Radiographic follow-up of DDH in infants: Are x-rays necessary after a normalized ultrasound?

Eric Sarkissian, MD[1], Wudbhav N. Sankar, MD[2], Xiaowei Zhu, MS[2], Chia H. Wu, MD[2], John M. Flynn, MD[2]

[1]Stanford University Hospital, Department of Orthopedic Surgery

[2]Division of Orthopaedic Surgery,

Children's Hospital of Philadelphia, Philadelphia, PA

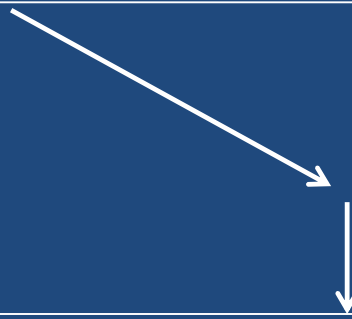
Disclosures

We report no relevant conflicts of interest

Objectives

Identify incidence of radiographic acetabular dysplasia in infants with normalized DDH

Quantify risk of radiation exposure



Determine need for radiographic follow-up

Background

Concerns exist about long-term radiographic follow-up of DDH

- Radiation exposure: Bone JPO 2000, Rajaraman BMJ 2011
- Cost

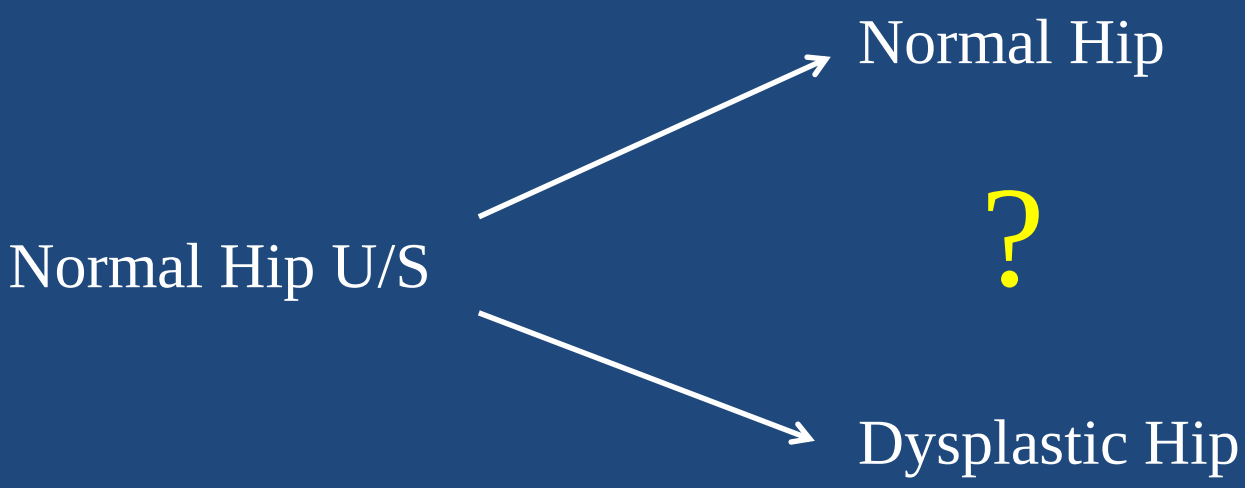
Background

How much follow-up after normalization?

- Con: Jellicoe JPO B 2007, Arumilli JBJS Br 2006, Osarumwense JPO B 2007
- Pro: Garvey JBJS Br 1992, Imrie JCO 2010
  - 2-30% incidence of residual dysplasia after successful Pavlik harness treatment

Hypothesis

Normal hip U/S in infancy → No future residual acetabular dysplasia requiring further radiographic monitoring



Methods

Consecutive series of infants over 4 year period

- Idiopathic DDH

Normalized DDH by 6 months of age:

- Stable clinical exam (neg Barlow/Ortolani)
- U/S with no signs of instability or dysplasia ($\alpha \geq 60°$)

Exclusion:

- Abnormal U/S indices, clinical exams
- Surgical reduction

Methods

Cohort analysis:

1. Successful Pavlik harness treatment
2. Spontaneous normalization (without treatment) having at least one major DDH risk factor

Methods

AP pelvic X-rays evaluated at

- 6, 12 mos

Acetabular dysplasia defined by Tönnis criteria

- AI > 30° (6-mo X-ray)
- AI > 28° (12-mo X-ray)

Radiation data calculated with PCXMC software

- Effective dose
- Exposure-induced death

Study population characteristics

		Infants with DDH Normalization (n=115)[1]
Gender	Male	23% (n=27)
	Female	77% (n=88)
Presentation	Breech	59% (n=68)
	Non-breech	41% (n=47)
Family History	Positive[2]	12% (n=14)
	Negative	88% (n=101)
Treatment	Pavlik harness	69% (n=79)
	None	31% (n=36)
Side Involved	Bilateral	12% (n=14)
	Unilateral	88% (n=101)

[1]Stable clinical exams and ultrasound evaluations without hip instability or acetabular dysplasia before 6 months of age

[2]In first-degree relative

Sarkissian JPO 2015

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Notable incidence of residual dysplasia at 6 and 12 months

	All	Pavlik Harness Tx	No Tx	p value
6-mo X-ray	17% (19/115)	13% (10/79)	25% (9/36)	0.1
12-mo X-ray	33% (35/106)	34% (25/74)	31% (10/32)	0.8

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No differences between treated and untreated infants

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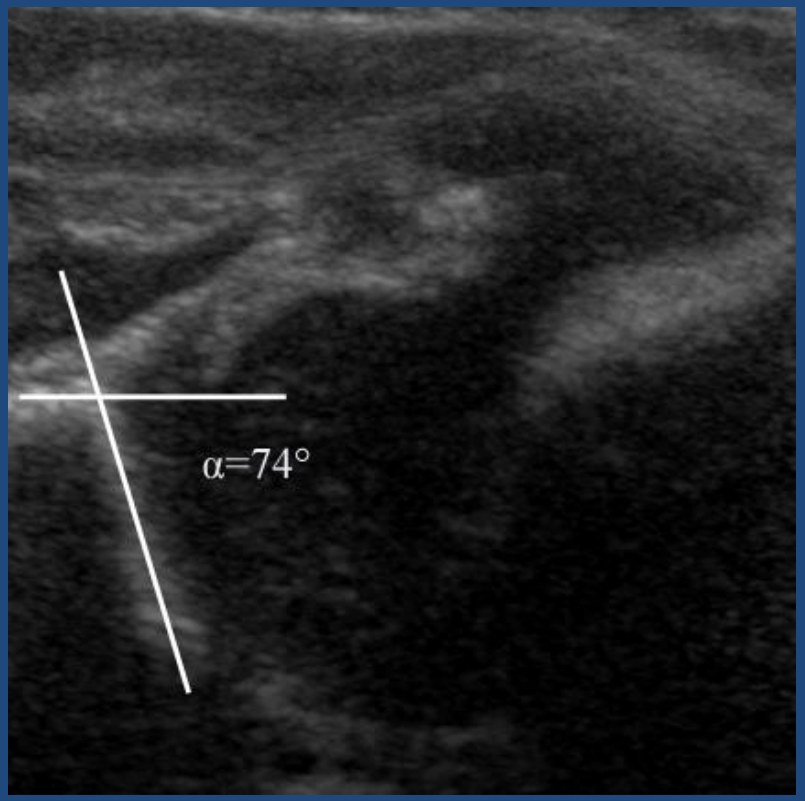
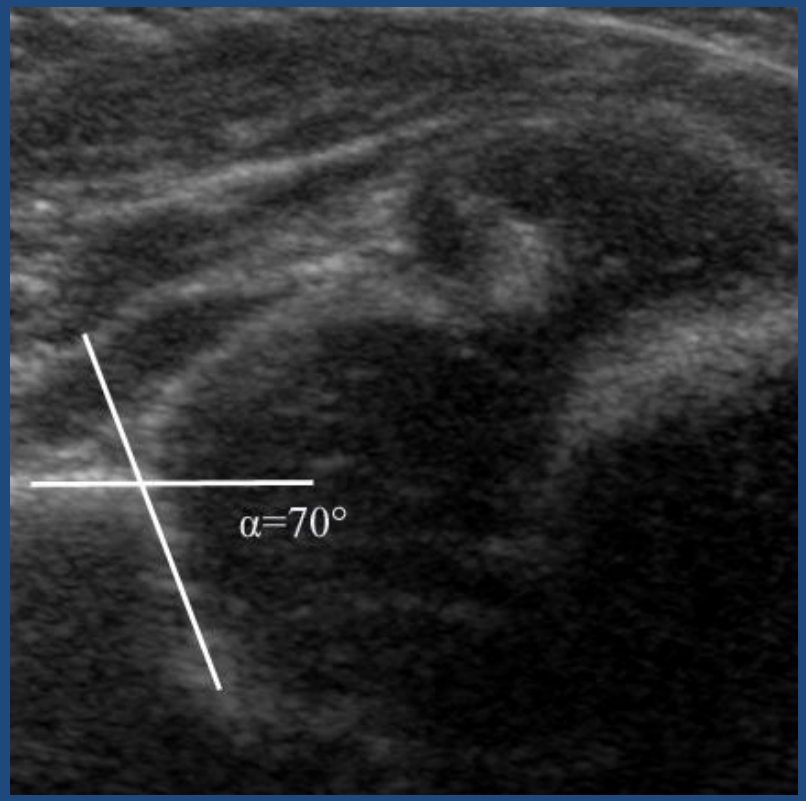
Residual dysplasia after normalized U/S

Female, non-breech, no FH, + Pavlik tx

At 4 mos – Normal U/S



Right



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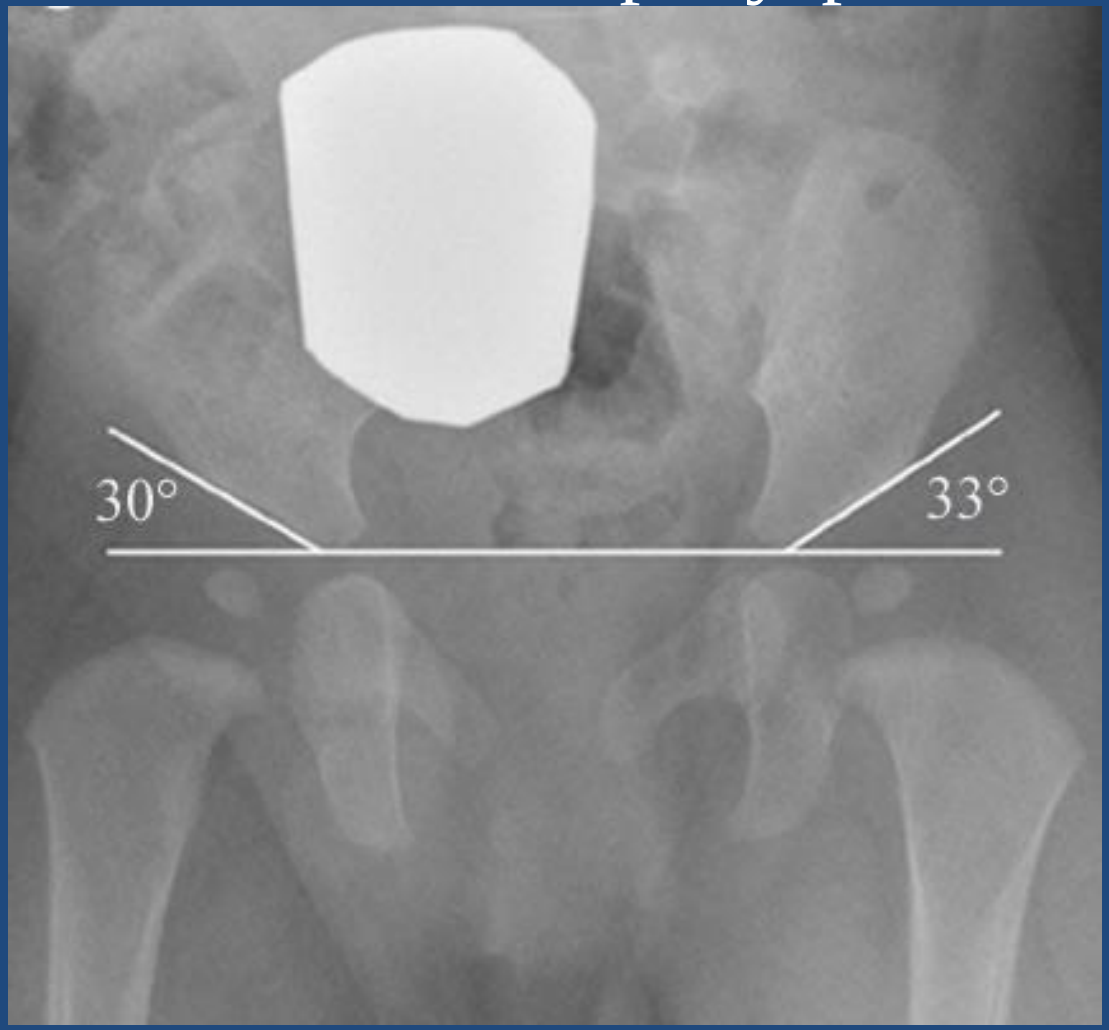
Residual dysplasia after normalized U/S

At 6 mos – L Hip Dysplasia



Residual dysplasia after normalized U/S

At 12 mos – B/L Hip Dysplasia

Low risk of radiation-associated mortality during infancy

	6-mo X-ray	12-mo X-ray
Effective dose (mSv)	0.003	0.006
Risk of exposure-induced death	0.29/million	0.67/million

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Limitations

- Retrospective design
- Short length of follow-up
- Initial severity of DDH in cohort may have affected our reported incidence of residual dysplasia

Conclusion

- Substantial incidence of residual dysplasia in DDH normalized infants > incremental risk of radiation exposure
  - 17% at 6 months, 33% at 12 months
- Serial radiographic monitoring through at least 1 yr of age of Pavlik-treated infants and untreated infants with DDH risk factors
- Early detection and intervention with nonoperative modalities during infancy may improve AI

Thank you!