Sensitivity Range for Ototoxicity (SRO): Screening Method to Improve Access

Dawn Konrad-Martin, PhD, CCC-A
NCRAR

Jake Hulswit, BS
NCRAR

Outline

Earlier Detection

Individualized SRO

Measurement considerations

Portability

Conclusions

Citations

Identifying Ototoxicity

Sensitivity (hit rate)

- Percentage of times ears with heading change identified as having hearing change by the experimental measure

Specificity (correct rejection rate)

- Percentage of times ears with no hearing change are correctly labeled as no change by the experimental measure

Reliability (test-retest)

- Determine size change (e.g., in pure-tone threshold or OAE amplitude) likely to be real and not random variability
- Significantly different change with 0.05 level of confidence provides 95% probability that change is real

Time Efficiency & Out of the booth access (clinically practical)

Inter-professional Collaborative Practice (IPP)

Monitoring Principles

- High- to low- frequency progression
- High-frequency testing is reliable (Fausti et al., 1998; Frank,1990; Frank & Driesbach, 1991; Gordon et al., 2005)
- High-frequency testing is sensitive (Dreschler et al., 1989; Fausti et al. 1984; Jacobson et al., 1969; Ress et al., 1999; Tange et al., 1985; Van der Hulst et al., 1988; Fausti et al., 1993; Fausti et al., 1994)
- Studies have shown testing in 1/6th – octave intervals provides earlier detection (Fausti et al., 2003; Vaughan et al., 2003)
- Testing in 1/3rd – octave intervals provides similar sensitivity and false positive rates
- Individualized protocols targeting the ***highest frequencies*** a person can hear

Exposed Ears with HFA Changes

Compared with conditional audiometry, HFA had greater sensitivity in detecting changes in patients receiving ototoxic drugs

- Jacobson et al., 1969; Fausti et al., 1984,1992; Tange et al., 1985; Rappaport et al., 1985; Dreschler et al., 1989; Kopelman et al., 1988

Individualized Sensitive Range for Ototoxicity (SRO)

S = Sensitive, detects ototoxicity 90% of the time

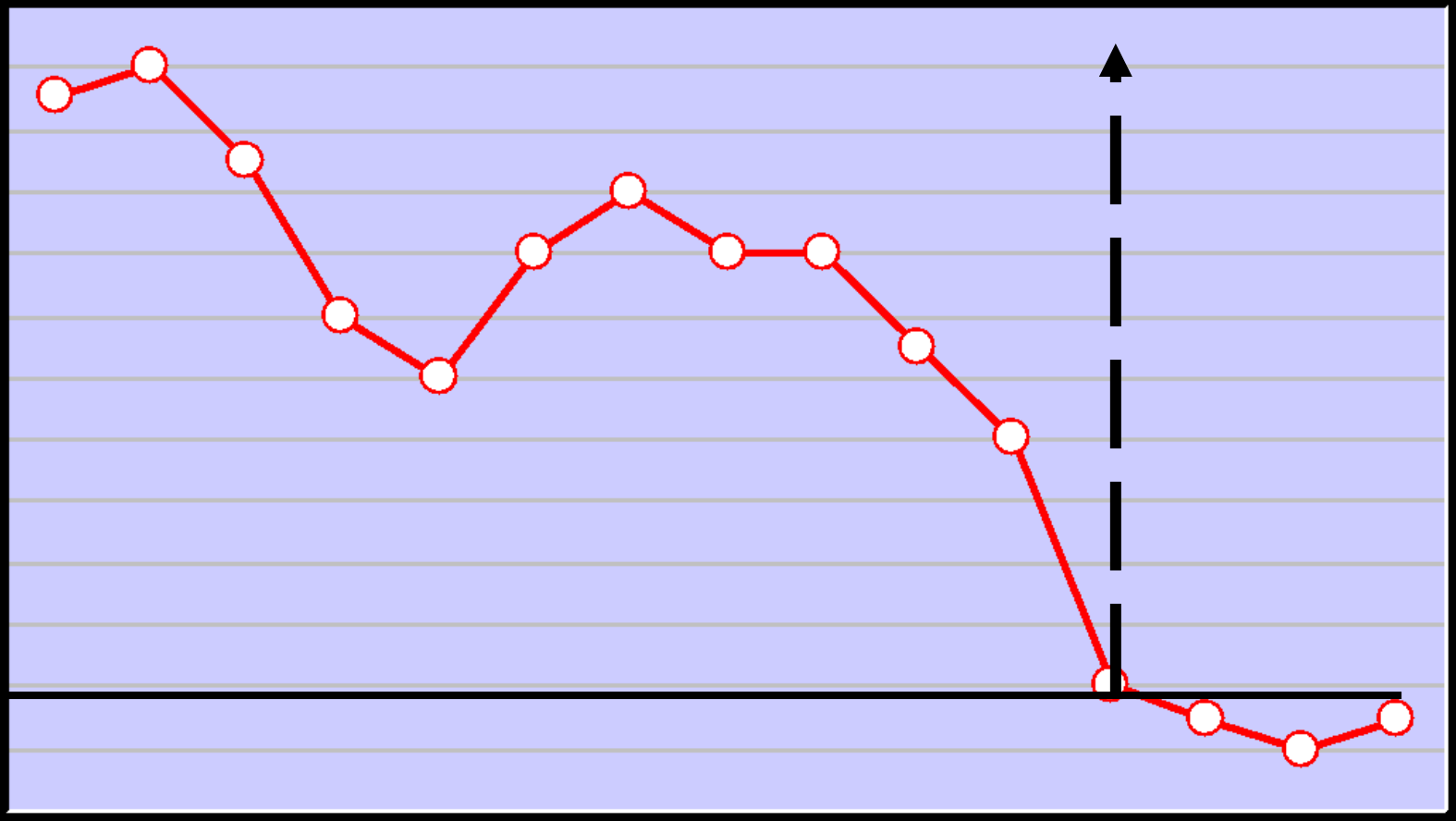
R = Range, 1 octave 1/6 octave steps (7 frequencies) at the upper limits of hearing

O = Ototoxicity, early detection is key

Most initial changes seen within **one octave** below the highest audible frequency and the range for each **individual is unique** and specific to their hearing configuration

A sensitive range for ototoxicity (SRO) is the uppermost frequency with a threshold ≤ 100 dB SPL and 6 lower consecutive frequencies in 1/6th octave steps

Individualized SRO
Highest Audible Frequency



ASHA Significant Shift Criteria

Presence/absence of hearing threshold change defined as[1]

- ≥ 20 dB change at any 1 test frequency
- ≥ 10 dB change at any 2 consecutive test frequencies
- Loss of response at 3 consecutive test frequencies

Low false positive rates for ASHA criteria

- Within the conventional audiometric frequency range
- Within the sensitive range for ototoxicity (SRO)[2]

Non-exposed adults: Ears with ASHA Shifts in HFA (Booth vs. Ward)

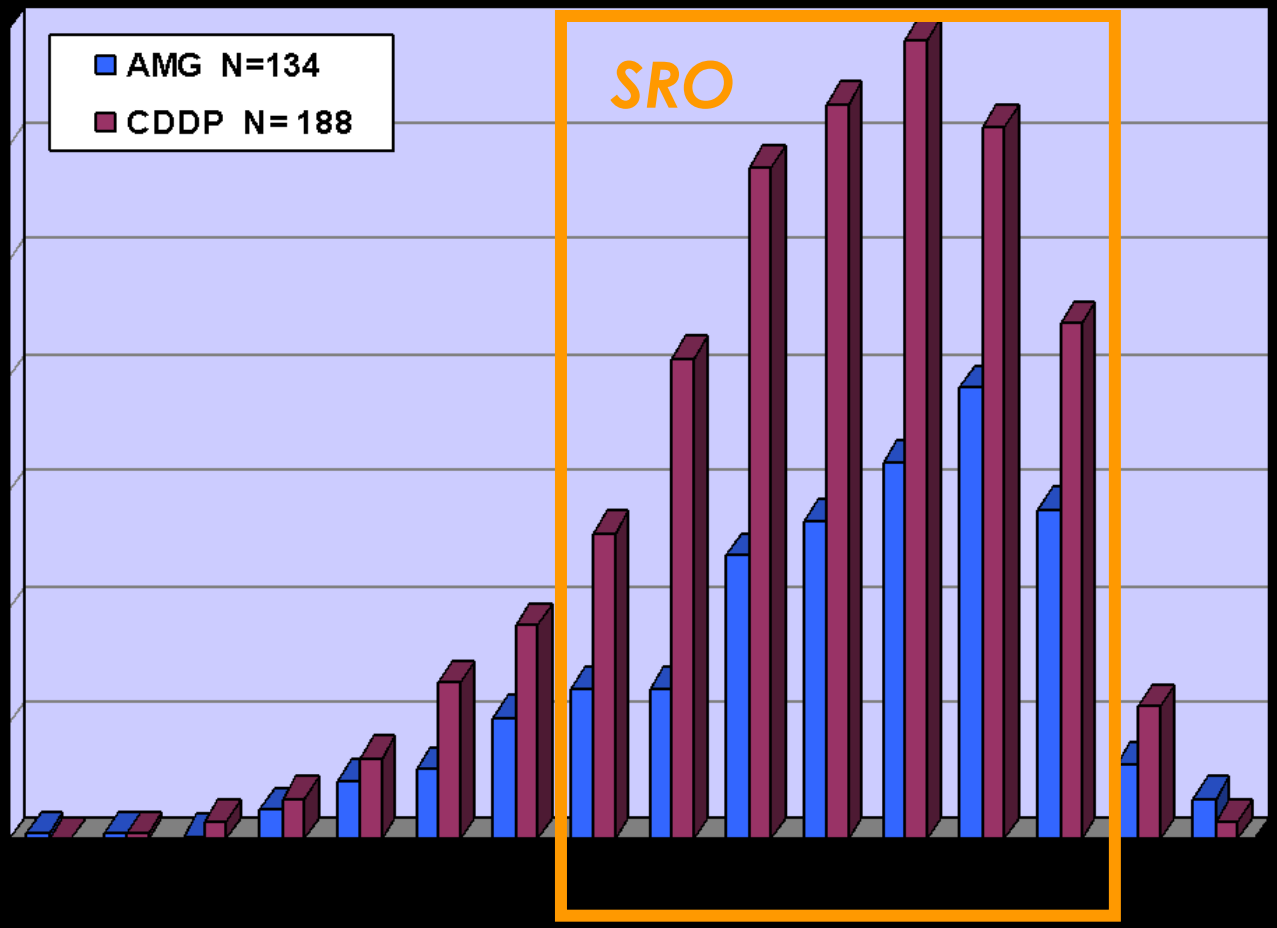
	Booth		Ward		
Earphone Type	**≥ 20 dB at 1 Frequency**	**≥ 10 dB at 2 Consecutive Frequencies**	**≥ 20 dB at 1 Frequency**	**≥ 10 dB at 2 Consecutive Frequencies**	**Frequency Range**
Koss Pro/4X*	0%	0%	0%	7%	2, 5-16
ER-4B*	0%	0%	0%	0%	2, 5-16
Sennheiser HDA 200**	0%	2%	n/a	n/a	8-16

HFA has good specificity in booth and ward

Most Exposed Ears Have Hearing Shifts within SRO

	Total (Ears)	Hit	Miss	Initial Change on SRO
AMG	54	46	8	85%
Cisplatin	226	207	19	92%
Carboplatin	59	50	9	85%
Total	339	303	36	89%

Individualized SRO
Initial Ototoxicity Detection



Portability

For greater accessibility, portable audiometers and diagnostic tools are available for monitoring

Ototoxicity Identification Device

- Portable handheld device
- Time-efficient, reliable and sensitive early detection
- Noise monitoring
- 500 – 20,000 Hz
- 1/6 octave capability

High Frequency Audiometry

A portable, handheld audiometer-like device that will enable ward testing of ototoxicity

Measurement Considerations

Audiometer
- Calibration, portability, octave capability

Listening check
- High frequencies, High Output

Earphone placement

Stimulus Tone
-Pulsed
-Increased duration of tone

Ambient Noise
- Single-walled vs. Double-walled
- Hospital ward testing

Earphone Selection

Reliable high frequency capability

ER-4B (Gordon et al., 2005)

Senheiser HAD 200 (Frank et al., 2001)

KOSS (Gordon et al., 2005) all reliable for high frequency OM monitoring in ward

Conclusions

Evidence-based protocol → High frequencies are reliable

Time-efficient protocol → Sensitive Range for Ototoxicity (SRO) exists
~90% initial detection rate using SRO
Only 7 frequencies in SRO

Portability → Oto Identification Device
Earphones can be used on ward

Citation

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