The Influence of Dexamethasone on the Blood-Brain-Barrier and Water Content in Experimental Brain Oedema*

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With 4 Figures

Summary

The influence of Dexamethasone (D) on BBB-function and water content of experimental brain oedema has been studied in rabbits with circumscribed cold injury according to Klatzo’s method using $^{125}$I-dijodofluoresceine as indicator.

Depending on the time of onset of D-therapy, BBB-dysfunction is repaired much faster and the grade of disturbance is about 15–40% lower than in the untreated control group. Furthermore the difference in water content between the injured and the uninjured hemispheres was 30–50% less in the treated as compared with the untreated animals.

The beneficial influence of D-therapy in this model of experimental brain oedema is evident.

The time course and extent of the disturbance of the blood-brain-barrier (BBB) as well as the alteration of the water content following a circumscribed cold lesion of the rabbit brain have been reported in a previous paper.

This experimental model was used to study the influence of Dexamethasone (D) on BBB and water content. The mode of action of this substance, which is widely used in the treatment of cerebral oedema, is still unknown and the quantitative aspects of its ability to inhibit the development or to enhance the resolution of brain oedema is still controversial. With the following two sets of experiments we hoped to gain some more information about these problems:

* Prof. Tönnis dedicated to his 75th birthday.
a) D was injected regularly twice daily starting with the time of
the cold lesion and the time course of the BBB-disturbance as well as
the water content was determined.
b) D was injected regularly twice daily starting 48 hrs. prior to the
lesion.

The results of these experiments were compared with the above
mentioned untreated group.

Method

Normally fed rabbits of mixed breed and sex, weighing 2,400–3,200 g
were used for the experiments. The brain oedema was induced in one
hemisphere by Klatzo's method, care was taken not to injure the dura.
$^{125}$I-dijodo-fluoresceine was used as an indicator of the BBB-function.
To estimate the blood content of the tissue samples erythrocytes were
tagged with $^{51}$Cr.

In group a) each animal received 0.3 mg/kg body weight D twice
daily by i.v. injection starting at the time of injury.

In group b) the same dose was injected at the same time interval
but the medication was started 48 hrs. prior to the lesion.

At certain time intervals from induction of the lesion rabbits were
killed. The brain was removed and, after stripping off the arachnoid
and pia membrane (thus removing the main blood vessels), a small
strip of brain cortex close to the clearly visible cold lesion but free of
necrosis or petechial bleeding, as well as an analogous strip from the
uninjured hemisphere, was dissected out. In both tissue samples the
water content was determined by the wet and dry weight difference.
It was recorded as the difference between the percent water content
of the sample from the injured and uninjured hemisphere.

The concentration of the BBB-indicator and of the $^{51}$Cr-erythrocytes
was measured in 1 ml blood and the activity of each indicator was
determined in the brain samples. From the $^{51}$Cr-tagged erythrocyte
content of the brain slices the blood content of the slices could be
estimated. From the total $^{125}$J-activity measured in the brain slices,
the calculated $^{125}$J-activity of the blood which the slices contain was
subtracted. The net BBB-indicator content of the brain tissue as
calculated by this means was then referred to the fresh weight of the
sample measured. This BBB-indicator concentration was recorded
as the difference between injured and healthy hemispheres in counts
per minute per gram tissue.

Results

a) If D-treatment is started at the time of injury a BBB-disturbance
develops which is similar to that of the untreated animals and which
reaches a maximum 21 hrs. after the lesion. The indicator concentration