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CT of the Normal Pituitary Stalk

Robert G. Peyster[1]
Eric D. Hoover
Lee P. Adler

A prospective study assessed the size and frequency of visualization of the normal pituitary stalk on high-resolution computed tomography (CT). The normal pituitary stalk can be seen on the vast majority of high-resolution scans obtained with thin sections and intravenous contrast material. The upper size limit of the normal pituitary stalk is 4 mm at the level of the dorsum sellae and 4.5 mm above the dorsum. Stalks larger than this should be viewed with suspicion. Comparison of the size of the pituitary stalk with that of the nearby basilar artery is possible on most CT scans, providing a convenient and reliable visual check of the size of the stalk.

The normal pituitary stalk has received little attention in the computed tomographic (CT) literature. It was rarely identified on earlier-generation CT scanners, because of its small size. The capabilities of the newer high-resolution scanners permit visualization of this structure in a much higher percentage of cases than has been noted in reports based on studies from earlier-generation scanners [1, 2].

Neuropathologists have long been aware of several diseases that may involve the pituitary stalk [3–5]. These tend to be neoplastic or infiltrative processes, which would be expected to enlarge the diameter of the stalk. For the radiologist to recognize stalk enlargement, particularly in subtle degree, the normal range of size must be known. This information has not been adequately documented.

Although close attention to the size of the stalk is merited in all cases in which there is clinical suspicion of pituitary-hypothalamic disease, it would be cumbersome to measure it on every scan. Since enlargement of the stalk may be clinically silent, and recognition of stalk enlargement may have diagnostic and/or prognostic significance [6], a readily available criterion of stalk size within the scan itself would be useful. Having casually observed that the basilar artery often is seen on the same section as the stalk and usually is larger than the stalk, we hypothesized that the basilar could serve as this standard. We therefore undertook a prospective study to assess the size and frequency of visualization of the normal pituitary stalk on high-resolution CT and to explore the feasibility of using the stalk:basilar size relation as a sign of stalk enlargement.

Subjects and Methods

The study group comprised 184 of 205 consecutive axial CT scans of the brain in which intravenous contrast was employed. Twenty-one patients were excluded from the study because of abnormalities in the sellar-suprasellar area that either precluded identification of the stalk or clearly or possibly involved it. These cases included 13 pituitary adenomas, one chiasmatic glioma, one craniopharyngioma, one large (13 mm) suprasellar metastasis, one suprasellar meningioma, three unidentifiable suprasellar masses, and one large empty sella. The patients were otherwise unselected. None of the remaining 184 patients had diabetes insipidus. There were 98 male and 86 female subjects 9–84 years of age, with a relatively normal age distribution.

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[1]All authors: Department of Diagnostic Radiology, Section of Neuroradiology, Hahnemann University Hospital, Broad & Vine Sts., Philadelphia, PA 19102. Address reprint requests to R. G. Peyster.

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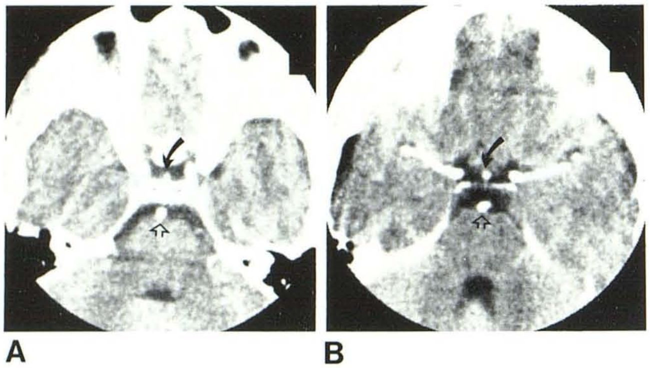

Fig. 1.—Two contiguous axial CT sections. Normal pituitary stalk (*solid arrow*) and basilar artery (*open arrow*). In **A**, stalk is seen at level of dorsum; in **B**, stalk is slightly above level of dorsum and just posterior to optic chiasm.

Scanning was performed on a GE CT/T 8800 unit immediately after drip infusion of 150 ml of Conray 60 (Mallinckrodt). The scan plane was roughly parallel to the orbitomeatal line, with alignment by external landmarks. Selection of slice thickness (10 or 5 mm) was based on case history. Indications for thin (5 mm) sectioning through the sellar area included suspicion of disease in the orbits (24 cases), sella (25), parasellar area (15), posterior fossa (22), or paranasal sinuses (three). In all cases, our routine scanning protocol was followed; no special effort was made to delineate the pituitary stalk, either during scanning or during photography. The window and level settings of the images on which the pituitary stalk was examined were adjusted to produce the most visually appealing image; no attempt was made to standardize these settings.

Measurements were taken to the nearest half-millimeter of the smallest diameter of the stalk and of the basilar artery, when visualized, both at the level of the dorsum sellae (fig. 1A) and at the suprasellar level (fig. 1B). Thus, two measurements of one or both structures were made in some patients. Measurements in the first 30 cases were made both with the cursor track ball and "measure distance" functions at the scanner console, and by using a ruler and film, with mathematical correction to anatomic size. Because no significant difference between these two methods was noted, subsequent measurements were performed by either but not both.

The effects of the level of measurement (at or above dorsum) and gender on stalk size were examined by Student *t* test, which also provided confidence limits for stalk and basilar artery size at each location. Variation in stalk size with age was evaluated by an analysis of variance (ANOVA I). Student *t* test was used to determine the likelihood of encountering a normal pituitary stalk larger than the basilar artery.

Results

Table 1 presents the frequencies of pituitary stalk and basilar artery visualization; both structures were seen more often on sections 5 mm thick.

The statistical measurements of the stalk and basilar artery are shown in table 2. No stalk was larger than 4 mm in diameter. The stalk was larger above than at the dorsum ($p < 0.005$). Six stalks 4 mm in diameter were found, four above the dorsum and two at the dorsum. According to the confidence limits (recorded in table 2), a stalk 4.5 mm in diameter should be encountered only once in 100 cases above and even less often at the dorsum.

TABLE 1: **Frequency of Visualization of Pituitary Stalk and Basilar Artery on High-Resolution Axial CT with Contrast Enhancement**

Slice Thickness (mm)	Frequency of Visualization (%)		
	Pituitary Stalk	Basilar Artery	Both Simultaneously
5 ($n = 80$)	95	90	88
10 ($n = 104$)	69	87	62

Note.—Subjects were 184 normal patients.

The stalk was larger than the basilar artery only six times in 144 measurements, four times above the dorsum and twice at the dorsum. In five of these instances, the basilar artery was bifurcating at the level at which it was measured, lessening the reliability of its measurement. In the sixth case, the basilar artery was unusually small (1.5 mm diam). The probability of encountering a normal pituitary stalk larger than the basilar artery seen on the same CT section was less than 0.05.

No significant relation between age or gender and pituitary stalk size was noted ($p < 0.1$ for both relations).

Discussion

Visualization of the pituitary stalk on CT scans depends on both the natural contrast provided by the surrounding cerebrospinal fluid-containing cistern and the enhancement from intravenous contrast material. Contrast enhancement of the stalk probably can be attributed to its high vascularity and the fact that it lies outside of the blood-brain barrier [7].

Since the advent of high-resolution CT scanning, passing references to visualization of the normal and abnormal stalk have appeared in the literature [7–13], but specific reports about this structure are rare. No documented statement of its size or its frequency of visualization on high-resolution CT appears in the English literature. We were unable to find reference to the size of the normal stalk even in the anatomy and pneumoencephalography literature.

Our results indicate that the pituitary stalk should be recognized almost routinely on axial CT scans using 5 mm sections and intravenous contrast material. The use of thinner sections probably would increase the frequency of stalk visualization.

Some inaccuracy in CT measurements of small structures, such as the pituitary stalk, can be expected as a result of partial-volume averaging [1, 2, 9]. However, the consistency (small variance and range) of our measurements, the reproducibility of measurements by either the ruler or cursor methods, and the agreement of the other published stalk dimensions [1, 2] with ours suggest that stalk measurements on CT scans are reliable and should correspond closely to actual stalk size. Due to the low probability ($p < 0.01$) of encountering a normal pituitary stalk greater than 4 mm in diameter at the level of the dorsum or greater than 4.5 mm above the dorsum, larger stalks should be viewed with suspicion.

TABLE 2: **Statistical Measurements of Normal Pituitary Stalk and Basilar Artery on High-Resolution Axial CT with Contrast Enhancement**

Structure: Level	No. Visualized	Dimensions (mm)		Confidence Intervals (mm)	
		Mean ± SD	Range	95%	99%
Pituitary stalk:					
At dorsum sellae	137	2.1 ± 0.7	0.5–4.0	0.5–3.5	0.0–4.0
Above dorsum sellae	32	2.8 ± 0.6	1.5–4.0	1.5–4.0	1.0–4.5
Basilar artery:					
At dorsum sellae	152	3.2 ± 0.8	1.5–7.5	1.5–4.5	1.5–5.5
Above dorsum sellae	29	3.6 ± 0.9	2.5–6.0	2.0–5.5	1.0–6.0

Note.—Subjects were 184 normal patients.

We found comparison with the basilar artery to be a quick and reliable visual check of stalk size, which, if performed conscientiously, soon becomes automatic. Since both structures are seen on nearly 90% of scans obtained with 5-mm-thick sections, this comparison can be made in most cases. The predicted false-positive rate (less than 5%) for this comparison is quite acceptable, in that very little effort is required to measure the stalk in these few cases to confirm that its size is within normal limits. False-negative observations may occur when the basilar artery has a diameter of 5 mm or greater, whereby an enlarged stalk might go unrecognized if one relied entirely on the stalk-basilar comparison. In our study, only five (3%) of 181 measurements of the basilar artery were equal to or greater than 5 mm, which suggests that false negatives should occur infrequently. In 11 patients with pathologic pituitary stalks (Peyster RG et al., unpublished data), the stalk was larger than the basilar artery in every case. In cases with signs and/or symptoms related to the pituitary stalk (e.g., in diabetes insipidus), direct measurement of the stalk seems prudent in order to avoid even a small chance of a false-negative observation.

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