Nursing Intervention and Medical Management of TB Adverse Drug Events

Melissa Davis, RN, BSN, MS

September 11, 2024

Introduction to TB Nurse Case Management Online
September 4th – September 25th, 2024
Online Course

Melissa Davis, RN, BSN, MS has the following disclosures to make:

- No conflict of interests
- No relevant financial relationships with any commercial companies pertaining to this educational activity

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Objectives

1. Discuss the nursing interventions and medical management of some of the most common adverse drug events.
2. Case studies

https://www.coolpun.com/topic/medical

Test Your Knowledge

- What anti-TB medication has the potential of causing hepatotoxicity?
  - A. INH
  - B. Rifampin
  - C. PZA
  - D. All of the Above

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First Line Drug Adverse Reactions

	Adverse Reaction	Signs and Symptoms
Any drug	**Allergic reactions**	**Skin Rash. Itching.**
INH RIF PZA	**Hepatitis**	**Abdominal pain. Yellow skin or eyes. Fatigue. Dark urine. Abnormal liver function. Lack of appetite. Nausea/ vomiting. Fever > 3 days**
INH	**Nervous system damage** **Peripheral neuropathy**	**Convulsions. Dizziness. Tingling/ numbness around the mouth.** **Tingling sensation in hands and feet.**
RIF	**Bleeding Problems** **Fluid Discoloration** **Sensitivity to the sun**	**Slow blood clotting. Easy bruising.** **Orange urine, sweat or tears.** **Easily sunburned**
PZA	**Upset stomach** **Increased uric acid**	**Upset stomach, vomiting, lack of appetite.** **Joint aches. Gout (rare). Abnormal uric acid level**
EMB	**Eye Damage (optic neuritis)**	**Blurred or changed vision. Changed color vision**

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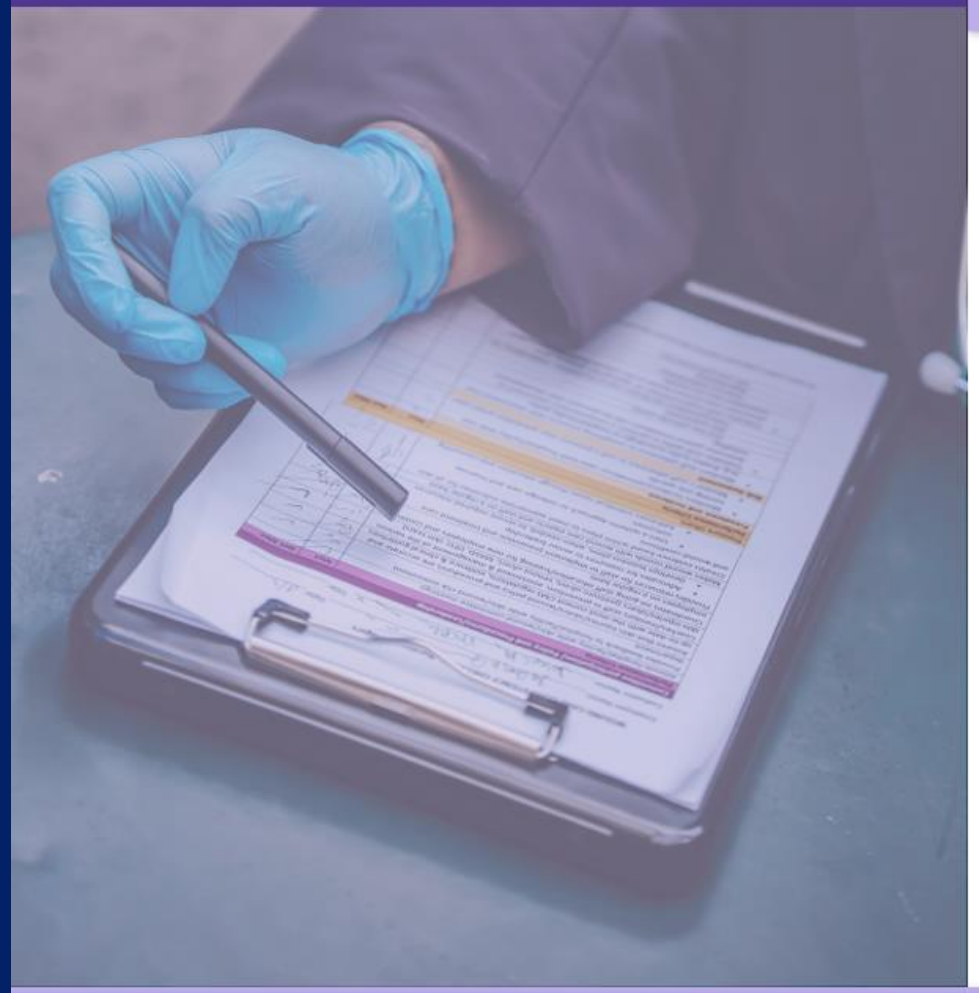
Case Study 4

TB Treatment in Patient at Risk for Hepatotoxicity



TB Treatment in a Patient at Risk of Hepatotoxicity

OBJECTIVES:

- List the factors that increase a patient's risk of hepatoxicity while on tuberculosis (TB) treatment.
- Describe the monitoring process for patients who have an increased risk of hepatotoxicity.
- Identify the signs and symptoms of hepatotoxicity.
- Discuss managing TB treatment in patients who experience hepatotoxic effects while on TB treatment.

CASE HISTORY:

The patient is a 65-year-old male Air Force veteran with a right-sided below the knee amputation and a history of untreated hepatitis C (HCV). During his workup for HCV treatment, the clinician orders a chest x-ray (CXR) due to the patient's complaint of a "cough that will not go away." The CXR reveals extensive bilateral cavitary lesions. The physician's office provides him with a surgical mask and notifies the local health department of a person with possible TB.

The patient is referred to the city health department where the TB public health nurse (PHN) conducts a nursing and social assessment revealing a history of alcohol use and untreated HCV. She notes that his current liver function tests (LFTs) are, ALT 150 units/L and AST 80 units/L. His housing situation is precarious, and he is currently sleeping on the sofa at his sister's trailer.

1.) What medical and/or social risk factors increase the patient's risk of hepatotoxicity while taking TB medications? (Circle all that apply.)

a. History of untreated HCV
b. Unstable housing
c. Veteran of the Armed Services
d. Alcohol use
e. Using over-the-counter (OTC) pain medication(s)

During the assessment at the health department, the PHN collects one sputum specimen due to the initial abnormal CXR consistent with TB. She provides the patient with containers to collect two additional specimens at least 8 hours apart, including one in the early morning.

> One sputum specimen should be collected during the initial clinic visit. Specimens should be obtained in an airborne infection isolation (AII) room, a sputum collection booth, or another isolated, well-ventilated area (e.g., outdoors).
>
> Patient education video for sputum collection: https://globaltb.njms.rutgers.edu/educationalmaterials/sputumcollectionvideo.php

The three sputa are 4+, 3+, 4+ AFB smear positive, and the Cepheid Xpert® (Xpert®) MTB/RIF results are positive for MTB complex and rifampin susceptible. Final cultures and susceptibilities are pending. His clinician, in consultation with a Center of Disease Control and Prevention (CDC) TB Center of Excellence physician, starts him on a liver friendly TB regimen due to his untreated HCV.

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Case Study: Hepatotoxicity

Case Study, Hepatotoxicity

- 80 yr. old HF from Mexico.
- In 2015, had close contact with family member with infectious TB, TSPOT pos., but declined LTBI therapy.
- Diagnosed with M.TB in 2016
- Medical Hx: Uncontrolled DM, HTN, crosses border to see physician
- ~19 lb. weight loss
- CT on 0/16/2016 consolidated infiltrates, cavity.

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Case Study, Hepatotoxicity, Cont.

- Pt. started RIPE daily in the hospital on 01/18/2016.
- CMP baseline outpatient-

DATE	Alk Phos (38-126)	AST (15-41)	ALT (10-45)	TBIL (0.3-1.2)	Glucose
1/20/16	113	25	19	0.6	140

- Pt. cont. meds outpatient

- 01/27/2016, pt. c/o vomiting, meds held and CMP drawn.

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Nursing Intervention

Nausea/vomiting (N/V)-

Ask questions:

1. Have you had stomach problems in the past? Did it feel like this?
2. What helped in the past?
3. Did you eat/drink, do anything different?
4. How often do you have N/V?
5. When does it start in relation to your TB medicine?
6. How long does it last?
7. Does it happen every time you take the medicine?
8. Is it difficult to swallow the pills? How much water or juice do you take with your pills?

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Case Study, Hepatotoxicity, Cont.

What things in her history, indicate she might be at risk for adverse drug-effects?

a. uncontrolled DM

b. Prior hospitalization for stomach issues.

c. Crosses border for medication for health care- any hepatotoxic medications?

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Estafiate Tea

- Exact ingredients and dosages difficult to ascertain.
- Difficult to find study information.
- Important to be sensitive but if pt. having toxicity issues may be necessary to hold.
- Probably not cause of pt.'s liver toxicity

Safety/Precautions

This plant, of which there many species and varieties throughout the western hemisphere, is closely related to wormwood (ajenjo), with which it shares similar properties.

Estafiate seems to be safer than wormwood, at least as a tea for adults, but unfortunately there are no clinical trials to ensure its correct dose or safety.

In any case, treatment with this plant should not be prolonged, as the safety of long term use is presently unknown.

Estafiate contains some chemical compounds known as *terpenes* that could be toxic to the nervous system should the patient ingest very concentrated forms of the tea.

WORMWOOD

Spanish Name: Estafiate

Scientific Name: Artemesia absinthium

Form: Tea

Constituents
Absinthin, anabsinthin, 0.25-1.32% volatile oils (containing thujone)

Therapeutic Effects
None proven

Safety/Toxicity
Thujone is a toxin and can cause effects similar to THC.

Adverse Effects
Habitual use or large doses cause absinthism, which is characterized by restlessness, vomiting, vertigo, tremors, and convulsions

Potential Drug Interactions
THC

Comments
Commonly used as a flavoring agent and a fragrance

H:\WP Docs\PUBLICATIONS\Dictionary of Herbal Remedies Used by Migrant Farmworkers.doc

Calculation: Determining Toxicity How High are the Liver Function Tests (LFTs)?

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Normal values (varies by lab):

Alk. Phos: 38 -**126** IU/L

AST (SGOT): 1-**41** IU/L

ALT (SPGT): 7 - **45** IU/L

TBIL: 0.3 -**1.2** mg/dL

DATE	Alk Phos (38-126)	AST (15-41)	ALT (10-45)	TBIL (0.3-1.2)	Glucose
1/20/16	113	25	19	0.6	140
1/27/16	132	**300**	**95**	2.2	123

Divide abnormal lab result by upper limit normal value

AST 300/41 = 7.3 X ULN

ALT 95/45 = 2.1 X ULN

Hepatotoxicity

Table 6.12
Hepatic Toxicity

AST and ALT Level	Levels of Toxicity
AST and ALT <5 times the upper limit of normal	Mild
AST or ALT 5– 10 times the normal limit	Moderate
AST or ALT >10 times the normal limit	Severe

- Continue therapy
  - AST <5 x upper limit of normal and no signs /symptoms of hepatitis
    - 20% of patients on standard therapy have asymptomatic elevation in LFT's
- Stop therapy
  - AST > 5 times upper limit of normal *with/ without symptoms*
  - AST > 3 times upper limit of normal with *symptoms*

Case Study - Hepatotoxicity

What do we do?

Hold TB medications!

Probable drug induced liver injury

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Case Study – Hepatotoxicity, Cont.

Cannot restart anti-TB therapy until LFT's ≤ 2 times upper limit of normal

a. Re-challenge medications
   - Introduce one drug at a time
   - Monitor enzymes carefully
   - Stop therapy if symptomatic or increased enzymes and eliminate last drug added from regimen

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Case Study, Hepatotoxicity, Cont.

01/28/2016-continued to hold meds

02/03/2016-CMP re-done

DATE	Alk Phos (38-126)	AST (15-41)	ALT (10-45)	TBIL (0.3-1.3)	Glucose
1/20/16	113	25	19	0.6	140
1/27/16	132	**300 (>5xULN)**	**95 (>2xULN)**	2.2	123
2/03/16	100	26	**61(<2xULN)**	0.7	190

02/08/2016- Rifampin 600mg and EMB 800mg re-started daily

02/16/2016 – CMP re-done

DATE	Alk Phos (38-126)	AST (15-41)	ALT (10-45)	TBIL (0.3-1.3)	Glucose
1/20/16	113	25	19	0.6	140
1/27/16	132	**300 (>5xULN)**	**95 (>2xULN)**	2.2	123
2/03/16	100	26	**61(<2xULN)**	0.7	190
2/16/16 RIF/EMB	96	18	13	0.6	293

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Case Study, Hepatotoxicity, Cont.

- 02/18/2016-INH 300mg daily added (Rifampin 600mg, EMB 800mg, INH 300mg daily)
- 02/25/2016- CMP re-drawn Alk Phos 105, **AST 227**, **ALT 77**, **TBIL 1.2**, Glucose 277,

DATE	Alk Phos (38-126)	AST (15-41)	ALT (10-45)	TBIL (0.3-1.2)	Glucose
1/20/16	113	25	19	0.6	140
1/27/16-held	132	**300 (>5xULN)**	**95(>2x ULN)**	**2.2**	123
2/03/16	100	26	**61(<2xULN)**	0.7	190
2/16/16-RIF/EMB	96	18	13	0.6	293
2/25/16-RIF/EMB/INH	105	**227 (??xULN)**	**97(??xULN)**	**1.2**	277

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Calculation: Determining Toxicity How High are the Liver Function Tests(LFTs)?

Normal values (varies by lab):

Alk. Phos: 38 -126 IU/L
AST (SGOT): 1-41 IU/L
ALT (SPGT): 7 - 45 IU/L
TBIL: 0.3 -1.2 mg/dL

DATE	Alk Phos (38-126)	AST (15-41)	ALT (10-45)	TBIL (0.3-1.2)	Glucose
1/20/16	113	25	19	0.6	140
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2/16/16-RIF/EMB	96	18	13	0.6	293
2/25/16-RIF/EMB/INH	105	**227 (??xULN)**	**97(??xULN)**	**1.2**	277

Divide abnormal lab result by upper limit normal value

ALT 97 /45 = 2.2 X ULN

AST 227/41 = 5.5X ULN

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Case Study - Hepatotoxicity

What do we do?

Hold TB medications!

Probable drug induced liver injury

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Case Study, Hepatotoxicity, Cont.

02/26/2016-Meds held due to elevated liver enzymes

03/03/2016-CMP drawn

03/03/2016 - Alk Phos 93, AST 20, ALT 36, TBIL 0.5, Glucose 655,

DATE	Alk Phos (38-126)	AST (15-41)	ALT (10-45)	TBIL (0.3-1.2)	Glucose
1/20/16	113	25	19	0.6	140
1/27/16-held	132	**300 (>5xULN)**	**95(>2xULN)**	**2.2**	123
2/03/16	100	26	**61(<2xULN)**	0.7	190
2/16/16-RIF/EMB	96	18	13	0.6	293
2/25/16-RIF/EMB/INH	105	**227 (??xULN)**	**97(??xULN)**	**1.2**	277
3/03/16	93	**20**	**36**	**0.5**	655

Consulted with Dr. Armitage re liver friendly regimen

Pt. restarted TB regimen since >18 days interruption

Pt. treated with Rifampin 600mg, Ethambutol 800mg, Moxifloxacin 400mg, daily for 9 mo. No further liver toxicity. Pt. did very well.

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Most at Risk for Hepatotoxicity

Underlying liver disease

- Clarify preexisting conditions that may increase risk of hepatotoxicity, i.e., hepatitis B, C

Increased alcohol use

- Take a good social history
- Ask specific questions about daily ETOH use

Post-Partum

- Immediate (4 months) post-partum period

Other hepatotoxic medications

- Prescribed
- Over the counter

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Case Study:

Hepatotoxicity Example 2

Case Study, Hepatoxicity 2

- 79 yr. old HF, 84.5 lbs., h/o pulmonary fibrosis, HTN, anemia, malnutrition
- Hospitalized & Dx. w/ TB 12/1-12/14/2021, CXR cavitary, smear >10 per field, NAA + M.TB
- RIPE started in Hospital 12/2
- 12/12/2021 in hospital, pt. had nausea, sl. Elevated. LFT

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Case Study, Hepatotoxicity 2

Hospital LFTS:

TBIL 1.2 mg/dl	Normal 0.2-1.2 mg/dl
AST 87 mg/dl	Normal 15-37 mg/dl
ALT 91 mg/dl	Normal 0-55mg/dl

ID doc office called field nurse to “not worry” and to monitor closely

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Case Study, Hepatotoxicity, Cont.

Pt. started RIPE treatment with heath Dept. 12/15/2021.

Pt. with mobility, weakness and SOB, and unable to come to clinic, so nurse saw pt. in home.

Daughters very supportive, care givers

Nurse discussed concerns with treating MD, with plan to monitor w/labs closely

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Case Study, Hepatotoxicity 2, cont.

CMP drawn 12/20/2021

12/22/2021 – Public Health Laboratory call

AST 65 Normal 7-35mg/dl

ALT 69 Normal 15-41 mg/dl

TBil 11.1(H!) Normal 0.3-1.2 mg/dl

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Case Study, Hepatoxicity, Cont.

Nurse Interventions:

1. Hold Medications
2. Symptom assessment – difficult to assess – pt. didn't want to go to hospital – wanted to make tamales for Christmas, baseline nausea, yellowish skin color
3. Coordinated with family and primary care physician to have pt. admitted to hospital

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Case Study, Hepatotoxicity 2, cont.

Pt. hospitalized 12/22-12/31/2021 for hyperbilirubinemia

TB meds held

Worked up for other causes for isolated hyperbilirubinemia (gall bladder, liver, etc.)

Consulted with Heartland and ID doc and Dr. Armitage spoke directly

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Case Study, Hepatotoxicity 2, cont.

	12/01/21 (hosp.)	12/12/21	12/20/2021 (DSHS)	12/22/2021 (hospital)	12/23/2021	12/27/21	12/29/21
AST	16	87	65		52	25	22
ALT	13	91	69		42	38	28
Total Bili	0.3	1.2	11.1	13.1	14.2	4.4	3.4

Consult w/Dr. Armitige: "Isolated hyperbilirubinemia is likely due to rifampin. I would recommend switching to rifabutin." Recommendations:

1. Hold treatment until her bili is ≤2.0.
2. Check with the lab to see when you can expect susceptibilities. If it is longer than 2-3 weeks, ask that one of her specimens be sent for MDDR.
3. Restart the patient on rifabutin 300 mg daily + INH 300 mg (+ pyridoxine 50 mg) daily + EMB 800 mg daily
4. Recheck labs 1 week and 2 weeks after restarting medications to assure she is not trending back upward
5. Depending on her susceptibility results and whether she tolerates the new regimen, decide about PZA based on these facts

Case Study, Hepatoxicity, Cont.

01/04/2022 Labs

TBIL	1.6 U/L	Normal <=1.2 U/L
AST	22 U/L	Normal 9-40 U/L
ALT	18 U/L	Normal 5-40 U/L

- Pt. restarted DOT per consult recommendations: (Restart the patient on rifabutin 300 mg daily + INH 300 mg (+ pyridoxine 50 mg) daily + EMB 800 mg daily)

01/14/2022 Labs

TBIL 1.3	Normal .3-1.2
AST 47	Normal 15-41
ALT	Normal 7-35

- Pt doing well now

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Test Your Knowledge

- What anti-TB medication has the potential of causing a rash?
  - A. INH
  - B. Rifampin
  - C. PZA
  - D. EMB
  - E. All of the Above

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Test Your Knowledge

- What anti-TB medication has the potential of causing rash?
  - A. INH
  - B. Rifampin
  - C. PZA
  - D. EMB
  - E. All of the Above

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Case Study:

Rash with TB Medications

Rash Assessment and Description Guide

1. Evaluate the Rash

1) Identify the type of lesion (size, layers of skin involved, and characteristics)
2) Identify location and distribution of lesions
3) Identify the configuration
   - The shape of one lesion:
     - **Linear** – straight line
     - **Target** – Bullseye or iris appearance; rings with central duskiness; purplish center, surrounded by pale pink, outer ring darker pink
   - The arrangement of clusters of lesions:
     - **Confluent** – Flowing into or coming together
     - **Random**
     - **Patterned**
4) Evaluate the texture
5) Color
6) Warm to the touch
7) Inspect oral mucosa

See back-side for terms and examples

2a. Gather Pertinent Information

1) Where is the rash? Is it unilateral or bilateral?
2) Where on the body did it start?
   - To where is it spreading?
   - Is it symmetrical or asymmetrical?
3) When did you notice the rash?
4) Are there any accompanying symptoms?
   - Itching, burning, fever
   - Shortness of breath, tingling of lips
5) Do you have any thoughts on what caused the rash?
   - New detergent, perfume, cleaners, lotion, soap
   - Outdoor activities, hiking, picnic, sunbathing
   - Environmental factors, vacation, travel, hotels
   - Any change in diet?
6) Complete a drug reconciliation; are their any medications known to cause drug-drug reactions?
   - Are TB Medications taken as directed?
   - Any new prescriptions?
   - New over the counter medications or supplements?
7) Have you tried any remedies?
8) What makes it better?
9) What makes it worse?
   - Is it worse at night?
10) Palpate the skin for texture and temperature changes

2b. Investigative Considerations

1) Is the eruption indicative of an infection, fungus, infestation, or drug rash?
2) HIV, Diabetes, Auto-Immune Disorders, Eczema, and Asthma increase rash prevalence, and drug-drug interactions
3) Is sunlight sensitivity a factor?

2c. Types of Reactions

Exanthemata (external rash) – Diffuse macule and papule, evolve over days after drug initiation
Urticaria & angioedema – Onset within minutes to hours after drug administration; potential for anaphylaxis
Fixed drug eruption – Hyper-pigmented plaques; upon drug re-exposure, plaques reoccur at same site.
DRESS – Cutaneous eruption, fever, eosinophilia, lymphadenopathy
Anaphylaxis – Urticaria, angioedema, bronchospasm, gastrointestinal
Stevens-Johnson Syndrome – Lesions, ulcers on mucous membranes, mouth, lips, truncal area; fever, fatigue, sore throat, ocular involvement

Seek immediate medical attention

HEARTLAND NATIONAL TB CENTER
THE UNIVERSITY OF TEXAS AT TYLER HEALTH SCIENCE CENTER

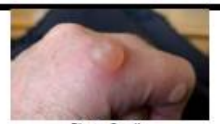
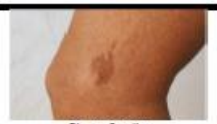
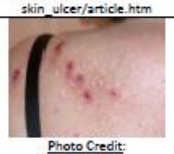
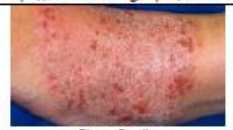
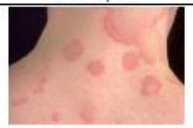
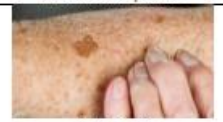
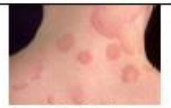
Consultations

Heartland National TB Center's Toll-Free Warm-Line
(800) TEX-LUNG *or* (800) 839-5864

https://www.heartlandntbc.org/

Rash Assessment and Description Guide

Rash Terms with Photo Examples

Bullae – Vesicle >1cm in diameter	 Photo Credit: whitemay/Getty Images	**Patch** – Irregular shaped macule; >1cm in diameter	 Photo Credit: jaojormami/Shutterstock
Erosion – Loss of epidermis; depressed, moist; follows rupture of vesicle	 Photo Credit: https://www.medicinenet.com/skin_ulcer/article.htm	**Plaque** – Elevated, firm, rough lesion; >1cm in diameter	 Photo Credit: https://www.medicalnewstoday.com/articles/323152#what-is-psoriasis
Excoriation – Loss of epidermis, linear, hollowed out, crusted area	 Photo Credit: https://dermnetnz.org/topics/compulsive-skin-picking-images	**Pustule** – Vesicle filled with purulent fluid	 Photo Credit: https://www.healthdirect.gov.au/acne
Erythema – A redness of the skin caused by congestion of the capillaries in the lower layers of the skin	 Photo Credit: https://dermnetnz.org/topics/sunburn	**Scale** – Heaped-up accumulation of keratinized cells; flaky, can be dry or oily, varying in size	 Photo Credit: AboutnuyLove
Lichenification – Rough, thickened epidermis from scratching or rubbing; normal skin markings are observable; often found on flexor surface of extremity	 Photo Credit: https://www.healthline.com/health/lichenification#pictures	**Urticaria** – Hives, raised, itchy wheals; of varying size	 Photo Credit: https://www.nidirect.gov.uk/conditions/urticaria-hives
Macule – Flat, non-palpable, circumscribed area; with change in skin color; <1cm in diameter	 Photo Credit: CRISTINA PEDRAZZINI/SCIENCE PHOTO LIBRARY/Getty Images	**Vesicle** – Elevated, circumscribed, superficial, filled with serous fluid; <1cm in diameter	 Photo Credit: Jere Mammino, DO
Papule – Elevated, firm, palpable, circumscribed area; <1cm in diameter	 Photo Credit: https://www.healthline.com/health/skin/maculopapular-rash#pictures	**Wheal** – Elevated, irregular-shaped area of cutaneous edema; solid welt, pale red, transient; or varying diameters	 Photo Credit: https://www.nidirect.gov.uk/conditions/urticaria-hives

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Case Study, Rash

- 54 yr. old F, HIV +/ART, h/o Hep. C, drug use, COPD, Asthma, seizures, wt. 95 lbs.
- Close contact to infectious case
- IGRA +, cough, >30 lb. wt. loss, CXR normal
- Sputum specimen X 3 collected, smear, NAAT –
- Started TX with Rfb 300mg, INH 300mg, PZA 1000mg, EMB 800mg, Vit. B6 50mg 09/29/2021

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Case Study Rash, cont.

- 10/2/2021 pt. c/o itching/rash, rash localized to (L) buttock + upper back, minimal.
- Meds held, CBC/CMP drawn, results normal
- Meds restarted 10/6/2021
- 10/7/2021 pt. c/o rash/itching to abdomen and back, redness.
- Meds held until 10/11
- 10/12/2021 – pt. reported allergic to Vitamin B6, and documentation received from MD

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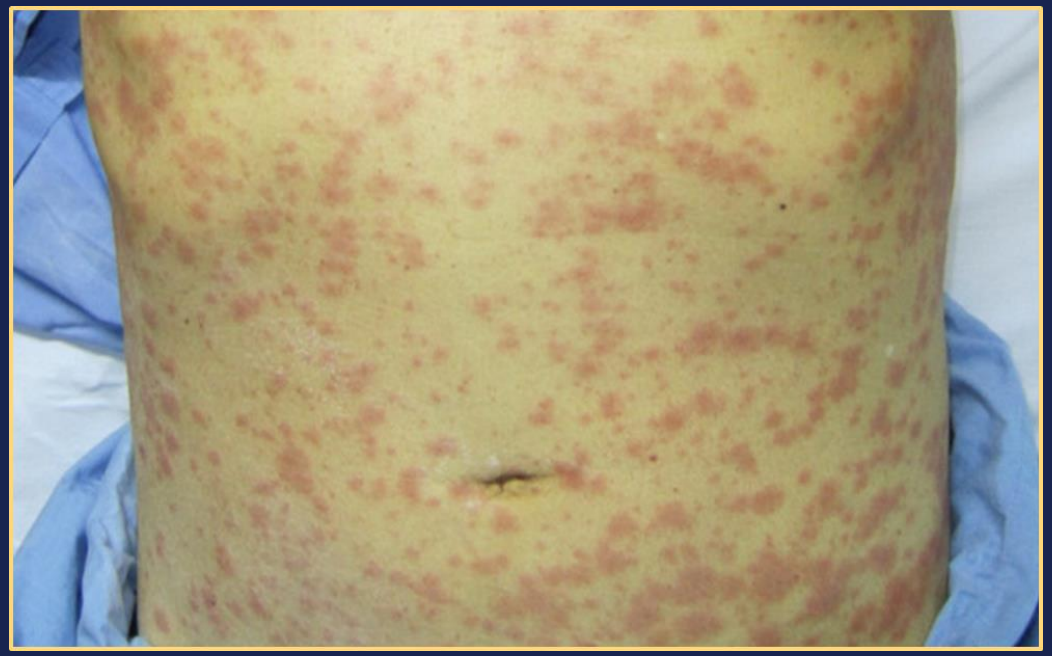
Case Study Rash, Cont.

- 10/11/2021 Rfb, INH, EMB Adm w/o Vit. B6
- 10/13/2021 – rash returned, more severe, to back, + torso, MD notified, meds held



https://www.researchgate.net/figure/Generalized-exanthematous-rash-on-the-trunk-and-extremities-of-our-patient_fig1_235390482

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Case Study, Rash, cont.

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Start drug re-challenge on a Monday or Tuesday.

Day 1: Rif 300mg + Benadryl 30 min prior meds

Day 2: Rif 600mg + Benadryl 30 min prior meds

Day 3: Rif 600mg + Benadryl 30 min prior

Day 4-6: Rif 600, if day 3 is tolerated, d/c Benadryl, Take 600mg daily over weekend

Week 2: INH

wk2, day 1: Benadryl 30 min prior + INH 150mg + riff 600 mg

wk2, day2: Benadryl 30 min prior + INH 300mg + riff 600 mg

wk2, day3: Benadryl 30 min prior + INH 300mg + riff 600 mg

wk2, day 4-7: Rif 600, INH 300, if day 3 is tolerated, d/c Benadryl, take RIF and INH daily over weekend

Week 3: EMB

wk2, day 1: Benadryl 30 min prior + INH 300mg + riff 600 mg + EMB 100mg

wk2, day2: Benadryl 30 min prior + INH 300mg + riff 600 mg + EMB 400mg

wk2, day3: Benadryl 30 min prior + INH 300mg + riff 600 mg + EMB 400mg

wk2, day 4-7: Rif 600, INH 300, and EMB 1600 if day 3 is tolerated, d/c Benadryl, take RIF, EMB, and INH daily over weekend

Case Study, Rash, cont.

Pt. tolerated re-challenge with Rfb, INH, EMB

11/18/2021, cultures came back negative, CXR remained normal

Med orders received to finish TX. With Rfb. for TB infection. Pt. doing very well.

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Case Study, Rash, cont.

Nursing Questions re rash –

- When did it start?
- Where did it start?
  - Has it spread?
- What does it look like?
  - What makes it better or worse?
- Who has it?

Other conditions:

- Insect bites, scabies, Bed bugs
- Other drugs
- Contact dermatitis
- Acne/folliculitis
- Immunologic/hypersensitivity reactions
- Sunburn
- Pellagra
- Eczema
- Dry skin
- Infections

Test Your Knowledge

1. What anti-TB medications place the patient at risk for vision related toxicities?
   A. Rifampin
   B. Ethambutol
   C. Linezolid
   D. B & C only
   E. All of the above

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Test Your Knowledge

1. What anti-TB medications place the patient at risk for vision related toxicities?
   A. Rifampin
   B. Ethambutol
   C. Linezolid
   D. B & C
   E. All of the above

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Characteristics of Commonly-Used Second-Line Drugs for Drug Resistant TB

For complete information on these and other drugs for MDR-TB, consult medication package inserts or medication fact sheets in Drug-Resistant Tuberculosis: A Survival Guide for Clinicians, 3rd edition available at: currytbcenter.ucsf.edu/product/view/drugresistant-tuberculosis-a-survival-guide-for-clinicians-3rd-edition

Drug	Standard Adult Dosing*	Considerations	Side Effects
Bedaquiline	400 mg once daily for 14 consecutive days; then 200 mg 3 times/wk for 22 wks (may give longer); 26 wks total duration as part of BPaL regimen	CNS penetration unproven; can be safely used with moderate chronic kidney disease (CKD) or moderate liver disease; give with meal to increase bio-availability	QTc prolongation, decreased appetite, nausea, hepatitis, headaches, arthralgias, elevated amylases, vivid dreams
Moxifloxacin	400 mg once daily, PO or IV	Good CNS penetration.	GI upset, dizziness, hypersensitivity, photosensitivity, headaches, arthralgias, tendonitis, tendon rupture (rare), CNS irritability, QTc prolongation, thrush, peripheral neuropathy, elevated liver enzymes (rare hepatotoxicity with moxifloxacin)
Levofloxacin	750-1,000 mg once daily, PO or IV	Good CNS penetration; adjust dose with creatine clearance < 30; avoid caffeine, milk-based products, antacids, or mineral supplements within 2 hrs of medication	
Linezolid	600 mg once daily, PO or IV	Good CNS penetration; trough < 2 µg/ml is associated with lower toxicity	Peripheral and optic neuropathy (reversible with early recognition), anemia, thrombocytopenia, neutropenia, headache, GI upset, rash, serotonin syndrome, lactic acidosis, acute pancreatitis, black hairy tongue
Pretomanid (As part of BPaL or BPaLM regimen)	200 mg once daily for 26 wks	No dose adjustment in patients with mild to moderate renal impairment; use with caution with severe renal impairment; should be taken with food	Hepatotoxicity, myelosuppression, peripheral and optic neuropathy, lactic acidosis, QTc prolongation, pancreatitis *[side effects are for entire BPaL regimen]*
Delamanid	100 mg twice daily for 24 wks (longer is possible)	CNS penetration unknown; can be safely used with moderate CKD or moderate liver disease; should be taken with food	GI upset, dizziness, insomnia, upper abdominal pain, QTc prolongation
Clofazamine	100 mg once daily	Skin darkening and photosensitivity can be limited by early use of sunscreen and lubricants; patients should be advised to minimize sun exposure	Hyperpigmentation, GI complaints, retinopathy, dry skin, ichthyosis, QTc prolongation; note – some patients may become depressed due to skin changes
Cycloserine	250 mg twice daily or 500 mg once daily	Avoid in patients with history of seizures/ psychosis or ETOH abuse; check level before increasing dose >500 mg daily; adjust dose with creatinine clearance < 30; some physicians use pyridoxine 50-100 mg daily	CNS toxicity (psychosis, depression, suicidal ideation, seizures), insomnia, unusual skin reaction
Pyrazinamide	Standard dosing: 25-35 mg/kg once daily	Adjust dose and/or interval with creatinine clearance < 30, avoid with clinical history of gout	Polyarthralgia (non-gouty), asymptomatic hyperuricemia, hepatotoxicity, GI upset, Rare: acute gout, usually in those with pre-existing gout

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Thank you

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