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CT and MRI of Pancreatic Neuroendocrine Tumors Reveal More Than Just a Round, Enhancing Mass: Associations Between "Atypical" Imaging Features

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BACKGROUND: Pancreatic neuroendocrine tumors (NET) are classically considered round, homogeneously hyperenhancing lesions. "Atypical" features are increasingly appreciated in the literature. The goal was to determine the associations between enhancement patterns and other qualitative features of the tumor.

METHODS: This single institution retrospective study was populated using a surgical database of resected tumors. Patients with preoperative CT/MRI were included and images reviewed for qualitative features. Enhancement of the solid portion of the tumors was assessed for homo- or heterogenous enhancement. Degree of enhancement relative to the pancreas was characterized as hyper, hypo, or isoenhancing. For multiphase exams, progressive enhancement was assessed. Tumor contour was categorized as round, lobulated, or ill-defined. Calcifications and cystic components within the tumor were recorded. Secondary findings such as infiltration into adjacent structures, ductal dilatation, tumor thrombus, vascular occlusion, and upstream atrophy were assessed. Chi-square/Fisher's exact tests were performed to evaluate for associations.

RESULTS: Most tumors (n=72/131) were hyperenhancing and compared to hypo or isoenhancing tumors were less likely to be infiltrative (7% vs 38.5% vs 24.2%,

p<0.001) and demonstrate vascular occlusion (6.9% vs 30.8% vs 21.2%, p<0.008). Hypoenhancing tumors (n=26/131) were more likely to show heterogeneous enhancement than hyper or isoenhancing tumors (84.6% vs 53.5% vs 53.6%, p=0.016). Homogeneously enhancing tumors were associated with round contours (60% vs 42.9%, p=0.004). Heterogeneously enhancing tumors (n=77/127) were more likely to show hypoenhancement (29.3% vs 8%,p=0.016), progressive enhancement (39.4% vs 4.4%,p<0.001), lobulated contour (53.2% vs 26%, p=0.004), calcifications (29.4% vs 4.7%, p=0.001), cystic components (36.4% vs 14%, p=0.006), tumor thrombus (9.2% vs 0%, p=0.041) and vascular occlusion (22.4% vs 8%,p=0.034) than homogenously enhancing tumors.

CONCLUSION: Heterogeneous enhancement in pancreatic NET is common and is associated with other “atypical” features such as hypoenhancement, progressive enhancement, lobulated contours, calcifications, cystic components, tumor thrombus, and vascular occlusion.