Iodine-131 MIBG Scintigraphy in Pediatric Neuroblastoma: Three Illustrative Cases

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Abstract

This retrospective report describes three pediatric neuroblastoma cases evaluated with iodine-131-labelled metaiodobenzylguanidine (MIBG) scintigraphy. Planar imaging was performed in all three patients, with additional SPECT/CT in two. In Case 1, a 3-year-old boy had a biopsy-confirmed right adrenal neuroblastoma and distant osseous lesions; a bone-lesion biopsy confirmed metastatic disease. In Case 2, an 11-year-old girl undergoing follow-up had a non-MIBG-avid retroperitoneal lesion and new right adrenal uptake suspicious for recurrence, prompting a decision for further surgery. In Case 3, an 11-year-old girl previously treated for high-risk neuroblastoma had no pathological MIBG uptake, with a reported SIOPEN score of 0. Discontinuation of metronomic chemotherapy was reported after this assessment. These cases illustrate the contribution of MIBG imaging to disease localization and follow-up. A negative MIBG scan describes scintigraphic findings and should be interpreted with anatomical imaging and bone marrow assessment when determining overall response.

Keywords: Neuroblastoma; MIBG scintigraphy; Pediatric oncology; Tumor staging; Metastasis detection

Introduction

Neuroblastoma is a pediatric malignancy arising from neural crest cells of the sympathetic nervous system. Its clinical behavior ranges from localized disease to disseminated, high-risk disease [1]. MIBG scintigraphy contributes to disease localization and assessment of skeletal involvement alongside anatomical imaging [2, 3]. This report describes three pediatric cases investigated with iodine-131 MIBG scintigraphy for initial staging or follow-up.

Materials and Methods

This retrospective three-case report was conducted at the Department of Nuclear Medicine, CHU Hassan II, Fez, Morocco. Iodine-131-labelled MIBG was used because iodine-123-labelled MIBG was reported to be unavailable locally. Planar imaging was acquired at 24, 48 and 72 hours after intravenous injection; SPECT/CT at 48 hours was additionally performed in two patients. The reported preparation included Lugol's iodine before injection for thyroid blockade and laxatives for bowel clearance. Clinical and imaging findings were reviewed from the medical records.

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Case 1

A 3-year-old boy from a non-consanguineous marriage, with no significant medical history, presented with three months of diffuse abdominal pain. The pain had worsened over the preceding month and was accompanied by abdominal distension. Ultrasound and CT demonstrated a large right adrenal retroperitoneal mass with regular contours, heterogeneous density, necrosis, calcifications and progressive heterogeneous enhancement. It measured 10 × 7.9 × 11 cm (transverse × anteroposterior × height).

The mass displaced the liver, with loss of the fat plane at segment I, and displaced the kidney while retaining a regular interface with its upper pole. It compressed the patent inferior vena cava and contacted the right diaphragmatic pillar with loss of the fat plane. It remained separate from the aorta and right paravertebral space. Biopsy confirmed neuroblastoma, and the patient was referred for staging.

MIBG scintigraphy demonstrated uptake in the known right adrenal tumor and distant osseous foci in the cranial vault, left fronto-orbital region and right mandibular region. Biopsy of a bone lesion confirmed metastasis. The patient was classified as stage IV and started systemic chemotherapy. The scintigraphic findings are shown in Figure 1.

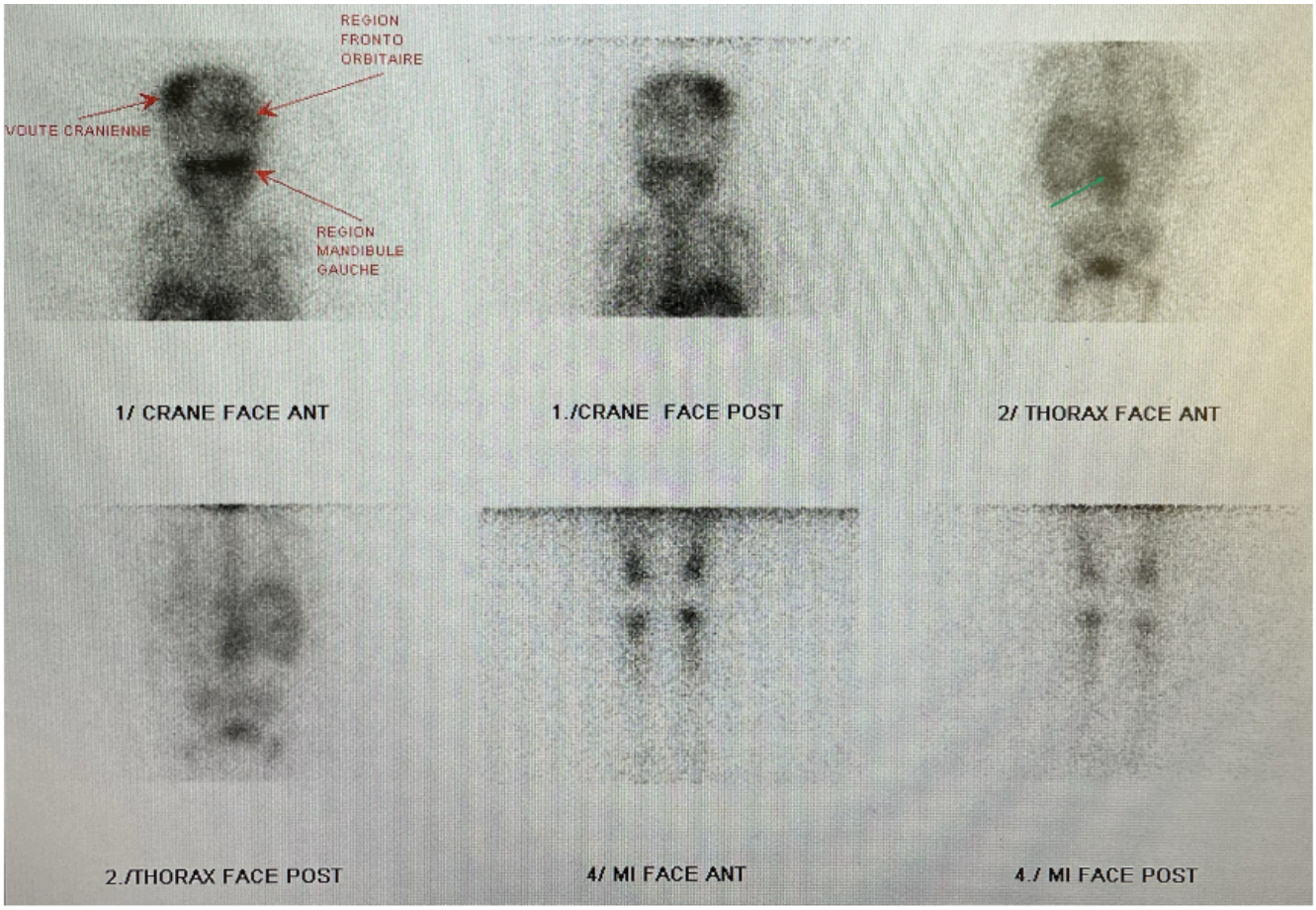


Figure 1. Case 1: static MIBG scintigraphy showing uptake in the right suprarenal primary tumor (green arrow) and osseous lesions (red arrows). Original image annotations are retained.

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Case 2

An 11-year-old girl had been diagnosed at 4 years and 7 months with retroperitoneal and thoracic neuroblastoma, classified as stage IV because of bone and bone marrow metastases. She was treated according to a multicenter high-risk neuroblastoma trial protocol. Initial management included incomplete resection of the retroperitoneal mass, followed by chemotherapy and external radiotherapy. The retroperitoneal mass persisted. Cis-retinoic acid was discontinued after three cycles because of adverse effects.

A stable 19 mm retroperitoneal mass prompted a transition to metronomic chemotherapy. After multiple cycles, CT continued to show a stable mass without new suspicious abnormalities. The retroperitoneal surgical-site lesion showed no MIBG uptake. New right adrenal uptake was considered suspicious for recurrence and prompted a decision for further surgical intervention. Planar and SPECT/CT findings are shown in Figures 2 and 3.

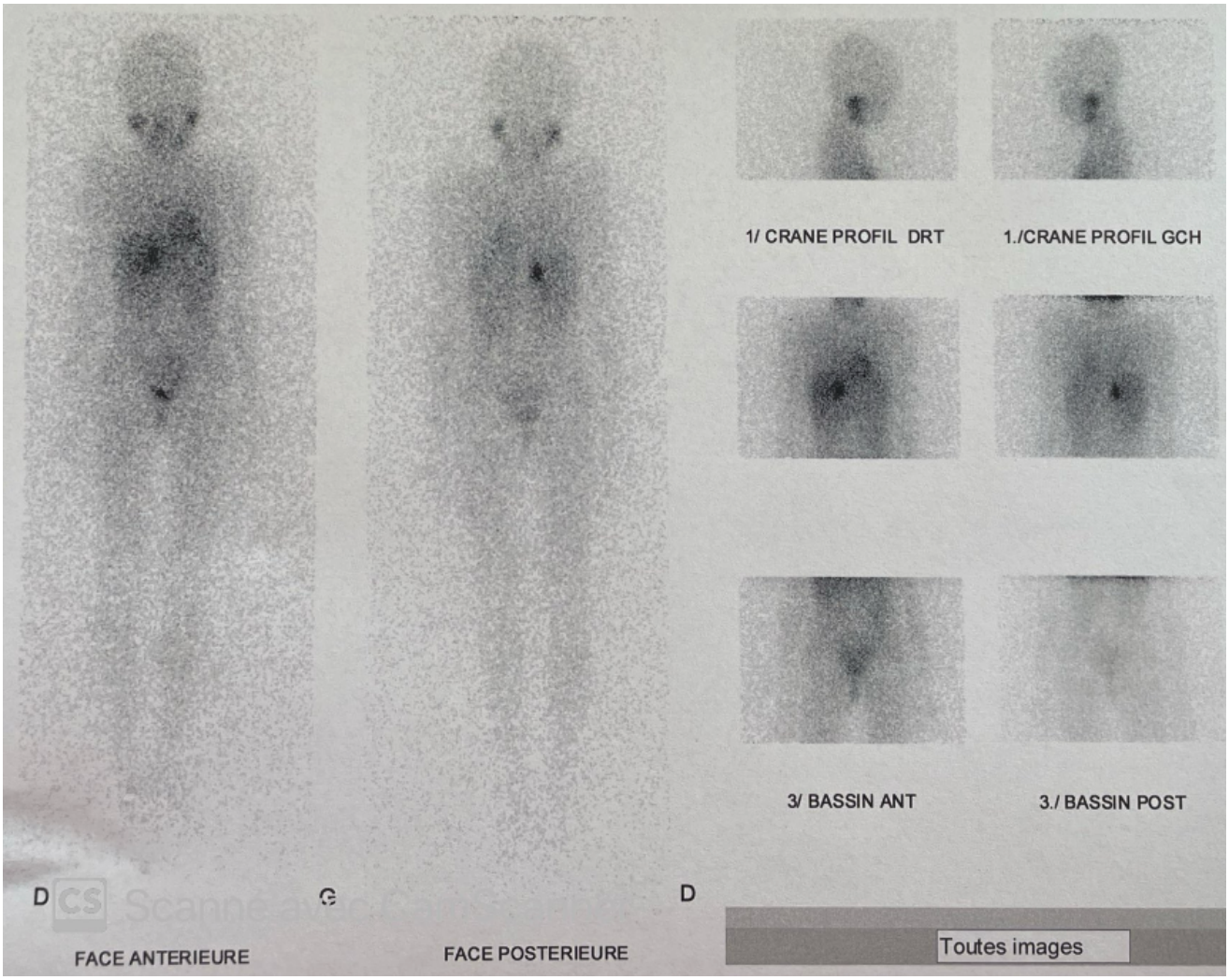


Figure 2. Case 2: whole-body and static MIBG acquisitions in anterior and posterior projections at 24 hours. Complementary SPECT/CT is shown in Figure 3.

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Case 2 Imaging and Case 3

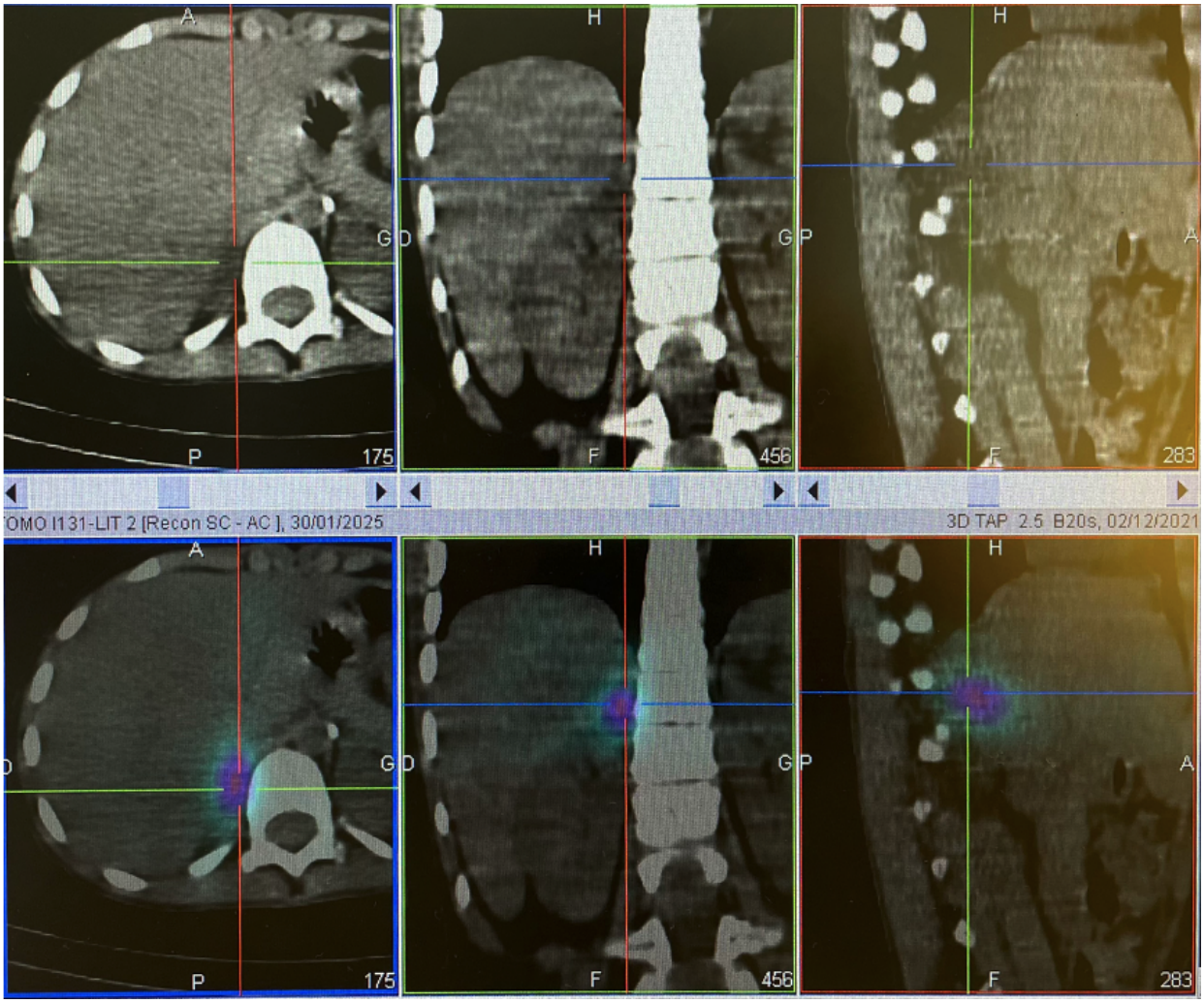


Figure 3. Case 2: complementary MIBG SPECT/CT showing right adrenal uptake considered suspicious for recurrence. The finding prompted a decision for further surgery.

Case 3

An 11-year-old girl with no notable medical history presented with worsening right flank pain and vomiting. She was diagnosed with right adrenal neuroblastoma, classified as stage IV high-risk disease because of bone and bone marrow metastases. CT demonstrated the right adrenal tumor. Bone scintigraphy revealed lesions in the right humeral head, described as osteolytic secondary lesions in the clinical account.

Initial treatment followed a multimodal high-risk protocol and included tumor resection. Persistent bone marrow involvement led to palliative metronomic chemotherapy. Follow-up MIBG scintigraphy showed no pathological uptake, with a reported SIOPEN score of 0. The treating team subsequently discontinued metronomic chemotherapy. The follow-up images are shown in Figures 4 and 5.

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Case 3 Follow-up Imaging

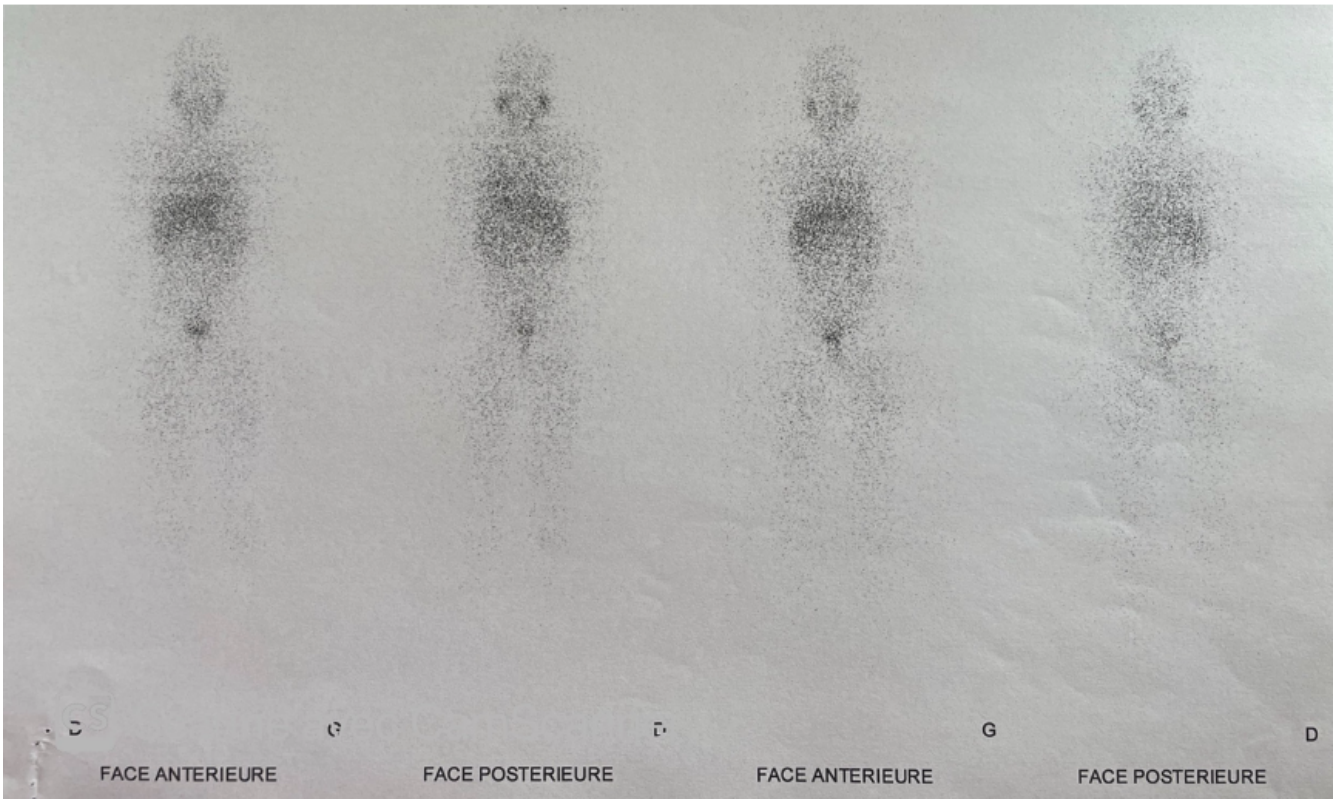


Figure 4. Case 3: whole-body MIBG scintigraphy at 24 and 48 hours. No pathological uptake was reported, with a SIOPEN score of 0.

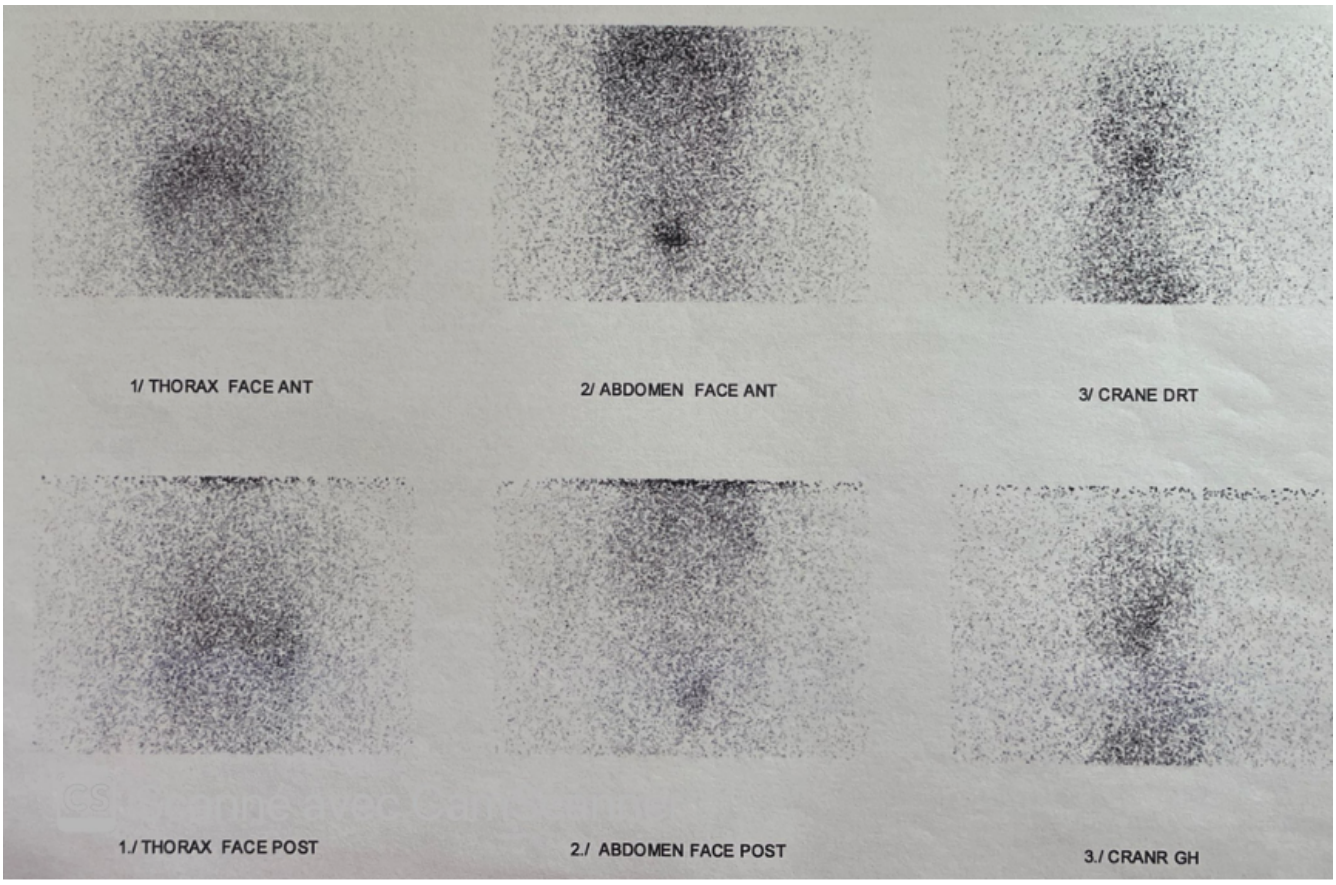


Figure 5. Case 3: static MIBG acquisitions at 24 hours. No pathological uptake was reported. The negative scintigraphic findings alone do not establish complete overall remission.

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Discussion

The three cases illustrate different uses of MIBG scintigraphy: demonstration of osseous metastatic disease in Case 1, detection of new adrenal uptake suspicious for recurrence in Case 2, and absence of pathological uptake on follow-up in Case 3. In Case 1, the reported biopsy was of a bone lesion; this finding is described as osseous metastasis rather than automatically equated with diffuse bone marrow involvement. MIBG findings contribute to assessment of disease extent alongside anatomical imaging [2, 3]. The revised International Neuroblastoma Response Criteria integrate the primary tumor, soft-tissue and bone metastases, and bone marrow [4]. Consequently, the negative MIBG scan and SIOPEN score of 0 in Case 3 describe the scintigraphic assessment without establishing complete overall remission by themselves. The reported treatment decision is retained as part of the clinical course. This descriptive series does not establish comparative diagnostic accuracy or improved survival.

Conclusion

In these three cases, iodine-131 MIBG scintigraphy provided information on disease distribution and follow-up. Scintigraphic findings should be distinguished from the overall response assessment, which integrates anatomical imaging and bone marrow findings. No comparative diagnostic-accuracy or outcome benefit is inferred from this three-case series.

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Conflict of Interest

The authors declare that there were no conflicts of interest within the meaning of the recommendations of the International Committee of Medical Journal Editors when the article was written.

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