



THE CUTTING
EDGE
OF PEDIATRICS



Birth Brachial Plexus Injury: Making Sense of It

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Brachial Plexus

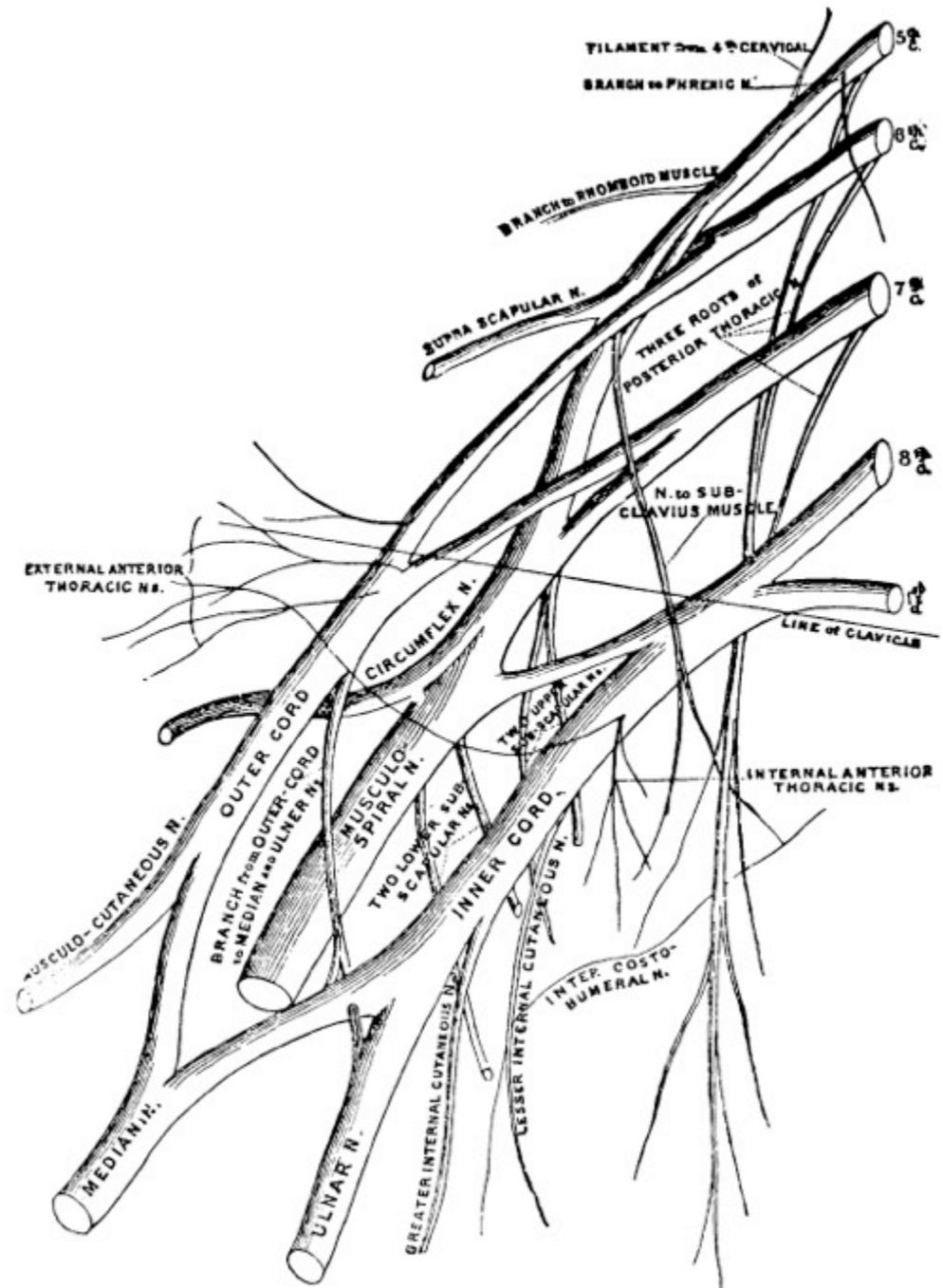
- Anatomy
- Incidence
- Etiology
- Workup
- Management

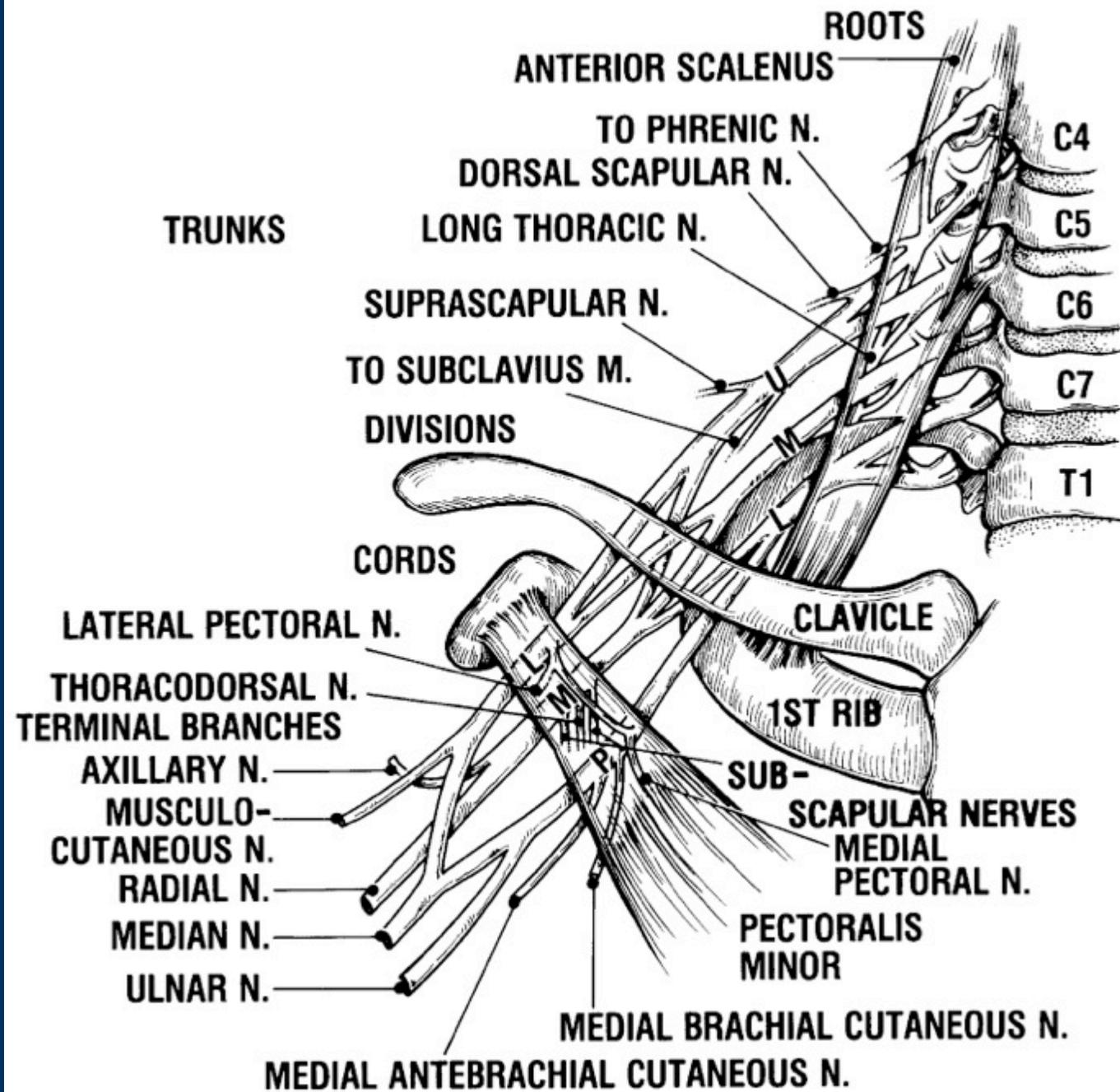


Albrecht Dürer
1499

What is the Brachial Plexus Anyway?

- It is the conglomeration of nerves in the neck and shoulder that go to the arm and hand
- It starts out from the 5th through 8th cervical nerve roots and the first thoracic nerve root (C5 – T1)
- These spinal roots join shortly after they exit the cervical spine and then mix and match until about the level of the shoulder where they become the nerves to the arm and hand







Brachial Plexus – Anatomy

C5 **Arm abduction, external rotation, & extensor muscles**

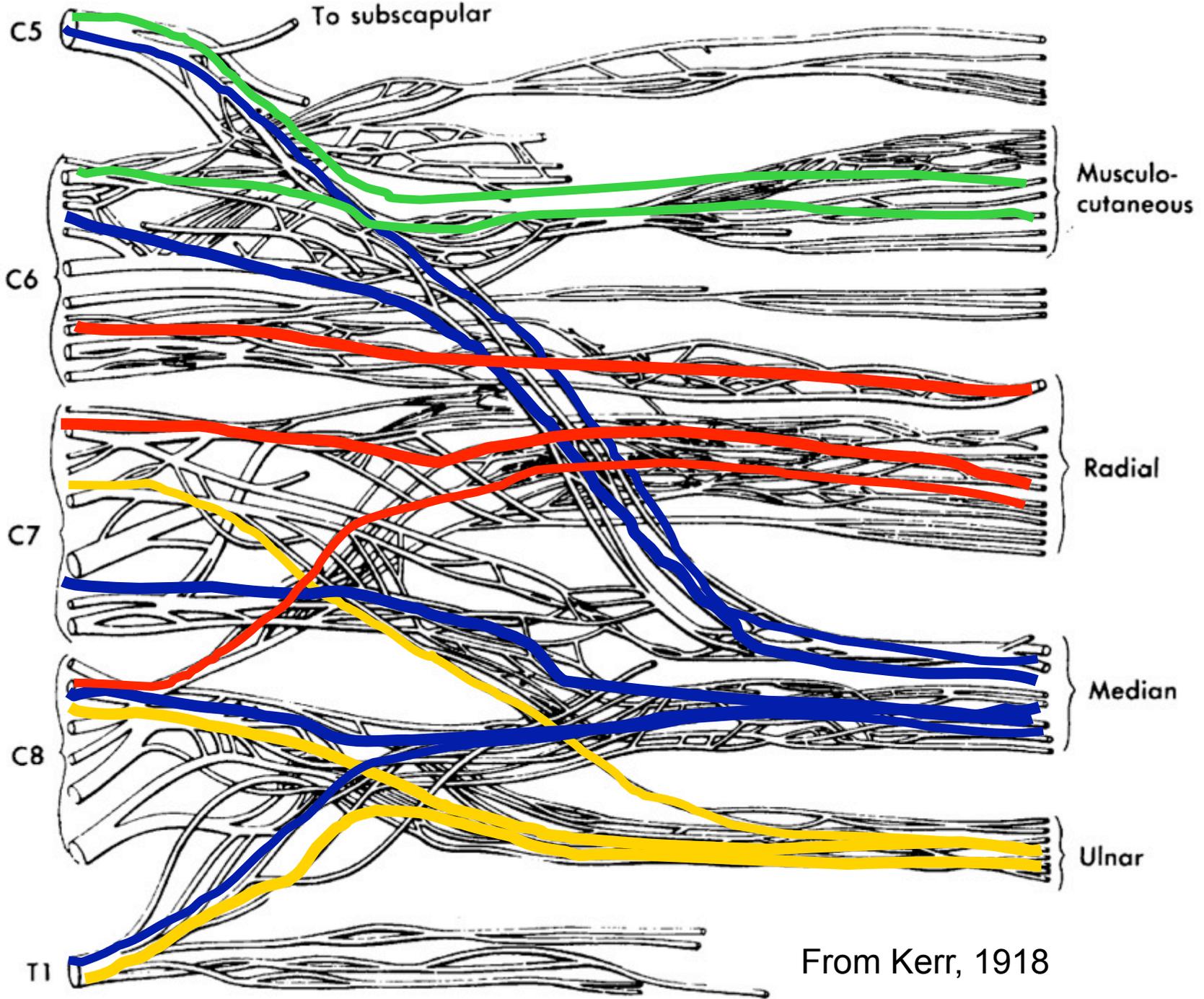
C6 **Brachioradialis, biceps, & wrist extensors**

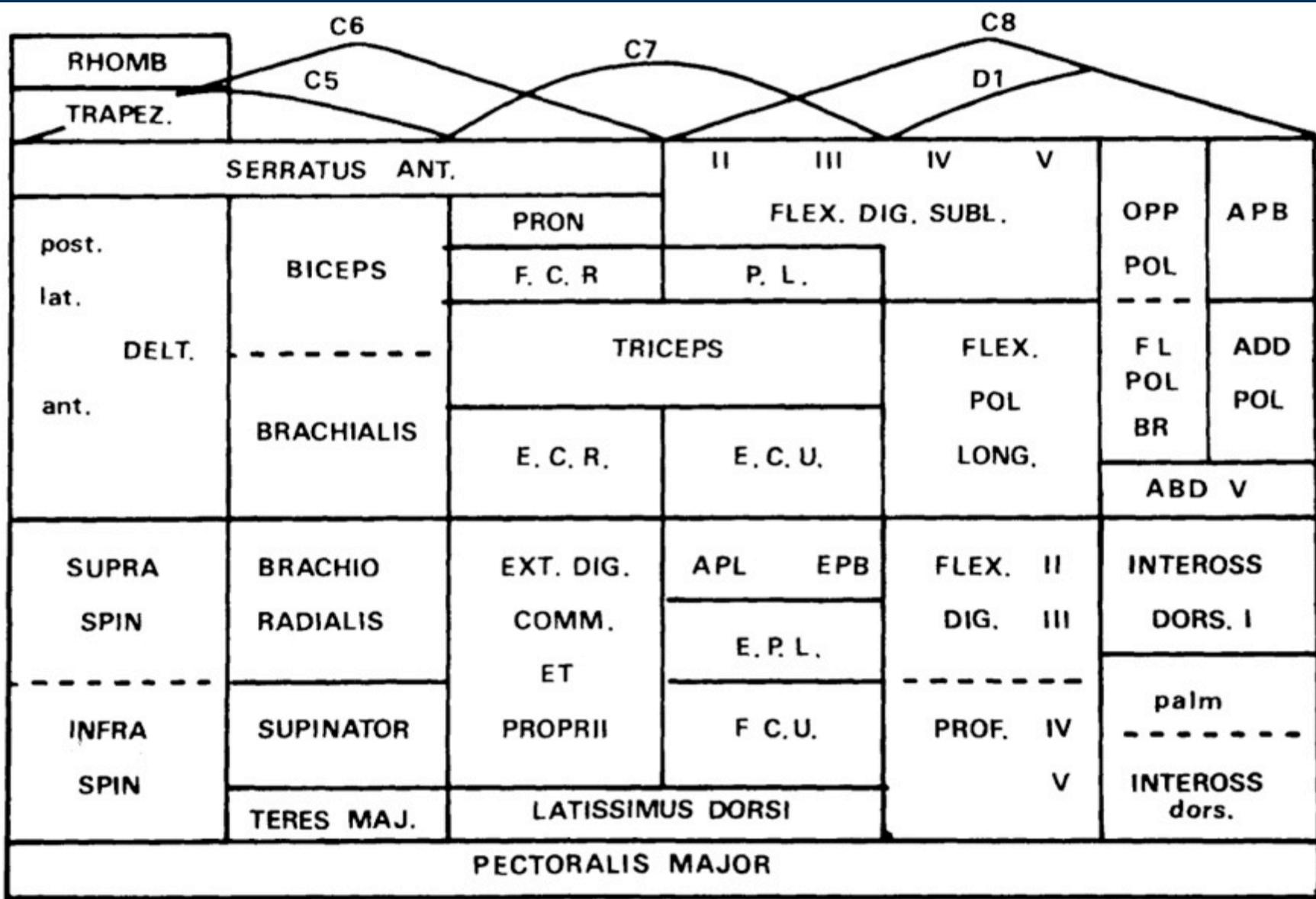
C7 **Triceps, pronator teres, wrist flexors & finger extensors**

Brachial Plexus – Anatomy

C8 **Finger flexors**

T1 **Intrinsic muscles of the hand**





Incidence

Backe, et al, Acta Obstet Gynecol Scand, 2008

- Looked at 30,574 live births over 9 years (Norway)
- Every child examined for arm weakness in first 24 hours
 - 91 were diagnosed with birth palsy (3/1000)
 - 2 were Cesarean deliveries
- 15 did not recover spontaneously (84% recovery)
- Total risk of permanent damage was 0.5/1,000
- Risk factors were high maternal body mass index, shoulder dystocia, fractured humerus, and fetal asphyxia
- Clavicular fracture was associated with *decreased risk*

Incidence

Wall et al, Obstetrics and Gynecology, 2014

- Parkland Memorial Hospital
- 1,291 children with brachial plexus palsies out of 366,408 births – 3.5/1,000 births
- Approximately 73% resolved completely by six months
- High birth weights correlated with poor recovery
- Patients with a concomitant clavicle fracture had a better rate of complete recovery than those infants without clavicle fracture
- Total with residual palsy was .02/1,000

Incidence

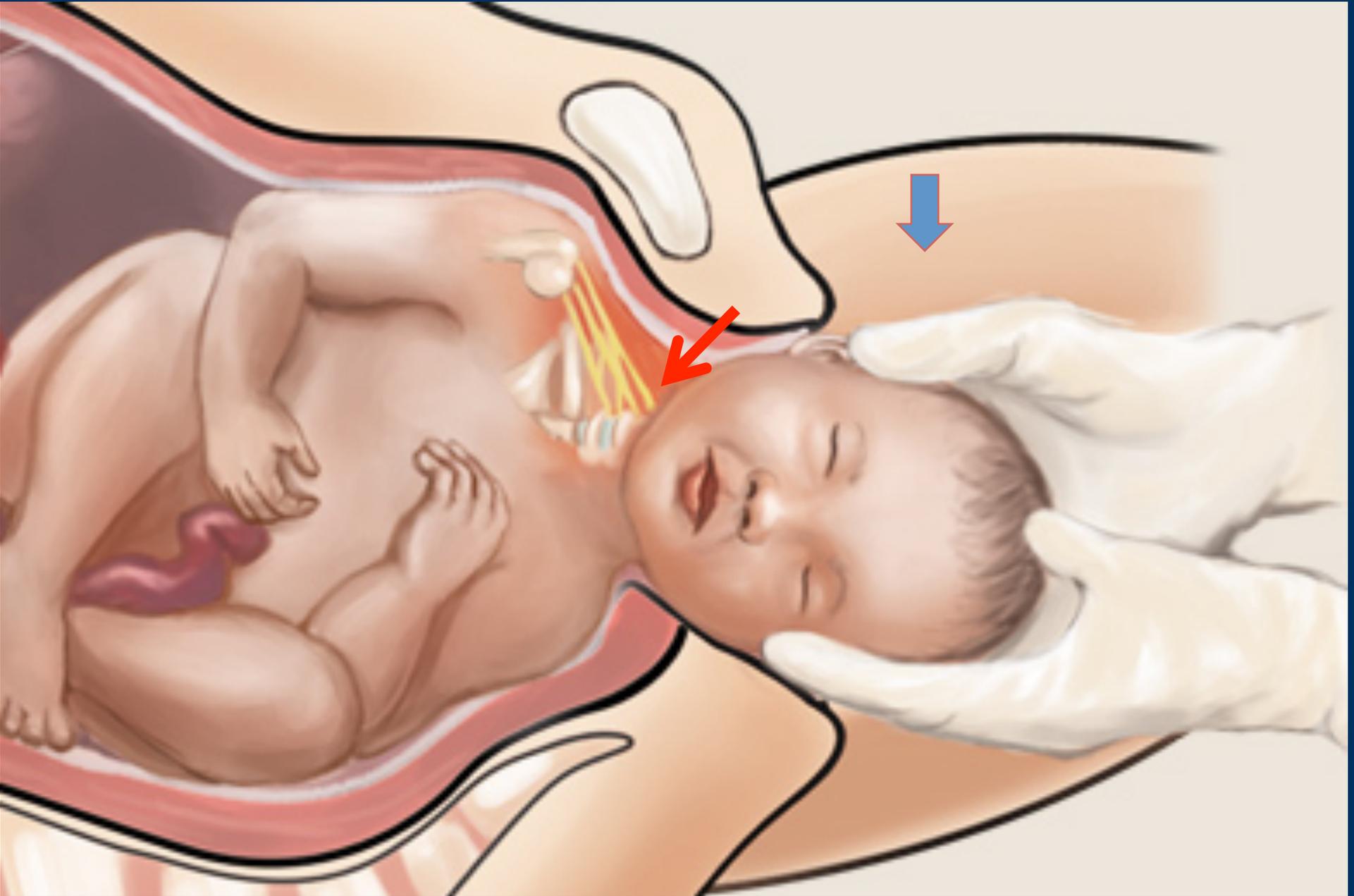
- Most textbooks quote the incidence at 1.5/1,000
- It is clearly higher if the babies are examined closely at birth
- The important thing to remember is that most of them recover spontaneously
- *70% to 80% will recover with no surgical intervention*

Etiology

- High birth weight
- Shoulder dystocia
- Difficult deliveries
- *However, brachial plexus palsies have been reported after Cesarean sections*

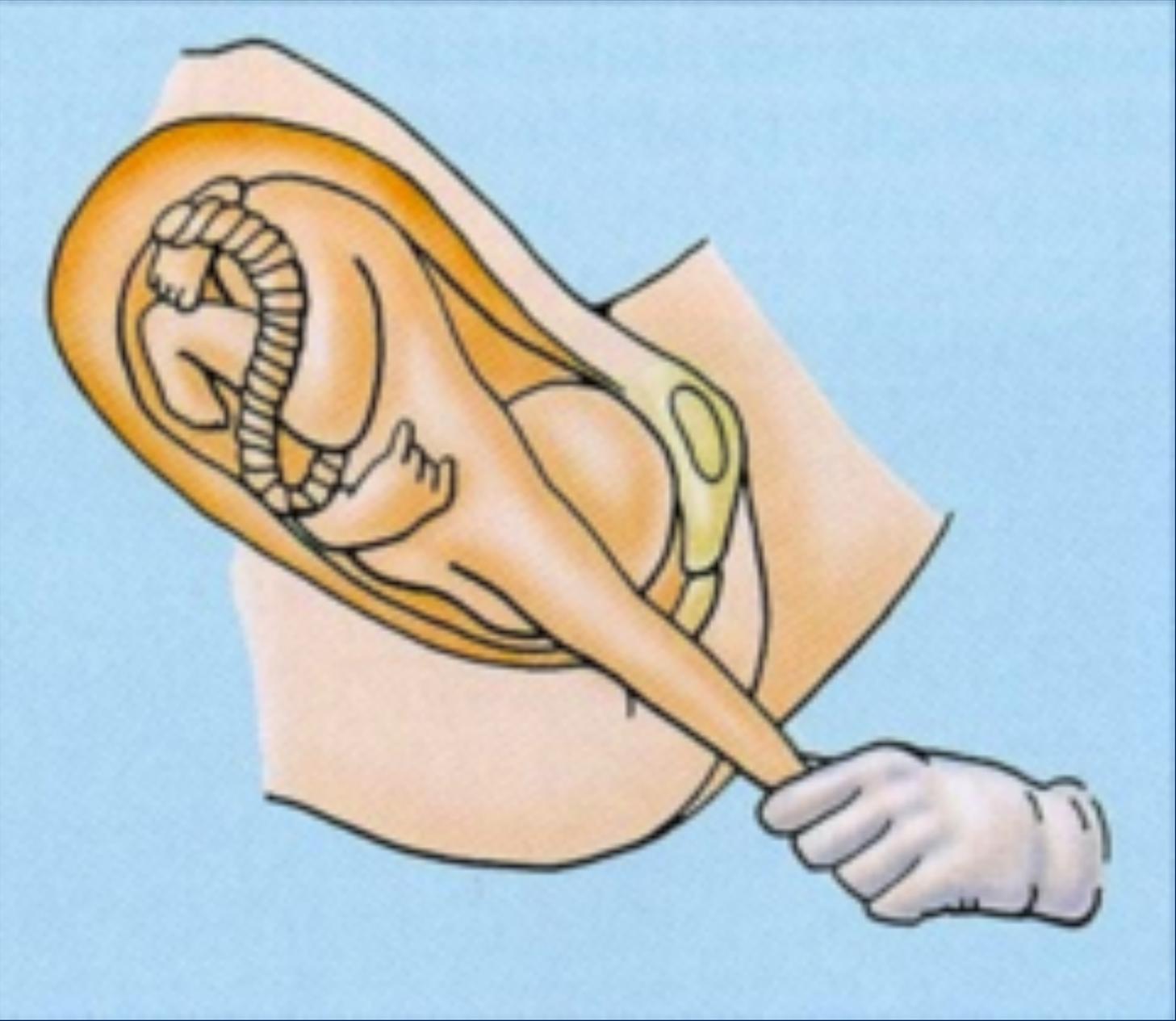
Etiology – Erb's Palsy (C5 – C6)

- Downward traction on head during delivery
- Puts stress on upper part of plexus
- Can lead to stretch injury or avulsion of the nerves from the spinal cord



Etiology – Klumpke's Palsy (C8 – T1)

- Upward traction on arm
- Puts traction on lower plexus with the clavicle acting as a fulcrum
- Can cause stretch or root avulsion



Erb's Palsy

- Involvement of upper part of plexus
- See weakness in shoulder and elbow flexion
- Often see poor wrist extension
- Arm and hand are held in the so called “waiter’s tip” posture with elbow extended and wrist flexed



Klumpke's Palsy

- Lower part of plexus
- Much less common than Erb's (fortunately)
- Shoulder and elbow work, hand doesn't function
 - May see a “Horner's Sign” if severe
 - Disruption of sympathetics, eyelid ptosis
- Due to the slow nature of nerve regeneration, recovery may be poor

Horner's Syndrome

in **C**ats
and
Dogs

© photodeti / iStock / Thinkstock



Problems

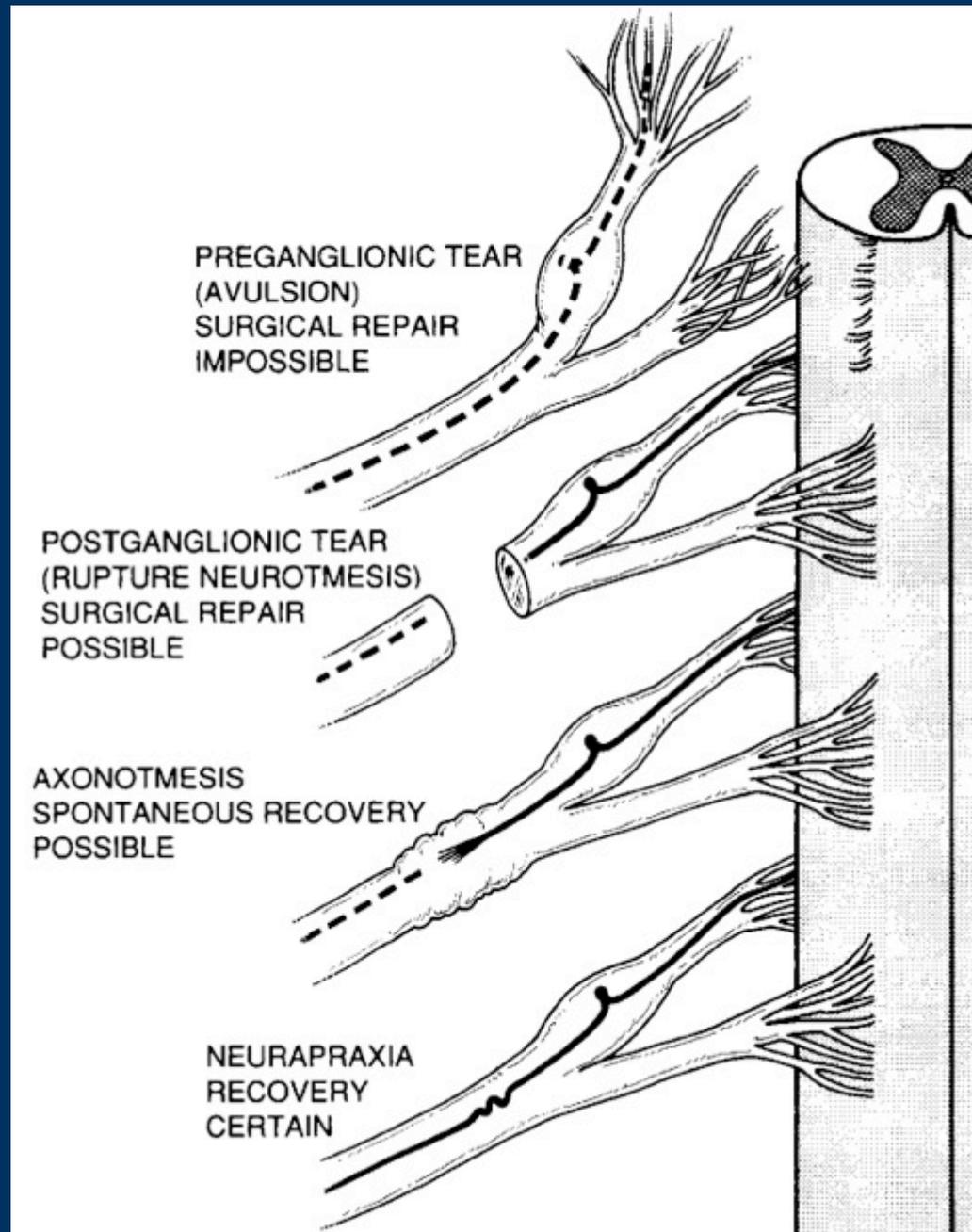
- Most common type seen is upper palsy (Erb's)
- Many will not have a clear picture on exam
 - May have no motion in the beginning
- Can have a mixture of nerve injuries
 - Root avulsion, ruptures, and stretching injuries
- Need to diagnose those injuries that can't recover

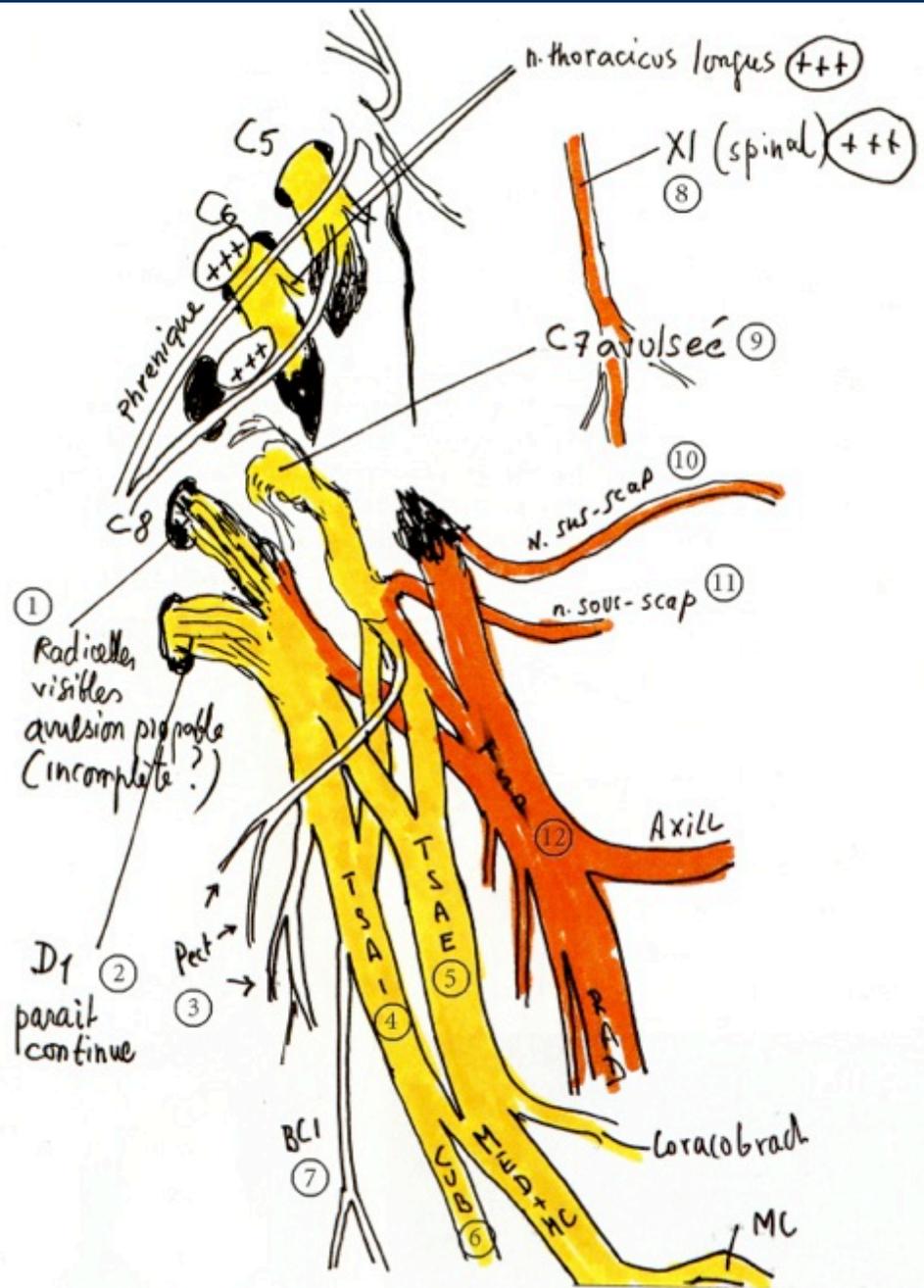
PREGANGLIONIC TEAR
(AVULSION)
SURGICAL REPAIR
IMPOSSIBLE

POSTGANGLIONIC TEAR
(RUPTURE NEURITIS)
SURGICAL REPAIR
POSSIBLE

AXONOTMESIS
SPONTANEOUS RECOVERY
POSSIBLE

NEURAPRAXIA
RECOVERY
CERTAIN





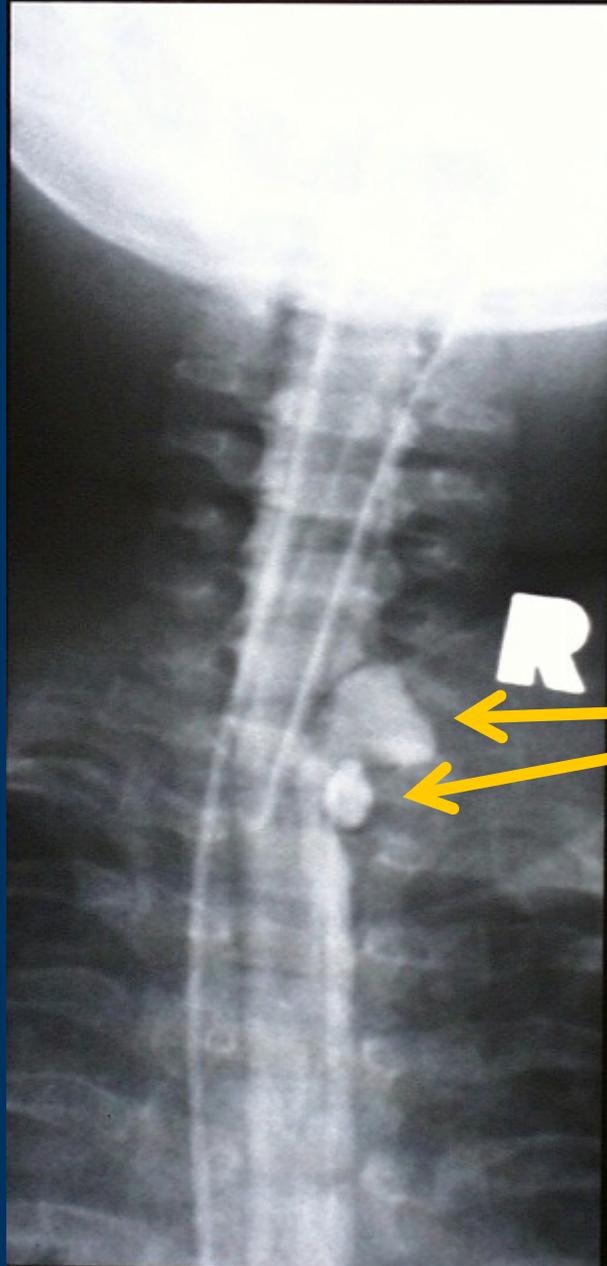
Workup

- Early on need to do serial exams to evaluate recovery
- We need to diagnose patients with irreparable injuries early
 - Early surgical intervention gives the best results
- This diagnosis is made with imaging
 - Usually wait three months for evidence of recovery

Imaging

Myelogram

- Look for “pseudomeningocele”
- An outpouching of the dural sac filled with CSF caused by avulsion of the nerve root
- This cannot regenerate
- Largely supplanted by CT and/or MRI



Pseudomeningocele

11 HMG:35
Scan 17
TP -427

C2-T1



MRI

- Can see pseudomeningoceles
- Can also see nerve roots
- May be able to diagnose extra-dural ruptures as well

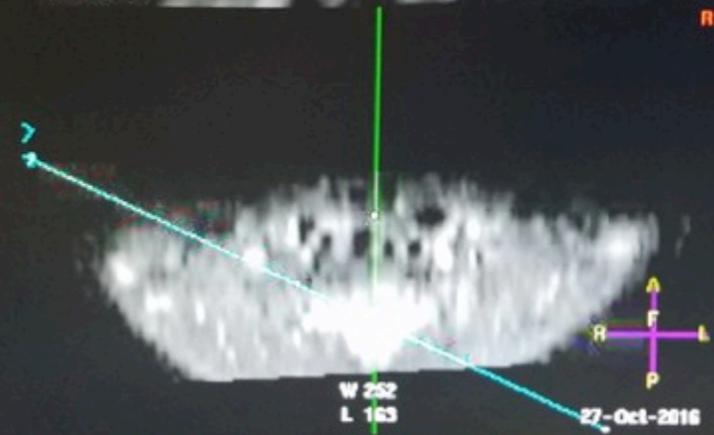


Sc 3.1 IRM



W 252
L 163
R1

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27-Oct-2016
R2



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L 163

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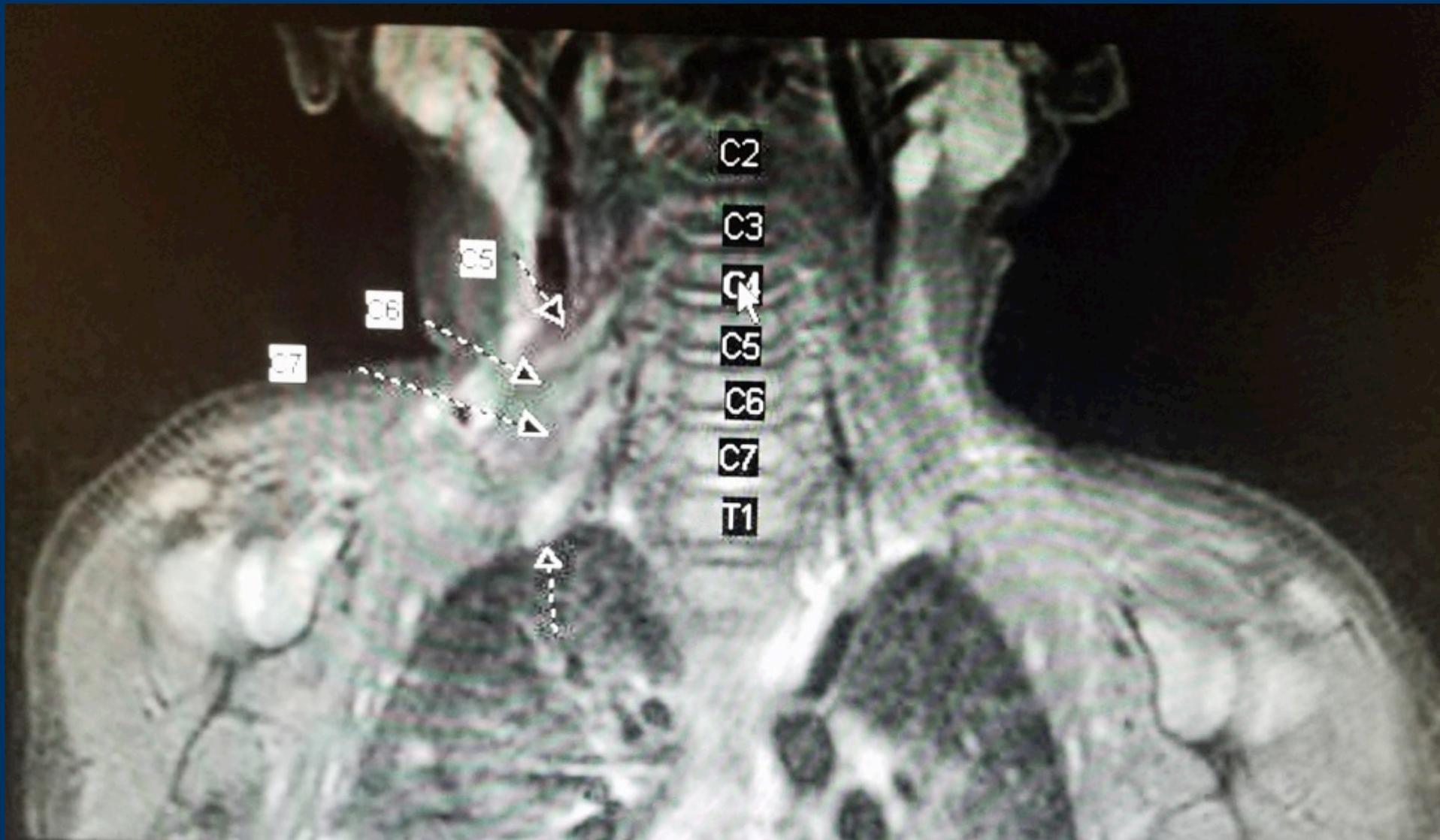
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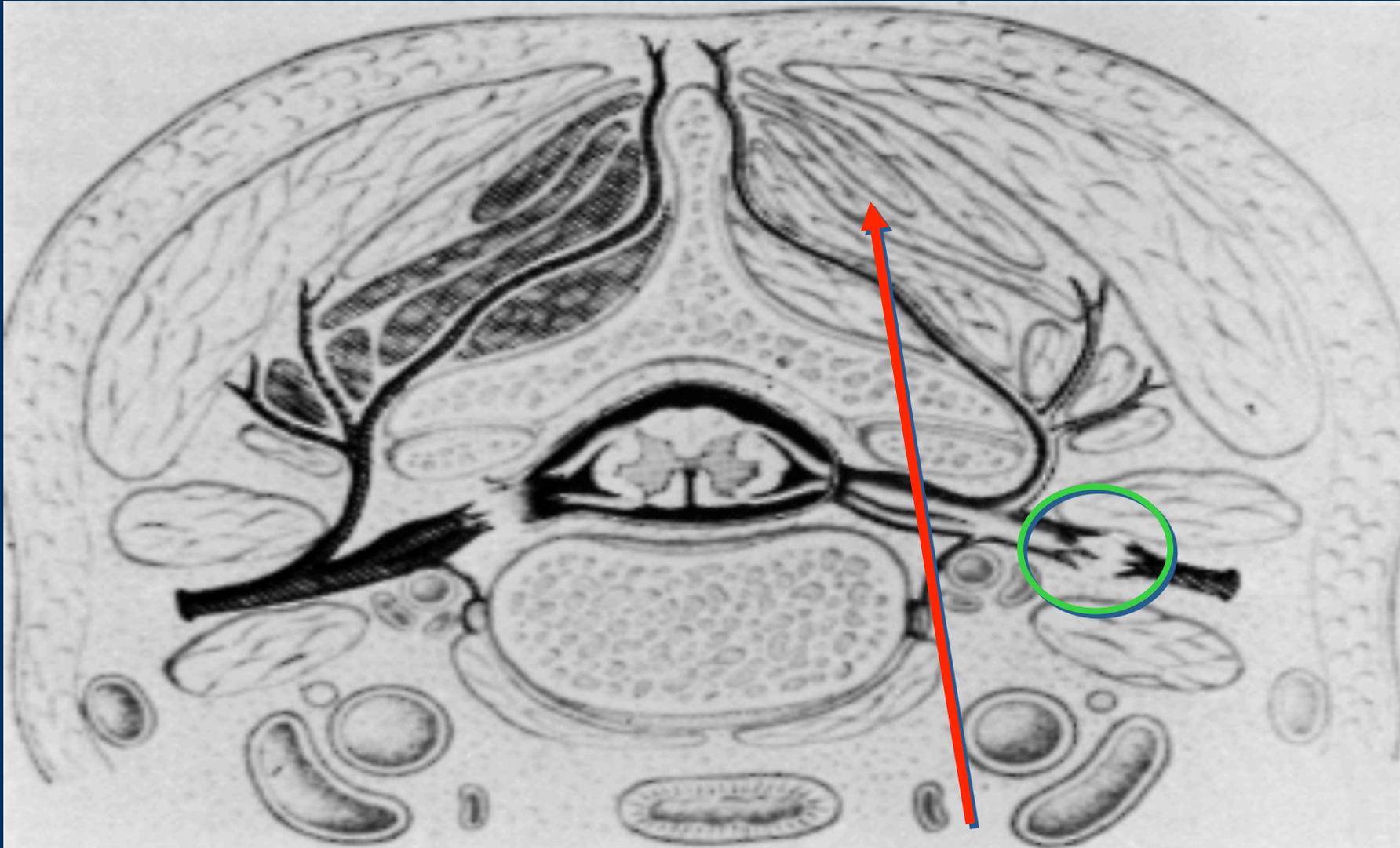
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MRI BRAC



Electrodiagnostic Studies

- Won't be of much use until 3 weeks postpartum
- These are not a lot of help early on, often difficult on little children
- I use EMG's *sometimes* later on to help plan surgery (primarily late tendon transfers)
- Can help diagnose where lesion is if erector spinae in neck is still innervated



With postganglionic lesion, erector spinae
will still be innervated on EMG

Management

- The most important thing to do is...

**TO KEEP THE
ARM AND SHOULDER MOVING**

Remember

- The great majority of these children will recover
- However, the shoulder starts getting stiff immediately, and this can lead to
 - Abnormal development of the joint
 - Posterior dislocation
- Some children recover nerve function only to have a very stiff shoulder

In Terms of Referral

- Consult therapy as an inpatient
- Education of the parents on the necessity of passive motion is **ESSENTIAL**
 - And they still don't always do it
 - You can even move them gently with a fractured clavicle
- We will see any patient with a brachial plexus injury in the clinic
 - Prefer to see them early

Who Needs Surgical Intervention?

- If no motion by three months, we will do an MRI
- If there is no evidence of nerve root avulsion, we will wait until six months
 - If no biceps at six months, will usually explore and do nerve grafts or nerve transfers
- Nerves grow back at about an inch a month in an adult, much quicker in babies
 - *Earlier nerve surgery has better results*



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