Hypokalaemia after Pneumoencephalography

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Summary

The changes in plasma electrolytes and blood pH and gases following the insufflation of air into the subarachnoid space for pneumoencephalography were investigated. The only significant change observed was a rapid fall of plasma potassium most evident at 60 minutes. A concomitant reduction of the urinary Na/K ratio supports the possibility that the change observed may be due to the stimulation of aldosterone secretion caused by this procedure, though its rapid occurrence and reversibility indicate that other influences might at least in part be responsible.

Introduction

We reported the case of a young girl who presented an extremely severe metabolic alkalosis after pneumoencephalography (Agostoni *et al.*, 1969). Since no evidence was found in the literature that this procedure can produce such a metabolic effect, we investigated the plasma electrolytes and blood pH and gases shortly after the insufflation of air into the subarachnoid space.

Patients and Methods

Twenty-three patients undergoing pneumoencephalography for the following reasons were randomly selected for study: cerebral tumours (11), head injuries (8), epilepsy (2), trigeminal neuralgia (1), basal impression (1). Fractional pneumoencephalography was performed with the introduction of 30-50 ml of air. In a series of six cases venous blood samples for the determination of plasma electrolytes were taken immediately before and at 30, 60, 90, 180, and 360 minutes after the insufflation of air. In the remaining patients arterial blood samples were taken only before and 60 minutes after beginning the procedure; in this group the blood pH and gases were also determined. From three patients who had an indwelling catheter for incontinence of urine samples were

taken immediately before and at 30, 60, 90, 180, and 360 minutes after the insufflation of air in order to determine the Na/K ratio.

Plasma sodium, potassium, and calcium were measured with an Eppendorf flame photometer and chloride by an EEL (Evans Electro-selenium Limited) chloride meter using standard methods. Blood pH and gases were analysed by means of an IL (Instrumentation of Laboratory) model 127 pH meter, while plasma bicarbonates were obtained by means of Siggaard-Andersen's (1965) nomogram. Results have been evaluated according to Student's *t* distribution.

Results

The behaviour of plasma electrolytes at different intervals of time after beginning pneumoencephalography in six patients is shown in Table I. While sodium, calcium, and chloride did not show any significant change, potassium constantly showed a progressive fall during the first hour, with a mean decrease of 15.5% of the starting values at 60 minutes.

The values of both plasma electrolytes and blood pH and gases in the larger series of patients investigated before and 60 minutes after the beginning of the test are shown in Table II. Again a statistically significant change was recorded only for potassium. The urinary Na/K ratio fell markedly in each of the three cases studied, the effect being more pronounced at 60 minutes (see Chart).

TABLE II—Mean Values and Standard Deviation of Plasma Electrolytes and Arterial Blood pH and Gases in 17 Patients Before and 60 Minutes After the Insufflation of Air for Pneumoencephalography. The Last Column Gives the Percentage Change from Starting Value

	Initial	60 Minutes	% Change
Na ⁺ mEq/l.	145.0 ± 5.9	145.5 ± 6.9	+ 0.34
K ⁺ mEq/l.	4.36 ± 0.80	3.75 ± 0.64	-14.57*
Ca ⁺⁺ mEq/l.	4.91 ± 0.53	4.67 ± 2.36	- 4.83
Cl ⁻ mEq/l.	102.2 ± 5.2	102.3 ± 5.0	+ 0.04
HCO ₃ ⁻ mEq/l.	25.85 ± 3.93	25.15 ± 4.08	- 2.73
pH	7.461 ± 0.037	7.465 ± 0.060	+ 0.05
Pco ₂ mm Hg	36.49 ± 4.66	36.34 ± 6.59	- 0.47
Po ₂ mm Hg	75.51 ± 14.39	72.92 ± 22.99	- 3.43

*P < 0.005.

Discussion

Though disturbances of function have been shown to occur in several organs and systems after pneumoencephalography (Boudin *et al.*, 1954; Jørgensen, 1957; Wender, 1957; Vara López and Durán Sacristán, 1958; Davie, 1963; Hudson *et al.*, 1967; Pużyński, 1967; Mannucci *et al.*, 1969) no significant

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TABLE I—Mean Plasma Electrolytes in 6 Patients Before and at Different Times After the Insufflation of Air for Pneumoencephalography. In Addition to Absolute Values the Percentage Change is Calculated

	Na ⁺		K ⁺		Ca ⁺⁺		Cl ⁻	
	mEq/l.	% Change	mEq/l.	% Change	mEq/l.	% Change	mEq/l.	% Change
Initial	143.8		4.24		4.55		104.8	
15'	143.7	-0.18	3.91	- 7.9	4.57	+0.4	103.5	-1.3
30'	143.8	—	3.82	-10.1	4.63	+1.7	104.5	-0.3
45'	143.8	—	3.64	-14.1*	4.79	+5.1	103.3	-1.4
60'	142.8	-0.7	3.60	-15.3*	4.44	-2.5	104.3	-0.5
90'	145.3	+1	3.95	- 6.8	4.43	-2.7	102.8	-1.9
180'	146	+1.5	3.91	- 7.9	4.32	-5	103.5	-1.3
360'	142.3	-1	4.51	+ 6.2	4.35	-4.4	103.7	-1.1

*P < 0.05.

Change in urinary Na/K ratio in three patients after pneumoencephalography.

alteration of plasma potassium concentration had previously been reported. Wise *et al.* (1958) could not find any significant change in their three patients, but the measurement of serum electrolytes, though not clearly stated, seems to have been recorded 24 hours after pneumoencephalography had been carried out. Kadotani (1967) did not find any significant alteration of plasma electrolytes in a small series of patients three hours and one, two, and three days after pneumoencephalography and Myodil (iopendylate) ventriculography.

Our results show that plasma potassium levels are significantly affected only during a very short period after the insufflation of air, since the rapid initial fall is followed by a slower but constant return to the basal value. Our data do not enable us to draw any definitive conclusion regarding the

mechanism by which pneumoencephalography affects plasma potassium levels. The most obvious explanation would attribute it to the stimulation of aldosterone secretion which was reported by Lieberman and Luetscher (1957) during this procedure, and indeed the fall of the urinary Na/K ratio after pneumoencephalography in the three patients we studied seems to support this view. Nevertheless, the extent, the prompt occurrence, and the rapid reversibility of the phenomenon indicate that other influences might at least in part be responsible.

From the practical point of view the present series and our previous case of a young patient with an adrenal adenoma (Agostoni *et al.*, 1969) suggest that hypokalaemic patients are at risk when they undergo pneumoencephalography. Serum potassium levels should be estimated and, if necessary, corrected before the procedure is carried out.

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PRELIMINARY COMMUNICATIONS

Therapeutic Abortion by Intrauterine Instillation of Prostaglandins

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Summary

In a preliminary study of 15 patients the clinical effectiveness of prostaglandins (PGE_2 and $\text{PGF}_{2\alpha}$) as abortifacients when administered by intrauterine instillation compared favourably with previous studies using the intravenous route.

Abortion was successfully induced in 14 patients. The average total dose of prostaglandins required was about one-third of the amount needed intravenously, and side effects were minimal.

Introduction

Evidence is rapidly accumulating that the prostaglandins, by virtue of their significant oxytocic properties, seem likely to have an important therapeutic part to play in obstetric practice. Already it has been shown that prostaglandins of the E and $\text{F}\alpha$ series (PGE_1 , PGE_2 , and $\text{PGF}_{2\alpha}$) have a potential value both as parturigenic agents (Embrey, 1969, 1970a; Karim *et al.*, 1969, 1970; Beazley *et al.*, 1970; Roth-Brandel and Adams, 1970) and as abortifacients (Embrey, 1970b; Karim and Filshie, 1970a, 1970b). These studies have used the intravenous route of administration almost exclusively and have given an indication of dose/effect relationships. They have shown the greater potency of PGE_2 compared with $\text{PGF}_{2\alpha}$, so that the dose rate of PGE_2 needed for the termination of pregnancy as well as the total dose is only about one-fifth to one-tenth that of $\text{PGF}_{2\alpha}$.

Again it has been found that for both PGE_2 and $\text{PGF}_{2\alpha}$ the dose rate and total amount which has to be administered for induction of labour at or near term is about one-fifth to one-tenth that required to produce abortion in early pregnancy.

While serious toxic effects have not been a problem, the intravenous administration of prostaglandins can sometimes be accompanied by the side effects of vomiting and diarrhoea. Particularly frequent with $\text{PGF}_{2\alpha}$, vomiting can occur with both drugs usually at higher dose levels, but diarrhoea is commonly seen only with $\text{PGF}_{2\alpha}$ and with the higher doses

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