The empty sella turcica is an anatomo-radiological entity characterized by an incomplete or even missing diaphragma sellae. In the course of encephalography the sella appears filled with air or contrast material to a greater or lesser degree.\(^9,16,18,20\) The pituitary gland is flattened to a thin disc lying against the floor of the sella,\(^4,13,19\) and at first sight is not detectable during surgical exploration by the subfrontal route or at necropsy.\(^4\)

The sella may be normal or may appear rounded in shape and larger than normal. Its rounded appearance seems to indicate an early stage of enlargement.\(^15\) An empty sella of normal size is fairly common; according to Bergland, et al.,\(^2\) the subarachnoid space extends well into the sellar cavity in about 20\% of the normal individuals. Our experience confirms that substantial filling of the sellar cavity can occur during air studies.

When the sella is enlarged in patients affected by headache or hypopituitarism, the empty sella may simulate an intrasellar pituitary adenoma.\(^5,12\) In other cases the empty sella may manifest itself clinically with cerebrospinal fluid (CSF) rhinorrhea.\(^3,21\) In such cases the sella is often but not necessarily enlarged.\(^9\)

The primary empty sella must be sharply distinguished from the secondary condition described by Colby and Kearns\(^3\) and Lee and Adams\(^19\) under the name of "empty sella syndrome," which is a completely different nosological entity. The only feature common to both conditions is that air fills the sella turcica. The etiology, pathogenesis, x-ray picture, and symptomatic patterns are quite different.

During the last year, six cases of primary empty sella have come under our observation; five were referred to us because of pituitary adenoma and one for CSF rhinorrhea.

**Case Reports**

**Case 1**

This 31-year-old man had had headaches since 1965 and diminution of libido since 1967 to the point of impotence. Neurological examination was normal. Visual acuity, fields, and fundi were normal, as was the EEG. Endocrine evaluation disclosed functional deficits in the hypothalamus, pituitary, adrenal, and gonadal glands. Plain skull films and tomograms showed enlargement of the sella in depth and backward into the basisphenoid. The outlines were regular and
V. Bernasconi, M. Giovanelli and I. Papo

Fig. 1. Case 1. *Left:* Midline skull tomogram showing a great enlargement of the sella turcica, mainly in depth. The outlines of the sella are well defined and the margins well calcified. *Right:* Lateral pneumogram showing a gas shadow superimposed upon the anterior aspect of the sella turcica. This air was mistaken for gas lateral to the sella.

dense (Fig. 1 left). Pneumoencephalography showed an air bubble projected in the lateral view at the level of the superoanterior half of the sellar cavity (Fig. 1 right); in the absence of a tomogram this air was mistaken for air lateral to the sella. The CSF pressure was normal. At operation (transsphenoidal approach) the sellar cavity was found filled with CSF. With the aid of the microscope a hypoplastic hypophysis was seen. The patient was discharged on endocrine replacement therapy.

*Case 2*

This 57-year-old woman had had arterial hypertension for 5 years, hypertricosis for 4 years and headache for 5 months. Neurological examination was normal. Visual acuity, fields, and fundi were normal, as was the EEG. Endocrine evaluation disclosed slight hypopituitarism. Skull films showed a rounded sella larger than normal due to sinking of the anterior portion of the floor. The sella had well-defined outlines and calcified margins. The CSF pressure was normal. At pneumoencephalography air filled the anterosuperior half of the sella. Coronal and sagittal tomograms confirmed that air was

Fig. 2. Case 3. Midsagittal pneumotomogram with hyperextension of the head. The gas entered the large ballooned sella turcica, which appears completely filled with air. The margins of the sella are well calcified.
Primary empty sella

inside the sella. The patient was discharged on endocrine replacement therapy.

Case 3

This 34-year-old woman had had severe frontal headaches for 1 month. Neurological examination and endocrine evaluation were normal. Visual acuity, fields, and fundi were normal, as was the EEG. Skull films showed an enlarged and roundish sella with well-preserved and dense outlines. The CSF pressure was normal. Pneumoencephalography filled the sellar cavity with air almost completely; this was confirmed by sagittal as well as coronal tomograms (Fig. 2). The patient was discharged without treatment.

Case 4

This 51-year-old woman had a 1-year history of severe headache. Neurological examination and endocrine evaluation were normal. Visual acuity, fields, and fundi were normal. Skull films showed a slightly enlarged sella with dense margins and sunken floor. The CSF pressure was normal. Pneumoencephalography showed that half of the sellar cavity was filled with air; this was confirmed by coronal and sagittal tomograms (Fig. 3).

Case 5

This 61-year-old woman had gained 30 kg over the last 5 to 6 years, and had had bitemporal and parietal headaches for 3 years. Neurological examination and endocrine evaluation were normal. Visual acuity, fields, and fundi were normal. Skull films showed an enlarged sella with a thinned dorsum vertically displaced but with defined sellar outlines. The CSF pressure was normal. Pneumoencephalography showed a sellar cavity almost completely filled with air; this was confirmed by sagittal (Fig. 4) and coronal tomograms. The patient was discharged without treatment.

Case 6

This 62-year-old woman had a sudden and copious left-sided CSF rhinorrhea 1½ months before admission. Neurological ex-
amination, endocrine evaluation, visual acuity, fields, and fundi were normal. Skull films showed an enlarged sella with well-defined outlines. Tomograms showed an anterior extension of the left half of the sellar cavity under the anterior clinoid. The CSF pressure was normal. Pneumoencephalography showed penetration of air into the anterior portion of the sellar cavity; this was confirmed by sagittal and coronal tomograms. Exploration of the sellar region by a left subfrontal approach showed a prefixed chiasm. The diaphragma sellae appeared reduced to a narrow ring 2 mm in diameter. Through the wide opening in the tentorium the sellar cavity was observed as being divided by arachnoidal septa and filled with CSF. The bottom of the sellar cavity could be seen but no breaches in the dura mater or bone. The sella was packed with cotton and filled with fragments of temporal muscle. A temporal fascia flap was placed over the sellar opening. Up to this date, the patient has had no recurrence of CSF rhinorrhea.

Discussion

In all our cases the sella was enlarged but its contours were regular and dense. The enlargement proceeded primarily along the vertical diameter; the dorsum, although thinned, was never curved. None of our patients complained of or showed any visual deficit.

The first case clearly shows how symptoms, endocrine tests, patterns of the sella, and insufficient pneumoencephalography may make it difficult to differentiate an empty sella from an intrasellar pituitary adenoma, and lead to improper treatment.

The case of an empty sella associated with CSF rhinorrhea (Case 6) has to be added to the two described by Ommaya, et al.,15 the one studied by Zatz, et al.,21 and the four found by Brisman, et al.3 In addition to an overall enlargement of the sellar cavity, there was an asymmetrical expansion under one anterior clinoid. This peculiarity was evident in two of Brisman’s cases3 and may be related in some way to the mechanism of the sellar dilatation. Surgical exploration by subfrontal route demonstrated unequivocal hypoplasia of the diaphragma sellae with a remarkable extension of the subarachnoid space into the cavity. As with the cases of Brisman, et al., the only existing sign in this patient was CSF rhinorrhea. One of the two cases described by Ommaya, et al.,15 was affected by hypopituitarism as well as CSF rhinorrhea.

Several attempts have been made to explain the empty sella.4,8,10,11,15,17 Some authors18 consider CSF hypertension as one of the most important etiological factors; in all our patients the CSF pressure was normal and the sella enlarged at the time of hospitalization. On the other hand, in the case explored by the transsphenoidal route (Case 1), the hypophysis was small and of normal appearance, and a pituitary or tumoral cyst opening into the suprasellar subarachnoid spaces4,10 could be ruled out.

The anatomy of the sella can only be investigated directly in the case of an empty sella with CSF rhinorrhea, this being a clear indication for surgery. In such patients, including our Case 6, hypoplasia of the sellar diaphragm was the outstanding operative finding. We agree with Kaufman13 that hypoplasia of the diaphragm seems to be the fundamental pathogenetic factor both in empty sellas simulating pituitary adenoma and in those manifesting CSF leakage.

References

Primary empty sella


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