UPPER EXTREMITY

William J. Little – 1862

EVALUATION of the Upper Extremity in Children with Cerebral Palsy

1. Rule out other treatable diagnoses
2. Understand the patient/family goals in order to **Individualize care**
3. Multi-disciplinary approach
4. Identify associated neurologic disorders * recognize contraindications to surgery*

Goals of Examination

1. 1) Evaluate spasticity vs. joint contracture
2. 2) Functional status qualification and quantification
   - Motor and sensory
   - Activities of daily living, hygiene
3) Other contributing factors
   - Cognitive / IQ, Vision, hearing, speech, Seizure disorder, movement disorder,
   - Level of motivation, behavioral disorders

Key Points in Examination of the Upper Extremity

Resting posture, Spasticity, Motor, Active ROM, Contracture, Passive ROM Strength,
Sensibility, Hygiene, Functional pattern

“Typical spastic deformity” = Shoulder IR, Elbow flexion, Forearm pronation, Wrist and
digital flexion, Thumb in palm deformity

Assessment: Spasticity
Elastic. Stretching → resistance and increased strength. Present at rest.
Exacerbated by voluntary movement, pain, fatigue, emotion, Exaggerated
reflexes, Synkinesis (hand-shoulder), Ashworth Scale of Muscle Tone

Assessment: Motor Function
Voluntary motor control = #1 PREDICTIVE OF SURGICAL OUTCOMES Weakness
of antagonists (extensors, EPL, supinator, ext rotators) Spastic muscles
Shoulder: internal rotators (Subscapularis, teres major, latissimus) Elbow:
flexors (biceps, brachialis, brachioradialis)
Wrist: flexors, ulnar deviators (FCU> FCR> palmaris)
Fingers: flexors (Intrinsics and Extrinsics)
Thumb: ( adductor pollicis, FPL, FPB, Opponens, 1st dorsal interossei)
Synkinesis (thenar muscles + elbow extension)

Assessment: Fibrous contracture
Permanent, fixed, Motor block, Spasticity vs. contracture, Flexors, adductors,
pronator, Lidocaine, alcohol, phenol, Botox, Inject nerve trunk or motor end plate
Assessment: Joint ROM
  PROM usually ok in kids (vs adults), Difficult to isolate joint itself, SHOULDER, ELBOW, WRIST, FINGERS, THUMB, Some HYPERmobile joints
Assessment: extrapyramidal neurologic conditions
  Athetosis, Involuntary rhythmic oscillatory movement, Chorea, Rapid contortions, Parkinson’s – Primary or Secondary, Tremor, hypertonia, cogwheeling, akinesia

CLASSIFICATIONS
  MACS / Type of Spasticity
  Zancolli E: overall function/appearance Structural and dynamic bases of Hand Surgery.

FUNCTIONAL EXAM TESTING
  Numerous tests with objects/toys
  Jebsen test, AHA, SHUEE, Video recording, Bimanual activity, Dynamic EMG, 3D Kinematics and Motion Analysis Dynamic EMG, etc.
  Quality of Life Questionnaires

INDIVIDUAL CARE, GOAL DIRECTED TREATMENT DECISION MAKING
  No validated questionnaire by the child for upper extremity function in CP, Parent questionnaires are inconsistent

TREATMENT of the Upper Extremity in Children with Cerebral Palsy
  1. Spend time emphasizing that NO treatment will cure or magically reverse condition
  2. Help set realistic goals for outcome of any proposed treatment
  3. Most studies shows cummulative effect of multidisciplinary operative and non-operative treatments

Goals of Treatment
  1. Independence with ADL’s
  2. Communication
  3. Mobility
  4. Pain control
  5. Prevention of progressive deformity
  6. Psychosocial issues
  7. APPEARANCE = COSMESIS = ? REPOSITIONING ?

BOTULISM TOXIN

SURGERY Upper Extremity Surgery in CP
  Only 10% of patients undergo UE surgery: 50% functional improvement, 50% hygiene, position NORMAL ANATOMY

Predictive Outcome Factors
  1. Voluntary upper extremity use
  2. Sensibility
  3. Cognitive function IQ > 50?
  4. No athetosis or dyskinesia
  5. ***PICKING THE RIGHT GOALS***

Key Strategies of Surgery
  -Improve function by rebalancing and stabilizing
  -Release of spastic muscles
  -Augmentation/transfers to antagonist muscles
  -Fuse joints that require stability to increase function across them -Prevent hygiene
problems by improved resting posture
- TIMING of surgery **Controversial**

**SHOULDER:**
- Subscapularis/pectoralis release
- Humeral rotational osteotomy
- External rotation muscle releases and lengthenings

**ELBOW:**
- Dynamic vs. Fixed
- Biceps Z-lengthening, Brachialis fractional lengthening, Capsular release,
  Musculocutaneous neurectomy / sympathectomy

**FOREARM:**
- Flexor-pronator slide, PT tenotomy, PT rerouting/transfer

**WRIST:**
- *Increasing digital extension may help wrist extension*
- *Limiting wrist may limit digital flexion, May lose tenodesis effect*
- FCU -> ECRB ECU -> ECRB FCU -> EDC PT -> ECRB BR -> ECRB Arthrodesis,
  Proximal row carpectomy

**FINGERS:**
- Type I: Active extension with wrist extended
  - fractional lengthening vs. no tx Type II: Active extension with wrist
    flexed
  - fractional lengthening + wrist extension augmentation Type III: No active
    extension of digits
  - FCU > EDC
  - Flexor-pronator slide, Fractional lengthenings, Z-lengthenings, Superficialis-to-
    profundus (STP) transfer
  - Bony shortening (e.g. proximal row carpectomy), Arthrodesis, PRC
  - Key considerations
  - Tendon transfers often used when spastic
  - Lengthenings weaken muscle-tendon units
  - If both FCU and FCR involved, one should be kept in continuity
  - Pre-op and Intra-Operative testing of tenodesis sets surgical technique
  - Arthrodesis NOT salvage

**THUMB**

ALL IN ONE
Great detriment to hand function Multifactorial causes

4 key elements to evaluate:
1. 1) Spastic flexors/adductors
2. 2) Flaccid extensors/abductors
3. 3) Hypermobile MCP joints
4. 4) Web space contracture

Operative principles:
1. 1) Release spastic flexors/adductors
2. 2) Augment extensors/abductors
3. 3) Stabilize MCP joint
   1) ARTHRODESIS
   2) CASULOSESISIS
4. 4) Release 1st web space contracture