Purpose: To compare the dose to critical structures using HDR brachytherapy versus IMRT in pediatric tumors.

Method: Two sarcoma cases, for which both HDR and IMRT could be options, were selected for this case study. Case 1 targeted a volume on the posterior neck/upper back with an HDR prescription of 600cGy x 5 fractions, 3000cGy total. The IMRT prescription used was 180cGy x 25 fractions, 4500cGy total with a boost of 180cGy x 6 fractions, 1080cGy. The IMRT PTV used was a 0.5cm expansion of the HDR PTV; the boost PTV was identical to the HDR treatment plan. Case 2 targeted a volume on the palate of the mouth with an HDR prescription of 300cGy x 12 fractions, 3600cGy total. The IMRT prescription used was 180cGy x 28 fractions, 5040cGy total. A 0.5cm expansion of the HDR PTV was used for the IMRT PTV. In both cases, for both HDR and IMRT, at least 95% of the PTV received 100% prescription dose, following Children's Oncology Group protocols.

Results: Case 1: the mean doses to the body, brachial plexus, esophagus, spinal cord and thyroid were higher using IMRT than HDR. Integral dose was 6.6 times higher using IMRT than HDR. Case 2: the mean doses to the body, mandible, and parotids were higher using IMRT than HDR. Integral dose was 2.9 times higher using IMRT than HDR.

Conclusion: This study shows the potential benefit of treating with HDR compared to IMRT in select pediatric cases. These results suggest that HDR can be superior to IMRT in the sparing of critical structures and in delivering less integral dose to the patient while still achieving adequate target coverage. However, lower mean doses to critical structures must also be weighed against the possibility of complications from HDR's very high hotspots.