Chemotherapy Outside the Box: Non-Oncologic Indications For Chemotherapy

Rebecca Gonzalez, Pharm.D., BCOP
Clinical Pharmacist Blood and Marrow Transplantation
Moffitt Cancer Center

Pharmacist Objectives

1. Identify non-oncologic indications for specific chemotherapy and biotherapy agents
2. Discuss barriers to distribution and administration of chemotherapy/biotherapy in non-oncology settings
3. Review common toxicities and monitoring associated with use of specific chemotherapy/biotherapy agents

Technician Objectives

1. Identify chemotherapy and biotherapy agents that may be used for non-oncologic indications
2. Discuss barriers to distribution of chemotherapy in non-oncology settings
3. Describe safe storage, preparation, and disposal of chemotherapy agents used in non-oncology settings

Background

- Approximately 80 different diseases result from the immune system attack on its own cells, tissue and organs
- Loss of regulation and differentiation of immune cells
- Irregular function and production cytokines
- Production of autoantibodies
  - AD/IMIDs
- Up to 24 million Americans suffer from AD
  - Cancer: 9 million
  - Heart Disease: 22 million

Background: IMIDs

<table>
<thead>
<tr>
<th>Historic treatment</th>
<th>New treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steroids</td>
<td>Chemotherapy</td>
</tr>
<tr>
<td>Analgesics</td>
<td>Biotherapeutic agents</td>
</tr>
<tr>
<td>Non-steroidal anti-inflammatory agents</td>
<td>Immunosuppressant or immunomodulating effects</td>
</tr>
</tbody>
</table>

- Improve symptoms
- Achieve remission

Off label use disclosure:

- This session will include a discussion of off-label treatment and investigational agents not approved by the FDA for use in the US

Disclosure

The speaker of this presentation has the following disclosure:

<table>
<thead>
<tr>
<th>Name</th>
<th>Company</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rebecca Gonzalez, Pharm.D., BCOP</td>
<td>None</td>
<td>N/A</td>
</tr>
</tbody>
</table>

AD=autoimmune Disorders; IMIDs, immune-mediated chronic inflammatory diseases
Extending Landscapes of Chemotherapy & Biotherapies
Use Beyond Cancer

Chemotherapy for Autoimmune Disorders
- Suppression of the immune system
- Inhibition of cell growth and apoptosis
- Reduction in pro-inflammatory cytokines
- Macrophages/lymphocytes (IL-2, TNF and interferon-y)

<table>
<thead>
<tr>
<th>Classification</th>
<th>Chemotherapy Agents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkylating Agents</td>
<td>Cyclophosphamide</td>
</tr>
<tr>
<td>Antimetabolites</td>
<td>MX, 6-MP</td>
</tr>
</tbody>
</table>

Cyclophosphamide: Indications
- FDA Indications:
  - Hematologic malignancies: HL, NHL, MM, AML, CML
  - Solid tumors: Breast, Ovarian, Lung cancer
- Off label indications:
  - SLE, Rheumatoid vasculitis
  - Scleroderma, MS
  - HCT conditioning/GVHD
  - ITP/ITP

Cyclophosphamide: Overview
- Introduced in 1959 as the 8th anti-cancer therapy
- Nitrogen Mustard: Alkylating agent
- Cell-Cycle Non-Specific
- Cross-links DNA strands
- Reduces DNA replication and RNA transcription
- Immunosuppressant/immunomodulatory: DMARD
  - Reduces B and T-lymphocytes
  - Regulates immune responses

Cyclophosphamide: Indications
- PO formulations: 25mg, 50mg capsules
- IV Concentration: 20mg/mL (500mg, 1g, 2g vials)
- Storage: room temperature
- Bioavailability: 75%
- Phosphate mustard
  - Phosphoramide mustard
    - Acrolein, phosphoramide mustard
    - Activation
    - Inactivation
- Solid tumors: Breast, Ovarian, Lung cancer

Cyclophosphamide: Administration
- RA: 1.5-3mg/kg PO Daily
- SLE:
  - 1-3mg/kg/day PO + corticosteroids
  - 500-1000mg/m² IV Qmonthy x 6 doses (severe)
- Lupus nephritis:
  - 500mg IV Q2 weeks x 6 doses
  - 500-1000mg/m² IV Qmonthy x 6 doses
- HCT conditioning/GVHD:
  - 500mg/m² IV Qmonthy x 6 doses
- ITP/ITP:
  - 1.3-3mg/kg/day PO Daily
  - 500-1000mg/m² IV Qmonthy x 6 doses
  - 900mg/m² IV Q2 weeks x 6 doses
  - 500-1000mg/m² IV Qmonthy x 6 doses

Cyclophosphamide: Metabolism
- TP; P450: Prodrug
  - Acrolein, phosphoramide mustard
  - Activation
  - Inactivation

Cyclophosphamide: Absorption
- Bioavailability: 75%
Cyclophosphamide

**Adverse Effects (AE)**
- Hair loss
- Fatigue
- Nausea
- Vomiting
- Diarrhea
- Hypersensitivity
- Severe myelosuppression
- Gastrointestinal toxicity
- Hemorrhagic cystitis
- Pulmonary toxicity
- Risk of secondary malignancies

**Contraindications/Cautions**
- Hemorrhagic cystitis
- Pulmonary toxicity
- Risk of secondary malignancies

**Dosage Adjustments**
- Oral: Doses >2g/m²/day
- IV: Max Concentration: 250mg/mL (50mg/mL for vials)
- SQ: Available ~June 2017

**Clinical Considerations**

**Pearls**
- Avoid use with bone marrow suppression
- Monitor CBC with differential

**Monitoring**
- Labs: CBC and platelets
- Monitor for toxicity

**Methotrexate (MTX): Overview**

Introduced in 1940’s for treatment of acute leukemia’s

- Anti-metabolite-Folate Analog
- Targets thymidylate biosynthesis
- Inhibiting dihydrofolate reduclease
- Depletes purine and pyrimidine precursors
- Blocking DNA and RNA synthesis
- Cellular proliferation
- Cell-cycle specific (S-phase)

- Immunosuppressant: DMARD 1
- Anti-inflammatory effects
- Inhibits production and activity of IL-1, reduces TNFα and IL-6 concentrations
- Hepatic: Bilirubin 3.1-5mg/dL or AST >3x ULN: 75% of normal dose
- PD: 75% of normal dose as supplement (dialyzable)
- PO: Bioavailability = 60% at dose <30mg/m²
- PO formulations: 2.5mg, 5mg, 7.5mg, 10mg, 15mg Tablets
- SQ formulations: Single-dose auto-injectors
- IV Max Concentration: 250mg/mL (50mg/mL for vials)

**Methotrexate: Indications**

- FDA Indications:
  - Oncology use in acute leukemias, lymphomas, lung, head/neck and breast cancer
  - RA, psoriasis
  - Off label indications:
    - KS, SLE
    - Severe Crohn’s disease
    - Post-organ/HCT rejection

**Methotrexate: Dosage**

- RA=Rheumatoid arthritis; SLE=Systemic Lupus Erythematosus; MS=Multiple Sclerosis
- SQ formulations: Single-dose auto-injectors
- IV Max Concentration: 250mg/mL (50mg/mL for vials)
- SQ: Available ~June 2017
Methotrexate: Clinical Pearls

- Give lowest effective dose
- Clinical effect may take ~3-6 weeks
- Reduce toxicity
  - Administer with folic acid 1mg PO Daily or leucovorin 5mg PO weekly
- Check Indication before dispensing!!!
- Use in alcoholic liver or chronic hepatic disease is contraindicated when use in NON-oncology indication
- SQ injections are NOT approved for use in malignancy therapy
- Stop therapy at least 3-months before planned conception

Methotrexate: Clinical Considerations

- Administration
  - Intervals less than 1 week apart = toxicity
  - Higher bioavailability with SQ administration
  - SQ injections given in abdomen or thigh
- Monitoring
  - Baseline LFT’s, total bilirubin, Scr, CBC with diff, hepatitis B/C testing
  - Monthly CBC with differential, LFT’s
  - Signs/Symptoms of infections

Patient Assistance Programs

**Otrexup® (methotrexate injection)**-855-OTREXUP (855-687-3987)
- TotalCare Co-Pay Assistance Program
- TotalCare Patient Assistance program

**Rasuvo® (methotrexate injection)**-855-33MEDAC (855-336-3322)
- Core Connections Rasuvo Co-pay Assistance Program
- Core Connections Medac Pharma Patient Assistance Program

Eligibility:
- Commercially insured
- Does NOT include Medicare, Medicare Advantage, Medicare Part D, Medicaid, VA, or Tricare
- Income requirements

Dosage Forms
- PO formulations: 50mg tablets, 20mg/mL suspension
- Absorption: Bioavailability: 50%
- Metabolism
  - Liver, GI mucosa (first-pass metabolism)
  - Active: 6-thioguanine, inactive: methylmercaptopurine, 6-thiouric acid
  - 6-MP undergoes thiol methylation → inactivation via methylation by TPMT
  - Homozygous deficient polymorphisms (~0.3%) 1 6-MP TOXICITY
  - Oxidation by xanthine oxidase

Administration
- PO only
  - Crohn’s: 1.1-5mg/kg PO Daily
  - Luteic or ulcerative colitis: 50-125mg PO Daily

6-Mercaptopurine (6-MP)

- Introduced in early 1950’s
- Anti-metabolite → Purine Analog:
  - Guanine and adenosine
  - Inhibits DNA/RNA synthesis (S-phase specific)
- Immunomodulator:
  - Anti-inflammatory effects (cytokines/interleukins)

6-MP: Indications

- FDA Indications:
  - ALL
- Off label indications:
  - CML
  - APL
  - Crohn’s disease or Luteic or ulcerative colitis
  - Histioctasis

6-MP: Adult Dosing

<table>
<thead>
<tr>
<th>Dosage Forms</th>
<th>PO formulations: 50mg tablets, 20mg/mL suspension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absorption</td>
<td>Bioavailability: 50%</td>
</tr>
<tr>
<td>Metabolism</td>
<td>Liver, GI mucosa (first-pass metabolism)</td>
</tr>
<tr>
<td></td>
<td>Active: 6-thioguanine, inactive: methylmercaptopurine, 6-thiouric acid</td>
</tr>
<tr>
<td></td>
<td>6-MP undergoes thiol methylation → inactivation via methylation by TPMT</td>
</tr>
<tr>
<td></td>
<td>Homozygous deficient polymorphisms (~0.3%)</td>
</tr>
<tr>
<td></td>
<td>1 6-MP TOXICITY</td>
</tr>
<tr>
<td></td>
<td>Oxidation by xanthine oxidase</td>
</tr>
</tbody>
</table>

Administration (PO only)
- Crohn’s: 1.1-5mg/kg PO Daily
- Luteic or ulcerative colitis: 50-125mg PO Daily
6-MP: Adult Dosing

<table>
<thead>
<tr>
<th>Adverse Effects (AE’s)</th>
<th>Headache, N/V/D</th>
<th>Malaise, arthralgias</th>
<th>Rash</th>
<th>Stomatitis</th>
<th>Pancreatitis</th>
<th>Hyperpigmentation</th>
<th>Hepatotoxicity</th>
</tr>
</thead>
</table>

Contraindications/ Caution
- Pregnancy (Category D), Breastfeeding (possible unsafe)
- Risk of infections
- Dose-related bone marrow suppression

Dosage Adjustments
- Renal: CrCl <50ml/min: Administer Q48hrs
- Hepatic: Consider dosage reduction

6-MP: Clinical Pearls

- Assess for TPMT deficiency
  - Heterozygous
    - Reduce dose based on toxicity
    - Standard dosing
  - Homozygous
    - Up to a 90% dose reduction
  - Reduce dose by up to 75% when given concurrently with allopurinol
  - Clinical effect ~3-6 months w/ steroids

6-MP: Clinical Considerations

- Administration
  - Take on empty stomach
  - Avoid/reduce dosage with additional agents with myelosuppressive properties

- Monitoring
  - Monitor CBC and LFT’s baseline then Q1week x 4 weeks, then Q2weeks x 3mo
  - Amylase/Lipase Q2weeks x 2mo
  - Look/Sound-Alike: Purinethol ® – propylthiouracil, methotrexate

Biotherapies

- Biological response modifiers
  - Genetically tailored monoclonal antibody
    - Derived from mouse, non-human and/or combined genetic material
    - Bind to a specific antigen (cells or protein)
      - Utilized since mid 1970’s
    - 5 different classes of antibodies: IgM, IgG, IgA, IgE and IgD

ABC’s of Monoclonal Antibody (mAbs)

- Inhibit bioactive cytokines, augment or modulate autoimmune processes
- Recognize foreign antigens and providing immune response to them
- Provide immunologic memory
- Therapeutic effects
  - Complement-mediated cytotoxicity
  - ADCC
  - CDC

Biotherapies

- Structure
  - 4 chains: 2 light/2 heavy
  - Fab contains variable domain antibody specificity

ABC’s of Monoclonal Antibody (mAbs)

- Suffix “-mab”=mAbs
- Different preceding word parts (morphemes)
  - Structure and function
  - The sub-stem denotes the animal where the antibody is obtained
  - Key elements:
    - 1. Prefix
    - 2. Infix (disease/target) +
    - 3. Sub-stem (source) +
      - α=murine
      - ω=humanized
      - α=chimeric/humanized
      - ω=human
    - 4. Stem (-mab)
**Monoclonal Antibody (mAb’s): Infusion Reactions**

- **Prevention:** Pre-medications given ~30 minutes prior
  - Acetaminophen 650mg x 1
  - Antihistamine
    - Diphenhydramine 50mg IV/PO x 1 OR
    - Cetirizine 10mg PO x 1

- **PRN Hypersensitivity Reaction Medications:**
  - Methylprednisolone 125mg IV Push x 1
  - Diphenhydramine 25mg IV Push x 1
  - HYDROMORPHONE 0.5mg IV Push x 1 PRN rigors/chills
    - May repeat in 15 minutes x 1 if symptoms present
  - EpINEPHrine 0.3mg SQ auto-injector x 1 PRN anaphylaxis

**Rituximab**

- **FDA Indications:**
  - NHL, CD-20 + CLL
  - RA (moderate-severe)
- **Off label indications:**
  - PTLD
  - Treatment of graft-versus-host-disease
  - TTP/TIC/autoimmune hemolytic anemia

- **Dosage Forms**
  - IV Concentration: 10mg/mL (100mg, 500mg single-use vials)
  - Storage: Refrigerated

- **Pre-Medications:**
  - Acetaminophen + antihistamine

- **Excretion**
  - Half-life: 18-32 days

- **Metabolism**
  - Unknown

- **Administration**
  - Rheumatoid Arthritis: 1000mg IV Q2 weeks x 2 doses
    - In combo with methotrexate
    - Given Q16-24 weeks based on response
  - **Initial Infusion rate:** Infuse at 50mg/hr (____ml/hr) x 30 minutes and increase rate by 50mg/hr (____ml/hr) every 30 minutes up to a maximum of 400mg/hr (____ml/hr)
  - **Subsequent Infusion rate:** Infuse at 100mg/hr (____ml/hr) x 30 minutes and increase rate by 100mg/hr (____ml/hr) every 30 minutes up to a maximum of 400mg/hr (____ml/hr)
  - **Rapid Infusion:** Infuse at 150mg/hr (____ml/hr) x 30 minutes then increase to 275ml/hr until completion

- **Immunosuppressant:** DMARD 1
  - Anti-inflammatory effects
    - cytokines (IL-1, 1-cells, autoantibodies)

**Rituxan** [package insert], Genentech, Inc., San Francisco, CA; April 2016.
**Rituximab: #FSHP2017**

### Precautions

- **Infusion Reaction:** Fever, chills, rigors, hypotension, headache, myalgia, phlebitis, cough.
- **Infections:** Bacterial > fungal, respiratory infections, progressive multifocal leukoencephalopathy, hepatitis, and angina.
- **Pregnancy Category C.**

### Contraindications

- Do NOT administer as IV push or bolus.
- **BBW:** Infusion reactions-serious or fatal reactions (80% with 1st infusion), severe mucocutaneous reactions, progressive multifocal leukoencephalopathy (PML), hepatitis B reactivation, cardiac arrhythmias and angina.
- **Pregnancy Category C.**

### Dosage Adjustments

- Consider lower infusion rate in patients with history of prior infusion reaction.

---

**Infliximab: #FSHP2017**

### Introduced in 1998

- Chimeric anti-TNF antibody
- Fused to IgG1
- Binds/inhibits TNF communication with TNF receptors on inflammatory cells
- Soluble and membrane-bound TNFα
- **TNF Inhibitor: DMARD 2**
  - Anti-inflammatory effects (TNFα)
  - Blocking synovial tissue and intestinal inflammation

### FDA Indications:

- Crohn’s disease and ulcerative colitis
- RA, Psoriatic Arthritis, Plaque Psoriasis

### Off-Label Indications:

- GVHD Treatment
- Sjogren’s syndrome
- Refractory sarcoidosis

### Dosage Forms

- IV Concentration: 25mg/mL (100mg single-use vials)
- **Storage:** Refrigerated (do not freeze)

### Pre-Medications

- Acetaminophen + antihistamine

### Excretion

- Half-life 8-9.5 days

### Metabolism

- Unknown

### Administration

- **Standard Dosing BDMARDs:** 3mg/kg IV @ 0, 2, 6 weeks in combo with MTX, then Q8 weeks.
  - Increase to 10mg/kg or give Q4 weeks if incomplete response
  - 3-10mg/kg IV given at 0, 2, 6 weeks, then Q8 weeks
  - **Dosage:** 3mg/kg IV @ 0, 2, 6 weeks, then Q8 weeks +/- MTX

### Infusion Rate

- **Infuse over 1 to 2 hours (250mL NaCl)**
- Infusion should begin within 3 hours of reconstitution and dilution

### Adverse Effects (AE's)

- Infusion reaction: Fever, chills, rigors
- Headache, nausea
- Abdominal pain/abscesses (Crohn’s disease)
- Transaminitis
- Respiratory infections
- Development of antinuclear antibodies (50%)
Infliximab: Clinical Pearls

- Discontinue therapy if lack of response @ 14 weeks for IBD indication
- Risk of antibodies towards infliximab (Immunogenicity)
  - Recommendation for concomitant immunosuppression
- Combo of MTX + infliximab superior to MTX alone in RA
- Screen all patients for TB and HBV before initiating
  - HBsAg and anti-HBc
  - Consider HBV prophylaxis in higher risk patients
- Live vaccines NOT recommended

Monitoring: CBC with diff baseline and Q2-4 months, sx of hepatitis or HBV reactivation, dermatologic exam baseline and periodically

Infliximab Patient Assistance: Janssen CarePath

Infliximab Biosimilar

- Indications: Includes all original indications for reference product
- Biosimilars mimic existing biologic agents
  - Same amino acid sequence and mechanism of action
  - Different inactive ingredients, manufacturing processes, host cell line
- Have no clinical meaningful differences in safety, purity, potency or immunogenicity

Reimbursement?
- Medicare: Part B-slightly higher than ASP (ASP+6% of reference agent)
- Medicare: Part D- “branded” medication (ineligible for 50% coverage gap discount)
- Commercial: based on cost differential, therapeutic indication, interchangeability

Patient assistance program: Inflectra [infliximab-dyyb] 1-844-722-6672

Clinical Application

Non-Oncologic Disease Specific Indications

Rheumatoid Arthritis: Pathophysiology

- Cascade effect: Activation/amplification of immune response by Immunoglobulin’s (Ig’s)
- Triggered by complement system→ Activated B and T lymphocytes
  - Cytokines released from both B and T cells can enhance inflammation and augment the immune attack by triad of Autoantibodies
  - Antigen presentation
  - Cytokine secretion

1. Activated T-cells produce cytokines and cytotoxins
  - Release of inflammatory cytokines: TNF, IL-1 and IL-6
  - Triggering a cascade inflammatory response

2. Activated B-cells produce plasma cells and memory B-cells
  - Autoantibodies produced from Ig’s
  - Cellular damage to synovium and bone

3. Vasoactive substances released
  - Histamine, prostaglandins, bradykinins
  - Blood flow and vascular permeability
  - Edema, erythema, pain

Rheumatoid Arthritis

- Chronic inflammatory condition → dysregulated humoral and cell mediated systems
  - Production of autoantibodies rheumatoid factors (+ in 60-70%)
  - Chronic inflammation of synovial lining in joints→ Pannus formation
  - Erosion of bone/cartilage and joint destruction
  - Symptoms may include
    - Fatigue, weakness, low grade fever and loss of appetite
    - Symmetric joint pain and stiffness

Rheumatoid Arthritis: Therapeutic Agents

**Goals of therapy**: reduce symptoms (swelling, stiffness, pain), preserve ROM, improve QOL and prevent systemic complications.

**Disease-modifying Targets**
- Anti-inflammatory= cytokines
- MTX: established use in late 1950’s/early 1960’s
- Clinical onset 2-3 weeks
- Cyclophosphamide
- Biologic response modifiers (Biologics)
  - Infliximab: anti-TNF
  - Rituximab: B-cell depletion

**Disease-modifying Targets**
- Anti-inflammatory= cytokines
- MTX: established use >20 years
- 6-MP
- Biologic response modifiers (Biologics)
  - Infliximab: anti-TNF
  - Early initiation may improve outcomes/natural course of disease
  - Steroid-sparing effect

Irritable Bowel Disease (IBD)

**Chronic inflammation of the digestive tract**
- TNFα = key mediator in dysregulated immune response/inflammatory cascade
- Leaky mucosal barriers, permeability and epithelial resistance
- Pro-inflammatory responses mistakenly triggered by commensal bacterial in gut
- Epithelial cells may trigger T-cell activation
- Release of pro-inflammatory cytokines
- Tissue damage/stricture

**Symptoms may include**
- Abdominal Pain, diarrhea (possibly bloody), rectal bleeding
- Weight loss
- Painful bowel movements

**IBD: Therapeutic Agents**

**Crohn’s Disease**: Affects any part of the GI tract (mouth-perianal area)
- Most commonly-distal ileum and colon
- Ulcerative colitis: Disease activity limited to the colon

**Goals of therapy**: achieving remissions, maintaining remissions, improving QOL

**Disease-modifying Targets**
- Anti-inflammatory= cytokines
- MTX: established use >20 years
- 6-MP
- Biologic response modifiers (Biologics)
  - Infliximab: anti-TNF

**Ensuring Safe and Effective Treatment**

**Review of Orders: Chemotherapy or biotherapy**

- Hazardous?
- Safe Handling practices
- Prevention of medication errors
- Look/Sound-Alike medications
- Correct formulation
- Right route of administration
- Correct dose for indication
- Right frequency
- Refill history too soon, too late?
- Laboratory labs assessed (when possible)
- Drug/Drug-Drug interactions or disease state histories considered
- Assess for previous or current toxicities
- Holding/delaying of medication

**Role of Pharmacy Team**

**Physician Tasks**: 1. Prescribing of therapy with indication for use
2. Patient education
3. Management of toxicities

**Technician Tasks**: 1. Verification of therapy with indication for use
2. Preparation of medications
3. Dispensing of therapy
4. Patient education
5. Assistance with hazardous spills
6. Disposal of hazardous materials
7. Management of toxicities

**Nursing Tasks**: 1. Final verification of correct patient, route, freq and dose
2. Patient education
3. Management of toxicities

**Pharmacist Tasks**: 1. Verification of therapy with indication for use
2. Preparation of medications
3. Dispensing of therapy
4. Patient education
5. Assistance with hazardous spills
6. Disposal of hazardous materials
7. Management of toxicities

**Medical Tasks**: 1. Administration of therapy
2. Patient education
3. Management of toxicities

**Physician Tasks**: 1. Prescribing of therapy with indication for use
2. Patient education
3. Management of toxicities
Hazardous Waste: Why You Should Care

- Waste disposed of improperly can contaminate soil, ground water and drinking supply.
- Potential to impact wildlife and fish if disposed of improperly near a body of water.
- Includes pharmaceuticals that are:
  - Outdated medications not-returnable for credit
  - Used in compounding or IV preparations
  - Spilled, broken or unusable products
  - Items used to clean up a spill
- Hazardous waste may be ignitable, toxic, corrosive or reactive
  - P-listed medications (acutely hazardous): ex. Warfarin, nitroglycerin, arsenic trioxide
  - U-listed medications (toxic): ex. Cyclophosphamide, melphalan, chlorambucil

What Goes Where?

**Regular Trash:**
- DoD/DoD non-hazardous drug waste, IV bags and tubing
- Electrolytes, NS, dextrose or amino acids
  - 10% or less of container’s waste

**Yellow Trash**
- ENPDT hazardous (P-listed drug) G, D or NCDM listed, waste from compounding
  - IS, Other chemotherapy, biotherapy

**Black Bin**
- DoD/DoD Partial P-listed hazardous drugs (i.e. amoxicillin)
- Partial non-P listed drugs >10% content and non-hazardous drug/bag/vial
- Chemo spill cleanup

**Sharps Container:**
- DoD/DoD drug syringes and needles

Patient Education

- PRO-actively discuss potential $$$ for treatment
  - Social workers and/or financial counselor
  - Utilize drug assistance from pharmaceutical companies and/or advocacy groups when possible
  - Needy Meds: www.needymeds.org/pdp
  - Partnership for Prescription Assistance: https://www.ppa.org/
- Pharmaceutical based-assistance programs: https://www.prescriptionaidprogram.com/patientassistance-program/
- Routinely check for ability to afford medication and avoid non-compliance

Safe Handling and Disposal of Waste

**Do**
- Inspect all areas for outdated products
- Designate a clearly marked area for outdated pharmaceuticals/products
- Designate separate area to store cytotoxic agents
- Follow guidelines for personal protective equipment (PPE)
  - Gloves (latex) should be worn during receiving, unpacking, and placing in storage
  - Use one tray to dispense oral cytotoxic agents
- Minimize risk of contaminating other therapies

**Don’t**
- Never remove hazardous waste without proper PPE
- Dispose of to a drain or septic tank unless permitted to
- Place oral cytotoxic agents in automatic dispensing machines
- Combine hazardous and non-hazardous waste or biomedical waste
- Designated waste bins for specific agents

Patient Education

- Skewed perceptions of chemotherapy or biotherapy
  - Media, internet or personal/family experience
- Hesitant about taking similar agents used to treat cancer
- Barriers: financial burden, transportation issues, coordination with retail/mail order pharmacies for RX’s

**Improve patient acceptance and adherence by discussing:**
- Medication administration schedule/timing
  - Lower dosages for autoimmune indications
- Common side effects and supportive medications
  - Verbally and in written form
- Discuss when and how to notify provider if major side effect occurs

**Provide detailed instructions for safe administration:**
- Medication administration schedule/timing
- Lower dosages for autoimmune indications
- Discuss when and how to notify provider if major side effect occurs
- Provides detailed instructions for safe administration
- Hazardous medications—avoid skin contact, proper hand washing and storage

Take Home Points

Treatment of autoimmune conditions with traditional chemotherapy and biotherapy will continue to grow
- AD are a heterogeneous group that effects many different organ systems
- Assume nothing and look at the whole patient picture
- Newer targeted biotherapies are emerging specifically for autoimmune disorders

Specific attention should be made to ensure these patients receive individualized care and education beyond the oncologic use
- Prevent medication errors, unsafe handling practices and misinformation
- Encourage patient empowerment
- Understanding potential toxicities and management of these agents will allow continued use of these agents in non-oncology settings
Chemotherapy Outside the Box: Non-Oncologic Indications For Chemotherapy

Rebecca Gonzalez, Pharm.D., B.COP
Clinical Pharmacist Blood and Marrow Transplantation
Moffitt Cancer Center

References

#FSHP2017