Safe Handling: Implementing Evidence-Based Standards

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Objectives

- Discuss the components of a comprehensive hazardous drug safety and health program
- Describe strategies for standardizing hazardous drug safe handling practices
- Initiate a plan for preventing environmental contamination and personnel exposure to antineoplastic drugs in one’s own practice setting

Criteria for Defining Hazardous Drugs

- Carcinogens
- Genotoxins
- Teratogens
- Reproductive toxins
- Organ toxicity at low doses
- Structure or toxicity similar to drugs classified as hazardous

Chemotherapy Agents: Known Carcinogens

<table>
<thead>
<tr>
<th>Drug</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic trioxide</td>
<td>Triaxone® (Teva)</td>
</tr>
<tr>
<td>Amsacrine</td>
<td>Amsa® (LGM Pharma)</td>
</tr>
<tr>
<td>Bleomycin</td>
<td>Bleomycin (Hospira)</td>
</tr>
<tr>
<td>Daunorubicin</td>
<td>Cerubidine® (Bedford)</td>
</tr>
<tr>
<td>Dacarbazine</td>
<td>Dacarbazine (Hospira)</td>
</tr>
<tr>
<td>Daunorubicin</td>
<td>Cerubidine® (Bedford)</td>
</tr>
<tr>
<td>Dactinomycin</td>
<td>Dactinomycin® (Bristol-Myers Squib)</td>
</tr>
<tr>
<td>Doxorubicin</td>
<td>Adria® (Bristol-Myers Squib)</td>
</tr>
<tr>
<td>Dextroamphetamine</td>
<td>Dextroamphetamine® (Novartis)</td>
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<tr>
<td>Docetaxel</td>
<td>Taxotere® (Pfizer)</td>
</tr>
<tr>
<td>Etoposide</td>
<td>VePesid® (Bristol-Myers Squib)</td>
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<td>Fludarabine</td>
<td>Fludara® (GlaxoSmithKline)</td>
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<tr>
<td>Ifosfamide</td>
<td>Ifosfamide® (Bristol-Myers Squib)</td>
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<tr>
<td>Mitomycin</td>
<td>Mutamycin® (Bristol-Myers Squib)</td>
</tr>
<tr>
<td>Nitrogen mustard</td>
<td>Mustargen® (Baxter)</td>
</tr>
<tr>
<td>Paclitaxel</td>
<td>Taxol® (Bristol-Myers Squib)</td>
</tr>
<tr>
<td>Procarbazine</td>
<td>Matulane® (Sigma-Tau)</td>
</tr>
<tr>
<td>Teniposide</td>
<td>Vumon® (Bristol-Myers Squib)</td>
</tr>
<tr>
<td>Vinblastine</td>
<td>Velban® (GlaxoSmithKline)</td>
</tr>
<tr>
<td>Vinorelbine</td>
<td>Vinorelbine® (Sanofi-Aventis)</td>
</tr>
<tr>
<td>Vincristine</td>
<td>Oncovin® (Novartis)</td>
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Chemotherapy Agents: Probable Carcinogens

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<th>Drug</th>
<th>Manufacturer</th>
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<tbody>
<tr>
<td>Azacitidine</td>
<td>Vidaza® (Celgene)</td>
</tr>
<tr>
<td>Carmustine</td>
<td>BCNU® (Bristol-Myers Squib)</td>
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<tr>
<td>Carboplatin</td>
<td>Platinol® (Bristol-Myers Squib)</td>
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<tr>
<td>Doxorubicin</td>
<td>Adriamycin® (Bedford)</td>
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<tr>
<td>Lomustine</td>
<td>CeNu® (Bristol-Myers Squib)</td>
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<tr>
<td>Nitrogen mustard</td>
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Chemotherapy Agents: Possible Carcinogens

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</table>
Adverse Outcomes From Occupational HD Exposure

- **Acute symptoms** (for example)
  - Nausea
  - Dizziness
  - Nasal sores
- **Genotoxicity**
  - Chromosome 5 or 7 changes
- **Cancer** (Odds ratio \[ OR \] = 3.27)
  - Increased cancer occurrence
  - Leukemia
  - Lymphoma
- **Reproductive effects**
  - Fatal abnormalities
  - Spontaneous abortion (OR = 2.3.5)
  - Infertility (OR = 1.4-1.5)
  - Premature labor (OR = 2.98)
  - Learning disabilities in offspring (OR = 2.56)


Nurses’ Experiences of Adverse Health Effects

Speaking about her chronic nasal sores:
“In retrospect, it was very obvious to me. The exposure was there and I had this problem. The exposure was gone and I didn’t have it and never had it again.”

After mixing cyclophosphamide:
“The next day I would get up with blood in my urine and bladder spasms, and it was only the day after I mixed. And since I’ve quit mixing like that, I don’t have them now.”

Polovich & Minick, 2009

Summary of Published Evidence

- **Contamination on external vial surfaces** *(15 studies since 1992)*
- **Excretion of drugs and drug metabolites in urine of health care workers** *(>55 studies since 1992)*
- **Workplace surface contamination** *(>100 studies since 1994)*

Environmental Contamination: Two U.S. Studies

<table>
<thead>
<tr>
<th>Year</th>
<th>Hospitals</th>
<th>Drugs</th>
<th>Pharmacy</th>
<th>Nursing</th>
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</thead>
<tbody>
<tr>
<td>1999</td>
<td>6</td>
<td>3</td>
<td>75% wipe samples &gt; LOD</td>
<td>65% wipe samples &gt; LOD</td>
</tr>
<tr>
<td>2010</td>
<td>3</td>
<td>5</td>
<td>75% wipe samples &gt; LOD</td>
<td>43% wipe samples &gt; LOD</td>
</tr>
</tbody>
</table>

LOD = Limit of Detection
Connor et al., 1999; Connor et al., 2010

Occupational HD exposure persists

Onctology Nurses: Exposure

- **Routine handling**:
  - 11-17% reported dermal or eye exposure in previous year
  - 4-11% reported skin contact in previous 7 days
  - 12-24% reported taking home potentially contaminated clothes
  - 1.4% reported sharps injury involving chemotherapy in previous year
- **Spills**:
  - 12% reported spills in previous 7 days
  - Multiple staff usually involved in spill clean-up
  - Staff reporting spills had HDs in urine
  - Staff who did NOT report spills had HDs in urine

Boiano, 2014; Boiano, in press; Finke, 2012, 2014

What Exactly is the Problem?

- Lack of knowledge about HD exposure?
- Low perceived risk of harm from HDs?
- Work place issues / environment?
- Barriers to HD precaution use?
Research Results: HD Knowledge

- Most oncology nurses were knowledgeable about preventing chemotherapy exposure
- 15% lacked knowledge regarding
  - Potential absorption from contaminated surfaces
- 40% lacked knowledge regarding
  - Appropriate respiratory protection

Polovich & Clark, 2012

Literature & HD Knowledge

- 1996: Hands-on testing & feedback improved performance
- 2001: Increased knowledge improved HD handling
- 2012: No relationship between knowledge and use of HD precautions

Ben Ami, 2001; Harrison, 1996; Polovich & Clark, 2012

What Guidelines Say

- Hazard Communication Standard (HCS), NIOSH, OSHA, ONS, & ASHP stress education about hazards and hazard assessment for all workers
- USP 797, USP 800 & HCS require training in job performance
- OSHA, NIOSH, ONS, and ASHP specify:
  - Initial & periodic education & training
  - Periodic evaluation of performance

ASHP, 2006; NIOSH, 2014; OSHA, 2012; Polovich, 2014; USP, 2013, 2014

Best Practice #1:
Education, Training & Competency

- Classroom instruction
- Supervised practice with a preceptor
- Measurement of knowledge
- Validation of competency

Evidence: Workplace Safety Climate

- Nurses working in organizations with better safety climate also reported
  - Fewer barriers to using HD precautions
  - Higher perceived risk of harm from HD exposure
  - Coworkers who value and use HD precautions
- Better workplace safety climate was associated with higher HD precaution use

Polovich & Clark, 2012
Literature and Safety Climate

- Safety climate affects safety performance
  - Industrial settings:
    - Better use of safety equipment
    - Lower injury rates
  - Healthcare settings:
    - Higher use of PPE
    - Fewer workplace exposures

Kerr, 2002; Zohar, 2002; DeJoy, 2004; Gershon, 2000

Best Practice #2:
Focus on Staff Safety

- Policies & procedures exist; compliance is expected
- Education & training in safe practices is provided
- Equipment & supplies necessary for safety are available
- Safe behavior is reinforced & feedback provided to workers
- Management supports safety programs

DeJoy, 1995; 2000; Gershon, 2007; Moore, 2005

Barriers to HD Precaution Use

- Things that interfere with HD precaution use, for example:
  - Practical difficulties
  - Psychological hurdles
  - Situational obstacles

Harrison, 1999; Mahon, 1994; Polovich & Clark, 2012; Valanis, 1991; Valanis & Shortridge, 1987

Workload and HD Precautions

- It takes time to:
  - Locate and access safety equipment/PPE
  - Don gowns, gloves, and use safety equipment
- Amount of time related to:
  - Number of HD doses
  - Number of vials per dose / drugs in regimen
  - Number of staff involved in process

Harrison, 1999; Mahon, 1994; Polovich & Clark, 2012; Valanis, 1991; Valanis & Shortridge, 1987

Literature and Barriers

- Barriers interfere with use of protective equipment across occupations
- Studies about HD precaution use suggest barriers:
  - Lack of time / work pace / time pressure
  - Lack of PPE
  - Cost of equipment
  - Discomfort associated with wearing PPE

Best Practice #3:
Address Barriers

- Assess the workplace
- Identify barriers
  - Work flow
  - Work load
  - Staffing
  - Cost of PPE / safety equipment
- Redesign / Re-think / Redistribute
- Involve staff in the process
Conclusions
• Several factors interfere with use of HD safe handling precautions
  – Characteristics of individuals
  – Circumstances in the workplace
• HD safe handling requires a program:
  – Time
  – Effort
  – Commitment
  – Multidisciplinary team

Potential for Exposure
• Routes of Exposure
  – Inhalation
  – Injection
  – Ingestion
  – Absorption (skin)
• Surface Contamination

Coordination of a Comprehensive Program
• Promote a team approach
  – Bedside nurse involvement
  – Multidisciplinary collaboration
• Nursing
• Pharmacy
• Physicians
• Occupational Health and Safety Officer
• Other – Informaticist, Housekeeping

Assessment of the Environment
• Assessment of Current Program and Risks
  – Accurate data collection/reporting
  • Consider assessment of staff injury (exposure)
  • Assessment of factors that may have caused the spill/exposure
  • Equipment involved

Policies and Procedures
• Policies and Procedures are in place that include current recommendations and reviewed on a regular basis
  • ONS
  • OSHA
  • ASHP
  • NIOSH
• Examples:
  • NUR: HD Safe Handling
  • NUR: HD Safe Handling of Spills and Exposure
  • NUR: HD Intravenous Administration (Procedure)
  • PHARM: Decontamination and Cleaning / Waste Management
  • PHARM: Storage and Transportation
  • PHARM: Preparation Spiking / Priming / CSTD
  • MED: Safe Prescribing of Chemotherapeutic Agents

Assessment of the Culture
• Staff
  – Training / Knowledgeable
  – Perception of Risk
• Barriers
  – Equipment and ease of access
  – Patient conflicts
• Communication
  – OSHA Hazard Communication Standard
    • i.e. signage (Environmental Precautions)
Minimize exposure during ALL Hazardous Drug related activities

- Storage
- Preparation
- Transport
- Administration
- Waste Disposal

ASHP, 2006

Preparation

- Ventilated cabinet
- Train staff about proper techniques used preparing drugs
  - Closed System Transfer Device
  - Impact on Workload and Collaboration with Pharmacy
    - Spiking
    - Priming

** Collaboration with Pharmacy

ASHP, 2006

Hazardous Drug Transport

- Store and transport hazardous drugs in closed containers that minimize the risk of breakage
  - After preparation, wipe “container” down prior to placing in a bag to be delivered to the area of administration.

ASHP, 2006

Storage

- Environmental consideration:
  - Pharmacy
    - Store hazardous drugs separately from other drugs
  - Nursing unit
    - How are hazardous drugs handled the moment they arrive on the unit?
  - Labeling
    - Drug
    - MAR

ASHP, 2006

WEAR PPE

- For all activities
  - Opening bag
  - Preparing lines / Infusion set up
  - Administration
  - Disposal
  - Keeping a closed system to avoid unnecessary exposure

**Where are PPE stored on the unit or clinic?

ASHP, 2006; NIOSH, 2004; OSHA, 2012

Administration: Gowns

- Gowns
  - Disposable polyethylene-coated polypropylene (nonlinting and nonabsorbant)
  - Single use
  - Solid front
  - Knit or elastic cuffs

* Consider all the hazardous drug related activities that involve gown use (pharmacy, nursing, etc.)

- Pilot:
  - Many gowns on the market, consider a trial in order to give the nursing staff and pharmacy the opportunity to review and select

ASHP, 2006
Administration

• Gloves
  – chemotherapy designated gloves
  – Double gloving for all activities with the outer cuff extending over the cuff of the gown
  – Change gloves every 30 minutes
  – Powder free
  – ASTM Standards

• Eye Protection / Mask
  – Goggles
  – Surgical mask
  – NIOSH N95

ASHP, 2006

Administration

• Closed System Transfer Device
  – Limit potential for aerosols and sharp exposure
  – Evidence of decrease environment contamination
  – Things to consider:
    • Selection / Multidisciplinary approach (preparation and administration)
  • Locking / Needleless connections

** CSTD Pilot: Pharmacy and Nursing Collaboration

Waste Disposal

• PPE
  – Proper removal to avoid environmental contamination

• 48 hours
  – Communication

• Chemo Bucket / Container

• Double-bag

Handling Spills and Environmental Exposure

• Cleaning / Decontamination
  – Spill Kit
  – Deactivating agent
  – Policy & Procedure
  – Housekeeping
    • Double gloving when handling excreta
    • PPE Removal procedure
    • Faceshields
    • Chemo waste container

Medical Surveillance

• Collaborate with Occupational Health
• Tell your primary provider about your occupational risk
• Clinician
  – Focused assessment

** Consider environmental contamination if symptoms are persistent

Patient Education

• Education for patients and families
  • Equipment to be used during hazardous drug activities
    – PPE
    – What to do if they notice something is leaking or disconnected
  • Post-hazardous drug plan
    – Hazardous Drug Safe Handling continues for 48 hours
  • Discharge instructions
    – Drug handling, consider route (Oral, IV)
    – Waste Management
This takes time... do the best that you can!!

A Comprehensive Hazardous Drug Safe Handling Program EVOLVES!
- Timeframe 3-4 years
- Multidisciplinary Collaboration – dedication and buy in
- ONGOING...

**Case Study
- 46 yo male research participant.
- Apheresis with research compound injected into bag 15 minutes into procedure