β-ENDORPHINS IN LABOR

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SUMMARY

The Authors have studied β-endorphin in the different phases of labor, that has shown a characteristic behavior: *a*) at the beginning of labor the β-endorphin level is higher than the basal levels; *b*) it inereases alongside with dilatation; *c*) during the expulsion a constant peak is observed; *d*) wich rapidly disappears.

Moreover the Authors found higher β-endorphin in the umbilical cord blood too.

The discovery of endorphins ([16, 17]) and of many new endogenous opiate neuropeptides has fostered new research in many medical fields. The action mechanisms of these substances are still being studied although some have already been clearly detected. β-endorphin, for instance, plays an unquestionable role in the mechanisms of stress and, particularly, of pain ([4, 5]). Its secretion follows the same trend as that of ACTH ([10]), another stress hormone with which endorphins and encepfalins share a common 'forerunner', BIG ACTH ([6]). All these neuropeptides originate from the Central Nervous System and exist in everyone in minimum quantities ([19, 21]). They are thought to have an analgesic-behavoral function ([4, 11, 18]). Many pathologies like cronic pain ([1]), Nelson's Syndrome ([12]), Cushings Syndrome ([8]) and Addison's disease have proven to increase these substances significantly. But β-endorphins increase also in physiologic conditions, like pregnancy and, particularly, labor ([3, 9]). In all cases, the increase occurs under intense-stress conditions involving the traditional stress hormones, including ACTH ([14]).

It was the observation that ACTH and β-endorphin, the most important endorphin, increase simultaneously under stress conditions that provided the cue for this study. Working on the assumption that pain is the main element in the clinical picture, we studied the behavior of endorphins during labor. In particular, we resolved upon evaluating the rise of these substances plasma levels vis-à-vis non-pregnant women, and their possible significant changes during the different phases of labor in view of the varying pain intensity.

MATERIAL AND METHODS

We observed the whole delivery course of 12 women. 4 samples of venous blood were taken from each of them, from the elbow median vein, in the following phases of delivery:
– 1st sample: prodromal period;

TABLE I — *β-endorphin values (expressed in pmol/l) in the various periods of labor (P = prodromal period; D = dilatation period; E = expulsion period; PP = post-partum period) and in the umbilical cord mixed blood. M = mean; SD = standard deviation; SE = standard error.*

Patient	P	D	E	PP	F
1	14.49	19.07	38.15	16.02	6.62
2	9.07	11.40	16.22	13.67	10.22
3	11.17	16.90	29.80	6.00	9.12
4	3.50	7.37	13.25	3.50	7.22
5	14.40	17.87	24.20	12.50	3.37
6	1.99	2.72	11.87	8.52	1.57
7	3.50	4.70	8.57	3.37	3.75
8	9.05	34.32	44.39	7.22	33.87
9	15.87	22.40	30.75	4.50	32.45
10	6.32	10.17	29.45	3.27	9.39-13.12
11	8.00	13.25	23.52	6.89	18.10
12	12.40	32.10	50.00	13.98	40.05
M	9.15	16.02	26.68	8.29	14.64
SD	4.67	9.96	13.06	4.61	13.34
SE	1.35	2.88	3.77	1.33	4.23

- 2nd sample: dilatation period;
- 3rd sample: expulsion period;
- 4th sample: post-partum period (within 30').

We compared these patients to 6 non-pregnant, physically and psychologically healthy women in fertile age, from whom we took venous blood samples (5 cc) between 8 h and 9 h a.m.

Furthermore, each newborn underwent umbilical mixed blood sampling within 3' from birth and before the placental detachment. All blood samples were kept in centrifuge test-tube with EDTA, at −4 °C, for at least 10 hours, and subsequently centrifuger ar 3000 rev./10'. The obtained plasma was kept at −20 °C.

β-endorphin assays were than performed using Immuno Nuclear Corporation kits (P.O. Box 285, Stillwater, Minnesota 55082) distributed in Italy by Medical Systems.

TABLE II — *β-endorphin levels in non-pregnant adult women in fertile age.*

	pmol/l
No. 1 :	6.61
No. 2 :	5.82
No. 3 :	4.97
No. 4 :	5.51
No. 5 :	4.00
No. 6 :	4.33

The β-endorphin vaules we obtained were not invalidated by the total β-endorphin-like immunoactivity because we had previously separated β-endorphin from β-LPH, the peptide mainly responsible for endorphin-like activity, given the structural similarity of the two molecules –61 –91 [2] and the β-LPH proven role of 'forerunner' [15].

RESULTS

During labor, β-endorphin levels (tab. 1) are higher than in non-pregnant adult women in fertile age (tab. 2).

However, the most significant observation (fig. 1) concerns the characteristic behavior of β-endorphins during labor. From the prodromal (P) to the dilatation (D) periods, β-endorphins gradually increase. The longer this period, the higher the levels of this substance.

A further increase occurs between the dilatataion and the expulsion (E) periods. This is the most characteristic feature. The peak-level is reached during expulsion, independent of the duration of labor. This duration, however, probably in view of the more difficult clinical course and

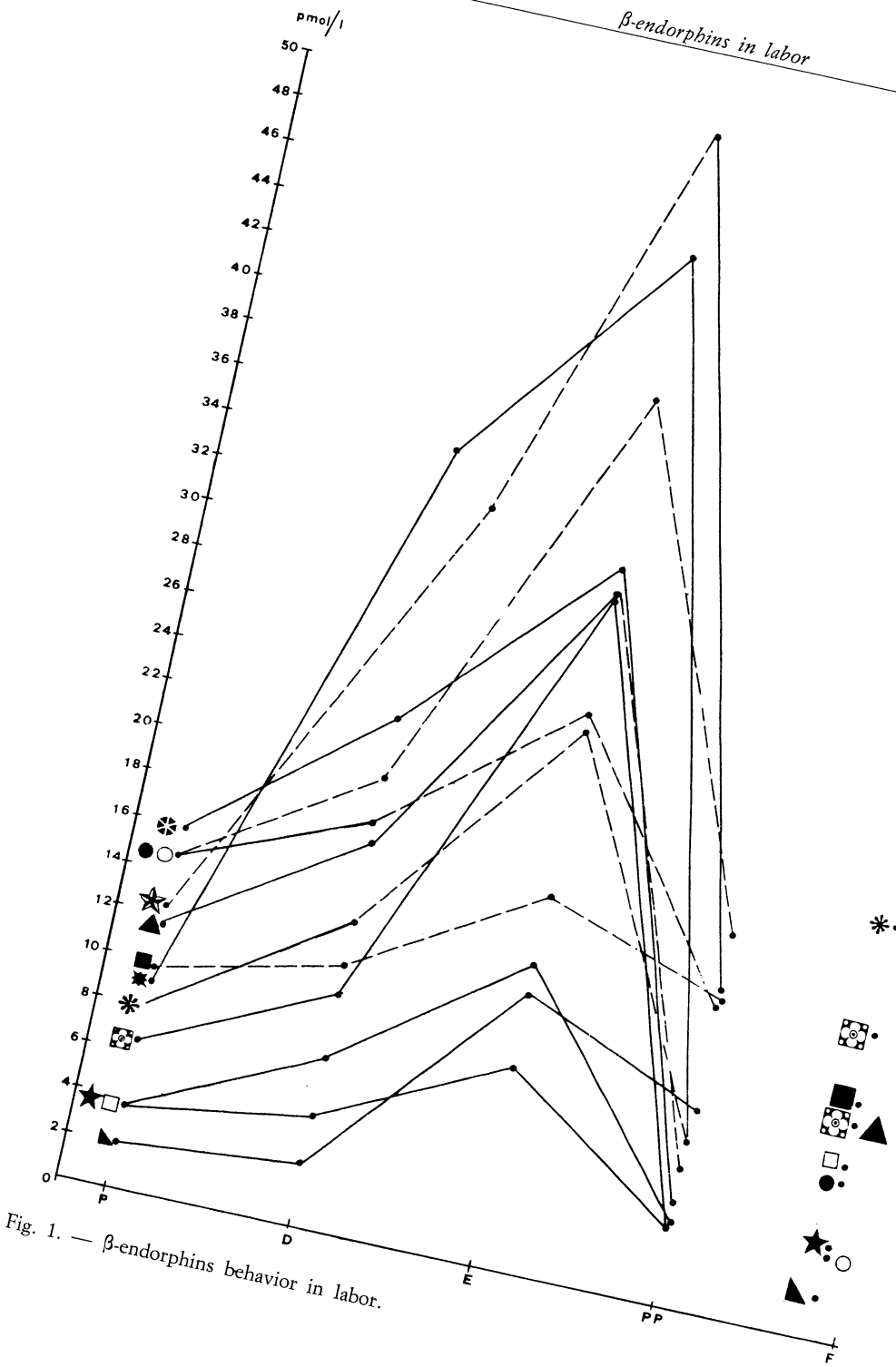

Fig. 1. — β-endorphins behavior in labor.

TABLE III — *Increase relations between the different periods of labor.*

Patient No.	Min. before o P	0	From o to dilatation D	Min. from dil. to expulsion E			
1	30		200	285	0.0229	0.0669	−0.7377
2	15		45	30	0.0518	0.1607	−0.0850
3	10		130	50	0.0441	0.2580	−0.7933
4	10		130	70	0.0298	0.0840	−0.3250
5	15		495	145	0.0070	0.0437	−0.3900
6	15		105	50	0.0070	0.1830	−0.1117
7	405		185	290	0.0065	0.0133	−0.1733
8	5		55	65	0.4595	0.1549	−1.2390
9	5		25	50	0.2612	0.1670	−0.8750
10	10		170	100	0.0226	0.1928	−0.8727
11	5		55	60	0.0955	0.1712	−0.5543
12	15		765	165	0.0258	0.1085	−1.2007
				Mean	0.0861	0.1337	−0.6131
				Standard dev.	0.1371	0.0709	+0.4024
				Standard err.	0.0396	0.0205	+0.1162
				t	2.1760	6.5352	5.2787
				p	n.s.	p<0.001	p<0.001

the consequent sharper pain, plays a fundamental role in determining the quantity of β-endorphins which mirrors the wider adjustments the mother's organism must undergo.

After the expulsion, β-endorphin levels lower generally to reach the basal levels at about 30′ from the delivery, thus narrowing the differences vis-à-vis the control values.

The values observed in the umbilical cord blood too are higher than in non-pregnant women though lower than the mother's.

It is worth noting that higher β-endorphin levels in the mother are matched by proportionally higher levels in the umbilical cord blood. This means that both the mother and the child bear the consequences of a hard delivery entailing greater efforts ([20]). These high neonatal values might origin from the mother's plasma, the placenta or the fetal hypophysis ([7, 13]). The most likely source is the fetal hypophysis because β-endorphin is unlikely to pass through the placenta; its molecular weight exceeds 600, that is the limit-weight to pass through the placental wall.

We have statistically processed all the data reported in table 1, working out mean value of each period, standard deviation and error. Furthermore, in each case, we have found the increase relation between the various periods of labor (tab. 3): $\Delta F_1 = \frac{\Delta - P}{\Delta t_1}$ (D = value of dilatation period; P = value of prodromal period; Δt_1 = lapse of time between the two samplings; $\Delta F_2 = \frac{E - D}{\Delta t_2}$ (E = value of expulsion period; D = value of dilatation period; Δt_2 = lapse of time between the two samplings) and $\Delta F_3 = \frac{PP - E}{\Delta t_3}$ (PP = value of post-partum period; Δt_3 = lapse of time between the two samplings).

We have also calculated the standard mean, error and deviation of these increase relations as well as Student's T and the significativity p.

ΔF_2 ($t = 6.5$; P 0.001) and ΔF_3 ($t = 1.19$; p n.s.) were the significant increase relations with no difference between the two periods ($t = 1.19$; p n.s.).

CONCLUSIONS

The data here reported gave rise to very interesting remarks. β-endorphin, that we dosed in the different phases of labor, has shown a characteristic behavior that can be summarized as follows:

a) at the beginning of labor the concentration of β-endorphins is higher than the basal levels;

b) it increases alongside with dilatation;

c) during the period of sharpest pain, expulsion, a constant peak is observed;

d) which rapidly disappears over the first hours following delivery.

Moreover, β-endorphins – most likely of fetal origin – are highly concentrated in the umbilical cord blood too, as the fetus undergoes remarkable stress when passing through the uterine canal.

β-endorphins can therefore help us to understand physiologic and pathologic phenomena either in labor or in other clinical conditions. They open up earlier unthinkable prospects like their possible future therapeutical use to control pain in labor.

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