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CASE REPORT

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Single photon emission computed tomography (SPECT) in the diagnosis of orbital cavernous hemangioma

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Summary

Background: Cavernous hemangiomas are among the most common benign neoplasms observed in the eye socket, making up 3–7% of all pathological orbital masses. Scintigraphy using ^{99m}Tc-labeled red blood cells is the currently approved method regarding liver hemangiomas. The aim of this study was to ascertain whether the application of single photon emission computed tomography (SPECT) with ^{99m}Tc-labeled RBCs is as useful in orbital hemangioma diagnostics as in evaluating liver hemangiomas.

Case Report: SPECT diagnostics of the facial skeleton using ^{99m}Tc–labeled RBCs was carried out in two patients suspected of orbital hemangiomas. The erythrocytes were labeled by an *in vivo* method; 20 mCi (700 MBq) of ^{99}mTc-pertechnetate was injected 20 minutes after intravenous application of pyrophosphate. SPECT of the facial skeleton with a one-head gamma camera was initiated 10 minutes after administering the radioisotope.

Conclusions: SPECT with application of ^{99m}Tc-labeled RBCs might be a useful supplementary examination to US, CT, or MRI, especially with the use of fusion techniques (SPECT/MRI, SPECT/CT) in suspected orbital hemangiomas.

Key words: hemangiomas • SPECT • fusion

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Background

Cavernous hemangiomas are among the most common benign neoplasms observed in the eye socket and make up 3–7% of all pathological orbital masses [1–4]. Changes of this type appear during the third to fifth decades of life, more often in women [3,5]. The typical location is the muscular conus, often lateral to the optic nerve [1–3]. Scintigraphy using ^{99m}Tc-labeled red blood cells (RBCs) is currently the approved method regarding liver hemangiomas (specificity: 100%, sensitivity: 94%) [3]. The aim of our study was to determine whether the application of SPECT with ^{99m}Tc-labeled RBCs in the diagnostics of orbital hemangiomas is as useful as in liver hemangioma evaluation.

Material and Methods

SPECT diagnostics of the facial skeleton using ^{99m}Tc-labeled red blood cells was carried out in two patients suspected of orbital hemangiomas. Erythrocyte labeling was performed by an *in vivo* method in which 20 mCi (700 MBq) of ^{99m}Tc-pertechnetate was injected 20 minutes after intra-

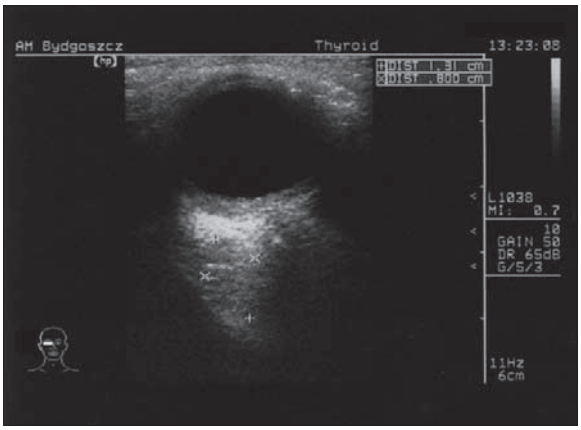

Figure 1. US of the right orbit. There is a visible hyperechogenic area marked with obelisks, size: 13×8 mm, in the lateral part of the orbital conus (angioma?).

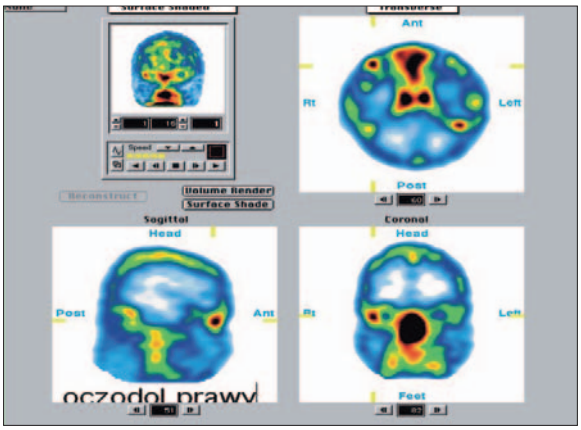

Figure 2. Single photon emission tomography (SPECT) of the facial skeleton after ^{99m}Tc-labeled erythrocyte application. There is a visible focus of tracer accumulation in lateral part of the right orbital conus, which is the location of the suspected hemangioma.

venous application of pyrophosphate. SPECT of the facial skeleton with a one-head gamma camera was initiated 10 minutes after application of the radioisotope. Fusion of SPECT/MRI by means of OSIRIS software was performed. The technical data of the gamma camera were rectangular crystal: glass, sight vision of crystal set at 39×53, crystal set diagonally at 65, amount of photoprinters: 59. A low-energy high-resolution collimator was applied. Time of the projections was 30 second, number of projections 64, and head turn 360 degrees. Acquisition was performed with a matrix of 128×128 pixels and an FBP (filtered back projection) with a Butterworth 0.40–0.45 filter was applied.

Case 1

A 19-year-old man was referred to the Ophthalmology Department because of right eye retinitis and neuritis of the optic nerve. During examination, the patient reported pain while looking at a computer terminal with concurrent headaches. Changes in the bottom of the right eye were detected in ophthalmologic examination: a choked disc of the optic nerve with obliterated borders, raised above the bottom level, retina swelling around the disc, arteries with

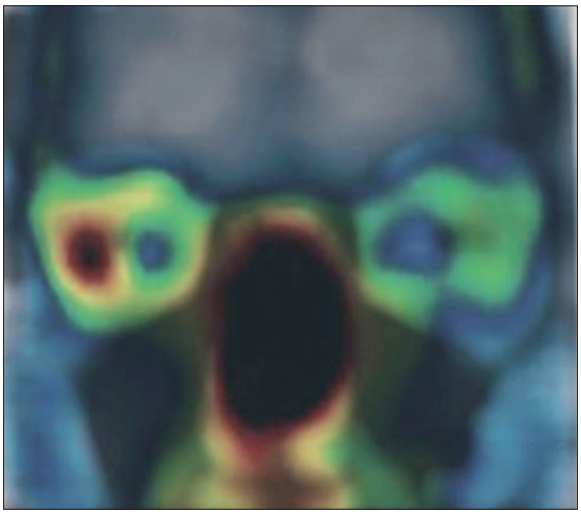

Figure 3. SPECT/MR fusion. Increased accumulation of erythrocytes in the lateral part of the right orbit.

increased halo, and crooked and brimful veins. A hyperechogenic space 13 mm x 8 mm in size was demonstrated in the lateral part of the right orbital conus during ultrasonography examination of the orbit (Figure 1). The patient was referred to magnetic resonance imaging (MRI) of the head and orbits because of suspected orbital hemangioma. Focal changes of pathological signal intensity were displayed neither in the area of the brain nor in the right eye socket. A focus of increased erythrocyte accumulation at the site of the suspected hemangioma was determined in the external part of the right orbit by SPECT with labeled RBCs. The size of this focus was around 15 mm (Figure 2). Fusion of the SPECT/MRI images was done in order to locate the change more exactly (Figure 3).

Case 2

A 38-year-old man was referred to the Ophthalmology Department because of slight exophthalmus of the left eye. The patient had had partial resection of the thyroid because of Graves' disease three years before. L-thyroxin was currently prescribed. Changes were not found except for exophthalmus on ophthalmologic examination. Endocrinological consultation showed that the clinical and laboratory results represented euthyreosis (maintenance treatment: L-T_4). Other ophthalmological causes should be excluded before inclusion of glycocorticosteroids. A hyperechogenic, slightly separated lesion was confirmed during ultrasonography of the orbits in the upper part of the left orbital conus, at least 10×7 mm in size. A single vein with slow flux was located in its anterior-medial part (Figure 4). An area of 8×5 mm was also observed laterally and in the upper part of the conus in MRI examination, with increased signal, adjacent to wall of the left orbit and in the area of lateral-straight muscle attachment. A hyperdense lesion at this location was also determined in CT (Figure 5). ^{99m}Tc-SPECT with labeled red blood cells of the facial skeleton was performed because of suspected hemangioma in US and MRI and the focus of increased erythrocyte accumulation in the upper part of the left orbit, at the site of the suspected hemangioma (Figure 6). Finally, fusion of SPECT/MRI results was conducted (Figure 7).

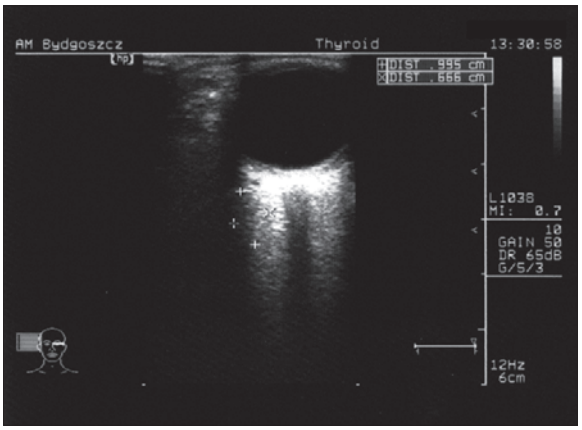

Figure 4. US of the left orbit. Hyperechogenic lesion, 10×7 mm, marked with obelisks, slightly separated from the surroundings, located medially in the left orbit (hemangioma?)

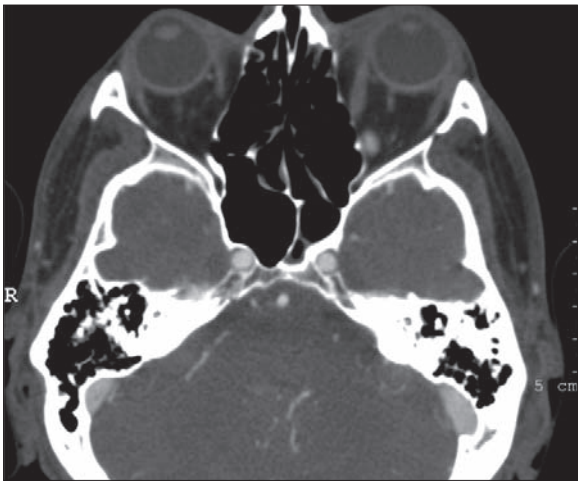

Figure 5. CT of the orbit. Lesion of hyperdensity, size: 8×5 mm, was affirmed in the upper-medial part of the left orbit after contrast medium application.

Discussion

Cavernous hemangiomas are among the most common local benign tumors in adults. They can be situated in various parts of the orbit, but they frequently occur within the retrobulbar muscle cone [1,2,4]. The hemangiomas manifest as painless, slowly progressive, one-sided eyelid prolapse. Deterioration of acute sight, double vision, decreased field of vision, together with dysfunction of the muscles connected to eyeball movements might result from pressure on the inner orbital elements by the developing lesions. The encysted character of hemangiomas prevents the infiltration of neighboring structures [3].

US, CT, and MRI are radiological methods that allow differentiation of lesions in the orbit [1,2]. Pathological masses are characterized by heterogenous echogenicity, connected with various acoustic shades caused by calcinations in US examinations [1]. Tumor vascularization can be found in US examination with the power-Doppler option. CT and MRI precisely define the shape, size, and also the anatomical relationships of lesions; however, the degree of vascularization is not satisfactorily specified [3]. Hemangiomas have a characteristic image in CT examination: clear, smooth, well-defined borders of ovoid or lobular structure [1,6]. Hemangiomas have characteristic signals in T1- and T2-dependent images in MRI examination. They are isointensive to muscles in T1-dependent images and hyperintensive to muscles in T2-dependent images [1,2,3,7,8]. Hemangiomas are not observed during the first 1-2 minutes after contrast application because the blood flow through the lesion is slow, uniform, and independent of the blood system [2,9].

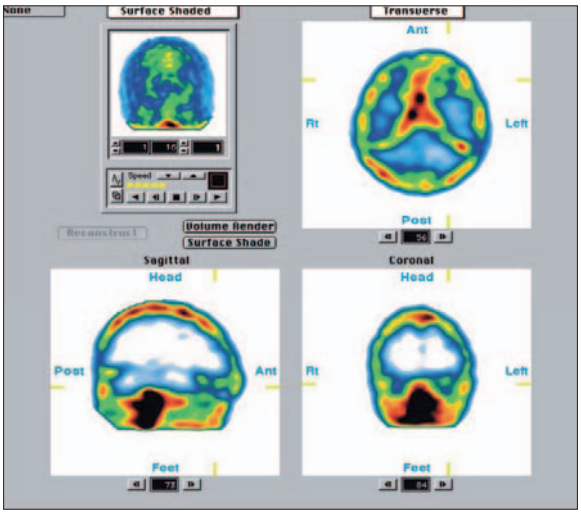

Figure 6. Single photon emission tomography (SPECT) of the facial skeleton after ^{99m}Tc-labeled erythrocytes. There is a visible focus of tracer accumulation in the upper part of the left orbital conus at the site of the suspected hemangioma.

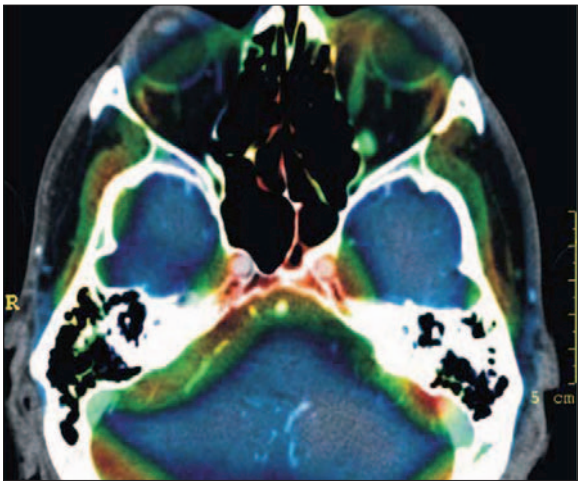

Figure 7. SPECT/MR fusion. Increased accumulation of labeled erythrocytes in the upper-medial part of the left orbit.

Liver hemangiomas are usually observed by means of ^{99m}Tc scintigraphy with labeled RBCs [1,2,10–12]. This non-invasive method can also be useful in the diagnostics of changes located extrahepatically, such as hemangiomas of the head and neck, of soft tissues in children, and of the spleen and eye socket [1–3,13–16]. ^{99m}Tc-labeled RBC scintigraphy is safe, relatively inexpensive, easy to perform, and extremely accurate [2,3]. The sensitivity and specificity of ^{99m}Tc RBC

scintigraphy increased after the SPECT technique was implemented [2]. Typical scans describing hemangiomas introduce hypoperfusion in the early phase of the examination together with hyperperfusion in scans in the late phase of examination. This phenomenon is explained by slow mixing of ^{99m}Tc-labeled and unlabeled RBCs in the hemangioma [1].

We believe that SPECT imaging is a highly useful method in the diagnostics of cavernous hemangiomas of the orbit considering the relatively small dimensions of these lesions and the close proximity of physiological vascular structures (the lacunar sinus, among others).

Conclusions

SPECT after application of ^{99m}Tc-labeled RBCs might be a useful supplementary examination to US, CT, or MRI, especially with the use of fusion techniques (SPECT/MRI, SPECT/CT) in suspected orbital hemangiomas.

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