Prototype for Adult Medical Facility Orders During a Radiation Event

Version 7/16/2008

Cautions

- Orders must be customized for each event and patient!
- Specific drugs are suggested for function only, and patients may not need any/every category of drug listed. Consult the notes at the end of this document.
- This Adult Orders Prototype lists only FDA-approved medications as radioisotope countermeasures for internal contamination; see page 9-10. These drugs are currently in the Strategic National Stockpile. Prescribers should consult the FDA drug label for complete information.
- All dosages in this prototype are based on a 70 kg adult with normal renal and hepatic function. Appropriate dosage adjustments should be made based on age, weight, drug-drug interactions, nutritional status, renal and hepatic function. Pediatric doses are not referenced, except for Potassium Iodide.
- This Adult Orders Prototype does **not** address threshold levels of internal contamination that would trigger initiation, continuation, or discontinuation of decorporation treatment. See REMM Countermeasures Caution and Comment information that discusses this issue.
- After a mass casualty event, practitioners may encounter counterfeit drugs. This FDA website will provide information on avoiding and detecting counterfeit drugs and assist reporting of suspected counterfeit medications.
- See "Notes" at end of order list for additional information.

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1. Administrative information

Name: _____
Unique Identifier: _____

Address: _____
Phone: _____

Spoken language: _____

Admit to:

__ Hospital ward _____ __ Area _____

__ Team: _____ __ ICU _____

__ Physician: _____ __ Other _____

Next of kin contact information: _____

Special needs: _____

2. Diagnoses: Radiation, Other

__ Radiation contamination: description

- See REMM Body Chart (page 14) to record whole body radiation survey.
  - __ External contamination with Isotope (Specify) _____
  - __ Internal contamination with Isotope (Specify) _____
  - __ Contamination suspected, Isotope uncertain

__ Radiation Exposure / Acute Radiation Syndrome (ARS)

- See REMM information on Dose Reconstruction.
  - __ Date of exposure _____
  - __ Time of exposure _____
  - __ Location of patient at time of exposure _____
  - __ Estimated whole body/partial body dose, specify _____ (dose)
  - __ Dose unknown

__ Other potential complicating factors

__ Combined injuries? e.g. burn, blast, fracture, other
Specify: _____

__ Mass casualty incident

__ Specific populations potentially requiring more customized management

See REMM Specific Populations page

__ Young age (e.g. children < 12-16 y) __ Older age (e.g., those > 65 y)

__ Pregnant/Possibly pregnant __ Immunosuppressed

__ History of prior significant chronic disease(s) or conditions.
Specify each, including meds or special needs required for each:

_____
_____
_____
_____
_____

Urgent Consultations as indicted:

__ Hematopoietic Stem Cell Transplantation
__ Hematology / Oncology
__ Mental Health / Psychiatry
__ Ophthalmology
__ Dermatology / Plastic Surgery
__ Radiation Safety
__ Radiation Oncology
__ Transfusion Medicine
__ Endocrinology
__ Radiation Oncology
__ Gastroenterology
__ Burn Therapy

3. Condition:

__ Good __ Fair __ Stable __ Guarded __ Critical

4. Vital Signs:

__ q 2 hours X 4
__ q 4 hours X 4
__ Ward routine

Notify physician for:
__ Temperature > 38.5 ºC
__ SBP > 180, <100
__ DBP > 100 < 50
__ HR >100 <50
__ RR >30 <8
__ O_2 saturation < 92%

5. Special orders for patients with radiation contamination:

__ Radiation precautions

Use radiation precautions unless patient is known with certainty to have had only external exposure to radiation.

- Universal precautions with gown, mask, cap, boots, and gloves
- Use medical facility procedures for discarding biological/physical/radioactive waste, including linens/towels/trash/personal protective equipment.
- Contact Radiation Safety Officer for additional instructions.
  phone: _____ page:_____
- Place radiation safety sign on door if patient has internal or external radioactive contamination.
- Notify pregnant staff that entry to room is prohibited if patient is/may be contaminated.
- Everyone entering room/area of contaminated patient must wear personal radiation dosimeter.

6. Allergies:

__ No Known Drug Allergies (NKDA)

__ Allergies (drugs, foods)

If yes, specify: _____

7. Activity:

__ Bed rest

__ Out of bed every ____ hrs.

__ Bathroom privileges

__ Ambulate as tolerated

8. Diet:

__ Regular Diet __ Liquids (full, clear) __ NPO
__ Advance as tolerated
__ Other _____

__ Special dietary needs/requests _____

9. Height, weight, age:

Height: _____ feet _____ inches
_____ cm

Weight: _____ lbs _____ oz
_____ kg

Age: _____ years

Repeat body weight:
q _____ hours
q _____ days

10. Peripheral IV management:

__ IV Fluids: _____ @ _____ cc/hr, with additive _____

__ IV Fluids: _____ @ _____ cc/hr, with additive _____

11. __ Foley catheter management
Use radiation precautions for urine and feces for patients with radiation contamination.

12. __ Monitor I / O
Frequency _____
Use radiation precautions for urine and feces for patients with radiation contamination.

13. Deep Venous Thrombosis (DVT) prophylaxis[1]:

__ TED hose to Bilateral Lower-Extremities

__ Sequential Compression Devices (SCD)

__ Anticoagulation regimen _____

__ Other

The potential benefit of anticoagulation (e.g. **heparin**[1,2]) should be balanced against the risk of excessive bleeding in patients with severe thrombocytopenia or significant gastrointestinal toxicity.

14. Respiratory Therapy: (Radiation precautions needed if patient is contaminated.)

__ Room air __ Chest tube care (Specify) _____

__ Titrate oxygen supplementation for Oxygen saturation > _____%

__ Nebulizer treatment (Specify) _____

15. Wound care[1]: (see also item 22: burn therapy)

__ Decontaminate external wounds if there is external contamination.
See REMM contaminated wound care recommendations.

__ Sterile dressing to wounds daily

__ Monitor waste: Use medical facility procedures for discarding biological/radioactive/physical waste and linens/towels/trash/personal protective equipment. Radiation precautions needed if patient is contaminated.

__ **Silvadene (Silver Sulfadiazine)** [2] cream topically to burns

__ Other wound management per Burn team/Dermatology/Plastic Surgery:
Pager _____ Phone _____

16. Orthopedic care:

__ Splint/brace/cast

__ Other orthopedic management procedure per orthopedics:
Pager _____ Phone _____

17. Admission labs / imaging studies / other:

__ CBC w/differential

__ Comprehensive Metabolic Panel (CMP) / Chem 14

__ Cardiac enzymes

__ PT / PTT

__ Urinalysis

__ Urine culture

__ Blood culture x 2

__ Urine HCG

__ Serum HCG

__ Thyroid Function Tests (Specify) _____

__ Serologies:
Herpes Simplex Virus type 1 (HSV-1)
Herpes Simplex Virus type 2 (HSV-2)
Cytomegalovirus (CMV)
Varicella-zoster virus (VZV)

__ Electrocardiogram

__ Chest x-ray _____ PA/Lat _____ Portable

__ Other imaging studies Specify:_____

18. Standing labs / studies:

__ CBC w/diff q ___ hours, x ___ days,
Followed by q ___ hours until further orders

__ Comprehensive Metabolic Panel (CMP) / Chem 14
Followed by q _____ hours, x _____ days
Followed by q _____ days

19. Electrocardiogram

__ STAT Electrocardiogram for chest pain, notify physician

20. Biodosimetry/Bioassay tests: See REMM's Explaining Biodosimetry.

For biodosimetry: See REMM for more on the Dicentric chromosome assay.

__ Draw extra green top tube on: date _____ time _____
Send this tube **ON ICE** for outside lab study
To the Attention of: _____
Name of Lab:_____
Address of Lab:_____
See REMM for location of laboratories that perform this test.

For Bioassay: tests evaluating/managing internal decontamination:

__ Spot urine for _____ name of radioactive isotope

__ 24-hour urine for _____ name of radioactive isotope

__ Spot fecal specimen for _____ name of radioactive isotope

__ 24-hour fecal specimen for _____ name of radioactive isotope

Send specimen to: _____

Special requirements for containment, labeling, and shipping of specimen:
_____

Note: Consult senior radiation event medical managers for name and location of specialized laboratories if your facility cannot perform these assays.

21. __ Type and screen

For _____ units of packed red blood cells
For _____ units of platelets

- **Use only leukoreduced AND irradiated products, if available, unless it is known with certainty that the patient was exposed to a low dose of radiation, e.g. less than 100 Gy.**
- **If dose is not known with certainty, leukoreduced AND irradiated blood is preferred, if available.**
- **See REMM blood use page for additional information.**

22. General Medications[1]:

For gastric acid suppression:

__ **Lansoprazole (Prevacid)**[2] 15-30 mg PO daily

For radiation-induced nausea & vomiting:

__ **Ondansetron (Zofran)** [2] 4 mg IV q 8h PRN nausea/emesis
__ **Lorazepam (Ativan)** [2] 0.5 mg – 1 mg PO q 6-8h PRN anxiety/insomnia/breakthrough nausea

- See American Society of Clinical Oncology 2006 Anti-emetic Guidelines[3]
- See NEJM June 5, 2008 article: chemotherapy induced nausea and vomiting[3]

For fever:

__ **Acetaminophen (Tylenol)** [2] 650 mg PO q 6 – 8h PRN temperature > 38 ºC

For diarrhea:

__ **Loperamide hydrochloride (Imodium)** [2]:
- Recommended initial dose is 4 mg (2 capsules) followed by 2 mg (1 capsule) after each unformed stool.
- Daily dose should not exceed 16 mg (8 capsules)

For constipation:

__ **Senna** (**Senokot**) [2] 2 tabs PO BID, hold for loose stools

__ **Docusate (Colace)** [2] 100 mg PO BID, hold for loose stools
FDA monograph: 50 to 360 mg QD or divided BID for adults

For rash:

__ Topical sterile dressing

__ **Diphenhydramine hydrochloride (Benadryl)** [2] 25-50 mg PO q 4-6 hours for pruritis, not to exceed 300 mg/24 hours

For pain:

__ **Morphine sulphate**[2] _____ mg _____ route _____ frequency

For skin burns: (see also item 15: wound care)

Burn topical regimen _____

Replace body fluid _____

Other burn therapy _____

For oral mucositis:

Mouth care regimen _____

23. For radioisotope decorporation or blocking:

- Note: Only FDA approved radiation countermeasures are listed in table below.
- See REMM Countermeasures Table for longer list of countermeasures which have been recommended by some experts but are not FDA approved as radiation countermeasures.

Medication	Administered for which Isotopes	Route of Administration & Dosage for adults	Duration
Ca-DTPA[2,4] **Zn-DTPA**[2,4] See REMM's DTPA information. See FDA's Zn-DTPA drug label. See FDA's Ca-DTPA drug label.	Plutonium-239[2] Americium-241[2] Curium-244[2] Californium-252[3] Thorium-232[3] Yttrium-90[3]	**IV**[2]**: (for Zn or Ca)** 1 g in 250 mL NS or 5% glucose, given in 1-2 h, or bolus over 3-4 min; given once daily as a single infusion **Nebulized inhalation**[2]**:** 1 g in 1:1 dilution with water or NS over 15-20 min	Up to 5 days

Potassium iodide[2] See REMM's KI summary information. See FDA's KI information.	Iodine-131	**PO**: **Adults >40 years of age** with thyroid exposure ≥ 500 cGy: 130 mg/d **Adults 18-40 years of age** with thyroid exposure ≥ 10 cGy: 130 mg/d **Pregnant or lactating women** with thyroid exposure ≥ 5 cGy: 130 mg/d **Children and adolescents 3-18** with thyroid exposure ≥ 5 cGy: 65 mg/d Adolescents approaching adult size (70 kg) should receive full adult dose of 130 mg/d. **Infants 1 month to 3 years** with thyroid exposure ≥ 5 cGy: 32.5 mg/d **Neonates from birth to 1 month** with thyroid exposure ≥ 5 cGy: 16 mg/d	• In some incidents only a single dose of KI is required. • Incident Managers may recommend additional daily doses if radioactive iodine ingestion (or inhalation) is a continuing threat. • In some incidents, a course of 7-14 days may be recommended.
Prussian blue[2] See REMM's Prussian Blue information. See FDA's Prussian Blue drug label.	Cesium-137, Thallium-201	**PO:** 1 - 3 g TID with 100-200 mL water, up to 10 g/day	≥3 weeks, titrated by urine and/or fecal radionuclide bioassay and whole-body counting

24. Neutropenia therapy, if indicated[1, 5]:

- Although the 3 drugs listed below are FDA-approved for the treatment of chemotherapy induced neutropenia, none is approved either for radiation induced neutropenia or as prophylactic treatment prior to the onset of neutropenia.
- In a mass casualty radiation event, use of these drugs would require a formal Emergency Use Authorization.
- Consult drug label in links below for each drug.
- See additional REMM information on white cell growth factors/cytokines.

Cytokine[3]	Adult dose	Pregnant Women[6]
G-CSF or filgrastim[3] (Neupogen)	• Subcutaneous administration • 5 ug/kg/day via single daily injection • Continue until absolute neutrophil count > 1.0 x 10^9 cells/L	Class C[6] (Same as adults)
Pegylated G-CSF or pegfilgrastim[3] (Neulasta)	• 1 subcutaneous dose, 6 mg	Class C[6] (Same as adults)
GM-CSF or sargramostim[3] (Leukine)	• Subcutaneous administration • 250 ug/m^2/day • Continue until absolute neutrophil count > 1.0 x 10^9 cells/L	Class C[6] (Same as adults)

See Practice Guidelines for myeloid growth factors

- **National Comprehensive Cancer Network**
- **American Society of Clinical Oncology**

Antimicrobial therapy[1]:

- Use as appropriate for each patient.
- Drugs listed are examples only.

Anti-bacterial

__ **Levofloxacin (Levaquin)[2]** 500 mg PO/IV qd

Anti-viral

__ **Acyclovir (Zovirax)[2]** 400 mg PO q12h, or
__ **Acyclovir (Zovirax)[2]** 250 mg/m^2 IV q12h

Anti-fungal

__ **Fluconazole (Diflucan)[2]** 400 mg PO/IV daily – beginning when absolute neutrophil Count (ANC) becomes < 1000, or

__ **Posaconazole (Noxafil)[2]** 200 mg PO tid with food – beginning when absolute Neutrophil Count (ANC) becomes < 1000

25. Fever and Neutropenia[1]

__ Blood cultures x 2 sets

__ Urinalysis w/culture

__ Sputum culture + sensitivity

__ Chest x-ray

__ **Cefepime (Maxipime)**[2] 2 gm IV q 8h (use as appropriate)

__ **Vancomycin (Vancocin)**[2] 1gm IV q 12h, check peak and trough level before the 4th dose

See current Neutropenia Guidelines from
- IDSA Infectious Diseases Society of America
- ASCO American Society of Clinical Oncology

Consider using one of the following[1]**:**

__ **Liposomal amphotericin B (Ambisome)**[2] 3mg/kg/day IV over 1-4h

__ **Amphotericin B lipid complex (Abelcet)**[2] 3mg/kg/day IV over 1-4h

__ **Voriconazole (Vfend)**[2] 6mg/kg IV q 12h for two doses, then 4mg/kg IV q 12h

__ **Caspofungin (Cancidas)**[2] 70mg IV once then 50mg IV q 24h

NOTES

1. Suggested drugs are listed as representatives of a functional class, and no specific medication endorsement is implied. Dosages are based on a 70 kg adult with normal baseline renal and hepatic function. Appropriate dosage adjustments should be made based on age, weight, drug-drug interactions, nutritional status, renal and hepatic function, and any other patient-specific characteristics that may apply.

2. FDA approved for this indication

3. This drug is **not** approved by the FDA for this indication. If used, this would be an "off label use", and physician discretion is strongly advised.

4. Ca-DTPA and Zn-DTPA have not been approved by FDA for treating internal contamination with californium, thorium, and yttrium. For initial treatment, Ca-DTPA is recommended, if available, within the first 24 hours after internal contamination. Zn-DTPA is preferred for maintenance after the first 24 hours, if available, due to safety concerns associated with prolonged use of Ca-DTPA.

5. When to initiate treatment with cytokines
- Initiation of treatment should be strongly considered for victims who develop an absolute neutrophil count of < 0.500 x 10^9 cells/L and are not already receiving colony-stimulating factor.
- Evidence from **animal studies** indicates that outcomes may be improved if colony stimulating factors are administered as soon as possible after radiation exposure, and prior to the onset of neutropenia.

- Although most therapy for ARS is directed at actual clinical signs and symptoms, some clinical effects of ARS can be **anticipated and potentially mitigated**, as with the use of prophylactic white cell cytokines. This prophylactic use is also off label.
- Emergency Use Authorization will be required for use of cytokines for radiation induced neutropenia in a mass casualty setting.
- See published guidelines links in section 24.

6. For pregnant women:
   - Experts in biodosimetry must be consulted.
   - Any pregnant patient with exposure to radiation should be evaluated by a health physicist and maternal-fetal specialist for an assessment of risk to the fetus.
   - Class C refers to U.S. Food and Drug Administration Pregnancy Category C, which indicates that studies have shown animal, teratogenic, or embryocidal effects, but there are no adequate controlled studies in women; or no studies are available in animals or pregnant women.

Body Chart for Recording Results of Radiation Survey