Early treatment of birth palsy

The Hong King Society for Surgery of the Hand

Dr. W.L.TSE
Department of Orthopaedics & Traumatology
Prince of Wales Hospital
Early management ... how?
Early management: crucial points

• Detail Documentation

• Appropriate Investigation

• Start Therapy ASAP
Documentation

• Assessment tools
  – Mallet score
  – Active Movement Scale
  – Gilbert & Tassin grading
  – Paediatric Outcome Data Collection Instrument
DDX

- Pseudo-paralysis of fracture clavicle/humerus
- Infection
- CNS injury
- Neuromuscular disorders
- Congenital anomalies of upper limb
## Muscle grading

Gilbert & Tassin 1987

<table>
<thead>
<tr>
<th>Observation</th>
<th>Muscle grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>No contraction</td>
<td>M0</td>
</tr>
<tr>
<td>Contraction without movement</td>
<td>M1</td>
</tr>
<tr>
<td>Movement with weight eliminated</td>
<td>M2</td>
</tr>
<tr>
<td>Complete movement</td>
<td>M3</td>
</tr>
</tbody>
</table>
Mallet Score
Gilbert modification 1993
# Active Movement Scale
Clarke & Cutis, Hospital for Sick Children 1995

<table>
<thead>
<tr>
<th>Gravity eliminated</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>No contraction</td>
<td>0</td>
</tr>
<tr>
<td>Contraction, no motion</td>
<td>1</td>
</tr>
<tr>
<td>&lt;50% motion</td>
<td>2</td>
</tr>
<tr>
<td>&gt;50% motion</td>
<td>3</td>
</tr>
<tr>
<td>Full</td>
<td>4</td>
</tr>
</tbody>
</table>

### Against gravity
| <50% motion                        | 5     |
| >50% motion                        | 6     |

<table>
<thead>
<tr>
<th>Joint</th>
<th>Movement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder</td>
<td>Abd, Add</td>
</tr>
<tr>
<td></td>
<td>Flexion</td>
</tr>
<tr>
<td></td>
<td>ER</td>
</tr>
<tr>
<td></td>
<td>IR</td>
</tr>
<tr>
<td>Elbow</td>
<td>Flexion</td>
</tr>
<tr>
<td></td>
<td>Extension</td>
</tr>
<tr>
<td>Forearm</td>
<td>Flexion</td>
</tr>
<tr>
<td></td>
<td>Extension</td>
</tr>
<tr>
<td></td>
<td>Pronation</td>
</tr>
<tr>
<td></td>
<td>Supination</td>
</tr>
<tr>
<td>Wrist</td>
<td>Flexion</td>
</tr>
<tr>
<td></td>
<td>Extension</td>
</tr>
<tr>
<td>Finger</td>
<td>Flexion</td>
</tr>
<tr>
<td></td>
<td>Extension</td>
</tr>
<tr>
<td>Thumb</td>
<td>Flexion</td>
</tr>
<tr>
<td></td>
<td>Extension</td>
</tr>
<tr>
<td>Observation</td>
<td>Sensory Grade</td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>No reaction to pain stimuli</td>
<td>S0</td>
</tr>
<tr>
<td>Reaction to pain but not touch</td>
<td>S1</td>
</tr>
<tr>
<td>Reaction to touch but not light touch</td>
<td>S2</td>
</tr>
<tr>
<td>Apparently normal sensation</td>
<td>S3</td>
</tr>
</tbody>
</table>
Candidate for Surgery?

- Nature/pattern of palsy
- Expected Time of recovery
Types of injury and prognosis

- Avulsion
- Rupture
- Traction
## Clinical categories
(Narakas & Slooff 1987, 1993)

<table>
<thead>
<tr>
<th>Group</th>
<th>Lesion</th>
<th>Clinical</th>
<th>Incidence</th>
<th>Prognosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>C5C6</td>
<td>Erb’s</td>
<td>46%</td>
<td>90% spontaneous recover</td>
</tr>
<tr>
<td>II</td>
<td>C5C6C7</td>
<td>Waiter’s tip posture</td>
<td>29%</td>
<td>Less predictable, Poorer</td>
</tr>
<tr>
<td>III</td>
<td>C5-T1</td>
<td>Fail limb</td>
<td>25%</td>
<td>Poor</td>
</tr>
<tr>
<td>IV</td>
<td>C5-T1 + Horner</td>
<td>Fail limb with Horner’s sign</td>
<td></td>
<td>Very poor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-ganglionic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horner’s</td>
<td>Sympathetic ganglion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elevated diaphragm</td>
<td>Phrenic n</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winged scapula</td>
<td>Long thoracic n</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absent rhomboid</td>
<td>Dorsal scapular n</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absent supraspinatus</td>
<td>Suprascapula n</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absent LD</td>
<td>Throacodorsal n</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Investigation

- Plain radiograph of CXR, humerus
- High resolution MRI
- Electrophysiological studies
Physical therapy

Goals

• To educate caregiver in handling, positioning & ADL
• To improve & maintain ROM
• To improve & maintain muscle strength
• To improve sensation
• To gain milestones and age appropriate skills
• To prevent joint contracture & Deformities
Physical Therapy should start ASAP

- Advice on positioning
• Passive joint motion with scapula stabilized

• Strengthening & stimulating sensation
• Joint compression & loading

• Bimanual task & play
• Age appropriate skills
• Hand, wrist, elbow splints
## Timing & Indication for early surgery

<table>
<thead>
<tr>
<th>Time</th>
<th>Clinical examine</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-3 months</td>
<td>Total plexus palsy with Horner’s syndrome</td>
</tr>
<tr>
<td>3-6 months</td>
<td>Upper trunk lesion with no antigravity elbow flexion</td>
</tr>
<tr>
<td>9 months</td>
<td>Cookie’s test positive</td>
</tr>
</tbody>
</table>
Cookie test at 9 months old
Clarke & Cutis
Surgery: Microsurgery

- Neurolysis with nerve grafting
- Nerve Transfer
Microsurgery

General strategy:

• Nerve graft for intact roots
• Nerve Transfer if not enough healthy roots
• (XI, ICN2-6, contralateral C7, hypoglossal, branch of UN, RN)

• Priority:
  - Hand > wrist
    > elbow > shoulder
Neurolysis

- No role in avulsion injury
- May be useful if >50% muscle action potential across a neuroma –in-continuity
Neuroma resection and nerve grafting
Upper trunk C5C6+/-C7 rupture: neuroma resection with sural nerve graft

- C5 6 ->SNG ->
  - Upper trunk (UT) anterior division / Lateral cord / MCN elbow flexion
  - SCN shoulder ER
  - UT posterior division / posterior cord / axillary / RN elbow & wrist extension
Upper trunk C5C6 rupture: nerve transfer

- XI branch -> SCN shoulder ER
- ICNs/UN branch to MCN elbow flexion
- Triceps LH branch -> axillary n elbow extension
Partial / Total plexus avulsion: multiple transfers from:

- XI
- ICN 2-6
- Contralateral C7
- Hypoglossal nerve
How often is operations for OBPI performed?

- NTEC data (only PWH has PICU support)
- Between 1988 to April 2011 (23 years)
- 23 children operated
- 45 major/ultra-major operations performed
- 6 children received operation before 1 year old at PWH
8 patients received > 1 operations

<table>
<thead>
<tr>
<th>Operations</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 operation</td>
<td>13</td>
</tr>
<tr>
<td>2 operations</td>
<td>4</td>
</tr>
<tr>
<td>3 operations</td>
<td>4</td>
</tr>
<tr>
<td>4 operations</td>
<td>1</td>
</tr>
<tr>
<td>6 operations</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>23</td>
</tr>
</tbody>
</table>
Dermographics ( n=23 )

- M: F=11:12
- Right 15 / Left 8
- Erb’s ( C5C6 +/- C7): 16
- Whole plexus: 7
- Exploration performed in 9 patients and document 4 patients with root avulsions
Microsurgical procedures performed:

- Nerve grafting alone in 2 patients
- Nerve transfer in 5 patients with 2 of them require grafting
- Free muscle (gracilis) transfer: 4
<table>
<thead>
<tr>
<th>Donar</th>
<th>No. of patients</th>
<th>Recipient</th>
</tr>
</thead>
<tbody>
<tr>
<td>XI</td>
<td>2</td>
<td>UT(x2), SCN</td>
</tr>
<tr>
<td>ICNs</td>
<td>5</td>
<td>MCN (x4), TDN, MN</td>
</tr>
<tr>
<td>Cervical plexus</td>
<td>1</td>
<td>C5</td>
</tr>
<tr>
<td>Contralateral C7 VUNG</td>
<td>1</td>
<td>MN</td>
</tr>
</tbody>
</table>
Other reconstructive procedures

• Muscle/tendon transfer: 14 patients
• De-rotational osteotomy of radius: 2
• Arthroscopic shoulder release: 3
• Arthroscopic elbow release: 1
Case examples

• Ching Ching, girl
• FTNSD
• BW 7.31 lb
• No record of shoulder dystocia
• Apgar score 1(8), 5(10)
• Failed right upper limb at birth
5 month old

- No Horner
- M1 shoulder abduction
- M2 biceps
- Flickering of middle finger flexion

- MRI: normal
Exploration at 5 months old

- Grossly swollen Upper, middle trunk with thick swollen Lower trunk

- Neurolysis reveal healthy fascicles in continuity within LT
32 months old
Ka Lok

- Boy
- FTNSD
- Shoulder dystocia
- Left Erb’s palsy
- Exploration at 2 year old noted rupture C5, C6
- Sural nerve grafting C5C6 to Upper trunk done
16 years post grafting
Chi ming

- M/18
- Total plexus injury with contralateral C7 transfer done at Huashan Hospital, Shanghai
- Elbow flexion 5/5
- Floppy wrist and fingers with no active control
Surgical procedure

- 2-team approach
  - Donor site
  - Recipient site
DONOR Site

Neurovascular bundle
Gracilis muscle retracted
• Identify 2 branches from MCN to brachialis muscle
• Nerve stimulator to confirm motor f(x)
Anastomosis
- Brachial artery
- Deep brachial vein/cutaneous vein
- Nerve
• Muscle anchored with mitek at supracondylar region
• Gracilis tendon splitted and transferred to FDPs and FPL with Pulvertaft technique
Results

• Re-innervation of graft
  – Finger flexion +ve in all 3 cases
  – 6 months
Results

- Hook Grip
  - holding briefcase and shopping bag
Most Important point in early management of Birth Palsy

• Establish Rapport
Rapport

- Child
- Parents
- Family
- PRO ?!
• See consultation & referral ASAP
• Close FU
• Multi-Disciplinary Approach
• Emphasis the role & participation of the Family
• Medical and psychological support throughout children’s development
Bring home message

• Birth palsy is a potential devastating condition that give profound impact to the patient and the family

• Early establishment of good rapport form the foundation for the family to comply with the rehabilitation

• Early surgical intervention achieve better outcome for those with delayed neurological recovery
Thank you