Spinal Deformity Surgery in a Limited-Resource Environment: Trinidad, West Indies

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Introduction

Access to care is a major obstacle to the worldwide treatment of spinal deformity. While surgical correction is often considered a resource-intensive intervention, we aim to report the perioperative safety of a series of procedures performed in a limited-resource environment.

Materials and Methods

We performed a retrospective review of a non-consecutive series of posterior spinal fusions (PSF) from 2006 to 2013 in Trinidad, West Indies. All procedures took place in operative suites that include C-arm fluoroscopy, cell-saver, and total-intravenous anesthesia capability. No intensive care unit (ICU) was available on site. Additional donations included instrumentation and intraoperative neuromonitoring services. Primary outcome measures were surgical time, estimated blood loss (EBL), and complication rates at a minimum of three months postoperatively. We hypothesized that our series would demonstrate perioperative safety comparable to reports in the literature.

Results

A total of 56 procedures were performed, including 45 primary PSF, 8 revision PSF, and 3 growing constructs, all via posterior-only approaches. Of the 45 primary PSF, there was a minimum three month follow-up data for 37, with a median follow-up of 12 (range 3-36) months, including 11 males and 26 females at a median age of 16.4 (9.5-46.9) years. Diagnoses included idiopathic (n = 28), congenital (n = 5), and neuromuscular (n = 4) scoliosis. Median surgical time was 5.0 (2.8-8.8) hours and EBL was 1,300 (261-2,517) mL. Complications included two unplanned transfers for ICU care, two infections (one superficial, one deep), one pneumothorax, one instrumentation failure, and one dural tear. All intraoper ative neuromonitoring events reversed with appropriate measures, and there were no neurologic complications or mortalities. Median major curve Cobb angle preoperatively was 80 (50-120) degrees, and at last follow-up 30 (0-70) degrees, with a median correction of 61 (30-100) percent.

Discussion

Spinal deformity represents a substantial worldwide burden of disease with similar impacts on health-related quality of life across a wide range of cultures and locations.[1] Surgical correction of spinal deformity is a complex and resource-intensive intervention with the potential for severe complications, and there is limited agreement on standards of care for surgical treatment.[2] Even within developed nations, significant variability exists with regard to rates and types of interventions performed.[3]

Few reports exist of clinical outcomes following non-tuberculous spinal deformity correction using modern spinal instrumentation techniques from sites within the developing world. Unnikrishnan et al reported retrospectively on a series of 235 patients undergoing surgical correction of adolescent idiopathic scoliosis.[4] Of this series, 123 patients underwent all-posterior correction and fusion with pedicle screw or hybrid constructs. Mean percent major curve coronal plane corrections varied from 58 to 84% depending on fixation strategy, with improved corrections seen in the all-pedicle screw group. A total of eight complications (3.4%) were reported, including one mortality due to vascular injury during anterior surgery, three neurologic deficits (two full recoveries, one partial recovery), three infections, and one pseudoarthrosis. Nemani et al also reported on a series of 29 patients that underwent spinal deformity correction following the use of preoperative halo-gravity traction, 21 of whom had deformities not secondary to spinal tuberculosis.[5] They observed a mean preoperative major curve correction of 31% with halo gravity traction, with a mean final 56% correction postoperatively. Greater corrections were achieved in patients with pure scoliosis as opposed to kyphosis, and only one three column osteotomy was required in the non-tuberculosis group. There were no neurologic complications with traction, and only one transient neurologic complication postoperatively following a two-level vertebrectomy. In addition to facilitating surgical correction, the authors postulate that traction may have other potential benefits in terms of preoperative optimization of pulmonary

Figure 1. Preoperative clinical photographs and posterior-anterior radiograph of a 13 year old female with severe idiopathic kyphoscoliosis treated in 2014 at the Princess Elizabeth Centre, Port of Spain, Trinidad, West Indies. The preoperative major curve Cobb angle measures approximately 160 degrees.

Figure 2. Postoperative clinical photographs and chest radiograph of the same patient following two weeks of halo-femoral traction and subsequent T3-L4 instrumented posterior spinal fusion with multiple Ponte osteotomies and bilateral costectomies. The postoperative major curve Cobb angle measures approximately 70 degrees.

function, nutritional status, and even mental health. This technique may be especially useful in ameliorating the challenges specific to performing spinal deformity correction in the developing world.These series and our results are largely consistent with reports from similar procedures performed in developed nations.[6,7]

Conclusion

The complication rates and corrections in our series compare favorably to those reported from the developing world as well as institutions with greater resource availability. By achieving these results with relatively small donations of time and equipment, the authors hope to encourage the ongoing expansion of spinal deformity outreach work to other underserved areas.

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References

1. Verma K, Lonner B, Toombs CS, et al. International utilization of the SRS-22 instrument to assess outcomes in adolescent idiopathic scoliosis: what can we learn from a medical outreach group in Ghana? *J Pediatr Orthop* (2014);34(5):503-8.

2. de Kleuver, M, Lewis SJ, Germschied NM, et al. Optimal surgical care for adolescent idiopathic scoliosis: an international consensus. *Eur Spine J* (2014);23(12):2603-18.

3. Daffner SD, Beimesch CF, Wang JC. Geographic and demographic variability of cost and surgical treatment of idiopathic scoliosis. *Spine* (2010);35(11):1165-69.

3. Unnikrishnan R, Renjitkumar J, Menon VK. Adolescent idiopathic scoliosis: Retrospective analysis of 235 surgically treated cases. *Indian J Orthop* (2010);44(1):35-41

4. Nemani VM, Kim HJ, Bjerke-Kroll BT, et al. Preoperative halo-gravity traction for severe spinal deformities at an SRS-GOP site in West Africa: Protocols, complications, and results. *Spine* (2015);40(3):153-61.

5. Reames DL, Smith JS, Fu KM, et al. Complications in the surgical treatment of 19,360 cases of pediatric scoliosis: a review of the scoliosis research society morbidity and mortality database. Spine (2011);36(18):1484-91.

6. Coe JD, Smith JS, Berven S. Complications of spinal fusion for Scheuermann kyphosis: a report of the scoliosis research society morbidity and mortality committee. *Spine* (2010);35(1):99-103.