OUTCOME MEASURES: Intraoperative outcomes, perioperative and long-term complications, coronal and sagittal radiographic alignment correction, and patient-reported outcomes (PROs) including the Oswestry Disability Index (ODI) and Scoliosis Research Society (SRS)-22r survey.
METHODS: AIS and YAdIS patients were stratified based on their age at operation (10-18 vs 19-40). Any patients with fusion to the sacrum or previous spine surgery were excluded. 1:1 propensity score matching (PSM) was done in SPSS based on curve type, gender, main coronal Cobb angle, and instrumented levels. Surgical outcomes were collected and compared, as were coronal and sagittal radiographic parameters at final or most recent follow-up.
RESULTS: Conducting 1:1 PSM of the initial 237 patients generated 2 groups of 27 patients with identical gender ratios and curve types. The AIS group had lower preoperative Hb/Hct than YAdIS (11.8[1.9] vs 13.2[1.2] and 35.2[5.5] vs 39.4[3.3], p=0.0213 and 0.0147 respectively) and lower age and BMI ($p<0.05$), which was expected. Preoperative radiographic parameters were equal, except that AIS patients had slightly less lordosis (55.6°[14.0] vs 61.8°[11.7], p=0.0486). AIS had lower OR time (4.7[1.2] hrs vs 5.2[1.5] hrs, p =0.0468), intraoperative transfusion rates (70.4% vs 96.3%, p=0.0082), and postop Hb/Hct (9.0[1.9] vs 10.1[1.4] and 26.4[5.4] vs 29.7[3.7], p=0.0280 and 0.0453 respectively). Other intraoperative outcomes and complications were the same (EBL, transfused pRBC and cell saver, surgical site infection, dural tears, and nerve root weakness, $p>0.05$). Postoperatively, AIS patients had a lower rate of hypotension (7.4% vs 25.9%, p=0.0253) and less pRBCs transfused (1.0[0.0]u vs 1.6[0.8]u, p=0.0400). They also had smaller T2-T12 TK (36.3°[11.0] vs 42.7°[13.6], p=0.0412), T2-T5 TK (13.3°[8.7] vs 19.4°[9.4], p=0.0187), and T1PA (7.4°[8.9] vs 12.4°[7.9], p=0.0200). The magnitude of correction of all spinal parameters was equal except for T1PA (1.0°[5.1] vs 5.3°[5.0], p=0.0060) and CVA (-0.9[2.0]cm vs 0.6[2.1]cm, p=0.0085), indicating that AIS had greater coronal correction to the left while YAdIS had greater correction to the right. Long-term rates of complications, revisions and mechanical failures, as well as baseline and follow-up PROs, were equivalent ($p>0.05$).
CONCLUSIONS: AIS patients have lower OR time, intraoperative transfusion rate, and postoperative transfused pRBCs and hypotension. Otherwise, they have comparable perioperative and long-term complication and revision rates and PROs to YAdIS patients. Radiographically, they have smaller postoperative T2-T12 TK, T2-T5 TK and T1PA, with greater CVA correction to the left versus the right.
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54. Potential benefit of staging surgery for complex spinal surgery: taking advantage of the opportunity to change the operative plan between stages

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BACKGROUND CONTEXT: Staged reconstructive spine surgical procedures are routinely performed for patients with multilevel degeneration and degenerative deformity of their spine, whose symptoms are refractory to conservative measures. In such complex cases, determining the most appropriate extent of surgical treatment is challenging, including projecting the amount of correction achieved with the interbody stage and the optimal posterior surgery after the interbody stage. Careful evaluation between stages provides an opportunity to optimize the second stage involving posterior procedures.
PURPOSE: To determine the incidence of altering the initial surgical plan based on assessment between the first and second stages of major reconstructive spine surgical procedures.
STUDY DESIGN/SETTING: Retrospective chart review.
PATIENT SAMPLE: Adult spine deformity patients that underwent staged spinal reconstruction surgical procedures from 2016 to 2021.
OUTCOME MEASURES: Frequency and reasons for altering the initial surgical plan Modalities of alteration to the initial surgical plan.
METHODS: We reviewed clinical charts for patients who underwent staged spinal reconstruction procedures between 2016 to 2021 by a single experienced surgeon. We collected pre-, intra- and postoperative data including the initial operative plan, the executed plan, and any alterations that were made to the initial preoperative plan between the staged surgical procedures.
RESULTS: A total of 159 patients underwent staged reconstructive spinal surgery. F:M ratio was 2:1, mean age 64.6 yrs (33 − 80) and mean BMI 27.43 (17.57 − 40.77). The most common surgical indication was degenerative deformity, followed in descending order of frequency by adjacent segment disease, infection, and pseudarthrosis. About 60% of these patients had undergone at least one prior spine surgical procedure. The most common surgical approaches for the initial and second stage procedures were an anterior lumbar interbody fusion via a left-sided retroperitoneal approach and a posterior midline approach respectively. The average number of days between these procedures was 5. The initial operative plan was altered in 31.4% of patients (n = 50); this resulted in less extensive surgical procedures, including conversion to minimally invasive posterior percutaneous approaches, in up to 90% of these patients with altered plans. The remaining patients had persistent, worsened or new clinical symptoms, requiring a more extensive 2nd stage surgical approach.
CONCLUSIONS: While traditionally, staging of complex reconstruction spinal surgery may have been due to risk factors related to operative time, anesthesia time, and/or blood loss, the results of this study found an additional benefit of the opportunity to alter the initial surgical plan - in 31% of cases - for the second stage. In the majority of these cases, the alteration resulted in a less extensive procedure. Staging complex procedures, and carefully evaluating patients between the stages allows for optimization of the second stage. Additional investigation is warranted to determine the implications of this finding on cost and complications/reoperations.
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55. Sarcopenic obesity: an underrated phenomenon impacting adult spinal deformity intervention outcomes

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BACKGROUND CONTEXT: The amount and quality of tissue do not always positively correlate as is the case with sarcopenic obesity. As the population of elderly people with adult spinal deformity (ASD) continues to increase, sarcopenia (decreased muscle mass) and obesity continue to soar in prevalence, although sarcopenia is underacknowledged.

PURPOSE: To determine how sarcopenic obesity may impact adult spinal deformity surgery outcomes and better characterize the health of important surrounding structural tissue that is key to alignment.
STUDY DESIGN/SETTING: Retrospective cohort review of prospectively enrolled database.
PATIENT SAMPLE: A total of 529 adult spinal deformity patients.
OUTCOME MEASURES: radiographic parameters, mechanical complications, complications
METHODS: Operative ASD patients with complete baseline (BL) and 2-year (2Y) baseline, radiographic, and health related quality of life (HRQL) data were included. Sarcopenia was defined based on the validated European Working Group of Sarcopenia in Older People (EWGOSOP2). Obesity was classified via traditional BMI categories. The cohort with sarcopenic obesity (SO) was compared to a cohort of patients without. Descriptive statistics, means comparison testing, and regression analyses were applied to identify differences and trends, including a subanalysis of those with SO vs each condition alone.
RESULTS: A total of 529 patients met inclusion criteria (mean age: 60.2± 14.3, mean BMI: 27.1±5.8, mean CCI 1.6±1.7, mean weighted mASD-FI: 6.5±4.9). In terms of surgical characteristics, mean operative time 414.1± 175.3 minutes, mean EBL 1565.9±1387.2, mean levels fused 10.9 ±4.6). 311 patients (58.8%) registered a confirmed diagnosis of sarcopenia, while 100 patients (60.4%) were considered obese. Altogether, 206 (38.9%) of patients demonstrated aspects of SO. The SO cohort was significantly older (61.9 vs 59.1, p=0.032) with a significantly greater number of comorbidities and higher frailty score (p<.001, both). At baseline, patients with SO demonstrated significantly lower baseline lower extremity motor scores (p=.004). Radiographically, SO patients had greater pelvic tilt (25.2 vs 22.9, p=0.018), greater PI-LL (19.6 vs 12.6, p<.001), less lumbar lordosis (41.7 vs 36.3, p=0.004), greater vertebral pelvic angles (p<.01) at T1, T4, T9, L1 and L4, and greater GAP scores indicating higher disproportionality (p=0.032). In terms of complications, SO patients demonstrated considerably higher rates of cardiac complications (83.3% vs 16.7%, p=0.025) and surgical infection (66.7% vs 33.3%, p=0.025).The SO cohort also sustained a significantly greater rates of pseudarthrosis (64.3% vs 35.7%, p=0.049) and failure with reoperation (60.0% vs 40.0%, p=0.027), with a significantly higher rates instrumentation failure (50.7% vs 49.3%, p=0.045). From a prevention perspective, the use of PJK prophylaxis amongst those with SO showed lower rates of screw breakage (p=0.039) and mechanical complications (p=0.004) as opposed to SO patients who did not receive prophylaxis. SO was a positive predictor of instrumentation failure (OR 1.7, p=0.047) while obesity or sarcopenia were not significant predictors alone. SO patients also achieved age-adjusted match goals at a lower rate than non-SO patients (p<.001). Clinically, this manifested as greater back and leg NSR pain scores at every time point up to 2 years.
CONCLUSIONS: Sarcopenic obesity appears to significantly hamper outcomes after ASD, and awareness of the patient's muscle quality could guide operative decision-making as well as serve as a valuable target for preoperative optimization through measures such as nutritional counseling and prehabilitation.
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56. Defining a high-risk adult spinal deformity patient: utilizing predictive analytics to assess factors associated with increased risk of medical and surgical complications following thoracolumbar corrective surgery

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BACKGROUND CONTEXT: High-risk committees have recently been instituted at many hospitals, in an effort to minimize operative risk and recruit a multidisciplinary discussion. Both surgical and medical risk factors can lead to the occurrence of adverse events and prolonged recovery course. Little consensus has been reached as to which components of patient profiles and surgical factors predispose preoperative discussion.
PURPOSE: To investigate baseline and surgical factors that will identify which ASD patient presents as a high-risk patient.
STUDY DESIGN/SETTING: Retrospective cohort study of a prospective adult thoracolumbar deformity database.
PATIENT SAMPLE: A total of 689 ASD patients.
OUTCOME MEASURES: Complications, patient reported outcome measures (ODI).
METHODS: Operative ASD patients (scoliosis >20°, SVA>5cm, PT>25°, or TK>60°) with available baseline (BL) and 2-year (2Y) radiographic and HRQL data were included. Determination of risk of surgery was assessed by medical and surgical complications. High medical risk was defined as experiencing a major medical complication with a negative clinical impact (failing to meet MCID for ODI). High surgical risk was defined as experiencing a major surgical complication or revision surgery with a negative clinical impact. Conditional inference tree machine learning developed threshold cutoffs for continuous variables. Multivariable logistic regression developed medical risk and surgical risk scores.
RESULTS: A total of 377 ASD patients met inclusion criteria (61.1yrs± 14.0, 78%F, BMI: 28.0 kg/m2 ±6.0, CCI: 1.9 ±1.7). Surgically, patients had 11±4.3 levels fused, length of stay was 7.9±4.6, EBL 1476±1434ml, and Op-time 376±133 min, with 63% undergoing an osteotomy, 54% a decompression. In terms of surgical approach, 71% posterior-only and 28% had a combined approach. For High Medical Risk, age >70, BL ODI >56, BL Frailty Index >5, CCI >3, prior revision, history of heart disease, liver disease, lung disease, BL SVA >15cm, BL C7PL >7cm, and BL PI-LL >25 predicted a poor outcome with an AUC of 97% and accuracy of 98%. Patients with at least 1 of these factors had a greater degree of major (21% vs 5%), mechanical (19% vs 10%), and overall complications by 2 years (64% vs 46%, all p<.05). For High Surgical Risk, age >70, BL ODI >56, BMI >34, Frailty >5, BL SVA >15cm, BL C7PL >7cm, BL PI-LL >25, previous surgical fusion, >16 levels fused, 3CO, instrumentation removal, and >3 interbody fusions predicted poor outcome with an AUC of 93% and accuracy of 94%. Patients with at least 2 of these factors had higher rates of major (20% vs 9%), mechanical (20% vs 10%), and overall complications (65% vs 48%, all p<.05).
CONCLUSIONS: Recognition of patient-specific and surgical factors that contribute to a high risk of major medical and surgical complications with poor clinical outcomes will allow surgeons to better profile which patients may require multidisciplinary collaboration for appropriate perioperative optimization. The present study reveals patients greater than 70 years of age, increased baseline disability and deformity, heightened frailty status, and planned 3-column osteotomy are at increased risk of major, mechanical, and overall complications.
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