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The role of technetium-99m-HMPAO-labeled WBC scintigraphy in the diagnosis of orbital cellulitis

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Bacterial orbital cellulitis is an infection of the soft tissues behind the orbital septum. Cellulitis is seen as a poorly defined area of increased CT density or T2 signal intensity within the fat. There is an amorphous enhancement following contrast infusion. Radiolabeled leukocytes or granulocytes are now established widely as a means of localizing various forms of inflammatory disease and infections. We report a case of orbital cellulitis detected with Tc-99m-HMPAO-labeled WBC scintigraphy and three-phase bone scintigraphy. Tc-99m-HMPAO-labeled WBC scintigraphy was superior to bone scintigraphy in delineating the extension and limits of the infectious process in the orbita. Tc-99m-HMPAO-labeled WBC scintigraphy is appropriate in the investigation of such infectious lesions, leading to early diagnosis and therapy to avoid severe complications.

Key words: cellulitis, orbita, Tc-99m-HMPAO-labeled WBC scintigraphy

INTRODUCTION

BACTERIAL ORBITAL CELLULITIS is an infection of the soft tissues behind the orbital septum which is frequently a polymicrobial infection, including those caused by anaerobes. The causes of bacterial orbital cellulitis are sinus infections, infections of adjacent facial structures, penetrating trauma and surgery. Exposure keratopathy, increased intraocular pressure, occlusion of the central retinal artery or vein and contiguous inflammation of the optic nerve are its ocular complications, and meningitis, brain abscess and cavernous sinus thrombosis are its intracranial complications.[1] Early diagnosis and treatment are important to avoid those serious complications. We report an orbital cellulitis case whose diagnosis was established by Tc-99m-HMPAO-labeled WBC imaging.

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CASE REPORT

A 57-year-old woman was admitted to the ophthalmology department complaining of pain on attempted eye movements, swelling of the right eyelids and diplopia for 10 days after an episode of severe toothache. She had had non-insulin dependent diabetes mellitus for 14 years and her blood sugar level was under control with oral antidiabetics. In her ophthalmologic examination, visual acuity was 20/20 in each eye. There was a 6-mm left proptosis. The left upper and lower eyelids were erythematous and edematous. Ocular motility was significantly decreased in the medial and lateral fields of vision in the left eye. The pupils were briskly reactive to light with no relative afferent pupillary defect. Color vision with Ishihara's pseudoisochromatic plates was normal in each eye. Slitlamp examination of the left eye revealed diffuse mild conjunctival chemosis. Intraocular pressure was 15 mm Hg in the right eye and 19 mm Hg in the left eye. Fundus examination revealed background diabetic retinopathy in both eyes. Visual fields with the Goldmann perimeter were within normal limits. Conjunctival, nasal and pharyngeal cultures were negative.

Right maxillary opacity was present in Waters graphy.

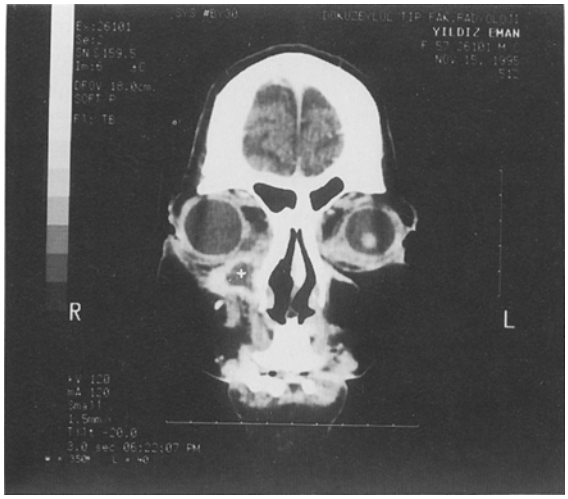

Fig. 1 Coronal enhanced orbital CT scan of a 57-year-old woman. A lesion is seen in the inferomedial part of the right orbit (cursor). The lesion shows a low density and demonstrates marked rim enhancement. Note also the extensive soft tissue changes around the right eye, indicative of infection.

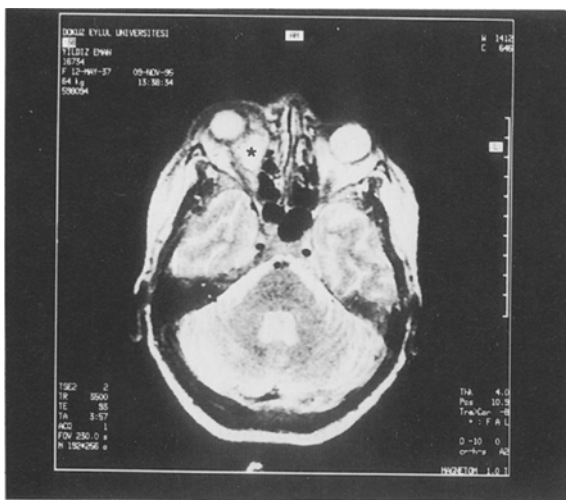

Fig. 2 Axial T2-weighted cranial MRI scan shows a hyperintense lesion between the right optic nerve and ethmoid cellules (star). The right eye is proptotic in appearance.

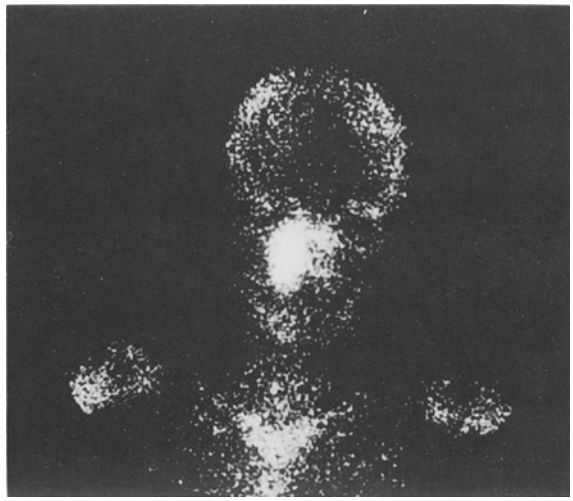

Fig. 3 Twenty-four hour anterior image of the head shows increased accumulation of Tc-99m-HMPAO-labeled WBCs in the right maxillary region and clearly delineates the area of cellulitis. There is also extension of the infection to the orbital floor.

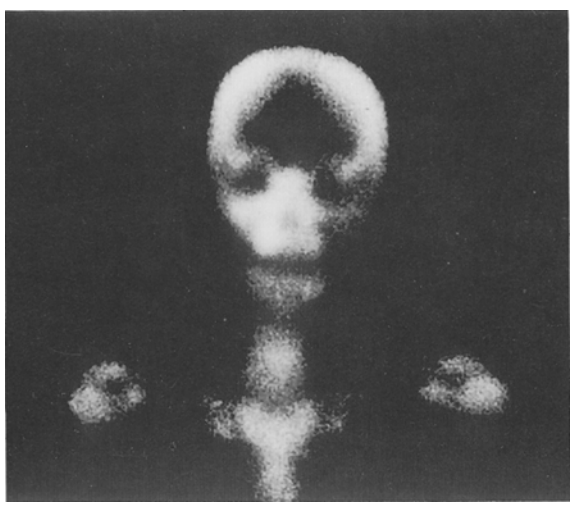

Fig. 4 Increased uptake of Tc-99m-MDP in maxillary and zygomatic bones is seen in the late anterior head image. Tc-99m-MDP uptake is more extensive than Tc-99m-HMPAO-WBC uptake.

A lesion was observed in the inferomedial part of the right orbit in orbital CT. The lesion was of low density and showed thick rim enhancement. There were also extensive soft tissue changes around the right eye. These findings were in favor of cellulitis or a suspected abscess formation (Fig. 1).

Cranial and orbital MRI study demonstrated the lesion as hyperintense on T2-weighted sequences and hypointense on T1-weighted sequences. The lesion was located between the right optic nerve and ethmoid cellules, and the right eye was proptotic in appearance (Fig. 2).

The patient was referred for Tc-99m-HMPAO-WBC imaging in order to evaluate a possible infectious process. One hundred and eighty-five MBq of Tc-99m-HMPAO-labeled autologous WBCs was administered intravenously and early and late planar imaging was performed after 4 hours and 24 hours, with a single head gamma camera (GE XR/T, St. Albans, UK). In the early and late images, significant uptake of Tc-99m-HMPAO-WBC was noted in the right maxillary region and there was also extension of the infection to the orbital floor. These findings were in favor of an infection and clearly delineated the area of infection (Fig. 3).

Three-phase bone scintigraphy was performed after the intravenous injection of 740 MBq Tc-99m-methylene diphosphonate (MDP). After the bolus injection of the tracer, dynamic perfusion images of the head were acquired at a rate of 2 seconds per frame for 60 seconds. A blood pool image was obtained at 5 minutes and a delayed static image at 3 hours after injection. We observed increased activity on dynamic perfusion images in the right maxillary region. Increased uptake of Tc-99m-MDP was observed in the blood pool and late static images in maxillary and zygomatic bones (Fig. 4). Tc-99m-MDP uptake was more extensive than Tc-99m-HMPAO-WBC uptake. The findings supported the presence of infection in the right maxillary and orbital region, but the area of infection was better defined by leukocyte imaging. Because of the reactive changes in bone due to infection and hyperemia, bone scintigraphy seemed to overdiagnose the extent of infection.

The patient was put on IV Cefotaxime 1.5 g every 6 hours and oral metranidazole 500 mg every 8 hours. She responded well to this treatment and all symptoms and signs were resolved within a few days.

DISCUSSION

Orbital cellulitis is an infection of the soft tissues of the orbit that is caused primarily by sinus infections, infections of adjacent facial structures and trauma.[1] In the diagnosis of orbital cellulitis coronal CT imaging is extremely useful, as most infections are extraconal broad-based against the bony orbital wall. Cellulitis is seen as a poorly defined area of increased CT density or T2 signal intensity within the fat. There is an amorphous enhancement after contrast infusion. Abscesses are more discrete and mass-like, and may contain central low CT density or higher T2 signal intensity, with peripheral enhancement on CT and T1-weighted sequences after contrast administration. Air may occasionally be seen within the abscess.[2] Since infection of the orbit could mimic the appearance of space occupying lesions radiologically,[3] we performed Tc-99m-HMPAO-WBC scintigraphy in order to confirm the infectious nature of the process. Tc-99m-HMPAO-WBC scintigraphy enabled the early diagnosis of infection and prompt treatment of the patient, therefore avoiding any potential complication, though it could not differentiate cellulitis from abscess formation.

The classic findings of osteomyelitis in the multiphase bone scan are increased regional perfusion as seen in flow and blood pool images and a corresponding increased uptake on delayed images. This is different from cellulitis, which shows regional or diffusely increased perfusion with either no corresponding increase in bone uptake on static images or only mild diffuse or focally increased uptake due to hyperemia of adjacent soft tissue infection. In some cases, however, osteomyelitis affects the entire bone or more than one bone, particularly in infants. The clearance of blood pool activity despite persistent bone uptake on delayed images may help differentiate such cases from cellulitis, which shows hyperemic changes on delayed images but blood pool activity remains.[4] In our patient, the findings of three phase bone scintigraphy were considered suspicious for osteomyelitis.

Radiolabeled leukocytes or granulocytes are now established widely as a means of localizing various forms of inflammatory disease and infections. The essential requirement for their success is that the disease to be localized is associated with a pyogenic, i.e., a neutrophilic infiltrate. Diseases in which radiolabeled leukocytes have made a significant contribution to clinical management include inflammatory bowel disease, postoperative sepsis, intra-abdominal and soft tissue sepsis, and acute and chronic osteomyelitis.[5] In the literature many reports stress the importance of radiolabeled leukocyte scintigraphy in the early detection of infections and abscess formation.[5–8] In the study by Kao, it was reported that Tc-99m-HMPAO-labeled WBC scintigraphy is valuable in the detection of complicated bone and soft tissue infections.[7] Hovi reported that combined imaging with MR and Tc-99m-HMPAO-labeled WBC scintigraphy is useful in the detection of complicated bone and soft tissue infections.[8] In the case report by Fezza et al, it was reported that malignancies in the orbit can present as acute infections.[9] The bone scan should be performed in conjunction with labeled leukocyte imaging for anatomical localization.[4]

The findings of CT and Tc-99m-HMPAO-labeled WBC scintigraphy were in accordance with each other in defining the extent of the infection, whereas bone scintigraphy seemed to overdiagnose the limits of the infection, possibly because of the increased uptake of Tc-99m MDP related to reactive changes in bone due to infection and hyperemia. Tc-99m-HMPAO-labeled WBC scintigraphy was superior to bone scintigraphy in delineation of the extent and the limits of the infectious process in the orbita. Tc-99m-HMPAO-labeled WBC scintigraphy is appropriate in the investigation of such infectious lesions, leading to early diagnosis and therapy to avoid severe complications.

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