

Commotio Cordis

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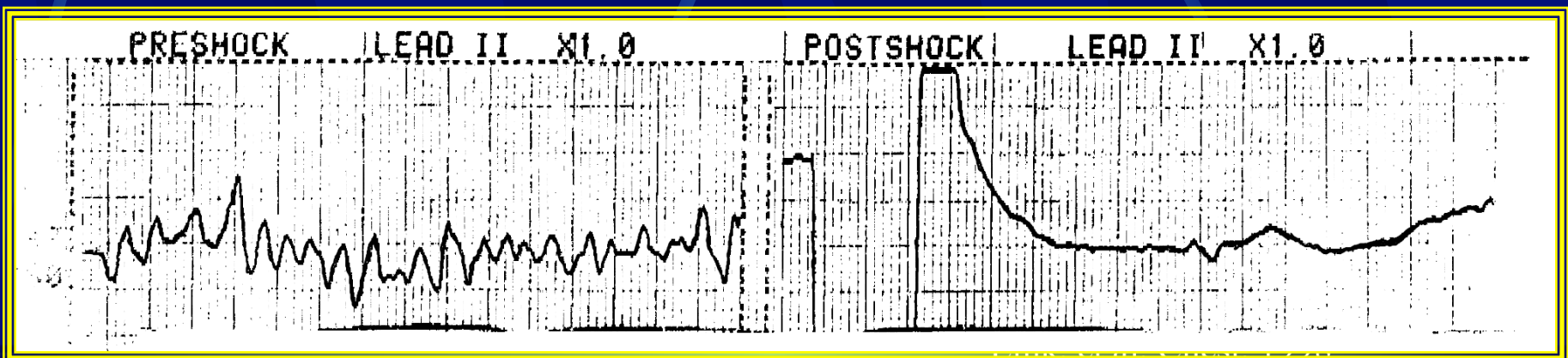
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Athletes Heart, HCM, SCD Athlete Conference

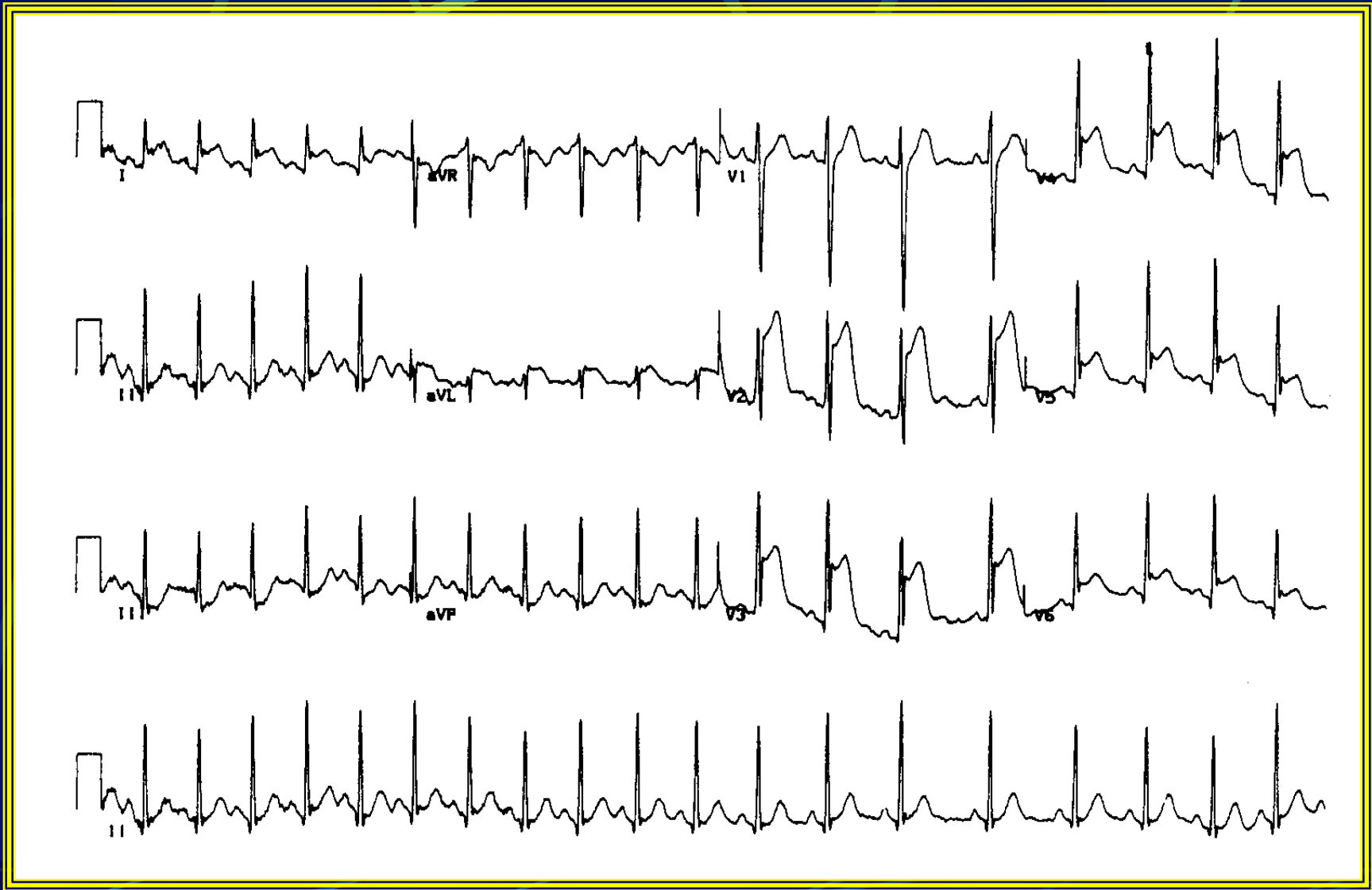
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Case Report

- 14 year old healthy boy.
- During football he is hit in anterior chest.
- Patient immediately states that he is dizzy and then loses consciousness.
- CPR begins within 1 minute, and EMS arrives at 6 minutes.



Initial Electrocardiogram



Definitions and Background

Commotio Cordis

- Concussion of the heart
- *Commotio cordis*-disturbed or agitated heart motion (*Latin*)
- Chinese Martial Art Dim Mak (*death touch*) precordial blow results in sudden death in one's opponent
- Sudden death from chest wall impact
- At autopsy, no pathologic abnormalities.

Collapse and Arrhythmias

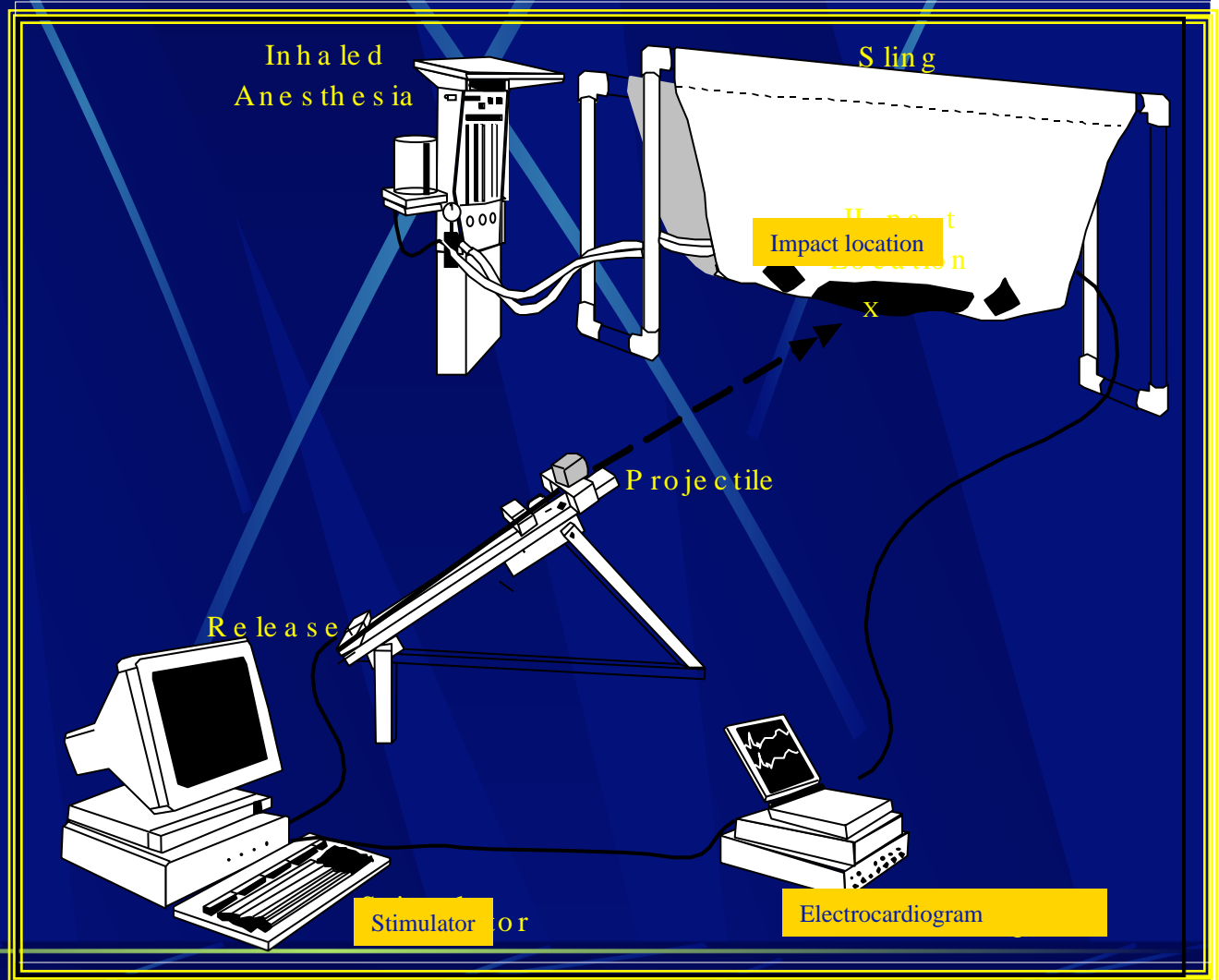
- Instantaneous collapse in one half
- In the others a brief period of consciousness with lightheadedness
- Initial rhythms are generally ventricular fibrillation
- Post resuscitation ECGs show ST elevations

Karate: 14 year old boy



Animal Studies-Our Protocol

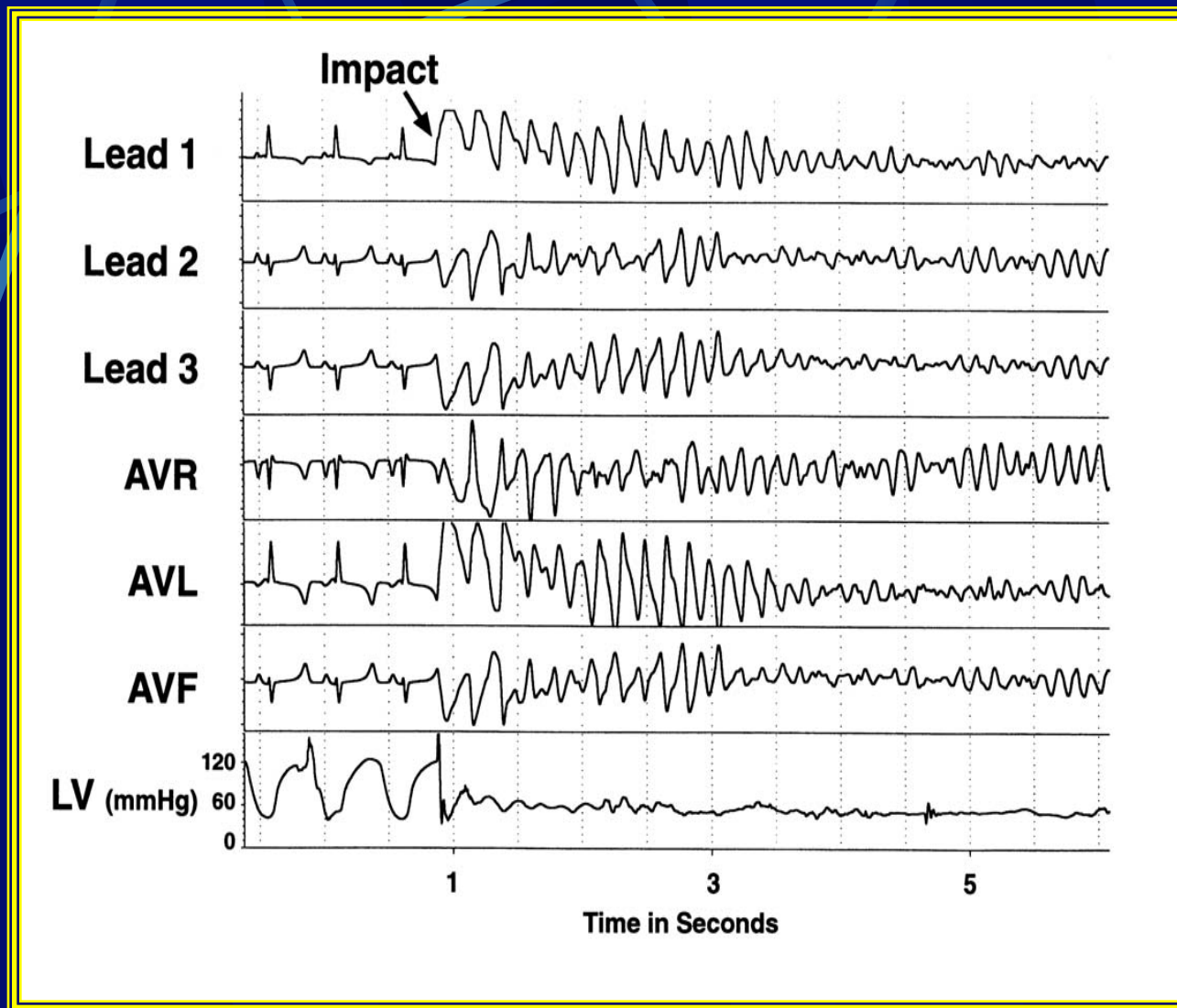
- Juvenile anesthetized male swine placed prone in a sling.
- Baseball propelled at 30 mph.
- Release of the object was timed so that the impact could be adjusted according to the cardiac cycle.



AN EXPERIMENTAL MODEL OF SUDDEN DEATH DUE TO LOW-ENERGY CHEST-WALL IMPACT (COMMOTIO CORDIS)

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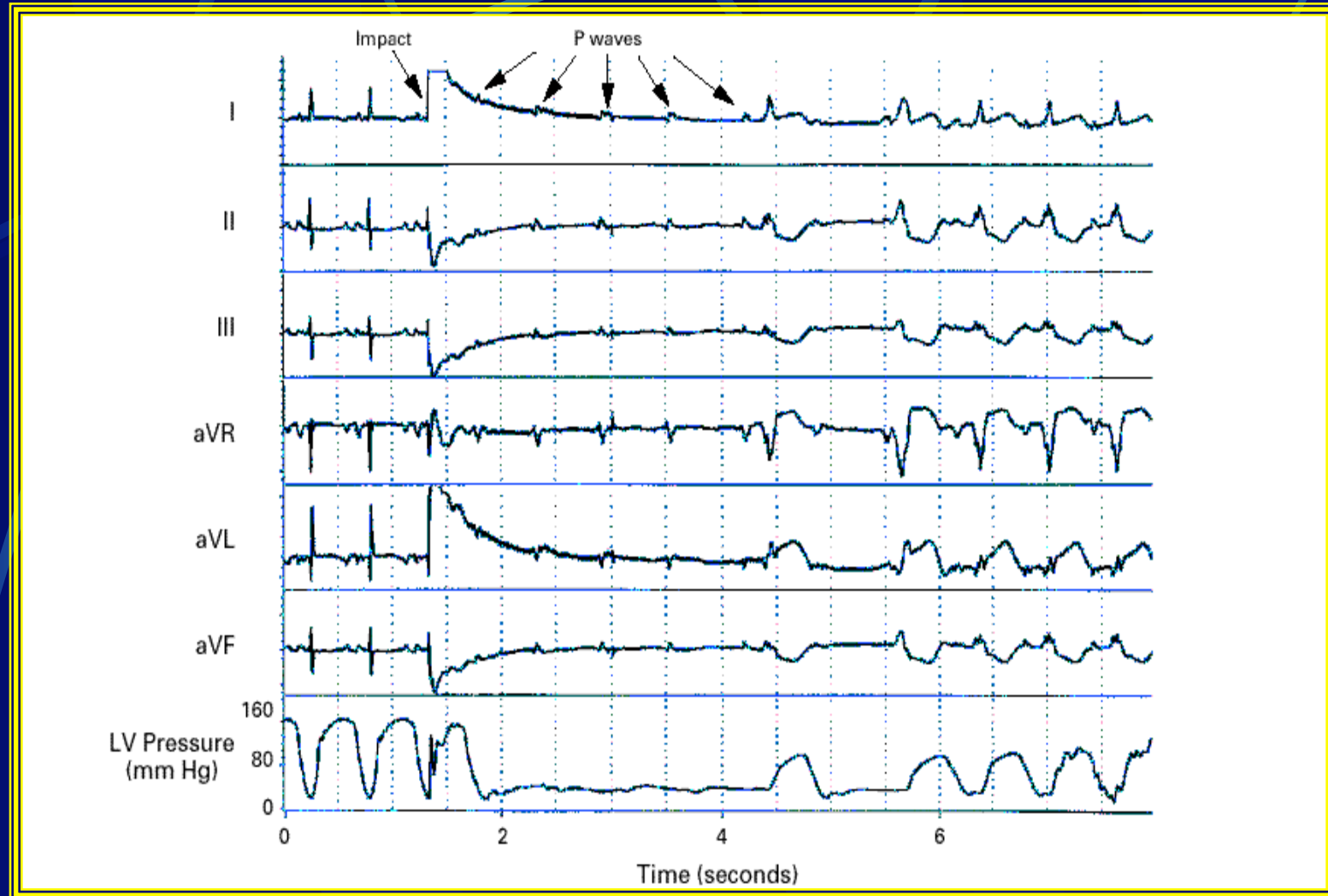
T-wave Impact



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QRS Impact



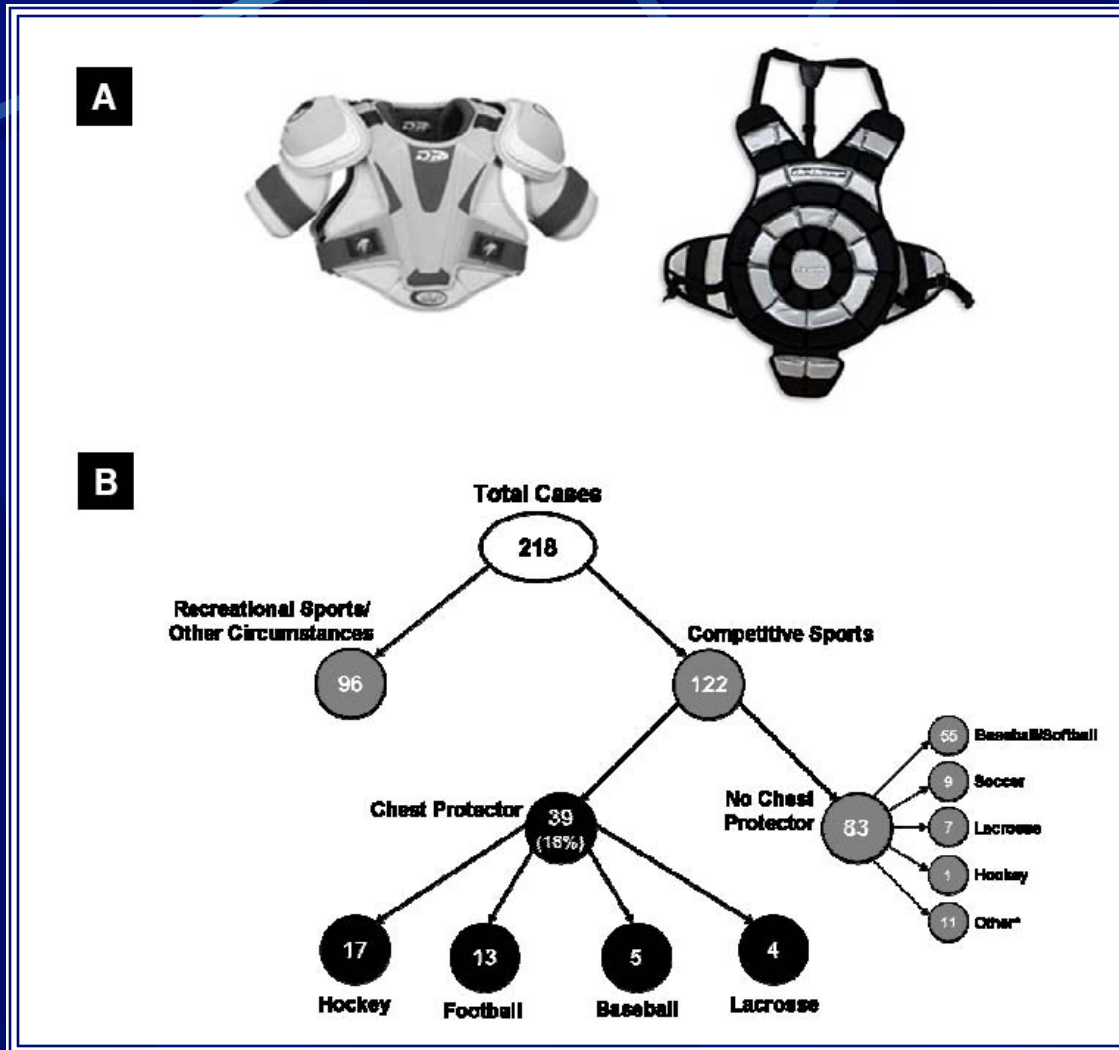
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Hockey-Chris Pronger



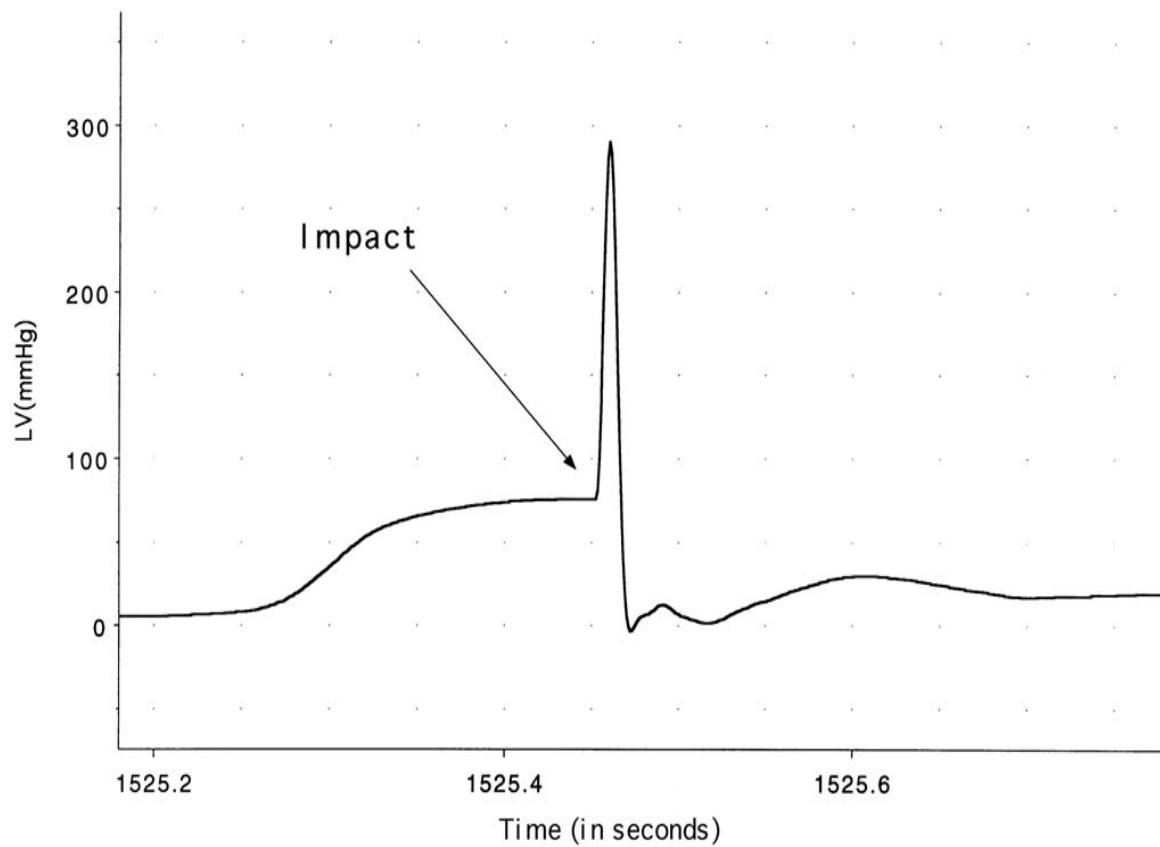
Lacrosse Chest Wall Protection



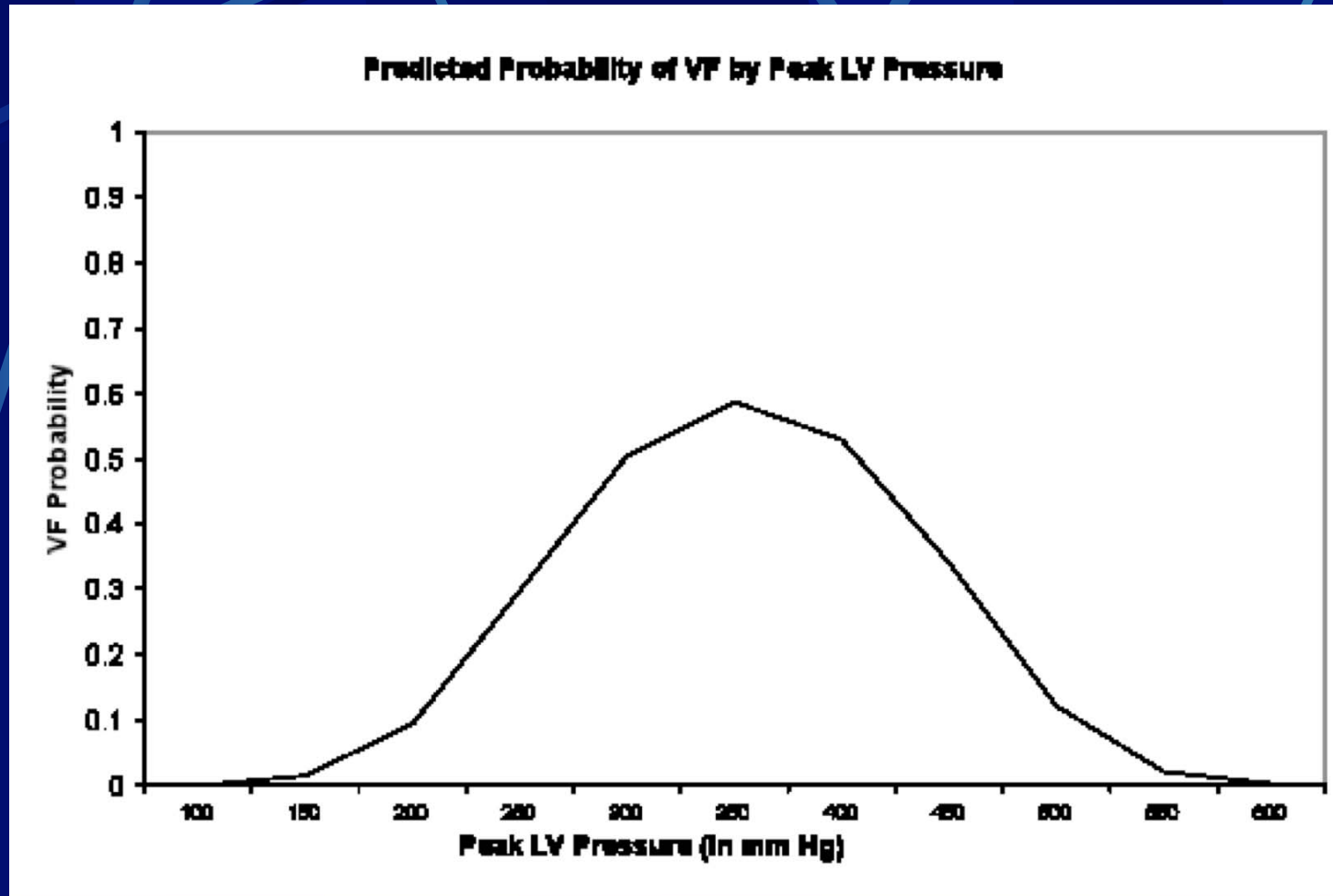
Possible Variables Important in Commotio Cordis

- Timing (examined)
- Energy of impact (examined)
- Location of impact (examined)
- Hardness of impact object (examined)
- LVP in commotio (examined)
- Role of ANS (examined)
- Role of K_{ATP} Channel (examined)
- Efficacy of chest wall protectors/ safety balls
- Efficacy of defibrillation (examined)

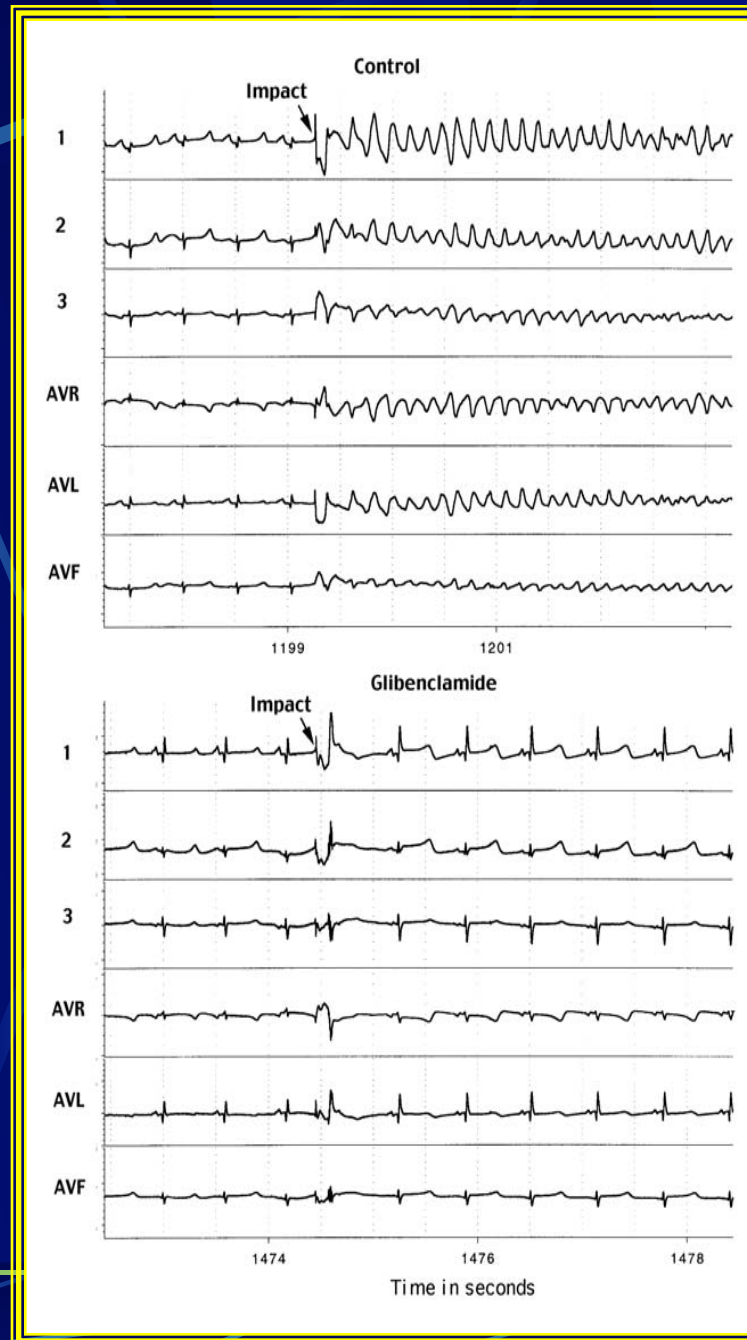
Left Ventricular Pressure In Comotio Model



Energy: Peak LVP/VF

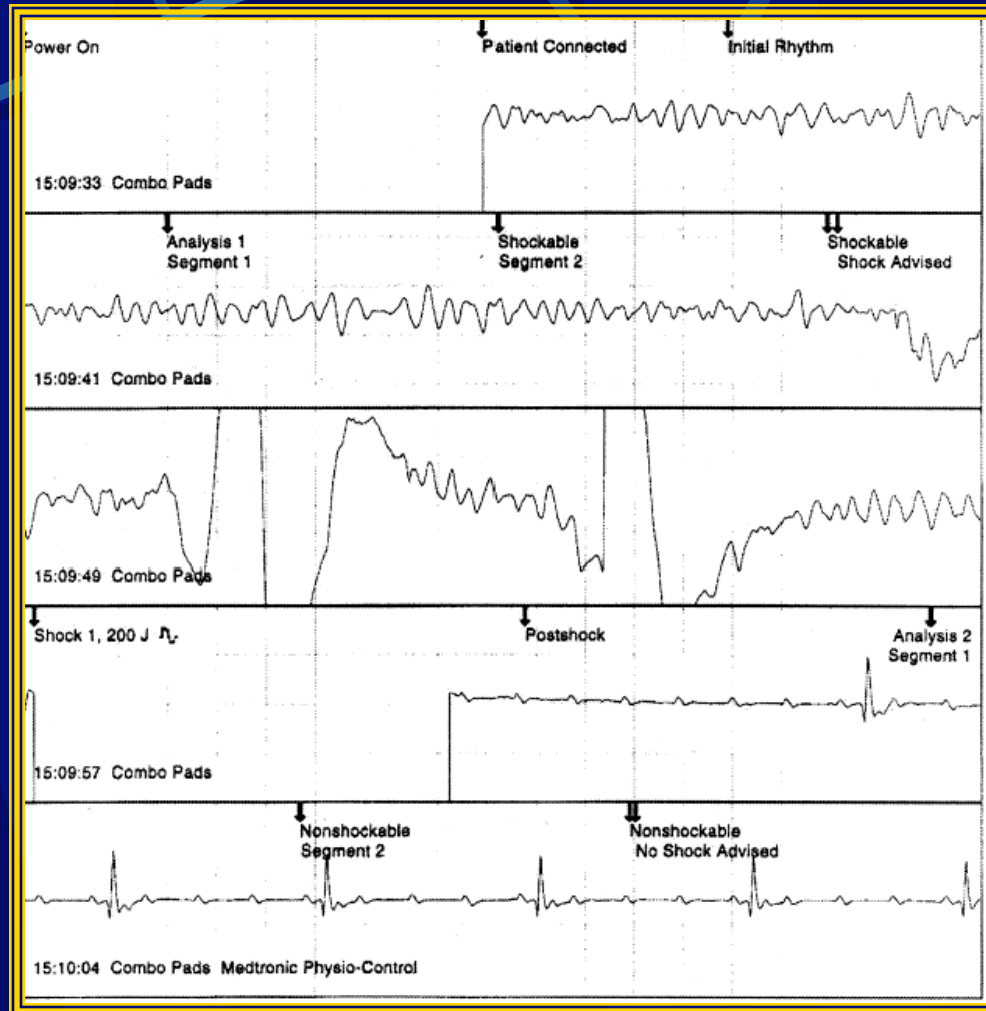


T-wave Impact

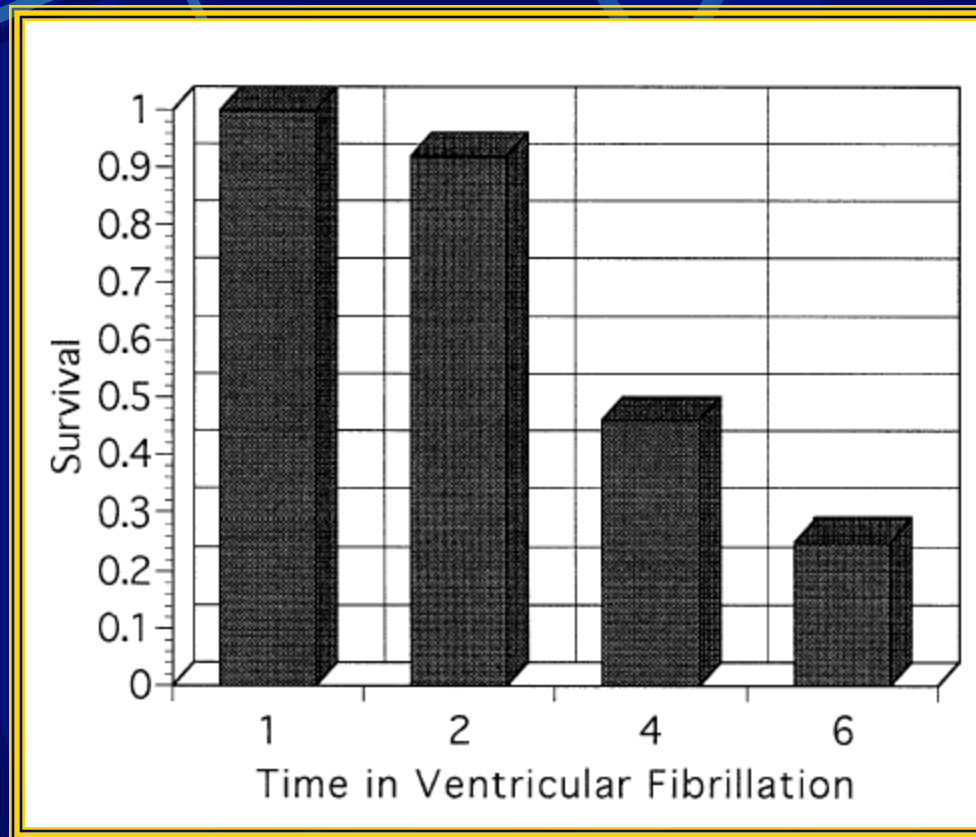


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Circulation,
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Commotio AEDs



Commotio AEDs



Commotio Cordis Conclusions

- In humans, the clinical scenario is produced by low energy chest wall impact in an area overlying the heart
- Young males are the most susceptible to commotio cordis
- The initial rhythm, when documented, is most often ventricular fibrillation
- Survivors have had ST elevation on EKGs

Comotio Cordis Conclusions

- Low energy trauma during a 30 ms window on the upslope of the T-wave causes ventricular fibrillation in juvenile swine
- The VF produced is immediate and not preceded by PVC's, ST elevations or other EKG abnormalities
- The site of impact must directly overlie the cardiac silhouette
- Changes in LV pressure may mediate VF

Commotio Cordis Conclusions

- Activation of the K^+_{ATP} channel may be the cause of the ventricular fibrillation seen with chest wall impact
- Softer than standard baseballs (safety balls) decrease the incidence of commotio cordis
- Currently available chest wall protectors are inadequate to protect against sudden death
- Immediate defibrillation can result in improved survival
- Further research is needed to identify methods of reducing the risk of death from commotio cordis

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