MD, Grand Rapids Medical Education Partners, Grand Rapids, Michigan, USA, presented the Correlation of Cervical Sagittal Alignment Parameters on Full-Length Spine Radiographs Compared with Dedicated Cervical Radiographs study [Smith CL et al. *Spine*. 2014].

In this retrospective cross-sectional study from a single tertiary spine practice, a billing database was used to identify patients who had both dedicated C- and full-length spine radiographs within a period of 4 months. Sets of radiographs from single patients were measured by one reviewer. Each radiograph set consisted of a dedicated lateral C-spine radiograph and a lateral full-length spine radiograph. Radiograph sets were excluded if the sagittal parameters on 1 or both images could not be accurately measured.

The outcome measures were the following sagittal parameters: C0-C2, C0-C1, C0-C7, C1-C2, and C2-C7 Cobb angles; C1-C7, C2-C7, and CGH-C7 sagittal vertical axis (SVA) differences; T1 tilt; and chin-brow vertical angle. Paired *t* tests and correlation analyses were performed for the corresponding paired radiographs from each patient. A marked correlation was defined as correlation coefficients between 0.60 and 0.80. A robust correlation was defined as correlation coefficients between 0.8 and 1.0.

Radiograph sets were collected from 40 patients. There were 33 women and 7 men. The mean patient age was 48.9 ± 14.5 years. All of the cervical sagittal alignment parameters measured were significantly correlated between the full-length and dedicated C-spine radiographs ($P < .001$). The sagittal Cobb angle correlation coefficients ranged from 0.62 to 0.81. The SVA difference correlation coefficients ranged from 0.42 to 0.65. Paired *t* tests showed that only the C0-C7 angle and T1 tilt angles were significantly different between the full-length and C-spine radiographs ($P = .000$, both).

There were no statistically significant differences between the full-length and C-spine radiographs in C1-C7 SVA and CGH-C7 SVA. The full-length and C-spine radiograph measurement differences were statistically significant for the C2-C7 SVA ($P = .049$).

The results of this study are limited by the small sample size. Although >100 pairs of radiographs were identified, many were excluded due to poor C-spine visualization on the full-length spine radiograph.

Strong correlations were observed between most cervical sagittal measurements taken from dedicated C-spine radiographs and full-length spine radiographs. Most of the measurements were similar between the pairs of radiographs. Dr Smith concluded that a 36-inch full-length spine radiograph may not be necessary for evaluation of C-spine sagittal alignment when a C-spine radiograph has already been obtained.

Intrawound Vancomycin May Influence Postsurgical Bone Fusion

Written by Phil Vinall

Deep surgical site infection rates up to 15% have been reported after multilevel spinal surgery [Caroom C et al. *Spine (Phila Pa 1976)*. 2013]. Furthermore, there is an increasing incidence of cephalosporin-resistant bacterial strains [Sweet FA et al. *Spine (Phila Pa 1976)*. 2011]. Interest in intrawound vancomycin powder has grown, with early data suggesting decreased infection rates [Pahys JM et al. *J Bone Joint Surg Am*. 2013]. In a prior study, however, drainage from wounds treated with vancomycin was found to contain levels of vancomycin high enough to cause toxic effects in the surrounding tissue [Sweet F et al. *Spine J*. 2009]. Thus, further research is needed in order to determine the vancomycin dose for intrawound application that optimizes bactericidal effects while minimizing detrimental effects on bone healing.

Michael Ogon, MD, PhD, Orthopaedic Hospital Speising, Wien, Austria, reported data from an in vitro study entitled Does Intrawound Application of Vancomycin Influence Bone Regeneration in Spinal Fusion? [Eder C et al. *Spine*. 2014], indicating that locally applied vancomycin interferes with migration, proliferation, and differentiation of human osteoblasts (particularly at doses of 6 and 12 mg/cm^2) and thus may influence bone fusion after spinal surgery.

The protocol for this study was based on a phase 1 US Dose Escalation Trial of Intrasite Vancomycin Pharmacokinetics study [NCT01764750], which was designed to develop rules for standardizing application and dosing, define peak/trough concentrations and clearance parameters, verify bactericidal potency, and select a dose for use in future studies. The study is not yet open for recruitment but expects to enroll 40 adult patients who are undergoing posterior instrumented spinal surgery with an instrumented fusion of ≥3 vertebral levels. The primary outcome measures were wound and seroma vancomycin concentrations.

The objectives of this study [Eder C et al. *Spine*. 2014] were to assess the effect of vancomycin on changes in local pH, cell migration, proliferation, viability, and morphological changes. Prof Ogon presented data based on an analysis of bone samples from 10 patients (5 men and 5 women; mean age 57 years; 2 smokers). Cells were cultured in Dulbecco's modified Eagle's medium plus 10% fetal calf serum plus 2 mM L-glutamine plus 0.05 ascorbic acid plus gentamycin 50 µg/ml plus vancomycin 3, 6, or 12 mg/cm^2 or no vancomycin.

Local application of vancomycin was associated with a significant decline in pH to a nonphysiologic range at doses of 6 mg/cm^2 ($P<.015$) or 12 mg/cm^2 ($P<.001$). It also resulted in a dose-dependent suppression of osteoblast migration (control, 100%; 3 mg/cm^2, 44%; 6 mg/cm^2, 33%).

After 24 hours, cell proliferation and viability were also reduced, with the reductions being significant at the 6 and 12 mg/cm^2 doses for proliferation and at the 12 mg/cm^2 dose for viability (both $P<.001$). The application of vancomycin also led to a significant ($P<.001$) inhibition of alkaline phosphatase expression (15.4% in controls vs 1.8% at 3 mg/cm^2 and undetectable at the 6 and 12 mg/cm^2 doses).

Dr Ogon concluded that cell migration, proliferation, and differentiation are key factors in osteogenesis. To properly balance the risks of infection and nonunion, controlled in vivo studies should be conducted to establish the minimal local concentrations of vancomycin necessary for infection prevention.

Deviation From Preoperative Planning Leads to Undercorrection of Sagittal Spine Deformities

Written by Phil Vinall

Bertrand Moal, MS, NYU Hospital for Joint Diseases, New York, New York, USA, presented details of the Discrepancies in Preoperative Planning and Operative Execution in the Correction of Sagittal Spinal Deformities study [Liu BS et al. *Spine*. 2014], demonstrating the complexity of intraoperative decision making and indicating that deviation from the preoperative plan may lead to undercorrection of sagittal spine deformities, especially in patients in need of large lumbar lordosis (LL) correction.

In patients with adult spinal deformity (ASD), sagittal malalignment correlates with disability. The SRS-Schwab ASD classification is a system that describes and classifies ASD and is used to define realignment objectives based on 3 sagittal modifiers: pelvic incidence–LL (PI-LL), global alignment (sagittal vertical axis [SVA]), and pelvic tilt (PT). Despite the known connection between sagittal realignment and postoperative outcomes, postoperative radiographs show suboptimal alignment in about 40% of cases as a result of either deterioration or lack of correction. Preoperative planning tools are needed.

This was a prospective study designed to evaluate the discrepancies in preoperative planning and operative execution in the correction of sagittal spinal deformities. The study comprised consecutive patients with ASD undergoing major sagittal realignment surgery. Data were collected on preoperative planning, surgical strategy, and complication and revision rates. Preoperative and 3-month postoperative radiographs were evaluated for thoracic kyphosis (TK), LL, PI-LL, SVA, and PT. Outcome measures included preoperative, planned, and postoperative spinopelvic alignment (SRS-Schwab) and major changes in plan (less aggressive procedure than planned, more aggressive procedure than planned, and no change).

The study enrolled 50 patients (mean age, 64 years; body mass index [BMI], 27 kg/m^2; 70% with a history of spine surgery). Data were incomplete for 9 patients. Most participants had large sagittal malalignment.

Only 14 patients (34%) were planned to reach grade 0 for PI-LL, PT, and SVA. The locations of the most common upper instrumented vertebrae (UIV) were T10 and T4. Twenty-seven patients were planned for single grade III resection, and 12 patients were planned for at least 1 grade II osteotomy. Only 4 patients (10%) had a postoperative grade 0 in all 3 modifiers.

For patients, the postoperative grade was a smaller grade than planned (PI-LL, 12%; PT, 10%; SVA, 23%), the same grade as planned (PI-LL, 51%; PT, 29%; SVA, 44%), or a greater grade than planned (PI-LL, 37%; PT, 61%; SVA, 33%).

There were significant differences in the mean planned vs postoperative change for LL, PI-LL, and PT ($P\leq.001$) but not SVA. Mr Moal suggested that this may have been due to greater-than-planned changes in TK and undercorrection of both LL and PT. Procedurally, UIV changed by 1 level for 6 patients (5 to 1 level less). Eight changes in planned interbody fusions were reported in 7 patients (5 unplanned; 3 were not performed).

Twenty-five patients received the planned procedure; 14 received less aggressive; and 2 received more aggressive procedures. There were no significant differences in age, BMI, blood loss, or distribution of short/long fusion between patients having more vs less aggressive surgery. Patients with less aggressive surgery had greater correction of LL and PT but more grade II osteotomies and fewer grade III resections. There were no differences between the groups having less aggressive surgery and those with no procedural changes. There were also no differences in complications or revisions.

This was the first study to examine surgical strategy and procedures from preoperative planning to postoperative alignment, and it indicated the need for better planning and intraoperative tools for predicting sagittal alignment.