C5-C8 neonatal brachial plexus palsy.
Operative findings, reconstruction strategy and outcome

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C5-C8 neonatal brachial plexus palsy

• Neonatal brachial plexus palsy (NBPP) occurs in 0.4 to 2% of children per births
• C5-C6 or C5-C7 are the most common
• Upper plexus injuries affect
  • Shoulder function (C5-C6)
  • Elbow flexion (C5-C6)
  • Elbow and wrist extension (C7)
• C5-C8 is less frequently encountered
  • Surgical strategy?
  • Prognosis?

C5-C8 neonatal brachial plexus palsy

- **Treatment strategy** based on:
  - T1 root
  - Thumb
  - Finger flexors
  - Grasping
  - Pinch strength
  - Hand sensation

- **Goals of the surgical strategy:**
  - To obtain active **elbow flexion** against gravity
  - To improve **shoulder abduction / external rotation**
  - To improve **elbow, wrist and fingers extension**

Patients

- Retrospective monocentric study from 1998 to 2014 at Trousseau Hospital

- 260 children operated treated for primary brachial plexus repair between 4 and 5 months old without elbow flexion against gravity

- 33 children included C5-C8 roots lesions and T1 integrity

- 24 children reviewed C5-C8 roots lesions and T1 integrity

- C5-C8 roots lesions were confirmed by direct roots visualization during exploration
Surgical strategy

• Supraclavicular brachial plexus dissection
  • Five roots identification and description:

<table>
<thead>
<tr>
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<th>Description</th>
<th>Points</th>
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<tbody>
<tr>
<td>Good</td>
<td>Nerve fascicule visualised without fibrosis after neuroma resection</td>
<td>2 points</td>
</tr>
<tr>
<td>Fair</td>
<td>Nerve fascicle with fibrosis inside the root</td>
<td>1 point</td>
</tr>
<tr>
<td>Avulsed</td>
<td>Root avulsion</td>
<td>0 point</td>
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• T1 root in continuity was released
• Roots quality score (RQS)

• Surgical goals:
  • To privilege direct suture or neurotisation versus graft
  • To restore elbow flexion > shoulder function > elbow-wrist-fingers extension
Surgical strategy

**First target**
Anterior division of the upper trunk (UT) covered with **sural graft from C5 and/or C6**

**Second target**
Supra scapular nerve was reinervated by a **graft from C5 or spinal accessory nerve transfer**

**Third target**
To manage the posterior division of the UT

When possible: **C8 roots was directly sutured to C6, C7 or C8 nerve stump**
Operative findings

• **Roots quality:** 35% good, 34% fair, 30% avulsed
• **Mean RQS:** 4.2 (range 2 to 8)

• **Anterior and posterior division of UT** were reinnervated in all patients by sural nerve graft
• **SSN** was reinnervated in all patients
  - 19 patients: grafting from C5
  - 5 patients: SAN neurotization
• **MT** was repaired in 13 patients
  - 2 patients: grafting from C5
  - 3 patients: grafting from C6
  - 7 patients: grafting from C7
  - 1 patient: grafting from C5 + C6
• **C8 part of lower trunk** was reinnervated in 7 patients:
  - 1 patient: graft
  - 6 patients: direct suture from C6,C7 or C8
Secondary and tertiary procedures

• **Secondary procedure:** 21 of 24 patients (mean age 4.6 years old)
• **Tertiary procedure:** 8 of 21 patients (mean age 8.6 years old)

Wrist extension lag: 67%
  • FCU to ECRB or ECRL

Shoulder externar rotation deficit: 42%
  • Subscapularis release +/- muscle transfer
  • Rotation humeral osteotomy

Elbow flexion deficit: 8%
  • Triceps transfer to the biceps
  • Steindler procedure
  • Pectoralis minor transfer to biceps (to reinforce)
Mean Mallet score: 9.4 (range 4 to 18, SD=3.16)
Mean Raimondi score: 3.3 (range 1 to 5, SD=1.27)
Mean AMS score:
- Deltoid: 4.2 (range 0 to 7, SD 2.44)
- Biceps brachii: 5.9 (range 0 to 7, SD=2.04)
- Triceps brachii: 4.4 (range 0 to 7, SD=2.74)

Patients treated by SAN to SSN: better shoulder external rotation and Mallet score (p=0.03)

Comparison group 1 (RQS<4) and group 2 (RQS >=4)
- Mallet score: no statistical difference (p=0.07)
- Raimondi score: statistical difference (p=0.01)
- Global AMS score: statistical difference (p=0.04)
Surgical strategy

• **Elbow** flexion successfully restored

• **Shoulder** function was less successful
  • 42% secondary procedures
  • SAN group compared to graft from C5-C6 group was better for shoulder external rotation

• **Wrist** extension recovery was the least successful
  • 67% secondary procedures but easy and good results
  • Because of only 54% had a MT reinnervation

• **Hand** function:
  • **Good final functionnal hand** because of T1 contribution and secondary procedures
C5-C8 brachial plexus palsy

1. Roots Quality Rcore (RQS) < 4 has a bad prognosis
2. Primary surgical repair improves elbow flexion
3. SAN to SSC is better than graft from C5 or C6 for elbow function
4. Secondary and tertiary procedures are necessary for shoulder abduction-external rotation deficit and wrist extension lag
5. Good functionnal hand after FCU transfer to ECRB or ECRL and a functionnal T1 roots
THANK YOU
FOR YOUR ATTENTION