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Neuro-Biochemistry of Immersion in Warm Water During Labour: The Secretion of Endorphins, Cortisol and Prolactin

M. Boulvain and S. Wesel

ABSTRACT: A warm bath during the first stage of delivery accelerates labour while it also has an analgesic and antispastic effect. This effect seems to be more obvious in "pathological" women. This study is devoted to the exploration of the variations of neurotransmitter plasma levels before, during and after the bath. The bath seems to lower the increase of endorphin and cortisol plasma levels during labour. An increase of prolactin levels is observed in the bath, and a decrease out of the bath.

INTRODUCTION AND HISTORICAL DATA

Following the experience of M. Odent (Pithiviers, France), the use of immersion in a warm bath during the first stage of labour was introduced six years ago in our maternity ward.

Beyond the obvious benefits provided by this practice in the field of psychological as well as physical comfort, on one hand, and of pleasure, on the other hand, we showed in 1982, at the 8th European Congress of Perinatal Medicine in Brussels, its advantage as an antalgic, antispastic and accelerating agent in labour.

In a large number of cases, the warm bath allows to avoid the use of more classical, but more invasive pharmacological or anaesthetic techniques.

At last, at the 2nd Congress of the North American Society of Pre and Perinatal Psychology (San Diego-USA) in 1985, we presented the results of a study about the experience of delivery in women who had been given a bath during dilatation. The conclusion of that work demonstrated that the bath improves mostly the delivery experience of "pathological" women (first of all primiparas). Through its reassuring,

Address all correspondence to S. Wesel, M.D. Hopital de Braine l'Alleud-Waterloo, Braine l'Alleud (Belgium).

relaxing and antalgic effects, it enables "pathological" women to live their delivery as a gratifying experience, and avoids their overwhelming by anxiety.

The bath could allow women to control pain, to look for protection in close relatives (like the husband, the mother, friends), and, at last, to regress enough to be in close accordance with their baby.

As naturalists, it seemed to us interesting to undertake a research about the biological mechanisms at stake during the bath at the cerebral level.

BIOLOGICAL DATA

A large number of neurotransmitters are present in very low concentration in the central nervous system. These substances have various important biological effects.

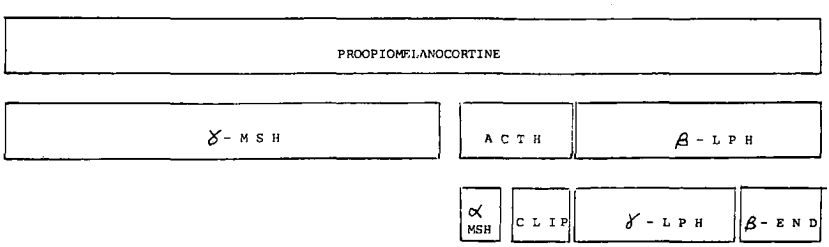
Our interest is mostly focused on peptides synthetized by the hypothalamo-hypophyseal system: nevertheless, their effects are ubiquitary and their distribution not restricted to this area.

They are mostly derived from pro-opio-melanocortin by enzymatic fragmentation (endo- and exopeptidases) according the the pattern shown in Fig. 1.

These neuropeptides act on synaptic receptors by modulating neurotransmission by means of the cellular ion-permeability and the AMPC system (inactivating adenyl-cyclase and thus decreasing the AMPC level).

The half lifetime of these substances is remarkably short (from 10 minutes for ACTH to 30 minutes for B-endorphin).

Figure 1



Two kinds of receptors have been characterized: μ receptors (mostly implied in analgesia) and δ receptors (principally connected with behaviour).

β endorphin acts on both types of receptors, as Enkephalins and Dynorphin act mostly on δ- and Morphine on μ receptors.

Other hormones are involved in the response to stress: cortisol and prolactin, for example.

Cortisol is an hormone secreted by the adrenocortical gland in response to an increase in ACTH plasma level. Thus cortisol acts as a marker of an ACTH rise in the central nervous system.

Prolactin is secreted by the anterior lobe of hypophysis. It acts on lactation, but also in connection with the dopaminergic system, modulating the response to stress.

The plasma levels of all these hormones are high in late pregnancy and labour. But, in case of an extra-stress, the secretion rate is high enough to create plasma level significantly different from normal pregnancy situations.

MATERIAL AND METHODS

Eighteen patients in active labour were included in the study, and randomly sorted in "BATH" and "NO BATH" groups. They must have regular contractions, ruptured membranes and a cervical dilatation of four cm. at least.

Explanations were provided to them about the study protocole and the usefulness of the experiment. They had to give their full consent when properly informed.

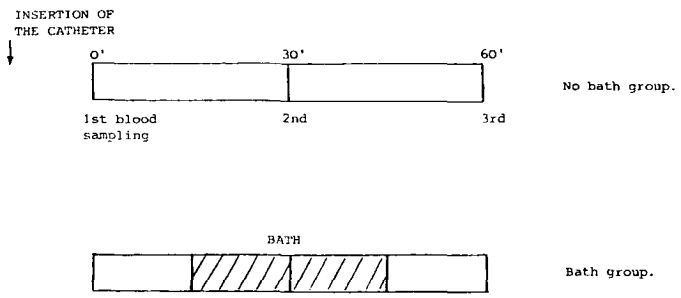
An heparinized intravenour catheter was inserted in a forearm vein, and three blood samples taken at intervals of 30 minutes.

In the "BATH" group, bathing took place 15 minutes after the first blood sampling and ended 15 minutes after the second one, according to the pattern shown in Fig. 2.

The blood samples were centrifugated at 2000 RPM and their plasmatic fraction preserved at a temperature of $-20°$. The analysis were performed by RIA in the Laboratory of Neruo-Endocrinology of Prof. FRANCHIMONT (Université de Liège, Belgium) and in the Laboratory of Isotopes of Dr. J. ETIENNE (Hôpital de Braine-Waterloo, Belgium).

Signification of results was estimated by statistical calculation.

Figure 2



Eleven patients were randomly selected for the "BATH" group, and seven for the "NO BATH" group. That unequal repartition was due to the fact that randomization was done on forty cases for the total, this study being preliminary.

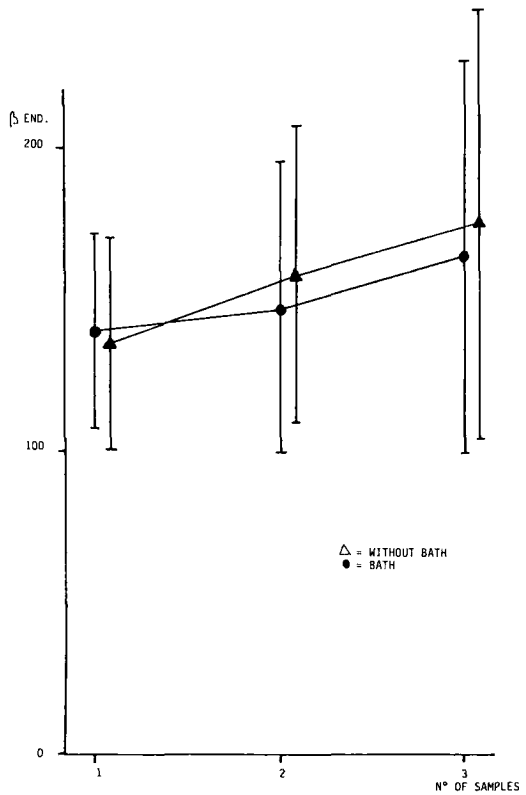
RESULTS

- One formerly elevated cortisol level was noticed in one patient from the "BATH" group.
- Two formerly elevated prolactin levels were indiced in two patients, one from each group
- One prolactin sampling was performed thirty minutes after an injection of metoclopramide for nausea, and thus subject to iatrogenic elevation.

β-Endorphin Plasma Levels (Fig. 3 & 4)

- Mean values are slightly different in the two groups.
- The increase of levels during time is not significant in the bath, and very significant out of bath.
- The standard deviations are large from one subject to another. But levels are relatively stable in the course of observation in one single subject.
- The calculated linear regression shows, better than mean values, a statistically significant between "BATH" and "NO BATH" groups.

Figure 3
β endorphin mean and standard deviation.

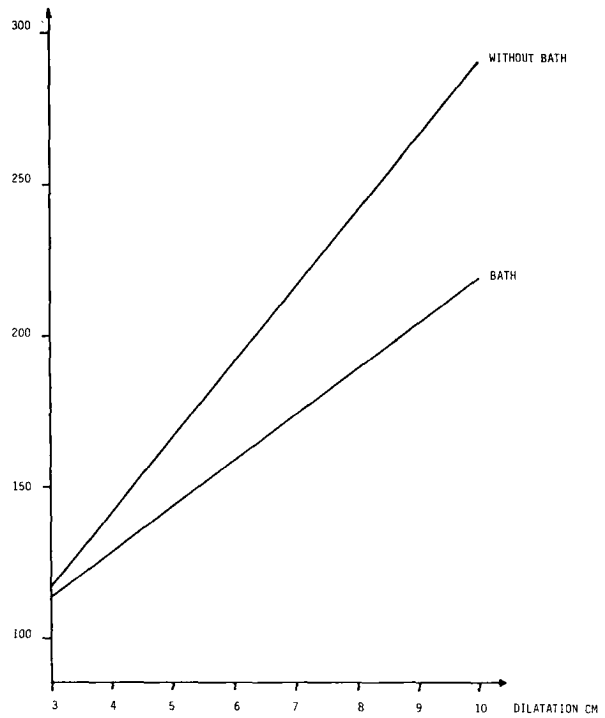


- The apparently slight difference in mean levels is enhanced by a more rapid dilatation rate.
- The bath seems to lower the increase of endorphin plasma levels during labour.

Cortisol plasma levels (Fig. 5 & 6) The same phenomenon is observed for cortisol as for endorphin.

Prolactin plasma levels (Fig. 7 & 8)

Figure 4
Linear regression of β endorphin/dilatation.

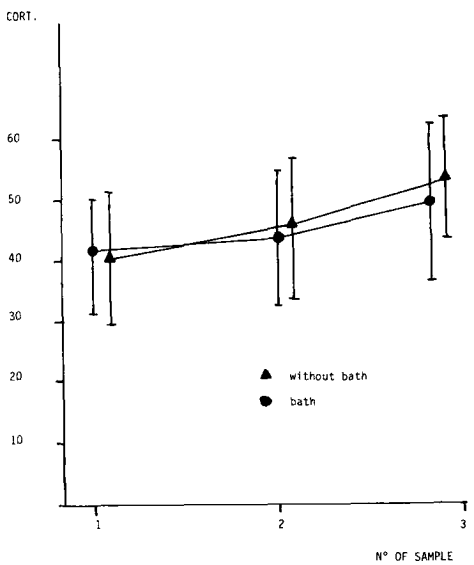


- Mean values are more marked for prolactin than for the other markers.
- Linear regression shows a statiscally significant difference between the two groups, i.e. an increase of PRL level in the bath, a decrease out of the bath.

SUMMARY

The differences observed in the plasma levels of Beta-endorphin and cortisol are probably related to a decrease in stress during the bath. The increase of PRL levels in the bath could be interpreted as a

Figure 5
Cortisol: Mean and standard deviations.



favourable effect. The number of our cases is not yet sufficient to reduce the standard deviations. Additional cases will be necessary for a more valuable statistical evaluation.

ACKNOWLEDGEMENTS:

We are happy to thank Prof. FRANCHIMONT who wellcame us generously in his laboratory. Our special gratitude goes to Mrs. REUTER who performed the endorphin assays.

We thank also Dr. ETIENNE who performed the assays for cortisol and prolactin, providing us his competence and a large amount of free time.

Figure 6
Linear regression of cortisol/dilatation.

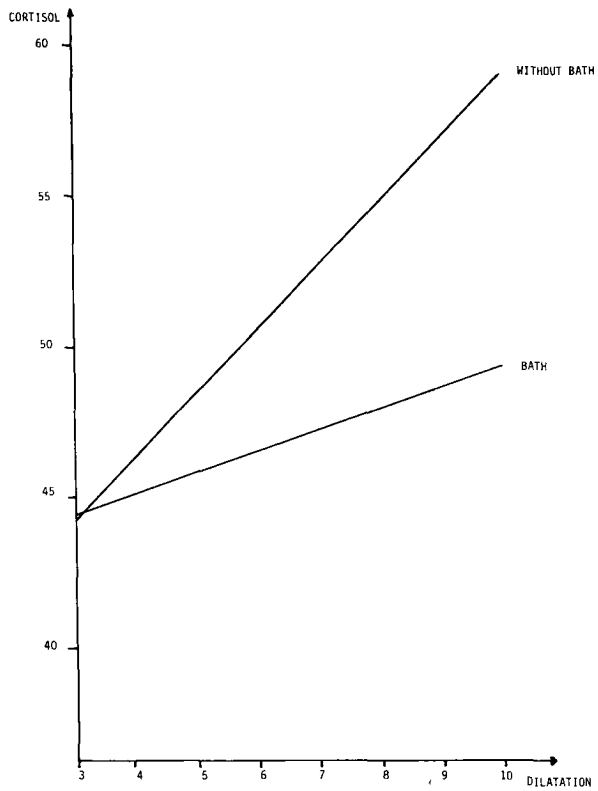


Figure 7
Prolactin: Mean and Standard deviations.

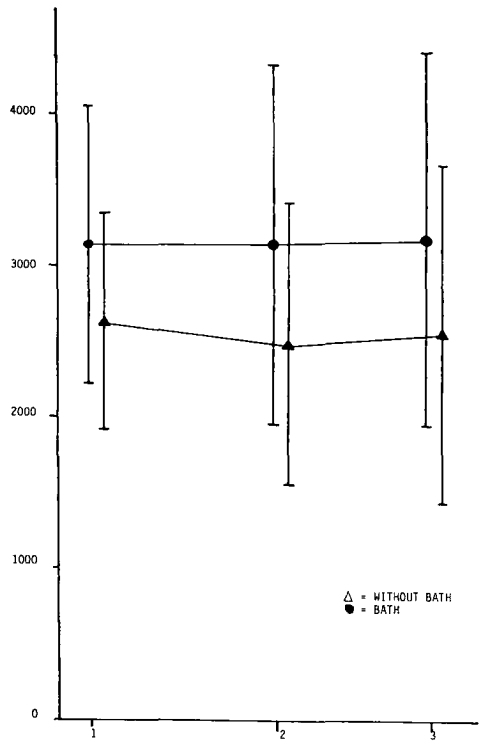
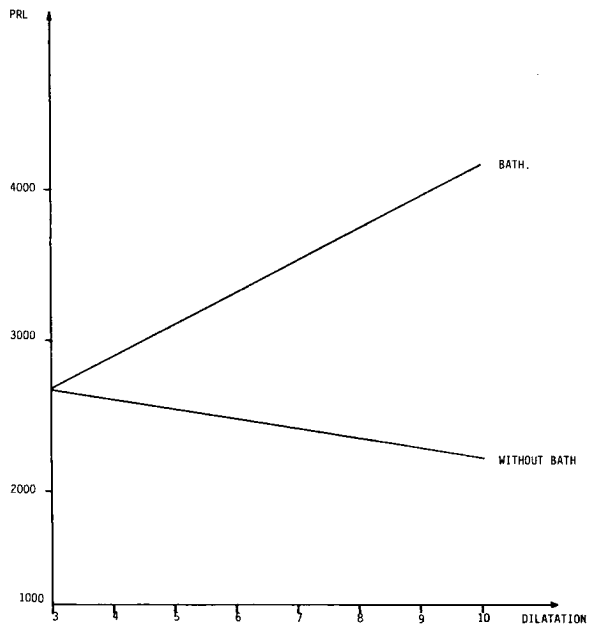


Figure 8
Linear regression of PRL/dilatation.



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