DEVELOPMENTAL DYSPLASIA OF THE HIP: CLOSED REDUCTION USING A VERTICALLY OPEN INTERACTIVE MR UNIT

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Introduction:
Developmental dysplasia of the hip (DDH) is a common disorder in newborns and infants that can lead to debilitating hip deformity in adult life (1). Treatment of DDH includes conservative management with a Pavlik harness, closed reduction, and open reduction. Closed reduction with subsequent casting is typically performed in the operating room and requires a post-reduction arthrogram and/or CT scan (2). In the present study, we evaluated the feasibility of MRI guided closed reduction in infants with DDH as an alternative to closed reduction in the operating room.

Methods:
Infants were positioned on a custom-made, MRI compatible hip holder (Fig. 1) attached to a vertically open, double-doughnut shaped MRI unit (GE Signa SP, 0.5T) affording access to one orthopedic surgeon and one radiologist. Pre-reduction coronal and axial MR images were obtained (SE T1, FSE T2). The position of the proximal femoral epiphysis was evaluated with kinematic MR imaging during passive joint motion from neutral position to abduction using a fluoroscopic EPI sequence (temporal resolution 5 images/sec, reconstructed at 10 images/sec). MR imaging was used to achieve optimal acetabular coverage and to guide limb position during casting (Fig. 2). Hip congruity was confirmed on post-reduction MR images. Six hip joints were treated in this fashion.

Results:
Prior to reduction, moderate pulvinar hypertrophy (n=2), blunting of the anterior labrum (n=2), and moderate joint effusion (n=2) were identified. Prior to reduction, the proximal femoral epiphysis was subluxed in all 6 hip joints (Fig. 3A). In abduction position, all 6 hips could be reduced successfully. Successful reduction was confirmed on MR images obtained after application of the cast (Fig. 3B).

Conclusion:
MRI guided closed reduction obviates the need for post-reduction arthrograms and CT scans and eliminates radiation exposure. MRI guidance can help identify soft-tissue structures impeding closed reduction. MRI guided closed reduction is also more cost-efficient than conventional closed reduction, since the MR charges are significantly lower than the operating room charges.

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References:

Fig. 1: MRI compatible hip holder placed inside magnet bore.

Fig. 2: Casting inside the magnet bore.

Fig. 3A: Pre-reduction MRI: The left femoral head is superiorly dislocated (arrows).

Fig. 3B: Post-reduction MRI: The left hip has been reduced successfully (arrows). Acetabular coverage is excellent.