

CASE REPORTS

Diabetes insipidus associated with an empty sella turcica

R. MATISONN
M.B., Ch.B., F.C.P.(SA)

B. PIMSTONE
M.D., M.R.C.P.

Department of Medicine, Grootte Schuur Hospital, Observatory, Cape Town, South Africa

Summary

A patient with severe diabetes insipidus for 14 years was found to have an enlarged and eroded sella turcica with greatly reduced pituitary tissue on pneumoencephalography. It is suggested that the permanent diabetes insipidus may have resulted from growth of an intrasellar tumour, which subsequently infarcted spontaneously. Thyroid and pituitary-adrenal function nevertheless remained good, which accounts for persistence of the diabetes insipidus.

Introduction

Pathologists have long recognized that approximately 5% of subjects examined at necropsy show an unusually small amount of pituitary tissue (Busch, 1951; Sunderland, 1945; Bergland, Ray & Torak, 1968). The 'empty' sella turcica is usually radiologically enlarged and fills with air on pneumoencephalography. Presumably this is the end-result of necrosis of a pituitary tumour, spontaneously (Paterson, 1948; Drury, O'Loughlin & Sweeney, 1970) or following pituitary irradiation (Lee & Adams, 1968; Hartog *et al.*, 1965). Occasionally an 'empty' sella is not enlarged and is discovered accidentally during pneumoencephalography. Sheehan & Summers (1949) have described this phenomenon following post-partum pituitary necrosis.

The few reported studies of pituitary function with the 'empty' sella have varied from complete normality to frank anterior hypopituitarism (Caplan & Dobben, 1969) though the deficiency is usually mild (Brisman, Hughes & Holub, 1972). To our knowledge, there have been no reports of the co-existence of posterior pituitary dysfunction and for this reason the following case is reported.

Case report

A 43-year-old female presented to Grootte Schuur Hospital in 1961 with a history of marked polyuria and polydipsia for 4 years and lactation which persisted for 3 years after an otherwise normal pregnancy in 1958. No headache, visual impairment or features suggestive of anterior pituitary dysfunction were noted.

Investigations. Hb 12.5 g/100 ml, ESR 15 mm/hr, serum sodium 134 mEq/l, potassium 4.5 mEq/l, chloride 108 mEq/l, bicarbonate 21 mEq/l, albumin 3.9 g/100 ml, globulin 2.5 g/100 ml and urea 29 mg/100 ml. Chest X-ray was normal, while the X-ray of the pituitary was reported on as being possibly slightly enlarged, but no further studies were performed at the time.

Further investigations suggested diabetes insipidus (Table 1). During 10 hr fluid-deprivation, the patient

TABLE 1. Urine volume, SG and osmolarity, serum osmolarity and body weight during a 10 hr water deprivation

Time (hr)	Weight (kg)	Urine output (ml)	SG	Urine osm. (mmol/l)	Serum osm. (mmol/l)
1	51	750	1001	62	—
2	50.5				
3	50.5	850	1001		
4	50				
5	50	500	1001		
6	49.5	75	1001	124	280
7	48.5				
8	48.5	500	1001	132	291
9	48.5				
10	48	400	1001		

lost more than 5% of her body weight and continued to pass large volumes of urine with low specific gravity and osmolarity. After 8 hr the urine osmolarity was still below that of the serum and this was considered diagnostic of diabetes insipidus. Nevertheless, serum osmolarity rose no higher than 291 mmol/l, possibly as a result of the patient overloading herself with fluid prior to testing. Her urine volume at the time was in excess of 8 l/day. Therapy was commenced with posterior pituitary snuff with marked improvement, the urine volume falling to less than 2 l/day. This confirmed diabetes insipidus, even though water deprivation failed to elevate serum osmolarity to the expected levels. The patient was subsequently discharged and followed up as an outpatient.

In 1965 a chest X-ray revealed active pulmonary tuberculosis and she received streptomycin for 6

copyright.

months and INH and PAS for 2 years. During her subsequent admission to hospital the skull was again X-rayed and a somewhat enlarged pituitary fossa reported. The urine output was well controlled with pituitary snuff and was at all times less than 2 l/day during that admission.

Following her discharge from the sanatorium, she was followed up regularly at Groote Schuur Hospital and in view of the previous comments on the appearance of the pituitary fossa, radiology was repeated. Tomography confirmed the presence of an enlarged sella turcica with asymmetry of the floor (Fig. 1). Pneumoencephalography revealed a completely normal ventricular system. The pituitary fossa was enlarged and showed little evidence of pituitary tissue, being largely filled with air (Fig. 2).

Tests of anterior pituitary function were as follows: ^{131}I uptakes 19 and 33% at 6 and 24 hr respectively, serum PBI 7 $\mu\text{g}/100$ ml, serum total thyroxine 7.4 $\mu\text{g}/100$ ml. Soluble insulin 0.1 unit/kg was given intravenously after an overnight fast. The blood



FIG. 1. Two tomographic sections of the pituitary fossa, showing gross enlargement and bony erosion.

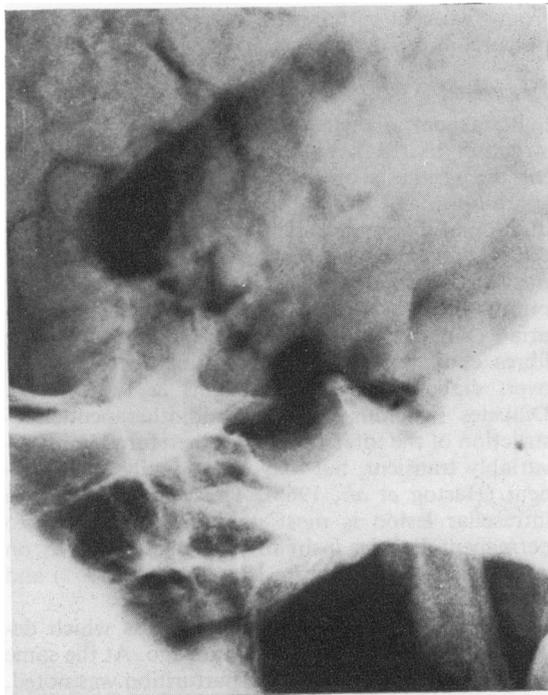


FIG. 2. Pneumoencephalogram showing a normal ventricular system and a pituitary fossa largely filled with air.

glucose, plasma cortisol and growth hormone responses to this provocative stimulus are shown on Table 2. Profound hypoglycaemia was present with a slight but subnormal human growth hormone response and a modest cortisol rise.

Visual acuity was 6/7.5 in the right and 6/9 in the left eye. Assessment of the visual field revealed gross impairment on the left with only macular sparing while some temporal field defect was present on the right. Repeat testing of posterior pituitary function was not performed on this occasion.

The patient has remained well-controlled since, without anterior pituitary replacement therapy. However, the need for vasopressin has persisted as on a number of occasions the patient has defaulted

TABLE 2. Response of blood glucose, plasma cortisol and plasma human growth hormone (HGH) to IV soluble insulin (0.1 $\mu\text{g}/\text{kg}$)

Time (min)	Blood glucose (ng/100 ml)	Cortisol ($\mu\text{g}/100$ ml)	HGH (ng/100 ml)
Fasting	64	6.5	5.4
20	25	7.1	3.5
40	<25	14.3	3.6
60	<25	18.7	8.6

from treatment with immediate recurrence of severe polyuria and polydipsia.

Discussion

Permanent diabetes insipidus results from destruction of the hypothalamic centres responsible for the synthesis of antidiuretic hormone, i.e. the supra-optic and paraventricular nuclei, or from a division of the supra-optico-hypophyseal tract above the median eminence. Transection of the tract below the median eminence or removal of the posterior pituitary lobe as a rule produces only transient polyuria as sufficient hormone can be released from the fibres ending in the median eminence to prevent overt diabetes insipidus (Coggins & Leaf, 1967). Diabetes insipidus following radiotherapeutic destruction of the total pituitary is therefore almost invariably transient, but may occasionally be permanent (Hartog *et al.*, 1965). Thus, even though an intrasellar lesion is most unlikely to give rise to permanent diabetes insipidus, this possibility may on occasion arise, as described by Thomas (1957) and Hockaday (1972).

Our patient shows diabetes insipidus which developed insidiously about 14 years ago. At the same time persistent lactation after parturition was noted, this latter symptom clearing spontaneously after 3–4 years. Subsequent investigation revealed an enlarged and eroded sella turcica with diminished pituitary tissue and subnormal anterior function. It would seem most likely that a pituitary tumour (possibly prolactin-secreting) at one stage grew to an extent that irreversible diabetes insipidus was induced and subsequently underwent spontaneous infarction, leading to an 'empty' sella with residual visual field defect. The close temporal association between the development of diabetes insipidus and the commencement of pregnancy which was later followed by spontaneous lactation, suggests that pregnancy might have produced rapid growth of the tumour, as shown by Burke, Joplin & Fraser (1972).

On the other hand, the co-existence of the pituitary tumour and diabetes insipidus may be coincidental, the latter a consequence of hypothalamic disturbance. A suprasellar tumour causing diabetes insipidus and extending downwards into the pituitary fossa seems a most unlikely third possibility, as infarction would have been unusual under these circumstances.

Other hypotheses regarding the aetiology of the 'empty' sella syndrome have been postulated, namely a developmental defect of the arachnoid space or pituitary, with herniation of the CSF space into the pituitary fossa (Brisman, Hughes & Mount, 1969; Caplan & Dobbin, 1969). However, the presence

of an enlarged and eroded pituitary fossa makes a tumour the more likely explanation in our patient.

Of interest in this case is the presence of normal thyroid function and a moderately good cortisol response to hypoglycaemia in spite of very little anatomically demonstrable pituitary tissue, a situation well documented with the 'empty' sella syndrome (Brisman *et al.*, 1972). However, the growth hormone response was subnormal and the degree of insulin-induced hypoglycaemia excessive. Ironically, the maintenance of relatively normal pituitary-adrenal function has allowed the diabetes insipidus to remain manifest. Had adrenocorticosteroid deficiency supervened, the polyuria may have been lessened by a drop in glucocorticoid induced free water clearance (Leaf *et al.*, 1952).

References

- BERGLAND, R.M., RAY, B.S. & TORACK, R.M. (1968) Anatomical variations in the pituitary gland and adjacent structures in 225 human autopsy cases. *Journal of Neurosurgery*, **28**, 93.
- BRISMAN, R., HUGHES, J.E.O. & HOLUB, D.A. (1972) Endocrine function in nineteen patients with empty sella syndrome. *Journal of Clinical Endocrinology and Metabolism*, **34**, 570.
- BRISMAN, R., HUGHES, J.E.O. & MOUNT, L.A. (1969) Cerebrospinal fluid rhinorrhea and the empty sella. *Journal of Neurosurgery*, **31**, 538.
- BURKE, C.W., JOPLIN, G.F. & FRASER, R. (1972) Pituitary tumour treated by pituitary implantation of ⁹⁰Yttrium during or before pregnancy. *Proceedings of the Royal Society of Medicine*, **65**, 486.
- BUSCH, W. (1951) Die morphologie der sella turcica und ihre Beziehungen zur hypophyse. *Virchows Archiv für Pathologisch Anatomie und Physiologie und für Klinische Medizin*, **320**, 437.
- CAPLAN, R.H. & DOBBEN, C.D. (1969) Endocrine studies in patients with the empty sella syndrome. *Archives of Internal Medicine*, **123**, 611.
- COGGINS, C.H. & LEAF, A. (1967) Diabetes insipidus. *American Journal of Medicine*, **42**, 807.
- DRURY, M.I., O'LOUGHLIN, S. & SWEENEY, E. (1970) Housay phenomenon in a diabetic. *British Medical Journal*, **2**, 709.
- HOCKADAY, T.D.R. (1972) Diabetes insipidus. *British Medical Journal*, **2**, 210.
- HARTOG, M., DOYLE, F., FRASER, R. & JOPLIN, G.F. (1965) Partial pituitary ablation with implants of ¹⁹⁸Gold and ⁹⁰Yttrium for acromegaly. *British Medical Journal*, **2**, 396.
- LEAF, A., MAMBY, A.R., RASMUSSEN, H. & MARASCO, J.P. (1952) Some hormonal aspects of water excretion in man. *Journal of Clinical Investigation*, **31**, 914.
- LEE, W.M. & ADAMS, J.E. (1968) The empty sella syndrome. *Journal of Neurosurgery*, **28**, 331.
- PATERSON, J.E. (1948) Cystic pituitary adenomas. *Journal of Neurology, Neurosurgery and Psychiatry*, **11**, 280.
- SHEEHAN, H.L. & SUMMERS, V.K. (1949) The syndrome of hypopituitarism. *Quarterly Journal of Medicine*, **18**, 319.
- SUNDERLAND, S. (1945) The meningeal relations of the human hypophysis cerebri. *Journal of Anatomy*, **79**, 33.
- THOMAS, W.C. (1957) Review of diabetes insipidus. *Journal of Clinical Endocrinology and Metabolism*, **17**, 565.