Magnetic Resonance Imaging of the Hypoplasia of the Rhinencephalon in a Patient with Kallmann’s Syndrome

Teiji Takeda, Nobuyuki Takasu, Keishi Yamauchi, Ichiro Komiya, Hiromi Ohtsuka, Yoshitaka Nagasawa, Noriko Ohara and Takashi Yamada

A patient with hypogonadotropic hypogonadism and anosmia (Kallmann’s syndrome) is described. Anosmia has been believed to be due to hypoplasia of the rhinencephalon. This anatomical defect was demonstrated in vivo in a patient with Kallmann’s syndrome by magnetic resonance imaging (MRI).

Key words: hypogonadotropic hypogonadism, anosmia, hypoplastic rhinencephalon, GnRH pulse therapy

Introduction

Kallmann’s syndrome is characterized by hypogonadotropic hypogonadism and hyposmia or anosmia (1). Postmortem studies have revealed either hypoplasia or aplasia of the rhinencephalon, respectively, in patients with hyposmia or anosmia. However, it had been difficult to demonstrate in vivo this hypoplasia or aplasia until 1987, when magnetic resonance imaging (MRI) became available to study the anatomy of the rhinencephalon. In 1987, using MRI, Klingmüller et al demonstrated hypoplasia or aplasia of the rhinencephalon in patients with Kallmann’s syndrome (2). We encountered a similar patient with hypoplasia of the rhinencephalon on MRI.

Case Report

A 16-year-old male was referred to us because of small testes and a short penis. Although his birth weight was 1,960g, he developed normally. At the age of 7 years old, it was found that his testes were small. He was seen by a doctor and was diagnosed to have idiopathic hypogonadotropic hypogonadism. He had been treated with 1,000IU of human chorionic gonadotropin (HCG) i.m. once a week until the age of 13 years old, when he stopped the HCG treatment. He did not notice any changes with this HCG treatment.

He had an abnormality of olfaction from infancy and had no experience of ejaculation. Otherwise, his past history is noncontributory. A family history of hypogonadism or olfactory abnormality was denied.

On examination, his height, body weight, and arm span were 162cm, 51.2kg, and 178cm, respectively. The length of his penis was about 3cm and the volume of each testis was about 1.5ml. He had no axillary or pubic hairs and had small bilateral gynecomastia.

The chromosomal analysis showed 46, XY and the bone age was the same as his chronological age. He had central anosmia, since he had a negative Alinamine test and no abnormalities in his paranasal sinuses. Endocrine study revealed that plasma levels of luteinizing hormone (LH), follicle-stimulating hormone (FSH) and testosterone were below 0.2mIU/ml, 1.1mIU/ml and 0.6ng/ml, respectively. The response of FSH to gonadotropin-releasing hormone (GnRH) was normal, but that of LH to GnRH was blunted (Fig. 1). Administration of HCG 5,000IU i.m. once a day for three days increased the plasma testosterone level from 0.6ng/ml to 2.2ng/ml on the 48 hours after the last HCG administration (370% increase) (Fig. 2). Other endocrine data were normal. The X-ray films of the chest, abdomen and Turkish saddle revealed no abnormalities (data not shown). The head MRI revealed that the bilateral olfactory sulci of this patient were clearly hypoplastic compared with a control subject (Fig. 3), and the head computed tomography (CT) scan did not reveal these abnormalities (data not shown).
Kallmann’s Syndrome and Head MRI

Discussion

We describe a patient with hypogonadotropic hypogonadism and anosmia (Kallmann’s syndrome). Anosmia has been believed to be due to hypoplasia of the rhinencephalon. We demonstrated in vivo this anatomical defect in our patient with Kallmann’s syndrome by MRI.

In 1856 Maestre de San Juan (3) and in 1914 Wiedenreich (4) described the association of hypogonadism and the lack of olfactory lobes in postmortem studies. In 1944 Kallmann et al (1) first described this association in 9 living patients. Since then, postmortem studies have revealed either hypoplasia or aplasia of the rhinencephalon, respectively in patients with hyposmia or anosmia. However, it had been difficult to demonstrate in vivo this hypoplasia or aplasia until 1987, when Klingmüller et al demonstrated in vivo the hypoplasia of the rhinencephalon in patients with Kallmann’s syndrome (2). Using MRI, they demonstrated that the olfactory sulci were rudimentary or absent in patients with Kallmann’s syndrome. The present patient is similar to theirs; MRI demonstrated the hypoplastic olfactory sulci. Thus MRI is very useful to reveal an abnormality of the rhinencephalon in patients with Kallmann’s syndrome.

Although the present patient had hypogonadotropic hypogonadism and the response of plasma LH to GnRH was decreased, the responses of plasma FSH to GnRH, and testosterone to HCG were sufficiently responsive (5). He had no family history as had some other reported cases (6), and was free from various anomalies.

Hypogonadism in Kallmann’s syndrome is caused by inadequate hypothalamic secretion of GnRH. Pulsatile GnRH therapy has been attempted in patients with Kallmann’s syndrome since 1979 (7) and has been more successful than HCG/human menopausal gonadotropin (HMG) therapy (8–10). It was thought that the greater physiological stimulation to the pituitary gland made it possible to induce normal plasma gonadotropin levels. The present patient is now on pulsatile GnRH therapy.
and its effectiveness will be evaluated in the future.

References