



# **Tetanus in an Unvaccinated Child – Oregon 2017**

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# Objectives

- Review recent Oregon case of pediatric tetanus
  - Highlight tetanus management in the 21<sup>st</sup> century
- Discuss medical, surgical, rehabilitation management
- Discuss attributed healthcare costs

# 2017

- School-aged child playing with sibling on a farm, fell and hit head on ground (dirt)
- Sustained laceration to scalp and forehead
- Parents cleaned & closed wound at home
- Six days later, developed sudden upper extremity and oropharyngeal spasms
- Next morning, symptoms worsened with arching of back and difficulty breathing
- Parent called 911 and child was transported to Doernbecher Children's Hospital

# Child's Past Medical History

- Previously healthy child
- No medications
- No immunizations
- No past hospitalization or surgeries

# Tetanus (lockjaw)

- *Clostridium tetani* is a spore-forming bacteria
- Wound contaminant – does not cause tissue destruction nor inflammation
- **EXOTOXIN:** The bacteria produces a potent neurotoxin (tetanospasmin)
  - Acts at several sites in central nervous system: peripheral motor end plates, spinal cord.
  - Blocks inhibitory impulses to motor neurons --> unopposed muscle contraction
- Incubation period: 3-21 days (most within 8 days)

# Epidemiology

- Tetanus occurs worldwide, more common in warmer climates and months
  - Wounds, especially with devitalized tissue & deep puncture, at highest risk
- Bacteria is a normal inhabitant of soil and animal intestine
- Ubiquitous in the environment, especially where contamination by excreta is common
- Not transmissible from person to person

# Epidemiology, cont'd

- **United States (2009-2015 CDC surveillance)**
  - Total of 197 cases and 16 deaths reported
  - All deaths among patients >55 years of age
  - Only 2 cases of neonatal tetanus
- **Worldwide (WHO)**
  - Estimated that 34,019 neonatal deaths estimated in 2015 alone

# Clinical Manifestations (3 types)

- **Generalized**
  - Gradual onset (1-7 days), severe spasms, autonomic dysfunction (tachycardia, labile BPs, fever, heart arrhythmia, diaphoresis)
  - **Neonatal tetanus:** Newborn infants, no maternal immunity, contaminated umbilical stump
- **Local tetanus**
  - Local muscle spasm in area contiguous to wound
- **Cephalic tetanus**
  - Dysfunction of cranial nerves associated with infected wounds on head and neck



# Treatment

- Transferred to tertiary care hospital Emergency Department (ED)
- Emergent intubation for impending respiratory failure
- Admitted to Pediatric Intensive Care Unit
- Consultants:
  - Pediatric Infectious Diseases
  - Pediatric General & Plastic Surgery
  - Pediatric Neurology

# Infectious Disease Care

- Tetanus immune globulin (3,000 U) given in ED
- DTaP #1 given in ED
- IV metronidazole 30mg/kg/day divided every 6 hours x 10 days
- Broad spectrum IV antibiotic for scalp wound
- Refusal of any additional vaccines during hospitalization
  - DTaP #2, Pneumococcal PCV7, Seasonal influenza

# Surgical Care

- Surgical irrigation and debridement of scalp incision
- Tracheostomy placed on Hospital Day #5 for expected prolonged ventilator support, and to minimize neurostimulation required with deep suctioning

# Respiratory Care

- Intubated on arrival due to impending respiratory failure
- Mechanical ventilator for 44 days, with blood gases every 12 hours at minimum during most active illness

# Cardiovascular Care

- Developed autonomic instability
- Body temperatures ranging from 97.0°F to 104.9° F
- Sustained high blood pressures and elevated heart rate
- Received continuous IV esmolol drip to manage hypertension
- Cooling blankets

# Neurologic Care

- IV midazolam continuous infusion + diazepam q4 (sedative)
- IV fentanyl continuous infusion (pain)
- IV cisatracurium (neuromuscular blockade, i.e. paralysis) infusion
  - Holiday attempted on HD#12 → spasms resumed in 40 minutes
- IV magnesium sulfate continuous infusion (titrated based on presence of deep tendon reflexes)
- IV dexmedetomidine continuous infusion (sedative)
- Dark room, minimal stimulation, ear plugs for nearly entire PICU stay

# Rest of Hospital Course

- HD #25: Sedation & paralytic holiday for 30 minutes → diffuse body spasms and pain (during every other day “holiday trial”)
- HD#35: Tolerated holiday, smiled and waved, still on ventilator support
- HD #39: Asking for apple juice, still on ventilator support
- HD #40: Successful completion of wean off neuromuscular paralytic
- HD #41-42: still on vent support. Still on magnesium drip. Begin weaning fentanyl. Still having some muscle spasms, managed with warm packs. Pain increased, so fentanyl continued and not weaned. Started vent weans.

# Hospitalization, continued

- HD #43: Formal evaluation by pediatric PM&R. Estimated length of stay for inpatient rehabilitation is 6-8 wks
- HD #44: Off ventilator during day. First sips of clear liquids
- HD#45: Fentanyl successfully stopped
- HD#47: Transferred to step-down pediatric floor
- HD #50: Ambulating 20 feet with walker, still needing valium for spasms



# Hospitalization, continued

- HD #54: Tracheostomy removed by ENT surgeon
- HD #57: Transferred by ambulance to inpatient rehab

# Follow Ups

- Seen in PM&R clinic one month after discharge from rehab unit
  - Approximately 3 months after initial hospitalization
  - Doing well, no follow up needed
- Evaluated by physical therapist one week later
  - Able to return to normal activities
  - Discharged from outpatient PT

# Hospital Stay and Charges

- Total inpatient hospital days: 57 days
- Days in critical care unit: 48 days
- Total charges for inpatient stay: \$811,929
  - Not included: Transportation to facilities, inpatient rehabilitation, follow up outpatient visits
- Inpatient rehabilitation stay: 17 days

# Conclusions

- Generalized tetanus is a life-threatening disease
- Medical advances allowed us to successfully treat a child with severe tetanus, but he suffered greatly during prolonged hospital care
- The bacteria is in soil; cannot rely on “community immunity”
- The healthcare costs attributable to treating one child are extraordinarily high
- Tetanus is a vaccine-preventable disease



# Notes from the Field: Tetanus in an Unvaccinated Child — Oregon, 2017

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[View suggested citation](#)

Tetanus is an acute neuromuscular disease caused by the bacterium *Clostridium tetani*. Bacterial spores found in soil can enter the body through skin disruption, with subsequent onset of clinical illness ranging from 3 to 21 days (usually within 8 days). In 2017, a boy aged 6 years who had received no immunizations sustained a forehead laceration while playing outdoors on a farm; the wound was cleaned and sutured at home. Six days later, he had episodes of crying, jaw clenching, and involuntary upper extremity muscle spasms, followed by arching of the neck and back (opisthotonus) and generalized spasticity. Later that day, at the onset of breathing difficulty, the parents contacted emergency medical services, who air-transported him directly to a tertiary pediatric medical center.

## Article Metrics

Altmetric:



# Since March MMWR Publication

- Contacted by three individuals via e-mail
  - Pediatrician managing unvaccinated child with severe tetanus in Europe
  - Family member of adult with tetanus in US (unknown vaccination history)
  - Adult with clinical symptoms suspicious for tetanus in US (overdue for tetanus booster)

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Thank You