Maintenance of Curve Correction and Unplanned Return to the Operating Room with Magnetically Controlled Growing Rods for Early Onset Scoliosis: A Cohort of 24 Patients with Follow Up between 2 and 7 Years

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INTRODUCTION:

The treatment of early onset scoliosis (EOS) remains challenging even among experienced pediatric spine surgeons. When curves progress despite casting and bracing , operative intervention is indicated. Traditional growing rods (TGR) have been a mainstay of treatment. Unfortunately, TGRs require planned return to the operating room every 6-9 months. Magnetic controlled growing rods (MCGR) ideally provide curve correction and allow the spine to grow without frequent surgeries. The purpose of this study is to evaluate maintenance of curve correction in patients treated primarily with MCGR and analyze the rate of complications including unplanned return to the operating room associated with MCGR.

METHODS:

The chart of 24 patients with EOS who were treated with MCGR between 2014-2016 at a single center were retrospectively reviewed. These patients were subdivided into 4 subcategories: congenital, idiopathic, neuromuscular (NMS), and syndromic. The major curve correction (%) and T1 to S1 distance were assessed utilizing scoliosis plain film radiographs over time. Complications were recorded. Patients were followed until conversion to posterior spinal fusion (PSF) or most recent lengthening of MCGR.

RESULTS:

There were 11 male and 13 female patients averaging 8-years-old at the time of index surgery. The average preoperative Cobb angle was 61.1°. Initial curve correction with MCGR obtained at the index procedure was 46.2%, reducing the mean Cobb angle to 32.7° ($p < 0.05$). Curve correction at a mean 6.2 years [2.4- 7.4] follow up was 36.1°, 40.9% curve correction. Curve correction was observed in all subgroups (Figure 1). Average preoperative T1-S1 distance was 297.0mm ± 48.2 [220-440mm] and increased to 361.4mm ± 54.3 [288-473mm] after two years. At final MCGR follow up T1-S1 distance was 380.4mm ± 52.6 [303-476mm], with an overall increase of 101.9mm ± 38.6 [34-180mm]. In total, 75% of patients underwent conversion to PSF during the study period at an average age of 13.5 [11.3 - 16.0] (4.8 years[2.4-7.0] after initial MCGR surgery). Some 15% of patients were still undergoing MCGR lengthening after 6.1 years. Over half the patients (54.2%) of patients had at least one unplanned return to the operating room (Table 1). Average time to unplanned return to the operating room was 2.5 years (0.8 - 4.1 years). 30.7% of unplanned return to the operating rooms (n= 4/13) were within the first 2 years due to screw pull out or malposition. After two years, failure to lengthen (n=3/13) or running out of room (n=5/13) were the most common reason for unplanned return to the operating room.

DISCUSSION AND CONCLUSION:

This study demonstrated that MCGRs have the ability to maintain curve correction and increase thoracic length well after 2 years. Furthermore, MCGR allowed patients to grow over time in order to safely delay timing to definitive fusion. On average, patients underwent conversion to PSF after 4.7 years at an average age of 13.5. In total, 54.2% of patients required unplanned return to the operating room, with the majority of revisions occurring after two years (69.3%, 9/13). As the use of MCGR increases, surgeons should be aware of possible complications associated with this technology and counsel patients accordingly. Further research is needed to continue to evaluate the efficacy and safety of MCGR in this challenging patient population.

Figure 1 – Graph depicting average cobb angle of each subgroup at the time points of preoperative, immediately postoperative, 2 year and >5 year follow up.

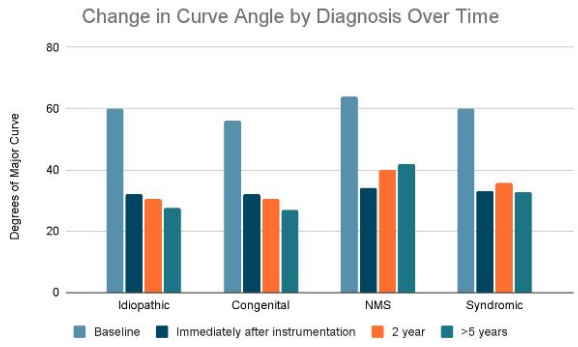

Table 1 -Indications for unplanned return to the operating room

- Screws backing out (n=5)
- Ran out of room (n=5)
- Stopped lengthening (n=3)
- Broken rod (n=2)
- Crankshaft phenomenon (n=1)
- Screw malposition (n=1)