

## **Efficacy and Safety of Pediatric MR-guided Musculoskeletal Interventions: A Multicenter Analysis of 200 cases**

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### **Background and Purpose**

The growing field of pediatric interventional radiology represents a tremendous benefit for the diagnosis and treatment of a variety of musculoskeletal conditions of children and adolescents. X-ray fluoroscopic and computed tomography (CT) guidance are frequently used; however, the procedure-related exposure to ionizing radiation raises health concerns. The ALARA (as low as reasonable achievable) practice mandate urges interventionalists to use as little ionizing radiation as possible. Because of the absence of ionizing radiation, interventional magnetic resonance (MR) imaging superbly complies with the ALARA practice mandate, however very little data exist about the efficacy and safety of pediatric MR-guided musculoskeletal procedures. Therefore, we analyzed the technical efficacy and safety of MR-guided percutaneous musculoskeletal procedures in children and adolescents.

### **Materials and Methods**

This retrospective analysis included three academic centers. Procedures were determined by searching the hospital information systems. Search criteria included the specific descriptor for the interventional MRI systems, age younger than 18 years, and the procedure codes for interventional MR imaging. The search derived 200 procedures, which were performed in 171 subjects (91 girls and 80 boys; median age, 14 years; range, 1-17 years). Procedures were performed with 0.2-Tesla (39/200, 19.5%), 0.23-Tesla (51/200, 25.5%) and 1.5-T (110/200, 55%) MR imaging systems. Procedures were evaluated for a.) procedure type, b.) type of anesthesia, c.) technical success, defined as adequate drug delivery on post-procedural MR imaging, acquisition of an adequate tissue sample for diagnosis at pathologic analysis, or successful percutaneous therapy of an osseous condition confirmed during follow-up, d.) length of time of procedures, and e.) major complications, defined according to American College of Radiology guidelines.

### **Results**

The 200 procedures consisted of 113 (56.5%) targeted drug delivery [sacroiliac joint (35, 17.5%), epidural space (26, 13%), temporomandibular joint (24, 12%), spinal nerve (11, 5.5%), facet joint (6, 3%), shoulder injection (5, 2.5%), hip injection (3, 1.5%), and lumbar sympathetic nerves (3, 1.5%)], 33 (16.5%) osseous biopsies, 32 (16%) percutaneous therapy [retrograde drilling of osteochondritis dissecans 19, 9.5%, ablation of osteoid osteoma (10, 5%), drill assisted resection of a physeal bone bridge (3/1.5%)], 16 (8%) soft tissue biopsies, 5 (2.5%) preoperative percutaneous tumor marking procedures, and 1 (0.5%) abscess drainage. 94 (47%) procedures were performed with local anesthesia, 77 (38.5%) with conscious sedation, and 29 (14.5%) with general anesthesia. Technical success was achieved in 200/200 (100%) procedures. The average total length of time of a procedure was 40 min (range, 11-221) min, including 35 (11-90) min for targeted drug delivery, 72 (17-221 min) for percutaneous osseous therapy, 58 (51-68 min) for percutaneous tumor marking procedures, 66 (15-104) min for soft tissue biopsies, 49 (18-124) min for osseous biopsies and 29 min for the drainage). No major complications occurred. Two minor complications occurred. One minor local infection occurred around a percutaneous micro-catheter at post-procedural day 6, which healed after catheter removal and oral antibiotics without further intervention. One focal subcutaneous atrophy occurred after steroid injection of a temporomandibular joint.

### **Conclusions**

A wide variety of pediatric MR imaging-guided percutaneous musculoskeletal diagnostic and therapeutic procedures can be efficaciously performed and are safe for use in clinical practice mandating more vigilant implementation of the ALARA practice mandate in selected pediatric musculoskeletal interventions.