Adolescent Idiopathic Scoliosis Spinal Fusion Guideline

July 1, 2019

Definition

Scoliosis

Scoliosis is defined as curvature of the spine in the coronal plane greater than 10 degrees (as measured by the Cobb angle). Idiopathic scoliosis is scoliosis with no definite etiology. Adolescent idiopathic scoliosis (AIS) is scoliosis that presents in a patient at age 10 or older and accounts for 80-85 percent of scoliosis cases (Workman J.K, Wilkes J., Presson A.P, et al., 2018).

Scoliosis surgical correction

Treatment modalities for scoliosis include observation, bracing, and surgery. Surgical correction is indicated for skeletally immature and mature patients with curves with a Cobb angle greater than or equal to 50 degrees. Skeletally mature patients with curves between 40 and 50 degrees are managed by a provider on an individual basis (Workman J.K, Wilkes J., Presson A.P, et al., 2018).

Surgical treatment of AIS is done by a spinal fusion procedure. Spinal fusions can be done posteriorly or anteriorly; posterior spinal fusion with instrumentation and bone grafting is the most common surgical procedure for AIS correction. The primary surgical treatment goal for AIS is prevention of curve progression and the secondary goal is improved quality of life, including enhanced patient reported self-image, function, and level of activity (Workman J.K, Wilkes J., Presson A.P, et al., 2018).

Common barriers in the immediate postoperative period for spinal fusion patients include delayed mobilization, delayed return of bowel function, pain management, opioid use side effects, and prolonged hospitalization. Literature supports the use of a rapid recovery pathway for AIS spinal fusion patients that focuses on early mobilization, early initiation of a bowel regimen, early transition from intravenous opioid pain management to oral opioid and non-opioid analgesic pain management, and multimodal pain regimens to mitigate common postoperative barriers to full functional recovery (Muhly WT, Sankar WN, Ryan K, et al., 2016).

Epidemiology

AIS is the most common spinal condition that requires surgery in children (Fletcher N., Lazarus D., Bruce R., et al., 2018). The prevalence of AIS is approximately 1 to 3 percent; only 0.3 percent of the AIS population require treatment (Shan L.Q, Skaggs D.L, Lee C., et al, 2013). Males and females are affected equally, but the risk of curve progression is 10 times higher in females. Overweight or obese patients seem to have increased severity of AIS on initial presentation, possibly due to delayed detection.

From 2001 to 2011, an average of 5,000 AIS spinal fusions were performed annually in North America (Muhly WT, Sankar WN, Ryan K, et al., 2016).

Etiology

There is no clear etiology of AIS. Literature supports a potential genetic component. There is also research that proposes abnormalities in growth hormone secretion, connective tissue structure, paraspinal musculature, vestibular function, melatonin secretion, and platelet microstructure may contribute to the pathogenesis of AIS (UpToDate, 2019).

Guideline Eligibility Criteria

Patients with a diagnosis of AIS undergoing a spinal fusion procedure, aged 10-18.

Guideline Exclusion Criteria

Patients with a scoliosis diagnosis undergoing a spinal fusion procedure secondary to trauma or cerebral palsy, muscular dystrophy, spina bifida, or other similar birth defect or syndrome

Evidence Found with Searches

Check Type of Evidence Found	Summary of Evidence – All Questions	Number of Articles Obtained
☒	Systematic Reviews	2
☐	Meta-analysis articles	
☒	Randomized Controlled Trials	1
☒	Non-randomized studies	7
☒	Review articles	1
☐	Government/State agency regulations	
☒	Professional organization guidelines, white papers, ect.	2
☐	Other:	

Evaluating the Quality of the Evidence

The GRADE criteria were used to evaluate the quality of evidence presented in research articles reviewed during the development of this guideline. The table below defines how the quality of evidence is rated and how a strong versus a weak recommendation is established.

Recommendation	
Strong	Desirable effects clearly outweigh undesirable effects or vice versa
Weak	Desirable effects closely balanced with undesirable effects
Type of Evidence	
High	Consistent evidence from well-performed RCTs or exceptionally strong evidence from unbiased observational studies
Moderate	Evidence from RCTs with important limitations (e.g., inconsistent results, methodological flaws, indirect evidence, or imprecise results) or unusually strong evidence from unbiased observational studies
Low	Evidence for at least 1 critical outcome from observational studies, from RCTs with serious flaws or indirect evidence
Very Low	Evidence for at least 1 critical outcome from unsystematic clinical observations or very indirect evidence

Recommendations

Evidence Supports	Evidence Lacking/Inconclusive	Evidence Against
Use of a standardized rapid recovery pathway for the healthy, AIS spinal fusion patients developed by a group of multidisciplinary stakeholders using evidenced based research and expert opinion.	Pre-operative carbohydrate loading facilitates an early return of bowel function in pediatric spinal fusion patients.	Use of a traditional post-operative spinal fusion pathway that does not emphasize early mobilization, early initiation of bowel regimen and regular diet, and early transition to oral analgesic from IV narcotics and antispasmodics.
Early mobilization, early initiation of a bowel regimen, and an early transition to oral analgesic from IV narcotics and antispasmodics.		
The healthy, AIS post-operative spinal fusion patient can be managed on the surgical floor without compromising patient safety or patient outcomes.		
A multi-modal pain approach is effective for post-operative spinal fusion patients.		
Preoperative carbohydrate loading may help with the post-operative surgical stress response, thirst, hunger, anxiety, & malaise in surgical patients.		
Post-operative gum chewing may facilitate a quicker return to normal bowel function in pediatric spinal fusion patients.		
Managing patient expectations and education before surgery may enhance patient satisfaction post-operatively.		

Idiopathic Spinal Fusion Algorithm
Evidence Based Outcome Center

Inclusion Criteria

Patients undergoing a spinal fusion with a diagnosis of adolescent idiopathic scoliosis age 10-18

EXCLUSION CRITERIA

Scoliosis secondary to:
- Cerebral palsy
- Muscular dystrophy
- Spina Bifida
- Similar birth defect or syndrome
- Spinal Injury

Anesthesia Pre Op

Post Op Day 0
- Disposition- IMC/PICU or 3N
- Management
- Goals

Post Op Day 1
- Disposition- Transfer to 3N if not already there
- Management
- Goals

Post Op Day 2
- Management
- Goals

Post Op Day 3
- Management
- Goals

Meets Discharge Criteria? ❶

DISCHARGE

Discharge Criteria
☑ Tolerating Oral Analgesia and pain controlled
☑ PT/OT Clearance
☑ Tolerating Diet
☑ Urinating without difficulty, passing gas/ abdomen soft and non-distended

Anesthesia consult checklist preoperative appointment:

1. **Education given to family at pre-admission testing appointment:**
    a. Discuss plan and associated risks including: Endotracheal tube (ETT), Total intravenous anesthesia (TIVA), IVs, possible central line, arterial line, pain management, wake up test, risk of vision loss, potential need for blood transfusion, post-op facial swelling, and pressure points.
    b. Give time of arrival for surgery and where to check in
    c. NPO instructions
    d. Instruct patient to drink 10-12 oz of clear carbohydrate drink 2 hours prior to arrival (Gatorade, apple juice, etc.), if possible
    e. Bring chewing gum to use post-operatively if patient able to chew gum
    f. Bathing protocol- Per Physician Preference

2. **Pre-operative Anesthesia Labs:**

    CBC

    PT, PTT, INR

    TEG & fibrinogen

    Pregnancy Test

    Type & Screen

3. **Anesthesia to order appropriate medications at pre-admission testing appointment, including:**

    a. Premeds for anxiety or nausea as indicated
    b. Order Acetaminophen and Gabapentin per spine guidelines:
        i. Gabapentin 600 mg for patients weighing > 50 kg or 10 mg/kg/dose for patients <50 kg. Take one dose in the morning on DOS
        ii. Acetaminophen 15 mg/kg/dose. Take one dose in the morning on DOS

4. **Preadmissions Nursing**
    a. Obtain weight and height and record in Compass
    b. Draw ordered lab work. Send for diagnostic testing if indicated.
    c. Arrange for EKG if ordered
    d. Sign and witness surgical and anesthesia consent

Adolescent Idiopathic Scoliosis (AIS) Spinal Fusion Post Operative Algorithm

Evidence Based Outcome Center

	Post-Op Day 0	Post-Op Day 1	Post-Op Day 2	Post-Op Day 3
Nursing Assessment	VS q2, Neurovascular assessment of UE and LE q2. Braden Q q12, notify MD if change in NV status	VS q4, neurovascular q4, Braden Q q12, notify MD if change is NV status	VS q4, neurovascular q4, Braden Q q12, notify MD if change is NV status	VS q4, neurovascular q4, Braden Q q12, notify MD if change is NV status
Respiratory	Cont pulse ox & O2 per protocol (greater than 92%). IS q2 while awake.	Cont pulse ox & O2 per protocol (greater than 92%). IS q2 while awake. CXR once per order.	Cont pulse ox as needed once PCA removed and o2 per protocol (greater than 92%), IS q2 while awake.	Cont pulse ox as needed once PCA removed and o2 per protocol (greater than 92%), IS q2 while awake.
Thromboprophylaxis	SCDs while in bed	SCDs while in bed	SCDs while in bed. Discontinue if OOB bid.	SCDs while in bed. Discontinue if OOB bid.
GU	foley to gravity, foley care qshift, strict I&Os q4	DC foley 6 am per orders unless otherwise noted by provider. I&Os q4	I&Os q4	I&Os q4
Antibiotic Therapy	Per MD order	DC ANTBX 24 hours post-op. If drain present continue antibiotic per provider order.		
Diet, Bowel	Maintenance IV fluids ordered, advance to clears as tolerated, begin bowel regimen, encourage gum chewing, fluids, ambulation.	Advance to regular diet as tolerated Continue bowel regimen Gum chewing Fluids, Ambulation	Regular diet as tolerated Continue bowel regimen Gum chewing Fluids, Ambulation	Regular diet Continue bowel regimen Gum chewing Fluids, Ambulation
Skin	Full skin assessment qshift, monitor drain sites	Full skin assessment qshift, monitor drain sites	Full skin assessment qshift, monitor drain sites	Full skin assessment qshift, monitor drain sites
Dressing/Drains	Monitor surgical dressing q4 for saturation. Reinforce as needed, dressing change by MD only. Record hemovac output q4 if present.	Monitor surgical dressing q4 for saturation. Reinforce as needed, dressing change by MD only. Record hemovac output q4 if present.	Monitor surgical dressing q4 for saturation. Reinforce as needed, dressing change by MD only. Record hemovac output q4 if present. Hemovac dc'ed by provider.	Monitor surgical dressing q4 for saturation. Reinforce as needed, dressing change by MD only. Record hemovac output q4 if present. Hemovac dc'ed by provider
Activity	OOB to chair with nurse or PT night of surgery. No bending, lifting or twisting.	OOB to chair, Ambulate bid as tolerated. No bending, lifting or twisting.	OOB to chair, Ambulate bid. No bending, lifting or twisting.	OOB to chair. Ambulate bid. No bending, lifting or twisting.
Labs	Drawn in OR	CBC & BMP	H&H	H&H
Discharge Planning	Reinforce education-pain management, transfers/precautions after spinal fusion, follow up appts	Reinforce education-pain management, transfers/precautions after spinal fusion, follow up appts	Reinforce education-pain management, transfers/precautions after spinal fusion, follow up appts.	Reinforce education-pain management, transfers/precautions after spinal fusion, follow up appts

*See Pain Management Addendum for pain control

Adolescent Idiopathic Spine (AIS)
Pain Management Guidelines per US Anesthesia Partners Management PAGE 1

Pre-op	DOS	POD1	POD2
Acetaminophen: 15mg/kg/dose PO x1 (Max dose 1,000mg) **Gabapentin:** 10 mg/kg/dose PO x1 for < 50kgs 600mg PO x1 for > 50kg **Diazepam:** 0.1-0.2mg/kg/dose (5-10mg PO x 1)	IV PCA Morphine: Basal Rate: 0.01-0.15mg/kg/hr Bolus Dose: 0.015-0.02 mg/kg/dose every 15 min. **<u>Scheduled Medications:</u>** **Acetaminophen:** PO per protocol q 6 hrs. **Ketorolac:** 0.25mg/kg/dose IV q 6 hrs. x 48 hrs.(max dose 30mg) (1st Ketorolac dose in PACU: 0.5mg/kg x 1) *per surgeon preference/medical hx* **Gabapentin:** 5mg/kg/dose PO q 8 hrs. (Total of 5 doses; Give 1st dose at 8pm) **Diazepam:** *0.1 mg/kg/dose 2-5mg PO q 6 hrs. x 24-48 hrs ***Note: Order low dose Valium 2mg PO q 6 hours(not per kg dose) with back up IV Valium dose prn if not tolerating PO**	Discontinue IV PCA Morphine @0630 (30 minutes after 1st scheduled oxycodone) **<u>Scheduled Medications:</u>** **Acetaminophen:** PO per protocol q 6 hrs. **Ketorolac:** 0.25mg/kg/dose IV q 6 hrs. x 48 hrs. (max dose 30mg) **Gabapentin:** 5mg/kg/dose PO q 8 hrs. (Max dose 300mg). Total 5 doses. Last dose 0400 POD#2 **Diazepam:** *0.1 mg/kg/dose 2-5mg PO q 6 hrs. x 24-48 hrs **Oxycodone**: Patients < 44kg:0.1mg/kg/dose PO q 4 hrs. Patients > 44kg order 5mg PO q 4 hours **Step 2:** Oxycodone prn breakthrough pain Patients < 44kg: 0.05mg/kg/dose Patients > 44kg: 5mg tablet x 1 PO prn **ANESTHESIA SIGNS OFF TO ORTHO** ****Based on assessment of the patient, medications dosages &/or intervals may be changed. They may also be changed from scheduled to prn.*****	**<u>Scheduled Medications:</u>** **Acetaminophen:** PO per protocol q 6 hrs. **Ketorolac: Discontinue** **Ibuprofen: Start (Ortho to Order)** 10 mg/kg/dose PO q 6 hrs. (Per P&T protocol) **Gabapentin:** 5mg/kg/dose PO q 8 hrs. (Max dose 300mg.). Total 5 doses. (Complete) **Diazepam:** *0.1mg/kg/dose 2-5mg PO q 6 hrs. x 24-48 hrs **<u>PRN Medications:</u>** Change Diazepam to q 6 hrs prn Change Oxycodone to q 4 - 6 hrs prn **OR** Discontinue Acetaminophen and Oxycodone Start Hydrocodone/Acetaminophen or Tramadol per home RX

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Adolescent Idiopathic Spine (AIS)
Pain Management Guidelines per US Anesthesia Partners Management PAGE 2

	DOS	POD1	POD2
Management of Side Effects: **Antiemetics:**	**Zofran IV q 6 hours prn N/V** (dose: 0.1mg/kg/dose; max dose 4mg) **Phenergan x 1 IV prn** (dose per P&T protocol) **Scopolamine Patch** dose: 1mg patch/72 hours (for persistent/unrelieved N/V)	**Zofran IV q 6 hours prn N/V** (dose: 0.1mg/kg/dose; max dose 4mg) **Phenergan x 1 IV prn** (dose per P&T protocol) **Scopolamine Patch** dose: 1mg patch/72 hours (for persistent/unrelieved N/V)	**Zofran IV q 6 hours prn N/V** (dose: 0.1mg/kg/dose; max dose 4mg) **Phenergan x 1 IV prn** (dose per P&T protocol) **Scopolamine Patch** dose: 1mg patch/72 hours (for persistent/unrelieved N/V)
Antihistamines	**Benadryl PO/IV q 6 hours prn itching** (dose: 0.5mg/kg/dose PO; max dose 25mg) (dose:0.5mg/kg/dose IV; max dose 12.5mg) **Atarax** (if unrelieved by Benadryl) (dose: 0.5mg/kg/dose PO; max dose 25mg) **Nubain** (if unrelieved by Benadryl) (dose:0.05mg/kg/dose IV; max dose 3mg)	**Benadryl PO/IV q 6 hours prn itching** (dose: 0.5mg/kg/dose PO; max dose 25mg) (dose:0.5mg/kg/dose IV; max dose 12.5mg) **Atarax** (if unrelieved by Benadryl) (dose: 0.5mg/kg/dose PO; max dose 25mg) **Nubain** (if unrelieved by Benadryl) (dose:0.05mg/kg/dose IV; max dose 3mg)	**Benadryl PO/IV q 6 hours prn itching** (dose: 0.5mg/kg/dose PO; max dose 25mg) (dose:0.5mg/kg/dose IV; max dose 12.5mg) **Atarax** (if unrelieved by Benadryl) (dose: 0.5mg/kg/dose PO; max dose 25mg) **Nubain** (if unrelieved by Benadryl) (dose:0.05mg/kg/dose IV; max dose 3mg)
Constipation:	**Scheduled Medications:** **Docusate** (dose: q 12 hours per P&T protocol) **Senna** (dose: q HS per P&T protocol)	**Scheduled Medications:** **Docusate** (dose: q 12 hours per P&T protocol) **Senna** (dose: q HS per P&T protocol) **Miralax (max dose 17gm)** (dose: 17g PO q day; 17grams=1 packet)	**Scheduled Medications:** **Docusate** (dose: q 12 hours per P&T protocol) **Senna** (dose: q HS per P&T protocol) **Miralax (max dose 17 gm)** (dose: 17g PO q day; 17grams=1 packet)

Revised July 2019

Executive Summary

Approved by the Pediatric Evidence-Based Outcomes Center Team

Revision History
Original Date Approved: July 1, 2019
Revision Dates:
Next Review Date: July 2022

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Recommendations

Practice recommendations were directed by the existing evidence and consensus amongst the content experts. Patient and family preferences were included when possible.

Approval Process

EBOC guidelines are reviewed by DCMC content experts, the EBOC committee, and are subject to a hospital wide review prior to implementation. Recommendations are reviewed and adjusted based on local expertise.

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