

# Major Complications following Adult Spinal Deformity Surgery: Is There a High Risk Patient Profile?

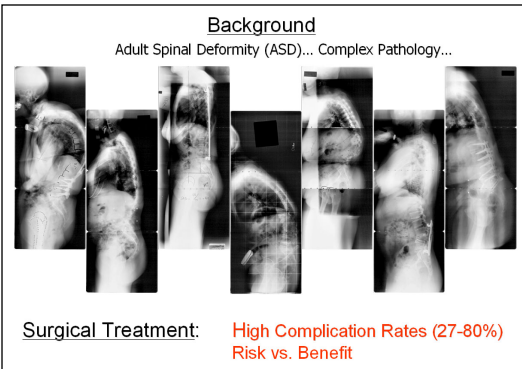
Nicola Hawkinson MA, NP; Frank Schwab; Beverly Kelly; Jean Pierre Farcy MD; Gregory Mundis MD; Matthew E. Cunningham MD, PhD; Behrooz A. Akbarnia MD; Richard A. Hostin MD; Robert Hart MD; Oheneba Boachie-Adjei; Douglas C. Burton MD; Eric Klineberg MD; Christopher I. Shaffrey MD; Shay Bess MD; International Spine Study Group



## International Spine Study Group

### Introduction

Perioperative complication rates for adult spinal deformity (ASD) have been reported as high as 80%. Reported risk factors: age, co-morbidities, and blood loss. Risk scores exist in other surgical disciplines, however, is lacking for ASD. The goal is to identify major peri-operative complications and determine if patient profiles can be defined in ASD surgery.



### Methods

Retrospective, consecutive, multi-center (n=8) review of major perioperative (<6wks post-op) complications in ASD patients (coronal/sagittal deformity). Major complications were identified and categorized as: pulmonary, neurological, cardiovascular, gastrointestinal, and infectious. Clinical chart reviews were conducted to obtain; ASA grade, comorbidities, preoperative labs, and intra/postoperative parameters. Incidence of complications and patient profiles described.

### Method / Inclusion Criteria

Multicenter (n=8), Retrospective, Consecutive Chart & Radiographic Review

Adult Spinal Deformity	Intraoperative Complications
- Cobb > 30 degrees	<input type="checkbox"/> Cardiac Arrest
- Sagittal imbalance > 5cm	<input type="checkbox"/> Low Blood
- Coronal imbalance > 5cm	<input type="checkbox"/> Death
- Kyphosis > 60deg	<input type="checkbox"/> Blood Spill
- Lordosis < 30deg	<input type="checkbox"/> Open Dural Sac/Spinal Cord
- TK Kyphosis > 20deg	<input type="checkbox"/> Spinal Cord Injury
	<input type="checkbox"/> Spinal Cord Hematoma
	<input type="checkbox"/> Spinal Cord Palsy
	<input type="checkbox"/> Excessive Bleeding / Hemolysis
	<input type="checkbox"/> Major Vessel Tear
	<input type="checkbox"/> Other
Major Complication	Postoperative Complications
- Per-op. before / after dc (<6w)	<input type="checkbox"/> Hypotension (<60)
- Categorized	<input type="checkbox"/> Sepsis / Sepsis Shock
• Pulmonary	<input type="checkbox"/> Deep Vein Thrombosis
• Neurological	<input type="checkbox"/> Stroke
• Cardiovascular	<input type="checkbox"/> Myocardial Infarction
• Gastrointestinal	<input type="checkbox"/> Pulmonary Embolism
• Infectious	<input type="checkbox"/> Hemiparesis
	<input type="checkbox"/> Paralysis
	<input type="checkbox"/> Spinal Cord Injury
	<input type="checkbox"/> Stroke
	<input type="checkbox"/> Acute Respiratory Distress Syndrome
	<input type="checkbox"/> Cholestasis
	<input type="checkbox"/> Pancreatitis
	<input type="checkbox"/> Urinary Tract Infection
	<input type="checkbox"/> Hospital Acquired Infection >10d
	<input type="checkbox"/> Prolonged ICU Stay >mean + 2SD
	<input type="checkbox"/> Death
	<input type="checkbox"/> Sepsis / Sepsis Shock
	<input type="checkbox"/> Deep Vein Thrombosis
	<input type="checkbox"/> Stroke
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	<input type="checkbox"/> Prolonged ICU Stay >mean + 2SD

### Results

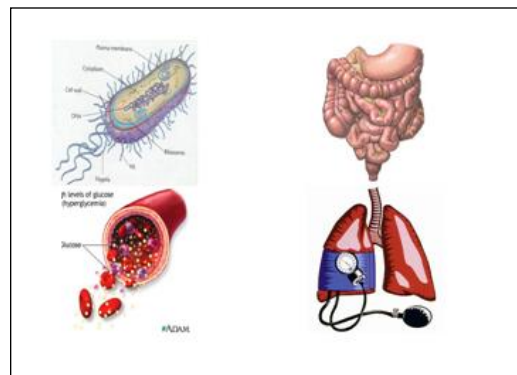
72(18M, 54F) of 953 consecutive ASD patients were identified with a mean age of 54 (18-79) and total incidence of 99 major and 133 minor complications. Mean operative time was 491mn, mean EBL was 2440ml and mean transfusion was 3100ml RBC's. 54% were revision cases (mean 1.9 previous surgeries) and 50% were staged procedures. 44% of patients were ASA grade III (mean ASA 2.33).

### Results - Demographic

- 72 Patients** (from 953 consecutive ASD Surgeries)
- 7.5% Incidence Major Complication
    - Total Incidence 99 Major and 133 Minor Complications
  - Mean Age 54yrs (18-79) 18M, 54F

Mean Co-Morbidity Rate: 2.5 per patient

- HTN
- Depression/Anxiety
- CAD
- Hypothyroidism



There was a mean co-morbidity rate of 2.5 per patient. Most common comorbidities: hypertension, depression/anxiety, coronary artery disease and hypothyroidism. The mean length of ICU stay: 3.4 days. Most common major complications: excessive (>4L) intraoperative bleeding (n=11), return to the OR for deep wound infections (n=11) and pulmonary embolus (n=10).

### Results – Complications

Most Common Major Complications:

- Excessive (>4L) Intra-operative bleeding (15.3%, n=11)
- Return to OR for deep wound infection (15.3%, n=11)
- Pulmonary embolus (13.9%, n=10)

### Discussion

#### Inherent Risk of ASD surgery not avoidable

- risk profiles critical to make risk-benefit decisions
- procedure/patient profiles associated with major complications:
  - High EBL, OR time, ASA grade, thyroid condition...
  - not necessarily old or obese
- ongoing prospective studies
  - refine risk profiles
  - develop risk scoring system for ASD



### Conclusions

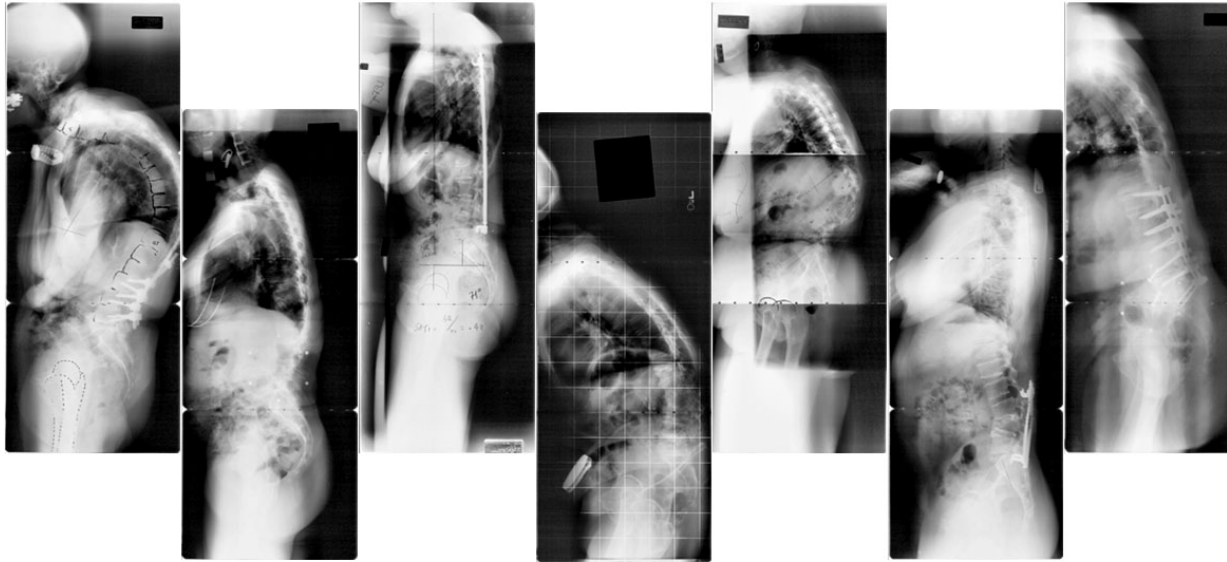
Improved understanding of risk profiles and procedure-related parameters is critical. Such information can assist in pre-operative risk-benefit decisions and preemptive approaches to reduce risk. This study reveals that patients affected by major complications in ASD surgery may not be 'typical' high risk patients. This study will form the basis for a prospective multi-center study and aid in the development of a risk scoring system for ASD.

### References

- Baron EM, Albert TJ. Medical complications of surgical treatment of adult spinal deformity and how to avoid them. Spine 2006;31:S106-18
- Daubs MD, Lenke LG, Cheh G, et al. Adult spinal deformity surgery: complications and outcomes in patients over age 60. Spine 2007;32:2238-44.
- Hu SS, Berven SH. Preparing the adult deformity patient for spinal surgery. Spine 2006;31:S126-31.
- Swank S, Lonstein JE, Moe JH, et al. Surgical treatment of adult scoliosis. A review of two hundred and twenty-two cases. J Bone Joint Surg Am 1981;63:268-87.

## Background

Adult Spinal Deformity (ASD)... Complex Pathology...



Surgical Treatment:

**High Complication Rates (27-80%)  
Risk vs. Benefit**

# Method / Inclusion Criteria

*Multicenter (n=8), Retrospective, Consecutive Chart & Radiographic Review*

## Adult Spinal Deformity

- Cobb > 30 degrees
- Sagittal imbalance > 5cm
- Coronal imbalance > 5cm
- Kyphosis > 60deg
- Lordosis < 30deg
- TK Kyphosis > 20deg

## Major Complication

- Per-op, before / after dc (<6w)
- Categorized
  - Pulmonary
  - Neurological,
  - Cardiovascular,
  - Gastrointestinal,
  - Infectious.

### Intra-operative Complications

- Cardiac Arrest
- Cord Defect
- Death
- Nerve Root Injury
- Optic Defect/Blindness
- Coagulopathy (DIC)
- Vessel/Vorgan injury
- Excessive Bleeding if >4liters
- Malignant Hypothermia
- Other:

### Post-operative Complications

#### In patient (before dc)

- Bowel / Bladder Deficit
- Death
- Deep Vein Thrombosis
- Cauda Equina Deficit
- Infection-Deep return to OR
- Motor Deficit/Paralysis
- Myocardial Infarction
- Neuropathy
- Optic Defect/Blindness
- Pneumonia
- Pulmonary Embolism
- Reintubation
- Sepsis
- Stroke
- Acute Respiratory Distress Syndrome
- Cholecystitis
- Pancreatitis
- Unplanned return to OR
- Tracheotomy/Prolonged intubation >10d
- Prolonged ICU stay\* greater than 72hr

#### Outpatient (up to 6 weeks)

- Bowel / Bladder Deficit
- Death
- Deep Vein Thrombosis
- Cauda Equina Deficit
- Infection-Deep return to OR
- Motor Deficit/Paralysis
- Myocardial Infarction
- Neuropathy
- Optic Defect/Blindness
- Pneumonia
- Pulmonary Embolism
- Sepsis
- Stroke
- Acute Respiratory Distress Syndrome
- Cholecystitis
- Pancreatitis
- Unplanned return to OR
- Tracheotomy

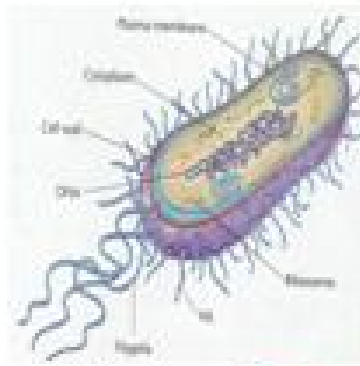
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**72 Patients** (from 953 consecutive ASD Surgeries)

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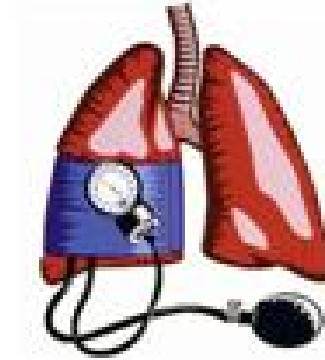
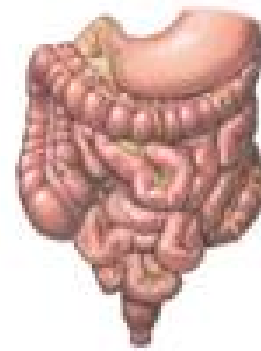
1. HTN
2. Depression/Anxiety
3. CAD
4. Hypothyroidism



High levels of glucose (hyperglycemia)



#ADAM



# Results – Complications

## Most Common Major Complications:

1. Excessive (>4L) Intra-operative bleeding (15.3%, n=11)
2. Return to OR for deep wound infection (15.3%, n=11)
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