

Brachial Plexus Palsy Management

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What is a Clinical Pathway?



An evidence-based guideline that decreases unnecessary variation and helps promote safe, effective, and consistent patient care.



Objectives of Pathway



- Prompt diagnosis infants with brachial plexus palsies
- Early referral to Brachial Plexus Clinic for Orthopaedic and Neurosurgical for initial and serial evaluations
- Early motion exercises and therapy referral to optimize motion and recovery



Why is Pathway Necessary?



- Neonatal brachial plexus palsy occurs at a rate of about 1/1000 live births
- In our community, patients are currently managed by a combination of pediatricians, neurologists, therapists, neurosurgeons, and orthopaedic surgeons, and often they are referred to neighboring states for further management.
- Patients may be referred for unnecessary and invasive testing (EMG and sedated MRI), or they may not undergo recommended testing (Xrays to rule out diaphragm palsy or concomitant fractures)



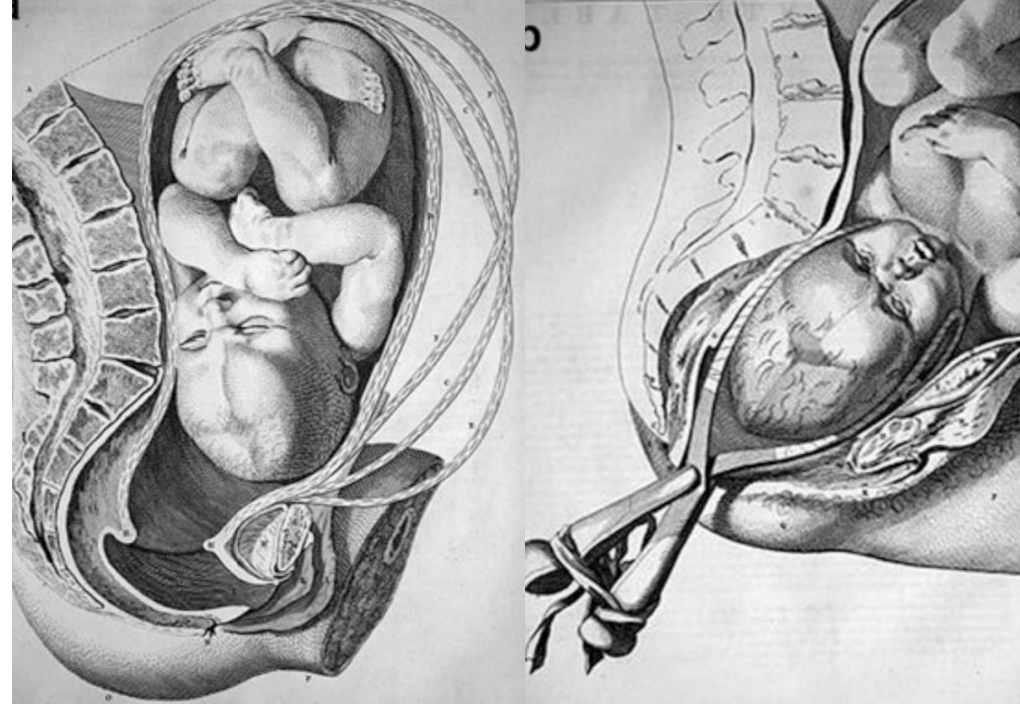
Why is Pathway Necessary?

- Almost all patients "recover" to some degree, however this may not be to a clinically useful extent. There is a window of time roughly between 6-12 months, during which microsurgical exploration and plexus reconstruction may benefit these patients.
- Secondary deformities of the shoulder and elbow occur in over 1/3 of patients, yet often go unidentified for several reasons:
 - Children adapt well and do not miss functionality they never had
 - Children may not yet participate in activities that give them functional deficits from their limitations
 - Families may not be aware that treatment options exist for these late deformities
- CCMC now offers comprehensive treatment including microsurgical reconstruction in infants, correction of secondary deformities in older children, formal motional analysis, and skilled therapy from infancy through childhood

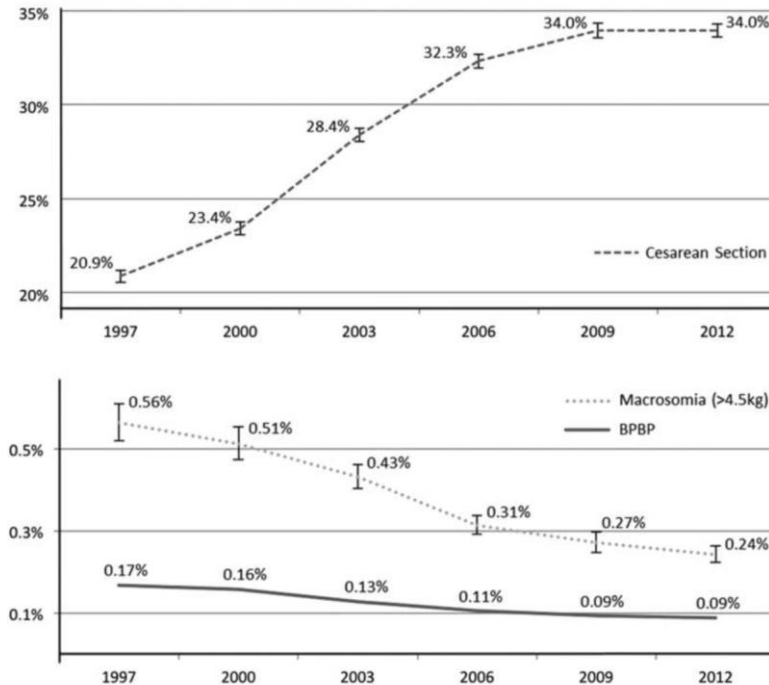
Background: Pathophysiology

TRACTION

- Shoulder Dystocia
- Cephalo-Pelvic Disproportion
- C-Section?
 - Fetal Distress
 - Loss of Muscle Tone



Background: Epidemiology



- From 1997→2012
 - Incidence dropped 47% (1.7→0.9 per 1000 live births)
 - C-section rate increased 63% (21→34%)
 - 55% had no risk factors
 - Shoulder dystocia is strongest RF
 - 8% BPI
 - Association with birth hypoxia

The Epidemiology of Brachial Plexus Birth Palsy in the United States: Declining Incidence and Evolving Risk Factors

Christopher J. DeFrancesco, BS,* Divya K. Shah, MD, MME,† Benjamin H. Rogers, BA,* and Apurva S. Shah, MD, MBA*

Background: Prognosis

- 66% recovery rate
 - Old lit. quotes 95%
 - 15% significant permanent weakness
- Recovery < 3mo
 - Minimal sequelae
- Recovery 3-4mo
 - More sequelae
- Recovery > 4mo
 - Continue to observe
 - Possible exploration



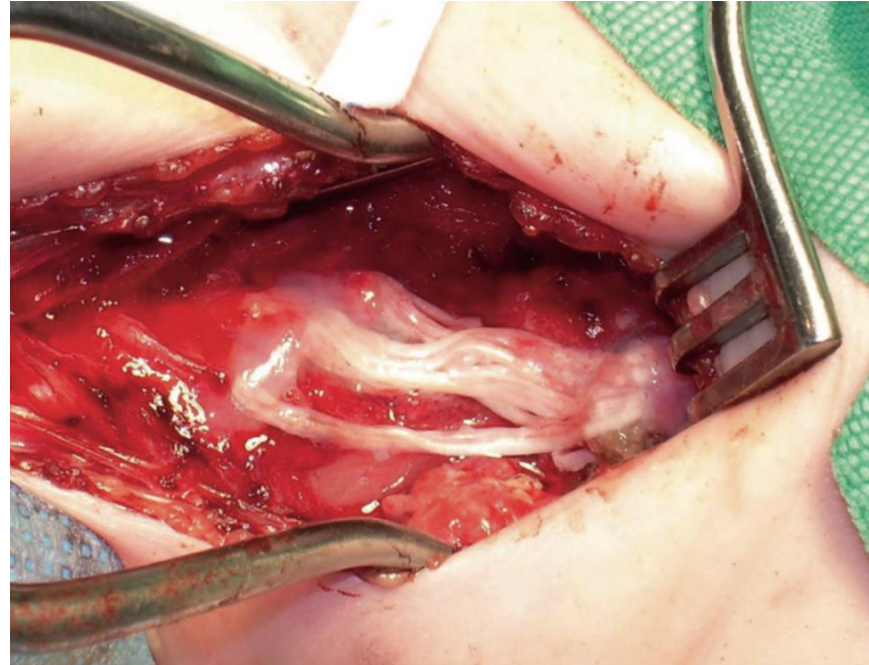
Background: Treatment

- Referrals- Ortho & OT
- Stretching
- Tactile Stimulation
- Electrical stimulation
- Botox
- Surgery



Background: Surgical Options

- Surgery: 10-30%
 - Neurolysis
 - Nerve grafting
 - Nerve transfers
 - Secondary nerve transfers
 - Joint fusions
 - Tendon transfers
 - Muscle transfers
 - Free functioning muscle transfer

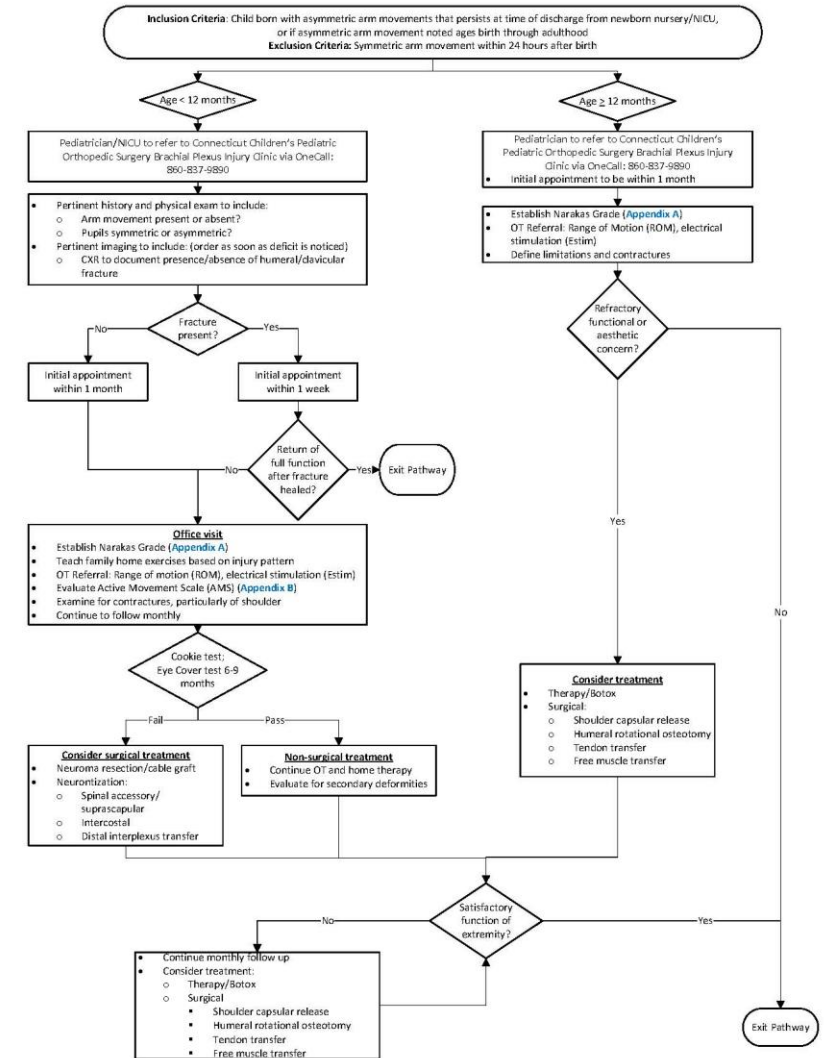


- Abzug JM, Kozin SH. Evaluation and management of brachial plexus birth palsy. *Orthop Clin North Am.* 2014;45(2):225-232. doi:10.1016/j.jocl.2013.12.004

CLINICAL PATHWAY:
Brachial Plexus Palsy Management

THIS PATHWAY
 SERVES AS A GUIDE
 AND DOES NOT
 REPLACE CLINICAL
 JUDGMENT.

This is the Brachial Plexus Palsy Clinical Pathway.
 We will be reviewing each component in the following slides.



NEXT PAGE

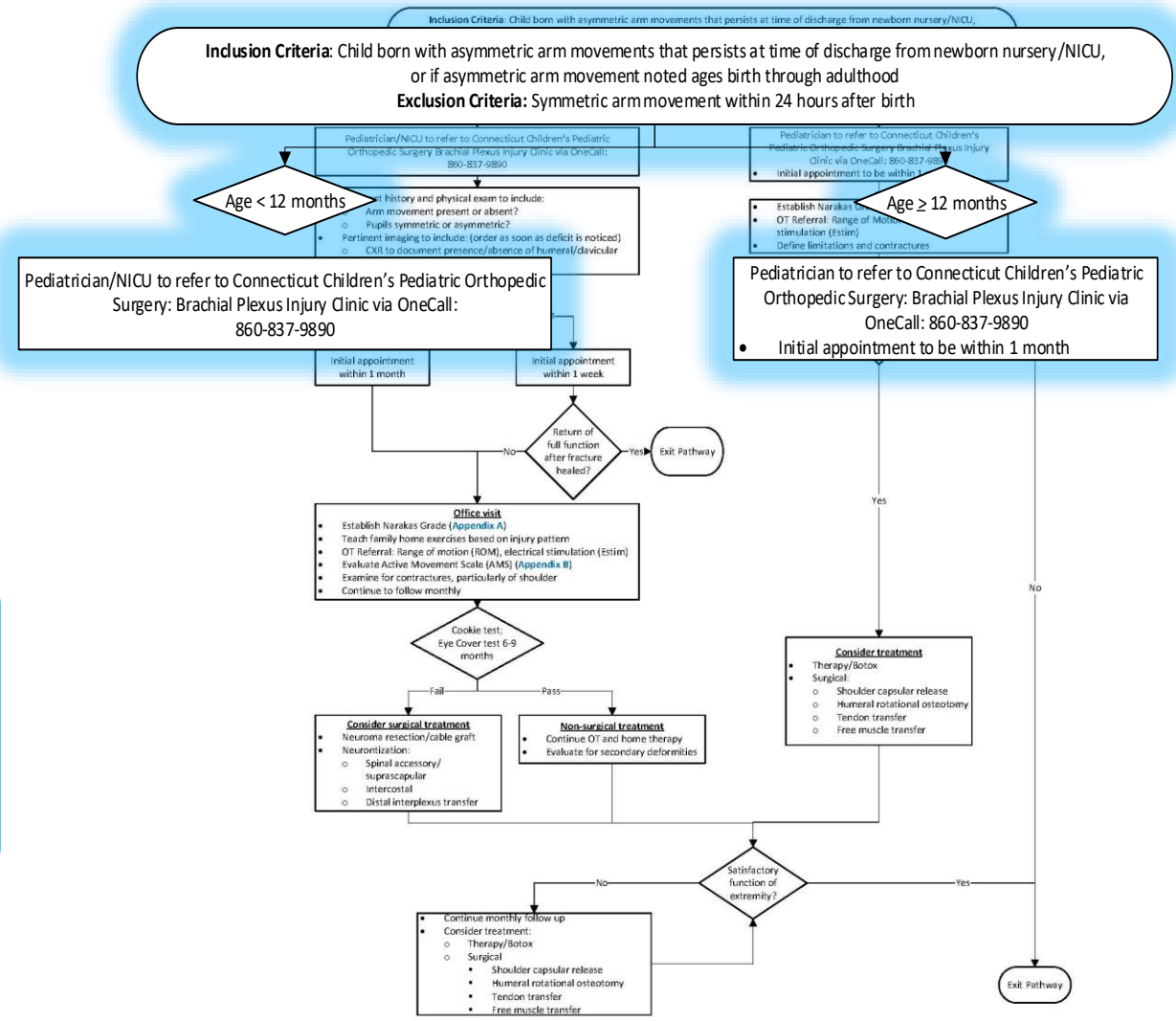
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Asymmetric arm movement in a newborn persisting for more than 24 hours should prompt referral to Orthopaedics, ideally within 1 month of age.



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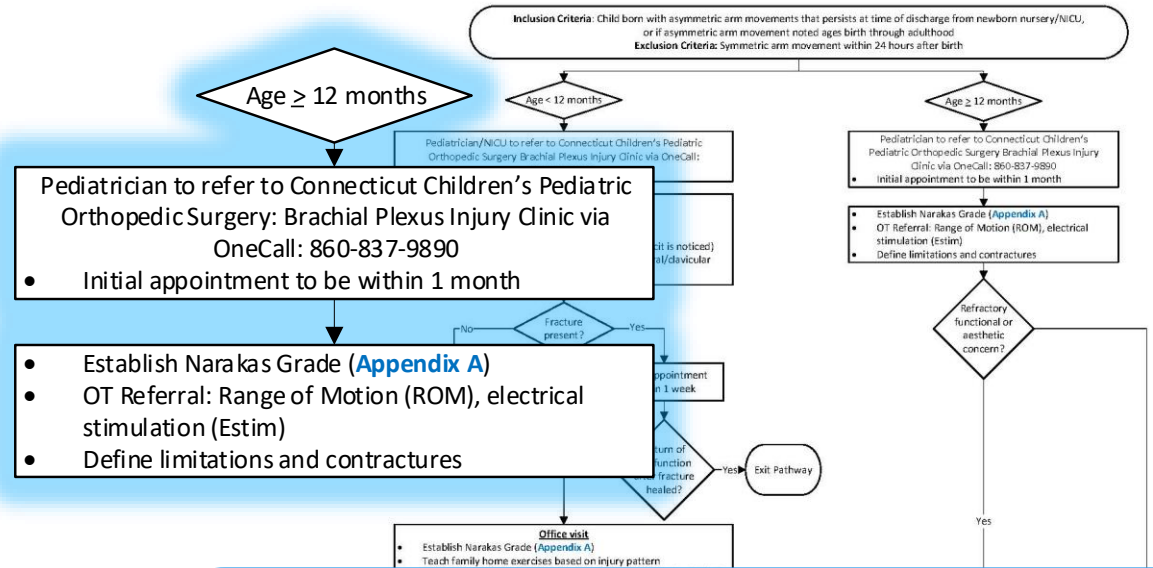
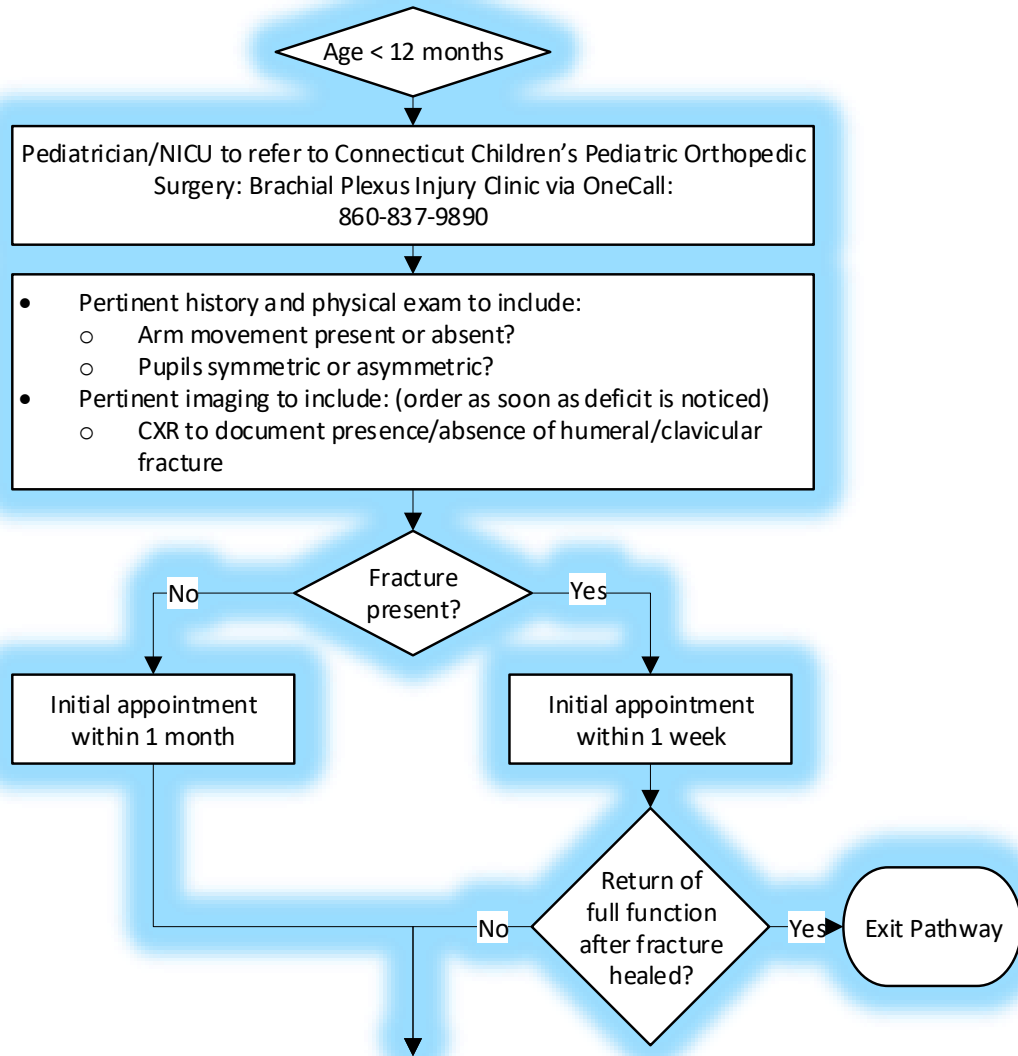
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At this visit we will rule out concomitant pathologies (joint dislocations, fractures, diaphragmatic palsy), establish the level and grade of injury, and ensure appropriate exercises are being performed

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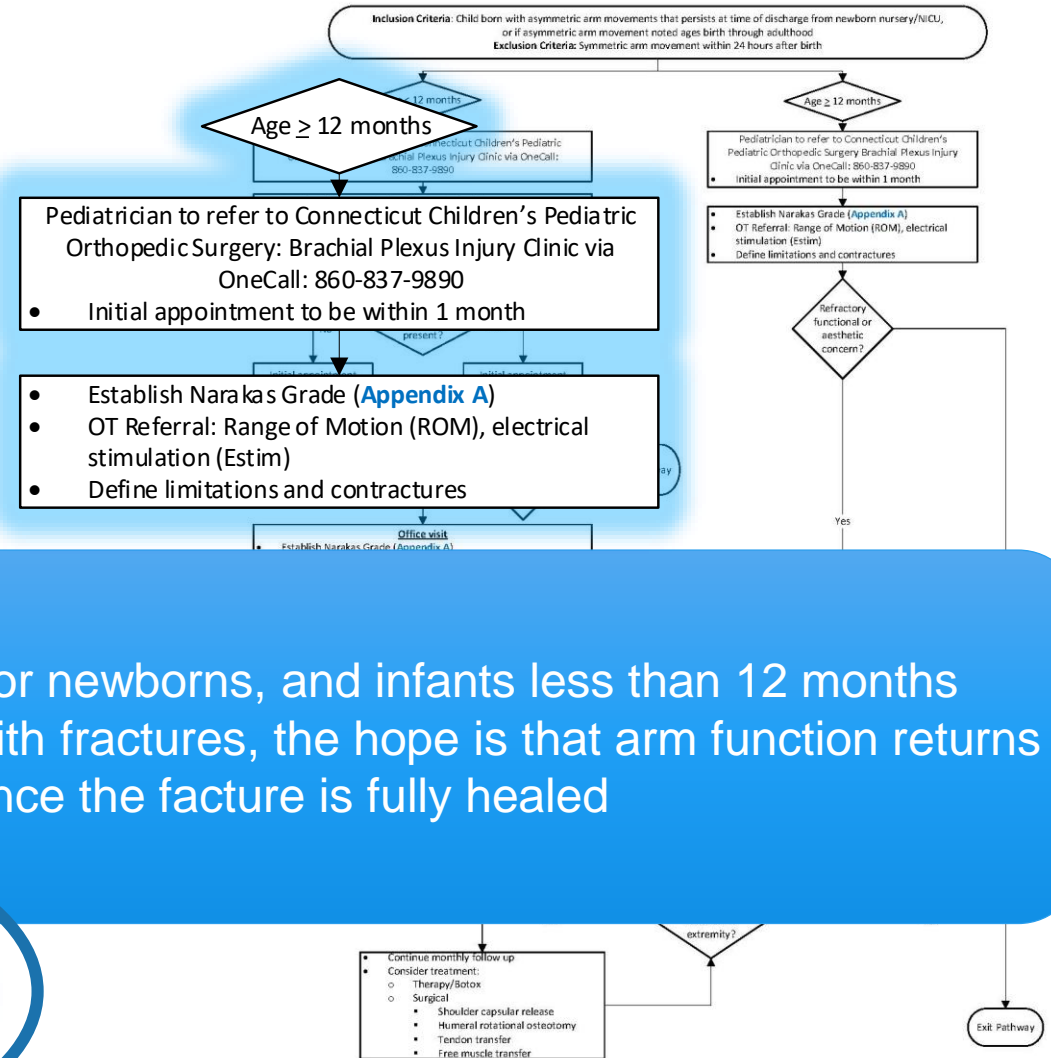
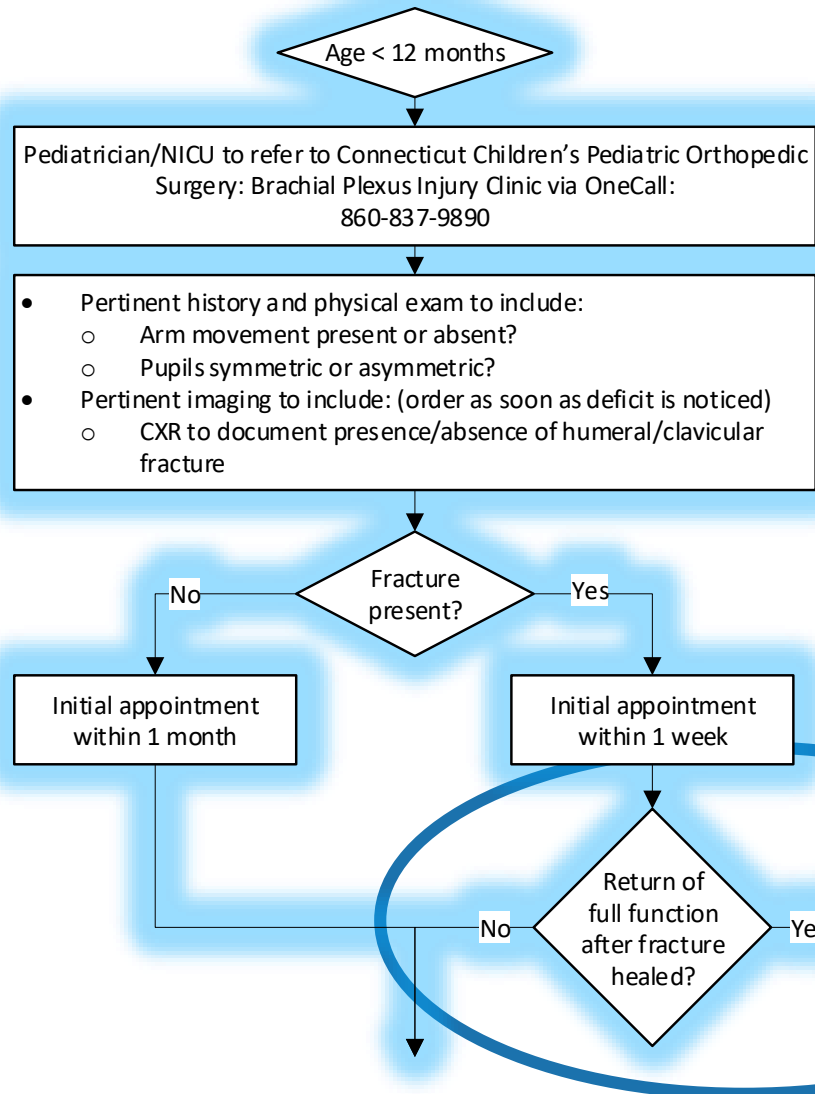
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For newborns, and infants less than 12 months with fractures, the hope is that arm function returns once the fracture is fully healed

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CLINICAL PATHWAY:
Brachial Plexus Palsy Management
Appendix A: Narakas Grade

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Classification (Narakas)

Assess at 2-4 weeks (to allow for recovery of minor nerve contusions)

Group 1	C5, 6 Biceps and deltoid paralysis
Group 2	C5, 6, 7 Only the long finger flexors working
Group 3	Whole plexus involved with slight finger flexion only
Group 4	Whole plexus involved ± Horner's syndrome

Reference: Narakas AO. *The treatment of brachial plexus injuries. Int Orthop* 1985;9:29-36.
[doi:10.1007/BF00267034](https://doi.org/10.1007/BF00267034)



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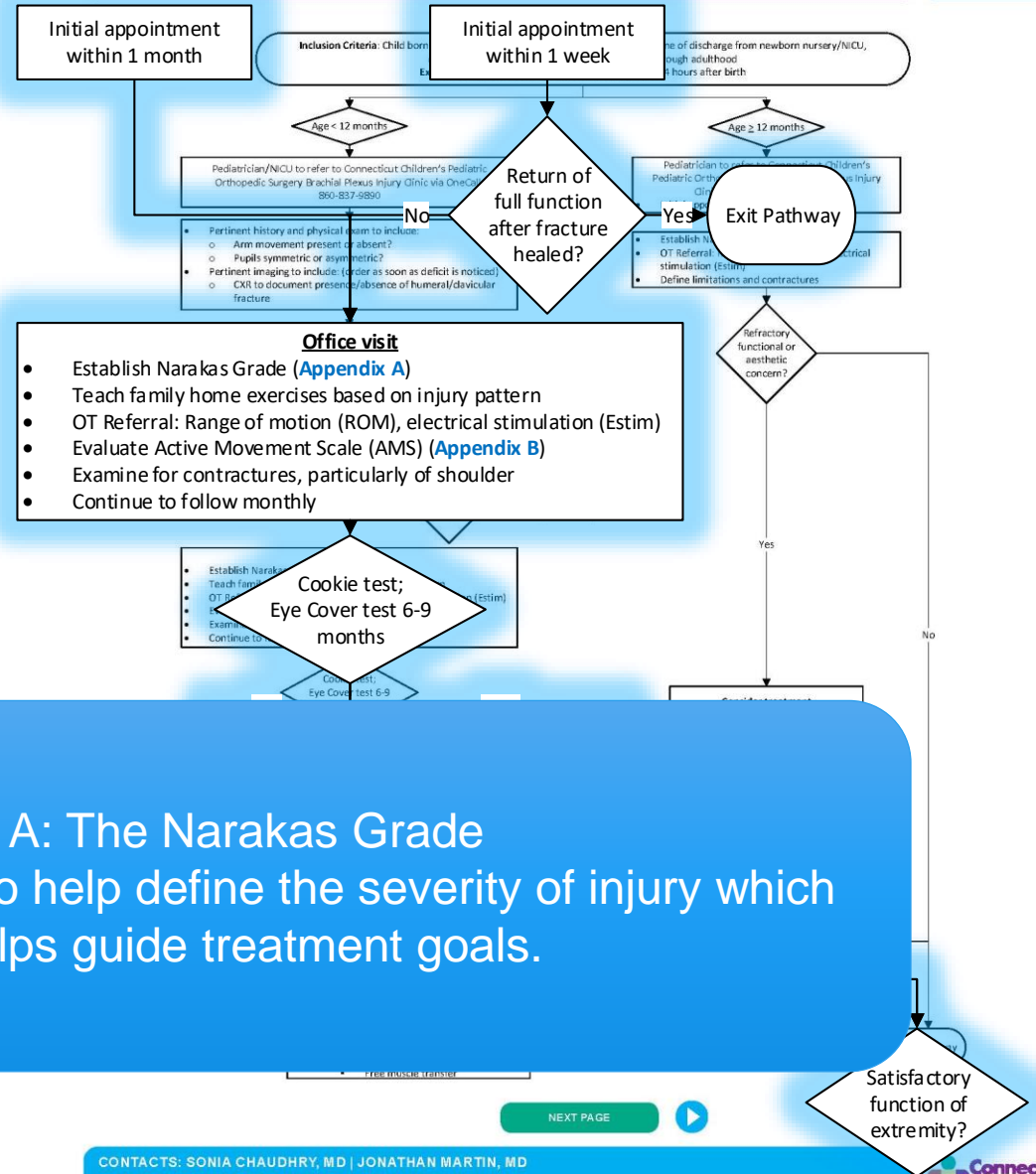
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CLINICAL PATHWAY:
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Appendix A: The Narakas Grade
Is a tool to help define the severity of injury which
in turn helps guide treatment goals.

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CLINICAL PATHWAY:
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Appendix B: Active Movement Scale

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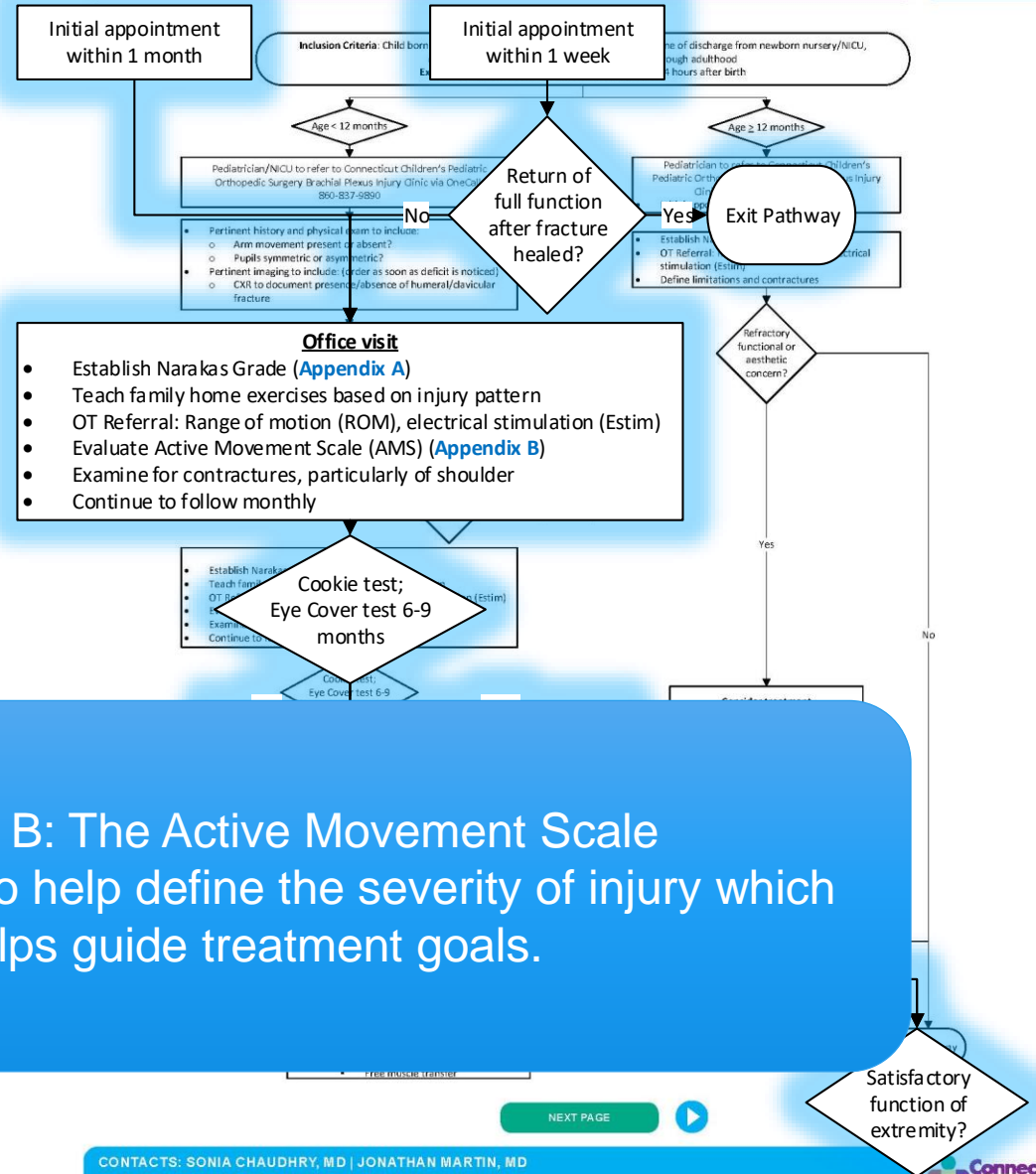
Hospital for Sick Children Active Movement Scale

	Gravity eliminated	Score
a. Shoulder abduction:	No contraction	0
b. Shoulder adduction:	Contraction, no motion	1
c. Shoulder flexion:	<50% motion	2
d. Shoulder external rotation:	>50% motion	3
e. Shoulder internal rotation:	Full motion	4
f. Elbow flexion:	Against Gravity	5
g. Elbow extension:	<50% motion	6
h. Forearm pronation:	>50% motion	7
i. Forearm supination:	Full motion	
j. Wrist flexion:		
k. Wrist extension:		
l. Finger flexion:		
m. Finger extension:		
n. Thumb flexion:		
o. Thumb extension:		

Reference: [Curtis C](#)¹, [Stephens D](#), [Clarke HM](#), [Andrews D](#). The active movement scale: an evaluative tool for infants with obstetrical brachial plexus palsy. [J Hand Surg Am](#). 2002 May;27(3):470-8.

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Appendix B: The Active Movement Scale
Is a tool to help define the severity of injury which
in turn helps guide treatment goals.

RETURN TO THE BEGINNING

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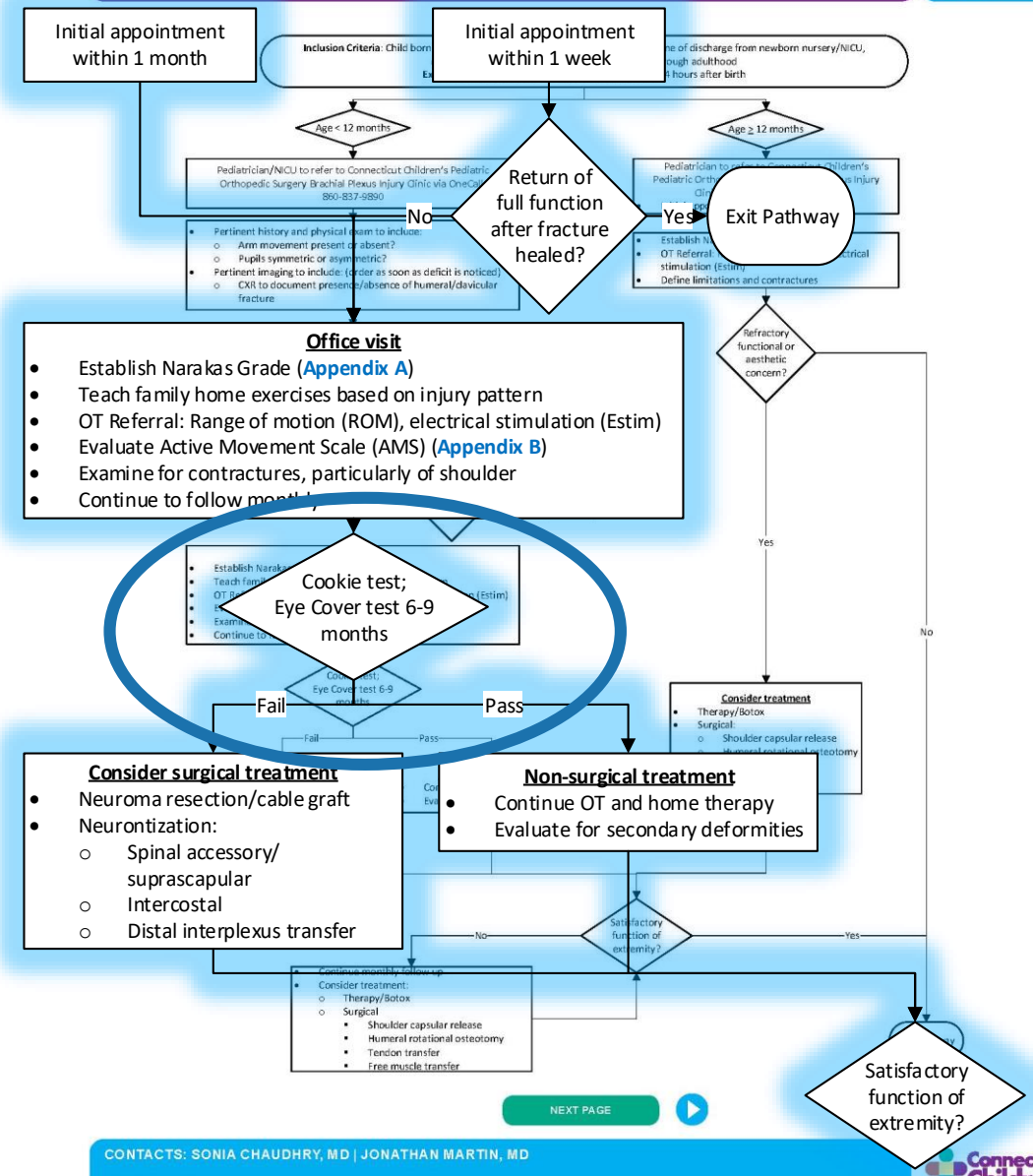
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CLINICAL PATHWAY: Brachial Plexus Palsy Management

The "Cookie Test" can be used to assess biceps function at 9 months in infants with brachial plexus birth injury and aid in surgical decision-making.

1. A cookie is placed in the child's hand on the affected side.
2. The examiner holds the child's elbow adducted at the side to prevent compensation for biceps weakness by flexing the arm in the plane of gravity rather than against it (the "Trumpet Sign").
3. If the child can bring the cookie to the mouth without bending the neck forward more than 45 degrees, she or he passes the "Cookie Test." If the child does not pass the cookie test, surgical repair of the brachial plexus should be considered.



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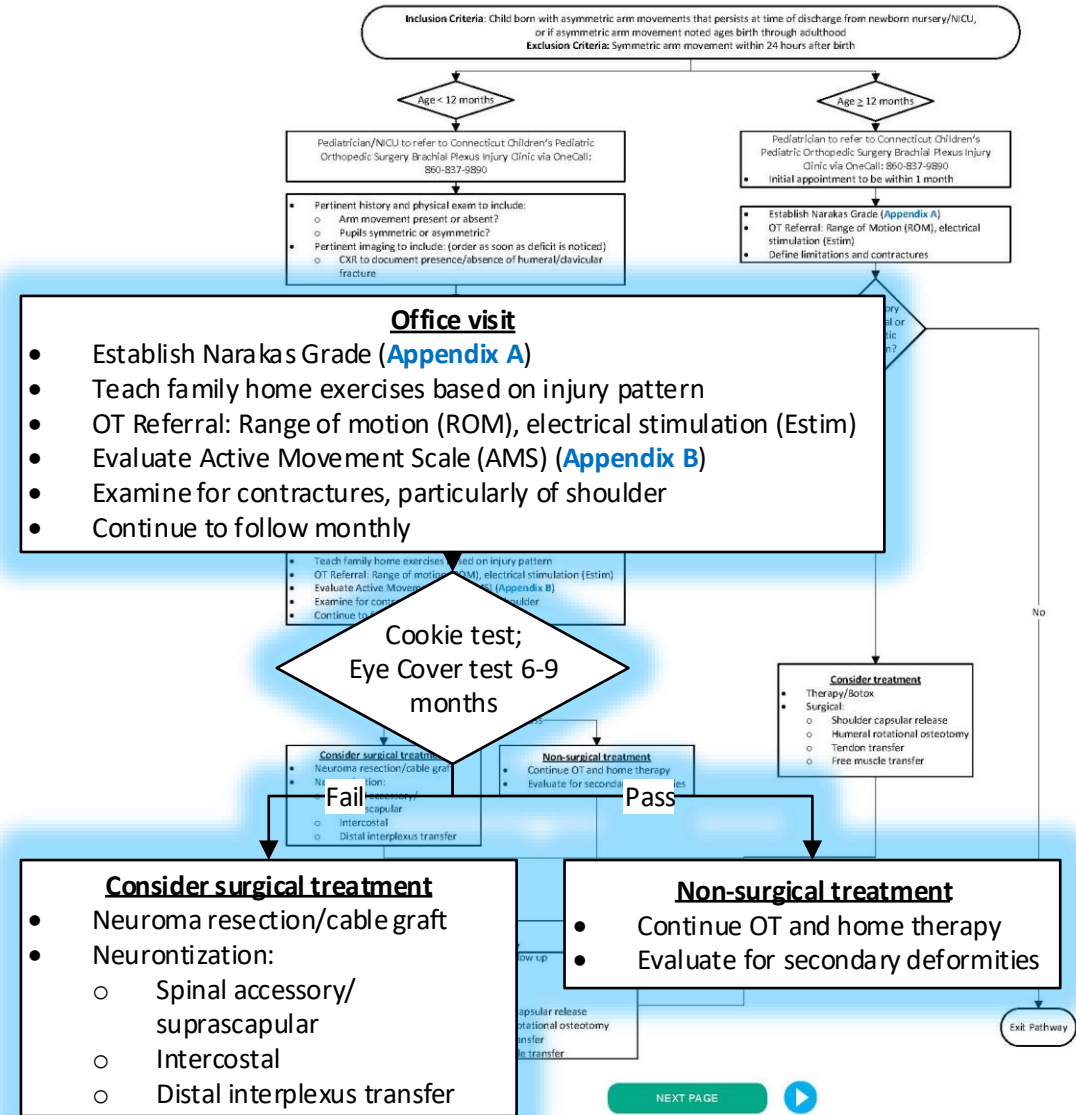
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Serial examinations will be performed, usually monthly.

Infants with recovery of clinically useful movement will be intermittently followed for secondary deformities or until functional normalized.

Infants not recovering will be considered for microsurgical exploration, neuroma resection and grafting, and nerve transfers

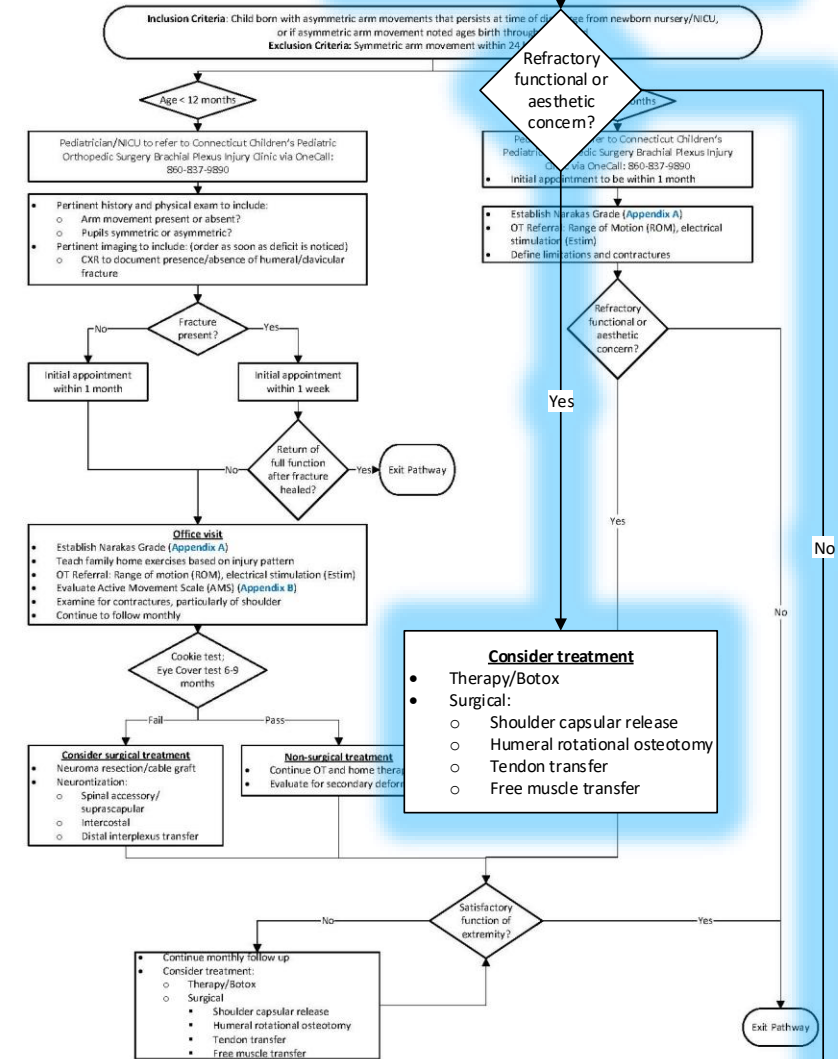


CLINICAL PATHWAY:
Brachial Plexus Palsy Man

- Establish Narakas Grade (Appendix A)
- OT Referral: Range of Motion (ROM), electrical stimulation (Estim)
- Define limitations and contractures

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Children with residual weakness or deformity that are beyond the window for microsurgical exploration, around age 1yo, will have their function optimized with therapy and procedures as indicated.



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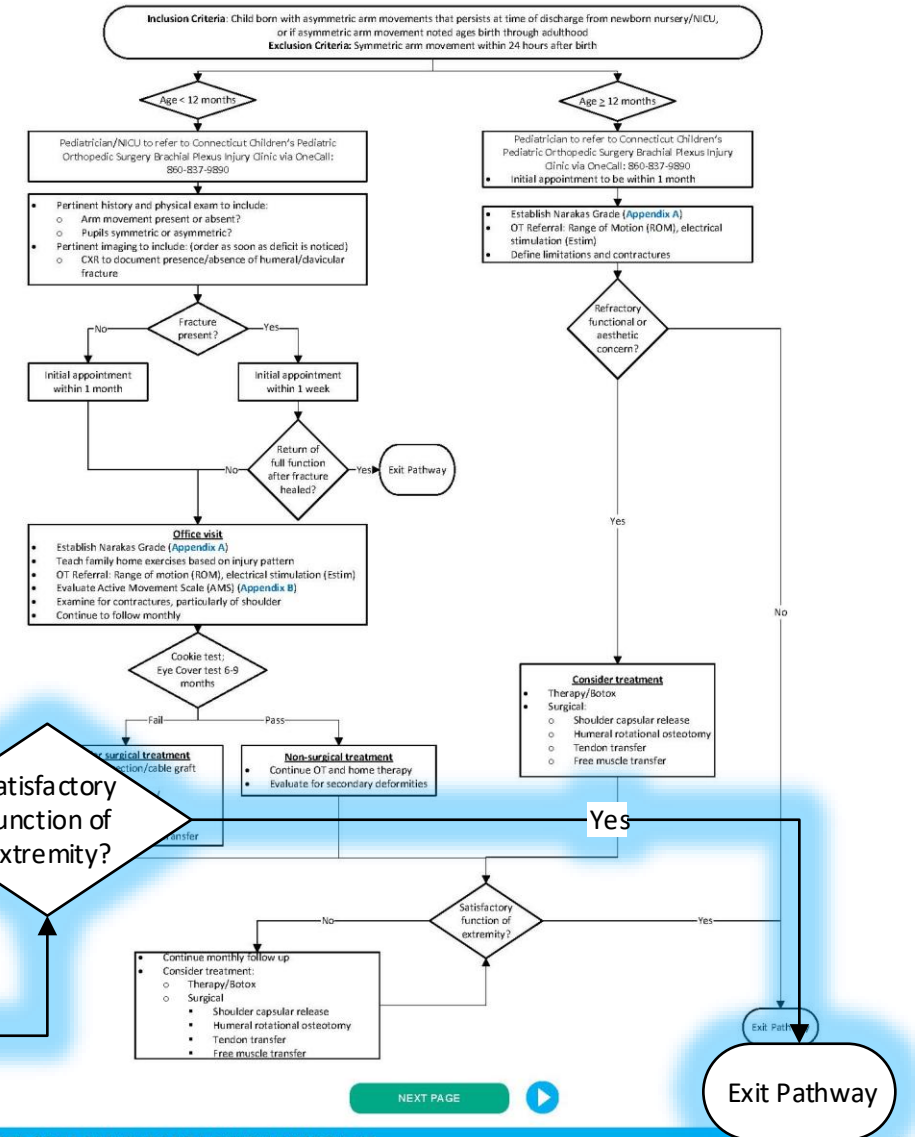


Exit Pathway

CLINICAL PATHWAY:
Brachial Plexus Palsy Management

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The goal in both arms of the pathway to achieve satisfactory function of the extremity. Patients may undergo multiple interventions in order to achieve this.



- Continue monthly follow up
- Consider treatment:
 - Therapy/Botox
 - Surgical
 - Shoulder capsular release
 - Humeral rotational osteotomy
 - Tendon transfer
 - Free muscle transfer

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Exit Pathway



Review of Key Points

- Early referral to orthopaedics to establish level and severity of injury, initiate serial examinations, and intervene in a timely manner when indicated
- Early range of motion exercises performed by family to minimize contractures during recovery
- Secondary deformities are common and have many treatment options

Use of Order Set



- Referral to Orthopaedic Brachial Plexus Clinic
- Referral to Occupational Therapy



Quality Metrics



- Percentage of patients with spontaneous recovery by 12 months of age
- Percentage of operative patients (cable graft or neurontization) with recovery of antigravity motor function in biceps by 1 year post-op



Pathway Contacts



- Sonia Chaudhry, MD,
 - Department of Orthopaedics
- Jonathan Martin, MD
 - Department of Neurosurgery



References

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doi:10.1016/j.ocl.2013.12.004

Thank You!



About Connecticut Children's Pathways Program Clinical pathways guide the management of patients to optimize consistent use of evidence-based practice. Clinical pathways have been shown to improve guideline adherence and quality outcomes, while decreasing length of stay and cost. Here at Connecticut Children's, our Clinical Pathways Program aims to deliver evidence-based, high value care to the greatest number of children in a diversity of patient settings. These pathways serve as a guide for providers and do not replace clinical judgement

**This Educational Module was edited by:
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