ABSTRACT:

**Audience:** This modified team-based learning (mTBL) exercise is appropriate for junior and senior emergency medicine learners.

**Introduction:** Rashes and dermatologic complaints are common in the emergency department. It is essential that emergency physicians understand various types of lesions and rashes as well as be able to distinguish between benign and life-threatening dermatologic complaints. The Modified Lynch Algorithm provides a systematic approach to the diagnosis of rashes by providing a number of questions and branching points to narrow down the differential diagnosis of important and life-threatening rashes for the emergency physician. While there are a number of other methods to narrow down the differential diagnosis for rash, the Modified Lynch Algorithm is primarily based on the type of rash and is well suited for this exercise because it provides an excellent opportunity for learners to think about the differential diagnosis for those rashes.

**Objectives:** By the end of this educational session, the learner will: 1) List the six primary types of rash (maculopapular, petechial/purpura, diffuse erythematous, non-erythematous, vesiculo-bullous, and pustular). 2) Be able to accurately describe various types of lesions and rashes with appropriate terminology; 3) Understand the use of the Modified Lynch Algorithm and how it can be used to narrow down the differential diagnosis in patients presenting with rash.

**Method:** This is an mTBL session.

**Topics:** Dermatology, emergency rashes, life-threatening rashes, maculopapular, petechial, purpura, erythematous, vesiculo-bullous, pustular.
Linked objectives, methods and results:
In the individual readiness assessment test, the learners are asked to match each lesion or rash with the appropriate terminology. This test ensures they know the appropriate terminology to describe various rashes. Learners then participate in the group readiness assessment test by completing the Kahoot (or PowerPoint) which goes through more examples of rashes and allows the entire group to practice their rash identification. For the group application exercise, learners will implement their understanding of rash types and brainstorm in small groups on the differential for the primary rash types by filling out their blank Modified Lynch Algorithm.

Recommended pre-reading for instructor:

Results and tips for successful implementation:
This mTBL was first implemented during a residency conference with approximately 30 learners (medical students to senior residents). It was very well-received by learners.

Prepare:
1. Read instructor pre-reading
2. You will need a computer with Keynote or PowerPoint and projector/screen to present the Derm TBL Keynote or PowerPoint.
3. The gRAT can either be run through the Kahoot! link (https://play.kahoot.it/#/?quizId=c0ef5945-7694-4483-accb-9de3c5ced71f) or through the provided separate gRAT Keynote/PowerPoint. If using Kahoot! each learner will need a device (smart phone, tablet or laptop) with internet access.

For the in-classroom didactic session, you will also need to prepare the following:
1. One copy of iRAT chart for each learner
2. One copy of GAE for each learner or each group, depending on if you want learners to each have their own copy.
USER GUIDE

3. One copy of the gRAT explanations form (also provided in the Keynote and PowerPoint presenter notes)

4. One copy of the GAE key

In class implementation:

1. Learners take the iRAT (third slide of the EM Dermatology presentation). They will need to view the slides with the pictures of 10 different rashes in order to complete the iRAT. Give your learners 5 minutes to complete the iRAT. They should not be allowed to use articles or other materials during the iRAT.

2. Review the answers to the iRAT (see provided iRAT Key). Answer any questions from learners.

3. Go through the gRAT via Kahoot! or the gRAT Keynote/PowerPoint. The competition of the Kahoot! often encourages residents to either argue about answers or work together. If using the gRAT Keynote/PowerPoint you can have learners shout out answers, write down answers, or call on them in turn. After learners answer each rash, provide the correct answer and a brief explanation (see gRAT explanation form or presenter notes). Many images have multiple findings, and the Kahoot! provides only certain answers to minimize confusion, but it is important to point out these findings to learners.

4. Now break up learners into groups of four. The instructor should assign the groups and we recommend evenly distributing junior and senior residents in each group. Provide each group or learner with a copy of the GAE, give them 15-20 minutes to brainstorm and complete the GAE. After groups have completed their forms, review answers from the Derm TBL presentation. Please note, if you want to help get your learners started or have less advanced learners, you could fill in part of the GAE before providing it to learners.

5. We recommend emailing the GAE Key to learners after completion of the session for their review.

Content:

- EM Derm TBL Presentation
  - Keynote
  - Powerpoint
- iRAT
- Derm gRAT
  - Kahoot
  - Keynote
  - Powerpoint
- GAE
- iRAT Key
- gRAT Key
- GAE Key

References/suggestions for further reading:


**EM Dermatology: individual Readiness Assessment Test (iRAT)**

Answer choices (use each term once)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Definition</th>
<th>Picture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macule</td>
<td>Circumscribed elevation of skin 1cm or larger in diameter; a confluence of papules</td>
<td>n/a</td>
</tr>
<tr>
<td>Papule</td>
<td>Excess dead epidermal cells produced by abnormal keratinization; sometimes with desquamation</td>
<td>n/a</td>
</tr>
<tr>
<td>Nodule</td>
<td>Circumscribed, fluid-filled lesion less than 1cm in diameter</td>
<td>n/a</td>
</tr>
<tr>
<td>Plaque</td>
<td>Solid, raised lesion 1cm or larger in diameter</td>
<td>n/a</td>
</tr>
<tr>
<td>Pustule</td>
<td>Small red or brown macules less than 1cm in diameter that do not blanch</td>
<td>n/a</td>
</tr>
<tr>
<td>Rash</td>
<td>Solid, raised lesion less than 1cm in diameter</td>
<td>n/a</td>
</tr>
<tr>
<td>Pustule</td>
<td>Circumscribed red or brown macules 1cm or larger in diameter</td>
<td>n/a</td>
</tr>
<tr>
<td>Pustule</td>
<td>Circumscribed area of skin containing pus</td>
<td>n/a</td>
</tr>
<tr>
<td>Pustule</td>
<td>Circumscribed area of change in skin color without elevation</td>
<td>n/a</td>
</tr>
<tr>
<td>Pustule</td>
<td>Circumscribed, fluid-filled lesion 1cm or larger in diameter</td>
<td>n/a</td>
</tr>
<tr>
<td>Pustule</td>
<td>An eruption of the skin involving more than one lesion</td>
<td>n/a</td>
</tr>
<tr>
<td>Pustule</td>
<td>Single diseased area of skin</td>
<td>n/a</td>
</tr>
</tbody>
</table>
EM Dermatology: group Readiness Assessment Test (gRAT)

The gRAT for this TBL can either be completed through the following Kahoot!

https://play.kahoot.it/#/?quizId=c0ef5945-7694-4483-accc-9de3c5ced71f

or through the associated Derm gRAT Keynote/PowerPoint.
EM Dermatology: Group Application Exercise (GAE)
Modified Lynch Algorithm
Possible life-threatening rash

Possible life-threatening rash

Solid

Erythematous

Fluid-filled

Clear

Pustular
EM Dermatology: Group Application Exercise (GAE)
Modified Lynch Algorithm
Maculopapular Rash

Maculopapular rash

Central

Sick contact?

Yes

Has the patient been using a new drug?

Yes

Consider:
1. 2. 3.

No

Peripheral

Sick contact?

Yes

Consider:
1. 2.

No

Has there been any travel or local incidence of tick-borne disease?

Yes

Consider:
1. 2. 3.

No

Consider:
1. 2.
LEARNER MATERIALS

EM Dermatology: Group Application Exercise (GAE)
Modified Lynch Algorithm
Petechial Rash

Petechial Rash

If patient is ill-appearing, consider empirically treating for meningococcemia and RMSF

Does the patient have any sick contacts?

No

Yes

Any travel or local incidence of tick-borne disease?

Consider:
1. 2. 3. 4.

Is there palpable purpura?

Yes

No

Possible thrombocytopenia:
1. 2.

Consider:
1. 2. 3. 4. 5. 6. 7.
EM Dermatology: Group Application Exercise (GAE)
Modified Lynch Algorithm
Erythematous Rash

1. Erythematous rash
2. Nikolsky sign?
   - Yes
   - No

   1. Febrile?
      - Yes
      - No

      1. (Children)
      2. (adults)

   2. Febrile?
      - Yes
      - No

      1. (mucous membranes)
      2. (children with swollen hands)
      3. ("sandpaper rash")
EM Dermatology: Group Application Exercise (GAE)
Modified Lynch Algorithm
Vesiculobullous Rash

Non-erythematous rash:
1. __________
2. __________
3. __________

Pustular:
1. __________
2. __________
3. __________
4. __________
INSTRUCTOR MATERIALS

Answer keys to all exercises with explanations, are on the following pages.

Learners: please do not proceed.
## EM Dermatology: individual Readiness Assessment Test Key (iRAT Key)

**Answer choices (use each term once)**

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<thead>
<tr>
<th>Condition</th>
<th>Definition</th>
<th>Picture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plaque</td>
<td>Circumscribed elevation of skin 1cm or larger in diameter; a confluence of papules</td>
<td>B</td>
</tr>
<tr>
<td>Scales</td>
<td>Excess dead epidermal cells produced by abnormal keratinization; sometimes with desquamation</td>
<td>E</td>
</tr>
<tr>
<td>Vesicle</td>
<td>Circumscribed, fluid-filled lesion less than 1cm in diameter</td>
<td>D</td>
</tr>
<tr>
<td>Nodule</td>
<td>Solid, raised lesion 1cm or larger in diameter</td>
<td>A</td>
</tr>
<tr>
<td>Petechiae</td>
<td>Small red or brown macules less than 1cm in diameter that do not blanch</td>
<td>H</td>
</tr>
<tr>
<td>Papule</td>
<td>Solid, raised lesion less than 1cm in diameter</td>
<td>F</td>
</tr>
<tr>
<td>Purpura</td>
<td>Circumscribed red or brown macules 1cm or larger in diameter</td>
<td>I</td>
</tr>
<tr>
<td>Pustule</td>
<td>Circumscribed area of skin containing pus</td>
<td>C</td>
</tr>
<tr>
<td>Macule</td>
<td>Circumscribed area of change in skin color without elevation</td>
<td>G</td>
</tr>
<tr>
<td>Bullae</td>
<td>Circumscribed, fluid-filled lesion 1cm or larger in diameter</td>
<td>J</td>
</tr>
<tr>
<td>Rash</td>
<td>An eruption of the skin involving more than one lesion</td>
<td>n/a</td>
</tr>
<tr>
<td>Lesion</td>
<td>Single diseased area of skin</td>
<td>n/a</td>
</tr>
</tbody>
</table>
gRAT answers are available on the Kahoot!
Answers and instructor notes can also be found on the Derm gRAT Keynote/PowerPoint presenter notes.
Notes for instructors are also available below.

1. Macule. Circumscribed area of change in skin color without elevation.
2. Pustules from Impetigo. Starting to coalesce into what could be called a plaque.
4. Maculopapular rash. Combination of circumscribed areas of change in skin color without elevation and solid, raised lesion less than 1cm in diameter.
5. Macule.
6. Papular. Solid, raised lesion less than 1cm in diameter. Likely viral exanthem.
7. Plaques. This is a maculopapular rash that has coalesced into plaques which is common with urticaria.
8. Papules. Solid, raised lesion less than 1cm in diameter.
9. This picture has a combination of macules, papule and pustules. Consistent with acne.
10. Nodule. Solid, raised lesion 1cm or larger in diameter.
11. Macule.
12. Maculopapular rash, coalescing into plaques.
14. Plaque with scales. Circumscribed elevation of skin 1cm or larger in diameter and excess dead epidermal cells produced by abnormal keratinization.
15. Nodule. Solid, raised lesion 1cm or larger in diameter.
16. Vesicles. Circumscribed, fluid-filled lesion less than 1cm in diameter.
17. Vesicles. A little difficult to tell the size but these are <1cm so vesicles not bullae.

18. Maculopapular rash. This was a drug rash.

19. Pustules overlying macular skin changes.

20. Macule.

21. Umbilicated flesh-colored papules. This is molluscum contagiosum.

22. Plaques. Circumscribed elevation of skin 1cm or larger in diameter; a confluence of papules.

23. Purpura. Circumscribed red or brown macules 1cm or larger in diameter.

24. Bullae. Circumscribed, fluid-filled lesion 1cm or larger in diameter.

25. Maculopapular rash with pustules.


27. Target shaped maculopapular lesions with multiple bullae.


29. Petichiae. Small red or brown macules less than 1cm in diameter that do not blanch.

30. Vesicles with an erythematous base.

31. Macules with pustules.

32. Bullae.

33. Scales. Excess dead epidermal cells produced by abnormal keratinization; sometimes with desquamation.

34. Vesicles. This is herpes zoster on an elbow.

35. Vesicles. Likely herpes zoster.

36. Bullae. This is bullous pemphigoid.
37. Plaques with scales. Circumscribed elevation of skin 1cm or larger in diameter; excess dead epidermal cells produced by abnormal keratinization.

38. Macules and bullae.

39. Petechiae. Small red or brown macules less than 1cm in diameter that do not blanch. This is in a child with Henoch-Schonlein purpura.

40. Bullae.

41. Purpura. Circumscribed red or brown macules 1cm or larger in diameter.

42. Maculopapular.
EM Dermatology: Group Application Exercise Key (GAE Key)

To wrap up, the instructor can review the answers for the Modified Lynch Algorithm with learners and have teams share their differentials with the larger group. Answers to the GAE are provided below.

**Modified Lynch Algorithm**

**Possible life-threatening rash**

```
<table>
<thead>
<tr>
<th>Possible life-threatening rash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid</td>
</tr>
<tr>
<td>Erythematous</td>
</tr>
<tr>
<td>Maculopapular</td>
</tr>
<tr>
<td>Petechial/purpura</td>
</tr>
<tr>
<td>Diffuse erythematous</td>
</tr>
<tr>
<td>Non-erythematous</td>
</tr>
<tr>
<td>Fluid-filled</td>
</tr>
<tr>
<td>Clear</td>
</tr>
<tr>
<td>Vesiculo-bullous</td>
</tr>
<tr>
<td>Pustular</td>
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</tr>
</tbody>
</table>
```
EM Dermatology: Group Application Exercise Key (GAE Key)
Modified Lynch Algorithm
Maculopapular Rash

Maculopapular rash

Central

Sick contact?

Yes

No

Consider viral exanthem

Has the patient been using a new drug?

Yes

No

Possible cutaneous drug reaction

Consider:
- Lyme disease
- Arbovirus
- Pityriasis rosea

Peripheral

Sick contact?

Yes

No

Consider:
- Meningococcal disease
- Hand-foot-mouth disease

Has there been any travel or local incidence of tick-borne disease?

Yes

No

Consider:
- Rocky Mountain Spotted Fever
- Ehrlichiosis

Consider:
- Erythema multiforme
- Secondary syphilis
- Anthrax
EM Dermatology: Group Application Exercise Key (GAE Key)
Modified Lynch Algorithm
Petechial Rash

If patient is ill-appearing, consider empirically treating for meningococcemia and RMSF

Does the patient have any sick contacts?

No

Any travel or local incidence of tick-borne disease?

Yes

Consider:
1. Rocky Mountain spotted fever
2. Dengue fever
3. Typhus
4. Rat bite fever

No

Is there palpable purpura?

Yes

Consider vasculitis

No

Consider:
1. Meningococcemia
2. Rubella
3. Epstein-Barr virus
4. Enterovirus
5. Hepatitis B
6. Gonococcemia
7. Rheumatic Fever

Possible thrombocytopenia:
1. Idiopathic thrombocytopenia purpura
2. Thrombotic thrombocytopenic purpura
EM Dermatology: Group Application Exercise Key (GAE Key)
Modified Lynch Algorithm
Erythematous Rash

- Erythematous rash
  - Nikolsky sign?
    - Yes
      - Febrile?
        - Yes
          - Staphylococcal SSS (Children)
          - TEN (adults)
        - No
          - TEN
      - No
    - No
      - Febrile?
        - Yes
          - TSS (mucous membranes)
          - Kawasaki disease (children with swollen hands)
          - Scarlet fever ("sandpaper rash")
        - No
          - Anaphylaxis
          - Scrombroid poisoning
          - Alcohol flush
Non-erythematous rash:
1. Syphilis
2. Anthrax
3. Vitiligo

Pustular:
1. Impetigo
2. Gonorrhea
3. Bacterial folliculitis
4. Pustular psoriasis