CEREBRAL PALSY TREATMENT

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• Though CNS insult is non progressive- deformities caused by abnormal muscle forces and contractures are progressive
• Treatment is not aimed at primary cause but to correct secondary deformities
• Deformities worse during time of growth it is better to delay few definitive surgeries to decrease the risk of recurrence
• Combined approaches (operative, non operative) are beneficial
OBJECTIVES

• Stabilization of joints for weight bearing
• Prevent deformity
• Overcome deformity
• Establish muscle balance
Commonly used as primary treatment or in conjunction with surgery

- Medication
- Splinting
- Bracing
- Physical therapy
MEDICAL MANAGEMENT

• Common agents - diazepam
  - baclofen
  - dantrolene
  - botulinum toxin

Oral agents:
• Diazepam → increases inhibitory neurotransmitter activity (GABA)
• Baclofen → inhibit abnormal monosynaptic extensor activity and poly synaptic flexor activity and decrease substance P levels
• oral baclofen
• intrathecal baclofen injection
• Intramuscular
  – Phenol
  – BTX

  – Intra muscular botulinum toxin for 2-6 months
  – Safe maximal dose 36-50 U/kg
Botox Indications

• Pre op Evaluation
• Improve Muscle balance for ROM
• Improve function (ADLs).
• Reduce spasticity (discomfort)
• Post op analgesia

contraindication

• Fixed contractures
• Serious weakness
• Aminoglycosides
• Previous failure
ORTHROSIS

Choice of orthosis is based on→

• Assessment of range of motion
• Foot alignment
• Voluntary control of movement in lower limbs
• Functional level of child
• Support the joints
• assists the range of movements
• Correct deformities
• During physical therapy
Ankle foot orthosis
Floor reaction AFO

• Uses floor reaction force through toe aspect of foot plate to prevent forward tibial progression & subsequent knee collapse
• May be articulated
Knee brace
Ankle-foot-knee orthosis
Abduction spint
SWASH orthosis
FOs
AFOs
Pediatric AFOs
GAIT TRAINING

• Adequate base of support
• Appropriate foot clearance
• Adequate step length
• Conservation of energy
Gait trainer

Shown with accessories in posterior position.
Assisted Gait Trainer
Walking aids

- Axillary crutches
- Elbow crutches
- Walking sticks
In management of CP patient

how to do a procedure is not a big deal
but
what procedure to do is most important

Without prior gait analysis the chance of faulty diagnosis and choice of treatment in experience hands is almost 50%

Choice treatment as per clinical diagnosis will be definitely altered after gait analysis
GAIT ANALYSIS

• To diagnose mechanisms responsible for gait disorders
• To assess the degree of disability
• To evaluate the improvement resulting from treatment
APPROACHES

- Observational gait analysis
- Gait parameters
- Kinematic data
- Force plate data
- Kinesiological data
- Energetics
MANNERISMS

- No abnormalities
- They are only individual characteristics
OBSERVATIONAL GAIT ANALYSIS
OBSERVATIONAL GAIT ANALYSIS
GAIT PARAMETERS

• Gait parameters - cadence (90 steps/min)
  - step length (0.7-0.9 m)
  - walking velocity (60-90 m/min)
  - single limb support (0.5-2 sec)
Kinesiological analysis

- Combined motion, forces, muscle function
Kinematic analysis
Force plate analysis

ground reaction force

Left foot
Right foot
SURGICAL MANAGEMENT OF HIP
Aims of operative management

• Evaluate muscle tone and determine type.
• Evaluate degree of deformity / contracture at each joint.
• Assess linear, angular and torsional deformities of spine, long bones, hands and feet.
• Appraise balance, equilibrium and standing / walking posture.
• Correct static or dynamic deformities
• balance muscle power across the joint
• reduce spasticity
• Stabilize uncontrollable joints
with

• Early regular stretching of tightened structure
• Reeducation and exercising weak antagonists
• Proper bracing
• Training of balance and posture
• Locomotion and relaxation
• Speech therapy

“MOST PATIENTS NEVER REQUIRE SURGERY”

And achieve good balance and independent gait
OPERATIVE MANAGEMENT

• Indications

• contracture or deformities causing
  pain
  Decrease function
  Interfere with ADL
PREREQUISITES FOR EFFECTIVE SURGERY

- spastic
- hemiplegics / diplegics: good results
  quadriplegics: minimal improvement
- Age: 3-12 years
- IQ: good
- Good upper limb function: for walking
- Underlying muscle power should be good

Surgery hardly changes status in walkers/nonwalker, but improves gait
PROCEDURE

• Neurosurgical procedures
• Tendon release
• Muscle tendon lengthening
• Capsulotomies
• Osteotomies
• Resection and replacement procedures
SELECTIVE DORSAL ROOT RHIZOTOMY

30 – 50% of abnormal dorsal rootlets L2 - S1

Pt selection: child 3-8 yrs with spastic diplegia voluntary motor and trunk control pure spastic and no fixed contracture

With physical therapy continued improvement can be expected for 6-12 months

Not recommended in - spastic quadriplegia - spastic hemiplegia

Complication: hip subluxation/dislocation lumbar hyperlaxosis spondylolysis/listhesis
HIP IN CEREBRAL PALSY

• All hips should be considered abnormal unless proved otherwise

• Deformities ranges from mild painless subluxation to complete dislocation

• Pain and joint destruction

• Impaired mobility
HIP AT RISK

• Quadriplegia, Nonambulator
• Age 2-6 yr.
• < 30° abduction in flex or ext.
• > 20° flexion contracture
• Valgus and anteversion
• Shallow acetabulum  AI > 40*
• Abnormal migration index

Film Pelvis Every 12 Mo. For Nonambulator
AB/AC = MIGRATION INDEX (MI)

ACETABULAR INDEX

33% → subluxation
100% → dislocation
DEFORMITIES

- **DEFORMITIES OF HIP:**
  - Flexion deformities
  - Adduction
  - Subluxation and dislocation

- **SECONDARY DEFORMITIES:**
  - Knee Flexion
  - Version deformities of tibia
  - Equinus foot
  - Pelvic tilt
  - Scoliosis
  - Lordosis
Causes of hip deformities

- Causes:
  - Muscle imbalance
  - Retained primitive reflexes
  - Abnormal positioning
  - Pelvic obliquity

- Structural changes
  - Acetabular dysplasia
  - Excessive femoral anteversion
  - Increased neck shaft angle
  - Osteopenia
• Pseudoadduction deformity
  ➢ Flexion internal rotation of hip
  ➢ Increased femoral anteversion
  ➢ External tibial torsion
  ➢ Planovalgus feet
Pt sit in the ‘W’ position
Crouch gait
Hip flexion deformity
Indication for surgery

- Hip flexion deformity never decrease by physiotherapy – orthoses – sleeping prone ...

- Hip flexion deformity > 20 needs surgery
Hip flexion contracture

- 15-30 deg flexion
  - ilioPsoas lengthening

- >30 deg flexion
  - more release of
    - rectus femoris
    - sartorius
    - TFL
    - anterior fibers of Gl.minimus
    - Gl.medius

Hip, knee & ankle contractures

- Single stage multi level correction
• Iliopsoas recession is most commonly used than complete tenotomy to avoid excessive flexion weakness
ILIOPSOAS RELEASE

• Better in non ambulatory patients
• Release at insertion of iliopsoas
• Causes risk of excessive weakness of hip flexion
• Often done with adductor release and varus derotational osteotomy

ILIOPSOAS RECESSION

• M.c used
• Preferred in ambulatory patients
• Good for subluxated hip
• Advised when hip internally rotated during walking

Lengthening (z plasty): best / easy satisfactory in ambulating patients. No risk of too much weakening of flexion power
• After treatment

• Co-operative pt → immediate physiotherapy started with hip extension and external rotation

• Non co-operative pt → pt are placed prone at bed
What not to do!

- Yount’s fasciotomy of Tensor F. Lata – not enough
- Souter’s muscle sliding of Sartorius, Rectus Femoris, and Tensor Fascia Lata – 66% recurrence
- Proximal Rectus Femoris tenotomy
- Myotomy of ant. Fibers of Gluteus Medius
  very important pelvic stabilizer in stance phase
ADDUCTION DEFORMITY

FIGURE 24-53 Three-year-old boy with cerebral palsy and scissoring of the hips.
ADDUCTION DEFORMITY

• **AGE \( \leq 4 \text{ YR} \)**
  - \(< 45^\circ \) abduction in ext, \( 60^\circ \) in flex \( \rightarrow \) soft tissue release

• **AGE 4-8 YR.**
  - MI 25\%-60\%,
  - abduction \(< 30^\circ \) \( \rightarrow \) soft tissue release

  MI \( \geq 60\% \), not improve in 1 yr \( \rightarrow \) soft tissue release+capsulorrhaphy+bony reconstruction

• **AGE > 8 YR**
  - MI \( \rightarrow \) soft tissue release & bone reconstruction
• Mild contracture  
  Early hip subluxation  
  
• Adductor tenotomy  
  more release of  
  - gracilis  
  - anterior half of adductor bevis  

• Leave adductor brevis (the major hip stabilizer)  
• No anterior branch obturator neurectomy  
  (Nerve to adductor brevis)  
• Release brevis if can not abduct 45°
Banks and green procedure
After treatment:
Abduction bar for 1 month
HIP SUBLUXATION

• MI $\geq 30\% \rightarrow$ Soft tissue release for very young Flexion adduction deformities

• MI $\geq 50\% \rightarrow$ open reduction + femoral osteotomy
  Correction of femoral valgus and anteversion

• AI $\geq 25^{\circ} \rightarrow$ pelvic osteotomy
  (Correction of acetabular deformities)
• Femoral varus and derotational (external rotation) osteotomy

• Acetabular osteotomies:
  • Salter osteotomy → redirection of the acetabulum anterioly and laterally
  • Postero-superior deficiency → shelves osteotomy
Neck shaft angle $\leq 115^\circ$
Anteversion 10-20$^\circ$ (30-45$^\circ$ passive IR)
HIP DISLOCATION

• MI=100%

Types:
• Posterior dislocation (m.c)
• Anterior dislocation

Seen in
  - spastic diplegics
  - spastic quadriplegics

• Significant acetabular changes present
Spastic Diplegia

FIGURE 24–3. Girl age 5 years with spastic diplegia. She walks with the aid of a walker and bilateral ankle-foot orthoses.

Spastic quadriplegia

hip dislocation:

if detected early: surgery

if detected late: no pain – leave

pain – proximal resection
• Criteria for open reduction of a dislocated hip:
  • Moderate intellectual
  • Should have at least sitting potential
  • Pelvic obliquity should be minimal dislocation ideally unilateral
  • No longer duration of dislocation
TREATMENT OPTIONS IN HIP DISLOCATION

• Observation
• Relocation procedure on femur and acetabulum
• Proximal femoral resection
• Hip arthrodesis proposed for painful unreducible dislocated hip
• Total hip arthroplasty
Combined one stage correction of spastic dislocated hip

1. Soft tissue release
2. Open reduction
3. Femoral osteotomy
4. Pericapsular pelvic osteotomy
Varus derotational shortening femoral osteotomy
Pericapsular acetabuloplasty
PROXIMAL FEMORAL RESECTION
NON AMBULATORY CP HIP DISLOCATION

- Resection
- Valgus Osteotomy
- Arthrodesis
- Arthroplasty
- Femoral & Pelvic osteotomy
Proximal Femoral Resection
Valgus Osteotomy
Arthroplasty
Arthrodesis

40° flexion, 15° abduction and neutral rotation
Femoral & Pelvic Osteotomy
Thank you