

Spasticity is a Risk factor of Complications and Surgical Outcome in the Management of Neuromuscular Early-Onset Scoliosis (EOS) with a Rib-Based Growing System (RBGS)

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DISCLOSURES

- Norman Ramirez MD - *none*
- Gerardo Olivella MPH - *none*
- Omar Rodriguez BS - *none*
- Pablo Marrero MD - *none*
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- Randal Betz MD - Abyrx: Paid consultant; Stock or stock Options. Advanced Vertebral Solutions: Stock or stock Options; Unpaid consultant. American Spinal Injury Association: Board or committee member. ApiFix: Paid consultant; Stock or stock Options. DePuy Synthes Spine: IP royalties; Paid consultant; Paid presenter or speaker; Research support. Electrocore: Stock or stock Options. Globus Medical: IP royalties; Paid consultant; Paid presenter or speaker. MacKeith: Publishing royalties, financial or material support. Medovex: Stock or stock Options. Medtronic: IP royalties; Paid consultant. MiMedx: Stock or stock Options. Orthobond: Stock or stock Options; Unpaid consultant. Spineguard: IP royalties; Paid consultant; Stock or stock Options
- Children Spine Study Group - *none*

NEUROMUSCULAR SCOLIOSIS

- Early Onset
- Rapid Progression
- Progression After Skeletal Maturity
- Compromise Functional Abilities
- Long Curves, May Include Sacrum
- Pelvic Obliquity



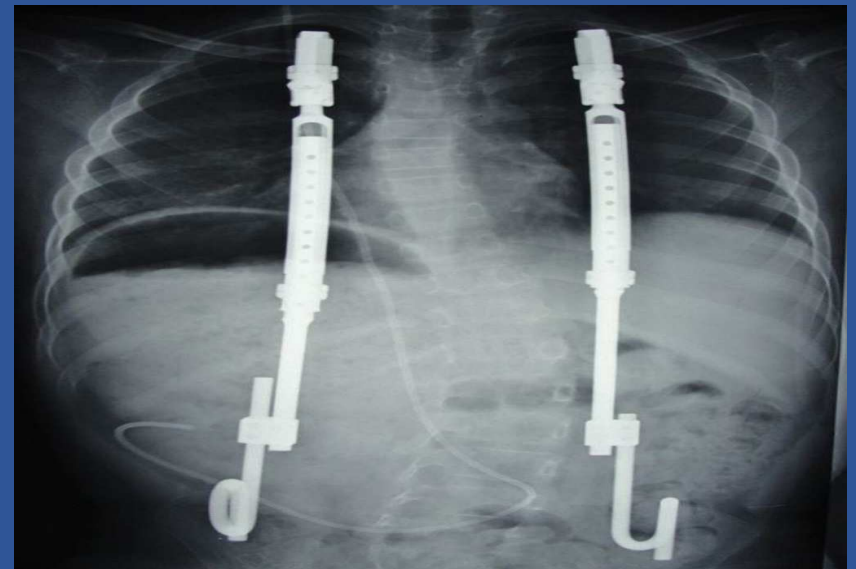
INTRODUCTION

- Neuromuscular EOS is difficult to treat and has a high rate of complications.
- The Neuromuscular patients can be divided in two groups:
 1. Spastic: eg. Cerebral Palsy
 2. Hypotonic: eg. Spinal Muscle Atrophy / Spina Bifida



Robert Campbell et al. (1992)

Rib-Based Growing System (RBGS) as option to control spinal deformity, allow spinal growth, and address thoracic insufficiency syndrome in children with neuromuscular Scoliosis



HYPOTHESIS

- Patients with spasticity would have poor surgical outcomes and a higher complication rate compared to patients with hypotonia treated with a Rib Based Growing System [RBGS].

METHODS

- IRB approved, retrospective cohort study, collected from Children Spine Foundation multicenter database.
- Comparison between both groups based on:
 - Pre-Operative
 - Intra-operative
 - Post-operative data



METHODS

- Complications were reported using a standardized scheme.

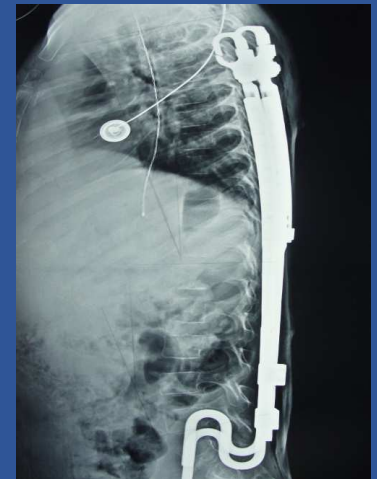
A New Classification System to Report Complications in Growing Spine Surgery: A Multicenter Consensus Study

John T. Smith, MD, Charles Johnston, MD,† David Skaggs, MD,‡
John Flynn, MD,§ and Michael Vitale, MD||*

(Smith et al JPO, Dec 2015)

RESULTS

- 131 non-ambulatory neuromuscular EOS patients treated with a RBGS
 - Spastic (32)
 - Hypotonic (99)
- All patients were treated with a Rib-Pelvis RBGS (VEPTR)



RESULTS

| Mean | PRE-OP DATA |
|------|---------------------------|
| NS | Gender (% female) |
| NS | Mean Age at Surgery (yrs) |
| NS | Mean Weight (kg) |
| NS | Mean Height (cm) |
| NS | Mean Follow-up (yrs) |
| NS | Mean Preop Cobb (Deg) |
| NS | Mean Preop Kyphosis (Deg) |

RESULTS - Cobb Angles (Immediate & Most Recent)

| COBB | SPASTIC | HYPOTONIC |
|---------------------------|---------|-----------|
| Immediate % of Correction | 37% | 40% |
| Residual % Correction | 16% | 11% |

RESULTS - Complications: (P<0.05)

| COMPLICATIONS (%) | SPASTIC | HYPOTONIC |
|-------------------------|---------|-----------|
| Infections | 53 % | 39 % |
| Device Migration | 29 % | 36 % |
| Death | 8 % | 1 % |
| Implant Failure | 6 % | 13 % |
| TOTAL % | 78 % | 56 % |
| Instrumentation Removal | 30 % | 10% |

CONCLUSION

- There was no significant difference in surgical correction between both groups.



CONCLUSION

- Spastic patients had more complications than those with hypotonia in the management of neuromuscular scoliosis treated with a RBGS.





GRACIAS!

REFERENCES

- Ramirez N, Flynn JM, Smith JT, Vitale M, Sturn PF, D'Amato C, Samdani A, Machiavelli R, El-Hawari R. ***Use of the S-hook for Pelvic Fixation in Rib-Based Treatment of Early-Onset Scoliosis: A Multicenter Study.*** Spine (Phila Pa 1976). 2015 Jun 1;40(11):816-22.
- Smith JT, Johnston C, Skaggs D, Flynn J, Vitale M. ***A New Classification System to Report Complications in Growing Spine Surgery: A Multicenter Consensus Study.*** (J Pediatr Orthop). 2015 Dec;35(8):798-803.
- Upasani V, Miller P, Emans J, Smith JT, Betz R, Flynn J, Glotzbecker M, Children's Spine Study Group. ***VEPTR Implantation After Age 3 is Associated With Similar Radiographic Outcomes With Fewer Complications.*** J Pediatr Orthop. 2016 Apr-May;36(3):219-25.
- Hell AK, Campbell RM, Hefti F. ***The vertical expandable prosthetic titanium rib implant for the treatment of thoracic insufficiency syndrome associated with congenital and neuromuscular scoliosis in young children.*** J Pediatr Orthop B. 2005 Jul;14(4):287-93.