

Evaluation of therapy response using sequential xSPECT Quant in a child with a mediastinal neuroblastoma

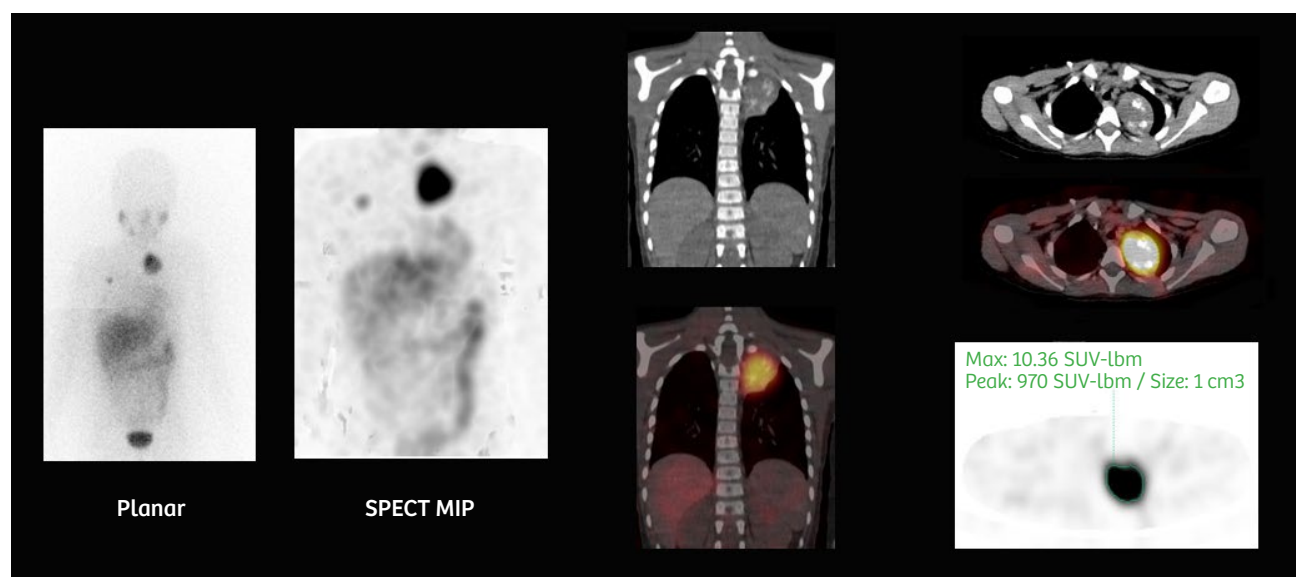
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Data courtesy of Centre Hospitalier Universitaire Vaudois, Lausanne, Switzerland

History

A 7-year-old girl was diagnosed in October 2016, with stage IV mediastinal neuroblastoma with osteo-medullary bone infiltration. During the first year following diagnosis, the patient underwent different chemotherapy regimens and received treatment according to protocol NRNBL 1.7/SIOPEN (November 2016-January 2017) and TVD followed by TOTEM (February 2017-December 2017).

A follow-up MIBG scintigraphy (December 2017; images not shown) exhibited positive response to chemotherapy and displayed a decrease in the tracer uptake and number of bone lesions. However, there was persistent uptake in the left upper thoracic-paravertebral mass.

Subsequent treatment included the administration of 6.9 GBq of Iodine-131 (^{131}I) MIBG (January 2018-February 2018), followed by stem cell reinfusion (February 2018). A follow-up Iodine-123 (^{123}I) MIBG scintigraphy was performed in March 2018, with SPECT/CT using a Symbia Intevo™ with xSPECT Quant™ (the first xSPECT acquisition) for absolute quantification of ^{123}I MIBG uptake. An intravenous injection of 111.6 MBq of ^{123}I MIBG (patient weight 48.5 lb/22 kg) was administered for a whole-body planar and SPECT/CT acquisition of the thorax and abdomen, performed 24 hours post injection. An initial CT was performed (80 kV, 30 eff mAs, 16 x 1.2 mm collimation), followed by a SPECT acquisition at 30 stops with 30 seconds per stop; the study was reconstructed with xSPECT Quant.



- 1 Whole-body planar, SPECT/CT, and xSPECT Quant images (acquired in March 2018, one month after the administration of a large-dose ^{131}I MIBG therapy) show high uptake in the left upper-mediastinal mass, which demonstrates significant areas of focal calcification on CT that are often associated with neuroblastoma lesions. The SUV_{max} was 10.36 with a small focal area of uptake in the right chest region that is related to uptake in the chemotherapy port attached to the chest wall.

Findings

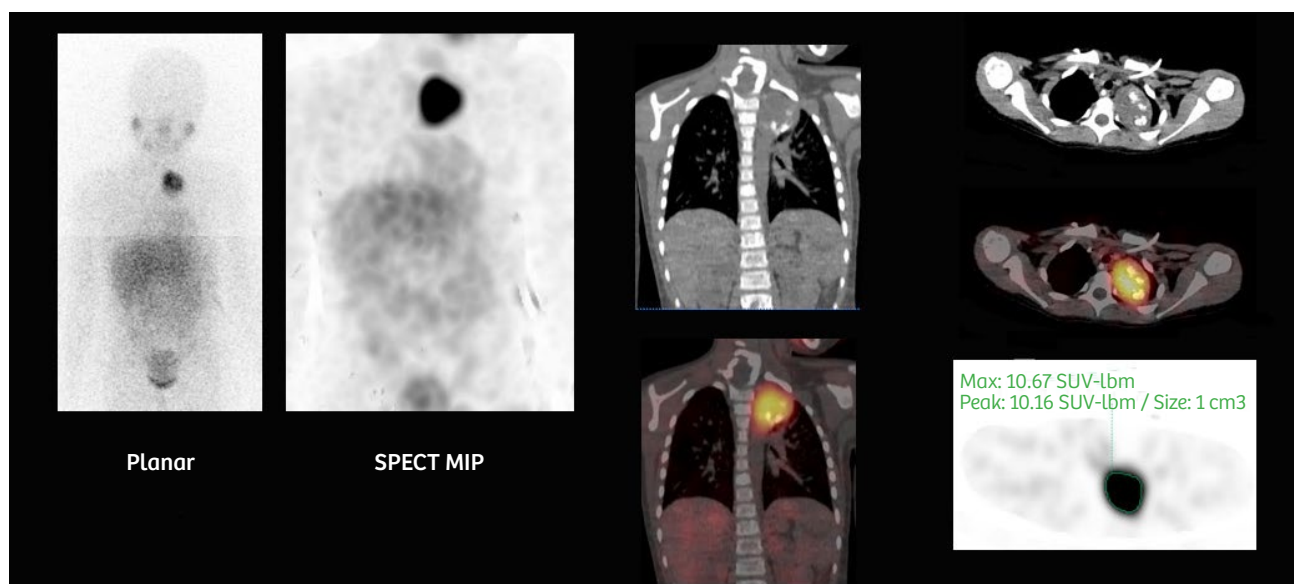
Compared to the initial ^{123}I MIBG scintigraphy (December 2017), the follow-up ^{123}I MIBG SPECT/CT (March 2018)—performed one month after 6.9 GBq ^{131}I MIBG therapy—showed decreased uptake in the 5th rib bone lesion and stable uptake in the mediastinal lesion, without any new bone uptake on visual

assessment. The SUV_{max} values obtained from the xSPECT Quant study provided a quantitative benchmark for subsequent evaluation of the MIBG-avid thoracic lesion.

The patient underwent a new cycle of high-dose chemotherapy with Busilvex®/melphalan (April 2018),

followed by autologous stem-cell reinfusion that same month.

A follow-up ^{123}I MIBG SPECT/CT study with xSPECT Quant was performed in May 2018, (the second xSPECT acquisition) using a similar injected dose with the same acquisition parameters as the initial xSPECT Quant study.

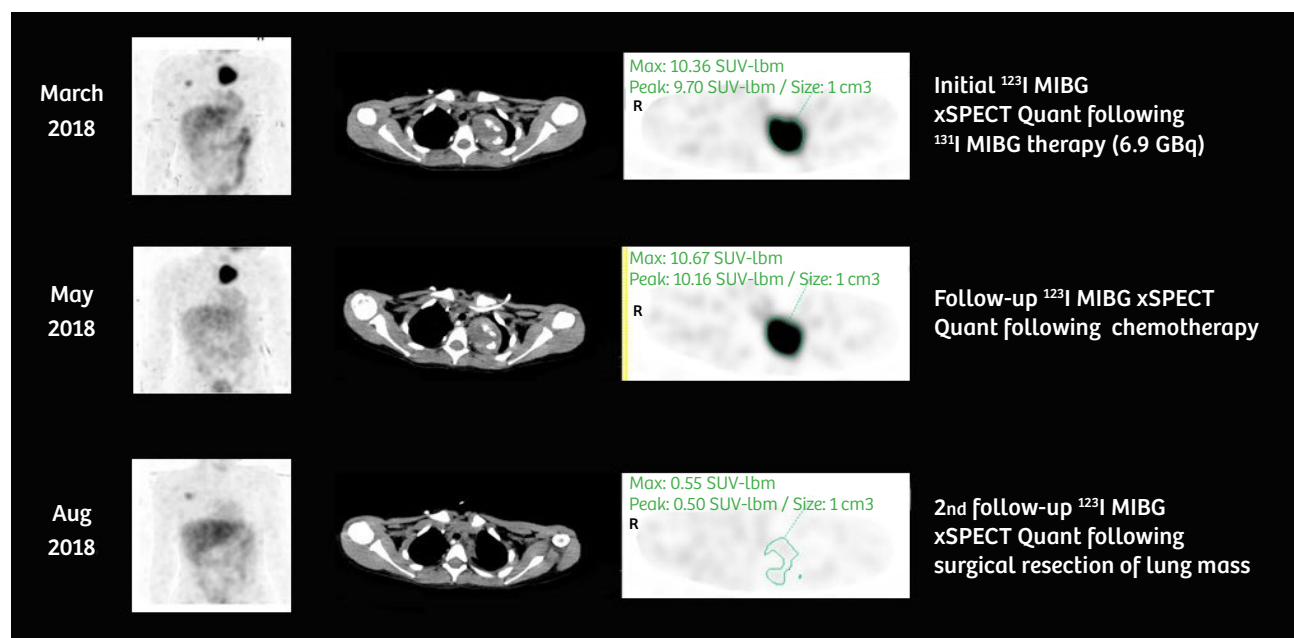


- 2 The second follow-up ^{123}I MIBG SPECT/CT study with xSPECT Quant, performed in May 2018, shows relatively stable size and intensity of uptake in the left-upper mediastinal mass without any new functioning lesions.

As noted in Figure 2, the second follow-up ^{123}I MIBG SPECT/CT study showed mediastinal lesion stability based on both visual and quantitative assessment (SUV_{max} : 10.67 versus 10.36 g/ml). In the absence of progression, the patient

underwent surgical resection of the left superior mediastinal tumoral mass (June 2018). Post-surgery thoracoabdominal MRI (July 2018) showed no residual lesion in the resection site, which was filled by a loculated pleural effusion. A follow-up

^{123}I MIBG SPECT/CT study (August 2018, the third xSPECT acquisition) confirmed the absence of tracer uptake in the resection site with minimal postoperative remodeling. No new suspicious lesions were detected on the whole-body images.



- 3 SPECT maximum intensity projection (MIP), CT, and xSPECT Quant images of the sequential SPECT/CT studies show stable uptake intensity and SUV_{max} between the studies performed in March and May 2018. A post-surgical resection ¹²³I MIBG SPECT/CT study, performed in August 2018, shows complete removal of the functioning thoracic mass without any residual and no new metastases.

Comments

In this case, the visual impression between the sequential ¹²³I MIBG SPECT/CT studies performed in March 2018 and May 2018 suggested an absence of any significant change in tumor size and intensity of uptake. However, the SUV_{max} values provided quantitative confirmation of the stable nature of the mediastinal lesion, which did not decrease in size or uptake intensity despite the high-dose ¹³¹I MIBG therapy and additional chemotherapy. In view of the absence of new metastases and the relatively stable volume and functioning tumor burden of the

mediastinal lesion, which was quantitatively evaluated by sequential xSPECT Quant, the decision for surgical removal of the tumor was adopted. Post-surgery scintigraphy shows positive results with a complete removal of the functioning tumor mass and an absence of new metastases as well as post-operative fibrosis.

Conclusion

This case demonstrates the value of xSPECT Quant to act as a precise and objective tool for evaluating neuroblastoma patients—allowing

for the assessment of tumoral activity on baseline MIBG scintigraphy, chemotherapy, or metabolic radiotherapy response, as well as remission after surgical treatment. Accurate knowledge of tracer uptake can guide a successful therapeutic plan by helping establish an appropriate treatment modality dependent on tumoral-activity evolution.

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Examination protocol

Scanner: Symbia Intevo

SPECT		CT	
Injected dose	¹²³ I MIBG 111.6 MBq	Tube voltage	80 kV
Scan delay	No delay	Tube current	30 eff mAs
Scan acquisition	Whole-body	Slice collimation	16 x 1.2 mm

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