

# Plasma catecholamines in children

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**Summary.** Plasma catecholamine concentrations in 46 children of various ages were determined by a sensitive radioenzymatic assay. Noradrenaline levels were found to be in the same range as in adults, whereas adrenaline levels in a few of the children were abnormally high.

Little information is available concerning the physiology and pathophysiology of the sympatho-adrenal system in children. Recently, radioenzymatic methods have been introduced which allow to determine even in little children in small volumes of blood the plasma adrenaline (A) and noradrenaline (NA) concentrations<sup>1</sup>. The concentrations of A and NA in plasma are commonly accepted as the best and most reliable parameters of sympatho-adrenal activity.

**Subjects and methods.** 32 'healthy' children from the orthopedic clinic and 14 children from the cardiologic clinic were investigated (see fig.). The 'healthy' children had been hospitalized for conservative treatment or surgical correction of club-foot, hip luxation or os tibiale externum. Before conservative or surgical treatment was started, a blood sample of 3 ml was drawn from the child's cubital vein immediately after venipuncture. During this procedure all the children were lying in bed and their arm was fixed by an assistant. These 'healthy' children had received no medication, and the collection of blood for the catecholamine (CA) assay was carried out in all the children at the same time of day (8.30-10.30 h). The children from the cardiologic clinic were hospitalized for cardiac catheterization. None of the children was in frank heart failure at the time of the study, although half of them were receiving digoxin. The blood sample of 3 ml was taken from the right heart during catheterization. These children were premedicated with atropine and sedated with diazepam and/or fentanyl. Concentrations of A and of NA in the blood sample were determined by a radioenzymatic assay<sup>1</sup>.

**Results and discussion.** As may be seen from the figure, the most striking but misleading result of the study is the abnormally high plasma NA level observed in the healthy, unsedated, very young children (age 4 months to 2 years). An age dependency for the level of plasma NA in children could be assumed from this result.

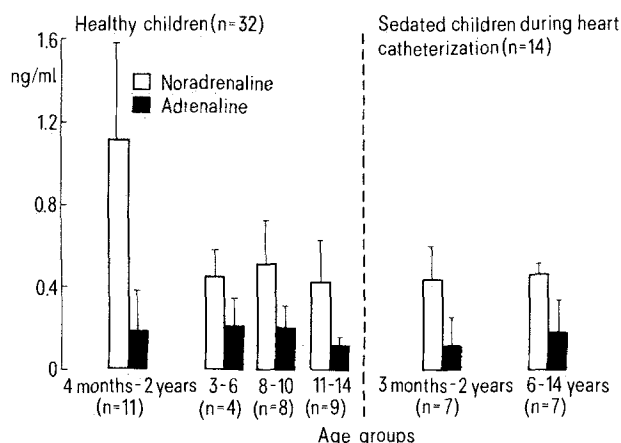
However, this assumption does not hold true, because in the control group of children who were under sedation, no such a difference in the NA levels between very young and

older children was observed (fig.). Furthermore, the NA levels of the sedated very young and the sedated older children did not differ from the NA levels obtained from the other healthy, unsedated children above 2 years of age. Undoubtedly, the results from healthy, unmedicated children cannot be compared directly with results from children who were sedated and were under heart catheterization. However, if plasma NA concentration is really age dependent in children, then this must also hold true for the children under sedation during heart catheterization; this was not the case. So, except for the abnormally high plasma NA levels in the unsedated very young children, the normal non-basal plasma NA level in children was in the range of 0.40 ng/ml, without substantial variation between the different age groups (fig.). The plasma NA concentration is not different from the basal plasma levels commonly observed in adults<sup>2-4</sup>.

No differences in the plasma A concentrations were found, either between the young and the older children or between the sedated and unsedated children. Although in most of the children the A levels were as low as in adult subjects (range 0.04-0.14 ng/ml plasma), 4 of the 32 healthy unsedated children and 3 of the 14 sedated children had A levels which were abnormally high (0.41-0.49 ng/ml plasma) and in the same range as their NA concentration. Such abnormally high plasma A levels cannot be observed in adults under resting conditions<sup>5</sup>. An explanation for this finding in children cannot be given; a technical error is excluded.

The plasma CA concentrations given for healthy children in this study must not be taken as basal values. True basal plasma CA levels can be obtained only from unmedicated subjects under defined physical and psychological resting conditions; taking the blood sample for the assay without any pain to the subject by means of an indwelling catheter. In this respect our study is of great practical significance; showing that the child's level of agitation is highly influential in determining the actual plasma NA level in the very young. However, in children older than 2 years of age, the actual plasma NA concentration is obviously not substantially influenced by excitement, hence similar values were obtained in sedated and unsedated children.

Our results suggest that in children older than 2 years of age the plasma CA concentration measured in samples taken from the cubital vein under non-basal conditions is normally sufficiently accurate to exclude a severe pathological derailment of the sympatho-adrenal system. In contrast, in very young children, misleadingly high plasma NA levels must be expected if blood is taken without observing true resting conditions.



Plasma concentrations of noradrenaline and adrenaline (mean  $\pm$  SD) in children of various age: Comparison of the results from healthy unsedated children and sedated children.

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