Critical Review Form

Therapy

CPR with Chest Compression Alone or with Rescue Breathing, *NEJM* 2010; 363:423-433

Objective: **"To compare outcomes when instructions consisted of chest compression alone with outcomes when instructions consisted of chest compression plus rescue breathing." (p. 424)**

Methods: **A randomized trial of dispatcher-assisted CPR instruction in King County (Washington state, June 2004-April 2009), Thurston County (Washington state June 2005-April 2009), and London England (June 2005-March 2008). The two American EMS systems are two-tiered EMS systems (both ALS and BLS-dispatch are available, protocols determine which level of care responds) while London is a single-tier system (all ALS ambulances).**

Inclusion criteria included adults >18 years old who had not already received CPR. Exclusion criteria included DNR orders, or recognized trauma, drowning or asphyxiation. After determining eligibility, dispatchers randomized consecutive patients stratified by center in blocks of 10 to chest compression alone (COCPR) or chest compression plus rescue breathing (15:2 ratio). The primary outcome was survival to hospital discharge. Secondary outcomes included return of spontaneous circulation and favorable neurological outcome as judged by a Cerebral Performance Category of 1 or 2.

A uniform data abstraction form was used in reviewing dispatch, EMS, and hospital information. The trial sample size was designed to detect an absolute difference of 3.5% in survival rates with two-sided alpha level 0.05 and 80% power. An efficacy analysis was also performed to assess the primary outcome in the proportion in which chest compression s actually occurred. Four subgroup analyses were planned *a priori*: underlying cause of arrest, rhythm on initial ECG, presence of witness, and EMS response interval (<6 minutes or > 6 minutes).

Guide		Comments
I.	**Are the results valid?**	
A.	**Did experimental and control groups begin the study with a similar prognosis (answer the questions posed below)?**	
1.	Were patients randomized?	Yes. "Dispatchers enrolled and randomly assigned each patient to one of the two CPR strategies by opening an opaque, sequentially numbered envelope to determine which instructions to give the bystander. Randomization was stratified by dispatch center and blocked in sets of 10." (p. 426)
2.	Was randomization concealed (blinded)?	Not to EMS personnel. Patients and receiving hospitals were likely unaware of what type of CPR was performed, but no active binding procedure was used.
3.	Were patients analyzed in the groups to which they were randomized?	There is no clear statement of intention-to-treat.
4.	Were patients in the treatment and control groups similar with respect to known prognostic factors?	No significant differences were noted between COCPR and chest compression with breathing for age, gender, arrest etiology, witnessed arrests, arrest location, proportion with a shockable rhythm or EMS response intervals (Table 1, p. 427)
B.	**Did experimental and control groups retain a similar prognosis after the study started (answer the questions posed below)?**	
1.	Were patients aware of group allocation?	No active blinding – but patients were probably not aware since they were in cardiac arrest.
2.	Were clinicians aware of group allocation?	Possibly. No active blinding of EMS or receiving hospitals was reported.
3.	Were outcome assessors aware of group allocation?	No. "The review of EMS and hospital information was done without knowledge of patient's randomization status." (p. 426)

4.	Was follow-up complete?	One site was unable to assess neurological status at discharge. No other loss to follow-up is reported in the CONSORT diagram (p. 425). Survival to hospital discharge could not be ascertained for seven subjects (0.4%)." (p. 427)
II.	**What are the results (answer the questions posed below)?**	
1.	How large was the treatment effect?	• 1941/5525 (35%) met exclusion criteria – the most common reason for exclusion was "found alive without arrest" or "signs of irreversible death" in which case resuscitation was not attempted. • 70% of eligible subjects had a cardiac arrest, <50% were witnessed and only 1/3 had shockable rhythm. • The average EMS response time was 6.5-minutes. • Patients were more likely to receive bystander intervention in the COCPR (80.5% versus 72.7%, p <0.001). • No differences were noted in survival to hospital discharge (12.5% COCPR versus 11.0% for conventional CPR, p=0.31) or the proportion surviving to hospital discharge with a favorable neurologic outcome (14.4% COCPR versus 11.5% for conventional CPR, p=0.13). • Among patients with a cardiac cause of arrest there was a trend toward increased survival to hospital discharge (COCPR 15.5% vs. 12.3%, p=0.09 for conventional CPR) and an increased proportion

		with favorable neurologic outcome (COCPR 18.9% vs. 13.5%, p=0.03). • Among patients with non-cardiac cause of arrest, survival favored conventional CPR (5% COCPR vs. 7.2% conventional CPR, p=0.29). • The magnitude of effect favoring COCPR was larger in the efficacy analysis that evaluated only those patients where CPR was recommended and bystanders complied.
	How precise was the estimate of the treatment effect?	No 95% confidence intervals were provided.
III.	**How can I apply the results to patient care (answer the questions posed below)?**	
1.	Were the study patients similar to my patient?	Yes – mostly adult patients with arrest of primarily cardiac etiology.
2.	Were all clinically important outcomes considered?	Yes – survival and cerebral recovery. However, the authors neglected to measure or adjust for therapeutic hypothermia.
3.	Are the likely treatment benefits worth the potential harm and costs?	In the context of other animal and human investigations uniformly suggesting a biologically plausible mechanism for improved bystander compliance and cardiac arrest patient survival, the current study strengthens the evidence that "a lay person CPR strategy that emphasizes chest compression and minimizes the role of rescue breathing." (p. 432)

Limitations

1) **The conventional CPR arm used the old 2:15 ratio of breaths to compressions, not the more current 2:30 ratio.**
2) **Neurologic status at discharge could only be obtained at two sites – although the missing site only accounted for 10% of survivals.**
3) **Under-powered to detect significant difference in cerebral outcomes.**

4) **No adjustment for type of EMS response unit of post-return of spontaneous circulation therapeutic hypothermia.**

Bottom Line

EMS-dispatch guided COCPR in cardiac arrest patients trends towards improved survival and good neurological outcomes. Future trials should assess COCPR in presumed cardiac arrest bystanders without the delay of dispatch instructions. Additionally, future trials should attempt to adjust for prognostic confounders such as age, co-morbidity and post-return of spontaneous circulation therapeutic hypothermia.