Neonatal Hydrotherapy
A Strategy to Improve Feeding and Movement in Neonates in the NICU Setting

Introduction

Pediatric Rehab Northwest, LLC
- Gig Harbor, WA

Rocky Mountain University of Health Professions
- Graduate Program Director
  - Doctor of Science in Pediatrics
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Plan
- Historical Perspective
- Hydrotherapy for Neonates
- Indications for Referral
- Physiological Prerequisites for Hydrotherapy

Plan
- Equipment
- Hydrotherapy Techniques
- Clinical Outcomes
- Research Outcomes
- Your experience, perspectives, questions

Historical Perspective
Hydrotherapy in Health Care
Historical Perspective

- Hydrotherapy: Greek derivation
- “hydro” = water
- “therapia” = healing

Hippocrates (460-375 BC)

- Contrast Baths (varying temperatures)
- Disease Management

Poliomyelitis 1940’s - 1950’s

- Physical Therapy Review, 1946
- Iron Lung & Hubbard Tank
Exercise in Water

- Medium for exercise
- Assisted or Resistive Mov’t
  - Buoyancy
  - Surface Tension

Exercise in Water

- Aquatic Section of the American Physical Therapy Association
- Aquatic Physical Therapy in Pediatrics

Winkel’s Warming Bath 1882

- Early model of incubator
- Warm water immersion to assist thermoregulation
Childbirth Without Violence

- Frederick Leboyer, 1975
- Gentle entry into extrauterine environment
- Enhanced interaction & attachment with parent

Neonatal Hydrotherapy in the NICU setting

- Adjunct to Neonatal Physical Therapy Program
- Early 1980’s
- Madigan Army Medical Center, Tacoma, WA

Collaborative Problem Solving

- Collaborator
- Carita Bird RN, MSN
- Nurse Manager of NICU, Madigan Army Medical Center
Original Case (1981)
Neonatal Hydrotherapy

- Chronological age 5 months
- Corrected age 2.5 months
- 1040 gm
- 30 wk gestation
- BPD; tracheomalacia; tracheostomy
- Anemia; hyperbilirubinemia
- Osteomyelitis talus
- Marked hypertonus

Indications for Referral

- Tone or movement abnormalities
- Joint ROM or muscle mobility limitations
- Behavioral state impairment
- Feeding impairment

Indications for Referral

- Exam of buoyancy assisted movement
  - Spinal Muscular Atrophy
  - Prader Willi syndrome
  - Hypertonia
  - Contractures (Arthrogryposis)
Prerequisites for Hydrotherapy

- Medical stability
- Discontinued
  - IV lines
  - Ventilator
  - Extremity casts
- Resolved apnea, bradycardia, & desaturation episodes

Prerequisites for Hydrotherapy

- Absent:
  - temperature instability
  - open wounds
- Management of umbilical cord:
  - transparent dressing i.e. “op site”
  - NANN guidelines on skin care: no precautions on immersion bath

Equipment

- Bassinette without mattress
- Overhead radiant heater
Equipment

- Neonatal vital signs monitor (Dynamap)
  - Mean heart rate
  - Mean arterial pressure
- Thermometer:
  - Digital or Floating (hot tub or pool model)

Water Temperature

- 100 – 101 degrees F
- Depends on
  - Size of tub
  - Duration of hydrotherapy session (maximum of 10 minutes advised)
  - Analyze water temp after 10 minutes

Duration of Hydrotherapy

- 10 minutes
- Shorter duration
  - If water cools
  - If desired effects achieved earlier
  - If infant becomes borderline unstable physiologically or behaviorally
Technique

• Apply blood pressure cuff to leg

• Swaddle in flexed, midline position

• Adjustment to immersion...quiet & usually without movement

Technique

• 2 caregivers

• graded, small excursion guided mov’t in one area while stabilizing opposite end of body

• Encourage active movement within & out of partial swaddling

Technique

• Guided by infant’s
  - Physiological state
  - Behavioral stability

• Stop if infant cannot be consoled and brought to calm state
Technique

- Guided by infant’s
  - Physiological state
  - Behavioral stability

Technique

- Infants must feel stable before tolerating mov’t in water
- Sitting against corner or side of tub for water adjustment

Cases

- Chondrodysplasia Punctata
- Arthrogryposis Multiplex Congenita
- Gastrochisis
- Hypertonus interfering w/ hip jt exam
- Hypotonus: Prader Willi
- Pentology of Cantrell
- Feeding Impairment
- Infants on ventilators
- Prenatal polydrug exposure
Chondrodysplasia Punctata

- High fracture risk
  - Abnormal cartilage development
  - Stippled calcifications on spine & ribs
- Flexion contractures knees & elbows
- Icthyosis
- Term gestation

Chondrodysplasia Punctata

- Guided movement in supported positions
  - Supine
  - Sidelying
  - Prone

Note: term gestation; graduated from using swaddling in water

Arthrogryposis Multiplex Congenita

- Multiple congenital contractures
- High fracture risk
- Myopathy often present

From slide file of Holly Cintas PhD, PT
**Gastroschisis**
- Congenital defect in abdominal wall
- Prolonged supine positioning with intestines in silo for elevation & gradual compression
- Abdominal incision
- Intolerance of prone position

**Hypertonus**
- Orthopedist unable to examine hip stability without triggering marked hypertonus
- Persistently adducted hip position
- Exam of hip abduction in warm water

**Hypotonus or Weakness**
- Minimal to no spontaneous movement
- Buoyancy of water supports trace to poor (2/5) muscle strength
- Active movement through partial range in water
Pentology of Cantrell

- Ectopic heart
- Multiple congenital heart deformities
- Not a candidate for transplant
- Palliative care
- Gentle death at home at 2 mo of age

Feeding Impairment

- Lethargic behavioral state
- Not awakening for feeding
- Drowsy state during feeding

Infants Requiring Supplemental Oxygen

- Medical clearance
- Preestablished safe vital signs range
- Nurse collaborator to assist
- Careful evaluation of risks vs benefits
- Is it therapeutic?
Infants on Ventilators

- Site visit experience
  - Crying
  - Relaxation & sleep confused with fatigue and exhaustion
- Anecdotal reports
- Priority for future research

Infants with Prenatal Polydrug Exposure

- Overstimulated and irritable with diaper changes, feeding, bathing
- Improved behavioral stability with swaddled, warm water immersion and bathing procedures vs. sponge baths

Clinical Outcomes (observations)

- Improved extremity movement & joint ROM
- Increased visual & auditory interaction
- Increased feeding proficiency
- Enhanced parent participation
Research Outcomes

- Feeding Effects
- Physiological Effects
  - Pilot Study
  - Current Study

Feeding Proficiency in Preterm Neonates Following Hydrotherapy in the NICU Setting

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Purpose

- Investigate the effects of hydrotherapy on feeding performance of preterm neonates in a neonatal intensive care unit
Research Question

- What differences exist in the feeding performance of preterm neonates after hydrotherapy compared to feeding after a rest period?

Sample

- 31 preterm neonates at 32 to 36 wks postconceptual age at the time of testing
- 9 were high risk (SGA, IVH, PVL, RDS; chromosomal abnormality)
- 21 were low risk (typically developing; uncomplicated neonatal course)

Inclusion Criteria

- Postconceptual age of 31 to 36 weeks
- History of one oral feeding in past 24 hours
- Medical stability confirmed by attending neonatologist and nurse
Inclusion Criteria

- History of one oral feeding in past 24 hours
- Postconceptual age less than 37 wks
- Absence of conditions which anatomically alter feeding function:
  - Cleft lip or palate
  - Micrognathia

- All conditions which anatomically alter feeding function:
  - Cleft lip or palate
  - Micrognathia

- Absence of conditions or equipment which prohibit water immersion:
  - Intravenous lines
  - Open wounds
  - Retained umbilical cord
  - Myelodysplasia
  - Extremity casts
**Instrumentation**
- Hydrotherapy tub: plastic bassinette without mattress
- Overhead radiant heater
- Floating thermometer
- Stopwatch

**Physiological Monitoring**
- Neonatal Vital Signs Monitor with plastic cuff (during hydrotherapy)
- Nellcor 200 oximeter
- Temperature
- Gould TA 5000 eight channel physiological recorder

**Design**
- Prospective cross over design
- Within subject; each subject serving as own control
- Randomized order in 2 consecutive days
  - Hydrotherapy before feeding
  - Rest period before feeding
Nurses conducting the feeding were blinded to treatment order.

Procedure

- Water temperature: 101 degrees Fahrenheit
- Infant is swaddled in semi-flexed position with head and extremities at midline

Procedure

- Duration: 10 minutes
  - Behavioral adaptation to water
  - Intermittent, slow, guided movement within or out of swaddling blanket
  - Two practitioners stabilize and move infant
Four Consecutive Phases

- Initial baseline: 10 minutes
- Hydrotherapy or rest period: 10 minutes
- Bottle feeding: variable (40 minutes maximum)
- Recovery baseline: 10 minutes

Data Collection

- Hydrotherapy: two pediatric physical therapists for all subjects
- Bottle Feeding: each infant’s neonatal nurse blinded to the treatment order (hydrotherapy vs. rest period)

Data Collection

- Two pediatric physical therapists conducted the hydrotherapy procedures for all subjects.
Results

• 100% of required feeding volume was ingested after both hydrotherapy and rest period

• Decreased (p<.004) mean duration of feeding after hydrotherapy (702 sec) compared to the rest period (912 sec)

• Increased (p<.026) mean daily weight gain after hydrotherapy (47.2 gm) compared to rest period (30.1 gm)

Results

• 100% of the required feeding volume was ingested after both hydrotherapy and rest period

• Increased (p<.026) mean daily weight gain occurred after hydrotherapy (47.2 gm) compared to rest period (30.1 gm)

• Improved feeding efficiency occurred after hydrotherapy
  - Decreased (p<.004) mean duration of feeding after hydrotherapy (702 sec) compared to the rest period (912 sec)
Conclusions

- Hydrotherapy of 10 minutes duration is an effective intervention for improving feeding efficiency in preterm infants.
- Increased short-term weight gain occurred after hydrotherapy.
- Compromised feeding or weight loss from post-hydrotherapy fatigue or overstimulation were not found.

Grant Support

- National Institute for Disability and Rehabilitation Research
- Section on Pediatrics, American Physical Therapy Association
- Research Assistants: Jeanne Fischer, PT and Allison Yocum, PT, MS, PCS
- Consultants: Lori Loan, PhD, RNC, Susan Blackburn, PhD, RN, C, FAAN, and Carolyn Heriza, PT, EdD

Physiological Effects

- Pilot study
  - 3 medically stable neonates
  - 20 hydrotherapy sessions
Pilot Study

- Measured physiological changes before, during, & after
  - Immersion in water without movement
  - Hydrotherapy (gentle facilitated movement)

Hydrotherapy Pilot Study

physiological changes from baseline

- 7% increase in heart rate
  - HR 150 baseline + 7% = 161
  - HR 160 " = 172
  - HR 170 " = 182
  - HR 180 " = 193
- 7% increase in blood pressure

Hydrotherapy Pilot Study

Conclusions

- Judicious referral for hydrotherapy
- Medical stability required
- Physiological monitoring advised during hydrotherapy
- Documentation of baseline physiological state is critical for measuring changes during & after hydrotherapy
Future Research

- Swaddling vs. no swaddling
- Hydrotherapy effects on breast feeding
- Varying durations of hydrotherapy
- Uncoupling stimuli (visual; auditory; kinesthetic; tactile)
- Other questions?

Questions, Experiences, Perspectives

Conclusions

- Useful adjunct to neonatal therapy services
- Judicious selection of infants based on physiological stability
- Excellent activity for empowering parents