

Anatomy and Pathology of the pterygopalatine fossa: The Piccadilly Circus of the head and neck

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Abstract

The pterygopalatine fossa (PPF) constitutes a major crossroad between the oral cavity, nasopharynx, orbit, masticator space, cavernous sinus, and the middle cranial fossa.

Understanding the anatomy of this region is crucial to radiologists, as the PPF is a major pathway of the spread of tumors and infections from the head and neck into the skull base. Since the PPF forms a busy intersection for normal anatomic "traffic," we call it "the Piccadilly Circus" of the head and neck. Perineural spread of tumors of the oral cavity, paranasal sinuses, and face, usually involving V2, into the PPF is a frequent complication that has profound implications in surgical and radiation therapy planning. We present several imaging considerations which can optimize visualization of both anatomy and pathology of the PPF. Our purpose is to review the complex anatomy of the PPF, including its contents and connections to the spaces of the deep face, and to illustrate patterns of disease involving the PPF as it pertains to cross-sectional imaging.

Keywords: pterygopalatine fossa, pterygopalatine ganglion, skull base anatomy, head, and neck anatomy, perineural spread

Introduction

The PPF is a complex anatomical space that forms an important crossroad of several important structures and spaces. As such we have termed it "the Piccadilly Circus" of the head and neck (**Figure 1**). In transmitting a major portion of the vascular supply and innervation of the face, the PPF provides a conduit between the middle cranial fossa, nasal cavity, orbit, infratemporal fossa, and oral cavity. Because the

transit of so many nerves and arteries require such a large thoroughfare, it is often the path of least resistance of the spread of disease, and as such is a common pathway of the spread of tumors and infection of the head and neck into the skull base. Early detection of disease in the PPF both with MRI and CT therefore can greatly affect treatment planning and prognosis.



Figure 1: Juxtaposition of the Piccadilly Circus, London, U.K. with a representation of the PPF and its various communications. Just as the Piccadilly Circus forms a major traffic junction of several large avenues of London's West End, The PPF is a busy intersection for normal anatomic "traffic" and forms a large junction between the middle cranial fossa, nasal cavity, orbit, infratemporal fossa, and oral cavity.

In the first half of the manuscript, we review its anatomy, which we have divided into its boundaries and contents; and its communications with other spaces of the head. In the latter half of the manuscript, we present a collection of cases that illustrate the relevant anatomy and include several points to consider when evaluating the PPF. We emphasize the importance of the presented anatomy to the

understanding and identification of several pathologic processes including perineural spread and direct extension of tumor, invasive fungal disease, osseous tumor involvement, and local vascular tumors. Knowledge of these processes allows an active search for foci of disease that might otherwise be overlooked when reviewing neuroimaging

Review of Anatomy:

Boundaries and Contents of the PPF

The pterygopalatine fossa (PPF) is an inverted pyramidal space bounded anteriorly by the posterior wall of the maxillary sinus, and posteriorly by the pterygoid plates and inferior aspect of the greater sphenoid wing. Medially it is bounded by portions of the palatine bone, and superiorly by the inferior orbital fissure. Laterally, it narrows to form the pterygomaxillary fissure, and inferiorly, it narrows to form the palatine canals.

The PPF contains the main source of parasympathetic innervation to the deep facial structures, as well as the source of sensory innervation of the nasopharynx, palate, the skin overlying the maxilla, and portions of the meninges of the anterior and middle cranial fossa. It contains the maxillary nerve, and the pterygopalatine ganglion (PPG). The maxillary nerve, or V2 division of the fifth cranial nerve, enters the cephalad portion of the PPF via the foramen rotundum [1,2]. The PPG, suspended within the PPF from the maxillary nerve, is the largest parasympathetic ganglion associated with cranial nerve V. Its sensory roots come from the palatine nerve (branch of V2). Its parasympathetic fibers come from the nervus intermedius via the

greater petrosal nerve (branch of cranial nerve VII), which combine with sympathetic fibers via the deep petrosal nerve to form the Vidian (or pterygoid) nerve. These parasympathetic fibers supply the lacrimal glands and provide a vasodilatory and secretory function to the paranasal sinuses, nasopharynx, palate, and oropharynx. The complex innervation transiting through the PPF provides variable routes of the perineural spread of disease.

The external carotid artery terminates into the superficial temporal artery and internal maxillary artery. Divisions of the internal maxillary artery from proximal to distal are the mandibular, pterygoid, and pterygopalatine arteries (**Figure 2**). As the pterygopalatine artery enters the PPF through the pterygomaxillary fissure, it further branches into the posterior superior alveolar, infraorbital, and descending palatine arteries, before terminating into the sphenopalatine artery which exits the PPF medially through the sphenopalatine foramen (**Figure 3**). These branches of the pterygopalatine artery provide blood supply to the maxillary teeth and gingiva, maxillary sinus, palate, pharyngeal wall, lateral nasal cavity wall, and nasal septum.

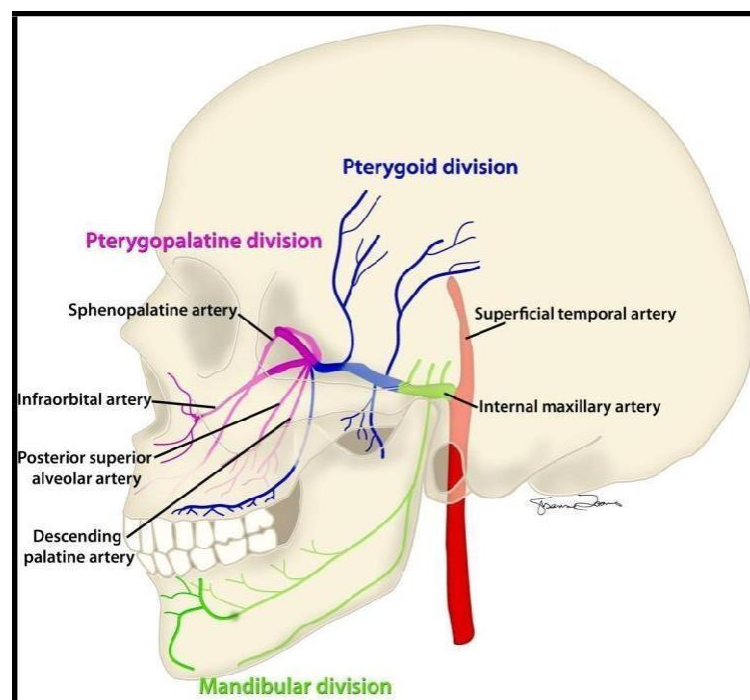


Figure 2: Divisions of the IMA from proximal to distal are the mandibular, pterygoid, and pterygopalatine arteries. The pterygopalatine artery enters the PPF through the pterygomaxillary fissure and branches into the posterior superior alveolar, infraorbital, and descending palatine arteries, before terminating into the sphenopalatine artery.

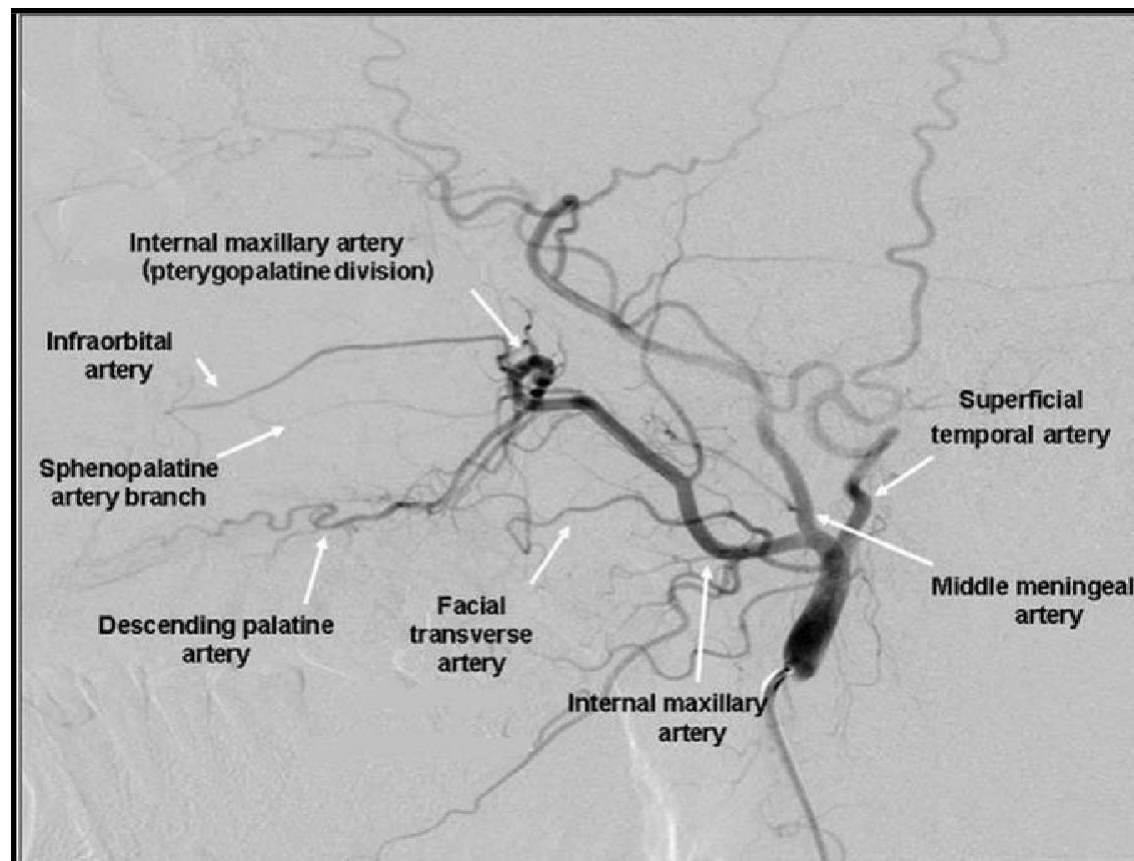


Figure 3: Angiogram depicting the pterygopalatine artery as it branches into the posterior superior alveolar, infraorbital, and descending palatine arteries, and terminates into the sphenopalatine artery.

Numerous anatomic variants exist with potential anastomotic connections to the carotid, ophthalmic, and vertebral arteries. This becomes critically important in planning the embolization of vascular tumors within the PPF.

Communications of the PPF

The PPF communicates with the following spaces through various foramina and fissures [3]:

Posteriorly, the PPF communicates with the middle cranial fossa via the foramen rotundum (**Figures 4C, 4D, 4F**). The foramen rotundum carries the maxillary nerve (V2), which originates in Meckel's cave and traverses the cavernous sinus to the upper PPF (**Figure 5**). The Vidian (or pterygoid) canal carries the Vidian (or pterygoid) nerve and artery and runs posteriorly below the foramen rotundum, forming a potential communication with the carotid canal and foramen lacerum (**Figures 4B, 4D, 4G, 6**). An additional small posterior opening, the palatovaginal or pharyngeal canal runs medial and inferior to the Vidian canal and is visualized with greater frequency with recent advances in imaging resolution ^[4]. It transmits the pterygovaginal artery and pharyngeal nerve.

Medially, the PPF communicates with the posterior nasal cavity through the sphenopalatine foramen, which runs through the vertical

portion of the palatine bone and opens into the superior meatus (**Figures 4B, 4E**). The sphenopalatine foramen transmits the sphenopalatine vessels, and the superior nasal and the nasopalatine nerves.

Laterally, the PPF communicates to the masticator space through the pterygomaxillary fissure, which runs between the maxilla and the lateral pterygoid plate (**Figures 4B, 4E**).

Inferiorly, the palatine canal (or foramen) carries the palatine vessels and nerves, forming a potential connection with the oral cavity (**Figures 4A, 4G**).

At its anterior and superior aspect, the PPF communicates with the orbit through the inferior orbital fissure, which transmits the zygomatic nerve (branch of V2) as well as the infraorbital artery and nerve (**Figures 4E, 4F**).

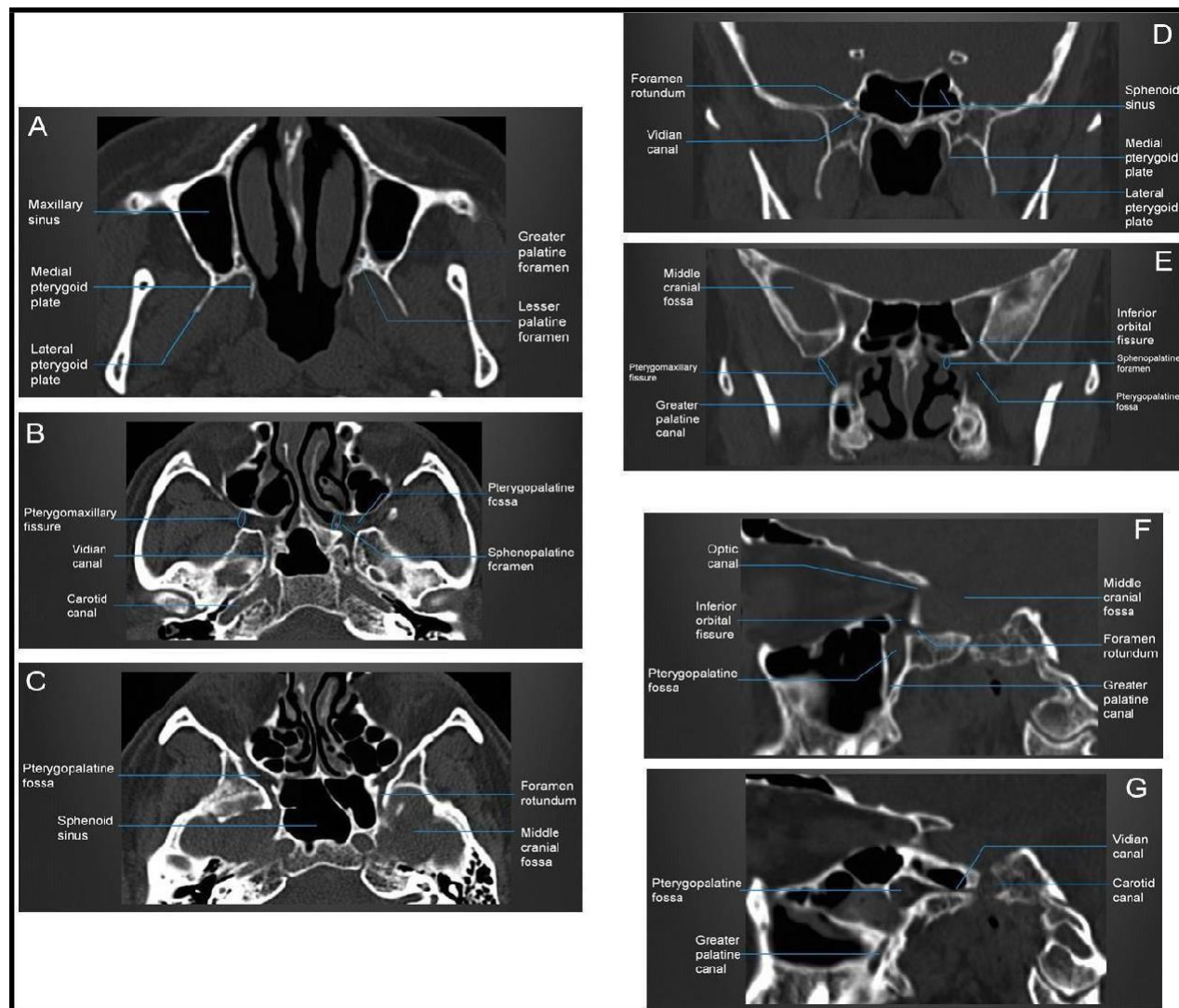


Figure 4: CT images through the PPF in axial plane from inferior to superior (A,B,C), coronal plane from posterior to anterior (D,E) and sagittal plane from lateral to medial (F,G).

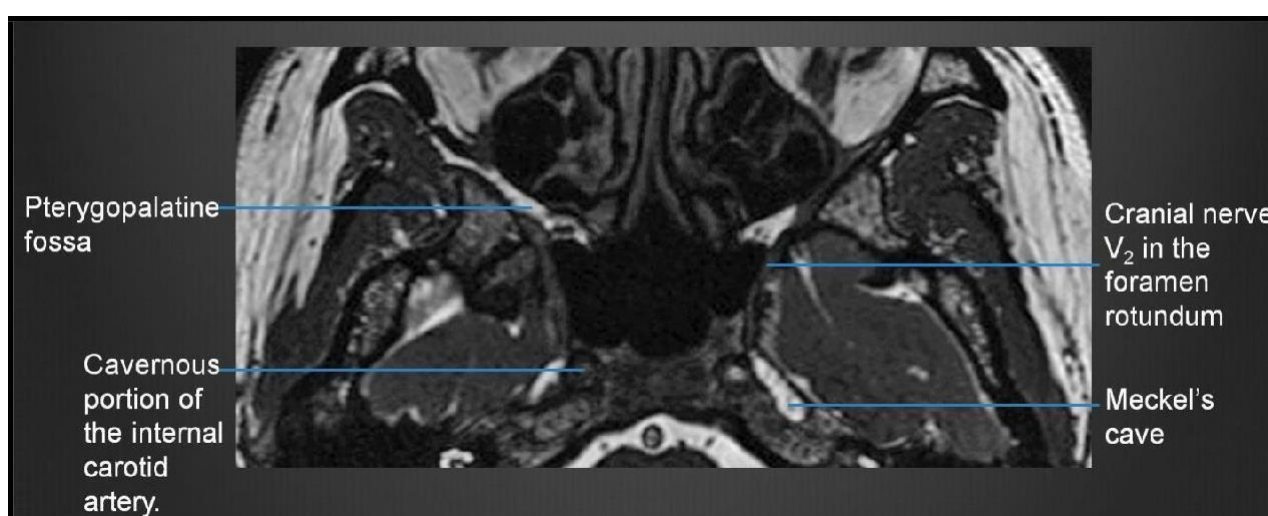


Figure 5: Axial FIESTA images through the PPF.

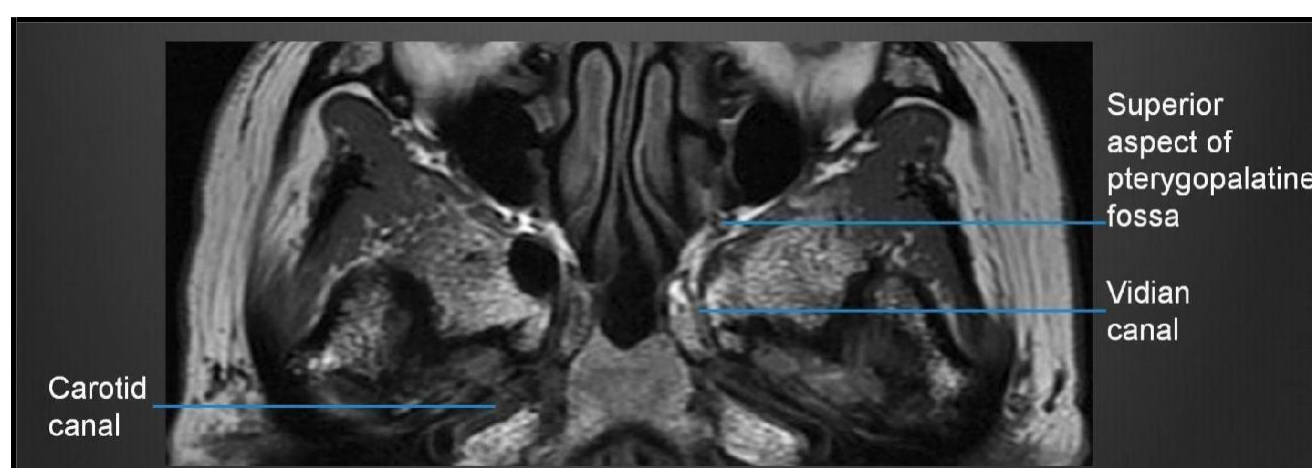


Figure 6: Axial T1-weighted images through the PPF.

Cases

Case #1 Metastatic thyroid carcinoma

A 21-year-old female with a history of thyroidectomy presented with gradual onset of right vision and hearing loss. Physical exam

demonstrated right eye proptosis and a mass in the nasal cavity.

Biopsy confirmed metastatic follicular thyroid carcinoma. Pre and post-contrast T1- weighted images (**Figure 7**) show extensive involvement of the right PPF by metastatic disease. A tumor (A)

extends medially through the sphenopalatine foramen filling the nasal cavity (B) and posteriorly obliterating the foramen rotundum, Vidian canal, and palatovaginal canal to involve the clivus posteromedially (C). Note the normal fat-containing contralateral left PPF (D).

Perineural spread of tumors of the head and neck into the PPF is a frequent and dreaded complication, and this case demonstrates a notable example.

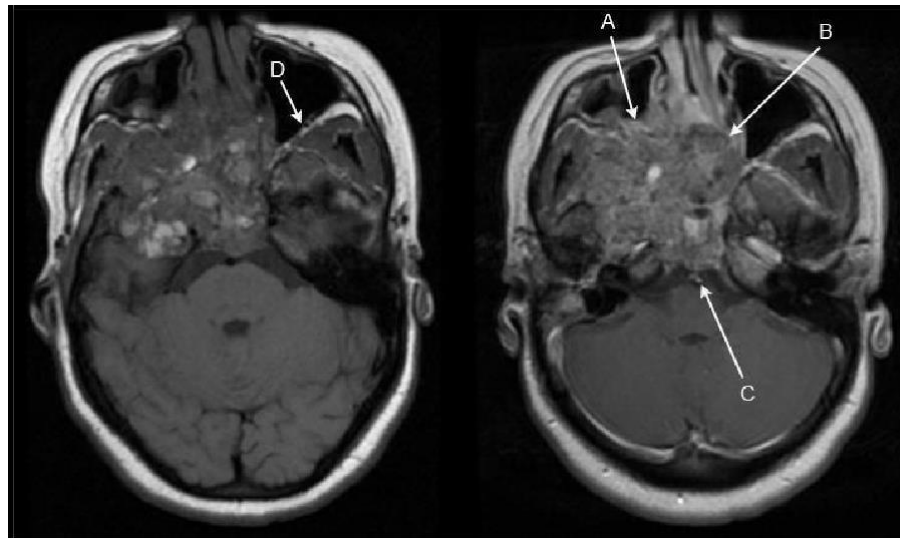


Figure 7: Pre and post contrast T1 images show extensive involvement of the right PPF by metastatic thyroid carcinoma. Tumor within the PPF (A) extends medially through the sphenopalatine foramen filling the nasal cavity (B). The posterior communications of the PPF have been obliterated, including the foramen rotundum, Vidian canal, and palatovaginal canal. This demonstrates a ease of direct tumor spread from the PPF into the nasal cavity and the middle cranial fossa, in this case involving the clivus(C). Note the normal fat containing left PPF (D). As the presence of normal fat is a reassuring finding, evaluation of this area should utilize T1- weighted images without fat saturation.

Case #2 Squamous cell carcinoma

This patient presented with bilateral CN VI palsies. CT and post-contrast T1-weighted images (**Figure 8**) demonstrate tumor expanding the right PPF (A) with obliteration of the normal fat and involving the foramen rotundum with extension into the sphenoid sinus (B) and retroviral space (C). The patient's cranial nerve palsy

was secondary to squamous cell carcinoma with involvement of bilateral CN VI in Dorello's canal. Obliteration of normal fat should prompt a search for primary tumors in mucosal surfaces of the head and neck.

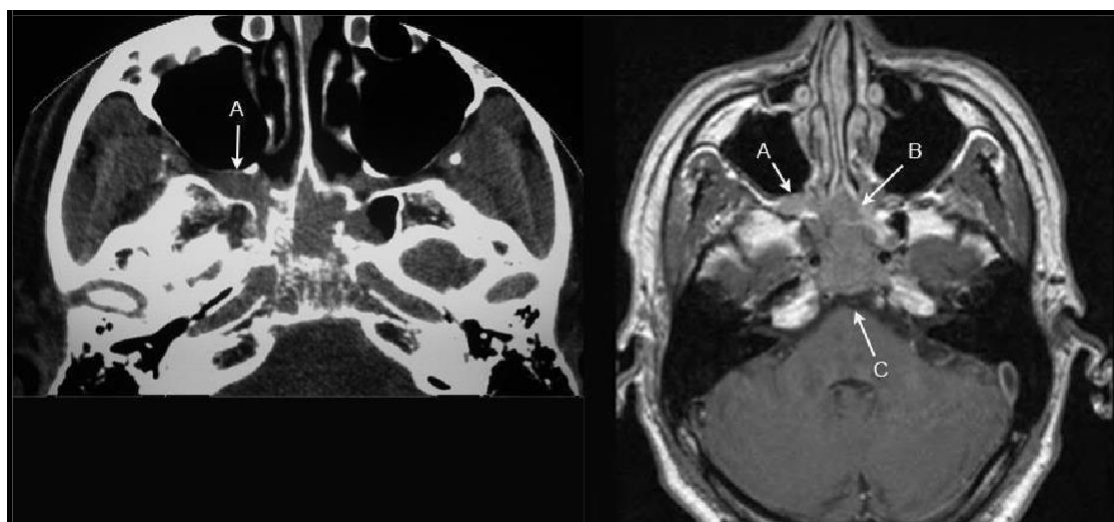


Figure 8: Squamous cell carcinoma in a patient presenting with cranial nerve VI palsies. Comparison of the right and left PPF on CT and post contrast T1 images demonstrate expansion of the right PPF by tumor with loss of the normal fat (A). Similar to the previous case, tumor extends into the sphenoid sinus (B) and retroclival space (C). Squamous cell carcinoma often spreads perineurally through the PPF, and obliteration of normal fat in this space should prompt a search for primary tumor in the mucosal surfaces of the head and neck.

Case #3 Inflammatory pseudotumor

A 52-year-old female presented with right facial pain. CT (**Figure 9A**) shows obliteration of fat in the right PPF (A) and inferior orbital fissure (B). Coronal precontrast T1-weighted images (**Figure 9A**) demonstrate an infiltrating lesion isointense to adjacent muscle obliterating the fat plane in the right PPF (C). Axial T1-weighted images (**Figure 9B**) show the extension of the lesion from the PPF

(A) through the inferior orbital canal into the extraconal space (B) adjacent to the inferior rectus. Biopsy confirmed inflammatory pseudotumor. Direct extension of tumor often affects cranial nerve V; therefore, a clinical history of facial pain should prompt thorough evaluation of the PPF.

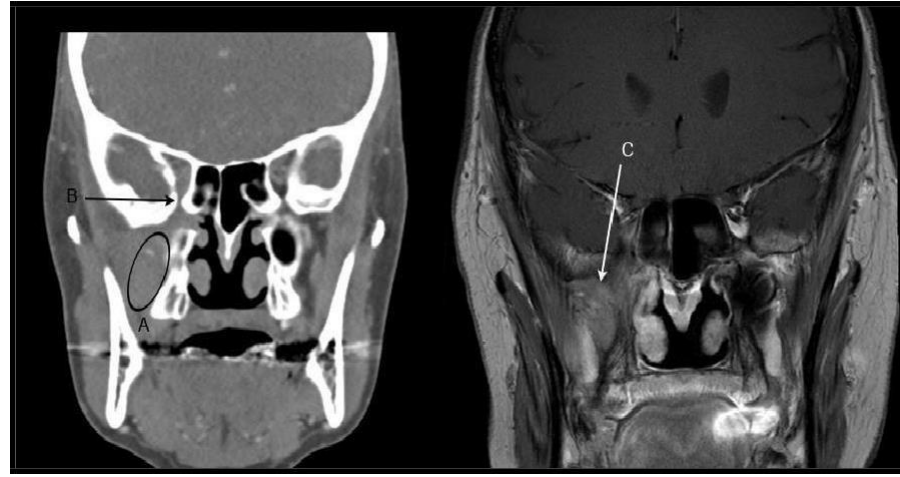


Figure 9A.

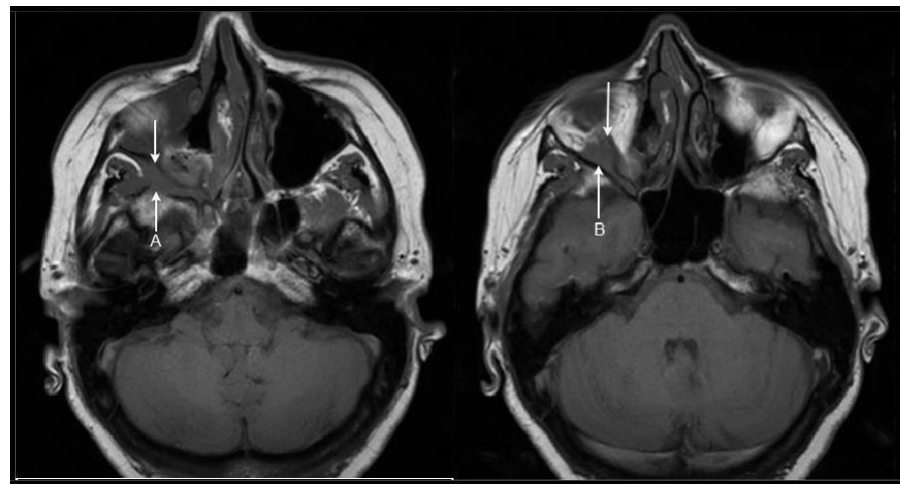


Figure 9B.

Figure 9A&B: Inflammatory pseudotumor in a patient presenting with right facial pain. CT (**Figure 9A**) shows obliteration of fat in the right PPF (A) and inferior orbital fissure (B). Coronal precontrast T1- weighted images (Figure 9A) demonstrate an infiltrating T1 isointense lesion in the right PPF (C). Axial T1-weighted images (**Figure 9B**) show extension of the lesion from the PPF (A) through the inferior orbital fissure into the extraconal space (B) adjacent to the inferior rectus. Direct extension of tumor through the PPF often affects the maxillary nerve (V2), which supplies sensory innervation to the nasopharynx, palate, and the skin overlying the maxilla. Therefore, a clinical history of facial pain in these areas should prompt thorough evaluation of the course of V2, including the PPF.

Case #4 Lymphoma

A 56-year-old male presented with sinusitis symptoms and was found to have MALT lymphoma by biopsy. Axial T2-weighted images and post-contrast fat saturation T1-weighted images (**Figure 10A**) show enhancing tumor (B) which slightly widens the PPF. There is a loss of T1 hyperintense fat signal on the left (A) compared to the right.

Coronal T1-weighted images and axial post-contrast fat saturation T1-weighted images (**Figure 10B**) demonstrate tumor extension posteriorly into the Vidian canal (A) and foramen rotundum (B). Many tumors are known to spread along nerves, including lymphoma, squamous cell carcinoma, and melanoma.

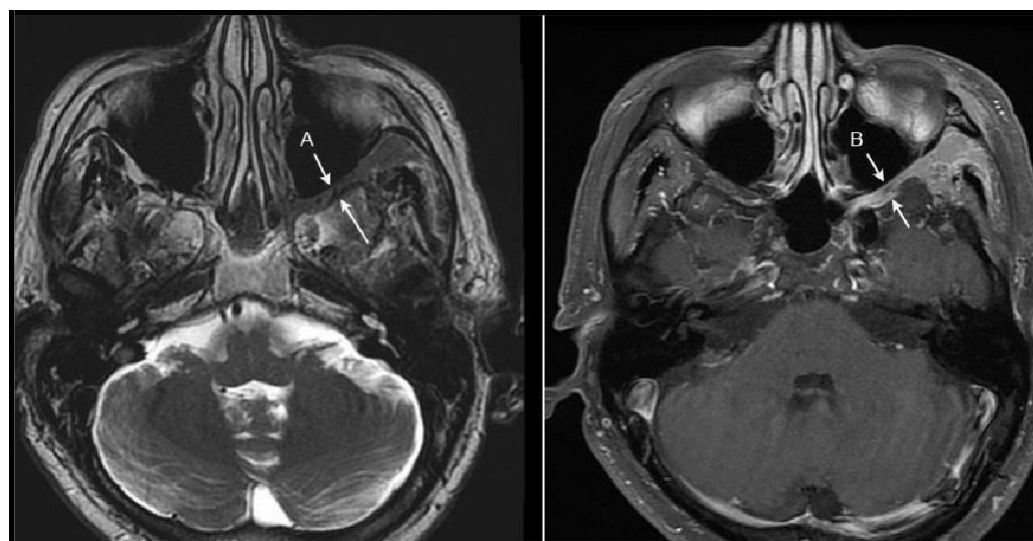


Figure 10A.

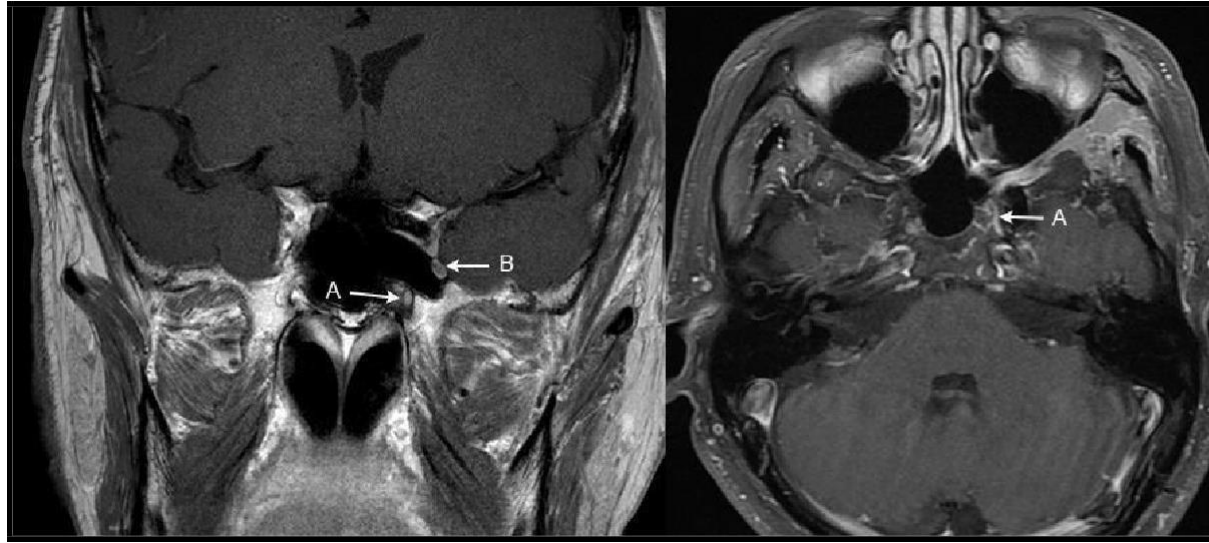


Figure 10B.

Figure 10A&B: MALT lymphoma in a patient presenting with sinusitis. Axial T2 and post contrast T1 fat saturation images (**Figure 10A**) show enhancing tumor (B) which slightly widens the PPF. There is loss of T1 hyperintense fat signal on the left (A) compared to the right. Coronal T1 and axial post contrast T1 fat saturation images (**Figure 10B**) demonstrate tumor extension posteriorly into the Vidian canal (A) and foramen rotundum (B). A finding of perineural spread of tumor should prompt an evaluation for a primary malignancy, most commonly lymphoma, squamous cell carcinoma, melanoma, or adenoid cystic carcinoma.

Case #5 Squamous cell carcinoma

An 81-year-old male with squamous cell carcinoma of the periorbital skin developed facial pain and numbness. Post-contrast T1-weighted images (**Figure 11A**) show the perineural spread of tumor along with V1 through the superior orbital fissure (A) to the cavernous sinus (B), then posteriorly to the cisternal portion (C) of cranial nerve V. Radiographic presentation of perineural spread includes enlargement

of the affected foramen, enhancement and enlargement of the affected nerve, and obliteration of the fat in the PPF. (**Figure 11B**) shows cranial nerve V enlargement and enhancement from its cisternal portion (A) to the convergence of V1 and V2 at Meckel's cave/ cavernous sinus (B), to the V2 division at the foramen rotundum (C).

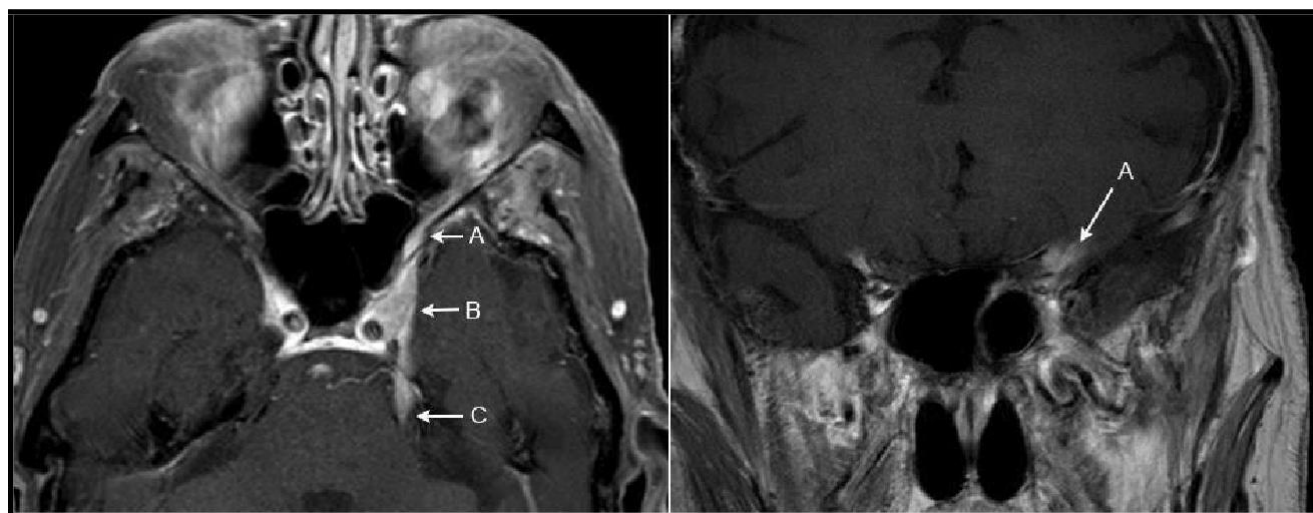


Figure 11A.

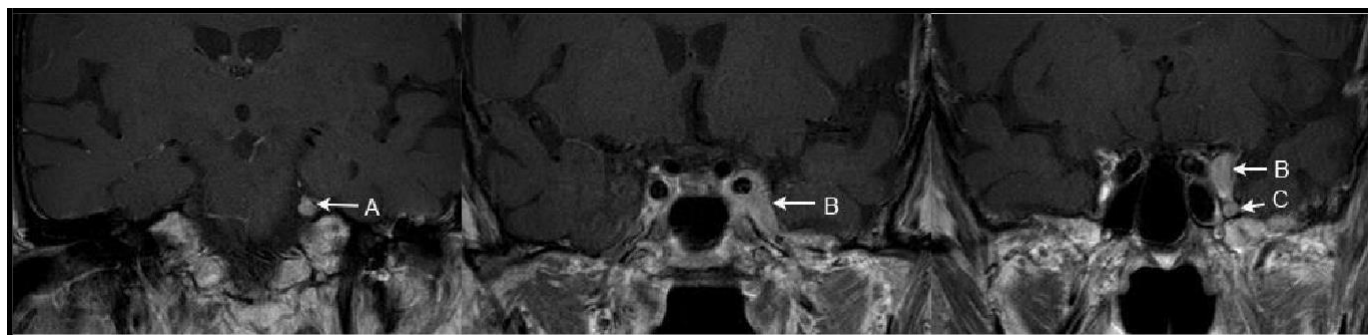


Figure 11B.

Figure 11A&B: This patient presented with facial pain and numbness, with biopsy of the periorbital skin showing squamous cell carcinoma. Post contrast T1 images (**Figure 11A**) show perineural spread of tumor along V1 through the superior orbital fissure (A) to the cavernous sinus (B), then posteriorly to the cisternal portion (C) of cranial nerve V. Cranial nerve V appears enlarged and enhancing (**Figure 11B**) from its cisternal portion (A) to the convergence of V1 and V2 at Meckel's cave/ cavernous sinus (B), to the V2 division at the foramen rotundum (C). Perineural spread of tumor can be identified as enlargement of the affected foramen, enhancement and enlargement of the affected nerve, local mass effect (especially in the Meckel's cave region), and obliteration of the fat in the PPF. This case illustrates that perineural spread can occur both retrograde and antegrade.

Case #6 Invasive fungal sinus disease

This patient had known sinus disease related to invasive aspergillosis. CT (**Figure 12**) demonstrates sphenoid sinus mucosal thickening (A) and fatty infiltration of the left PPF and retroantral fat (B). Although

not seen in this case, it is important to consider the potential for infectious processes of the sphenoid sinus extending into the PPF leading to cavernous sinus thrombosis.

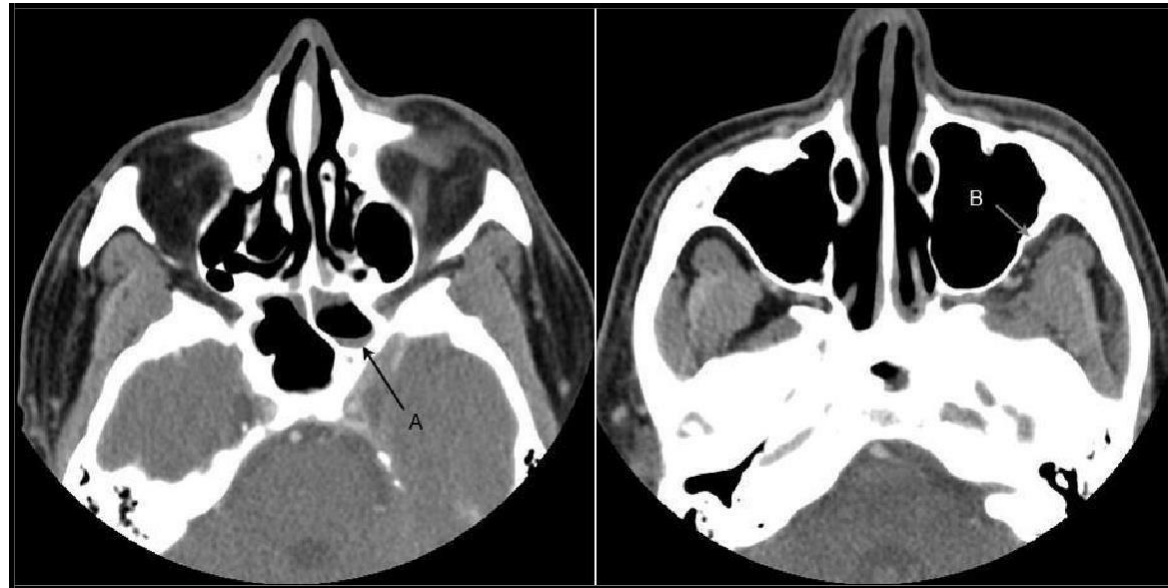


Figure 12: Invasive aspergillosis. CT demonstrates sphenoid sinus mucosal thickening (A) and infiltration of the left PPF and retroantral fat (B). Once again, the loss of the normal fat of the PPF indicates the spread of disease into adjacent anatomical spaces; however, extension of disease through the communications of the PPF is not limited to tumor. Infectious processes of the sphenoid sinus can also extend into the PPF, potentially leading to cavernous sinus thrombosis.

Case #7 Sinogenic CN V Perineuritis

A 14-year-old male presented with sinusitis and subsequently developed right V2 distribution facial numbness. CT (**Figure 13**)

shows sinus disease with soft tissue windows demonstrating obscuration of fat in the PPF.

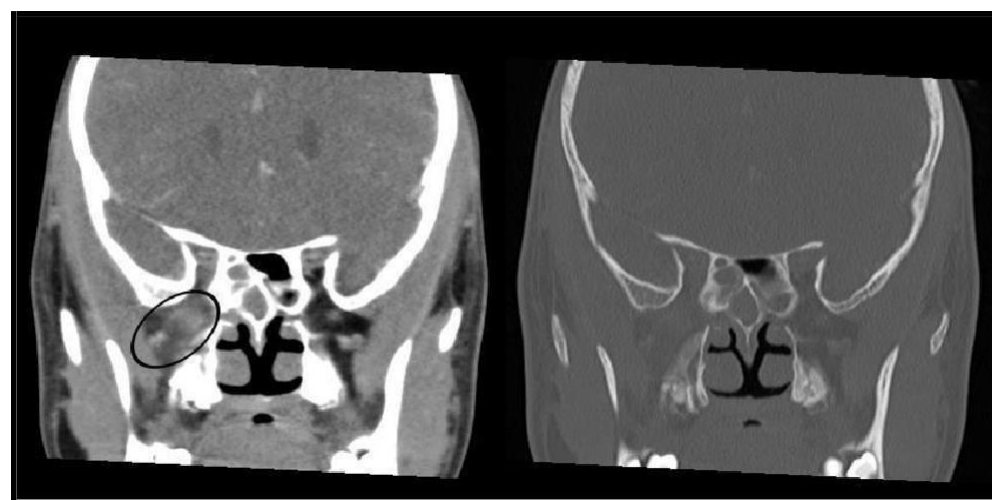


Figure 13: Patient presenting with facial numbness over the right nose and cheek. CT shows sinus disease with soft tissue windows demonstrating obscuration of fat in the right PPF. This case of sinogenic perineuritis reiterates that a clinical history of facial pain or numbness can indicate involvement of cranial nerve V, in this case V2, which supplies sensory innervation to the nasal cavity and the skin overlying the maxilla.

Case #8 Chondrosarcoma

This patient had known chondrosarcoma involving the clivus, left petrous apex, left the sphenoid body, and greater sphenoid wing. CT (**Figure 14**) demonstrates osseous erosion and destruction (A). There is an enlargement of the left inferior orbital fissure (B) compared to the right (C) suggesting extension inferiorly into the PPF. Post-

contrast T1-weighted images show heterogeneous enhancement. Differential considerations of osseous tumors which invade the PPF should include osteosarcoma, chondrosarcoma, hemangioma, lymphoma, and bony metastatic disease.

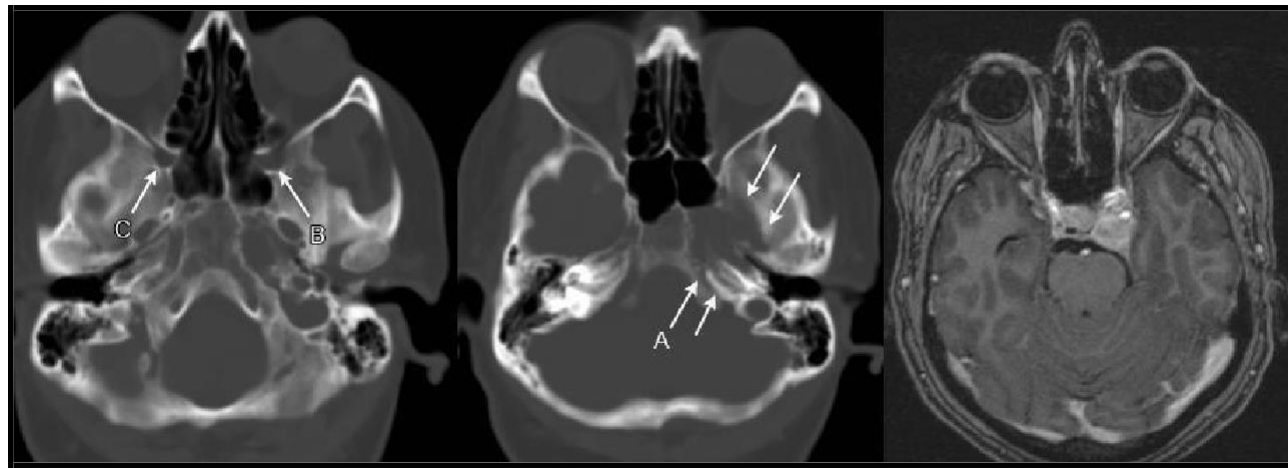


Figure 14: CT demonstrates osseous erosion and destruction involving the clivus, left petrous apex, left sphenoid body and greater sphenoid wing (A). There is enlargement of the left inferior orbital fissure (B) compared to the right (C) suggesting extension inferiorly into the PPF. Post contrast T1 images show heterogeneous enhancement. This patient had a known chondrosarcoma, however differential considerations of osseous tumors which invade the PPF should also include osteosarcoma, hemangioma, lymphoma, and bony metastatic disease.

Case #9 Osteosarcoma

This patient with known skull base osteosarcoma presented for follow-up. CT (**Figure 15**) demonstrates an expansile sclerotic lesion of the left sphenoid body, which on MR has heterogeneously low

signal compared to normal marrow on T1-weighted images. Osseous lesions such as these can result in the distortion or obliteration of the bony margins of the PPF, best demonstrated in CT studies.

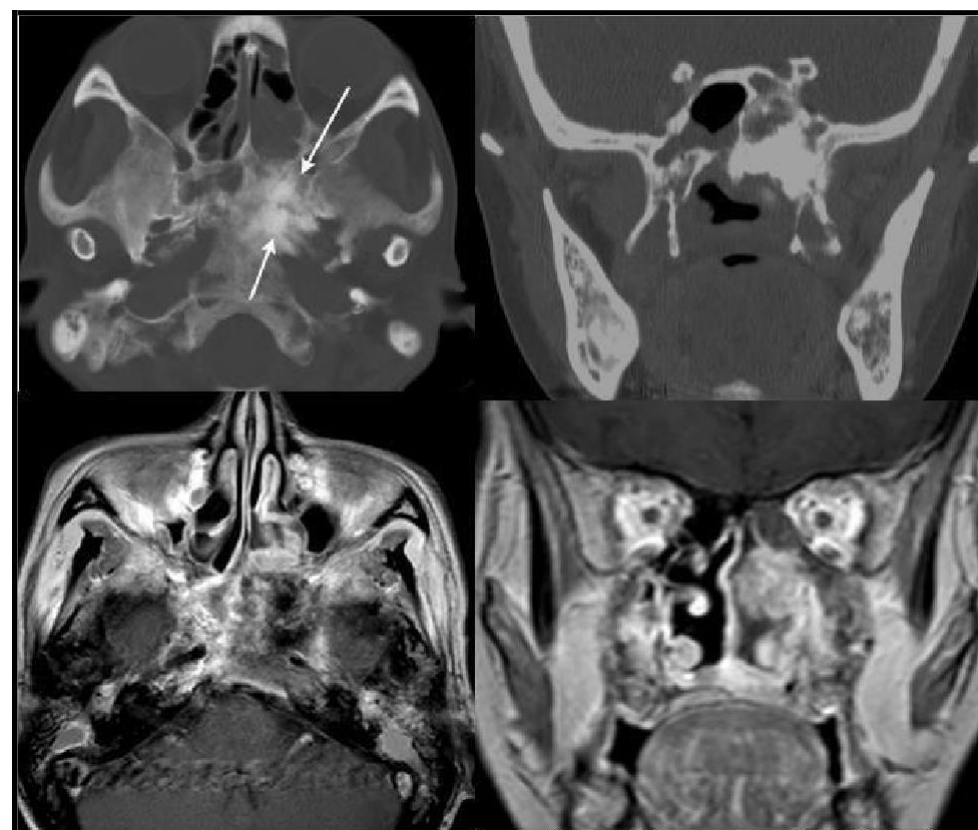


Figure 15: A patient with known skull base osteosarcoma presented for follow-up. On MRI the tumor shows heterogeneous low to intermediate T1 signal and is somewhat ill-defined. The extent of bony involvement and the distortion of bony margins is better demonstrated on CT, which shows an expansile sclerotic lesion of the left sphenoid body which obliterates the PPF and extends posteriorly to involve the clivus and portions of the petrous temporal bone.

Case #10 Idiopathic hypertrophic pachymeningitis

A 65-year-old female presented with decreased hearing and vision, gradual onset emotional lability, and hallucinations. Pre and post-contrast fat saturation T1-weighted images (**Figure 16**) show abnormal, thickened, enhancing dura in the posterior fossa (A) and in Meckel's cave (B). Enhancing soft tissue is seen extending through the left foramen rotundum (C) and replacing the fat in the left PPF

(D). She was also found to have Dural-based and parenchymal lesions in the frontal lobe (not shown), which by biopsy demonstrated chronic inflammation. Note that the fat-containing unaffected right PPF is more difficult to visualize on these fat saturation images (E). For this reason, a search for subtle lesions should utilize precontrast T1-weighted images without fat saturation.

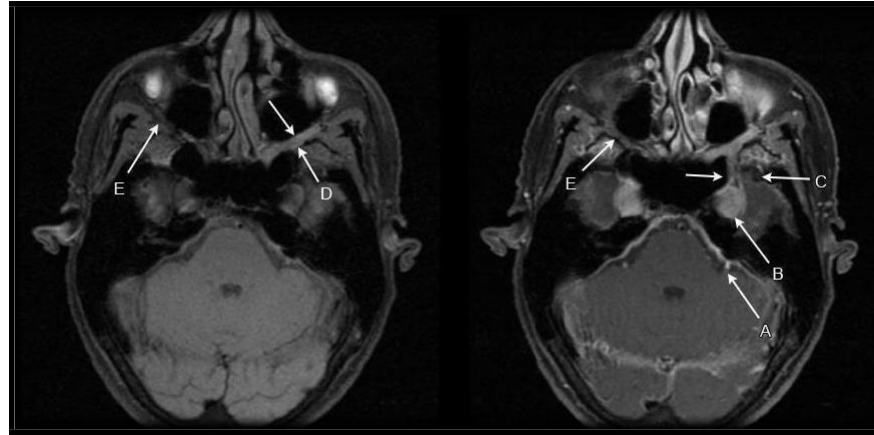


Figure 16: Idiopathic hypertrophic pachymeningitis in a patient presenting with decreased hearing and vision. T1 fat saturation pre and post contrast images show abnormal, thickened, enhancing dura in the posterior fossa (A) and in Meckel's cave (B). Enhancing soft tissue is seen extending through the left foramen rotundum (C) and replacing the fat in the left PPF (D). Note that the fat containing unaffected right PPF is more difficult to visualize on these fat saturation images (E). In general, the fat of the PPF is more difficult to evaluate on these images as compared to the case of squamous cell carcinoma in Figure 7. This case serves to reiterate that evaluation of this area should utilize T1-weighted images without fat saturation.

Case #11-#12 Juvenile nasopharyngeal angiofibroma

A 12-year-old male presented with recurrent epistaxis since age 3, worsening over the last year. The endoscopic exam showed fullness at the basal lamellar attachment of the middle turbinate to the lateral nasal wall and overall increased vascularity of the mucosa. Post-contrast CT and T1-weighted images (**Figure 17**) show the tumor centered in the left sphenopalatine foramen, extending laterally to involve and markedly widen the left PPF (A). Note that neurovascular contents surrounded by fat are clearly demonstrated in the unaffected right PPF (B).

In another adolescent patient who presented with epistaxis, axial CT and post-contrast fat saturation T1-weighted images (**Figure 18A**) show the tumor expanding the right sphenopalatine foramen (A) and extending into the maxillary sinus (B). A normal PPF is seen contralaterally (C). Coronal CT and post-contrast fat saturation T1-weighted images (**Figure 18B**) show the tumor expanding the right PPF (A) and inferior orbital fissure (B). MRI demonstrates extension into the right maxillary and sphenoid sinuses and nasal cavity.

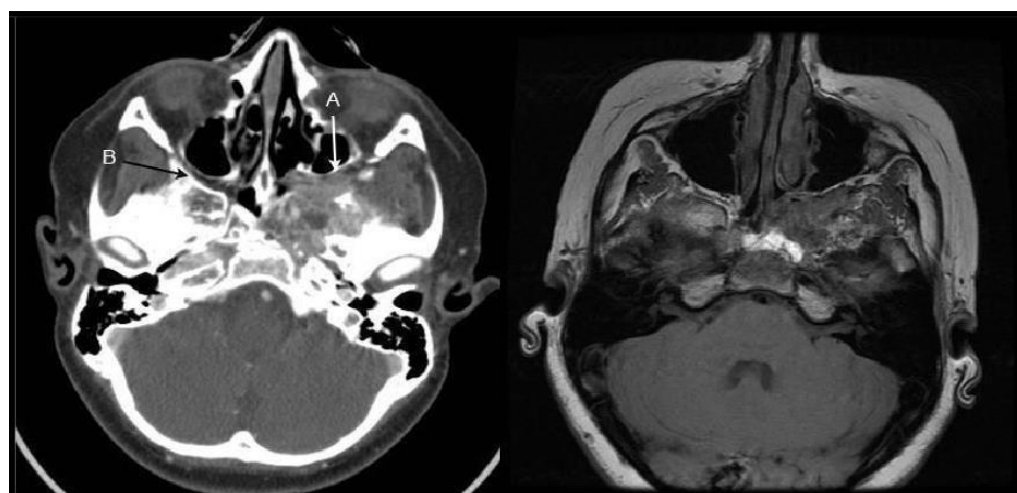


Figure 17: Post contrast CT and T1 images in a patient with juvenile nasopharyngeal angiofibroma show the tumor centered in the left sphenopalatine foramen, extending laterally to involve and markedly widen the left PPF (A). Note that neurovascular contents surrounded by fat are clearly demonstrated in the unaffected right PPF (B).

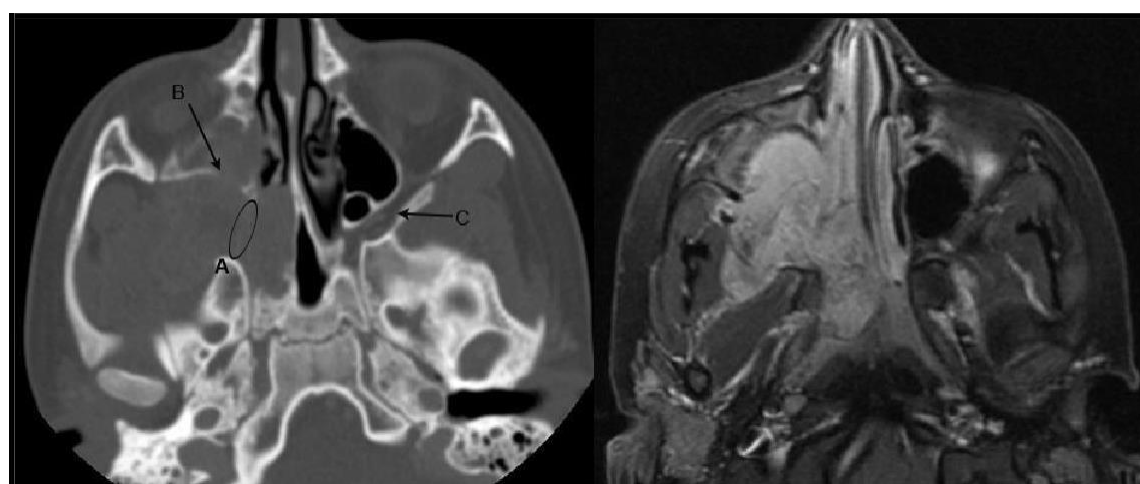


Figure 18A.

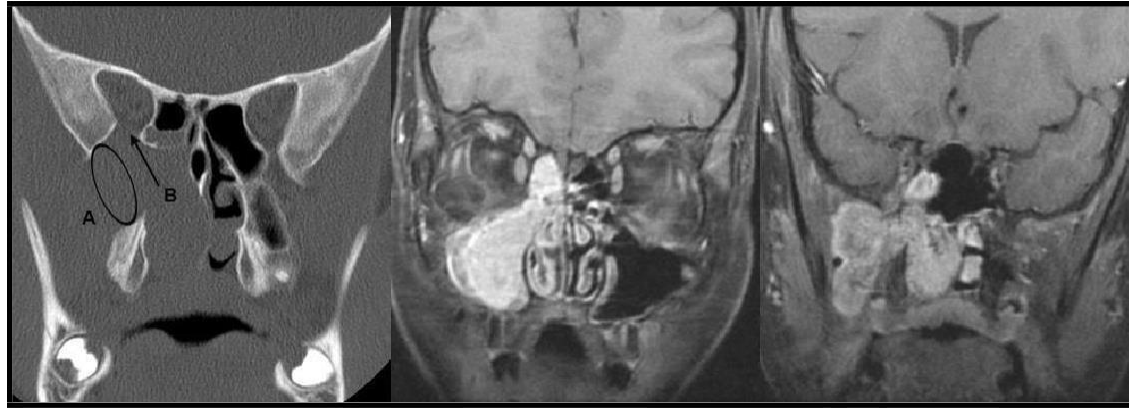


Figure 18B

Figure 18A&B: Axial CT and post contrast T1 fat saturation images (Figure 18A) in this patient with juvenile nasopharyngeal angiofibroma show the tumor expanding the right sphenopalatine foramen (A) and extending into the maxillary sinus (B). A normal PPF is seen contralaterally (C). Coronal CT and post contrast T1 fat saturation images (Figure 18B) show the tumor expanding the right PPF (A) and inferior orbital fissure (B). MRI demonstrates extension into the right maxillary and sphenoid sinuses and nasal cavity.

Discussion

Several imaging considerations can optimize the visualization of both anatomy and pathology of the PPF. For bony evaluation, non-contrast CT with thin slices is preferred. For soft tissue evaluation, precontrast T1-weighted images without fat saturation often best demonstrate subtle lesions. Post-contrast T1-weighted images can demonstrate enhancing lesions. Susceptibility artifact as a result of maxillary sinus air and dental amalgam may obscure the PPF.

Although a variety of pathologies have been reported to occur in the PPF, the perineural spread of tumors of the oral cavity, paranasal sinuses, and face into the PPF, usually involving V2 division of the trigeminal nerve, is a frequent and dreaded complication. This phenomenon has profound implications in surgical and radiation therapy planning [5-7]. The perineural spread of the tumor presents radiographically as enlargement of the affected foramen, enhancement and enlargement of the affected nerve, local mass effect (especially in the Meckel's cave region), and obliteration of the fat in the PPF.

Many tumors are known to spread along nerves including lymphoma (Figure 10), squamous cell carcinoma (Figures 8,11), and melanoma. However, adenoid cystic tumor, which arises in both major and minor salivary glands and lacrimal glands, is notorious for using nerves as a conduit to travel away from the primary site. Such spread has been reported to be discontinuous with intervening skip areas [7] and can be both antegrade and retrograde in direction. Since the highest concentration of the minor salivary glands is in the posterior roof of the mouth, adenoid cystic carcinoma frequently arises in this location, making the PPF an extremely important site for perineural tumor spread. Conversely, any obliteration of the fat in the PPF should prompt a thorough search for a primary tumor in all mucosal and cutaneous surfaces in the head and neck, especially in the region of the palate.

Tumors can also spread into the PPF via direct extension. Nasopharyngeal carcinoma can directly involve the pterygoid processes, foramen rotundum, and Vidian canal. Sarcomas (Figures

14,15) and lymphomas can also spread directly into the skull base. Bone erosion is best appreciated on computed tomographic imaging. Neurofibromas are tumors of the nerve sheath which can present as enhancing mass lesions in and around the region of the PPF. Cranial nerve V is the most commonly affected nerve in the central skull base. These lesions often arise in the Meckel's cave and extend through the foramen ovale or rotundum. The lesions can also be seen in association with neurofibromatosis [3].

Inflammatory and infectious processes can extend along the various channels leading into the PPF (Figures 9, 13, 16). Sphenoid sinus infection can extend to the bone and cause cavernous sinus thrombosis. Fungal infections including aspergillus infection of the orbit or the sinus can also invade the PPF (Figure 12).

Neoplasms that arise from the sphenoid bone that can directly invade the PPF include osteosarcoma (Figure 15), hemangioma, lymphoma, and bony metastatic disease from lung, kidney, breast, and prostate. Chondrosarcomas are locally invasive tumors, which can arise from various synchondroses in the skull base (Figure 14). There is often a significant soft tissue component. Similarly, fibrous dysplasia and Paget's disease can involve the base of the skull and result in distortion of the bony margins of PPF. Meningiomas can arise from any part of the sphenoid bone, and can directly invade, extend along the dura, or remodel the PPF.

Congenital anomalies, which can directly or indirectly involve PPF, include meningoceles and cephaloceles, which are protrusions of intracranial contents through a calvarial defect. These defects can be categorized as midline (transsphenoidal, sphenothmoidal, and transethmoidal) and lateral basal cephaloceles (sphenoorbital and sphenomaxillary). The sphenomaxillary type can extend through the PPF.

Juvenile angiofibroma is a benign tumor arising in the posterior nasal cavity or anterior nasopharynx, adjacent to the sphenopalatine foramen, and is most frequently seen in adolescent boys (Figures 17-18). The tumor is extremely vascular and locally invasive. In almost

all cases the tumor extends to the PPF which is widened, and its fat content obliterated. With tumor growth, the posterior wall of the maxillary sinus is pushed anteriorly, and the pterygoid plates are remodeled posteriorly. Eventually, the tumor can invade the cavernous sinus, and finally penetrate the dura to invade the brain. Laterally the tumor can grow into the infratemporal fossa [3].

Summary

Knowledge of the complex anatomy of the PPF is essential for radiologists. It has communications with the oral cavity, nasopharynx, orbit, masticator space, cavernous sinus, and the middle cranial fossa, and as such, it has the potential to act as a conduit for the spread of disease between these spaces. Perineural spread of tumors of the head and neck into the PPF is a complication that has implications in surgical and radiation therapy planning. Radiographically this presents as the obliteration of the fat within the PPF, best demonstrated on precontrast T1-weighted images without fat

Abbreviations: PPF = pterygopalatine fossa,

PPG = pterygopalatine ganglion

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Finally, isolated cases of a variety of other pathologic processes involving the PPF have been reported. These include post-traumatic pseudoaneurysm [12], abscess, hydatid cyst, heterotopic brain tissue [9-11], trauma, and foreign body.

saturation. A short checklist to consider when evaluating the PPF should include: 1) the obliteration of fat, 2) widening of the PPF or its communications, and 3) perineural enhancement and enlargement. The presence of these findings should prompt a search for primary tumors in the mucosal surfaces of the head and neck. Cross-sectional imaging of the PPF is key to understanding and identifying a variety of pathological processes at this convergence of spaces in the deep face.

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