Predicting excessive hemorrhage in adolescent idiopathic scoliosis posterior spinal fusion

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Background

Blood loss for Adolescent Idiopathic Scoliosis (AIS) patients undergoing Posterior Spinal Instrumentation and Fusion (PSIF) varies widely, including reports of unexpected massive hemorrhage associated with this surgery. The reason for the wide range of blood loss is not clear.

Past studies have reported blood loss in terms of ml per level fused, or as a percentage of estimated total blood volume. Past studies have also compared blood loss in AIS patients to patients with neuromuscular scoliosis patients.

Objectives

Examine the probability of high blood loss in Adolescent Idiopathic Scoliosis patients undergoing Posterior Spinal Instrumentation and Fusion. Identify clinical variables associated with blood loss in this population.

Use information from this study to:

• Advise approaches to perioperative planning.
• Guide future investigations.

Methods

• Retrospective chart review of 311 consecutive AIS patients undergoing PSIF at Children’s Hospital Colorado from 2005-2010.

• Data collected:
  • Demographic data
  • Autologous blood conservation strategies
  • Blood loss data
  • Injury severity data
  • Preoperative labs
  • Surgical history, results of preop labs and hematology consults (if any).

• Intraoperative data – surgeon, anesthesiologist, operative time, levels fused, screws placed, blood conservation techniques, estimated blood loss (EBL), blood loss (EBL) (visual method), blood products infused, intraoperative labs, lowest temperature recorded, adverse events.

• Post operative data – daily Hct, drain output, blood products transfused.

• Calculated variables - BMI, estimated blood volume (EBV) (Nadler’s formula).

Results

Pertinent demographic, preoperative and intraoperative factors:

• Number of levels fused mean was 10.41 ± 2.18
• Intraoperative mean EBL was 956.6 ± 591.86
• 103 patients (33.1%) predonated a mean of 1.83 units of autologous blood.
• Autologous predonation and preoperative Hct were inversely related (p = 0.001) but not clinically significant for excessive blood loss.
• Cell saver was used for 7 cases with mean infusion volume of 124.3 ml
• 201 (65%) received intraoperative transfusions with a mean PRBCs of 1.98 ± 1.18

Characteristics of those with excessive blood loss by any definition versus those without:

Estimates of the probability of excessive blood loss based on the number of levels fused:

In this retrospective chart review of 311 patients with AIS undergoing PSIF, we did not find a subset of patients that bled more than what could be defined as normal (expected) variation based upon surgical complexity (number of levels fused). We found equal utility and a 10% percentile incidence of bleeding with these three definitions: > 1700 ml EBL; > 50% EBL/EBV; > 150 ml level fused blood loss.

Conclusions

We recommend instituting an algorithm:

• Screen for laboratory tests
• Bleeding questionnaire
• Targeted hematology consultation
• Blood conservation strategies

When fusions of twelve or more levels are planned.

We further recommend:

• Using 90 ml (45-133) per level to preoperatively calculate expected EBL.
• Comparing expected EBL to EBV to inform intraoperative blood conservation strategy planning.

A prospective study incorporating an algorithm protocol along these lines may yield associations that could narrow the current range of expected blood loss in these cases.

References


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Implications

In this retrospective chart review of 311 patients with AIS undergoing PSIF, we did not find a subset of patients that bled more than what could be defined as normal (expected) variation based upon surgical complexity (number of levels fused). We found equal utility and a 10% percentile incidence of bleeding with these three definitions: > 1700 ml EBL; > 50% EBL/EBV; > 150 ml level fused blood loss.

The probability of reaching any cut-off was 11.5% with 12 levels fused. The probability of reaching any cut-off was 19.3% with 13 levels fused.