Sympathetic Ganglia are More Frequently Visualized on ^{68}Ga-Dotatate Total-Body PET/CT Imaging

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Introduction

- ^{68}Ga-Dotatate uptake has been described in the stellate (cervico-thoracic) sympathetic ganglia[1]. The uptake is usually faint, more commonly encountered on the left side compared to the right side. However, Dotatate uptake and the relative frequency of visualization, and uptake intensity in other sympathetic ganglia was not previously reported.
- New long axial field-of-view PET/CT scanners significantly boost image quality and lead to visualization of new findings.
- In this work, we describe the frequency of visualization and uptake intensity of sympathetic ganglia on total-body EXPLORER scans comparted to a standard conventional scanner.

Methods and Materials

- A total of **27 patients** (19 women, 8 men, mean age 59.4±14.3) were included.
- The 27 patients underwent **88 scans (44 scans on each scanner**; **EXPLORER and GE690**) on different visits along their course of follow-up.
- Scans were randomly and independently evaluated.
- Three pairs of sympathetic ganglia were qualitatively evaluated (stellate, celiac, and sacral) for each scan (total: **264 sites**).
- SUVmax was measured for any visualized ganglion. Background was measured on ascending aorta blood pool (BP) and the ganglia SUVmax ratio to BP was considered as the target-to-background ratio (**TBR**).

Results

- The injected dose was slightly higher for the scans performed on GE690 (193.3±10.8 vs. 181.3±21.3). No differences were seen regarding uptake time.
- The overall frequency of ganglia visualization was significantly higher on the EXPLORER compared to GE690 **(Table 1 & Chart 1)**.
- On EXPLORER images, 109 ganglia out of 264 sites (41%) were visualized compared to 53 (20%) on GE690 images ($P < 0.001$).
- The difference was still highly significant on site-basis for stellate (n= 72 vs. 38) and celiac (n = 24 vs. 2) but not for sacral ganglia (13 ganglia for each) **(Figures 1 & 2).**
- The overall TBR for all detected ganglia was significantly higher on EXPLORER compared to GE690 (2.1±1.2 vs. 1.7±1.0; $P = 0.002$).
- When detected bilaterally, left stellate ganglion was more intense compared to the right side on EXPLORER and on GE690. However, when the left stellate ganglion was seen on both scanners (n = 25, **Chart 1**), TBR on the EXPLORER was significantly higher (2.6±1.5 vs. 1.6±1.1 on GE690; P <0.001).

Site	EXPLORER			GE690		
	N (%)*	SUVmax	TBR	N (%)*	SUVmax	TBR
Stellate Ganglion						
Left	39 (89%)	3.2±1.2	2.3±1.3	27 (61%)	1.8±0.7	1.6±1.1
Right	33 (75%)	2.8±1.1	2.1±1.2	11 (25%)	1.6±0.5	1.8±1.0
Celiac Ganglion						
Left	8 (18%)	3.1±0.9	2.6±1.2	1 (2%)	3.1	3.7
Right	16 (36%)	3.1±1.1	1.8±0.8	1 (2%)	2.2	1.1
Sacral Ganglion						
Left	7 (16%)	2.0±0.8	1.3±0.3	5 (11%)	1.5±0.3	1.4±0.4
Right	6 (14%)	1.9±0.5	1.3±0.2	8 (18%)	2.1±0.4	1.8±1.1
Total (n=264)**	109 (41%)	2.9±1.1	2.1±1.2	53 (20%)	1.8±0.6	1.7±1.0

Table 1. Analysis of the 6 investigated sympathetic ganglia, according to frequency of visualization, SUVmax, and target-to-background ratio (TBR) on EXPLORER and GE690 scanners.

*Percentages are given in respect to the 44 scans
**6 ganglia x 44 studies on each scanner = 264

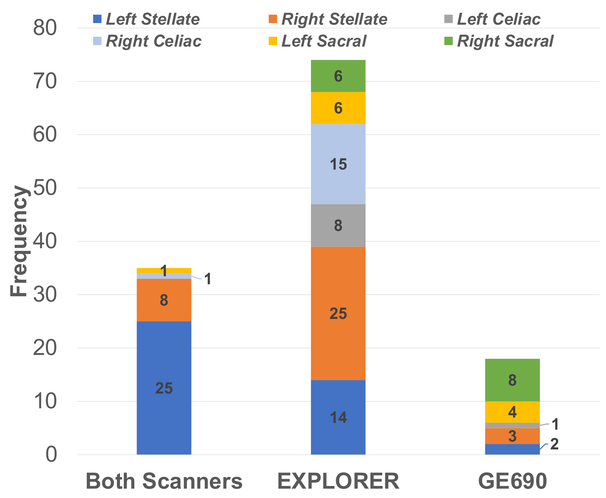

Chart 1. Frequency and distribution of ganglia visualized on EXPLORER alone, GE690 alone, and on both scanners

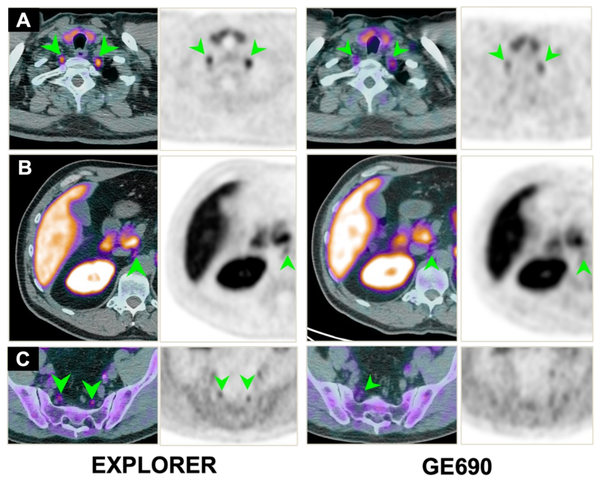

Figure 1. A 59-year-old man with metastatic small bowel neuroendocrine tumor. EXPLORER and GE690 PET/CT images revealed clear visualization of stellate ganglia bilateral (A), while the right celiac ganglia is well-visualized on EXPLORER (B) compared to very faint uptake on conventional scanner (B). The presacral ganglia at S1 are almost only visualized on EXPLORER (C).

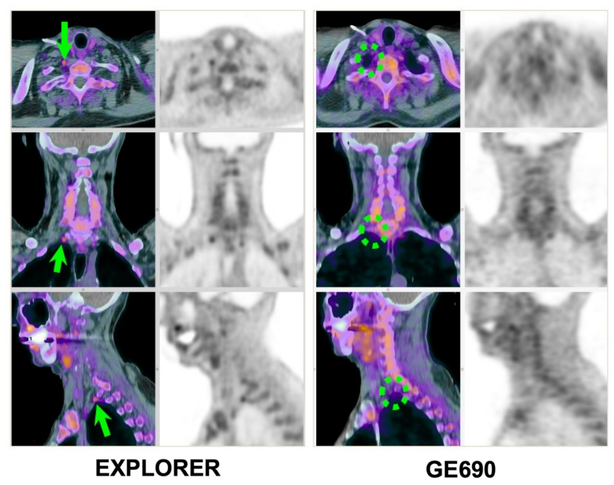

Figure 2. A 68-year-old man with gastric neuroendocrine tumor. EXPLORER and GE690 PET/CT images revealed clear visualization of the right stellate ganglia on EXPLORER images (arrow), while it is not visualized on the GE690 (dashed circle).

Discussion/Conclusions

- The described 6 pairs of sympathetic ganglia are anatomically close to structures that could be involved in various neuroendocrine tumors (e.g., paragangliomas, lymph nodes, … etc.)[2]
- Though physiologic, ^{68}Ga-dotataate tracer uptake in these ganglia could be more frequent and more intense on the new high-performance long axial field-of-view PET scanner, when compared to a standard conventional scanner.
- The described uptake should not be mistaken for a pathology and further investigations in this regard may not be necessary, unless supported by other suspicious findings.

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References

1. Berg Z, Koppula BR. 68Ga-DOTATATE Uptake by Cervicothoracic (Stellate) Ganglia. Clin Nucl Med. 2019;44:810–1.
2. Marcer N, Bergmann M, Klie A, Moor B, Djonov V. An anatomical investigation of the cervicothoracic ganglion. Clin Anat. 2012;25:444–51.