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8/20/2017

Complex Spine Fusion – Clinical Practice Guideline (CPG)

Children's Healthcare of Atlanta

Focus: Complex medical patients, such as neuromuscular, requiring spinal fusion that do not fall under the Idiopathic Guideline

Index:

INCLUSION Criteria:

- Any age needing a spine fusion **and** having one or more of the following:
- Complex medical problems often involving treatment by multiple specialists
- Congenital curve > 90 degrees or requiring 3 column osteotomy
- Idiopathic curve > 90 degrees
- GMFCS 4 & 5 Cerebral Palsy
- Anticipated Halo Traction

EXCLUSION Criteria:

- Patients that fall under Idiopathic Spine Guideline definition
- GMFCS 1-3 Cerebral Palsy
- Patient undergoing isolated anterior spinal instrumentation procedure

List of Medical Abbreviations used in the clinical practice guideline

AIS – Adolescent Idiopathic Spine
ASD – Atrial Septal Defect
BM – bowel movement
BMI – Basal Metabolic Index
CBC – Complete Blood Count
CBG – Capillary Blood Gas
CHD – Congenital Heart Disease
CM – Case Management
CMP – Complete Metabolic Panel
CP – Cerebral Palsy
CPT – chest physiotherapy
CSF – Cerebrospinal Fluid
CT – computed tomography (cat scan)
CTD – Connective Tissue Disorder
CVL – Central Venous Line
CXR – Chest X-Ray
d/c - discharge
DIC – Disseminated Intravascular Coagulation
EBL – Estimated Blood Loss
ECG - Echocardiogram

EF – Ejection Fraction
FVC – Force Vital Capacity
FFP – Fresh Frozen Plasma
GJ – Gastro Jejunal Tube
gm - gram
GMFCS – Gross Motor Function Classification Scale
GT – Gastrostomy Tube
hr – hour
HTN - Hypertension
Hb – Hemoglobin (lab)
Hct – Hematocrit (lab)
ICD – Intra-Cardiac Device
INR – International Normalization Ratio (lab)
IONM – Intra Operative Neuro Monitoring
IOP – Intra Ocular Pressure
IV – intravenous
IVF – intravenous fluid
LVEF – Left Ventricular Ejection Fraction
MAC – Monitored Anesthesia Care
MAP – Mean Arterial Pressure

MD – Medical Doctor
MEP – Maximal Expiratory potential (Pulmonary)
mg - milligram
MIP – Maximal Inspiratory Potential (Pulmonary)
MRI – Magnetic Resonance Imaging
MVV – Maximal Voluntary Ventilation (Pulmonary)
NIV – Non-Invasive Ventilation
NSGY – Neurosurgery
NV – Nausea/Vomiting
O&P – Orthotics and Prosthetics
OOB – out of bed
OSA – Obstructive Sleep Apnea
OT – Occupational Therapy
OR – Operating Room
PCA – Patient Controlled Analgesia
PO – by mouth
PT – Physical Therapy
PFT – Pulmonary Function Test
PLOF – Prior level of function
PRBC – Packed Red Blood Cells

PRN – as needed
PT – Thromboplastin Time
PTT – Partial Thromboplastin Time
Pulse Ox – pulse oximetry
RN – registered Nurse
SLP – Speech Language Pathology
SMA – Spinal Muscular Atrophy
SSEP – Somato Sensory Evoked Potential
SW – Social Work
Tabs - tablets
TEG - Thromboelastogram
TID – 3 times per day
TIVA – Total Intravascular Anesthesia
TLSO – Thoraco Lumbar Sacral Orthosis
TTE – Trans Thoracic Echo
TXA – Tranexamic Acid
UOP – Urinary Output
VNS – Vagal Nerve Stimulator
VS – vital signs

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Complex Spine Fusion – *PRE-OP* Clinical Practice Guideline

Focus: Pre-Operative evaluation and considerations for surgery clearance

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Service Lines →	Gastroenterology	Cardiology	Pulmonary	Neurology & Neurosurgery	Orthotics/Prosthetics/ Seating & Mobility	Orthopaedics PT/OT/Child Life
Referral Need?	**Yes** * No GT + BMI<10% = see GI + 2-3 months to improve nutrition. (Z scores provide a standard deviation) * If GT -see to make adjustments prn * GJ if surgeon concerned – GI decision **No** * If no GT and normal BMI * If obese	* Concerning Symptoms – palpitations, chest pain, episodes of shortness of breath, cardiac concerns. * Family history of aortic disease, cardiomyopathy * Abnormal Physical exam * Suspected underlying CTD * Dural Ectasia / Protrusio Acetabulae * If on anthracycline for chemo	* If FVC < 60% predicted or unable to obtain PFT's * Decline in PFT's > 10% * Serum Bicarb > 30 or abnormal CBG * SaO2 < 95% at normal baseline * Sleep disordered breathing (snoring, daytime somnolence) * If positive pulmonary screening: **Page 8** of guideline. * Consider PFT needed if COBB angle > 90 degrees	* Shunt not evaluated in > 1 year or not had imaging within last 12 months * symptoms like last malfunction, nausea, headache, seizures, or vomiting. * Myelo with progressive curve/ large curve * Fatty filum and low lying conus * Small Syrinx – consider NSGY at minimum * VNS – refer before / after to interrogate (Magnet not needed) * concern- need increased baclofen dose * Indwelling baclofen pump – consider letting NSGY know beforehand	**Contact O&P pre-op for:** * Call for Halo Consults & Halo Fittings * Notify if Post-Op TLSO is known to be needed **Seating and Mobility Clinic:** * parents to call Vendor for appointment for wheelchair adjustment-2 - 3 weeks post-operatively. * Vent dependent- custom molded back: parents call vendor for Pre-Op appointment or an in-hospital Post-Op appointment once surgery date is set.	**Consider Physiatry Referral if:** * Need help with discharge planning * Anticipating CIRU need **Child Life:** * consult to ensure spine surgery handbook has been presented to family and to assess post op child life need.
Labs / Tests	• CBC • Ferritin • CMP • Vitamin D (25-hydroxyvitamin D) • Prealbumin • Vitamin C • Zinc	• CXR, TTE, ECG, CBC, COAGS • DIC panel for Duchenne's	**PFT's If > 5 years + can comply** (do not need pulmonary referral) • Simple spirometry • Peak cough flow • MIP / MEP • MVV			**Orthopaedics** • **Patient is to have Type and Cross pre-operatively** • **Arrange for blood products to be ready before surgery**
Imaging needs		**Obtain Echocardiogram if:** * history of cardiomyopathy * Residual Complex CHD (not simple ASD)---(If history of repaired CHD, no echo need) * Concern for possible Right side Heart Failure or presence of Pulmonary HTN * Congenital Scoliosis –If just an echo then no clearance letter or consult needed. * * if COBB angle > 70 degrees **DMD (Duchenne Muscular Dystrophy)** * EF > 50% (echo within last 6 months) * EF < 50% (echo within last 3 months) MRI - pacemakers OK		**Indication for MRI:** * CP – not indicated * Myelo – indicated pre-op. * Syndromic – case by case * VNS – do not image * For the Order – designate "Pre-Op" and the date of surgery * Expedited need – include reason on order * Consider Anesthesia need for MRI's		
Admission Unit & pre-op needs	* consider miralax or other laxative pre-operatively before day of surgery (parent education)	**Cardiac floor indications:** * If repaired disease, not necessary * Residual disease – cardiac stepdown * If Fontan, heart transplant, significant pulmonary HTN, severe ventricular dysfunction – use cardiac floor with cardiology as primary and involve Pulmonary service * Cardiac valve – admit- heparin transition	**Pre -Operative Admission if:** * NIV or anticipated NIV (i.e. CPAP, BiPAP) observation preop and pulmonary referral * History of poor airway clearance or recent respiratory symptoms * Need for surgery is urgent * SMA and mitochondrial disease – admit night before surgery *** Notify PICU if post op admit expected.**		*** Arrange admission with unit comfortable with halo** **EG – 4E, PICU** **SR – 4S, PICU**	**Consider CIRU if:** * Anticipated decrease in function from baseline due to anticipated lengthy hospital stay / difficulty with pain tolerance in relation to mobility. * to qualify for Inpatient Rehab, requires eval from 2 of 3 (PT / OT/ SLP) and a decrease in function
Other Consideration and Contra-indications To surgery		**Consult Cardiac Anesthesia if:** * Significant ventricular dysfunction * Valvular disease * Fontan, single ventricle physiology * Pulmonary hypertension **Contraindication for surgery** * All patients with LVEF < 35% - If lower, consider ICD	Patient families to be given the "Pulmonary Preop Pamphlet"	**Combined Neurosurgery Cases** • Spinal Stenosis • Intra Dural • Possibly Vertebrectomy • Myelo with tether/need cord divided • With Myelomeningocele: consider resection of cord if placing MAGEC rods. • consider Plastic Surgery for closure and close monitoring.	**Parental Information** * bring wheelchair + orthotics to hospital * Make post-op appointment with wheelchair vendor prior to the surgery * no bending/twisting after surgery – so plan for daily routine & challenges * caregiver present for transfer training	
Pre-plan for Gen Peds need	*** If 3 or more organ systems with current issues AND patient does not already have an identified medical home (like pulmonary for their home vent) and would like Gen Peds involved post op;** ***call general pediatrics office once patient is scheduled for surgery***			**** If patient is truly complex, would prefer admission to General Pediatrics with Orthopaedic consult once patient exits PACU. (Ortho to see patient daily)***		

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Complex Spine Fusion – *INTRA-OP* Clinical Practice Guideline

Focus: Intra-Operative Patient Management for Anesthesia, OR Staff, Neuromonitoring Staff & Surgeons

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Lines and Positioning

Positioning

- Accommodative- Position upper extremities with less than 90 degrees abduction
- Verify Baclofen pump positioning before start of case

Traction

- Pelvic Obliquity > 30-40 degrees

Halo-Femoral Traction

- 10-15 lbs on head
- 15-20 lbs on high pelvis

Facial

- Prone view works for AIS vs pillow for Neuromuscular CP
- Consider reverse trendelenberg to decrease IOP

Patient Prep

- 2 Large Bore IV's
- A-Line
- CVL if pressors expected (Double/Triple Lumen Cath.)
- Room Temp 72 degrees
- Bair Hugger Blanket or warming pads

TIMEOUT Discussion

- Anesthetic being used
- EBL Anticipated
- Implant being used
- Antibiotics being used
- **MAPS- targets to be 65-75 mmHg during exposure and instrumentation. Then >80 mmHg during correction.**
- Consider short acting paralytic during exposure (Rocuronium)

Medications and Labs

Surgeons Order prior to Surgery start

- TXA (Tranexamic Acid) for all Complex Spine Cases – 20 mg/kg loading dose (max 2 grams) with 10mg/kg/hr maintenance dose (max 500mg/hr)
- Gabapentin 15mg/kg administer pre-operative (Max dose 900 mg)
- Gabapentin 5mg/kg TID x 2 days post - op. (max dose 300 mg).

Antibiotics (Reference Link)

- **Vancomycin and Fortaz if:**
  - Neuromuscular patient
  - incontinent
  - has a surgically created orifice
  - has Antibiotic resistance
  - history of gram negative infection
- Suggest Neuromuscular cases get antibiotic powder
- Beta-Lactam allergy – give Vancomycin and Cipro

Anesthetic

- Use TIVA in Neuromuscular cases (discuss TIVA + paralytic as needed)
- Volatile at <0.5 MAC and adjust by signals

LABS

Fibrinogen Labs

- If anticipate EBL > 15 ml/kg
- Consider PT, PTT
- Consider TEG lab **(EG only)**

All Complex Spine Patients

- arterial blood gas

Neuromonitoring / Vital Signs

When not to use Neuromonitor

- Incontinent of urine and stool
- No protective reflex
- High level GMFCS 5

Considerations

- TIVA if unable to obtain reliable signals using gas
- If cannot get baselines - can consider to send out monitoring personnel and consider to cancel.

VNS information

- Position electrodes away from pulse generator-on legs
- Magnet not needed if not running SSEP's – can make an artifact if SSEP's
- Do not need to turn off unless SSEP
- Should interrogate them afterwards – consult with Neurology or Neurosurgery

Neuromonitor until patient on bed

IONM - Neuromonitoring Guide Reference - Page 5 of guideline

After Incision

- Consider decreasing the room temperature
- Increase Bair Hugger temperature output
- Antibiotic Redosing timing Recommend vanc/fortaz
- Antibiotic Powder – Vancomycin and Tobramycin

Order labs when:

EBL 10% - get CBC, Fibrinogen, PT, PTT, and TEG.
(TEG – available at EG only)

Consider to Transfuse when:

- PRBC's if Hb/Hct < 8/24 and/or hemodynamically unstable in the setting of acute blood loss
- FFP if PT/PTT/INR is 1.5 times the normal range for patient
- Platelets if < 50K
- Cryoprecipitate if Fibrinogen <150

Dural Tears

- 4.0 Nurulon
- Consider a lumbar drain if cannot get a good repair
- Consider having Duraseal or Tisseal in room

During / After Closure

- Warm room up to 72 degrees
- Neuromonitor until patient is on the bed
- Verify Baclofen pump positioning
- Baclofen Pump - If more than a few mL of CSF leaks off, then may need Physiatry/ Neurology to prime line.

Recommend Occlusive dressing

Radiology Needs:

- **PA and LAT spine to be done in OR (prone)**

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Complex Spine Fusion – *POST-OP* Clinical Practice Guideline

Focus: Post Operative patient management on inpatient units through discharge

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Timeline	Surgical Day	POST OP Day 1	POST OP Day 2	POST OP Day 3
Unit	**Admit Inpatient:** EG-4E, SR-4S, ***PICU/TICU*** if: Pulm HTN, Complex Cardiac, OSA, q1h NV monitor need, Home O2, Trach, BiPAP/CPAP.	**Admit Inpatient**: EG-4E, SR-4S, PICU/TICU	**Admit Inpatient:** EG-4E, SR-4S, PICU/TICU	**Admit Inpatient:** EG-4E, SR-4S, PICU/TICU
Assessment and Monitoring	* VS q 4hr including Braden Q q 12hr * VS q 2hr in PICU/TICU * Neurovascular (NV) checks q 2hr * Cont. Pulse Ox & O2-keep sats>93% or back to baseline if cardiac/pulm patient * Strict intake & output q 4hr- include drains	* VS q 4hr including Braden Q q 12hr * Record pain scores with vital signs * Neurovascular (NV) checks q 4 hr * Cont. Pulse Ox & O2-keep sats>93% or back to baseline if cardiac/pulm patient * Strict intake & output q 4hr- include drains	* VS q 4hr including Braden Q q 12hr * Record pain scores with vital signs * Neurovascular (NV) checks q 4 hr * Cont. Pulse Ox & O2-keep sats>93% or back to baseline if cardiac/pulm patient * Strict intake & output q 4hr- include drains * Final pain score within 2 hours of discharge	* VS q 4hr including Braden Q q 12hr * Record pain scores with vital signs * Neurovascular (NV) checks q 4 hr * Cont. Pulse Ox & O2-keep sats>93% or back to baseline if cardiac/pulm patient * Strict intake & output q 4hr- include drains * Final pain score within 2 hours of discharge
Surgeon Notification	* Notify MD if change in VS / NV status * UOP < 0.5ml/kg/hr times 2hr * Hemovac output is >200ml/8hrs	* Notify MD if change in VS / NV status * UOP < 0.5ml/kg/hr times 2hr * Hemovac output is >200ml/8hrs * Notify if bilious emesis after feeding initiated	* Notify MD if change in VS / NV status * UOP < 0.5ml/kg/hr times 2hr * Hemovac output is >200ml/8hrs * Notify if bilious emesis after feeding initiated	* Notify MD if change in VS / NV status * UOP < 0.5ml/kg/hr times 2hr * Hemovac output is >200ml/8hrs * Notify if bilious emesis after feeding initiated
Laboratory	* CBC * Consider Pre-Albumin, Vitamin D, Vitamin C, Zinc if nutritional concerns * PT, PTT, INR, Fibrinogen (for high risk bleeding)	* H&H and CMP in am * PT, PTT, INR, Fibrinogen (for high risk bleeding) (see Bleeding Screen Panel)		
Radiology	* Portable Chest X-ray if chest tube * PA and LAT spine in OR	* PA & LAT spine Upright in Radiology if not done in OR / PACU * If patient in PICU, supine PA & LAT (if not done) * portable CXR if pt has chest tube	* portable CXR if pt. has chest tube * stat CXR if Chest tube discontinued	* portable CXR if pt. has chest tube * stat CXR if Chest tube discontinued
Medication and IV Therapy	* IV Fluids * Zofran IV 0.1 mg/kg per dose (max dose of 4mg) IV q8h PRN N/V * Vancomycin 20mg/kg IV (max 1250 mg) over 60 minutes. * Fortaz 50mg/kg (max 2 grams) IV over 15 min. * Consider Cefazolin 30mg/kg (max 2gm), IV q8hrs times 2 doses (for NON-neuromuscular) * discontinue all antibiotics 24hrs post-op ***See Ortho Prophylaxis Guideline for additional Antibiotic therapies (link)***	* IV Fluids – INT IV and discontinue IV Fluid when tolerating PO liquids without N/V * Discontinue Antibiotics after 24 hrs * order Miralax (0.5 mg/kg/day up to 17g daily), if tolerating some nutrition. Start POD 1 night, prn if no BM in last 24 hours * discontinue all antibiotics 24hrs post-op	* INT IV if tolerating PO liquids * continue Miralax * consider addition of Docusate and / or Bisacodyl tabs x 1 dose (if no BM in last 24 hours)	* discontinue IV * continue Miralax – consider d/c home on miralax daily for goal of daily stool * consider soap suds enema if bowel sounds present, abdomen compressible without flatus and no bowel movement
Pain Control	**Pain control:** * Valium 0.1 mg/kg IV q4h (schedule as such, no prn for day 0, no PO for day 0) (max dose 5mg) * PCA pump with bolus doses +/- basal rate **Optional:** * Neurontin 5mg/kg TID, PO (max 300mg TID) * Toradol 0.5mg/kg IV q 6hr (max 30 mg) max 8 doses * Zantac 1mg/kg/dose IV q8h if using Toradol (max dose 50 mg) (Toradol and Zantac linked together in order set) * consider Methocarbamol 15 mg/kg IV q8h (Max dose 1000 mg) - *to replace Valium. (do not use with Valium)*	**Pain control:** * Valium 0.1 mg/kg IV q4h PRN muscle spasticity (max dose 5 mg) - Consider to Change Valium to PO q 4hr PRN for muscle spasticity. * Discontinue PCA pump * Start Percocet or Norco PO q 4hr (5mg, 7.5mg, 10mg available) (max dose 3250 mg acetaminophen/day) * Morphine 0.05 mg/kg/dose (max 4 mg) IVq4h prn mod-severe pain not relieved by Percocet / Norco **Optional:** * Neurontin 5mg/kg TID * start Toradol 0.5mg/kg IV q 6hr, max 8 doses over 48 hours. Change to Motrin (max 10mg/kg/dose q8h) – if tolerating other meds PO. * Zantac 1mg/kg/day IV q8h (max dose 50 mg if using Toradol) * Consider change to Methocarbamol 15 mg/kg PO q8h (Max dose 1500 mg) PRN muscle spasticity *to replace Valium (do not use with Valium).*	**Pain Control:** * Discontinue Toradol after 48 hours * Consider Motrin (max 10mg/kg/dose q8h) * Percocet or Norco PO q 4hr PRN pain (5mg, 7.5mg, 10mg available) (max dose 3250 mg acetaminophen/day) * Morphine 0.05 mg/kg/dose (max 4 mg) IVq4h prn mod-severe pain not relieved by Percocet / Norco * Change Valium to PO q 4hr PRN muscle spasticity * Record full set of vital signs with a pain score at discharge	**Pain Control:** * Discontinue Toradol after 48 hours * Continue pain management program until discharged * Record full set of vital signs with a pain score at discharge * establish a plan for what kind of pain/spasticity meds patient is sent home on (consult pain team for recommendations if needed)
Pulmonary & Respiratory Treatments	* Incentive Spirometry q 2hr – awake (if unable, consider bubble/pinwheel therapy * If Intubated, extubate as soon as possible (Recommend 24 hrs in PICU if BiPAP) * order Pulmonary Hygiene care if needed	* Incentive Spirometry q 2hr – awake (if unable, consider bubble/pinwheel therapy) * Assess for Chest Physio Therapy (CPT) need and whether the patient can tolerate the therapy.	* Incentive Spirometry q 2hr – awake (if unable, consider bubble/pinwheel therapy) * Assess for Chest Physio Therapy (CPT) need	* Incentive Spirometry q 2hr – awake (if unable, consider bubble/pinwheel therapy) * Assess for Chest Physio Therapy (CPT) need
Procedures	* Check surgical dressing q 4hr and reinforce as needed * Foley to straight drain	* discontinue foley if UOP > 1ml/kg/hr AND the PCA is discontinued		* MD to discontinue drains
Nutrition, GI	* Ice chips & sips of clears as tolerated (carbonation free diet) * Assess bowel sounds * Start Tube feeds within 24-48 hours of being hemodynamically stable (start slowly and hold if high vasopressor use)	* Clear diet first day (to help with abd distention) (carbonation free diet). * Notify primary team if emesis. * Start Tube feeds within 24-48 hours of being hemodynamically stable (start slowly) * Assess bowel sounds	* advance to regular diet as tolerated. * Notify primary team if emesis. * Start Tube feeds within 24-48 hours of being hemodynamically stable (start slowly) * encourage gum chewing if possible * Nutrition consult to assess home feed regimen	* regular diet as tolerated. * Notify primary team if emesis. * encourage gum chewing if possible
Activity	* log roll q 2hr with patient assisting as able	* log roll q 2hr with patient assisting as able * goal is OOB to chair with PT initially. Then with Caregiver/RN 1-2 more times as tolerated * Goal to ambulate 1-2 times, if applicable, based on prior level of function.	* continue to log roll * ambulate or OOB to chair 2-3 times/day	* continue to log roll * ambulate or OOB to chair 2-3 times / day * attempt stairs if capable
Consults	* Critical Care Medicine Consult if admit to PICU * Pain Service consult as needed * Nutrition – plan calorie counts/feeding regimen * Case Management to assess for Durable Medical Equipment need and for new BiPAP patients * Pulmonary consult if patient on positive pressure * Plan for subspecialist consultation based on medical history if no prior medical home	* PT to evaluate and establish patient/family goals * PT to see Non-Ambulatory patient 1x/day and Ambulatory patient 2x/day. * PT and OT to identify equipment needs and notify Physician if seating/mobility or rehab order need. * Nutrition – plan calorie counts/feeding regimen * Child Life consultation as needed * Consult SW to begin discharge planning. * Consider School Program referral if school-aged.	* PT to see Non-Ambulatory patient 1x/day and Ambulatory patient 2x/day. * OT to evaluate ADL needs * Nutrition-tube feed or TPN needs, if not back on home feeds, for non-resolving ileus, and consult for BMI </= 10% or >/= 85%tile for age * Child Life consultation as needed	* PT to continue to see patient until discharge goals are met * Subspecialist / Child Life consultation as needed * ensure subspecialists are OK with discharge * Pain service consult if needed with establishing pain control plan for home.
Partnering with Parents and Education	**Reinforce Teaching Sheets** * Pain Management * Spinal Fusion * Spine Fusion Movement *Log rolling and side lie to sit & sit to stand transfers*	**Reinforce Teaching Sheets** * Spinal Fusion Movement – Ambulation / Mobility *Partner with parents for OOB / ambulation schedule*	**Reinforce Teaching Sheets** * Spinal Fusion Movement – Precautions and Body Mechanics *Partner with parents for OOB / ambulation schedule*	**Home Care Teaching Sheets** * Patient/Caregiver independence with ADL participation/modification * print out goals for family/patient *Partner with parents for OOB / ambulation schedule*
Discharge Planning	* Assess home health needs - CM * Assess transportation needs - SW * provide family with written needs - CM	* Assess home health needs - CM	* Ensure home health needs are met * ensure transportation needs are available for discharge day - SW	* Ensure home health needs are met day of discharge * plan for follow up arranged with Physician
D/C Criteria	* **Tolerating regular diet (home diet or equivalent)** * **Caregiver independent with assisting patient with all transfers/mobility (ambulating per PT protocol based on prior level of function)**		* **Pain controlled with oral medications** * **Caregivers verbalize spinal fusion precautions and activity modifications**	

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Complex Spine Fusion
Intra-Operative Neuro Monitoring

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IONM - Response to changes in Pediatric Spine Patients

Surgeon

- Gain control of room – Intraoperative surgical pause; Stop case and announce to room.
- eliminate extraneous stimuli (i.e. music, conversations, etc.)
- Anticipate need for intraoperative / perioperative imaging if not readily available to evaluate implant placement
- Discuss events and actions immediately prior to signal loss and reverse actions

Surgical Actions

- Remove traction if necessary
- Undo distraction or corrective forces
- Remove rods
- Remove screws, probe for breach and check x-ray
- Check for spinal cord compression, evaluate osteotomy or laminotomy sites (bone graft, gel foam, wax)

Circulating Nurse

- Mark Time
- Shut off music
- Get X-Ray Tech to Room
- Immediately contact Charge Nurse for assistance

Neuromonitoring

- Check electrodes – Monitor working? Connections intact?
- Discuss status of anesthetic agents
- Check extent of Neuromuscular blockage or paralysis
- Repeat SSEPs and MEPs
- Determine/communicate pattern and timing of signal changes-unilateral?
- Check neck and limb positioning – especially if unilateral loss
- Continue data collection for a minimum of **30** minutes after the last maneuver
- Immediately contact Neurologist or Neurophysiologist

Anesthesia

- Optimize **MAP: >80 mmHg**
  * Decrease propofol and narcotic
  * Decrease inhalational agents
  * IVF
  * Dopamine or Phenylephrine -discuss with surgeon
- Optimize Hematocrit - **30-35** Hemoglobin **> 10**
- Warm patient to **> 36.5 C**
- Optimize blood pH, pCO2 and Glucose
- Prepare for potential wake-up test with ATTENDING Anesthesiologist.
- Consider lidocaine 2mg/kg – vasodilation
- Summon ATTENDING Anesthesiologist

Ongoing Considerations

- REVISIT anesthetic/systemic considerations and confirm that they are optimized.
- Wake-up test
- Consult with Colleague
- Continue with surgical procedure vs staging procedure – abort if **< 70%** baseline returns
- Consider post-op TLSO
- Post – Op imaging: CT myelogram, MRI diffusion sequence
- Recommend PICU admission for q1hr NV monitoring

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Rehabilitation

Post Op Day 1 Goals – PT consult for initial evaluation

Non-Ambulatory at baseline:

- Patient is evaluated and goals are set based on patient's prior level of function (PLOF)
- Patient and caregiver are educated on the role of PT, post-op activity goals, and spinal precautions including; avoiding bending or twisting of the patient's back with all mobility.
- Caregiver assists patient with log rolling and appropriate transfer from bed to/from wheelchair, with minimal assistance from physical therapist
- If a mechanical lift is the only option for transfers, a TLSO is first obtained from orthotics and prosthetics, by physician order
- Patient to sit out of bed in a wheelchair a minimum of 2 times, for 1-2 hours each time*
- Equipment needs identified and addressed

If patient is Ambulatory at baseline:

- In addition to the goals listed above, patient ambulates 2-3 times daily; goal for distance and level of assistance to be set by PT based on PLOF
- PT to see patient twice a day post-op days 1 and 2, then daily until all PT goals are met

*Physical therapy will evaluate and assist caregiver the first time out of bed. Nursing staff to assist the second time, with physical therapy available as needed

Post Op Days 2-7 Goals - Patient to be discharged from PT once met:

Non-Ambulatory at baseline:

- Patient tolerates sitting out of bed in a wheelchair a minimum of 2-3 times, for 1-2 hours each time
- Caregiver demonstrates independence with assisting patient with transfers for supine to/from sitting, and bed to/from wheelchair, with patient assisting as able
- Patient/caregiver verbalizes understanding of activity goals for home to progress towards baseline level of function including: position changes every 2 hours, log rolling for transitions, and importance of upright sitting a minimum of 3 times/day

If a temporary wheelchair is ordered, a plan is set for adjusting the patient's permanent chair:

- Minor adjustments: the caregiver calls their specific vendor for an appointment at least 2-3 weeks post operatively
- Major adjustments OR a new chair: a prescription is signed by the doctor for seating and mobility clinic, and a referral is made to the rehab case managers, for an appointment at least 2-3 weeks post operatively

If patient is Ambulatory at baseline:

- In addition to the goals listed above, patient ambulates 2-3 times daily; goal for distance and level of assistance to be set by PT based on PLOF
- If applicable to home environment, patient ascends/descends 3 stairs with appropriate caregiver assistance
- PT to see patient twice a day post-op days 1 and 2, then daily until all PT goals are met

Occupational Therapy consulted post-op day 2 for initial evaluation

- Caregiver is educated on the role of occupational therapy and post-op activity goals
- Caregiver demonstrates independence with assisting patient with dressing, bathing, diapering/toileting
- Equipment needs identified for bathing and personal hygiene as appropriate

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Rehab Goals - Checklist - Prior to Discharge

For Non - Ambulatory Patients

Physical Therapy:

☐ 1. Caregiver is independent with assisting patient in & out of a wheelchair

☐ 2. Patient has a safe wheelchair for discharge home, either:
- His/her current custom wheelchair
- A temporary reclining wheelchair, with either:
  - An appointment (at least 2-3 weeks after surgery) with their current vendor for MINOR modifications/adjustments to the patient's permanent custom chair
  - An appointment for seating and mobility (at least 2-3 weeks after surgery) for MAJOR modifications/adjustments, OR needs a new permanent custom chair

☐ 3. Patient is able to tolerate sitting in a wheelchair 1-2 hours at a time, 2-3 times each day

☐ 4. Additional equipment has been ordered as needed

☐ 5. Caregiver understands process for resuming prior therapies if indicated

☐ 6. ***Individualized goal as set by your physical therapist:***

Occupational Therapy:

☐ 1. Caregiver is independent with assisting patient with Activities of Daily Living
- Dressing
- Bathing
- Diapering

☐ 2. Caregiver has identified use of 3-in-1, bath chair, or bedside commode for showering/toileting use and is independent with safe use

☐ 3. ***Individualized goal as set by your occupational therapist:***

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Children's Healthcare of Atlanta

Pulmonary Pre-Op Screening Questionnaire:

The following questions are to find out if the patient has any problems with his/her lungs and breathing; which are common in children with scoliosis. Please answer YES, NO or DON'T KNOW to the following questions.

Does the patient have: (questions to ask family/guardian)	Yes	No	Don't Know
1. Have persistent cough, chest congestion, or coughing up mucous with viral illnesses or colds			
2. Snore, have had an abnormal sleep study, gasp in sleep or have restless sleep such that he/she is always tired during the day			
3. Hold his/her breath, turn blue around the lips or have difficulty breathing in, or catching his/her breath			
4. Have difficulty with prior surgery and needed oxygen or help breathing afterward			
5. Have trouble handling saliva (spit) and secretions in his/her mouth or throat			
6. Cough or choke when eating, drinking or swallowing saliva			
7. Have a history of 2 or more pneumonias			