Outline

I. Learner Outcomes
II. Overview: Basic Principles
III. Tinnitus Monitoring
IV. Ototoxicity Monitoring in Adults
V. Objective Monitoring
VI. Ototoxicity Monitoring in Children
VII. Establishing Program
VII. Establishing Ototoxicity Monitoring Program

Jane S. Gordon, M.S., CCC-A
Enlisting Support

- **Health Care Providers**
  - Primary Care Physicians
  - Oncology and Infectious Disease Physicians
  - Nurses (!!!)

- **Hospital Administrators**
  - Medical Policy Committee
  - Other
Enlisting Support

- Program is worthwhile, feasible, affordable
- Should be standard of healthcare b/c fits WHO definition for screening test
- Support of National Organizations
  - ASHA, AAA
- Support of healthcare providers
  - oncologists, nurses
- Other hospitals do it
Key Questions

- Purpose for identifying Ototoxic change
  - Early Identification, Hearing Loss prevention
- Target patient population
- Tests you will use
  - Sensitivity/Specificity
  - Test-retest reliability
  - Speed of test & its analysis
  - Cost of equipment
- Level of training needed
  - Audiologist
  - Nurse
  - Technician
- Program management costs
Prevention is the BEST form of Rehabilitation
Major Components

- Patient identification
- Patient status
- Equipment
- Patient Communication
- Serial Monitoring
- Behavioral/Objective measures change criteria
- Test protocol adapted to the patient (flowchart)
- Patient counseling
- Report to primary care provider (PCP)
Patient Identification

- Coordinated effort between the audiologist and health care team
- Medical staff
  - Oncologist / PCP
    - Consults
  - Nurse Practitioners
  - Pharmacist
    - Drugs dispensed and hospital formulary
- Computer generated pharmacy lists
- At Risk Patients:
  - Drugs with high ototoxicity incidence rates (see table)
  - Children
  - Elderly
  - Co-morbidities
  - Multiple ototoxic agents (including radiation)
# Ototoxic Medications

<table>
<thead>
<tr>
<th>Antineoplastic Drugs</th>
<th>Aminoglycosides</th>
<th>Loop Diuretics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisplatin</td>
<td>Gentamicin*</td>
<td>Furosemide*</td>
</tr>
<tr>
<td>Carboplatin</td>
<td>Neomycin*</td>
<td>Ethacrynic acid*</td>
</tr>
<tr>
<td>Oxaliplatin</td>
<td>Kanamycin</td>
<td>Bumetanide*</td>
</tr>
<tr>
<td>Nitrogen mustard</td>
<td>Amikacin</td>
<td></td>
</tr>
<tr>
<td>Methotrexate*</td>
<td>Streptomycin*</td>
<td></td>
</tr>
<tr>
<td>Vincristine</td>
<td>Tobramycin*</td>
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<tr>
<td>Dactinomycin</td>
<td>Netilmicin</td>
<td></td>
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<tr>
<td>Bleomycin</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Other Antibiotics</th>
<th>Antimalarial Drugs</th>
<th>Salicylates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vancomycin</td>
<td>See handout</td>
<td>See handout</td>
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<td>See handout</td>
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*vestibulotoxic*
Patient Status

- Outpatient vs Inpatient
- Responsive vs non-responsive
- Booth vs Ward
- Good vs poor hearing
Patient Status

- **Responsive:**
  - Alert and Oriented x 4 (person, place, time, purpose)
  - Does not fatigue easily
  - Adults and older children

- **Limited Responsive:**
  - Alert and Oriented x 3-4
  - Fatigues easily
  - Adults and small children

- **Non-responsive:**
  - Alert and Oriented x 0
  - Pt sedate or Confused
  - Adults and infants

- Can oscillate between categories
Patient Status

Ward Testing Considerations

- Patient Safety, Mobility issues
  - Patient in ICU
  - Sedated
  - Isolation
  - Monitoring: Telemetry, Sugars, etc.
  - Physical limitations: Bedrest, Non-ambulatory, etc.

- Discuss with responsible attending physician or nurse

- Sound level meter recordings

- Maintain consistent test conditions
Patient Status

Good vs. Poor Hearing

- OAE particularly useful if hearing is good
  - Puretone Thresholds < 50 dB HL

- ABR if hearing loss precludes OAE use
  - Puretone Thresholds >50 dB HL at all test frequencies between 1 kHz and 10,000 Hz
  - Use if patient presents with fluctuating middle ear pathology
Test Equipment

- Audiometer / high-frequency headphones
- Immittance system
- OAE system &/or ABR system
- Maintain consistent conditions / document
- Calibration
Patient Communication

- Reasons for ototoxicity monitoring
- Prevalence of and risk factors for ototoxic hearing loss
- Possibility of late or progressive onset of hearing loss
- Realistic expectations
Serial Monitoring

- Baseline evaluation
  - ~platinum patients 1 week before or within 24 hours
  - antibiotic patients within 72 hours
  - 24 hour recheck evaluation

- Monitor evaluations
  - Performed periodically throughout treatment
  - ~platinum patients: *prior to each dose*
  - Antibiotic patients: 1-2 times per week
  - Re-test if significant changes are noted

- Post-treatment evaluations
  - Immediate post-drug evaluation
  - 1, 3, & 6 month follow-up evaluation
  - Continue to test if ASHA-significant changes are noted until hearing stabilizes
Deciding When to Monitor

According to drug regimen
- Chart review
  - Chemotherapeutic: Review hem/onc chart note for specific treatment regimen (i.e. Day 1, 8, 22, 29)
  - Antibiotics: Typically infused every day, sometimes 2-3 times per day (i.e. BID or Q12)

When patient subjectively reports any difficulties
- hearing difficulties, tinnitus, fullness, vertigo, etc…

Audiologist responsibility to track/coordinate
Change Criteria

- **ASHA Ototoxic Change Criteria**
  - >20 dB shift at one frequency
  - >10 dB shift at 2 consecutive test frequencies
  - “Response” shifting to “no response” at 3 consecutive test frequencies

- **Change confirmed by retest**

- **DPOAE Ototoxic Change Criteria**
  - > 6 dB shift
    - If worried about over referrals, make more stringent by requiring two consecutive test frequencies
  - Change confirmed by retest
  - Verify YOUR own test-retest reliability
EACH SUBJECT SERVES AS THEIR OWN CONTROL
Patient Counseling

- Hearing loss
  - Potential recovery
  - Permanent
  - Realistic expectations

- Other symptoms (tinnitus, dizziness)

- Noise potentiation
  - Use ear protection
  - Up to 6 months

- Amplification
  - Caution against over-amplification
  - Work with dispensing audiologist
Report to PCP

- Test results
  - Type of test

- Behavioral hearing change noted
  - ASHA significant criteria
  - Frequencies demonstrating ototoxic change
  - Confirmed by re-test

- Objective hearing change noted
  - Exceeds established (published) test-retest reliability, which has been validated in your clinic
  - Confirmed by re-test

- Other symptoms
  - Dizziness
  - Tinnitus
**Testing Protocol**

**FLOW CHART**

1. Identify Patients needing ototoxicity monitoring
   - Responsive
     - Sound Proof Booth
     - Ward
     - Control for Noise
     - Full Audiometric Assessment; Subjective & Objective Measures
   - Limited Responsive
     - Sound Proof Booth
     - Control for Noise
     - Limited Time: Subjective & Objective Measures; Gauge to patient’s responsiveness.
   - Non-Responsive
     - Sound Proof Booth
     - Ward
     - Control for Noise
     - Objective Measures Only
Conclusion

- Ototoxicity causes high burden disorders
  - Hearing loss, tinnitus, dizziness
  - Incidence may justify cost
  - Individuals at high risk can be targeted

- Test procedures exist that reliably identify ototoxic hearing loss

- Identifying ototoxicity can improve outcome of care