Brachial Plexus Birth Palsy

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How Common?

- Incidence usually quoted at 1:1000 to 1:2000
- Risk of palsy with vaginal delivery is 0.2% – 0.02% with c-section.
- About 8000 births in Sedgewick County a year
Risk factors

• **Shoulder dystocia** (76x)
• Gestational diabetes
• Multiparity
• Breech delivery
• Instrumental delivery
• Mother of short stature
• Macrosomia

Mechanism

• Has always been somewhat of a controversy
• Blamed it on instrumentation in the past
  – Rate of instrumentation use went way down
• Blamed it on poor technique of delivery
  – ACOG pressed for “gentleness” techniques in delivery
The Obstetricians Fault?

• Once thought that excessive lateral traction of the head with shoulder dystocia.
  – No level 1 evidence to support
  – The sacral arm is involved in only 1/3 of cases
Classification of Injury

• “Erb’s Palsy”
  – upper root palsy of the C5-c6 (extended c7).
• Total palsy
  – C5-T1
• “Klumpke’s Palsy” (C8 and T1) along with intermediate palsy (C7 alone)
Why Not a C-section

• The rate of c section has doubled in the past 25 years.
  – Rates of BPPB have gone up in the US
Why Not C-Section

• Macrosomia:
  – Ultrasound sensitivity 60%/Specificity 90%
  – Reduce palsy by 31%
  – Increase C section rate by 50%
  – $5,000,000 per palsy prevented
  – 1 maternal death per 3.2 cases palsy prevention
Maternal Labor Forces

• an abnormal relationship between the head and shoulders as it undergoes the second stage during cardinal movements

Shortened Second stage when associated with SD has a 4.7x greater incidence of BPP than a second stage of normal length
A. Pubic symphysis

Sacrum

Fetal head positioned transversely; shoulders front to back in mother’s pelvis

B. Fetal head rotates to face mother’s sacrum; shoulders remain front to back
Shoulder stuck above symphysis; fetal head descent and extension further increases stretching of plexus.
What About the Force of Delivery?

160 N = 40 lbs

100N = 22 lbs


Clavicle Fractures

• It has been labeled as “a natural risk of labor” (ACOG) and associated with the maternal force of labor.

• Presence of a clavicle fracture portends a greater risk of BPI.

• Clavicle fracture is not a prognostic indicator
  – Studies show that it is more common in affected neonates. 71-96 per 1000 affected births.
  – No difference in recovery
  – No difference in secondary procedures
Incidence and prognosis of neonatal brachial plexus palsy with and without clavicle fractures.


• 288 BPPB from Parkland Hospital
  – 74 also had ipsilateral clavicular fracture

• 72% resolved spontaneously (154/214);
  – concomitant clavicular fracture, 74% resolved spontaneously (55/74).
Other Culprits in Disguise

- Pseudoparalysis: Fracture of the humerus or clavicle.
- Congenital aplasia of nerve roots: described by Gilbert
- Congenital varicella
- Umbilical cord palsy: Most commonly of the radial nerve, elbow extension and wrist drop. Caused by intrauterine compression of the upper arm.
Classification of Injury

• At the ganglionic level
  – Preganglionic (aka Nerve Root)
    • Loss of the phrenic, long thoracic, dorsal scapular, suprascapular and thoracodorsal nerves
  – Postganglionic
    • Erb’s Point
suprascapular nerve (C5, C6)
Peripheral Branches

- Suprascapular Nerve (C5)
Terminal Branches

- Musculocutaneous nerve (C5,6,7)
- Median nerve (C5,6,7,8,T1)
- Ulnar nerve (C7,8,T1)
- Radial nerve (C5,6,7,8,T1)
- Medial antebrachial cutaneous nerve (C8, T1)
- Medial brachial cutaneous nerve (T1)
- Thoracodorsal nerve (middle subscapular) (C8,7,8)
- Upper subscapular nerve (C5, 6)
- Lower subscapular nerve (C5,6)
Peripheral Branches

- Axillary Nerve (C5, C6)
Peripheral Branches

• Musculocutaneous (C5-C6)
C5-C7 Palsy

• Most common presentation
  – Adducted, internally rotated, extended elbow, wrist flexed, forearm pronated.

• Etiology thought to be a hyperextension and lateral flexion of the neck.

• Best chance of spontaneous recovery
Total Palsy

- Make up less than 25%
- Flail Arm
- Thought to be the same etiology
- Associations with Horner’s and Phrenic Nerve Palsy

Bae et al.:
Arm/forearm/hand length was 95/94/97% less.
35% of parents/patients said that this along with noticeable difference in girth was a big deal to them.
<table>
<thead>
<tr>
<th>Group</th>
<th>Deficit</th>
<th>Nerve roots</th>
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</thead>
<tbody>
<tr>
<td>I</td>
<td>Dysfunction of deltoide and biceps brachii muscles</td>
<td>C5, C6</td>
</tr>
<tr>
<td>II</td>
<td>Function of long hand flexors is present</td>
<td>C5, C6, C7</td>
</tr>
<tr>
<td>III</td>
<td>Lack of upper limb function, possible minimal function of hand flexors</td>
<td>Whole plexus</td>
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<tr>
<td>IV</td>
<td>Lack of whole upper limb function</td>
<td>Group III and Horner syndrome positive</td>
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Prognosis

• The two most important prognostic indicators
  – Nerve root involvement
  – Spontaneous biceps recovery by 4 months

• Narakas Classification:
  – Group 1 – 90% with full recovery
  – Group II – 25% full recovery
  – Group III and IV, no full recovery
What is the Role of the Upper Extremity Surgeon?

• Make the right diagnosis.
• Characterize the pattern
• Establish rapport with the family
• **NOT** to establish etiology!!!
Non-Surgical Intervention

• Physical Therapy
• Splinting and Casting
• Onabotulism Toxin Injection
Surgical Indications

• Gilbert: lack of biceps recovery at 3 months
• AlQattan uses 4 months with lack of flexion against gravity
  – 11 patients who had recovery of elbow flexion against gravity between 3-4 months. 5/11 had satisfactory recovery. 6/11 had good recovery of elbow and incomplete shoulder.
• Zancolli and Zancolli broke the plexus down into three parts and assigned a key muscle (or muscles) to each, using recovery of these keys by 6-8 months as an indication for surgery.
  – Upper: Deltoid and biceps
  – Middle: triceps
  – Lower: finger flexors, wrist extensor
Surgical Indications

• Total palsy with Horner’s should be operated on by 3 months of age.

Biceps recovery by 6 weeks (complete) → Total Palsy with Horner’s (Poor recovery)

• No return of antigravity biceps function by 5 months of age.
• No shoulder external rotation by 10 months
  – Bahm and Van Ouwerkerk: selective suprascap transfer
Loss of External Rotation

- No shoulder external rotation
  - Bahm and Van Ouwerkerk: selective suprascap transfer
  - Tendon transfers
Summary

• Uncommon but devastating injury
• Etiology still not completely clear and preventive measures unsuccessful
• Early establishment in therapy is key to outcomes
• A multimodality approach to treatment may be necessary
• Early recovery of nerve function (whether by natural history or surgical means) is paramount to functionality