

Exertional Rhabdomyolysis: A Clinical Review of Presentation, Diagnosis, and Management

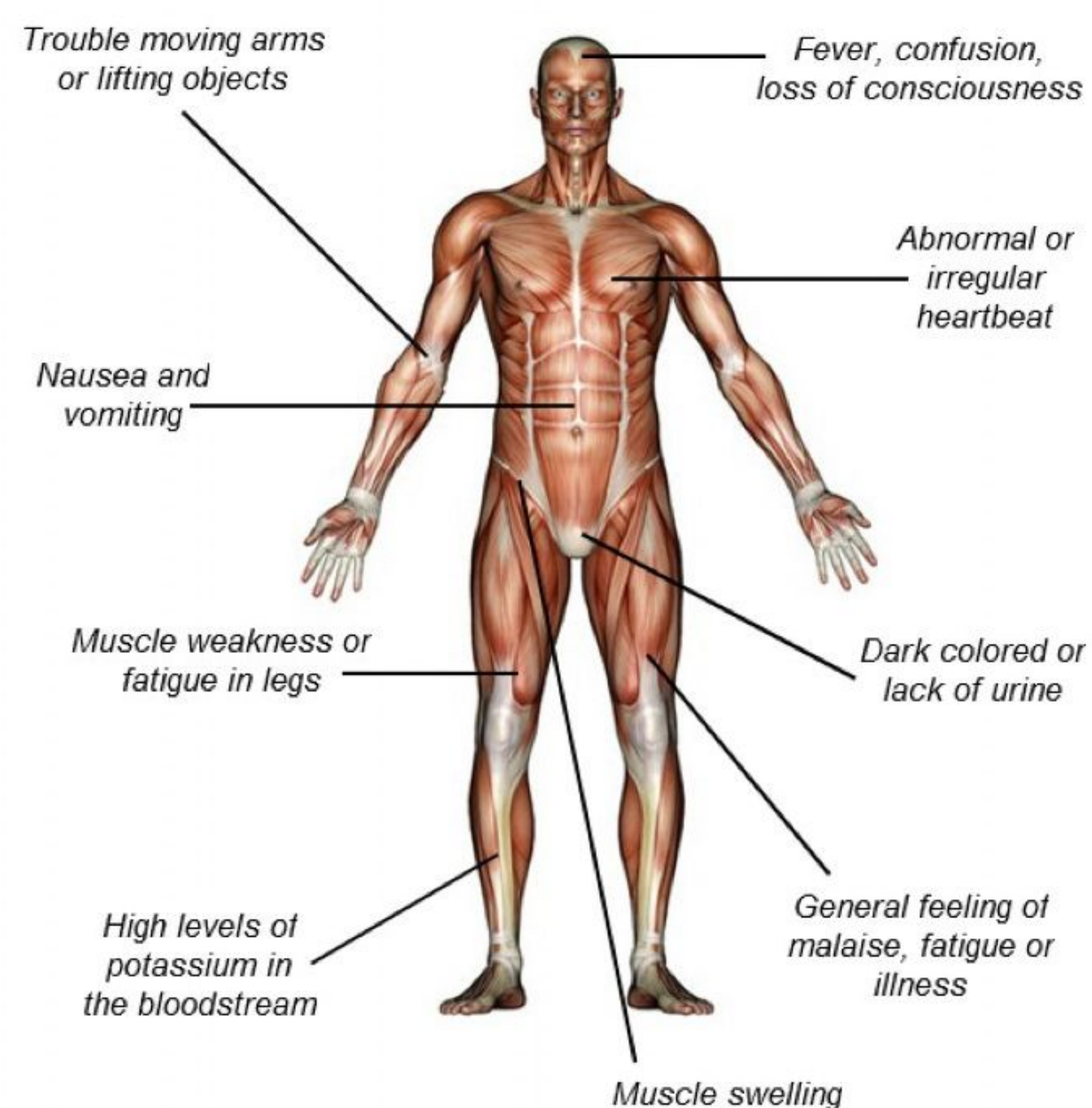
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Introduction

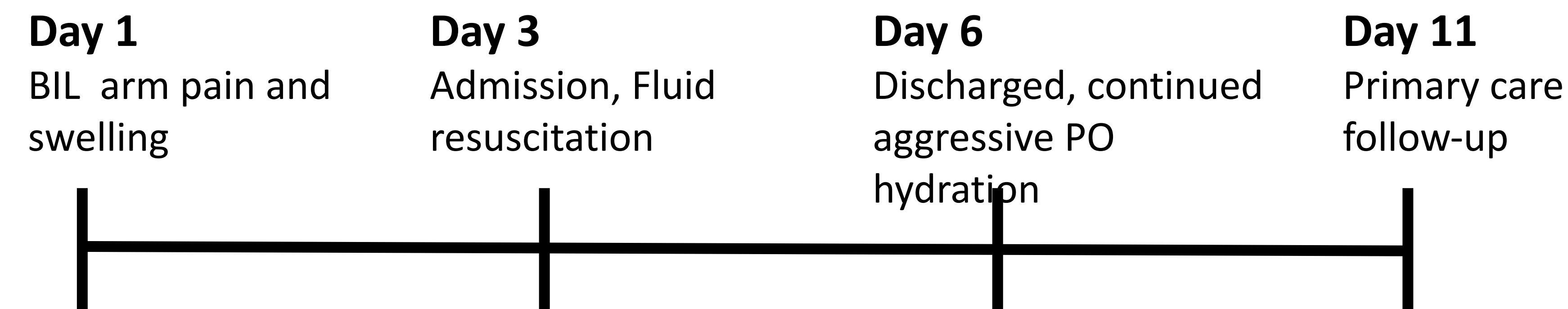
Rhabdomyolysis: (rhabdo) a toxic systemic condition resulting from muscle necrosis.

- Causes:
 - Trauma, overexertion, infection, toxins, substance abuse
- The US reports on average 26,000 cases of rhabdo per year
- 10-40% of patients with rhabdo develop an AKI
- Significant Increase in mortality in critically ill patients that develop rhabdomyolysis. (1)

Early recognition and intervention is essential for the prevention of life threatening complications.



Case Description



Case

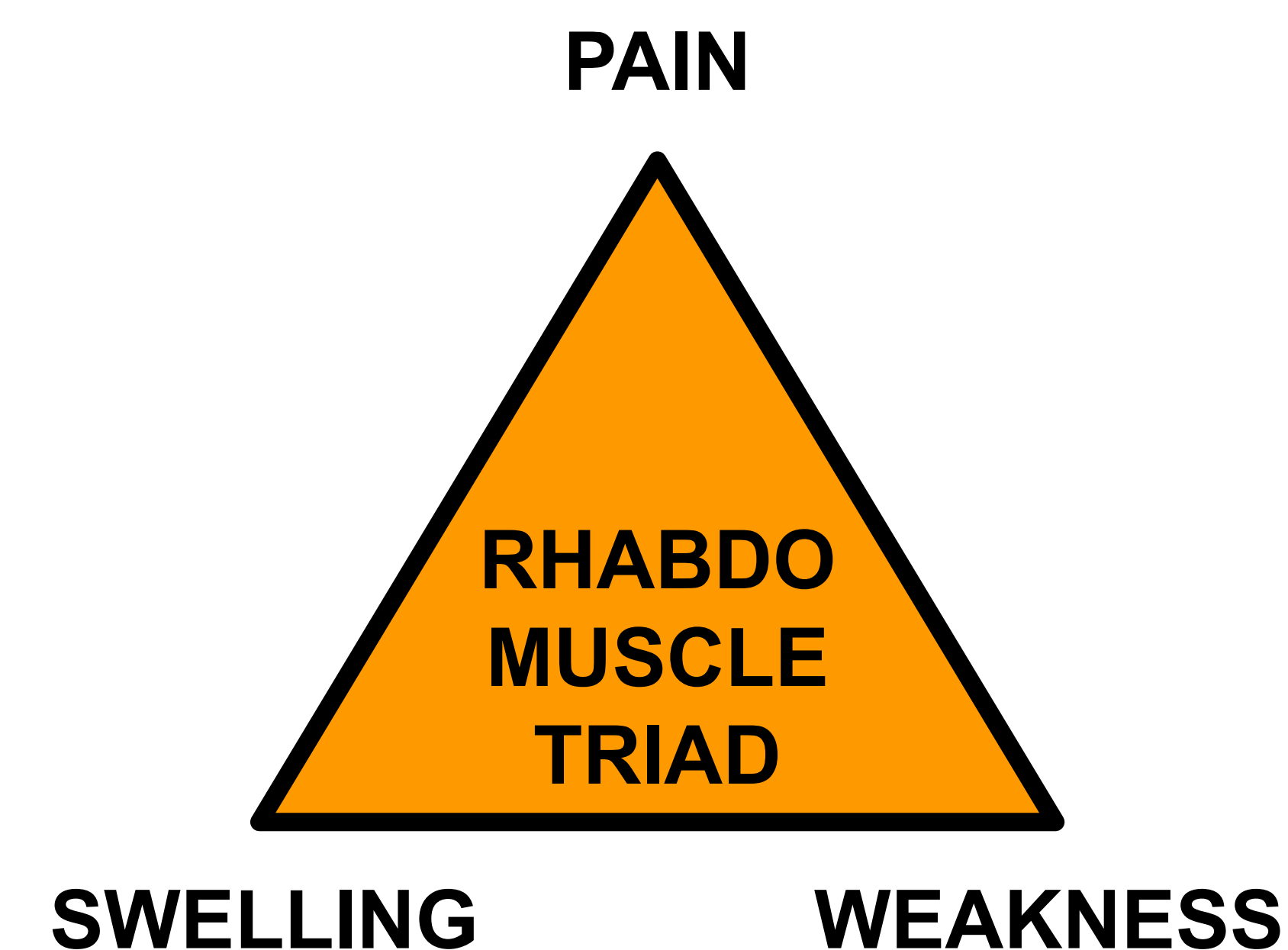
- 34 y/o female presents to the ED experiencing upper extremity myalgias and myositis after exercise three days prior
- CC: "Arm pain and swelling"
- Dx: Exertional Rhabdomyolysis

History

- Mhx: none
- Allergies: NKDA
- Medications: none
- Recently started strenuous exercise program
- Started experiencing arm pain and swelling the night of exercise.
- She has noticed darker-appearing urine
- Denies recent illness, traumatic injury, alcohol, tobacco, or recreational drug use

Physical Examination

- Well-appearing
- Afebrile, vital signs stable
- BIL L > R edema and tenderness to upper arms
- BUE strength 5/5, adequate range of motion



Diagnostics

- CK 42,797
- AST 519 | ALT 233
- UA: moderate hemoglobinuria
- Serum Creatinine: 1.02

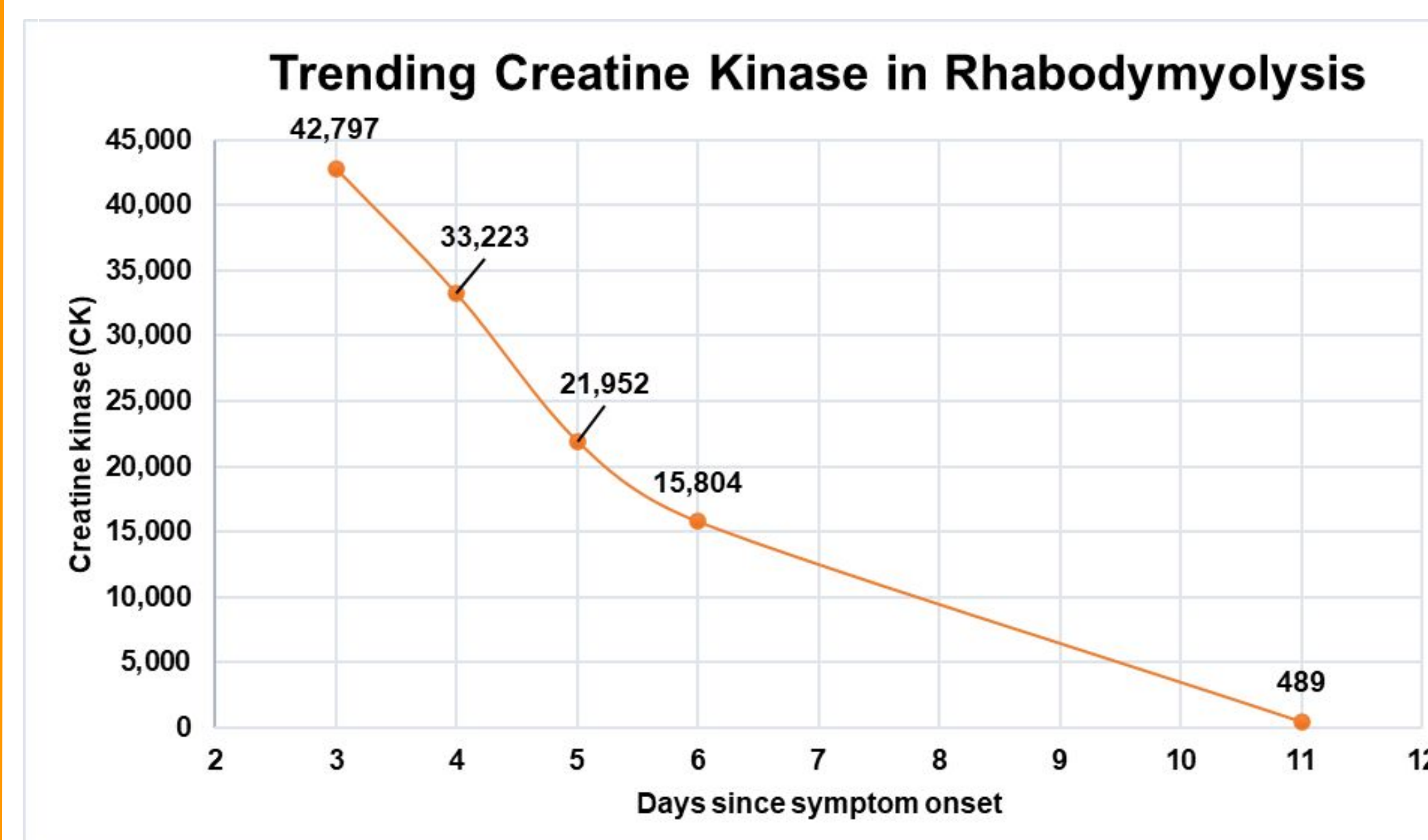


Figure 1: Trending of the patient's Creatine kinase level during their hospital stay and outpatient follow-up. The creatine kinase appropriately down-trended with the continuation of fluid management

Treatment

- Initial 2L normal saline fluid bolus given in ED
- Additional 1L normal saline fluid bolus upon admission
- Transition to maintenance 200 mL / hr normal saline
- Strict I/O
- Monitor CK, BMP, LFT, UA
- Avoid nephrotoxic medications
- Surveillance for complications

Complications of Rhabdo

- Acute renal failure
- Electrolyte disorders: hyperkalemia, hyperphosphatemia, hypo/hyperkalemia
- Metabolic acidosis
- Compartment syndrome
- Disseminated intravascular coagulopathy

Discussion

DIAGNOSTIC INTERPRETATION

Elevated Creatinine Kinase (CK):

- Female normal range: 30-145
- In this case (42,797), severely elevated

Elevated Aspartate Aminotransferase (AST):

- Normal range: 8-33

Elevated Alanine Transaminase (ALT):

- Normal range: 4-36

Urinalysis hemoglobinuria:

- A marker for acute kidney injury

DIAGNOSTIC CRITERIA

- **Triggers:** crush injury, prolonged immobilization, compartment syndrome, exertional, statins, burn injury, sickle cell trait, etc.

- **Muscle weakness and dark urine** (or myoglobinuria)

- **Acute CK elevation**

MANAGEMENT

- **IV fluid hydration/resuscitation:** to prevent further kidney injury and other end-organ damage.

- Strict **monitoring** of fluid **intake** and **output** measurement to evaluate kidney function.

- Serial lab work to ensure a **down trend** in **CK**.

Conclusions

- Patient presented with 2/3 classic triad symptoms & elevated CK
- Limitations
 - No ECG or TNI performed
 - Singular case study
 - Delayed care could have caused more serious consequences
- High incidence of AKI in patients with rhabdomyolysis ranging from 10-40%
- Rapid fluid resuscitation necessary to prevent further acute injuries

References

1. Gupta A, Thorson P, Penmasta KR, Gupta P. Rhabdomyolysis: Revisited. Ulster Med J. 2021 May;90(2):61-69. Epub 2021 Jul 8. PMID: 34276082; PMCID: PMC8278949
2. Torres PA, Helmstetter JA, Kaye AM, Kaye AD. Rhabdomyolysis: pathogenesis, diagnosis, and treatment. Ochsner J. 2015 Spring;15(1):58-69. PMID: 25829882; PMCID: PMC4365849.

REFERENCE/GUIDELINES POSTER

Title of Research Presentation: Use Title Case– Not All CAPS (Too Hard to Read): Centered or Left Justified

Additional Affiliation logo, such as the hospital logo, might go here.

Author One¹, Author Two¹, Author Three¹, Etcetera, and Last Author²

¹Department, Institution Name, City, State, ²Department, Institution Name, City, State (if applicable)

Email address and/or webpages might be listed here

Abstract/

If specified, your poster may be required to include the abstract as submitted. It is usually helpful to have it be the same here as in the abstract book for the meeting.

Helpful hints:

Body text: Arial or Calibri, 32-36 pt font size is a good readable size. Slide around the size of the text box and the other elements of the poster to best accommodate the abstract.

Most meetings specify the word count of the abstract, and can vary from 250-500 words.

Remember:

- Posters are designed to be viewed from a distance, and should not be too text heavy-- the reading should be quick reads; most people only take 5-10 minutes at a poster, even if it is one that is of interest
- Use text blocks that are not too wide
- Use visuals as much as possible to convey your information.
- Number the visuals in order so that the reader (or you, as you present) can easily follow the content
- Add figure legends to all diagrams, pictures, tables, graphs, etc.

Introduction

The introduction introduces the clinical presentation and should include:

- Relevant facts about the clinical condition
- Importance of the case
- Facts and statistics
- Context of the case with respect to current literature or new interpretation of previous understanding.

This can be bullet points of text, a graphic describing a method, or graphic of the overview of your project.

Additional helpful hints about text:

- To adjust the spacing of your text and/or bullets/numbers, use the indent slide along the ruler at the top of the PowerPoint. **Don't use the spacebar to adjust the position of your text.** The spacing will often print somewhat differently when using the spacebar.
- You can also use the align text tools for centering or justifying Left or Right

Case Description

- In this section, include what the reader needs to understand in order to understand the base.
- Make sure all pertinent findings are clearly stated.
- Provide only those tests and lab results that are relevant to the understanding of this case. This may include both positive and negative results.
 - If a test is an unusual test, be sure to include normal levels; consider normal levels for all test and laboratory results
 - Tables and/or figures can be used to present these findings
- Chronological order is a good way to present case information
- Photos and pictures should be included

Additional considerations related to posters:

- Choose your style of text carefully. It is usually better to choose one, and stay with it. You can use **bold** and regular (and italics for genus and species), but otherwise, your poster should be one style of text.
 - Sans serif fonts (e.g. Arial or Calibri) tend to be easier to read than serif fonts (Times New Roman)
- Turn off "Snap to Grid", so you move objects easier on the PowerPoint slide.

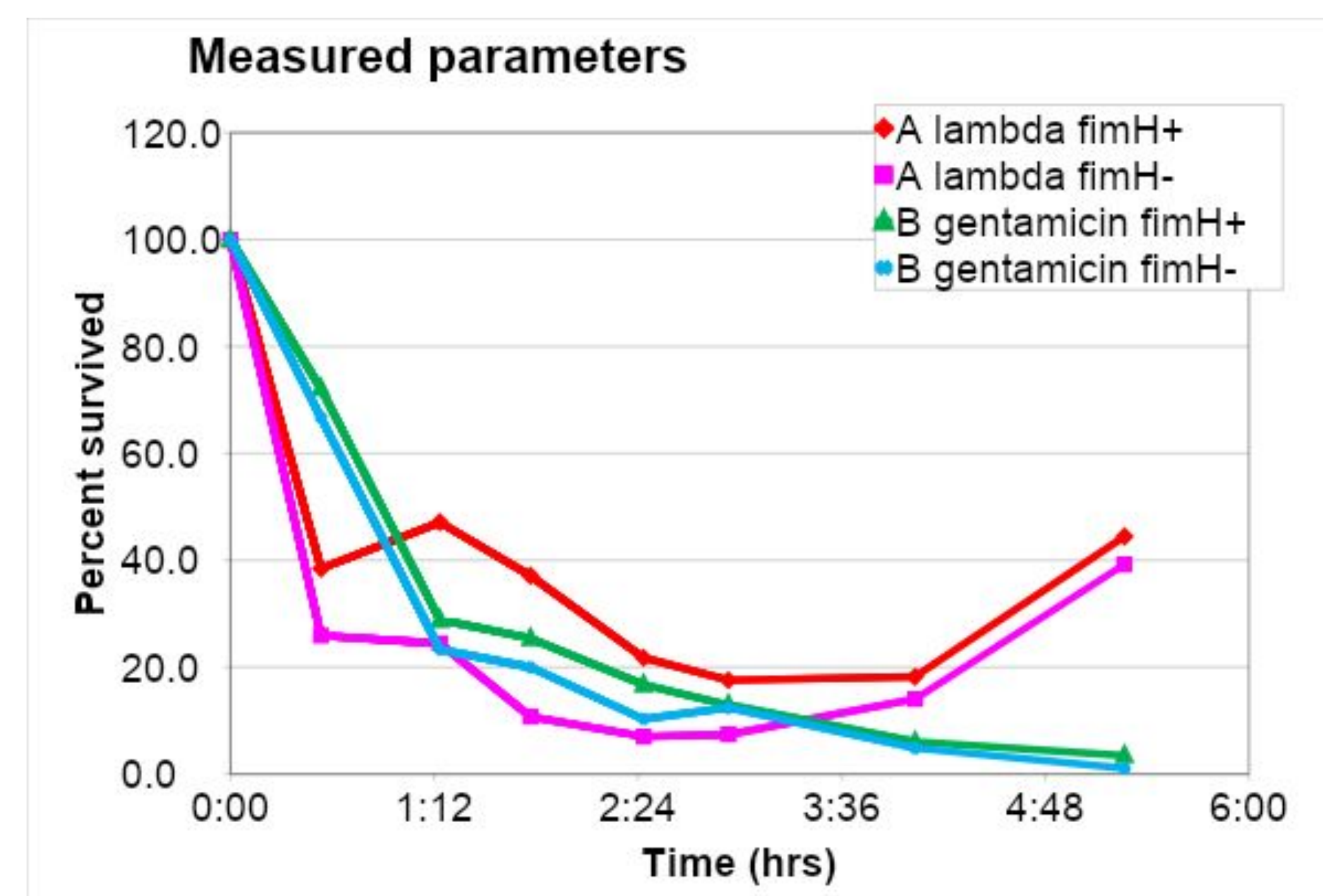


Figure 2. Title of this graph. This graph was made in Excel and then copied into the poster PowerPoint. Most of the features can be edited directly here (Chart tools). It is usually helpful to have a title on your graphs so the casual viewer can decide to stop and look at your data. The legend can be in the graph as it is here, or within this text. Don't forget to label the X and Y axis. I am not a clinician so the type of data or values you would include in your visuals will need to be determined by you and your collaborators. However, try to use visuals as much as possible.

Results

Date	A1C level (percent)	Estimated average blood sugar (mg/dL)	Some other data constraint
01/01/2015	7	154	Fasting
03/01/2015	9	212	Clear liquid diet
05/01/2015	13	326	High carbohydrate diet
07/01/2015	9	212	High protein diet
09/01/2015	7	154	High fat diet

Table 1. Laboratory data. This table was created in PowerPoint, but other ways to create tables can be used as well. Tables made in Word can be edited in Word. Keep the tables simple. If it gets too hard to follow, consider breaking it into 2 tables. Table and figure legends can use smaller font (26-28 pt). They are for the individual who wants the details. These details should not be necessary for the average viewer in order to understand the overall message in your poster.



Figure 3. Example of a picture file. Ideally this would be a picture of something important for your case. I don't have any patients, so I used a picture of my daughter from her shadowing. Try to use images that are at least 300 dpi. (This picture isn't, but it will keep the file size reasonable for distribution of the template.)

When inserting a picture file, be careful about resizing. It is easy to stretch a picture and make it look weird. When you resize, press the SHIFT key while you drag the corner of the picture to resize. This will keep the aspect ratio the same. If you accidentally stretch the picture, you can right click on the picture, and select "size and position". That will give you the option to "reset", which will put the picture back to its original size and shape, so you can start over again.

Discussion

The purpose of this section is to explain anything that isn't clear from the case description, and to interpret findings.

- Prevalence and incidence data might be included here.
- Implications beyond your individual case might be here also.

Some additional information about posters:

- Ask about the size of the printer paper roll BEFORE you start making your poster. It is easier to start with the right size poster than to resize everything to a different size later.
- This poster is 36 X 48 (H X W). You set that under the "design" tab, then page set up.

Conclusions

- Provide any closure regarding the case
 - Mention any limitations for your description-- such as limits to your literature review, geographical distribution, etc.
- If you need help with this template, or want to ask specific questions, please let me know.
- Hamrick@campbell.edu

References

The font on the references can be smaller (20-24 pt). Use the same format for all of your references.

1. Hamrick, T. S., J. R. Horton, P. A. Spears, E. A. Havell, I. W. Smoak & P. E. Orndorff, (2003). Infect Immun 71: 5202-5209.
2. Jorasch, P., F. P. Wolter, U. Zahringer & E. Heinz, (1998). Mol Microbiol 29: 419-430.
3. Kaya, S., Y. Araki & E. Ito, (1985). Eur. J. Biochem. 146: 517-522.

Acknowledgements

The departments, clinical affiliations, or individuals not included as authors should go here. Any funding sources, (grants, sponsors, etc.)