Outbreak of Mycobacterial Infections in a Dental Clinic / Matthew Zahn, MD

M. Abscessus in a Local Dental Office
Matt Zahn, MD
Orange County Health Care Agency
February, 2017

Topics to Be Covered
- Disease Epidemiology
- Facility investigation and renovation
- Laboratory testing and results
- Outreach to exposed patients
- Health order goals

Initial Report on September 5, 2016:
- 3 patients with oral cellulitis and mandibular osteomyelitis admitted to Children’s Hospital of Orange County from 7/28-9/5
- All 3 received pulpotomies at Dental Clinic A
- One patient was culture positive for M. abscessus by fine needle aspirate of cervical lymph node

Conflict of Interest Disclosure
I, Matt Zahn, MD hereby declare that the content for this activity, including any presentation of therapeutic options, is well balanced, unbiased, and to the extent possible, evidence-based.

My partner/spouse and I have no financial relationships with commercial entities producing, marketing, re-selling, or distributing health care goods or services consumed by, or used on, patients relevant to the content I am planning, developing, presenting, or evaluating.
Mycobacterium abscessus
- Member of nontuberculous mycobacterium group
- Ubiquitous in the environment
- Water is a particular source
- Infection primarily occurs in immunocompromised persons
- Pulmonary disease is common, but many other sites can be involved

On Reaching Out to Dental Clinic A:
- Clinic had identified 16 "suspect patients" including the 3 at CHOC
- All had:
  - Received pulpotomies since start of May, 2016
  - Subsequently had jaw pain and/or swelling
  - Treated with augmentin/clindamycin/amoxicillin, repeated courses without resolution of symptoms
  - Often had drainage of "abscesses" with minimal pus found
  - None systemically ill
  - 4 had been admitted to CHOC at some point
  - Only initial case with mycobacterial infection diagnosis

September 6: Clinic restricted from performing pulpotomies

What's a Pulpotomy?

Wikipedia
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Dental Clinic A
- Serves 50-70 patients/day
- Serves primarily Hispanic population
- 5-10 pulpotomies per day
- 869 pulpotomies performed since March 1
- Part of a 10 clinic group throughout California

M. Abscessus Outbreak, Georgia Dental Clinic, 2015
- Total of 20 children with confirmed (n = 11) or probable (n = 9) M. Abscessus infections were identified after receiving pulpotomy
- Median incubation period was 65 days (range = 18-164 days)
- All patients required hospitalization at least once
- Attack rate of 1%
- M. abscessus was isolated from all water samples
- CDC consulted: recommended OCPH focus on water system

Dental Clinic A Culture Results
- Multiple water sources tested positive for M. abscessus/chelonae group organisms
- Water sources of 5 of 6 treatment chairs tested +
- OCHCA Health Order, September 15: Clinic could stay open, but could not use the current water system

Current Case Epidemiology
- 67 total cases
  - 22 confirmed
  - 45 probable
- Ages range 2-11
- Received pulpotomies from February 5-August 20, 2016
- 27 patients have received antibiotic therapy thus far
- 20 have received multiple surgeries
### Characteristic for Cases (n=67)

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**Dental Outbreak: Incubation Period**

- Median: 11
- Range: 1-30
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Follow Up Recommendations

- All patients with pulpotomies from January 1 onward are recommended by OCHCA to be seen by a dentist:
  - Monthly for first six months
  - Every two months for second six months
  - All children are recommended to be seen at least once

Patient Care Process Flow

- Dentists patients initially
- Any symptomatic patients referred to local oral surgeon
- Oral surgeon assesses and potentially refers to CHOC Peds ID
- All suspect cases have facial and chest CTs
- Multidisciplinary treatment plan developed
- All suspect cases are admitted for evaluation and care
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**Treatment regimen**
- Principles of M. abscessus treatment:
  - Debridement is best option
  - Antibiotic therapy involves multiple drugs for long periods of time
- First 2-4 months: IV Amikacin, IV Imipenem, PO Azithromycin
- 2 months and later: PO Clofazamine, PO Azithromycin
- Antibiotic treatment can be avoided IF:
  - All oral disease debrided
  - Chest CT normal

**Local Oral Surgeon**
- Oral surgeon who has seen most of the patients identified to have evidence of infection by Clinic A dentists
- Estimates that he has seen 100-150 patients in addition to the probable and confirmed cases
- Performed local debridement around apparently infected teeth
- He believes it likely that at least some of these patients had mild infection that he debrided

**Patient Outreach Efforts**
- Phone call and letters from Clinic A
- For those not seen back by Clinic A, OCHCA sent certified letters then called
- OCHCA phone calls to all patients who have not seen a dentist
- 1,082 patients received pulpotomies from January 1, 2016 through September 6, 2016
- Examinations verified for all but <100
- Goal is to confirm that all patients either have seen a dentist or have received communication from OCHCA about the situation

**Clinic Water System Assessment and Replacement**
Previous Water Treatment

- Water from “Sterile Area” tap diverted to treatment system
- Water was passed through reverse osmosis (RO) and deionization (DI) filters
- Treated water went into 5 gallon holding tank with pressurized bladder; retrieved through a separate tap at the sink
- Clinic staff collected water from holding tank and filled 750 cc water bottles at each dental chair

Clinic’s Water Treatment System

1) Reverse osmosis (RO) filters; 2) deionizing (DI) filters

Treatment Room

Treatment Room Water System
Instruments at Dental Chairs

1. Suction  2. 3-way syringe   3. High speed drill

Prior Water System Treatment

- Water bottles not changed or washed; left in place overnight
- Every AM, water lines were flushed for 2 minutes (as per CDC and state recommendations) and for 30 seconds between each patient
- No chemical or ion treatment of the water system; no HPC tests done

Water System Testing

- Collected samples for mycobacteria, including water collected through the chair water lines, source taps and treatment system, and swabs of biofilm for all items in contact with water (water bottles, water bottle tubes, 3-way syringes, high speed drill and suction catheters)
- Heterotrophic plate counts (HPC) for total bacteria collected two days later through dental unit water lines, source taps and treatment system
- CDC Guidelines for water quality in dental offices*


Collecting Water Sample through 3-Way Syringe
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Culturing the Instruments

Culturing the Water Bottle

Collecting Water from Treatment System
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Initial Heterotrophic Plate Count Results
- HPC is a test of total bacteria (not specific for mycobacteria)
- 48 hour incubation
- Used to assess for microbial contamination
- Results should be below 500 cfu/ml
- Facility's HPC counts ranged from 610 to 16000 CFU/ml

Mycobacterial Culture Results
- Multiple sites started to show positive within 5-6 days; took another day to tell what type of mycobacteria was growing
- Positive tests for M. abscessus, M. chelonae, M. franklinii group from 5 of 6 treatment chairs
- Tap water and other water sources in facility grew other NTM organisms, including M. gordonae and M. mucogenicum
- Heterogeneous NTM results are not unexpected

Remediation Plan for Clinic
- Replace all of facility’s water system:
  - treatment system removed
  - All dental chair water systems (bottles, lines, chair-side instruments) replaced
- Prevent recurrence using:
  - Cartridge for each water bottle that contains iodinated resin beads
  - Alkaline peroxide-based solution to prevent biofilm formation
  - Regular testing of clinic water for HPC, intermittent testing for mycobacterium

Iodinated Cartridge
- In-line cartridge which contains iodinated resin
- Water is sucked from the water bottle through this cartridge into the dental unit waterline
- Elutes iodine at levels of > 0.5 PPM for 365 days
- "Used according to labeling, this cartridge reduces bacteria from the water supplied through the instruments to a level that will meet or exceed the current ADA recommendations for water quality having a maximum of 200 cfu/ml"
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"Shock Treatment" of Dental Lines

- Two solutions:
  - Solution I: hydrogen peroxide 3%
  - Solution II: quaternary ammonium compounds 1%

- Mix Solution I and Solution II together at the time of use, pour into the waterline bottle at the end of the day, run through the line, and allow the solution to soak in the dental unit waterlines overnight, rinse out in the morning.

- "specifically developed to penetrate and remove biofilm, kill biofilm bacteria, and disinfect interior surfaces in dental unit waterlines."

- "...the first and only product to be granted biofilm removal, biofilm prevention/suppression and biofilm bacteria kill claims by the US EPA."

Additional Clinic Assessment

Dentists and Chairs

- 8 of 12 dentists performed pulpotomies that led to at least one case
- Number of pulpotomies performed correlated generally with the number of cases for each dentist
- Different dentists preferred different specific chairs with no specific dentists associated, seems unlikely that specific chair was the source

What's a Pulpotomy?

- Pulpotomy
- Layer of tissue to remove infected tissue from tooth
- Root canal
- Enamel and dentin
- Cervical pulp
- Neurovascular bundle
- Neurovascular bundle
- Canal pulp
Medicament Investigation

- Medicament which had been used by the clinic for years was changed midway through the outbreak.
- Additional cases occurred after new medicament was utilized.

Infection Control of Instruments

- Spatula and condenser instruments are primary instruments used.
- Entire instrument tray is autoclaved after each procedure.
- Autoclaves have been documented to be functioning appropriately throughout 2016.

Outreach Efforts to Potential Exposed Children

Effect of Remediation on Water Testing Results

- After changes instituted:
  - All 6 treatment rooms with HPC counts of zero
  - *M. mucogenicum* cultured from all 6 treatment water lines
  - Facility re-closed
  - Facility instructed to use sterile water for treatment chairs
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Is *M. Mucogenicum* a Risk?

- CDC’s guidance focuses on HPCs, HPCs in this case are below 500
- Mycobacterial testing is not routinely performed in water used for patient care, so hard to interpret results
- *M. mucogenicum*:
  - Very commonly found in municipal water supplies
  - Less commonly a pathogen, though can cause human disease
- This is the second mycobacterial outbreak associated with water supplies in a dental clinic ever described
  - This is the largest outbreak yet identified
- Not a great deal of past precedent to refer to

12/16/16 Health Order Mandates

- Clinic shall cooperate fully with the Health Officer in his investigation
- Clinic shall implement additional measures necessary to identify and remove any and all ongoing sources of bacteria posing or potentially posing a risk to the public, including patients
- Certification by the Dental Board of California that the Clinic’s practices meet the Dental Board’s accepted standards of practice
- Certification by the Centers for Disease Control and Prevention that there are no bacterial levels at the Clinic that pose or potentially pose a risk to the public, including patients
- A Health Officer-approved independent expert, in addition to the Centers for Disease Control and Prevention, certifies that there are no bacterial levels at the Clinic that pose or potentially pose a risk to the public, including patients.

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