Purpose:
Quantitative analysis of dynamic contrast-enhanced (DCE)-MRI data is becoming increasingly utilized in early phase clinical trials as a means of assessing therapy response. The aim of this study was to characterize the effect of vascular through-plane blood flow on the quantification of DCE-MRI data in salivary glands and nodal tumors of the head and neck.

Methods:
Patients (n=8) were imaged using an axial 3D FSPGR sequence that acquired a frame every 6.4s. Gd-DTPA was administered (0.1mmol/kg) using a power injector. Pharmacokinetic parameter (Ktrans, kep, vp) maps derived from non-linear fits of the general kinetic model were calculated using various vascular input functions (VIFs) calculated from pixels selected by an automatic detection algorithm in either an internal jugular vein or carotid artery. Only VIFs for which 90% or more of the vessel's area was selected by the algorithm were considered. One-way analysis of variance (ANOVA) was performed and coefficients of variation (CVs) calculated for all pixels in each of the submandibular/parotid glands and nodal disease sites for individual patient maps calculated from each VIF.

Results:
One-way ANOVA results showed that kinetic parameter VOI averages for all sets of VIFs across axial slices were not equivalent ($p<<0.001$). CVs ranged from 15% to 70% and 11% to 127% for all kinetic parameters calculated using the jugular vein and carotid artery, respectively. Of the 20 slices, 11±2 slices in the imaging volume were above selection threshold for arterial defined VIFs compared with 14±3 slices using a jugular-derived VIF.

Conclusion:
Flow effects produced substantially more variation in DCE-MRI imaging biomarker measures when using arterial input functions to calculate pharmacokinetic parameters as opposed to venous-derived. Choosing a VIF defined in the jugular vein 2-3 slices below the volume's center provides reproducible results over several slices in this patient population.