INVASIVE PNEUMOCOCCAL PNEUMONIA:
The Vancouver Downtown Eastside Outbreak

Vancouver CoastalHealth
Promoting wellness. Ensuring care.

Tim T.Y. Lau, Pharm.D., FCSHP
Pharmacotherapeutic Specialist – Infectious Diseases
Vancouver General Hospital
Clinical Associate Professor
University of British Columbia
Email: Tim.Lau@vch.ca
March 2008

Outline

- Downtown Eastside Outbreak
- *Streptococcus pneumoniae*
- Risk Factors
- Clinical Presentation
- Treatment
- Prevention
- Role of the Pharmacist
- Lessons Learned

Downtown Eastside Outbreak

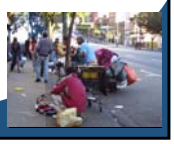
Background 2006

- In BC
  - 427 cases of invasive pneumococcal disease (IPD) (9.9 cases/100,000)
- In Vancouver
  - 161 (38%) cases (26.9 cases/100,000)
- *Streptococcus pneumoniae*
  - 140 serotype 5
  - Previously uncommon
    - In 2004 & 2005, 1 case per yr

Downtown Eastside Outbreak

August & September 2006

- St. Paul's Hospital (SPH)
  - Medical Microbiology Rounds
    - Review all positive blood cultures
    - Unusual cluster of IPD
    - 2 to 3 per wk (usually 0 to 5 per mo increasing in winter)
  - Downtown Eastside (DTES)
  - ED admission & intubation in ICU
    - Hemodynamic support
    - Dialysis



Downtown Eastside Outbreak

October 2006

- Vancouver Coastal Public Health notified
- Isolates sent for serotyping at National Centre for Streptococcus in Edmonton
  - Serotype 5 identified in 2/3 of cases
  - Novel type in Vancouver
  - Previously 15 different serotypes
  - Shift in invasive pneumococcal isolates

Downtown Eastside Outbreak

November 2006

- 46 cases admitted at SPH
- Communicable Disease Control & Vancouver Community launched pneumococcal campaign with annual influenza program in DTES
  - Pneumococcal polysaccharide vaccine (23-valent includes serotype 5)
  - 6,000 immunized in 3 wk period
  - Target rooming houses, shelters, food banks, & other locations by outreach nurses
  - Modelled after campaigns for influenza, Hepatitis A/B
- Vaccination in ED for high-risk individuals

Downtown Eastside Outbreak

Vancouver CoastalHealth

Downtown Eastside Outbreak

December 2006

- 14 cases admitted to SPH
- 75% cases managed at SPH
  - Increase burden to wards & ICU; surgeries cancelled
- As of December
  - 131 isolates serotyped
    - 89 (68%) serotype 5
  - 31% required ICU admission

Vancouver CoastalHealth

Downtown Eastside Outbreak

January 2007

- Number of cases declined

Vancouver CoastalHealth

Downtown Eastside Outbreak

February 2007

- As of February 22
  - 151 cases serotype 5 (119 Vancouver)
    - 20 to 64 yrs (30 to 39 yrs)
    - 82% IPD risk
    - 70% pneumonia/bacteremia
    - 51% drug use
    - 37% hospitalization
      - 36% ICU
    - 24% homelessness
    - 21% Aboriginal
    - 8% (10) died

Vancouver CoastalHealth

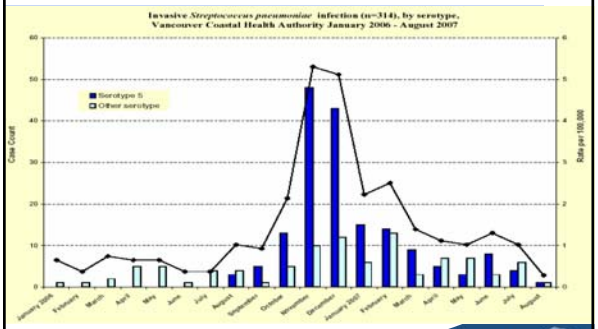
Downtown Eastside Outbreak

May 2007

- No cases for 3 to 4 wks
- Pneumococcal outbreak over

Vancouver CoastalHealth

Downtown Eastside Outbreak



(Courtesy of Dr. Reka Gustafson)

Vancouver CoastalHealth

Downtown Eastside Outbreak

Rest of BC

- Serotype 5 cases admitted to other hospitals
  - 22 cases
    - 3 from Interior
    - 13 from Fraser
    - 2 from Richmond
    - 3 from Vancouver Island
  - 5 linked to inner city neighbourhood

Downtown Eastside Outbreak

Prevention programs

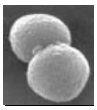
- Pneumococcal (23-valent) immunization of indigent & drug using people in adjacent regions
- Enhanced surveillance within BC
  - Local Public Health, BC Centre of Disease Control (Laboratory Services & Epidemiology Services), & National Centre for Streptococcus
- Stringent facility infection control

Downtown Eastside Outbreak

1. Largest outbreak of IPD in community
2. Rapid coordination & response by SPH, Public Health, & Vancouver Community
3. Outbreak controlled & limited to DTES

Streptococcus pneumoniae

(Curr Opin Crit Care 2006;12:470-476, Canadian Immunization Guide 2006, Cleveland Clinic J Med 2007;74:401-14)



- Gram-positive diplococcus with polysaccharide capsule
- Epidemiology
  - Leading cause of CAP, acute otitis media, meningitis, & bacteremia
  - In U.S., >500,000 pneumonia cases/yr
    - Up to 36% *S. pneumoniae*
  - Age specific incidence
    - <1 yr: 39.8 per 100,000 population/yr
    - 1 to 4 yrs: 24.6
    - ≥60 yrs: 13.3

Streptococcus pneumoniae

(Semin Respir Infect 1999;14(3):227-36, Microbiol Mol Biol Rev 2001;65:187-207)

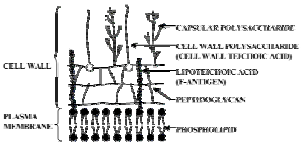
- Mortality rate
  - In U.S., 40,000/yr
    - 7 to 36%
  - Untreated bacteremic pneumococcal pneumonia
    - 80% case-fatality
    - Reduced to 20% with antimicrobial therapy
  - Associated factors
    - Elderly, comorbidities, PSI>90, severity of illness, antibiotic delay

Streptococcus pneumoniae

- Pathogenesis
  - Transmission via droplets
  - Nasopharyngeal colonization
  - Microaspiration
  - Infiltration, inflammation, & tissue damage

Streptococcus pneumoniae

- Serotypes
  - Over 90 capsular serotypes defined by chemical composition of capsule



Schematic of S. pneumoniae surface (modified: Musher 1995)

  - Capsular polysaccharide acts as virulent factor
    - Protects from phagocytosis

Vancouver CoastalHealth

Streptococcus pneumoniae

- Nasopharyngeal carriage in up to 40% of adults
  - At least one serotype
- Carriage provides immunity

Vancouver CoastalHealth

Streptococcus pneumoniae

- Serotype 5
  - Previously uncommon in BC
    - 1 case/yr in 2004 & 2005
  - Responsible for recent outbreaks in Alberta
    - 0 to 3 cases/yr to 40 cases in 2005
    - 177 cases in December 2006
    - Pneumococcal polysaccharide vaccine program expanded to homeless, including hepatitis C
  - Manitoba & Saskatchewan also reported recent increases
    - Cluster in northern community

Vancouver CoastalHealth

Streptococcus pneumoniae

- Invasive pneumococcal disease (IPD)
  - Infection of the bloodstream or cerebrospinal fluid by *Streptococcus pneumoniae*
  - Bacteremia in 10-20% cases
    - Increases mortality as compared to pneumonia alone
  - Susceptibility
    - Exposure to new serotype
    - Immunocompromise
      - Children & elderly, alcoholism, HIV
    - Chronic diseases
      - Cardiac, DM, pulmonary, liver, renal

Vancouver CoastalHealth

Risk Factors

(Semin Respir Infect 1999;14:227-36, Int J Antimicrob Agent 2002;19:85-93)

- Extreme of ages
  - <5 yrs: daycare, smoke
  - >65 yrs: nursing home
- Populations
  - Alcoholic
  - Higher in blacks vs. whites
  - HIV (41 times higher)
  - Homeless
  - Institutionalized
  - IVDU
  - Smoker
- Comorbidities
  - Asplenia
  - Cirrhosis
  - CSF leak
  - DM
  - Heart or lung disease
  - Immunocompromise
  - Malignancies
  - Sickle cell
  - Cerebrovascular disease

Vancouver CoastalHealth

Risk Factors

- DTES outbreak
  - Lived in or contact with DTES
  - 43 yrs mean age
  - 87% IPD risk factors
- Population
  - Homelessness
  - Rooming house
  - 77% smoked tobacco
  - **68% non-injection illicit drugs**
    - **Smoked crack cocaine** & other illicit drugs
- Comorbidities
  - Hepatitis C
  - HIV

Vancouver CoastalHealth

Risk Factors

- Multivariate model
  - Alcohol use
  - Smoking
  - **Smoking of crack cocaine**
    - Vector of transfer?
    - Damage of airway?
    - Similar risk in TB
  - Drug use not associated

Risk Factors

- Why did an outbreak occur in DTES?
  - Serotype 5 introduced to DTES
    - Outbreak in homeless in Calgary
    - Naïve highly susceptible population
    - Risk factors
      - Alcoholism, chronic liver disease, homelessness, immunocompromise
    - RSV circulation, boiling water advisory, cold spell
  - Increase virulence of serotype 5
    - Increase morbidity not mortality

Clinical Presentation

- *Streptococcus pneumoniae* infections
  (Semin Respir Infect 1999;14(3):227-36)
  - Otitis media
  - Sinusitis
  - Pneumonia
  - Meningitis
- Complications
  - Respiratory failure
  - Empyema
  - Bacteremia (lobar consolidation)

Clinical Presentation

- DTES presentation
  - Pneumonia
  - Pericarditis
  - PID
  - Joint infection
  - Wound infection
- 98% bacteremia
- Many require ICU admission
  - 10 deaths

Clinical Presentation

- KL 55 yr M, 65 kg, admitted Sep 5, 2006
- CC: Respiratory distress
- HPI: Unwell x 3 d, SOB, cough, fever & chills. H/a & L-sided pleuritic chest pain x 2 d, emesis x 8
- PMH: COPD, HTN, PUD, EtOH, IVDU (cocaine, heroin), Hep B/C+, HIV-
- MPTA: Methadone, morphine, ramipril, rabeprazole
- All: Phenytoin
- SHx: DTES-no fixed address, unemployed, 3 beers/d, 1 ppd x 37 yr

Clinical Presentation

- On admission
  - T39.2°C HR110 BP131/82 RR24 O_2Sat70%
  - WBC 18.2 SCr 312 Alb 17
  - Sputum: 4+Poly, 3+GPC
  - Blood: Pending
  - CXR: LLL consolidation
  - Dx: Hypoxemic respiratory failure with septic shock
- Transfer to ICU

Clinical Presentation

- Clinical Course
  - Sep 5/6
    - Intubated & ventilated, on norepinephrine
    - Moxifloxacin 400 mg IV daily
    - Vancomycin 1250 mg IV x 1, then 1 g IV q12 h
  - Sep 7/8
    - Afebrile, wean to PSV, off norepinephrine
    - Self-extubated
    - Sputum: *S. pneumoniae* S – Pen, Moxi, Erythro, Doxy
    - Blood: *S. pneumoniae* S – Pen 0.023, Erythro, Vanco
    - D/C Vancomycin

Clinical Presentation

- Clinical Course
  - Sep 11
    - Transfer to CTU ward
  - Sep 13
    - Afebrile HR93 BP144/92 RR18 O_2Sat93%
    - AMA
  - Sep 18
    - Readmitted for partially treated pneumonia
    - AMA
- Total of 6 ICU d
- LOS 9 d

Clinical Presentation

- FL 49 yr F, 50 kg, admitted Dec 30, 2006
- CC: SOB
- HPI: Sudden onset cough x 2 d, nausea & hemoptysis x 1 d
- PMH: Asthma/COPD, chronic pain, cholecystectomy, cirrhosis (Hep B/C+), DM2, ESRD, HTN, MVR, nephropathy, pacer, pancreatitis
- MPTA: Amlodipine, ASA, domperidone, metoprolol, omeprazole, sevelamer, renavite
- All: Codeine
- SHx: DTES, opioid dependent, remote EtOH

Clinical Presentation

- On admission
  - T39°C HR125 BP122/80 RR40 O_2Sat96% on 2 L
  - A&Ox3
  - WBC 19.5 SCr 329 Alb 26
  - Sputum: 2+Poly, 2+GPC, 1+GNR
  - Blood: Pending
  - CT Chest: L hemithorax consolidation
  - Dx: Pneumonia with respiratory failure
- Admitted to respirology ward
- Transfer to ICU

Clinical Presentation

- Clinical Course
  - Dec 30
    - Intubated & ventilated
    - Ticarcillin/clavulanate 3.1 g IV q12 h
    - Vancomycin 1250 mg IV x 1
    - On norepinephrine
  - Jan 1
    - Sputum: 2+poly, 2+GPC, 1+GNR *S. pneumoniae* NRF
      - S – Pen, Moxi, Erythro, Doxy,
    - Blood 4/4: *S. pneumoniae*
      - S – Pen 0.016, Erythro, Vanco
    - D/C Ticarcillin/clavulanate
    - Penicillin 2 MU IV q4 h
    - PSV

Clinical Presentation

- Clinical Course
  - Jan 6
    - Afebrile, WBC 10.7
    - Extubated
    - Transfer to ward
  - Jan 9
    - Discharge from hospital
- Total of 7 ICU d
- LOS 10 d

Clinical Presentation

- Summary
  - Acute onset
  - Respiratory failure
  - Intubation & ventilation
  - Bacteremia
  - Highly susceptible
    - Penicillin MIC 0.018
    - Cefotaxime MIC 0.033
    - Ceftriaxone MIC 0.043
  - Rapid resolution

Treatment

- CAP Guidelines

(CID 2007;44:S27-72)

Infectious Diseases Society of America/American Thoracic Society Consensus Guidelines on the Management of Community-Acquired Pneumonia in Adults

Lionel A. Mandell,[1,a] Richard G. Wunderink,[2,a] Antonio Anzueto,[3,4] John G. Bartlett,[5] G. Douglas Campbell,[6] Nathan C. Dean,[7,8] Scott F. Dowell,[9] Thomas M. File, Jr.,[10,11] Daniel M. Musher,[12] Michael S. Niederman,[13,14] Antonio Torres,[15] and Cynthia G. Whitney[9]

Treatment

(CID 2007;44:S27-72)

Table 9. Recommended antimicrobial therapy for specific pathogens.

Organism	Preferred antimicrobial(s)	Alternative antimicrobial(s)
Streptococcus pneumoniae		
Penicillin nonresistant; MIC <2 μg/mL	Penicillin G, amoxicillin	Macrolide, cephalosporins (oral [cefpodoxime, cefprozil, cefuroxime, cefdinir, cefditoren] or parenteral [cefuroxime, ceftriaxone, cefotaxime]), clindamycin, doxycycline, respiratory fluoroquinolone[a]
Penicillin resistant; MIC ≥2 μg/mL	Agents chosen on the basis of susceptibility, including cefotaxime, ceftriaxone, fluoroquinolone	Vancomycin, linezolid, high-dose amoxicillin (3 g/day with penicillin MIC <4 μg/mL)

The major issue with pathogen-specific therapy is management of bacteremic *S. pneumoniae* CAP. The implications of the observational finding that dual therapy was associated with reduced mortality in bacteremic pneumococcal pneumonia [231–235] are uncertain. One explanation for the reduced mor-

Treatment

Musfson et al, 1999

(Am J Med 1999;107(1A):34S-43S)

- Design: R, Huntington, W. Virginia ('78-97)
- Obj: To survey case-fatality, incidence, & abx usage in bacteremic pneumococcal CAP
- Intervention: Observational
- Results: N=423 (378 adults & 45 children)
  - Mortality 20.3% (22% adults & 2% children)
    - Decreased from '87-97 34.4% to 15.6%
  - Macrolide + penicillin or cephalosporin lower case-fatality vs. ß-lactam mono (7 vs. 22%, respectively) (p<0.001)

Treatment

- Conclusion: In 20 yrs, bacteremic pneumococcal CAP increased, case-fatality decreased, & treatment regimens changed
- ß-lactam + macrolide combo in adults >50 yrs associated with reduction in mortality
- Limitations
- Retrospective
- No adjustment for severity & comorbidities
- No susceptibility information
- Hypothesis generating

Treatment

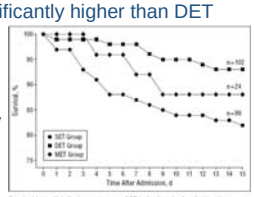
Waterer et al, 2001

(Arch Intern Med 2001;161;1837-42)

- Design: R, Memphis, Tenn (JAN96-JUL00)
- Obj: To examine if empiric combo abx is superior to mono abx in bacteremic pneumococcal CAP
- Intervention: Mono (SET) vs. 2 combo (DET) vs. >2 abx (MET)
- Endpts: Mortality
- Results: N=225 with pneumococcal bacteremic CAP
  - 99 SET vs. 102 DET vs. 24 MET
    - SET: 55% quino, 36% ß-lactam
    - DET: 41% 3rd ceph/macro, 20% 3rd ceph/quino
    - MET: 42% 3rd ceph/macro/other

Treatment

- Results: Mortality SET significantly higher than DET
  - OR 3.0 (95%CI 1.2-7.6)
  - 18.2% SET vs. 6.9% DET (p=0.02)
  - Adjusted for predicted mortality
  - OR 6.4 (95%CI 1.9-21.7)



Survival by antibiotic therapy group. SET indicates single effective therapy; DET, dual effective therapy; and MET, more than DET. For further explanation see the "Subjects, Materials, and Methods" section.

- Conclusion: Mono may be associated with significantly greater risk of death

Treatment

- Limitations
  - Retrospective
  - Excluded resistant strains
  - Timing of abx
  - Levofloxacin dose of 500 mg/d
  - Range of abx used
  - Change in abx not reported
  - Optimal duration
- Prospective, R, DB trial required in severe bacteremic pneumococcal CAP

Treatment

Martinez et al, 2003
(CID 2003;36:389-95)

- Design: R, Barcelona, Spain ('91-00)
- Obj: To assess if ß-lactam + macrolide is associated with lower mortality in bacteremic pneumococcal CAP
- Intervention: ß-lactam ± abx vs. ß-lactam + macro
- Endpt: Mortality
- Results: N=409 (171 (42%) ß vs. 238 (58%) ß/macro)
  - ß: 62% 3rd ceph, 13% pen/aminopen, 11% 2nd ceph (36% abx)
  - ß/macro: 82% 3rd ceph, 13% 2nd ceph, 68% erythro, 29% azithro

Treatment

- ß: HIV, SCT, neutropenia, nosocomial, steroids, chemo, prior abx
- ß/macro: Shock at presentation, ICU admission
- Mortality 9% (35/409)
  - 10% ß vs. 8% ß/macro (p=0.3)
  - Adjusted for shock: 0.4 (0.17-0.92, p=0.03)
- Prognostic factors for mortality
  - ß (p=0.03), shock (p<0.0001), age ≥65 yr (p=0.025), resistance (p=0.04)
- Conclusion: Addition of macrolide to ß-lactam regimen may be associated with reduced mortality

Treatment

- Limitations
  - Retrospective
  - Not randomized
  - Change in practice over time
  - Differences in groups
    - ß: Immunocompromised, 36% on other abx
    - ß/macro: Shock & ICU
  - Effect only when adjusted for shock
- Interpret conclusion with caution

Treatment

Baddour et al, 2003
(Am J Respir Crit Care Med 2004;170:440-4)

- Design: P, O, MC, International (98-00)
- Obj: To assess if combo abx reduces mortality in pneumococcal bacteremia
- Intervention: Mono abx culture vs. combo abx in 1st 2 d of blood
- Endpt: 14-day mortality
- Results: N=844 pneumococcal bacteremia
  - 592 for analysis of mono vs. combo
  - Mortality 16.5%
    - 11.5% mono vs. 10.4% combo (p=NS)

Treatment

- Critically ill (N=94)
  - 55.3% mono vs. 23.4% combo (p<0.01)
  - Mono: ß-lactam most often
  - Combo: ß-lactam/macrolide
- Conclusion: Combo abx may reduce mortality in critically ill
- Limitations
  - Not RCT
  - Not specific to pneumonia
  - Variable regimens
  - No definable regimen or duration
  - Combo effect only in critically ill pt
- Hypothesis generating

Treatment

Dwyer et al, 2006

(Eur J Clin Microbiol Infect Dis 2006;25:518-21)

- Design: R, Obs, MC (5 countries) ('93-95)
- Obj: To determine if ß-lactam + macrolide combo is more favourable in bacteremic pneumococcal pneumonia
- Intervention: ß-lactam vs. ß-lactam + macro
- Endpts: Mortality
- Results: N=340 (75 ß vs. 261 ß/macro)
  - Mech ventilation: 7.7% vs. 16.5%
  - Mortality: 10.7% ß vs. 19% ß/macro, p=0.08
    - NS after APACHEII adjustments
- Conclusion: Requires further study

Treatment

- Limitations
  - Data from epidemiological trial
  - Previous study performed over 10 yrs ago
- Further prospective studies required

Treatment

Chokshi et al, 2007

(Eur J Clin Microbiol Infect Dis 2007;26:447-451)

- Design: Retro, Obs, Cohort, 2 Texas hospitals (JAN00-JUL03)
- Obj: To examine mono vs. combo tx on LOS & mortality in bacteremic *S. pneumoniae* pneumonia
- Intervention: Mono or combo abx in 1st 24 h of admission
- Endpts: LOS & mortality
- Results: N=108 (42 mono vs. 66 combo)
  - Mortality 16% (10% mono vs. 18% combo, p=0.3)
    - PSI IV/V: 25% mono vs. 31%, p=0.6)
  - LOS 5.2±6.3 d mono vs. 9.1±9.5 d, p=0.05
- Conclusion: No differences in mortality, & increase LOS with combo

Treatment

- Limitations
  - Small sample size
  - Abx not standardized
  - Inability to follow tx resolution than LOS
- Further RCT for ideal CAP tx
- Conflicting data regarding use of combo, thus mono may be considered

Treatment

- Combination vs. Mono therapy

  (Harbarth et al. CID 2007;44:87-93)
  - Combination
    - May be beneficial in severe cases
    - Atypical pathogens in mixed infections
    - Immunomodulating effect
    - Bactericidal effect
    - Decreased resistance
  - Mono
    - Pathogen-directed treatment
    - Narrow spectrum
    - Less adverse effects

Treatment

- Summary
  - Remains controversial
  - Retrospective/observational/non-randomized
  - Numerous confounders
    - No standardized abx
    - Timing of abx
  - Further studies
  - No definitive guidelines

Prevention

- Modify risk factors
  - Reducing exposure
    - Daycare, institution, smoke
  - Control medical conditions
    - COPD, CVD, diabetes, renal disease, smoking cessation
- Pneumococcal vaccine

Prevention

- Pneumococcal vaccine

  (Vaccine 2004;2:2209-20)
  - Capsular polysaccharide highly immunogenic
  - Antibodies against polysaccharides protect against infection with homologous serotype
  - Reaction immature in young children
  - Polysaccharide vs. conjugate
    - Polysaccharide
      - Purified capsular polysaccharide antigens
    - Conjugate
      - Covalent binding to protein carrier (e.g. CRM197)

Prevention

- Pneumococcal vaccine

  (Vaccine 2004;2:2209-20, 2007;25:2194-2212)

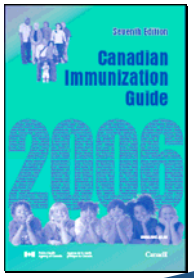
	Polysaccharide 23-valent	Conjugate 7-valent
Seroptypes	1,2,3,4,5,6B,7F,8,9N,9V,10A,11A,12F,14, 15B,17F,18C,19A, 19F,20,22F,23F,33F	4,6B,9V,14,18C,19F, 23F
Coverage of pneumococcal diseases	85-90%	>85%
Age	>2 yrs to adults	<2 yrs
Immunogenicity	Low	High
Efficacy	50-80%	97.4%



Prevention

- Pneumococcal vaccine recommendations

  (http://www.phac-aspc.gc.ca/publicat/cig-gci/index-eng.php)



Prevention

- Pneumococcal Polysaccharide 23-valent vaccine
  - Recommended usage
    - Ages
      - ≥5 yrs at IPD high risk
      - ≥65 yrs
    - Populations
      - Aboriginal
      - Alcoholism
      - HIV
      - Smoker
    - In BC

      Crack cocaine use
    - Comorbidities
      - Asplenia
      - Cardiac, pulmonary, or renal
      - Cirrhosis
      - Cochlear implant
      - CSF leak
      - DM
      - Immunosuppression

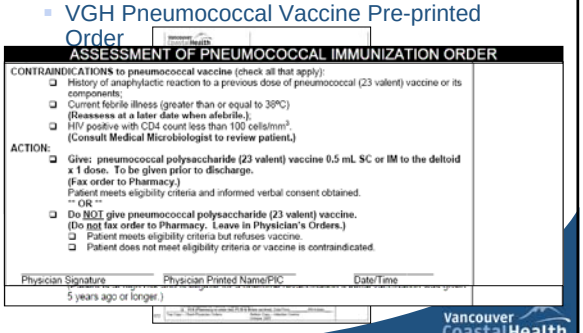
        (Malignancies, SOT, steroids)
      - Sickle cell

Prevention

- Pneumococcal Polysaccharide 23-valent vaccine
  - Dose: 0.5 mL IM or SC
  - Booster & re-immunization:
    - Routine re-immunization not recommended
    - For IPD high risk only
      - Anatomic or functional asplenia, cirrhosis, CRF or nephrotic syndrome, HIV, immunosuppression
      - One single re-immunization
        - After 5 yrs (if 1st dose >10 yrs) or
        - After 3 yrs (if 1st dose ≤10 yrs)
  - Adverse reactions
    - Local soreness & erythema, fever

Prevention

- VGH Pneumococcal Vaccine Pre-printed Order



ASSESSMENT OF PNEUMOCOCCAL IMMUNIZATION ORDER

CONTRAINDICATIONS to pneumococcal vaccine (check all that apply):
- ❑ History of anaphylactic reaction to a previous dose of pneumococcal (23 valent) vaccine or its components;
- ❑ Current febrile illness (greater than or equal to 38ºC) (Reassess at a later date when afebrile.);
- ❑ HIV positive with CD4 count less than 100 cells/mm³. (Consult Medical Microbiologist to review patient.)

ACTION:
- ❑ Give: pneumococcal polysaccharide (23 valent) vaccine 0.5 mL SC or IM to the deltoid x 1 dose. To be given prior to discharge. (Fax order to Pharmacy.) Patient meets eligibility criteria and informed verbal consent obtained. ** OR **
- ❑ Do NOT give pneumococcal polysaccharide (23 valent) vaccine. (Do not fax order to Pharmacy. Leave in Physician's Orders.)
  - ❑ Patient meets eligibility criteria but refuses vaccine.
  - ❑ Patient does not meet eligibility criteria or vaccine is contraindicated.

Physician Signature | Physician Printed Name/PIC | Date/Time

5 years ago or longer.)

Prevention

- Pneumococcal Conjugate 7-valent vaccine
  (Canadian Immunization Guide 2006)

Table 11. Summary Schedule for Pneumococcal Conjugate Vaccine in Previously Unvaccinated Children

Age at first dose	Primary series	Booster*
2-6 months**	3 doses, 2 months† apart	1 dose at 12 to 15 months of age
7 to 11 months	2 doses, at least 4 weeks apart	1 dose after 12 months of age
12 to 23 months	2 doses, 2 months apart	None
24-59 months		
Healthy children	1 dose	None
High-risk children	2 doses, 2 months apart	

* Booster doses to be given at least 2 months after the final dose of the primary series.
** Minimum age of 6 weeks
† Minimum interval of 4 weeks

Role of the Pharmacist

- Awareness & heighten surveillance
  - Promed (http://www.promedmail.org)
- Multi-disciplinary team involvement
- Report unusual activity
- Be familiar with treatment guidelines
- Ensure availability of supplies
- Promote prevention strategies
- Vaccination of high-risk patients
- Educate patients

Lessons Learned

1. Largest community outbreak of IPD
2. Rapid coordination & response
3. S. *pneumoniae* remains important pathogen
4. Treatment with combination therapy is controversial
5. Prevention key strategy

Acknowledgements

- Dr. Marc Romney, Providence Health Care
- Dr. Fawziah Marra, BC Centre of Disease Control
- Dr. Reka Gustafson, Vancouver Coastal Health
- Dr. Linda Hoang, BC Centre of Disease Control
- Dr. Sean Gorman, Vancouver Coastal Health