ELECTRONIC CIGARETTES AND NUCLEAR MEDICINE?

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OBJECTIVE

- Pilot study
- Feasibility of aerosolizing Tc-99m DTPA
- Explore alternate delivery device
- Compare to current nebulizer method
- Nuclear medicine lung ventilation procedures
Evidence of nebulizer inefficiency

25-35 millicuries (mCi) to nebulizer; 0.5-1.0 mCi to lungs

General range of 5-40% inhaled

Less than 20% total drug deposited

E-cigs: category of devices on market
E-CIGS BACKGROUND

Fourth Generation

http://www.casaa.org/electronic-cigarettes/

http://eciglopedia.com/the-4-generations-of-electronic-cigarettes/
MATERIALS & METHODS

- Performed in OUHSC nuclear pharmacy
- Fortified, air-tight box constructed
- E-cig aerosol sampled by filtration
- Respirable (RESP) and inhalable (IOM)
- Mixing fan
- HEPA filter
MATERIALS & METHODS

• Trials: n=11 hot, n=13 cold, n=5 nebulizer, n=8 blank
• Hot- Tc-99m DTPA propylene glycol (PG)
• Cold- PG only
• Hot trials- Dose calibrator reading
• Hot trials- Well counter recordings
• Post-vaporization tagging efficiency
• Nebulizer trials- DTPA aerosolized 5 min
SIMULATED PUFFING PROCESS
• Non-parametric methods used
• Filter count differences- Wilcoxon tests.
  • Also compared to blank trials
• All tests- 5% type 1 error (SAS 9.4 Cary NC)
Figure 1: Filter Radioactive Counts Among Blank, Hot E-Cigarette, and Nebulizer Trials.

<table>
<thead>
<tr>
<th>P Values</th>
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<tbody>
<tr>
<td>Both filters compared to blanks: p=0.0009</td>
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<tr>
<td>RESP to blanks: p=0.0189</td>
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<tr>
<td>IOM to blanks: p=0.0186</td>
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<tr>
<td>Nebulizer to e-cig RESP: p=0.0043</td>
</tr>
<tr>
<td>Nebulizer to e-cig IOM: p=0.0113</td>
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DISCUSSION

• Tc-99m DTPA- aerosolized through e-cig
• Benefit of e-cig- smaller particles\(^3\)
• E-cig aerosol particles:
  • 250-450 nanometers (nm) and 145-168 nm\(^8,9\)
• Venti-Scan IV nebulizer particles:
  • 500 nanometers (nm)\(^10\)
• Aerosolization of metal
DISCUSSION CONT'D.

• Our results- nebulizer superior, however:
  • Address power setting & puffs
• Enhanced delivery- increasing power levels\textsuperscript{11}
  • Drug administration more patient adaptive\textsuperscript{3}
• E-cig disadvantage- thermally stable drug\textsuperscript{3}
• Safety concerns- flavor-free, nicotine-free\textsuperscript{3} (PG)
• Safety concerns- appropriate power levels\textsuperscript{3}
LIMITATIONS & WEAKNESSES

• Low sample size
• Artificially mimicking processes
• E-cigarette trials assessed one power setting
• Didn’t assess different types - e-cigarettes
CONCLUSION

• Tc-99m DTPA was aerosolized
• Post-vaporization tagging efficiency greater than 90%
• Adaptable power option is promising
• Future studies
• Alternative delivery device hypothesis


