

# False-Positive Iodine-131 Whole Body Scintigraphy Due to the Chronic Cerebral Infarction in a Patient with Papillary Thyroid Carcinoma

## Papiller Tiroid Kanseri Bir Olguda Kronik Serebral İnfarktüse Bağlı Yanlış Pozitif İyot-131 Tüm Vücut Tarama Sintigrafisi

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**ABSTRACT** Accurate interpretation of I-131 whole body scintigraphy is extremely important for the appropriate management of thyroid cancer patients. Because false-positive images mimicking metastases may be seen in the I-131 scans. In this report, a case of chronic cerebral infarction as a novel cause of false-positive I-131 scan was presented. A 64-year-old woman with papillary thyroid carcinoma, who had surgery and I-131 ablation therapy, an I-131 whole body scintigraphy showed increased I-131 uptake in the left frontoparietal region of the head. However, laboratory tests and Tc-99m MDP bone scintigraphy did not indicate metastatic disease. Cranial CT showed an encephalomalacia and gliosis in the left frontoparietal region due to the chronic cerebral infarction. When the results of these studies were evaluated together, it was concluded that an increased I-131 activity in the left frontoparietal region of the head could be a false-positive image due to the chronic cerebral infarction.

**Key Words:** Radionuclide imaging; iodine radioisotopes; thyroid neoplasms; cerebral infarction

**ÖZET** İyi diferansiyel tiroid kanserli hastaların takibinde yaygın olarak kullanılan I-131 tüm vücut tarama çalışmasının görüntülerinin doğru yorumlanması büyük önem taşır. Çünkü, I-131 sintigrafisinde metastazı taklit eden yanlış pozitif görüntüler ortaya çıkabilmektedir. Bu makalede, I-131 tüm vücut tarama çalışmasında yanlış pozitifliğe yol açan yeni bir neden olarak kronik serebral infarktüs bulunan bir olgu sunulmaktadır. Opere edilmiş ve I-131 ablasyon tedavisi almış papiller tiroid kanserli 64 yaşındaki kadın hastaya yapılan kontrol I-131 tüm vücut tarama çalışmasında, kraniumda solda frontoparietal bölgede artmış I-131 tutulumu izlendi. Laboratuvar testleri ve Tc-99m MDP kemik sintigrafisinde metastazı düşündürür bulgu saptanmadı. Kranial BT'de solda frontoparietal bölgede kronik infarktüse bağlı ensefalomalazi ve gliosis gözlemlendi. Tüm incelemelerin sonuçları birlikte değerlendirildiğinde, kraniumda solda frontoparietal bölgede izlenen aktivite artışının beyin veya kemik metastazına bağlı olmayıp, kronik serebral infarktüsün neden olduğu yanlış pozitif görüntü olduğu sonucuna varıldı.

**Anahtar Kelimeler:** Radyonüklit görüntüleme; İyot radyoizotopları; tiroid tümörleri; serebral infarktüs

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Papillary thyroid cancer is the most common type of thyroid malignancy with slow course and good prognosis. It usually remains intrathyroidal and tends to metastasize locally to regional lymph nodes. Distant metastases are uncommon, they occur in 4-15% of thyroid cancer patients and they are associated with poor prognosis. The lung and bone are the common distant metastatic sites of this cancer. Brain metastasis is very rare, it has been detected only 0.4-1.2% of patients with papillary thyroid carcinoma, but it behaves more aggressively and increases the risk of mortality significantly.<sup>1,2</sup>

Iodine-131 (I-131) whole body scintigraphy is a valuable and commonly used method in the detection of distant metastases in well-differentiated thyroid carcinoma (papillary and follicular) patients.<sup>2-4</sup> However, an

increased uptake of I-131 outside the normal physiological sites does not always indicate metastatic disease. A variety of reasons such as artefacts, anatomical or physiological variants, contamination of body secretions, inflammation/infection, and non-thyroidal diseases may also account for some of these foci of radioiodine uptake. Accurate determination of these false-positive images is very important because they can lead to further unnecessary tests and therapies.<sup>1-3,5</sup>

The various causes have been reported as responsible for the false-positive I-131 scans mimicking metastases,<sup>1,3,5-16</sup> however, as far as we know, chronic cerebral infarction has not been reported as a reason of false-positivity until now. According to our knowledge, this is the first report to present a false-positive I-131 scan due to a chronic cerebral infarction mimicking brain or skull metastasis in a patient with well-differentiated thyroid carcinoma.

## CASE REPORT

A 64-year-old woman with papillary thyroid carcinoma had surgery followed by radioablation with 1850 MBq of I-131. Six months after the ablation, control I-131 whole body scan was performed. For this aim 185 MBq I-131 was administered orally and 24 and 96 hours later anterior and posterior whole body images and static images were recorded using a dual head gamma camera (E-Cam, Siemens, Germany) with high energy collimator. In the scan, was no abnormal I-131 uptake observed (Figure 1). At the time of the I-131 scintigraphy, when the patient had already stopped thyroxine for 4 weeks, the serum thyroglobulin level was 0.2 ng/mL (normal range: 0-75 ng/mL), the serum anti-thyroglobulin level was 20 ng/mL (normal range: 0-100 ng/mL), and the serum TSH was 38.82  $\mu$ UI/mL (normal range: 0.30-5  $\mu$ UI/mL). Since the results of I-131 scan, serum thyroglobulin and serum anti-thyroglobulin were normal, TSH suppression therapy was restarted and the patient was given an appointment for control in one year.

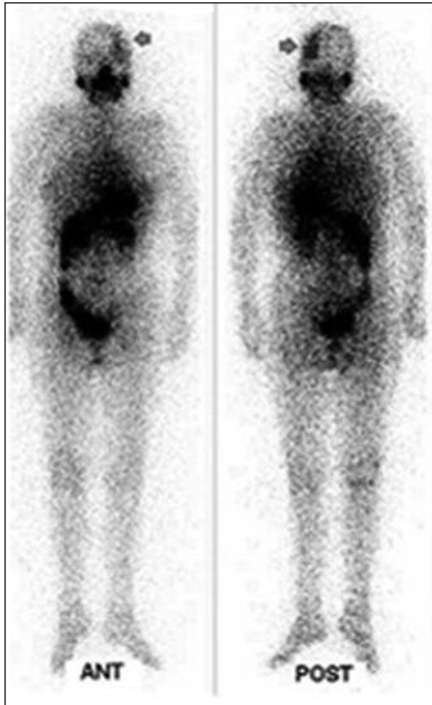
Five months later, she was hospitalized because of aphasia and right hemiparesis. A cranial computerized tomography (CT) demonstrated an area of acute cerebral infarction in the left frontoparietal



**FIGURE 1:** Six months after the ablation, normal physiologic I-131 uptake sites (salivary glands, bowel, bladder, etc.) were seen in the anterior and posterior I-131 whole body images. Pathologic I-131 uptake was not observed throughout the body.

region. Subsequently, the patient was treated medically and was discharged from the hospital.

One year after that, the patient came to the hospital and whole body scan with I-131 was performed. Anterior and posterior whole body images and static images were obtained 24 and 96 hours after the administration of a diagnostic dose (185 MBq) of I-131, using a dual head gamma camera (E-Cam, Siemens, Germany) with high energy collimator. These images revealed that there was an increased activity at the left frontoparietal region of the head (Figure 2) while no abnormal I-131 uptake had been observed in the previous scans of the patient. An increased I-131 uptake on the head persisted 120 hours after administration of I-131, although the patient was requested to wash her head frequently. For this reason, the possibility of skin-hair contamination was excluded. There was no pathological I-131 uptake in other parts of the body. At that time, when the patient had stopped thyroxine for 4 weeks, the serum thyroglobulin



**FIGURE 2:** One year later, anterior and posterior I-131 whole body images demonstrated an increased activity in the left frontoparietal region of the head in addition to normal physiologic uptake sites of I-131.

level was 0.2 ng/mL, the serum anti-thyroglobulin level was 20 ng/mL, and the serum TSH was 48.09  $\mu$ UI/mL.

When laboratory tests did not indicate metastatic disease, bone scintigraphy and cranial CT were carried out in order not to miss any brain or bone metastasis.

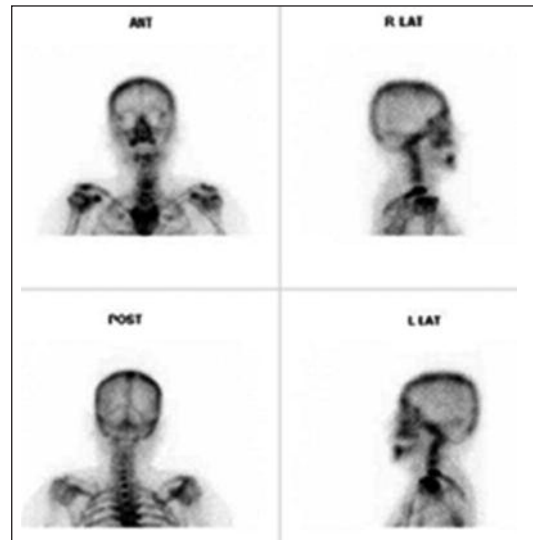
Whole body bone scan was performed 3 hours after an intravenous injection of 740 MBq of Tc-99m methylene diphosphonate (MDP) (Mallinckrodt Inc, USA) using dual head gamma camera (E-Cam, Siemens, Germany) equipped low energy-all purpose collimator. Anterior, posterior whole body and static images showed no cranial abnormality (Figure 3).

Cranial CT did not show any cerebral or skull metastasis. It revealed an encephalomalacia and gliosis in the left frontoparietal region due to the chronic infarction (Figure 4).

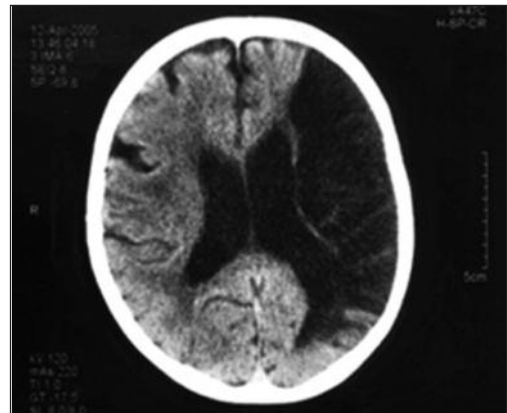
When results of laboratory tests, I-131 whole body scan, bone scan and cranial CT were analyzed together, it was concluded that an increased I-131 activity on the head could be a false-positive image due to the chronic cerebral infarction.

## DISCUSSION

In several well-differentiated thyroid carcinoma patients, false-positive I-131 whole body scans mimicking brain or skull metastases have been reported. Most of these false-positive images can arise from skin, hair, and head dress contaminations caused by radioactive saliva, nasal secretions, and sweat which are secreted by the organs that are capable of uptake and excretion of I-131.<sup>1,13</sup> The other cause is the physiological uptake sites of I-131. Lacrimal glands, nasal mucosa and salivary glands are frequently seen on I-131 scans as part of the normal physiologic metabolism of I-131. However, they may sometimes cause diagnostic confusion, especially in the presence of asymmetrical uptake.<sup>1,14</sup>



**FIGURE 3:** Tc-99m MDP bone scan revealed no abnormality on the cranium.



**FIGURE 4:** Cranial CT showed an encephalomalacia and gliosis in the left frontoparietal region due to the chronic infarction.

Inflammation, sterile (traumatic, autoimmune, ischemic) or infectious, is another reason that can cause false-positive I-131 scans in the region of head. Skin burns, dental disease/peridontal surgery, chronic sinusitis, dacryocystitis, scalp folliculitis, sialoadenitis, frontal sinus mucocele, infected sebaceous cyst, etc. were reported lesions mimicking thyroid cancer metastasis. The uptake mechanism of I-131 at the sites of inflammation and infection is thought to be due to increased perfusion caused by vasodilation and increased capillary permeability.<sup>1,7,12,15</sup> Non-thyroidal neoplasms such as meningioma, salivary gland adenocarcinoma, and teratoma can also cause false-positive I-131 images. The I-131 uptake mechanism in these tumors is uncertain but may be secondary to the increased perfusion and capillary permeability related to inflammatory response associated tumors. The other possible mechanism is that many of the tumors, such as salivary gland adenocarcinoma, teratomas including salivary and similar tissues, are derived from epithelia which show normal physiological iodide transport, thus they become visible in the I-131 scan.<sup>1</sup>

Another situations that cause false-positive scans mimicking brain or skull metastasis are porencephaly and post-traumatic cerebral malacia. The cause of iodine uptake in these regions is unexplained but it may

be related to ongoing chronic inflammation at that site.<sup>3,6,8</sup> Additionally, subdural hematoma is reported the source of false-positive scan that the uptake mechanism of I-131 was uncertain. It may be depending on the radioiodine accumulation in the subdural membrane or the hematoma.<sup>5</sup>

In our case study, we report a chronic cerebral infarction as a novel cause of false-positive I-131 whole body scintigraphy in a patient with papillary thyroid carcinoma. We could not fully explain the uptake mechanism of I-131 in the field of chronic cerebral infarction, however, we thought that it might have been due to the ongoing chronic inflammation in the chronic infarct area of the cerebrum. Because, it is known that acute inflammation is found in the 1<sup>st</sup> day of cerebral infarct area, and after 3 days the acute inflammatory response is gradually replaced by chronic inflammation which might persist up long years.<sup>17,18</sup>

In conclusion, while assessing I-131 whole body scans in patients with well-differentiated thyroid carcinoma, false-positive images owing to a unusual but possible causes such as chronic cerebral infarction should also be considered. The patient history, laboratory findings should be taken into account and if necessary, further studies should be performed for an accurate evaluation of scintigraphic studies.

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