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# The Radiology of the Pterygoid Canal: Normal and Pathologic Findings

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To better define the normal anatomy and pathologic features of the pterygoid canal, 100 normal subjects and 38 patients with disease of the paranasal sinuses, nasopharynx, and base of the skull were studied with pluridirectional tomography. Particular attention was given to the normal radiographic appearance of the pterygoid canal as well as to its anatomic variants and its relationship to the paranasal sinuses. Three radiographic signs of involvement of the pterygoid canal were detected: disappearance, enlargement, and narrowing. Moreover, a brief correlation between pluridirectional tomography and CT was made. Diagnostic accuracy in evaluating the bony lesions is the same with both techniques, but CT is superior to pluridirectional tomography in evaluating involvement of the soft tissues.

The gross anatomy of the pterygoid or vidian canal has been well described in a fundamental paper by Radoievitch and Jovanovitch [1]. In the radiologic literature, conversely, there are few reports on this topic [2]. The purpose of this study was to carry out a detailed analysis of the normal radiographic anatomy and the most common pathologic appearances of the pterygoid canal.

The pterygoid canal is a straight or curvilinear bony duct situated between the pterygoid process and the sphenoid sinus. It is directed forward and medially and connects the foramen lacerum with the pterygopalatine fossa [1, 2]. The width of the canal is variable because the canal widens as it extends forward (Fig. 1). In fact, the average width of its anterior opening is 2.5 mm, versus 1 mm for the posterior opening.

The pterygoid canal ends in a funnel-shaped groove situated in the anterior surface of the pterygoid process [1] (Fig. 2). The course of the canal can be seen well with axial CT (Fig. 3). The pterygoid canal transmits the vidian artery that arises from the internal maxillary artery and the vidian nerve that carries parasympathetic fibers to the sphenopalatine ganglion in the pterygopalatine fossa [1-3].

## Subjects and Methods

The pterygoid canals of 100 normal subjects (65 men and 35 women aged 23-67 years) were studied with pluridirectional tomography (Polytome U3-Philips) using hypocycloidal movement (48°) and 0.6 × 0.6 focal spot with an effective section thickness of 0.6-0.7 mm [4]. In all cases, four frontal tomograms with 0.5-cm increments and four lateral tomograms on each side were obtained. The patients were positioned on the radiographic table with the aid of laser lights, and their heads were held in the correct position with a neck support and two lateral blocks. The point of entry of the central ray was always marked on the skin to facilitate repositioning. The symmetrical position was always checked with a routine plain film before tomography was performed in order to avoid an improper position that could simulate a nonexistent asymmetry of the canals. Thirty-eight patients (28 males and 10 females, aged 14-70 years) with disease of the paranasal sinuses, nasopharynx, and base of the skull were also studied with the same technique. CT examination was also performed in 30 patients with proven neoplastic lesions.

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CT was performed on a Pfizer 450 or a Somatom DR 3 scanner before and after intravenous administration of 100 ml of Conray-60. All patients were examined with 5-mm contiguous sections both in the axial and coronal planes. The final diagnoses are summarized in Table 1.

**RESULTS**

*Normal Subjects*

On the frontal tomograms as well as on the coronal CT scans the pterygoid canal can be seen as a round lucency with a thin bony margin (Fig. 4). The width of the canal was

variable; in fact, it was smaller (0.5–1 mm) on the posterior tomograms and larger (1–4 mm) on the anterior ones. In two subjects the canal was not visible on one side, and in three it was invisible on both sides (Fig. 5). Thirteen subjects had an important inequality in the width of the two canals (Fig. 6).

In all cases the pterygoid canal had a close relation to the floor of the sphenoid sinus, from which it was separated by a variable (0–5 mm) bony thickness that was consistently smaller on the anterior tomograms. In 10 cases (5%), the superior wall of the canal was deficient (Fig. 7), and in 26 cases (13%) the pterygoid canal was almost completely surrounded by the sphenoid sinus (endosinusal canal), unilaterally in 14 subjects and bilaterally in six (Figs. 8 and 9).

In 98 subjects the sphenoid sinus was divided into two recesses, which were in relation to the ipsilateral canal. In two subjects, conversely, both pterygoid canals were in relation to the same sinusal cavity, because the sphenoid septum was lacking or asymmetrical (Fig. 10).

Finally, in seven subjects the most anterior part of the canal was in relation to the posterior ethmoid cells, which were very developed. On the lateral tomograms the pterygoid canal was identified all through its length in 60% of the cases (Fig. 11).

*Patients*

In 14 of 38 patients with disease of the pterygomaxillary region, the pterygoid canal was involved. In 12 patients the frontal tomogram showed the unilateral disappearance of a pterygoid canal (seven nasopharyngeal carcinomas; one an-

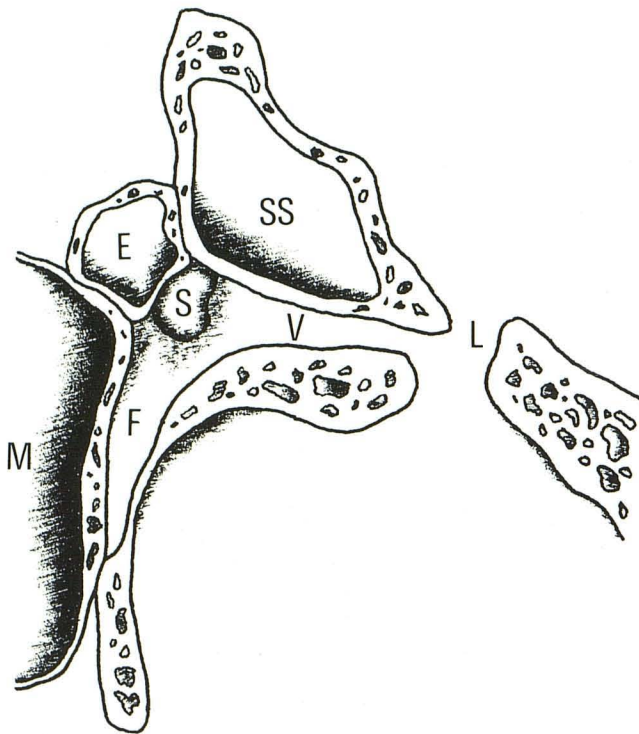
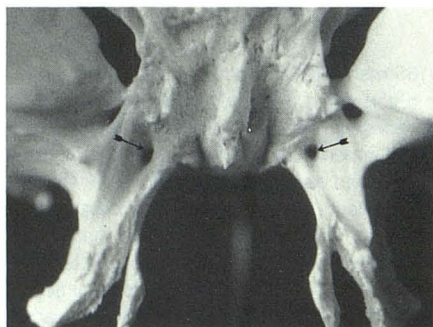


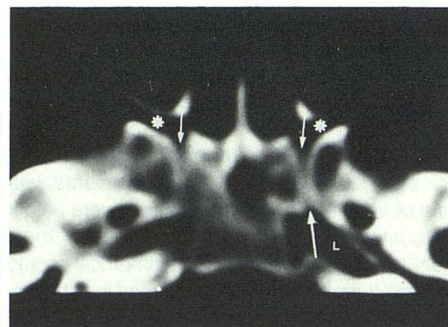
Fig. 1.—Representative lateral view of pterygoid canal showing characteristic “trumpet-like” shape. (V = vidian or pterygoid canal; L = foramen lacerum; F = pterygopalatine fossa; M = maxillary sinus; SS = sphenoid sinus; S = sphenopalatine foramen; and E = ethmoid sinus.)

**TABLE 1: Diseases of the Pterygomaxillary Region in 38 Patients**

Type of Finding	n
Nasopharyngeal carcinoma	11
Maxillary sinus carcinoma	8
Ethmoid sinus carcinoma	1
Sphenoid sinus carcinoma	2
Nasal fossa carcinoma	2
Tumors of unknown origin	2
Angiofibroma	4
Polyposis of the maxillary sinus	2
Chronic maxillary sinusitis	2
Chronic sphenoid sinusitis	4



2



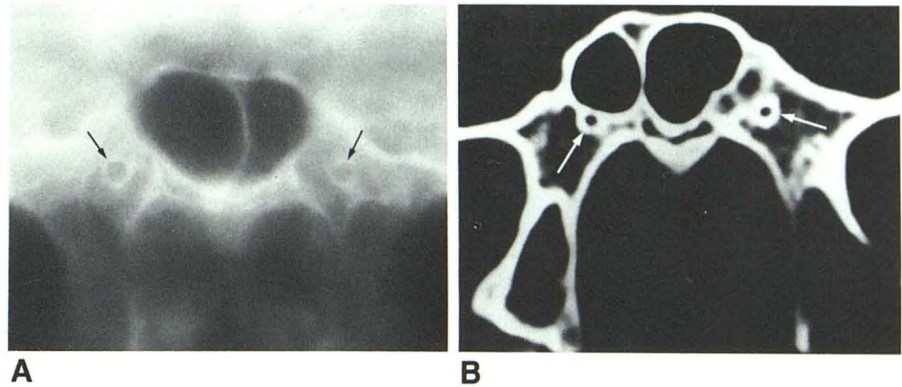
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Fig. 2.—Photograph of isolated sphenoid bone shows anterior end of pterygoid canals (arrows) opening in pterygopalatine groove.

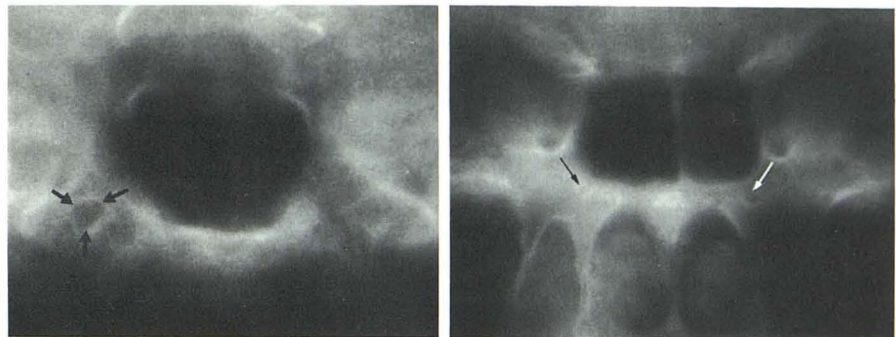
Fig. 3.—Axial CT scan shows course of pterygoid canal, which connects lacerum foramen (L) with pterygopalatine fossa (asterisks). (Short arrows = anterior openings of canals; long arrow = posterior opening.)



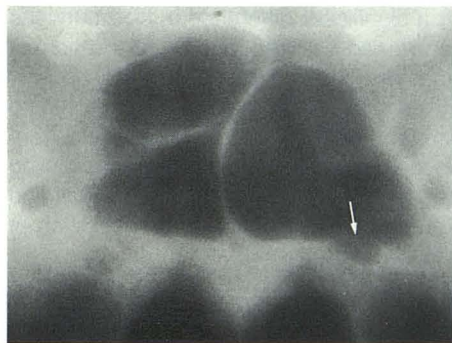
**Fig. 4.—**Normal appearance of pterygoid canals (*arrows*).  
**A,** Pluridirectional tomogram.  
**B,** Coronal CT section.



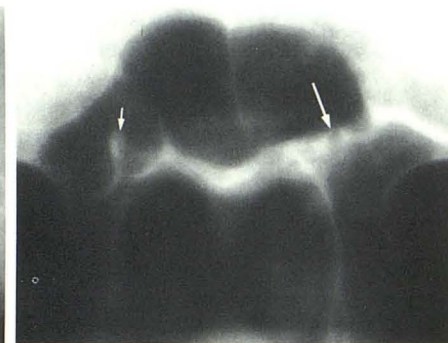
**Fig. 5.—**Invisible left pterygoid canal in a normal subject. (*Arrows* = right canal.)



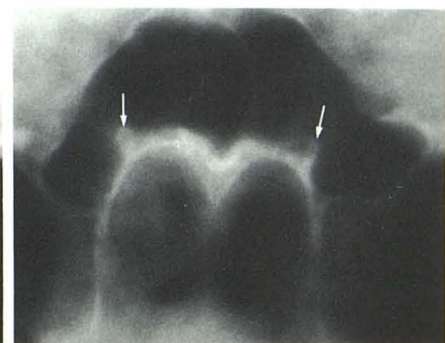
**Fig. 6.—**Unequal size of the two canals (*arrows*) in a normal subject.



**Fig. 7.—**Deficiency of superior wall of left pterygoid canal (*arrow*).



**Fig. 8.—**Intrasinusal course of right pterygoid canal (*short arrow*). (*Long arrow* = left pterygoid canal.)



**Fig. 9.—**Intrasinusal course of both pterygoid canals (*arrows*).

glofibroma involving the nasopharynx, the pterygopalatine fossa, and the nasal cavities; one sphenoid sinus carcinoma; one maxillary sinus carcinoma; one carcinoma of unknown origin; and one sphenoid sinusitis).

In all cases the disappearance of the canal was associated with osteosclerosis and/or osteolysis of the adjacent bone (Fig. 12). In a case of nasopharyngeal carcinoma with involvement of the sphenoid sinus, the unilateral enlargement of a pterygoid canal with erosion of its cortical wall was seen (Fig. 13). Narrowing of a pterygoid canal due to sclerotic thickening

of its bony wall was seen in a case of sphenoid sinusitis (Fig. 14).

Each of these pathologic features was always seen on frontal tomograms. Lateral tomograms, conversely, provided less useful and less reliable information. In all cases there were other and more obvious signs of disease, such as soft-tissue masses, fluid levels in the paranasal sinuses, and involvement of the pterygopalatine fossa with obliteration of its fatty contents. This latter sign is well seen with CT [5-8] but it can also be seen on lateral conventional tomograms [9].



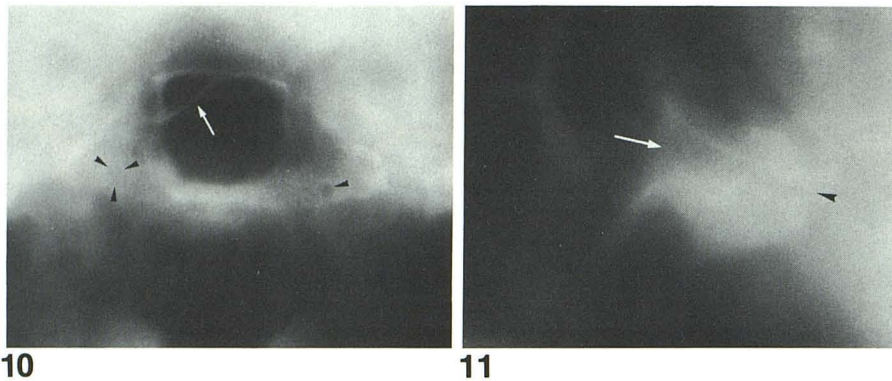


Fig. 10.—Asymmetrical sphenoid septum (arrow). Both canals (arrowheads) are in relation to same sinus cavity.

Fig. 11.—Lateral view of a normal pterygoid canal. Anterior end (arrow) is larger than posterior one (arrowhead).

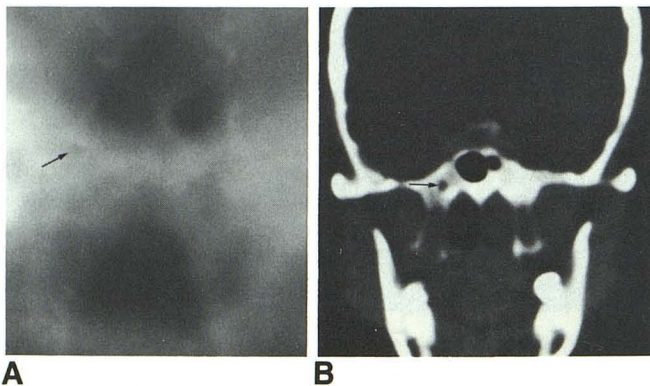


Fig. 12.—Disappearance of left pterygoid canal in a patient with osteosclerosis of the base due to nasopharyngeal carcinoma, well seen with pluridirectional tomography (A) and coronal CT (B). (Arrows = right pterygoid canal.)

Pluridirectional tomography and CT were comparable in evaluating bony lesions, but CT was more reliable in demonstrating soft-tissue involvement.

## Discussion

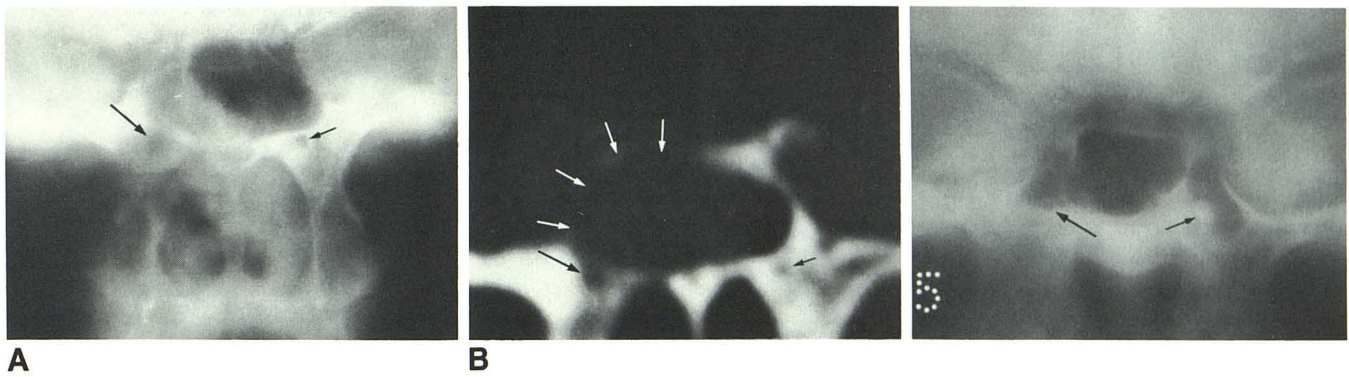
Our radiologic data obtained on 100 normal subjects are quite similar to those obtained by Radoievitch and Jovanovitch [1] in their anatomic study. It is particularly interesting to note the variable relationship between the pterygoid canal and the sphenoid sinus (Fig. 15). Such a variability can explain the polymorphous and unpredictable clinical patterns of the involvement of the pterygoid canals in sinus diseases [1, 10]. There is no doubt, in fact, that the endosinusal course and the deficiency of the superior wall of the canal can favor the involvement of the vidian nerve. Furthermore, the lack or asymmetry of the sphenoid septum can explain the contemporary involvement of both pterygoid canals during sinusitis of the sphenoid sinus.

Both neoplastic and inflammatory involvement of the vidian nerve can cause a clinical syndrome characterized by pain referred deeply in the nasal cavity (vidianalgia). In the study of the 14 patients with proven disease we found three radiographic signs of involvement of the pterygoid canal [2, 11]: disappearance, enlargement, and narrowing of the canal. In these cases it is essential to distinguish the pathologic alterations from the normal anatomic variants. The pathologic disappearance of the canal, therefore, must be distinguished from the lack of radiologic demonstration that characterized about 5% of the normal canals. The differential diagnosis is based on the presence of structural alterations (sclerosis and/or osteolysis) in the bone adjacent to the pterygoid canal.

The diagnosis of pathologic enlargement is also a very difficult one. In fact, a significant difference in size between the left and right canals can be seen in 13% of the normal subjects. The enlargement has pathologic significance only when associated with erosion of the bony wall of the pterygoid canal. The enlargement is generally due to perineural extension of neoplastic disease [6, 8, 12, 13]. Finally, the narrowing of the canal is caused by concentric sclerosis of its wall and is generally due to a chronic sinusitis in the presence of an endosinusal pterygoid canal.

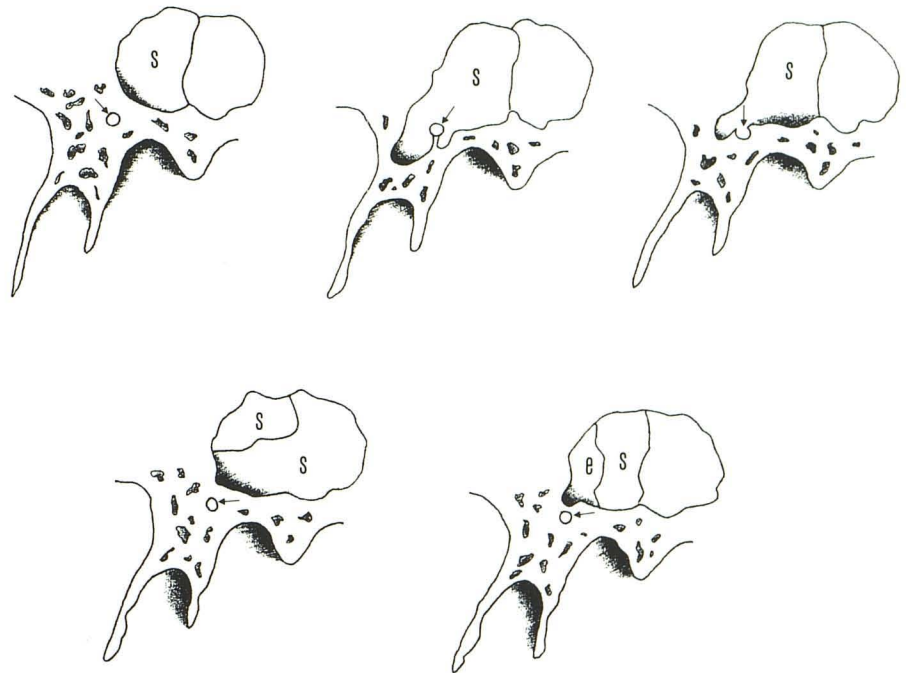
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**Fig. 13.**—*A*, Enlargement of right pterygoid canal (long arrow in *A* and *B*) and erosion of its cortical wall due to nasopharyngeal carcinoma. (Short arrow in *A* and *B* = normal left canal.)  
*B*, More anterior CT section also shows enlargement of right canal. At this level, invasion of sphenoid sinus with erosion of its wall is well detected (white arrows).

**Fig. 14.**—Narrowing of left pterygoid canal (short arrow) caused by concentric sclerosis of its wall due to a chronic sphenoid sinusitis. (Long arrow = normal right canal.)



**Fig. 15.**—Diagram showing variability of relationship between pterygoid canals and adjacent paranasal sinuses. (arrow = pterygoid canal; s = sphenoid sinus; e = ethmoid sinus.)

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