

institutions prior to repeated SRS at our facility. Eight patients had undergone embolization prior to initiation of repeated stereotactic radiosurgery, but no embolizations were performed during the latency period between repeated stereotactic radiosurgeries.

Patients were treated with 6 MV (with a mini-multileaf collimator) or 10 MV (with circular collimators) LINAC stereotactic radiosurgery (LINAC SRS) or GKSRS. Calculated volumes were determined from the treatment plans. The median single dose prescribed to the selected isodose surface was 1000 cGy (range: 800–2000 cGy). Radiosurgery was delivered at approximately 2–3 year intervals (median treatment interval: 30 mo, range: 21–52 mo). LINAC SRS was initially available and used for treatment in all of the cases until 2003. A total of 32 fractions were delivered at our institution, and 30 of these treatments were delivered with LINAC SRS. GKSRS was employed in 2 patients, once partial obliteration occurred. Responses were grossly assessed by gadolinium enhanced and T2-weighted brain MRIs at 6-month intervals. Enhancement within the AVM nidus was used as a surrogate representing nidus reduction. When a maximal response was achieved on the basis of MRI, patients were assessed angiographically to determine obliteration.

**Results:** The complete obliteration rate was 25%. The median number of radiosurgery treatments was 3 (2 treatments: n=4; 3 treatments: n=6; 4 treatments: n=2). Median reduction in AVM volume was 64%. Treatment complications included persistent headaches (n=2) and partial seizure (n=1). There were no episodes of post-treatment hemorrhage, although pre-treatment hemorrhages had occurred (n=6). No statistical differences were noted between the obliterated and partially obliterated group in the mean pre-treatment volume, mean follow-up time, total delivered dose, mean dose per fraction, median number of fractions, or mean interval between treatment fractions.

**Conclusions:** Repeated stereotactic radiosurgery is a feasible and safe method of treating large AVMs and can result in complete obliteration. Additional follow-up of our cohort will be necessary to determine the final complete obliteration rate, but these early results are encouraging for an otherwise intractable problem.

### 181 Secondary and Tertiary Irradiation of Pre-irradiated Hips to Prevent Heterotopic Ossification Following Repeated Hip Arthroplasty

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**Purpose/Objective:** Pre- and postoperative radiotherapy (RT) after total hip arthroplasty (THA) is a standardized, well accepted treatment for specific risk groups to prevent heterotopic ossification (HO) about the hip joint. Nevertheless, it is not established, how to treat patients after a second or third operation of the same pre-irradiated hip site. Thus, the aim of our study was to analyze the outcome of all patients and hips which had received a second or third irradiation to the same hip joint after repeated surgery and prior irradiation.

**Materials/Methods:** Over a period of 12 years (1990 to 2002) a total of 2.120 hips have been irradiated using pre- and postoperative (OP) RT for patients at various risks to develop heterotopic ossification (HO) after hip surgery. Of those, 151 hips received a second and 19 hips a third time prophylactic RT. The mean age of the 104 males and 66 females was 68 (48 to 82) years. Reasons for a secondary or tertiary RT were as follows: Loosening of the femoral component (n = 74), loosening of the acetabular component (n = 41) or both components (n = 11), local infection or trauma (n = 5) or hip functional impairment due to HO formation (n = 39) of Brooker grade II (12), grade III (15) or grade IV (12). Our risk adapted RT concept for secondary or tertiary treatment was 1 × 7 Gy preoperative RT for hips without HO or HO grade I to II (group A), 1 × 7 Gy postoperative RT for hips with HO grade III to IV (group B), and 3 × 3,5Gy postoperative RT after failing previous RT of 1 × 7 Gy (group C). Progression of HO was scored based on a comparison of HO seen on immediate post-OP radiographs compared to 12-months FU radiographs. Assessment of hip function was performed using the Harris Score.

**Results:** The second or third hip surgery was usually more complex and time-consuming than the first procedure. Prophylactic RT was well tolerated without any increased acute or delayed radiogenic toxicity. The highest cumulative hip dose achieved was 27.5Gy. Mean follow-up (FU) was 48 months: at 12 months FU, 21 of 170 (12.4%) hips had developed new or progressive HO about the irradiated hip (radiological failure), 12 (7%) hips had progressed by 1 Brooker grade, 6 (3.5%) hips by 2 grades and 3 (1.8%) hips by 3 Brooker grades. Patients with previous Brooker grade II had a low HO relapse rate (1 of 12; 8%) as compared to those with previous Brooker grade III and IV HO who had the highest HO progression rate: 5 of 15 (33%) with Brooker grade III and 3 of 6 (50%) with Brooker grade IV HO; 2 of 5 (40%) hips with local trauma or infection had recurrent HO; in contrast, patients with loose THA components had a comparably low HO progression rate: 10 / 132 (7.6%). Males encountered a higher HO failure rate (17 / =16.3%) than females (4 / = 6%) (p < 0.05). In addition, in univariate analysis, Brooker grade (p < 0.01) and previous HO were prognostically significant factors for outcome.

**Conclusions:** Pre- and postoperative RT applied in risk-adapted RT concepts provide excellent radiological and functional results and produce no increased acute or delayed radiogenic toxicity. Improved RT concepts are required for patients with pre-existing HO Brooker grade III to IV, e.g. by adding systemic NSAID.

### 182 Prospective Study of Predictive Factors of Outcome of Radiotherapy of Benign Disease: Painful Heel Spurs, Epicondylopathy, Periarthritis Humeroscapularis

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**Purpose/Objective:** Radiation therapy (RT) is increasingly offered to patients (pts) with painful heel spurs (HS), epicondylopathy (EP) and periarthritis humeroscapularis (PHS) because of patients convenience and low cost. Predictive factors of outcome and correlation of physicians and patients pain rating were studied prospectively.

**Materials/Methods:** From Jan. to Oct. 2004, 32 shoulders with PHS (32 pts), 29 elbows with EP (25 pts) and 32 HS (29 pts) were treated with electrons or photons of adequate energy with 1 Gy, 2–3 times weekly, total dose 6 Gy (ICRU 50).