

Adverse Events: Management & Recovery



How do our muscles get energy?

- ENERGY originally comes from FOOD to produce **ATP**
- Muscle cells need **ATP** to contract *and* relax

CARBOHYDRATES

- Fruit/vegetables/grains/beans
- Excess glucose is stored as glycogen (**muscle – 80%** & liver - 20%) until stores full, then fat

FAT

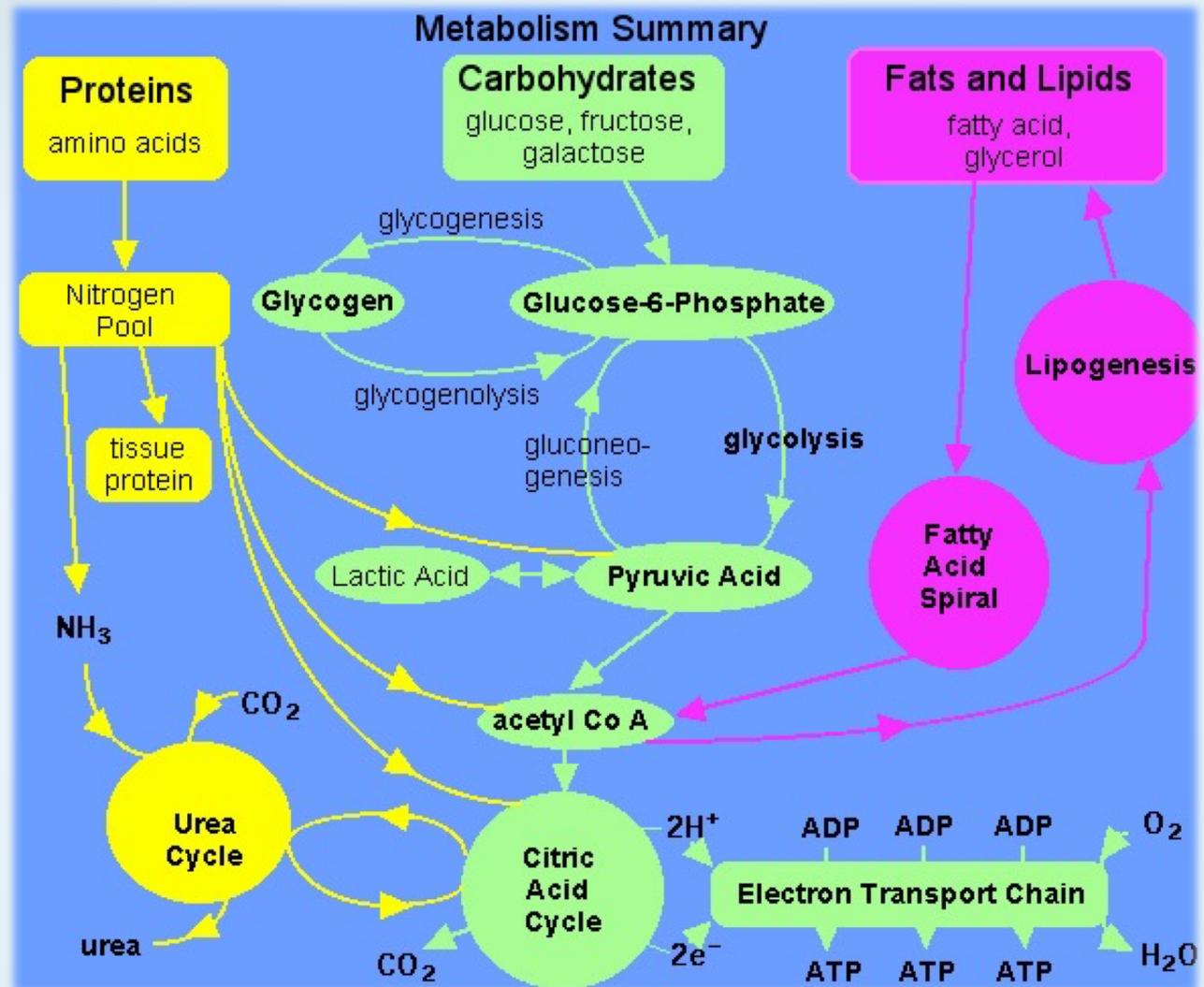
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- Oils/nuts/dairy/meat/olives
- Excess fat is stored in adipose tissue

PROTEIN

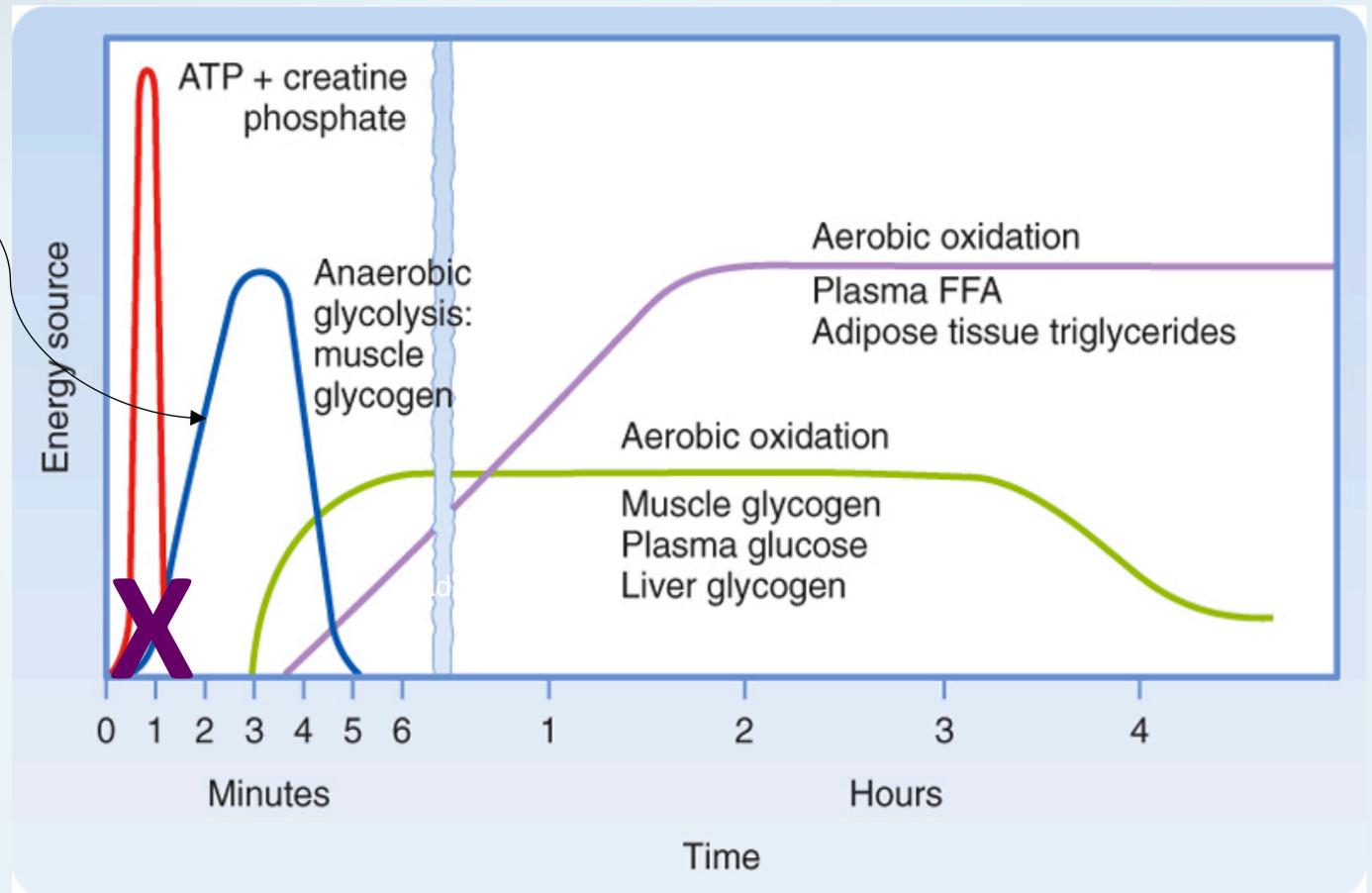
- Meat/dairy/nuts/eggs/fish
- Broken down into amino acids

What are the ingredients...

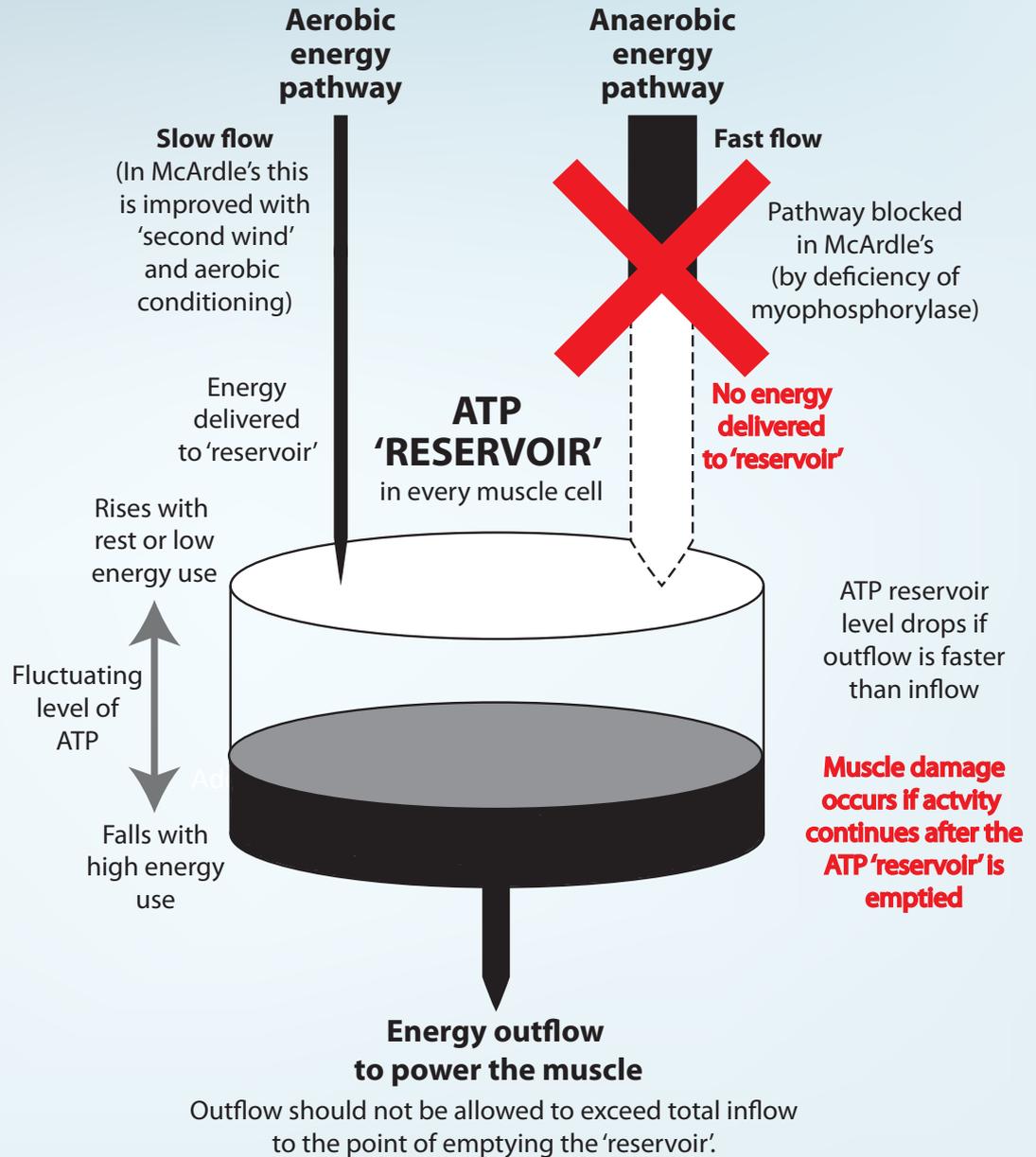


Different pathways...

Blocked
in
McArdle
Disease

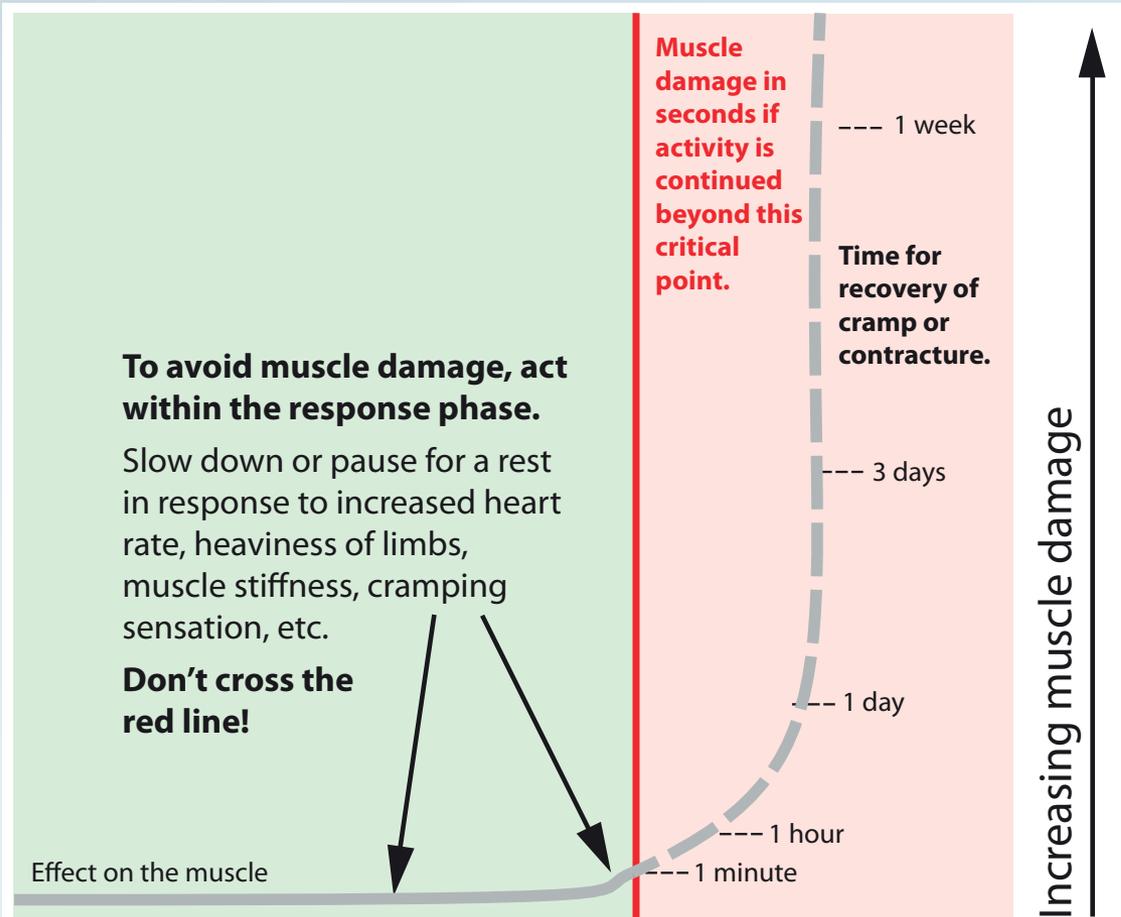


What happens in McArdle's?



What you may feel when your muscles don't have enough **ATP** (energy)





Stay in the 'safe zone'

Activity: increasing energy expended

Stay in the safe zone

6 seconds at maximum intensity.
 Many hours in aerobic phase.

← Expands with improved aerobic fitness →
 → Contracts with de-conditioning ←

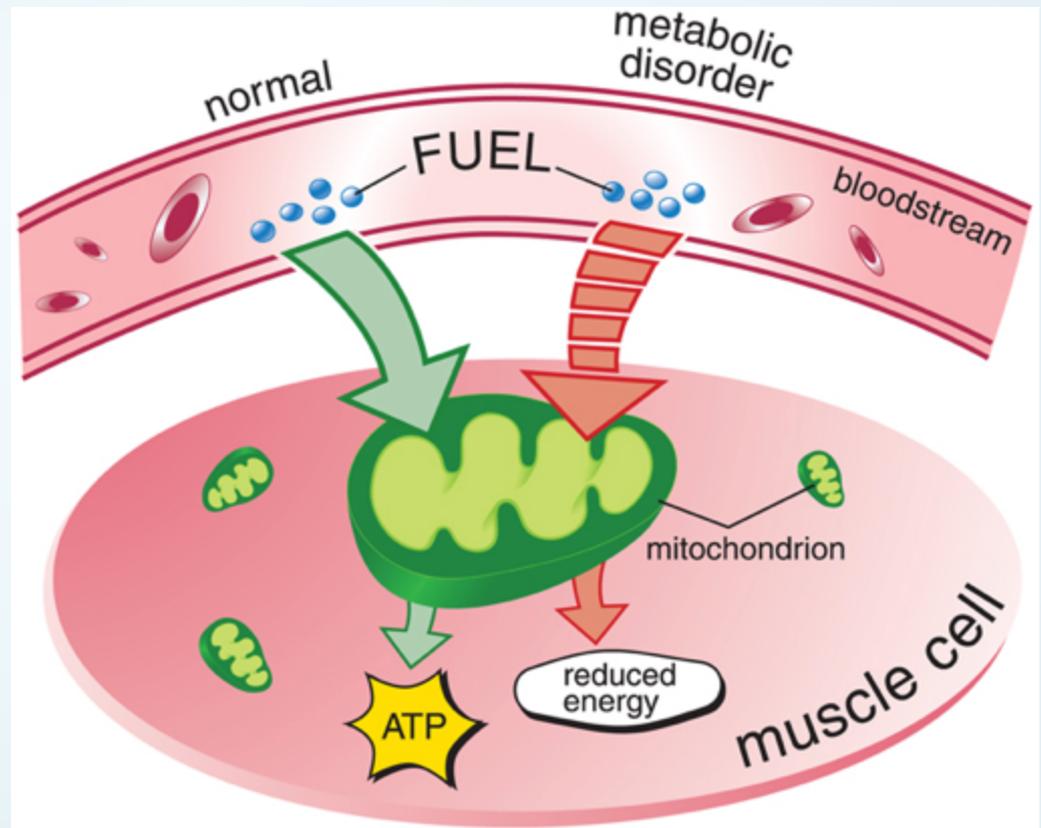


GOAL

Avoid emptying the
ATP 'reservoir'!!

A lack of **ATP** can result in muscle damage,
leading to...

- Rhabdomyolysis
- Myoglobinuria
- Contracture
- Acute Renal Failure
- Compartment Syndrome



Rhabdomyolysis

Cause	<ul style="list-style-type: none">• Lack of energy (ATP) for working muscles results in damage to muscle tissue
Presentation	<ul style="list-style-type: none">• Classic triad of symptoms – muscle pain, weakness and may have dark urine (myoglobinuria)• Usually involves specific group of muscles; although may be generalized• Feel unwell, fever, tachycardia, nausea, and vomiting• Elevated CK (rise within 12 hours, peaks around 24 hours, then reduces 30% to 50% per 24 hours)
Treatment	<ul style="list-style-type: none">• Preserve kidney function with IV fluid replacement (saline)• Dextrose (may reduce cell injury)• Diuretics (to increase urine)• Bicarbonate (restore urine pH)• Monitor for hyperkalemia, hypocalcemia, elevated liver enzymes, cardiac dysrhythmias, ARF, DIC

Myoglobinuria

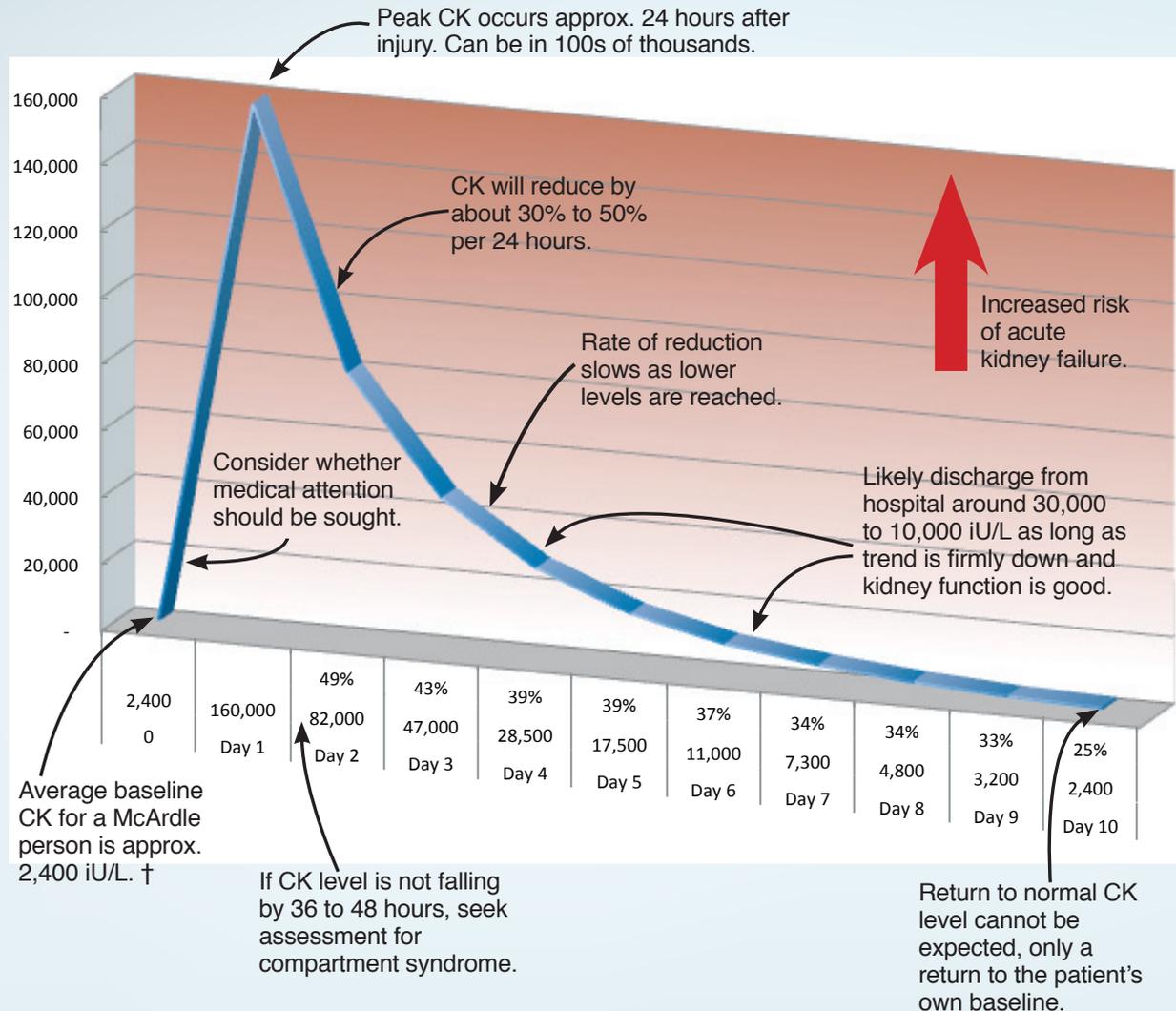
Cause	<ul style="list-style-type: none">• A result of Rhabdomyolysis• Myoglobin (protein) is released from damaged muscle tissue into the bloodstream• The kidneys filter the myoglobin into the urine
Presentation	<ul style="list-style-type: none">• Not always evident in Rhabdomyolysis• Pink-tinged/red/cola colored urine (myoglobinuria)• As myoglobin passes through the kidney, the tubules can become blocked --> acute renal failure• May have decreased urine output & rapid weight gain

When to seek medical attention

Treat at home	<ul style="list-style-type: none">• Cramp rather than fixed contracture• Small muscle group affected
Go to hospital if ANY of the following:	<ul style="list-style-type: none">• Large muscle group in contracture• Feeling very unwell after activity• Low volume of urine output (or none at all)• Myoglobinuria• Not starting to recover after 24 hours

CK levels and discharge

Typical trend in Creatine Kinase reduction following rhabdomyolysis



Contracture

Cause	<ul style="list-style-type: none">• Static or intense dynamic exercise (squatting or running), particularly if continued in the presence or pain• Insufficient ATP causes muscle damage
Presentation	<ul style="list-style-type: none">• Affected muscle goes hard, swells and becomes difficult to relax or move• Severe pain
Treatment	<ul style="list-style-type: none">• Rest• Cool/ice pack• Heat pack• Gentle massage (not for a fixed contracture)• Monitor pressure for to Compartment Syndrome

Acute Renal Failure (ARF)

Cause	<ul style="list-style-type: none">• Severe muscle damage (rhabdomyolysis) resulting in blocked tubules in the kidneys
Presentation	<ul style="list-style-type: none">• Muscle pain, weakness and dark urine (myoglobinuria)• Feel unwell, fever, tachycardia, nausea, and vomiting• Decreased urine output & rapid weight gain• Elevated CK (rise within 12 hours, peaks 1-3 days, half-life 1.5 days) and myoglobin
Treatment	<ul style="list-style-type: none">• Monitor renal function• IV fluid replacement to decrease severity of ARF• Dialysis• Typically reversible

Compartment Syndrome

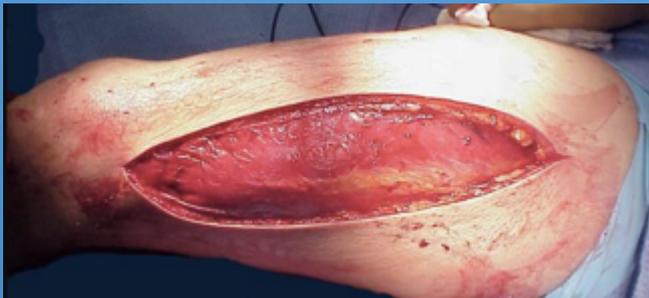
Cause

- Swelling of muscle, leading to the build up of pressure within the compartment (fascia) containing the muscle
- Vicious cycle – swelling/pressure/swelling/pressure

Presentation

- Severe muscle pain, swelling, weakness, and numbness
- Very tense, pale skin over the affected area
- Reduced ability to move affected area
- Diminished or absent pulse or sensation in affected area
- Elevated CK

Treatment



- Monitor CK, myoglobin, and kidney function
- Measure pressure within the compartment of affected area (insertion of a sterile needle)
- If caught early: elevation, ice therapy
- Surgery (fasciotomy) – open the compartment to relieve the pressure
- Close the wound



Considerations for Recovery from Rhabdomyolysis

- Follow-up with your physician (as advised)
- Have your CK checked
- Search for the help of a clinician that has expertise in McArdle disease
- If you do not have any symptoms (muscle weakness or pain), very gradually return to less-intense activity/exercise

Avoiding future episodes

- Avoid strenuous activity/exercise
- Avoid unaccustomed activity/exercise
- Prevent dehydration before, during, and after activity/exercise
- Limit activity/exercise in hot and humid environments
- Follow a well-balanced diet
- Practice getting into '*second wind*' routinely
- Exercise regularly to increase aerobic fitness
- Be sure not to empty your ATP '*reservoir*'
- Beware of '*other*' risk factors for rhabdomyolysis – medications, virus/infection, emotional stimulus

THANK YOU



Avoid

Recognize

Treat

Recover

Questions?