Purpose/Objectives
Local recurrence is common in locally advanced head and neck cancer after definitive chemo-radiation (CRT). PET-CT use in post-treatment assessment and surveillance of patients with locally advanced head and neck cancer has increased, however, false positivity in post-treatment PET-CT can occur leading to needless intervention. We sought to evaluate pre and post-treatment PET-CT of patients treated with definitive CRT to identify metabolic response patterns that could predict recurrence.

Methods/Materials
We retrospectively reviewed 23 patients with squamous cell carcinoma of the following sites: nasopharynx (5), oropharynx (14), larynx (2), hypopharynx (1), and nasal sinus(1); stage IIB (1), III (7) and IV (15). Patients were treated between January 2008 to December 2009 at University of Pittsburgh Cancer Institute. Seven female, and 16 male with median age of 52 years (36-75) received concurrent chemoradiation to a total of 74Gy (69.9-74), and had PET-CT for treatment planning. Post-treatment, patients were followed with PET-CT and routine clinical follow-up. PET-CT was usually performed at 2, 5, 8, 11 and 14 months after treatment according to our institutional guidelines. All failures were confirmed either pathologically or by clinical evidence during physical examination. For the analysis of the post-treatment scans, we used the MIM Maestro (MIM Software Inc, Cleveland, OH). Target volumes were defined based on GTV delineation from CT, and F18-fluorodeoxyglucose (FDG) uptake in pre-treatment scans using the PET edge, MIM Software, a gradient based method. PET edge was also used on follow-up scans with grossly visible tumors and was defined based on CT/CT deformable registration for tumors with low uptake for analysis of primary and lymph node tumors. We analyzed 66 target volumes over 81 scans. The SUV\textsubscript{max} (based on lean body mass), and % SUV\textsubscript{max} change for each lesion was calculated, from the pre-treatment PET-CT to the subsequent scans performed at median time of 2.0, 5.4, and 9.4 months.

Results
The median follow-up was 24.7 months (3.6-33.6). Two patients (8.6%) had loco-regional recurrences, 1 also had concomitant distant failure. Five patients (21.7%) had only distant failure. The median time for loco-regional recurrences, and distant failures were 6 and 10.1 months, respectively. Overall, the average SUV\textsubscript{max} pre-treatment for primary tumors was 7.0 which reduced over subsequent scans to 2.7, 3.1, and 2.5, corresponding to a SUV\textsubscript{max} reduction of 56, 50, and 58%, respectively.

Results (cont.)
For patients without recurrence (NED) the average SUV\textsubscript{max} pre-treatment was 6.2, with a respective SUV\textsubscript{max} reduction of 53.7, 50.7, and 60.8 %. For patients with loco-regional recurrence, the average SUV\textsubscript{max} pre-treatment was higher than NED patients (7.8), with a respective lower SUV\textsubscript{max} reduction of 39.3, 17 and 16.7% compared to NED patients. For lymph node status, overall the average SUV\textsubscript{max} was 6.38 pre-treatment reducing over subsequent scans to 1.6, 1.8 and 1.9, representing a SUV\textsubscript{max} reduction of 70.4, 67.6 and 71.4%, respectively. For the NED patients, the lymph node average SUV\textsubscript{max} pre-treatment was 6.4 with a respective SUV\textsubscript{max} reduction of 70.1, 67.8 and 71.4%. There was only 1 patient with lymph node recurrences detected on first post-treatment PET-CT. The average SUV\textsubscript{max} pre-treatment was 6.27 with a SUV\textsubscript{max} reduction of 71.4%.

Conclusions
The loco-regional recurrences for locally advanced head and neck cancer patients treated with definitive CRT was low in our cohort. Patients that demonstrated a SUV\textsubscript{max} reduction of less than 40% at the 8-weeks post-treatment PET-CT were more likely to fail locally and may benefit from earlier pathological confirmation and salvage strategies.