	0.9376	<0.0001	0.0024
Exp. Time	0.04483	0.17238	0.20185	1	-0.0986	-0.1185	-0.0626	0.20185	1.00000
	0.5044	0.0097	0.0024		0.1413	0.0768	0.3509	0.0024	<0.0001
Apgar 1 min.	0.02565	-0.0191	-0.08018	-0.09858	1	0.35899	0.13279	-0.0802	-0.09858
	0.7026	0.7759	0.2320	0.1413		<0.0001	0.0471	0.2320	0.1413
Apgar 5 min.	-0.0542	-0.0101	-0.14054	-0.11848	0.35899	1	0.10804	-0.1405	-0.11848
	0.4198	0.8804	0.0355	0.0768	<0.0001		0.1068	0.0355	0.0768
Weight	0.07448	0.22658	0.00526	-0.06261	0.13279	0.10804	1	0.00526	-0.06261
	0.2670	0.0006	0.9376	0.3509	0.0471	0.1068		0.9376	0.3509
Min. dil.	-0.0578	0.06046	1.00000	0.20185	-0.0802	-0.1405	0.00526	1	0.20185
	0.3891	0.3678	<0.0001	0.0024	0.2320	0.0355	0.9376		0.0024
Min. exp.	0.04483	0.17238	0.20185	1.00000	-0.0986	-0.1185	-0.0626	0.20185	1
	0.5044	0.0097	0.0024	<0.0001	0.1413	0.0768	0.3509	0.0024	

Table 7. — *Spearman's correlation matrix is, in group A (with analgesia): number of observations: n=139, prob > |r| with H0: Rho = 0.*

	age	week	Dilat. time	Exp. time	Apgar 1	Apgar 5	Weight	Min. dil.	Min. exp.
Age	1	0.09193	0.04453	-0.24632	-0.2152	-0.1177	0.11478	0.04453	-0.24632
		0.2818	0.6027	0.0035	0.0109	0.1676	0.1785	0.6027	0.0035
Week	0.09193	1	0.17835	-0.02184	0.02855	0.11181	0.19345	0.17835	-0.02184
	0.2818		0.0357	0.7985	0.7386	0.1901	0.0225	0.0357	0.7985
Dilat. time	0.04453	0.17835	1	-0.11971	0.04479	-0.0363	0.10962	1.00000	-0.11971
	0.6027	0.0357		0.1604	0.6006	0.6711	0.1990	<0.0001	0.1604
Exp. time	-0.2463	-0.0218	-0.11971	1	0.06026	0.08399	-0.0030	-0.1197	1.00000
	0.0035	0.7985	0.1604		0.4810	0.3256	0.9721	0.1604	<0.0001
Apgar 1 min.	-0.2152	0.02855	0.04479	0.06026	1	0.44666	0.04442	0.04479	0.06026
	0.0109	0.7386	0.6006	0.4810		<0.0001	0.6036	0.6006	0.4810
Apgar 5 min.	-0.1177	0.11181	-0.03633	0.08399	0.44666	1	-0.0199	-0.0363	0.08399
	0.1676	0.1901	0.6711	0.3256	<0.0001		0.8162	0.6711	0.3256
Weight	0.11478	0.19345	0.10962	-0.0030	0.04442	-0.0199	1	0.10962	-0.0030
	0.1785	0.0225	0.1990	0.9721	0.6036	0.8162		0.1990	0.9721
Min. dil.	0.04453	0.17835	1.00000	-0.11971	0.04479	-0.0363	0.10962	1	-0.11971
	0.6027	0.0357	<0.0001	0.1604	0.6006	0.6711	0.1990		0.1604
Min. exp.	-0.2463	-0.0218	-0.11971	1.00000	0.06026	0.08399	-0.0030	-0.1197	1
	0.0035	0.7985	0.1604	<0.0001	0.4810	0.3256	0.9721	0.1604	

for all 363 enrolled patients), the probability of having a dilation time < 3.10 increased by 1.8 times (Table 7).

Results

In a total of 363 women analyzed, 139 (38.29%) delivered with analgesia and 224 (61.71%) with spontaneous delivery. The results were uniform for maternal age (median 30) and neonatal weight (median 3,263 grams). Dilation time was different in the two groups: in the group with analgesia the median was 2.30 and 3.35 in the control group. The median expulsion time was 2.05 in the analgesia group and 0.40 in the control group. The dilation time therefore lasted more in spontaneous delivery without epidural analgesia, while the expulsion time was higher in deliveries with analgesia.

In the group with analgesia there was a higher proportion of patients requiring the administration of oxytocin (29% *vs* 19%; $p < 0.001$).

In group A, the probability of having a dilation time of less than 3.10 (median of the dilation-time variable of the 363 measured samples) increased by 5.71 times (odds ratio gr_cl), while an expulsion time of less than 1.05 (median of

the expulsion time variable of the 363 measured samples) increases the probability of having a dilation time of less than 3.10 (median of the dilation time variable of the 363 measured samples) by 1.81 times.

In group "N" the probability of having an expulsion time of less than 1.05 (median of the expulsion time variable of the 363 measured samples) increases by 8.62 times (odds ratio gr_cl), while the dilatation time of less than 3.10 (median of the dilation time of the 363 measured samples) increases the probability of having an expulsion time of less than 1.05 (median of the expulsion time variable of the 363 measured samples) by 1.81 times.

Discussion

The statistical analysis of this study has highlighted the fact the analgesia influences the dilation and expulsion time of labor, confirming on the one hand the clinical evidence, and on the other, adding important results that have not been analyzed by other scientific studies. Indeed the literature has shown that in nulliparous women with physiological term pregnancy who were treated with analgesia, there was an increase in the duration of the second stage of labor, but there were no statistical evaluations regarding the effects on the first stage of delivery. Hence owing to the poor homogeneity of the samples of patients included and of the various anesthesiology protocols used, the results offered by the literature on this analysis are discordant. The present study intended to minimize such confounding factors by selecting a homogeneous obstetric population, in terms of age, parity, concomitant disorders, neonatal anomalies, and by using a standard anesthesiology technique.

There is extensive scientific evidence showing that analgesia does not cause an increase in operative deliveries and cesarian sections which instead are influenced more by maternal-fetal factors and by obstetric pathologies, and it does not have a role in increasing major neurological incidents.

The aim of the present study was to analyze the influence of analgesia on the first stage of labor since there are little data on this in the literature. At the same time the evaluation was extended to the second stage of labor in order to acquire an overall view of the effects of this anesthesiology technique. The results have shown that in nulliparous women with spontaneous onset of labor, analgesia causes a major reduction in the dilation time of the cervical canal with respect to the control group. In analgesia, the dilation of the cervix is faster for the myorelaxing and sympatholitic effect of the administered drugs. Of course the latter have no effect on the time of descent of the fetus that occurs according to the time of spontaneous delivery without analgesia. This has a twofold advantage: the first is objective and concerns the time gain; the second is subjective and concerns the women in whom the absence of pain enables them not to experience the longer and more painful phase of labor and thus give birth more serenely. On the other hand, failure to perceive pain lowers the perception of the pressing sensation that is normally the input for using pelvic torque that increases the expulsion force exercised voluntarily by the woman. This clinically translates into an increase in expulsion time, a factor that is partially offset by the use of an intravenous infusion of oxytocin in the women who undergo analgesia. On the basis of the present evidence, the authors can state that analgesia accelerates the dilation period of delivery, thus extending the duration of delivery a little and in a non significant manner and it increases the need of the administration of oxytocin without influencing the vitality of the newborn measured as Apgar score at one and five minutes.

Conclusion

In conclusion the present authors' experience confirms that analgesia during labor is useful, is a safe technique for both mother and newborn, and offers an unquestionable advantage for mothers who can face labor more serenely and with greater emotional participation without interfering in neonatal outcome. Clinically it reduces the cervical dilation time without influencing the delivery mechanism in terms of overall length and incidence of operative deliveries and hence it is recommended as a safe and effective technique for natural delivery.

References

[1] Leighton B.L., Halpern S.H.: "The effects of epidural analgesia on labor maternal, and neonatal outcomes: a systematic review". *Am. J. Obstet. Gynecol.*, 2002, *186*, S69.

[2] Maresh M., Choong K.H., Beard R.W.: "Delayed pushing with lumbar epidural in labour". *Br. J. Obstet. Gynaecol.*, 1983, *90*, 623.

[3] Morgan B., Bulpitt C.J., Clifton P., Lewis P.J.: "Effectiveness of pain relief in labour: survey of 1000 mothers". *Br. Med. J. (Clin. Res. Ed.)*, 1982, *285*, 689.

[4] Wright R.G., Shnider S.M., Thirion A.V.: "Regional anesthesia for preterm labor and vaginal delivery: effects on the fetus and neonate". *Anesthesiology*, 1988, *69*, A654.

[5] Shnider S.M., Abboud T.K., Artal R., Henriksen E.H., Stefani S.J., Levinson G.: "Maternal catecholamines decrease during labor after lumbar epidural anesthesia". *Am. J. Obstet. Gynecol.*, 1983, *147*, 13.

[6] Levinson G., Shnider S.M., DeLorimier A.A., Steffenson J.L.: "Effects of maternal hyperventilation on uterine blood flow and fagel oxygenation and acid-base status". *Anesthesiology*, 1974, *40*, 340.

[7] Gaiser R.R.: "Labor epidurals and outcome". *Best. Pract. Res. Clin.Anaesthesiol.*, 2005, *19*, 1.

[8] Indraccolo U., Di Filippo D., Di Iorio R., Marinoni E., Roselli D., Indraccolo S.R.: "Effect of epidural analgesia on operative vaginal birth rate". *Clin. Exp. Obstet. Gynecol.*, 2011, *38*, 221.

[9] Walton P., Reynolds F.: "Epidural analgesia and instrumental delivery". *Br. Med. J. (Clin. Res. Ed.)*, 1986, *293*, 755.

[10] Beilin Y., Friedman F. Jr., Andres L.A., Hossain S., Bodian C.A.: "The effect of the obstetrician group and epidural analgesia on the risk for cesarean delivery in nulliparous women". *Acta Anaesthesiol. Scand.*, 2000, *44*, 959.

[11] Indraccolo U., Ripanelli A., Di Iorio R., Indraccolo S.R.: "Effect of epidural analgesia on labor times and mode of delivery: a prospec-

tive study". *Clin. Exp. Obstet. Gynecol.*, 2012, *39*, 310.
[12] Gerli S., Favilli A., Acanfora M.M., Bini V., Giorgini C., Di Renzo G.C.: "Effect of epidural analgesia on labor and delivery: a retrospective study". J. Matern. Fetal Neonatal. Med., 2011, *24*, 458.
[13] Nelson D.B., McIntire D.D., Leveno K.J.: "Relationship of the length of the first stage of labor to the length of the second stage". *Obstet. Gynecol.*, 2013, *122*, 27.

Address reprint requests to:
G. CARTA, M.D.
Department of Obstetrics and Gynecology
San Salvatore Hospital in L'Aquila
University of L'Aquila Italy
Viale San Salvatore Edificio 6 ingresso A
67100 Coppito, L'Aquila (Italy)
e-mail: gasparecarta@libero.it