

Intraoperative Epiphyseal Perfusion Monitoring during Treatment of Unstable Slipped Capital Femoral Epiphysis is Not Always Predictive of Avascular Necrosis

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INTRODUCTION: Avascular necrosis (AVN) has not been reported after demonstrated epiphyseal perfusion following closed reduction of an unstable slipped capital femoral epiphysis (SCFE). The purpose of this study was to determine the rate of AVN in patients with unstable SCFE with demonstrated perfusion to the femoral epiphysis using an intra-cranial pressure (ICP) perfusion monitoring system at the time of reduction.

METHODS: A retrospective cohort study of patients treated for unstable SCFE at a large tertiary pediatrics hospital from 2015 through 2023 was performed. Inclusion criteria were patients treated for an unstable SCFE during this period with a closed or open reduction, use of an ICP monitor intraoperatively to assess perfusion of the epiphysis after reduction, and at least 6-month radiographic follow up. Unstable SCFE was defined according to the Loder classification. Demographic, clinical, and radiographic data were collected including duration of symptoms, type of reduction performed, whether a capsulotomy was performed, whether a waveform was present or absent on ICP monitoring after epiphyseal fixation, Southwick slip angle after reduction, and presence of AVN at follow up.

RESULTS: Our cohort included 29 hips (28 patients) with an average age of 12.6 ± 2.0 years at time of presentation and median follow up of 14.5 months. Ten hips were treated with open reduction using the modified Dunn technique (9 patients) or anterior approach (1 hip), and 19 hips were treated with inadvertent (5 hips) or purposeful closed reduction using the Leadbetter technique (14 hips). Six of these 29 hips developed AVN (20.7%) and average time to AVN on radiographic follow up was 5.9 months. Of the hips that developed AVN, 5 hips were treated with purposeful or inadvertent closed reduction (4 purposeful, 1 inadvertent) and 1 hip was treated with open reduction using the modified Dunn technique. Four of the 6 hips that eventually developed AVN demonstrated a pulsatile waveform on ICP monitoring intraoperatively following fixation. Of the hips with a pulsatile waveform on ICP monitoring, 15.4% (4/26) developed AVN.

DISCUSSION AND CONCLUSION: Our data shows that intraoperative monitoring of epiphyseal perfusion using an ICP probe at the time of open or closed reduction of unstable SCFEs is not entirely reliable to predict the presence or absence of osteonecrosis during follow up. To our knowledge, this is the first study to report development of AVN after demonstrable intraoperative epiphyseal perfusion with an ICP monitor after closed reduction of unstable slips. Our data suggests that epiphyseal perfusion monitoring is not 100% reliable, and it is important to counsel patients and their families that demonstration of perfusion intraoperatively after closed reduction may not always be predictive of absence of AVN at follow up as has been previously reported. Further research is needed to determine whether these results should influence initial management, the use of intraoperative perfusion monitoring, or follow-up imaging of patients with unstable SCFE.