The Prevalence And Magnitude Of Leaning During Chest Compressions In The Bystander Community And Whether Leaning Can Be Reduced By Coaching.

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Highlights:

• The age distribution of the cohort approximately matched the age distribution of cardiac arrest victims.
• Sixty percent exhibited leaning. Leaning of seventy pounds was observed in one compression. The highest average value of leaning was 15.5 pounds.
• Seventy-nine percent of the sixty percent who had to be coached and re-tested were able to control leaning on the second trial.
• How long the coaching will be effective will not be determined until a follow-up study is conducted.
Leaning:

- Leaning (i.e., excessive force on sternum at top of recoil) is associated with factors that are correlated with reduced probability of survival. (citation 1,2 on next to last slide)
- Leaning by Bystanders is not because of lack of healthcare provider status – EMTs and Paramedics leaned excessively, as well. (citation 3 on last slide.)
- 0.5 pounds (~0.25kg) has been shown to be safe (Transducer puck on chest in citation 2) No upper limit on “safe loading at recoil” is known. This study assumed that 1.5 pounds would be benign, based upon extrapolation from the studies above and citation 3 on last slide.
- More than 79% of the cohort portion that exhibited excessive leaning on the first trial were able to control leaning on the second trial.
Study Protocol:

• Subjects were selected at random to fill age-group slots and were blinded to the purpose of study until after the first trial.
• Subjects were asked if they knew the purpose of this study. Subjects saying ‘yes’ were excused.
• Each subject’s downward force was measured when the subject pressed downward forcefully enough to cause the knees to slightly leave the ground.
• The subject was asked to perform compressions twice a second for 30 seconds pressing down as hard as he or she could. The force applied was recorded every 0.006 seconds.
• If an average of more than 1.5 pounds of leaning (~0.7kg) was recorded, the subject was coached in the problems caused by leaning and how to avoid it. The subjects requiring coaching were re-tested.
Equipment:

Laptop Computer  
Spring Column  
Load Cell at Bottom

Measures force +/- 0.5%, 160 times per second. Displays graph, writes file.
Data Set From One Subject:

Unsteady during HOSW test

Lowest Force (at recoil) is the residual sternal force. (Force in pounds). “HOSW” is “Hands On Scale Weight” – pushing on scale with enough force to barely get knees off the ground.

Trial 1: 0 9.8 17.3 min / mean / max leaning

Trial 2 (after coaching):

Trial 2: 0 0.7 13.5

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Distribution of Recoil Force During Trial 1:

- Forces were measured during each recoil and averaged for each subject.
- The values in the graph above are for the cohort and are sorted by value, not time.
- The min / mean / max leaning force for the cohort ‘s averages are 0 / 9.8 / 16.9
Performance by Age Group:

To pass either trial, the average force on the sternum at recoil had to be 1.5# or less.
Results:

• 60% of forty subjects failed to get within 1.5 pounds of “full recoil” on first trial.
  • They were coached to explain the reduction in survival probability that is caused by not getting rid of residual sternal force at the top of the cycle.
  • This 60% segment was then re-tested.
    • 79.2% of that 60% segment passed when re-tested.
    • 7.5% of those tested exhibited leaning in excess of 10% of the compression, and this was shown to be bad in citation 2.
• Of the 40% of the cohort that passed on Trial 1, three subjects’ maximum force on the sternum at recoil was less than 1.5 pounds.
Conclusions:

- Leaning in the Bystander community is:
  - Prevalent;
  - Reduces survival probability in 60% of cases;
  - Can be substantially solved in the short term with coaching.
- An inexpensive feedback device that provides audible feedback might help, if it can be distributed broadly.
- Periods of leaning during resuscitation may equate to periods of interruption in chest compressions, where the coefficient by which the period of leaning must be multiplied may well be from a value less than 1 for “small sins” to a value of more than 1 for more egregious leaning.

Citations and links (2):

Ref: 3

Aufderheide, Pirrallo, et al. [Ref: 3]
Leaning by EMT and Paramedic Personnel

Ref: 4

SLICC Class Video
www.slicc.org/ClassVideo
Pedal Compression CPR
Why 1.5 Pounds:


This chart was modified in January 3015 to include a later and more-complete source.
Leaning & Pedal Compressions: