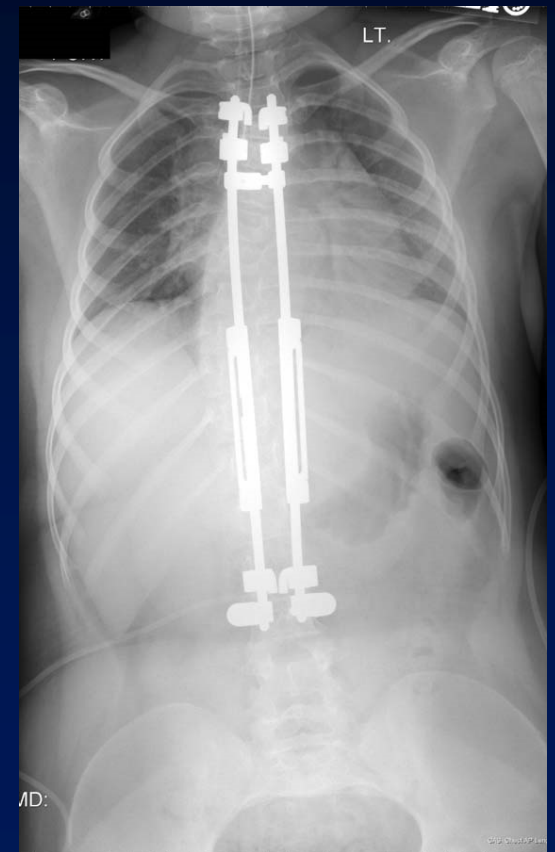


# Is fusion surgery always the end point?

ICEOS 2009  
Istanbul

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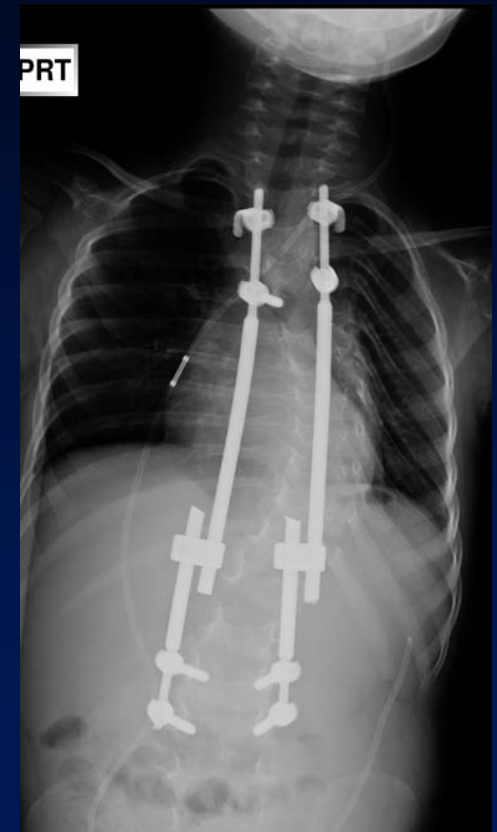


Non-fusion as an endpoint

# Introduction

## Current Conventional Wisdom

- Growing treatments are for growing children
- Expand periodically to match (or exceed?) growth expected in intervening segments



Non-fusion as an endpoint

# Introduction

## Current Conventional Wisdom

- There is an “endpoint” all EOS patients reach
- Endpoint can be
  - End of spine growth
  - A complication that pushes final fusion
    - Infection
    - Implant/fixation failure
  - Patient/family fatigue of multiple surgical procedures

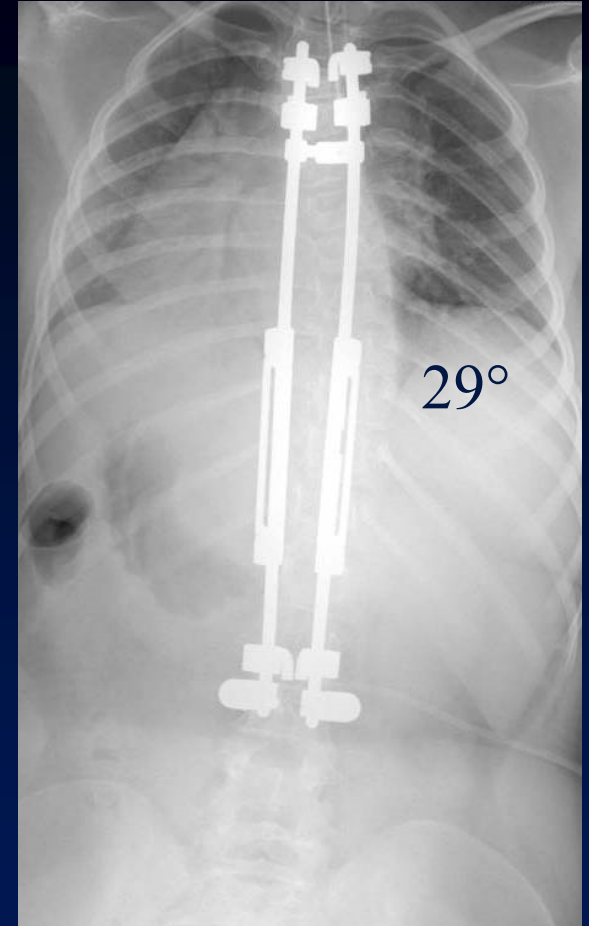


Non-fusion as an endpoint

# Introduction

What should be done at the endpoint (“graduation”)?

1. Remove all growing implants and fuse all segments previously spanned
2. Remove most growing implants and fuse (e.g. leave rib based systems)
3. Retain growing implants across a stiff (autofused?) spine and follow periodically
4. Remove growing implants, no fusion, follow



11 y/o, 5 yrs post instrumentation

Non-fusion as an endpoint

# Introduction

## Fusion required (?)

- Halt late progression
- Protect implants and bone/implant interface
- Decrease risk of pain with micromotion



Non-fusion as an endpoint

# GR Grads

## Growing Rod “graduates”

- No large multicenter reports available
- Cahill, et al. SRS 2009
  - 7 GR cases converted to final fusion
  - GR’s placed SQ
  - Found autofusion at multiple levels
  - Osteotomies required
  - Why was final fusion necessary?

Non-fusion as an endpoint

# Introduction

What do we know about the end of GR or VEPTR treatment?

- Not much to inform surgeons and families as they approach skeletal maturity
- Philly Shrine series of 7 GR pts converted to final fusion (SRS 2009)
- VEPTR graduates by CWSDSG (SRS 2008, POSNA 2009)

VEPTR Graduates

# Introduction

- Analyze the original treatment cohort as they complete the expansion phase of VEPTR management
- Inform surgeons as they counsel their current patients about future treatment



# Materials & Methods

## Using databases

- The VEPTR FDA Feasibility Study
- IDE study database

## Captured every VEPTR patient

- Had a final fusion or
  - No expansions for the past 2 yrs
- “VEPTR Graduates”

# Materials & Methods

## Patients assigned to a category

1. “fused” (had definitive spinal fusion, with or without VEPTR removal)
2. “VEPTR only” (no spinal fusion planned)
3. “undetermined” (not actively expanding, may or may not have fusion in future)

VEPTR Graduates

# Materials & Methods

## Evaluated

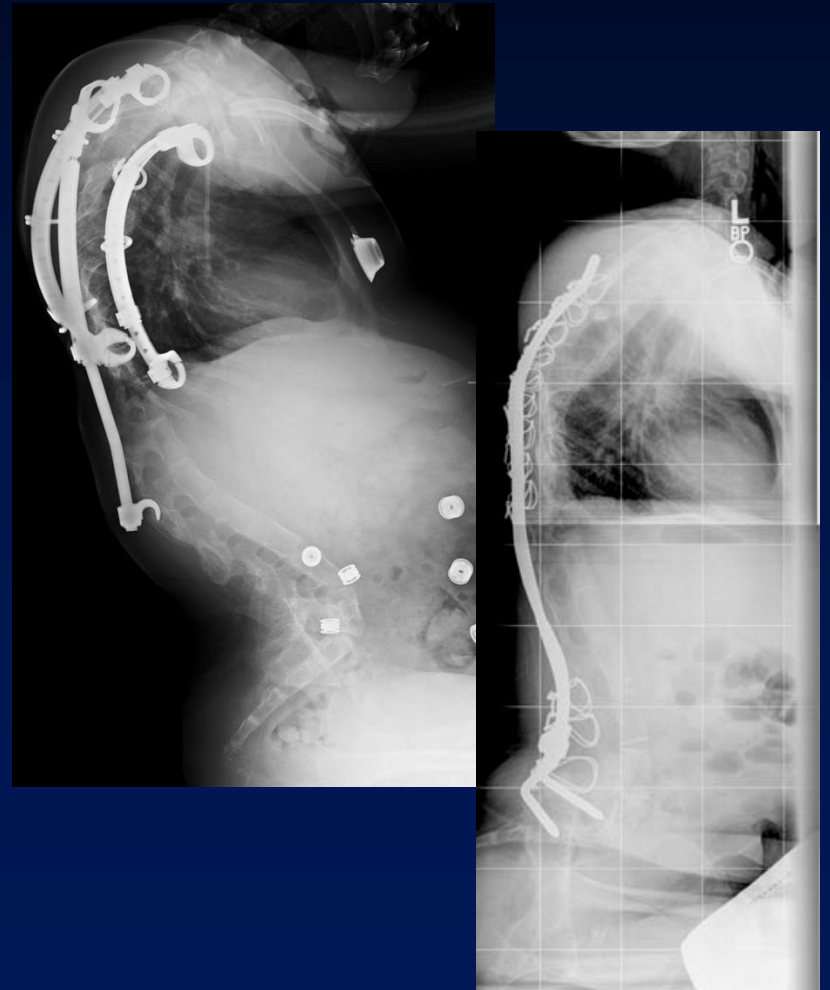
- Demographic data
- Diagnosis
- Age at last expansion
- Last surgical procedure
- Plans for fusion
- Device-related complication



## VEPTR Graduates

# Results

- 39 VEPTR grads: 12-25 y/o (mean 16.6 y/o)
- Status
  - 18 “fused”
  - 11 “VEPTR only”
  - 10 “undetermined”
- VEPTR retained
  - 10/18 “fusion”
  - 9/11 “VEPTR-only”



# VEPTR Graduates Results

Congenital  
Scoliosis  
Thoracogenic  
Scoliosis



Status	#	Congen/ Fused ribs	Progressive scoli no fused ribs	Hypoplastic chest	Flail chest	VEPTR still in	VEPTR removed
PSF	18	8	7	2	1	10	8
VEPTR only	11	3	1	3	4	9	2
Undeter- mined	10	3	0	7	0	10	0

# VEPTR Graduates Results

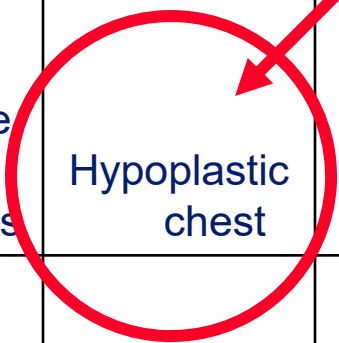
Neuromuscular  
and syndromes

Status	#	Congen/ Fused ribs	Progressive scoli no fused ribs	Hypoplastic chest	Flail chest		VEPTR still in	VEPTR removed
PSF	18	8	7	2	1		10	8
VEPTR only	11	3	1	3	4		9	2
Undeter- mined	10	3	0	7	0		10	0

# VEPTR Graduates Results

Jeune's  
VATER  
Jarcho-Levin

Status	#	Congen/ Fused ribs	Progressive scoli no fused ribs	Hypoplastic chest	Flail chest	VEPTR still in	VEPTR removed
PSF	18	8	7	2	1	10	8
VEPTR only	11	3	1	3	4	9	2
Undeter- mined	10	3	0	7	0	10	0



# VEPTR Graduates Results

Tumor  
resection, etc

Status	#	Congen/ Fused ribs	Progressive scoli no fused ribs	Hypoplastic chest	Flail chest	VEPTR still in	VEPTR removed
PSF	18	8	7	2	1	10	8
VEPTR only	11	3	1	3	4	9	2
Undeter- mined	10	3	0	7	0	10	0



## VEPTR Graduates

# Results

- 2 patients had device failure waiting for a fusion
- Interviewed surgeon caring for the “undetermined” patients:
  - only 3/10 patients likely to have a future spinal fusion
  - thus, most of the “undetermined” group probably will become “VEPTR only”

VEPTR Graduates

# Discussion

VEPTR endpoint management varies by underlying diagnosis

- Congen scol/fused ribs: mixed PSF and VEPTR only
- Neuromuscular and syndromes: almost all PSF
- Hypoplastic chest, Flail chest: usually VEPTR only
- The VEPTR devices are usually not removed at the end of treatment

# Non-fusion as an endpoint

## Summary thoughts

- Evidence-based answer not yet available
- Conventional wisdom is to remove growing implants and perform final fusion as growth slows/ends
- Need larger series of EOS instrumented “graduates”

# Non-fusion as an endpoint

## Summary thoughts

- Removal of growing implants?
  - Is it necessary if there is an autofusion?
  - Risk of “limited anchor” implants



# Non-fusion as an endpoint

## Summary thoughts

- Perhaps final solution should be based upon underlying diagnosis:
  - The “flexible” spine (NM and IS): final fusion
  - The stiff spine (congenital, hypoplastic chest, auto-fused): no formal final fusion

# Non-fusion as an endpoint

## Future

- Need much more data at final fusion
  - Condition of the spine (flexibility)
  - Extent/risks of final fusion
    - Fusion of same segments or more (dealing with PJK, etc)
    - Complication rate of final fusion
- Need natural history data from:
  - Adults with growing implants left in
  - Adults with growing implants removed without fusion

# Thank you

