Under Pressure:

Crush Injuries in Technical Rescue

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Disclosures

What is “technical rescue”?

The application of special skills, knowledge, and equipment to resolve unique and/or complex rescue situations.


TECHNICAL
RESCUE


N186SD

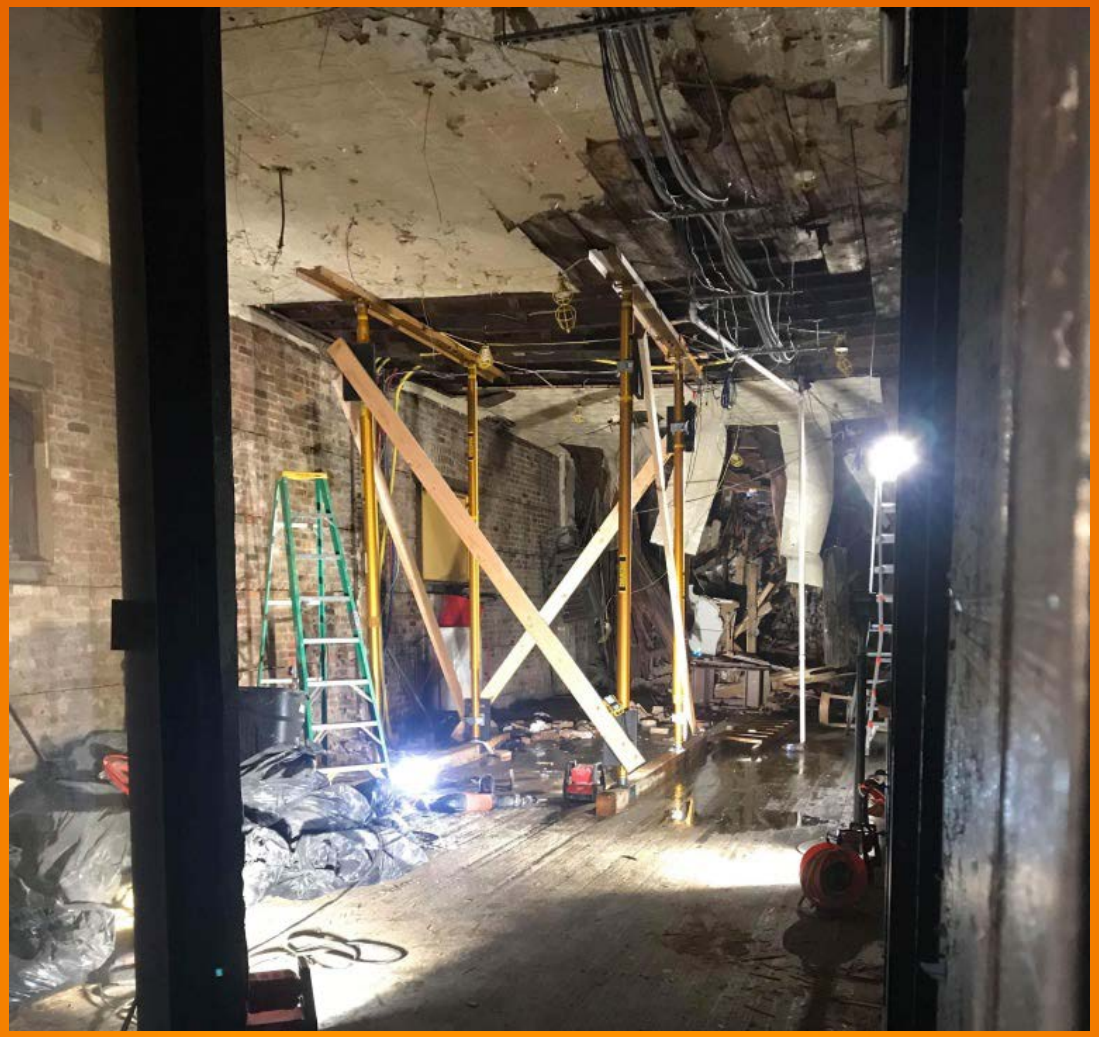

SURF


SEARCH & RESCUE


BUMP 8

Vehicle

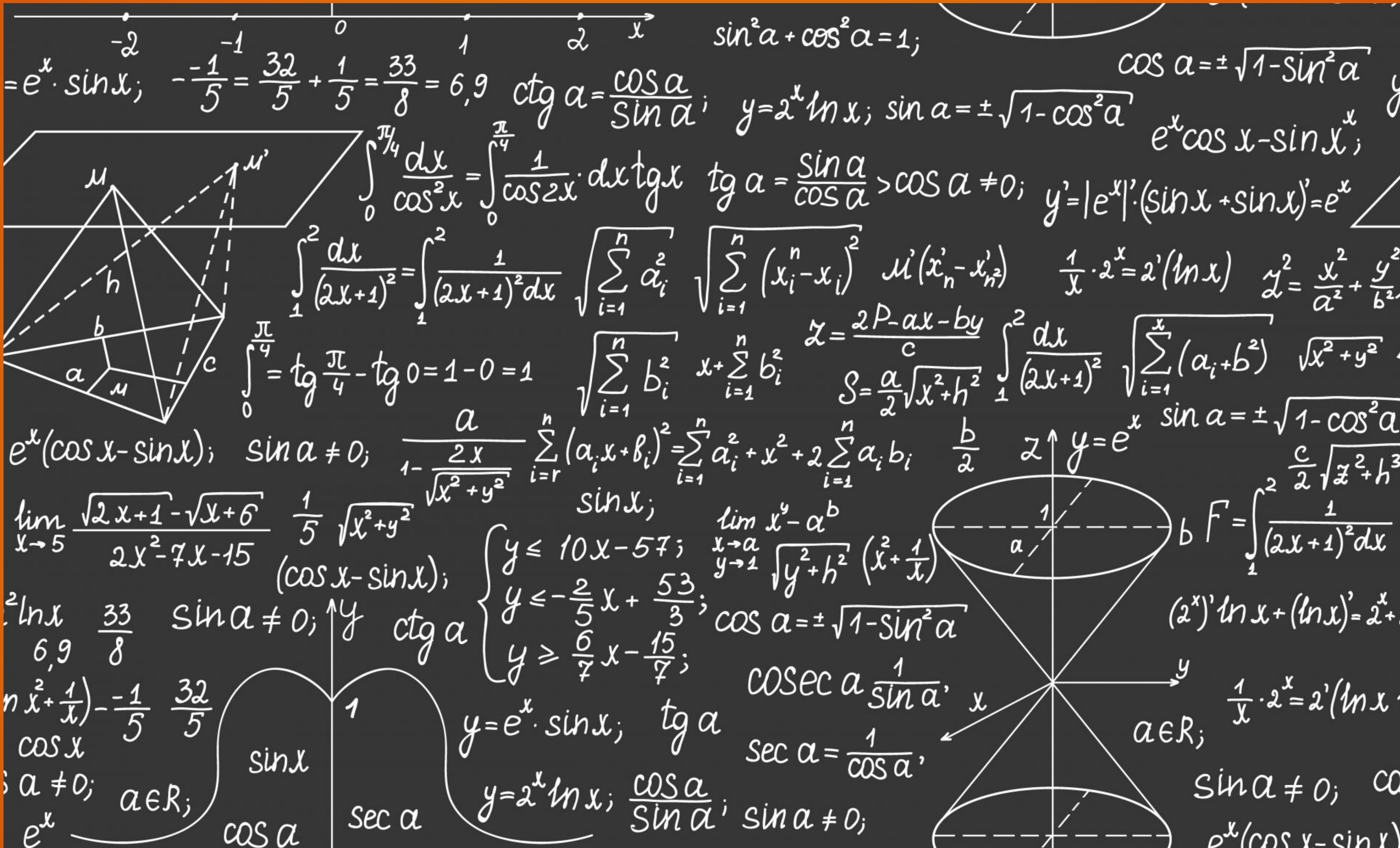
Structural Collapse



Trench

Machinery

Kinematics



sin²a + cos²a = 1;
cos a = ± √1-sin²a
ctg a = cos a / sin a;
y=2ˣ ln x;
sin a = ± √1-cos²a
tg a = sin a / cos a
cos a ≠ 0;
eˣ(cos x-sin x);
sin a ≠ 0;
cosec a 1/sin a;
sec a = 1/cos a;
y=eˣ · sin x;
a∈R;

Kinematics

Car Crash

- 2,000lb. Vehicle
- 60mph
- ~490kN of force

Kinematics

FEMA 329: Field Debris Estimating Guide

- ~1,000-2,000lbs./cubic yard building material

Kinematics

- Dry topsoil: ~75lbs/cubic foot
- Saturated topsoil: ~110lbs/ cubic foot

Kinematics

2 cubic yards = 4,000-6,000 lbs

Kinematics

- Shear wall collapse speed:

Kinematics

- 1 cubic yard of soil: 18kN

Kinematics

Kinematics

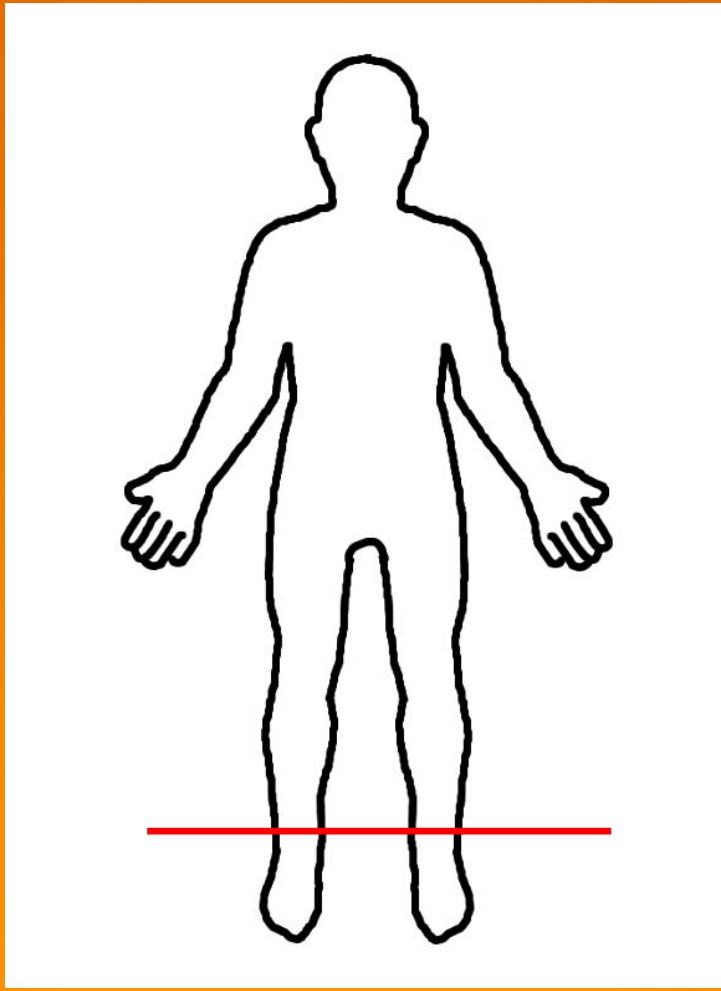
Kinematics?

- 3.3kN to break ribs
- 4kN to break femur

Trench Collapse

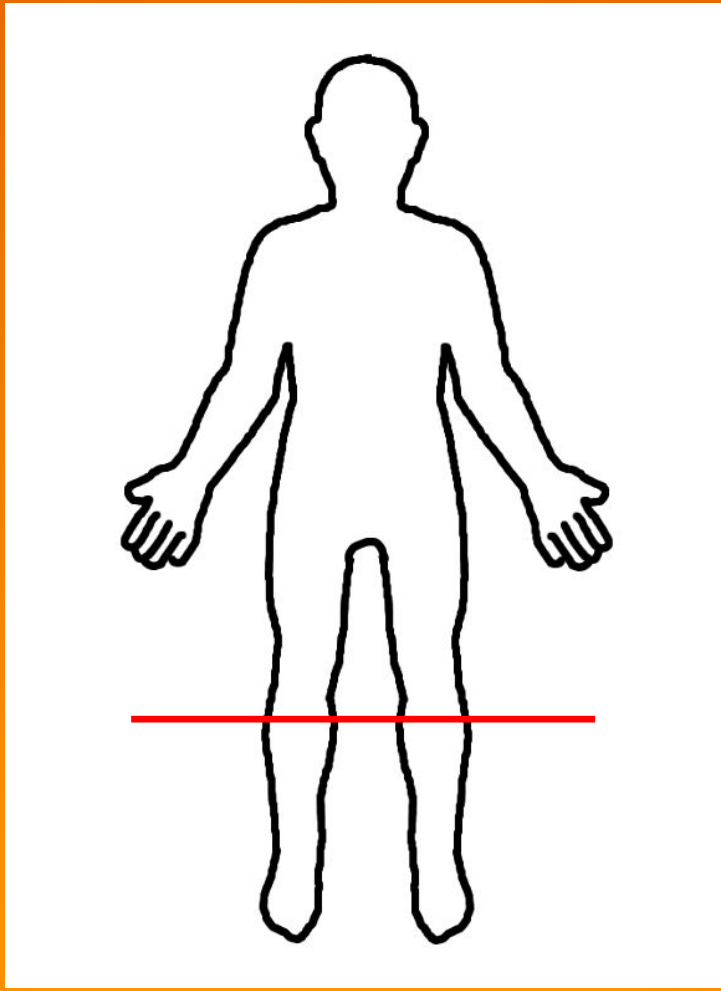
- Don’t have to be buried to die!

Trench Collapse



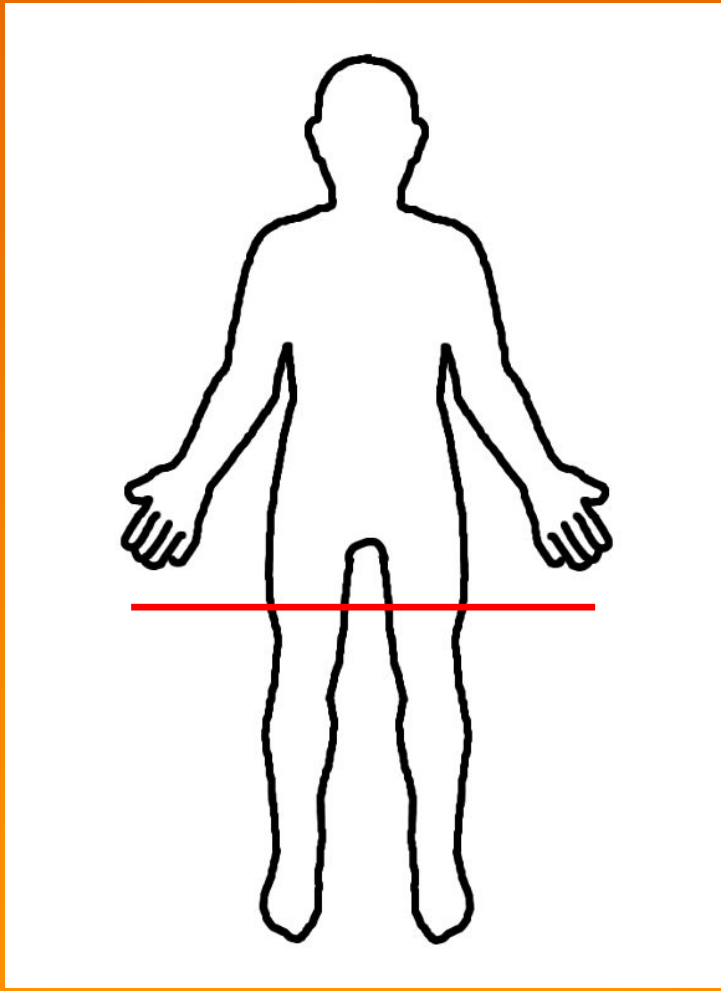
Can self-extricate

Trench Collapse



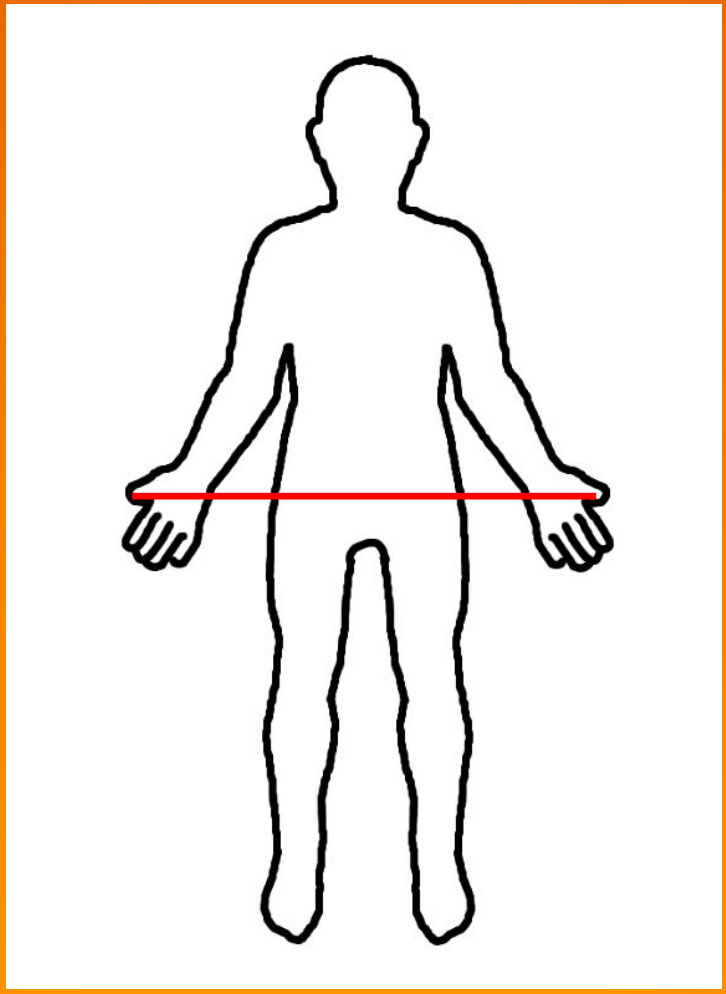
May self-extricate (with tools)

Trench Collapse



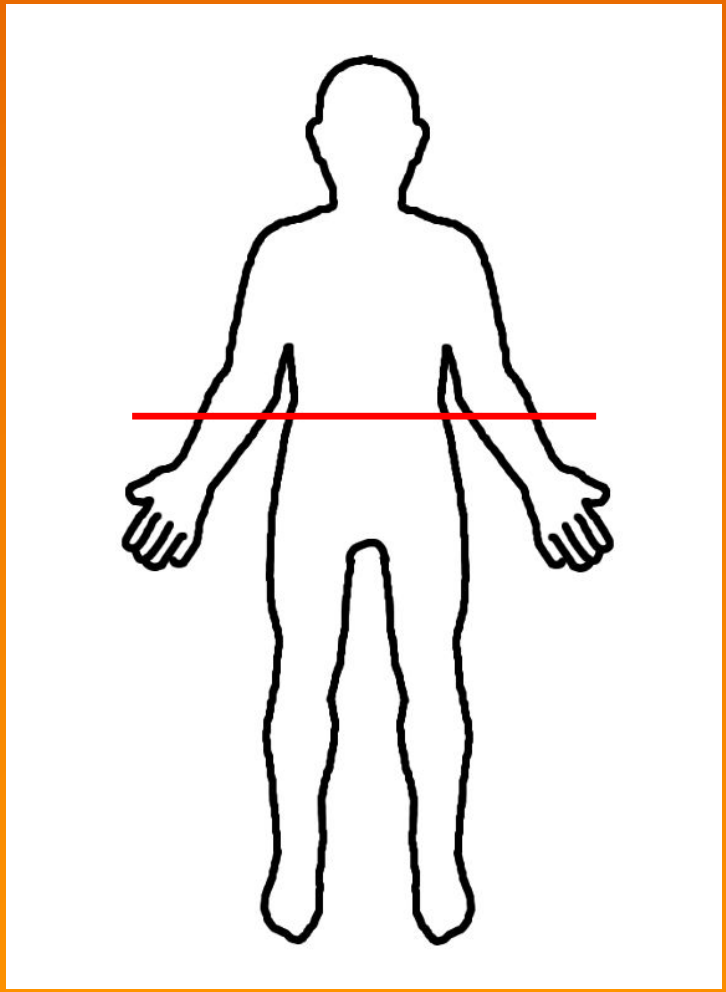
Self-extrication unlikely

Trench Collapse



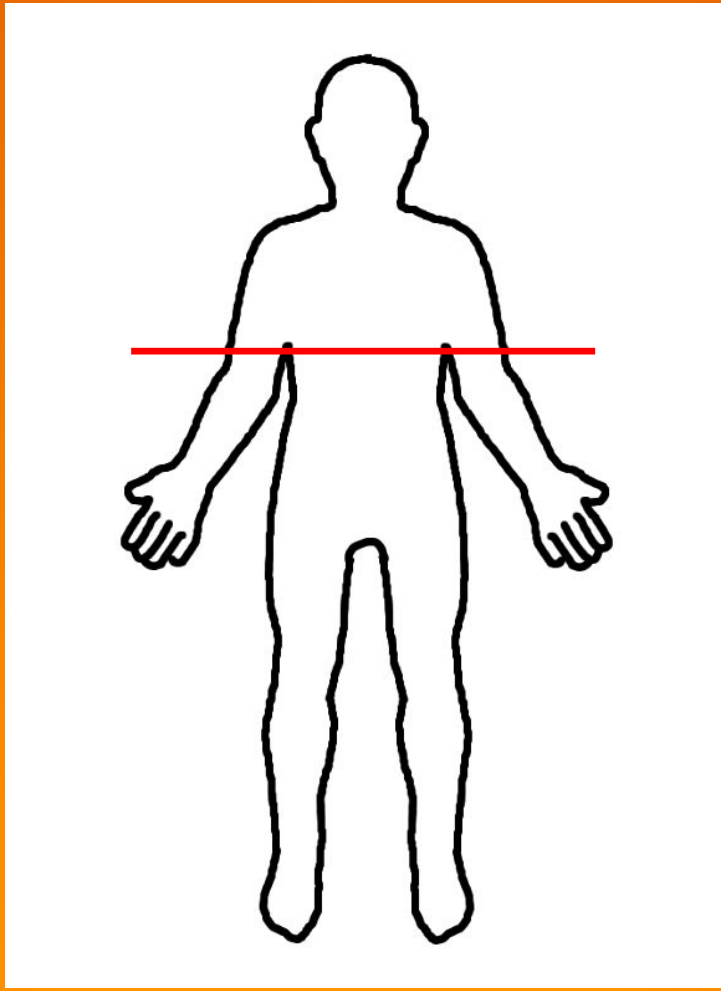
Self-extrication impossible
Significant medical concerns

Trench Collapse



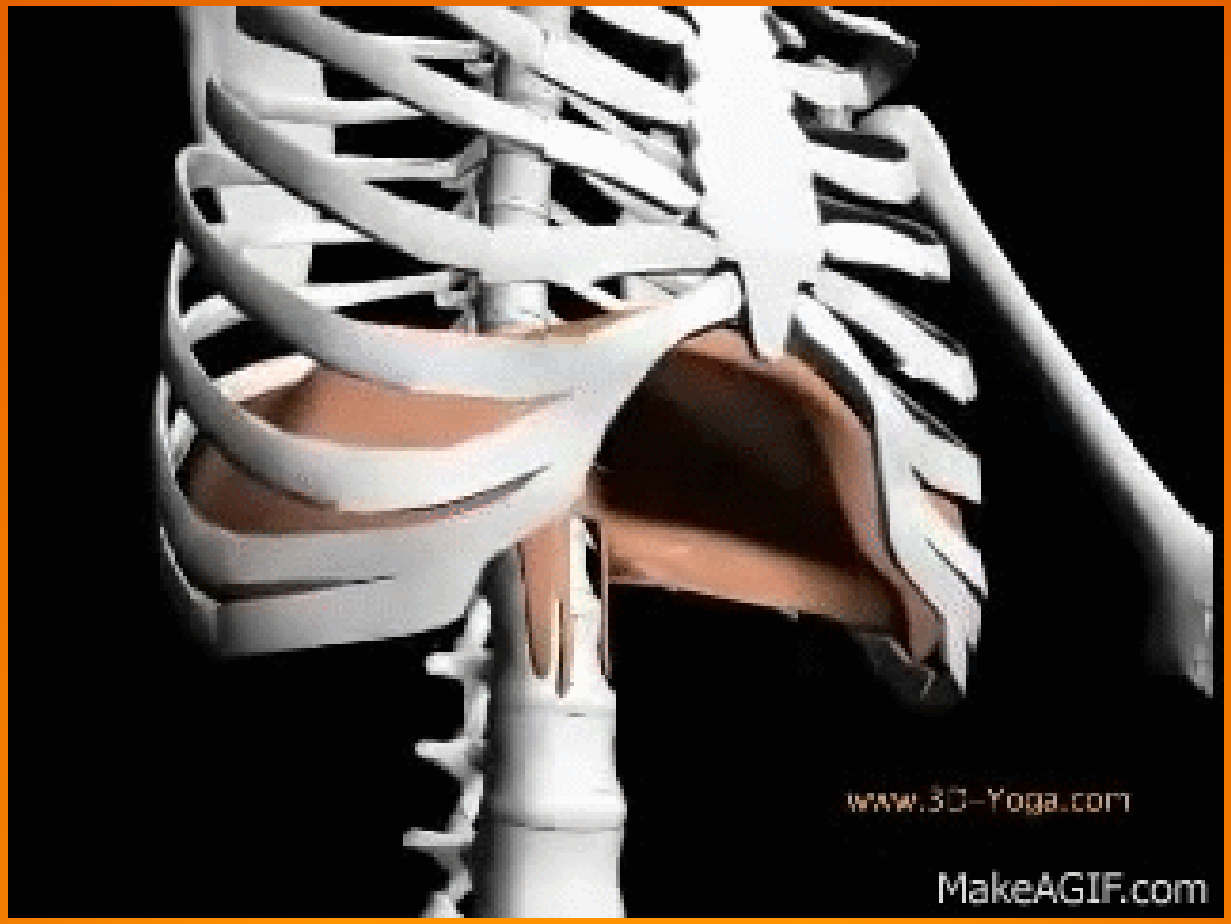
Self-extrication impossible
Urgent medical concerns

Trench Collapse



Self-extrication impossible
Likely fatal

Crush Injuries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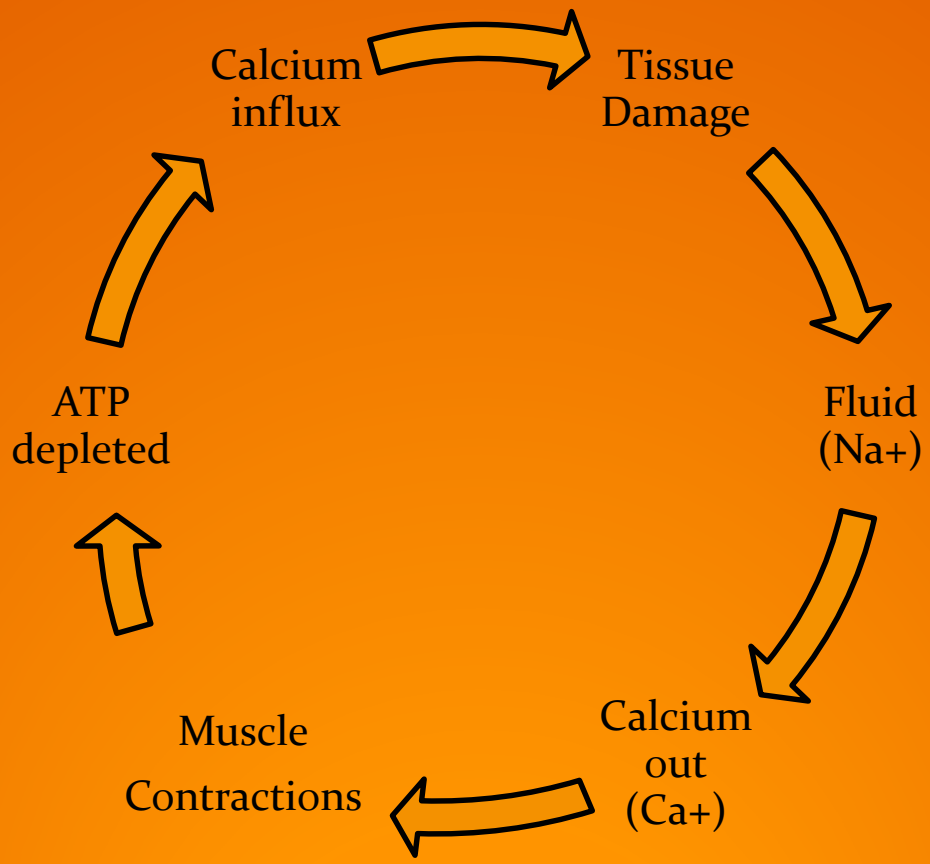
Rhabdomyolysis

- Tissue damage
- Tissue hypoxia
- Reperfusion

Rhabdomyolysis



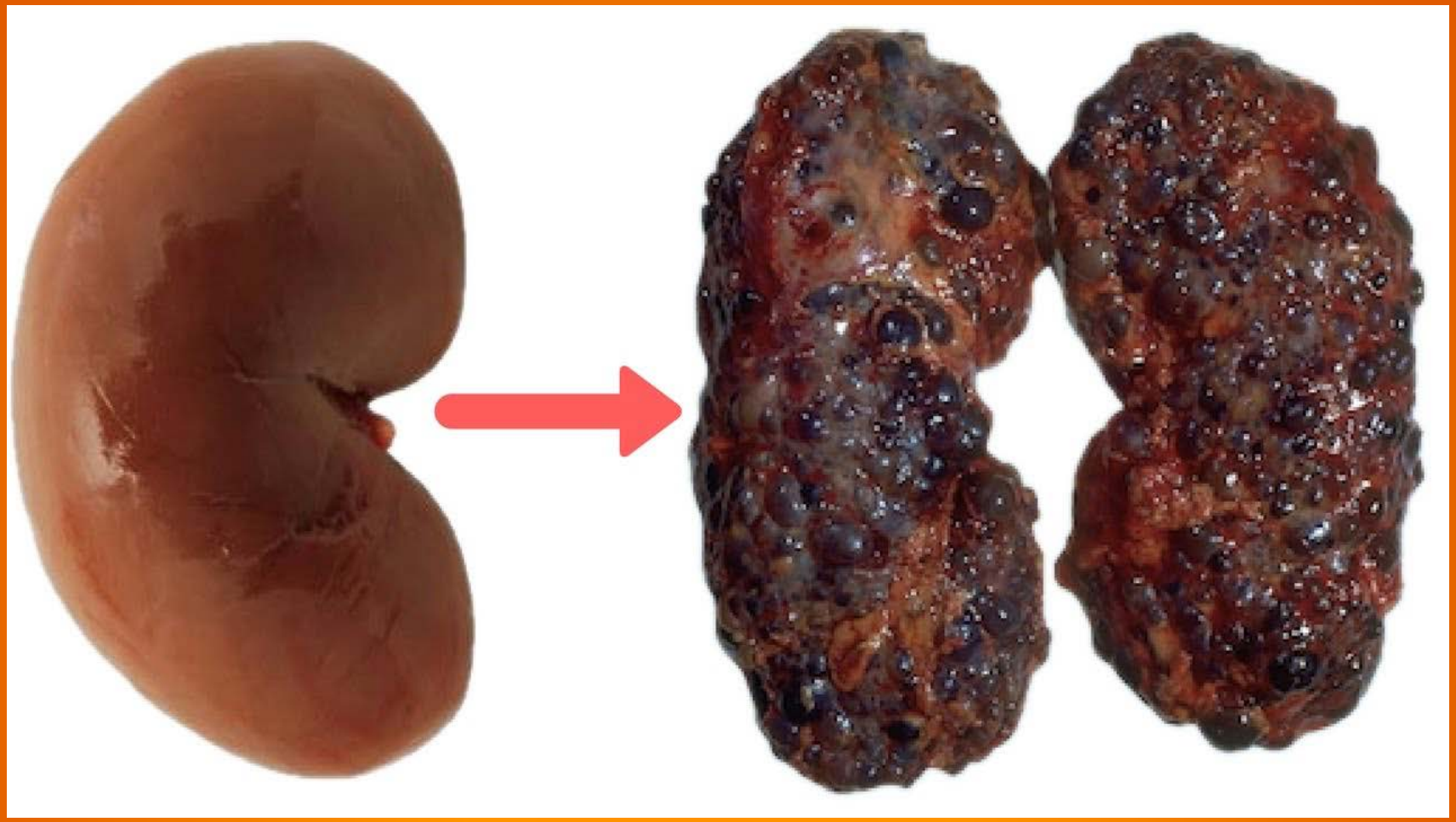
Rhabdomyolysis

- Potassium (K+)
- Myoglobin
- Phosphate
- Thromboplastin
- Creatine
- Creatine Kinase

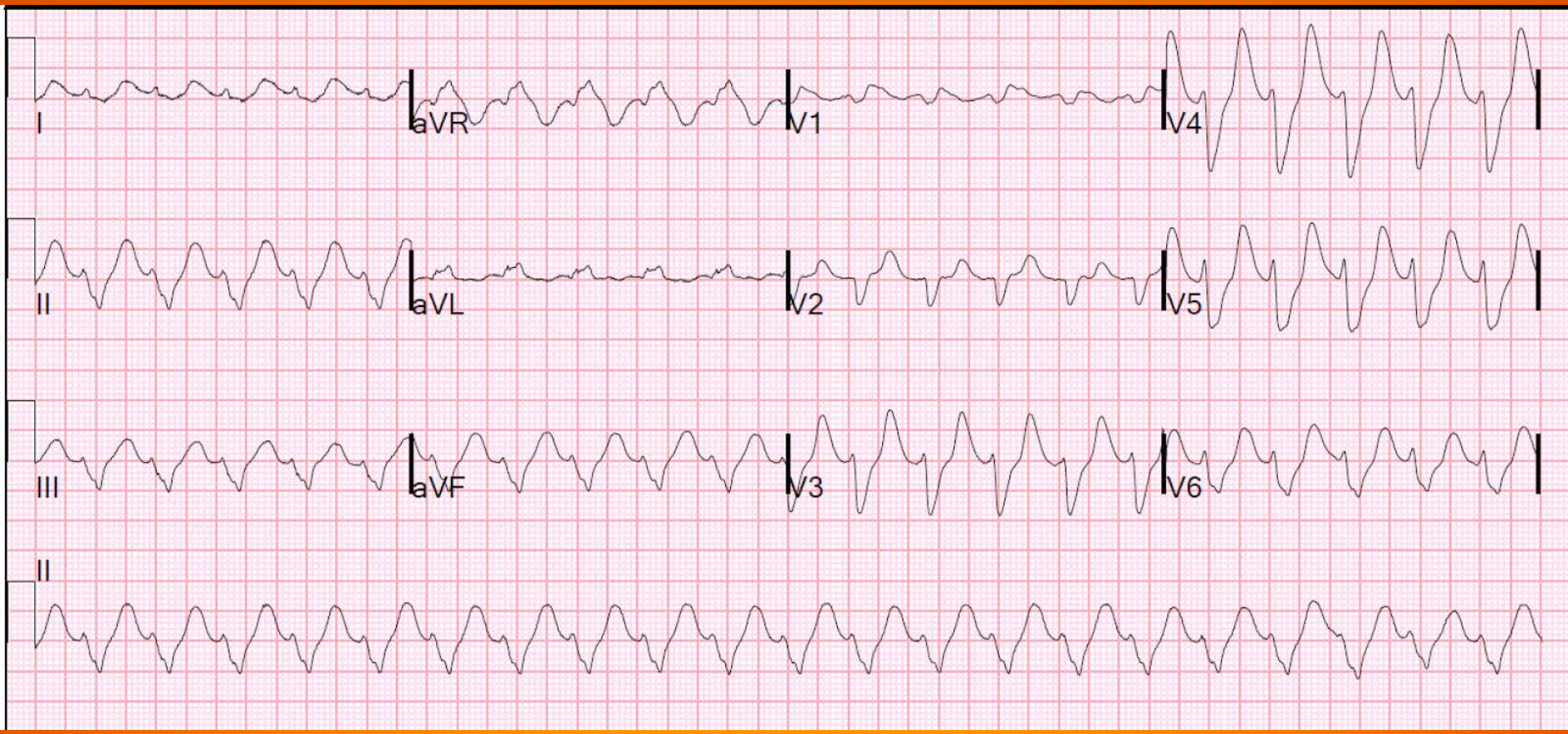
Rhabdomyolysis

- Acute tubular necrosis

Rhabdomyolysis



Rhabdomyolysis



Rhabdomyolysis

(2-16) General: Crush Injuries

EMT

- ABCs and vital signs every 5 minutes, if practical
- Airway management and appropriate oxygen therapy
- Consider EMS physician response, if available, or early physician consultation for prolonged entrapment

EMT STOP

ADVANCED

- Vascular access, ideally at 2 sites (no more than one IO)
- Normal saline 1 liter IV bolus
- Refer to the "General: Pain Management" protocol, as indicated

ADVANCED STOP

CC

- Cardiac monitor, if possible, with 12-lead ECG repeated at 30 minute intervals

CC STOP

PARAMEDIC

- If one complete extremity is crushed > 2 hours, or 2 extremities are crushed >1 hour:
  - Sodium bicarbonate 50 mEq IV slow push every 30 minutes
    - In addition, one minute prior to extrication: Sodium bicarbonate 50 mEq IV

PARAMEDIC STOP

MEDICAL CONTROL CONSIDERATIONS

- If hyperkalemia is suspected and ECG changes, calcium chloride 1 gram IV (over 5 minutes). Repeat in 10 minutes, if there is no resolution of the ECG changes of hyperkalemia
- Albuterol via nebulizer
- Consider application of a tourniquet for prolonged entrapment placed as close as possible to the crush injury prior to the release of the extremity

Key Points/Considerations

- Consider EMS physician response to the scene, if prolonged extrication is anticipated
- A minimum of 50 mL of normal saline should be given between the bolus of calcium chloride and the bolus of sodium bicarbonate
- Hyperkalemia is indicated by PVCs, peaked T-waves, or widened QRS complexes
- After extrication, immobilize the extremity and apply cold therapy; do not elevate the extremity


B BRAUN
1000 mL
250 mL
EXP 02/20 LOT J7K792
0.9% Sodium Chloride
Injection USP
1000 mL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INJ., USP, 8.4%
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