Although this case highlights the challenges with functional imaging and reports on a novel surgical hip joint-preserving technique.

### Clinical Case

1. A 43-year-old man was referred to Endocrinology clinic for evaluation of recurrent fractures and hypophosphatemia. His first stress fracture in left ankle was diagnosed at age 41, treated conservatively.

2. Few weeks after first fracture, he experienced musculoskeletal pain in several locations. Bone scan revealed multiple foci of increased tracer uptake in bilateral ribs, hips and lower extremities. Lower extremity MRI showed stress fractures in left fibula, fifth metatarsal and right tibia.

3. During initial evaluation at Penn Bone Center, he was noted to have hypophosphatemia with elevated phosphate excretion in urine and elevated FGF23 (table below) concerning for TIO. The patient was started on calcium and phosphate supplementation.

4. PET/CT 68Ga-DOTATATE showed multiple somatostatin avid lesions concerning for metastatic disease (Fig 1). However, after re-review with radiology, multiple areas of increased uptake were considered to be due to fractures and left acetabular lesion was presumed to be tumor of interest given remarkably higher SUVmax (SUVMAX 20 vs 4-5).

5. The patient underwent complete tumor resection using a novel hip joint-preserving technique (Figure 2). Pathology demonstrated 1.4cm phosphaturic mesenchymal tumor with uninvolved margins (Figure 3).

6. FGF23 normalized within 24 hours after surgery (127 RU/mL) and calcitriol and phosphate supplements were stopped on post-operative day 10.

### Laboratory Evaluation

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<th>Albumin</th>
<th>PO4</th>
<th>ALP</th>
<th>IPTH</th>
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<th>1,25(OH)D</th>
<th>FGF23</th>
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### Discussion

- Phosphorus is a critical element in skeletal development, bone mineralization, cellular signaling and membrane composition. FGF23 in one of the main regulators of phosphate homeostasis.

- TIO is a rare paraneoplastic syndrome commonly caused by phosphaturic mesenchymal tumors that secrete FGF23. FGF23 decreases expression of NaPi IIa/IIc co-transporters in renal brush border membrane leading to increased renal phosphate excretion. FGF23 also affects vitamin D metabolism reducing intestinal absorption of phosphate.

- Once the diagnosis of TIO is suspected, the tumor is localized by anatomical or functional imaging. Phosphaturic mesenchymal tumors have increased expression of somatostatin receptor 2A, which can be identified using radio-labelled somatostatin analogues such as 68Ga. Therefore, 68Ga-DOTATATE scan is currently the first imaging modality of choice.

- Although 68Ga-DOTATATE PET/CT scan is a sensitive and specific technique, other pathologic processes such as fractures could also demonstrate high uptake of radiotracer due to increased osteoelastic activity and high somatostatin receptor expression. Our patient was initially thought to have multiple avid lesions concerning for metastatic disease, but culprit lesion was differentiated based on SUVs and eventually confirmed with biopsy.

- Clinical and biochemical abnormalities resolved after surgical resection. To our knowledge, this the first report that describes complete surgical resection using a hip joint-preserving technique. Early recognition of culprit lesion in TIO is crucial, as successful surgery is curative and would lead to significant improvement in the quality of life of patients.

### References