SRS 2009, San Antonio, Texas

SUBMUSCULAR GROWING RODS

Technique, complications and results of 88 patients with minimum 2 year follow-up

N Farooq, E Garrido, F Altaf, J Dartnell, SK Tucker,
MHH Noordeen, SA Shah

Great Ormond Street Hospital for Children
The Royal National Orthopaedic Hospital
London, UK

Paper #39 SUBMUSCULAR GROWING RODS: Technique, Results . . .

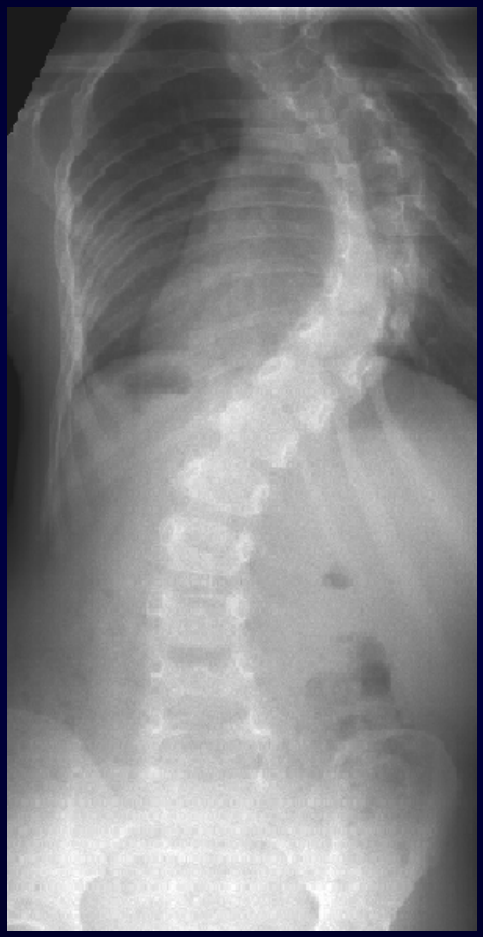
Presenter:	Najma Farooq	No Relationships
Co-Authors:	Enrique Garrido	No Relationships
	Farhan Altaf	No Relationships
	Joanne Dartnell	No Relationships
	Stewart Tucker	No Relationships
	Hilali Noordeen	No Relationships
	Suken Shah	(a)(b)(e)(f) DePuy Spine Inc (a)Axial Biotech, Inc

SRS 44th Annual Meeting Authors Disclosure Information

a. **Grants/Research Support**
b. **Consultant**
c. **Stock/Shareholder**
d. **Speakers' Bureau**
e. **Other Financial Support**

INTRODUCTION

- Aims of treatment early onset scoliosis
  - Control of deformity
  - Allow spinal and truncal growth
  - Preservation pulmonary function
- Safety and efficacy of growing rod constructs well reported in literature



BACKGROUND

- Previous publications have examined
  - Effects of simultaneous apical fusion
    (Blakemore et al Spine 2001, Thompson et al Spine 2005)
  - Optimum frequency of growth rod lengthening
    (Akbarnia et al Spine 2008)
  - Stability of anchor configurations
    (Mahar et al The Spine Journal 2008)
  - Outcomes of dual and single rod constructs
    (Thompson et al Spine 2005)

AIMS

- To review a large consecutive series of patients managed with growing rods from a single centre.
- To report on the surgical technique and on clinical and radiological outcomes of the growing rod programme

SURGICAL TECHNIQUE

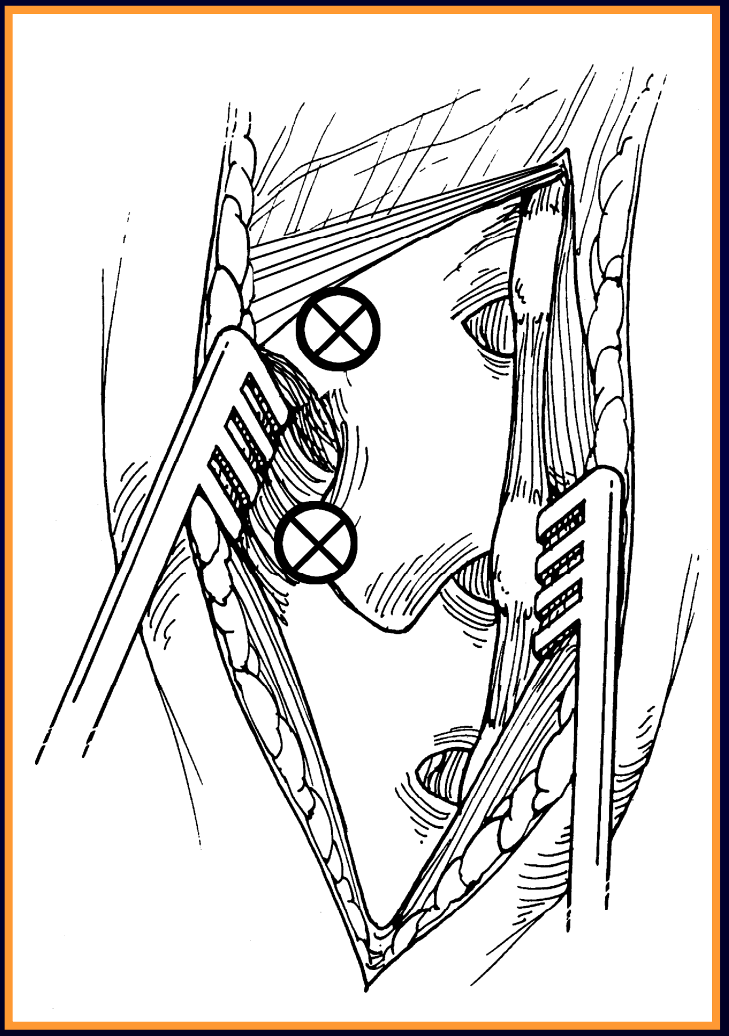
- Midline skin incision
- Subperiosteal dissection limited to foundation sites of proximal and distal anchors with limited fusion at these sites

- Proximal anchor forms claw configuration
  - Pedicle hook x2 plus
  - supralaminar or TP hook

    OR
- Pedicle screws x2

- Distal anchor -Pedicle screws x2

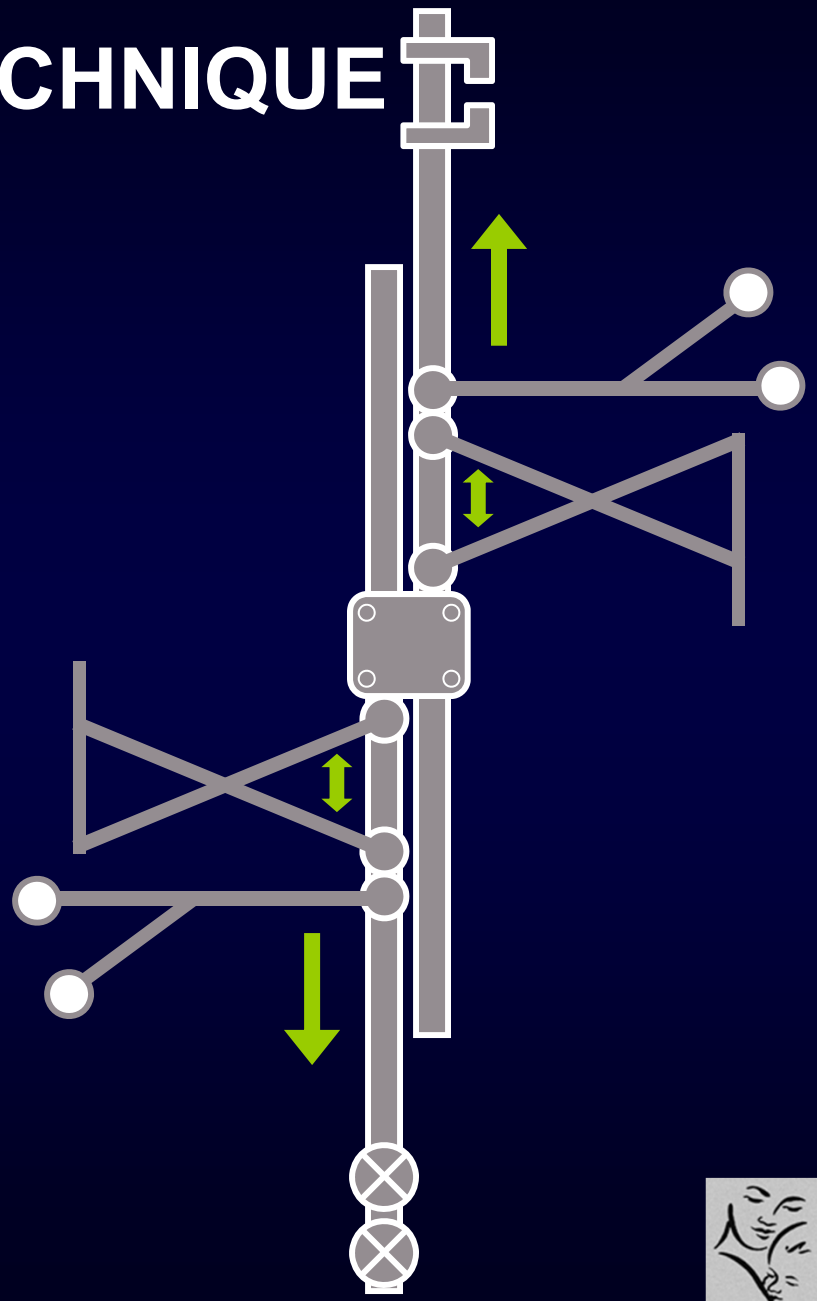
- Submuscular rod with side to side domino



SURGICAL TECHNIQUE

- Domino cross-connector is independently fixed to each rod at 2 consecutive points
- Allows independent distraction of each rod against the level of fixation/fusion

- Post-operative bracing (TLSO)
- Lengthening at ~6-8 monthly intervals via small incision over domino
- Short hospital inpatient stay



MATERIALS AND METHODS

- Between 1999 to 2007 88 patients were treated with a submuscular single growing rod (GR) construct for scoliosis
- Surgery was undertaken by the senior authors (SKT and MHHN) at one of two sites (RNOH or GOSH, London)
- A retrospective clinical and radiological review of 88 consecutive patients was performed.

MATERIALS AND METHODS

- Clinical data
  - Patient diagnosis
  - Age at insertion GR
  - Date surgery

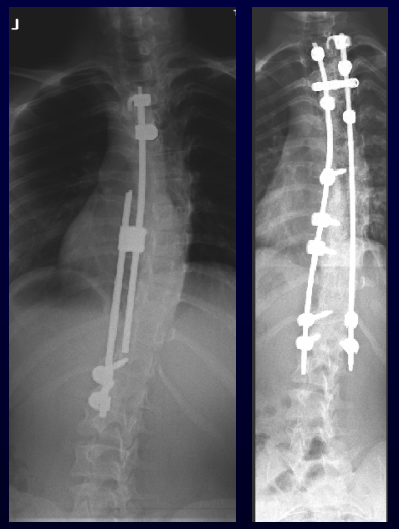
  - Instrumented levels
  - Anchor configuration
  - Simultaneous apical fusion performed?
  - Date and number of GR distractions

  - Complications (deep/superficial infection, rod fractures, anchor failures, deformity progression)

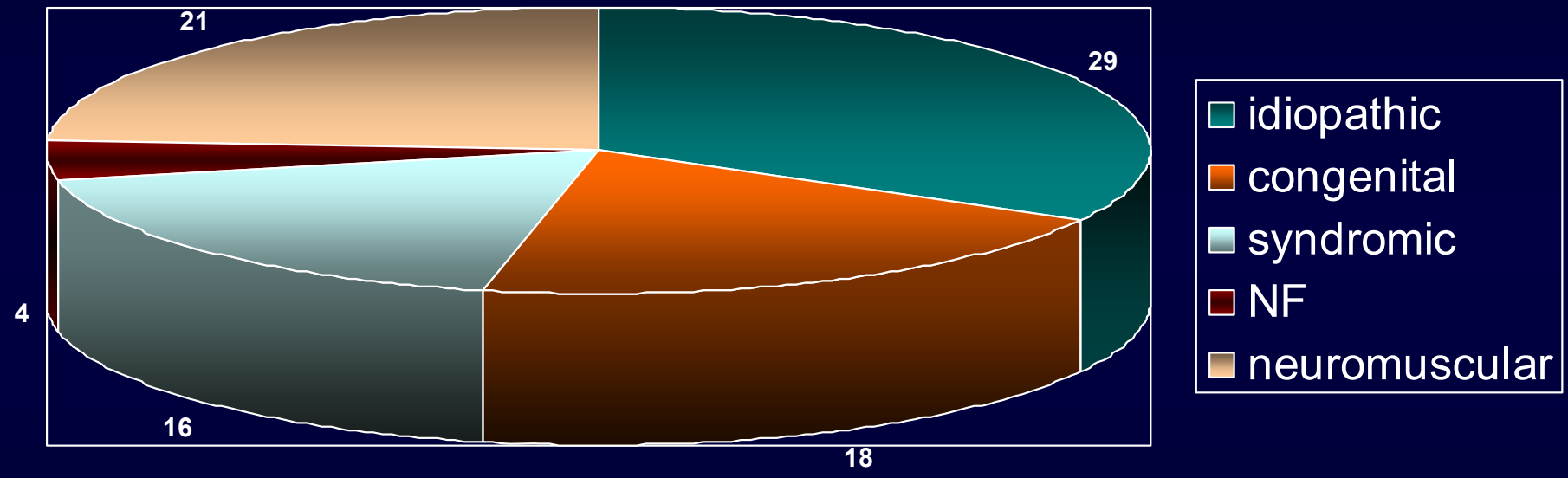
MATERIALS AND METHODS

- Radiological data
  - Cobb angle
  - T1-S1 heights
  - Measurements obtained immediately pre and post insertion GR, and at latest follow up.

- For patients beyond definitive fusion, radiographs immediately preceding the fusion were used for ‘latest follow up’ measurements.



RESULTS



DIAGNOSIS

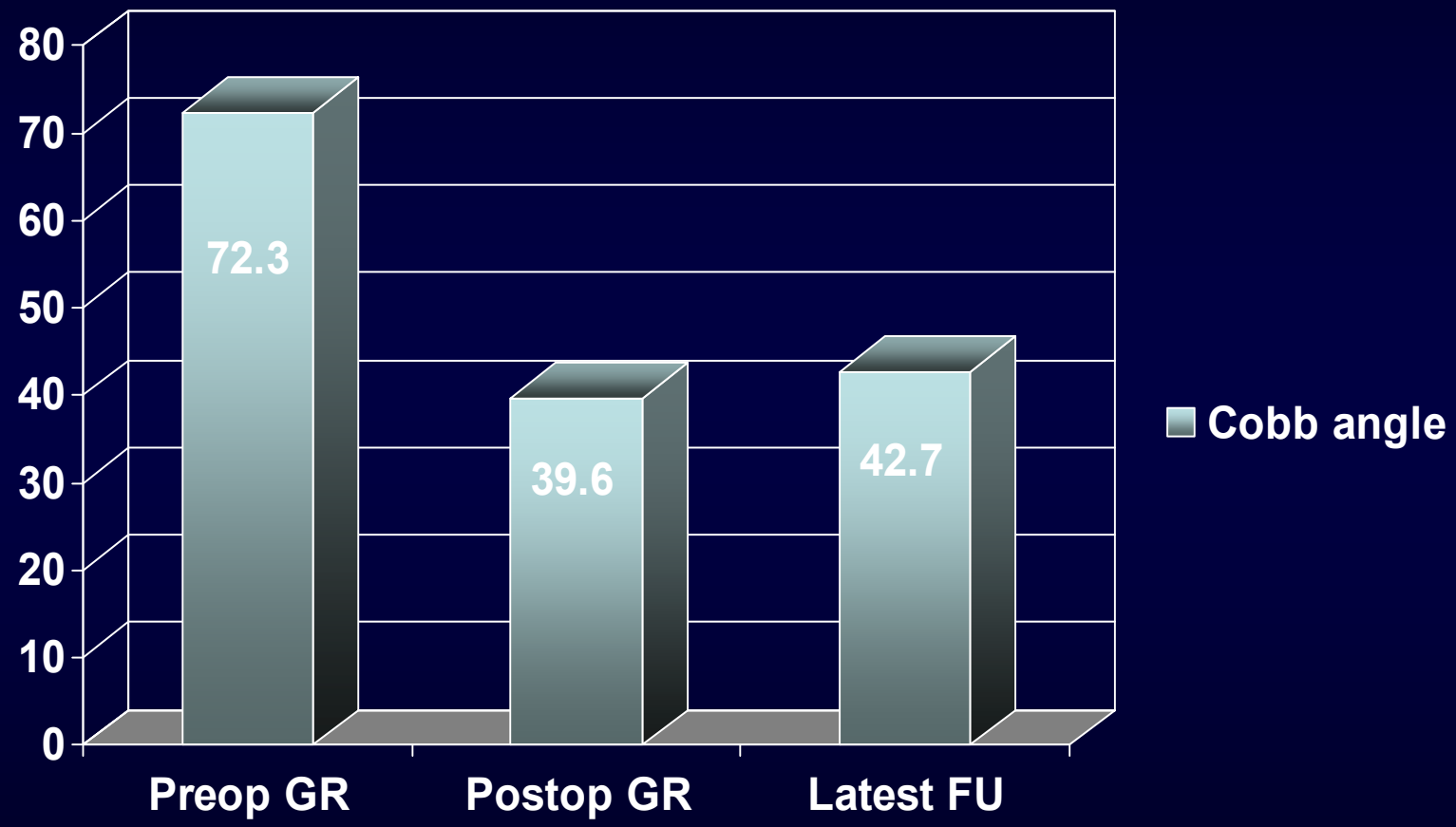
RESULTS

- Average age insertion GR 7.0 years (1.9-12.1)
- Simultaneous apical fusion 27 patients
- Average follow up period 3.5 years (2.0-6.8)

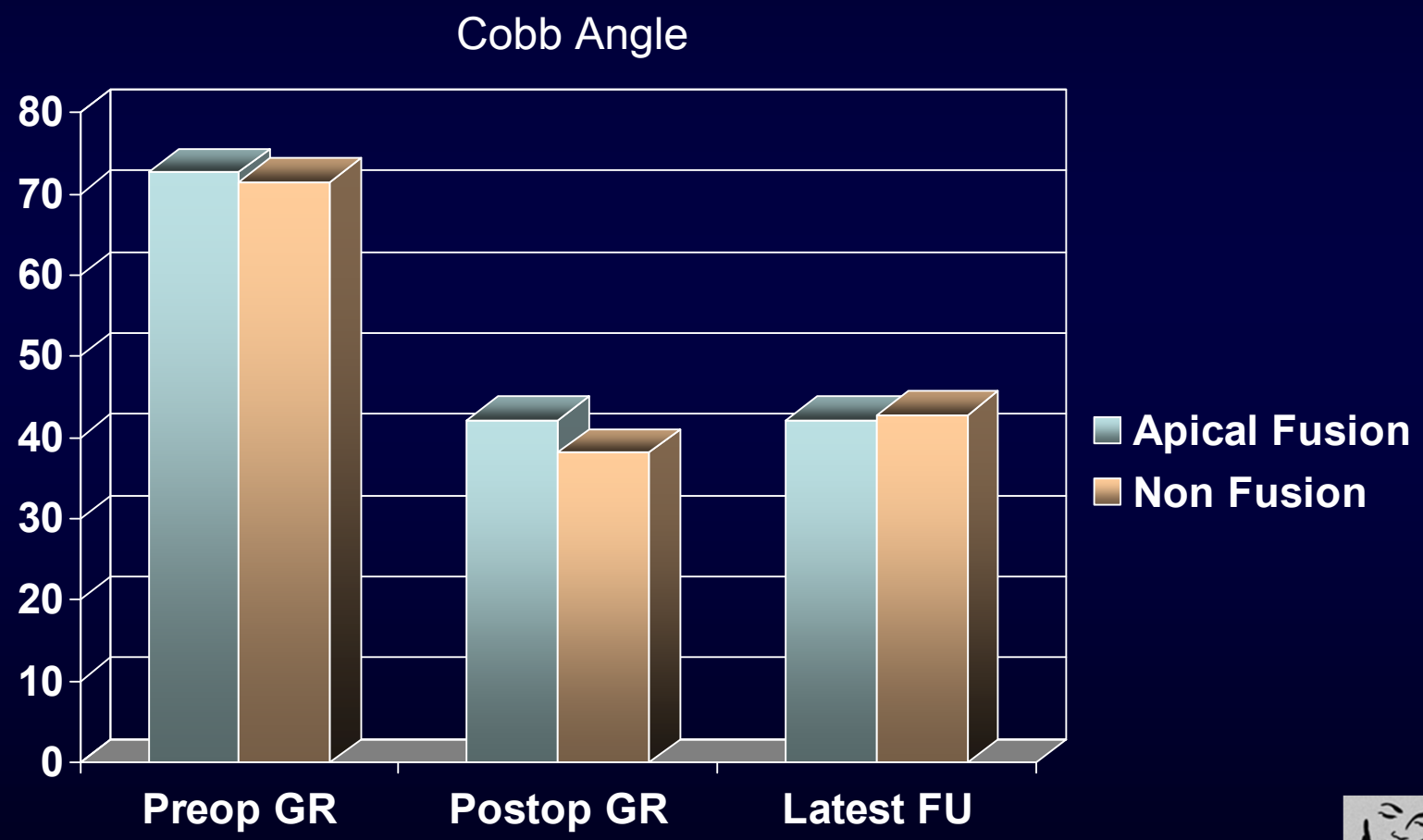
- Average time in the GR programme 4.9 years
- Average number of GR distractions 4.7 (0-12)

- 30 patients underwent definitive fusions within study period

RESULTS


80
70
60
50
40
30
20
10
0
72.3
39.6
42.7
Preop GR
Postop GR
Latest FU
Cobb angle

RESULTS


Cobb Angle
80
70
60
50
40
30
20
10
0
Preop GR
Postop GR
Latest FU
Apical Fusion
Non Fusion

RESULTS

- Average T1-S1 gain was 3.18cm
- Translates to 0.93cm/ year

- Apical fusion (27 patients) growth 0.89cm/yr
- Non-Fusion group (61 patients) growth 0.96cm/year
- Difference between groups not significant p=0.72

COMPLICATIONS

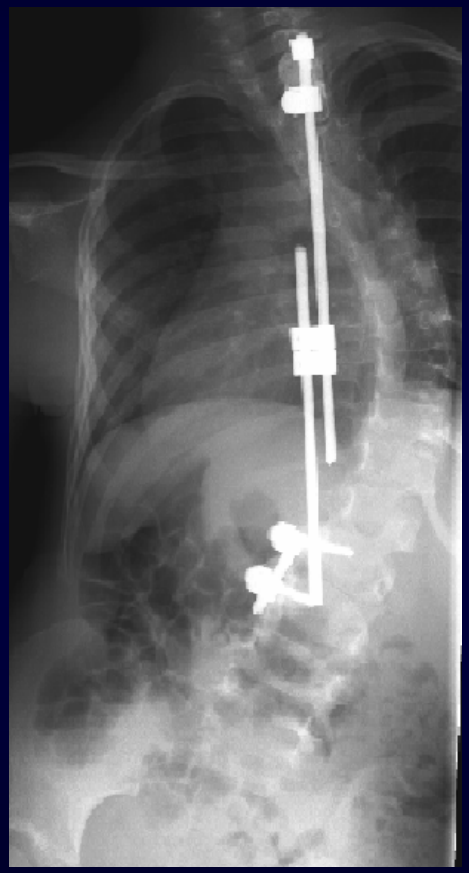
- Infection
- Superficial infections
  - 8 patients required wound debridement
- Deep infection
  - 3 patients
  - removal implants 1 patient

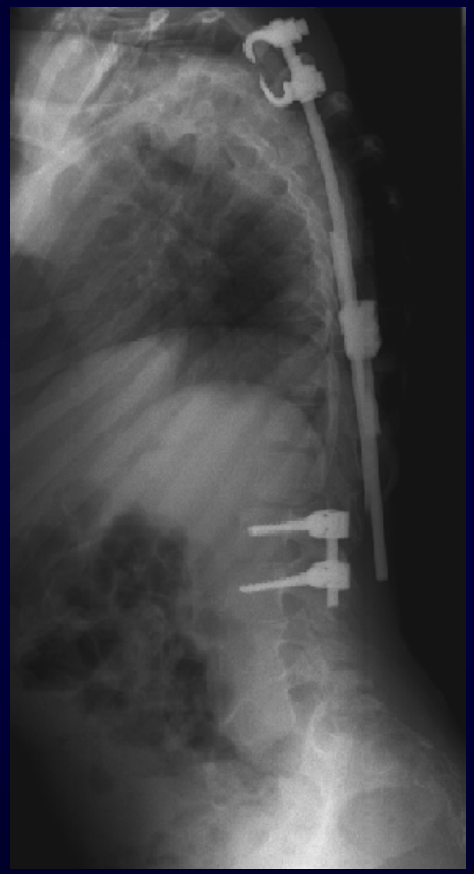
- Proximal junctional Kyphosis
  - 2 patients required early fusion for progressive deformity

COMPLICATIONS

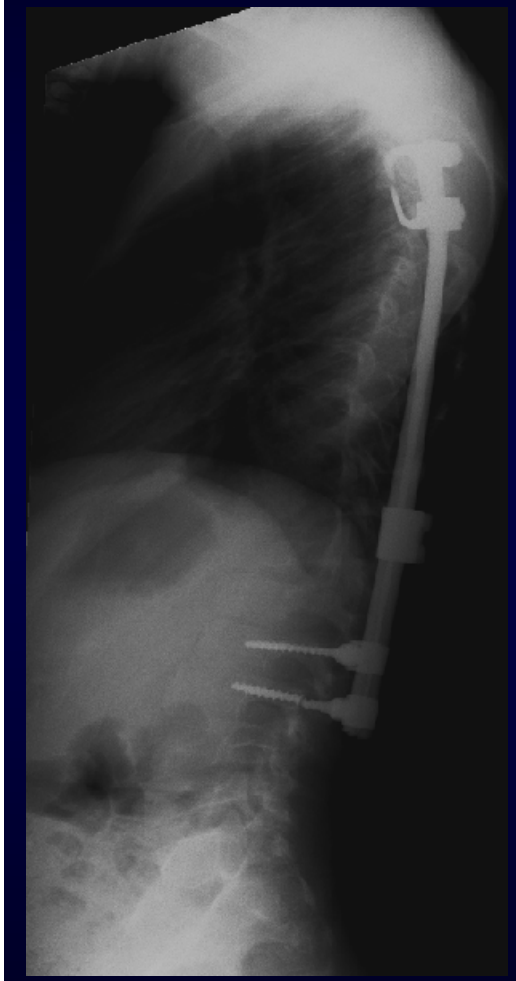
- Rod fractures
  - 28 in total
  - Higher incidence in apical fusion vs non fusion group.
    (11# in 27 vs 17# in 61)

- Caudal rod adjacent to distal anchors most frequently affected. (46%)

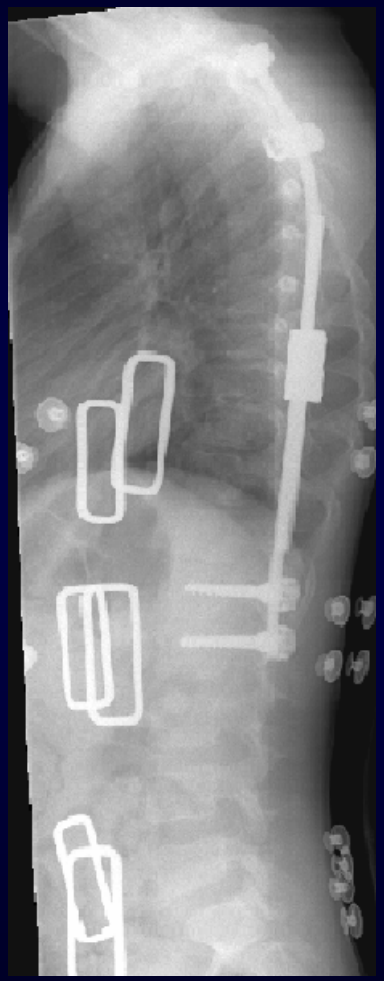


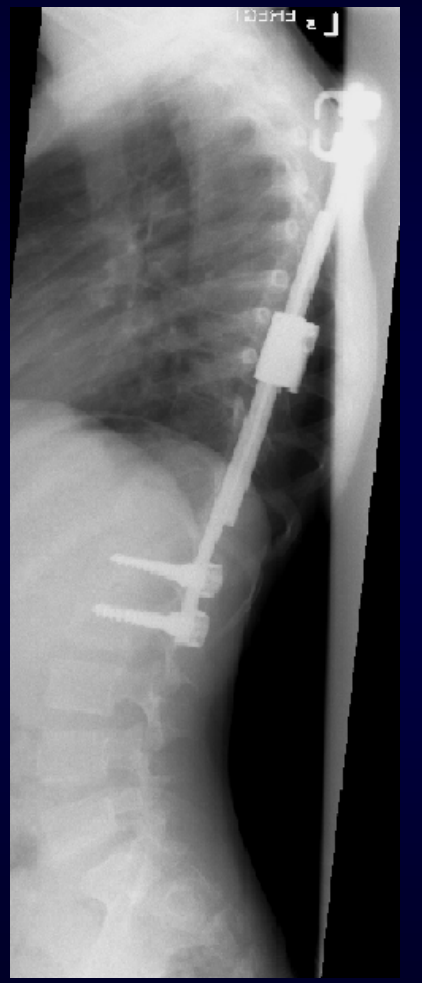


COMPLICATIONS



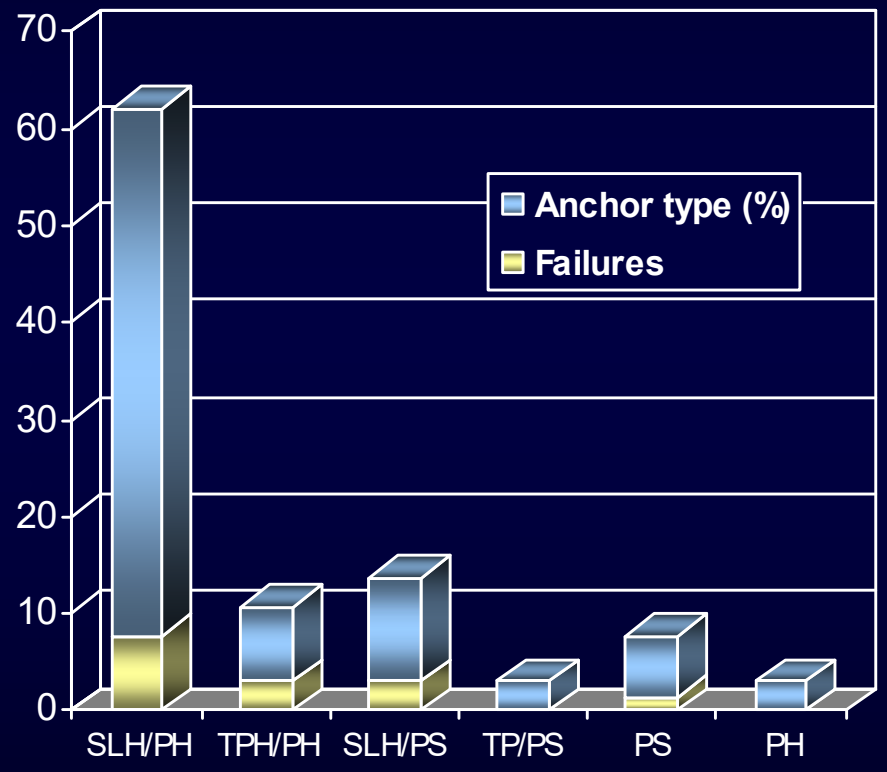
ANCHOR
FAILURE





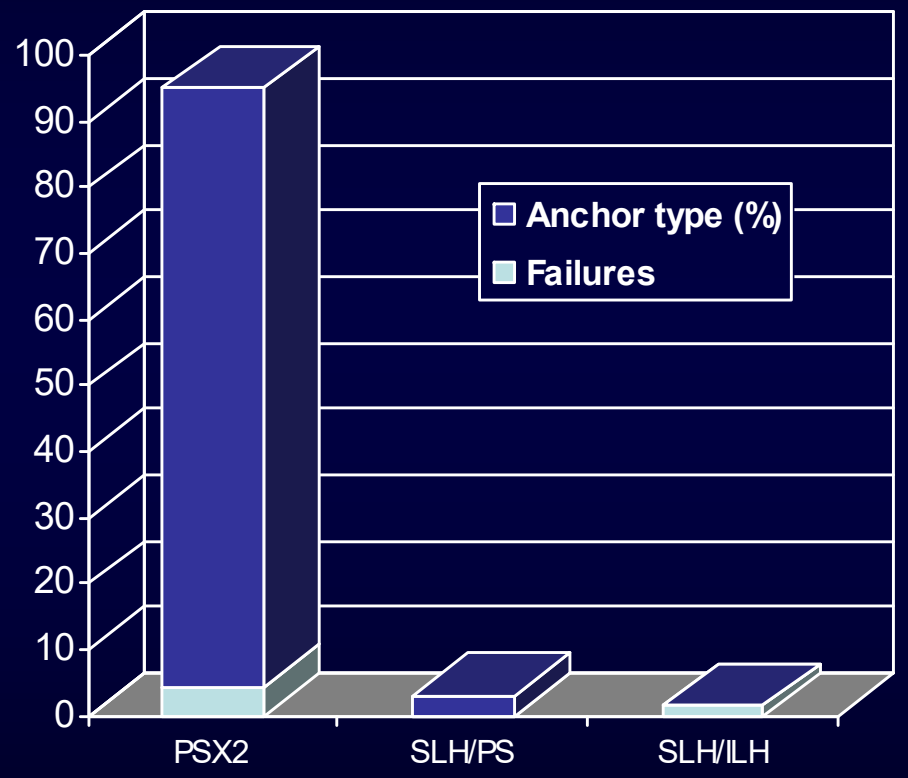
COMPLICATIONS

- Proximal Anchor failures (10)
- Primary anchor configuration
  - Mainly SLH/PH
- Revision configurations
  - SLH/PH to SLH/PH different levels
  - TP/PH to SLH/PS
  - SLH/PS to SLH/PH
  - PS to rib hooks



COMPLICATIONS

- Distal Anchor failures (5)
- Primary anchor configuration
  - Mainly PS x2
- Revision configurations
  - PSX2 to SLH/ILH
  - SLH/ILH to PSX2



CONCLUSIONS

- Submuscular single growing rod constructs were effective in maintaining spinal growth and correcting scoliosis in the growing spine.
- Acceptable complication rate given the number of procedures performed per patient.
- The results are comparable to dual rod instrumentation series and previously published series of single rod constructs.
- Continued follow up until final fusion is required

Thank you