

IMMEDIATE DEFIBRILLATION OR DEFIBRILLATION AFTER CARDIOPULMONARY RESUSCITATION

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INTRODUCTION

- Current cardiopulmonary resuscitation (CPR) guidelines recommend...
- Patients was found by EMS personnel to be in ventricular fibrillation (VF)
- Provide approximately five cycles (approximately 2 minutes) of CPR before defibrillation
- **Particularly** when the EMS system call-to-response interval is greater than 4 to 5 minutes

- These guidelines are supported by some evidence from animal and human studies...
- By increased blood flow generated by CPR ... Myocardial metabolic degradation may be slowed or partially reversed

- In a study on dogs, after 7.5 minutes of VF...
- CPR and high-dose epinephrine were given followed by defibrillation...
- Higher rate of return of spontaneous circulation than with defibrillation only.

- Cobb et al. carried out a population-based study...
- The result showed that 90 seconds of CPR prior to defibrillation improved survival.
- Predominantly in the subgroup of a later (≥ 4 min) response interval.

- Wik et al. showed that 3 minutes of CPR before defibrillation did not show overall improvement compared with shock first..
- But there was better survival in the subgroup of a later (≥ 5 min) response.

- In other randomized trials...
- Jacobs et al. showed that 90 seconds of CPR before defibrillation does not improve overall survival
- Baker et al. showed that 3minutes of CPR before defibrillation also does not improve overall survival.

- The optimal CPR duration prior to defibrillation is unknown...
- Bradley et al. demonstrated that 46–195 seconds of EMS CPR before defibrillation was weakly associated with a higher survival rate compared with that for ≤ 45 seconds.

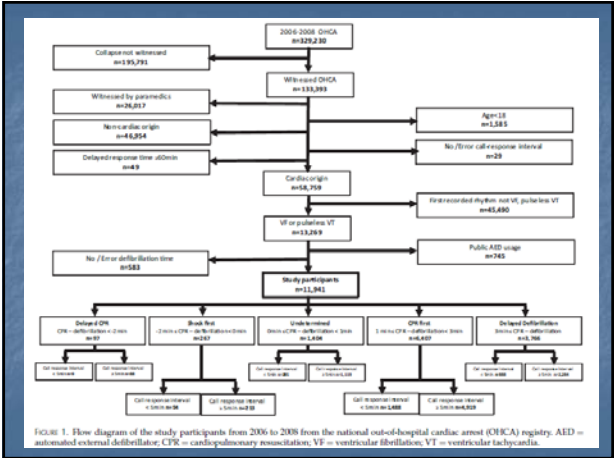
- It is still debatable whether shock first or CPR first has the best outcome...
- The purpose of this study was to determine whether EMS CPR first has a better outcome compared with immediate defibrillation (shock first) in patients with VF/pulseless ventricular tachycardia (pulseless VT) out-of-hospital cardiac arrest (OHCA).

METHODS

- Nonrandomized
- Nationwide
- Retrospective observational study
- Analyzed the national OHCA registry of the Fire and Disaster Management Agency between 2006 and 2008.

- # METHODS
- Nonrandomized
 - Nationwide
 - Retrospective observational study
 - Analyzed the national OHCA registry of the Fire and Disaster Management Agency between 2006 and 2008.

- In Japan, the emergency network covers the whole country
- The OHCA registry of the Fire and Disaster Management Agency comprises almost all cases of OHCA in Japan



RESULTS

TABLE 1. Characteristics of the Study Participants

	Total n = 11,941	CPR First (≥1 min and <3 min) n = 6,407	Shock First (≥1 min and <3 min) n = 267	Undetermined (<1 min) n = 1,404	Delayed (≥3 min) Defibrillation n = 3,766	Delayed (≥3 min) CPR n = 97
Survey year						
2006	4,089 (34.2%)	2,226 (34.7%)	156 (58.4%)	642 (45.7%)	1,033 (27.4%)	32 (33.0%)
2007	3,539 (29.6%)	1,898 (29.6%)	54 (20.2%)	331 (23.6%)	1,224 (32.5%)	32 (33.0%)
2008	4,313 (36.1%)	2,283 (35.6%)	57 (21.3%)	431 (30.7%)	1,509 (40.1%)	33 (34.0%)
Gender—male (%)	9,522 (79.7%)	5,152 (80.4%)	232 (86.9%)	1,146 (81.6%)	2,915 (77.4%)	77 (79.4%)
Age—mean (±SD), years	64.6 (±15.0)	64.4 (±14.9)	62.7 (±15.7)	63.8 (±14.6)	65.4 (±15.3)	67.1 (±14.1)
Bystander CPR	6,078 (50.9%)	3,347 (52.2%)	159 (59.6%)	837 (59.6%)	1,674 (44.5%)	61 (62.9%)
Intubation	5,855 (49.1%)	3,220 (50.3%)	138 (51.7%)	674 (48.0%)	1,784 (47.4%)	39 (40.2%)
Epinephrine	1,205 (10.1%)	625 (9.8%)	18 (6.7%)	122 (8.7%)	432 (11.5%)	8 (8.2%)
Call-to-response interval—mean (±SD), min	6.6 (±3.0)	6.5 (±2.9)	7.0 (±3.3)	6.9 (±3.5)	6.6 (±3.0)	8.7 (±4.0)
Time during which defibrillation was attempted—mean (±SD), min	2.4 (±1.7)	2.4 (±1.7)	2.6 (±1.9)	2.5 (±1.8)	2.3 (±1.6)	2.6 (±1.8)

CPR = cardiopulmonary resuscitation; SD = standard deviation.

Call-to-Response Interval and Outcomes

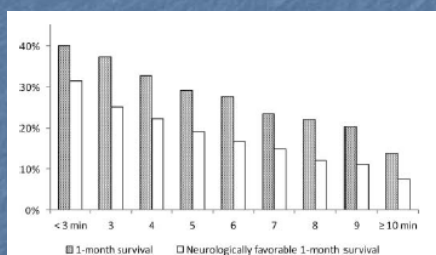


FIGURE 2. One-month survival and neurologically favorable one-month survival rates, presented by the call-to-response time interval.

Overall Outcomes by Intervention Sequence

Call-to-Response Interval, Total				
	No. / Total	(%)	OR	(95% CI)
One-month survival	3,125 / 11,941	(26.2%)		
CPR first (≥1 min and <3 min)	1,780 / 6,407	(27.8%)	Reference	
Shock first (≥1 min and <3 min)	66 / 267	(24.7%)	0.85	(0.64–1.13)
Undetermined (<1 min)	390 / 1,404	(27.8%)	1.00	(0.88–1.14)
Delayed (≥3 min) defibrillation	868 / 3,766	(23.0%)	0.78	(0.71–0.85)
Delayed (≥3 min) CPR	21 / 97	(21.6%)	0.72	(0.44–1.17)
Neurologically favorable one-month survival	1,983 / 11,934	(16.6%)		
CPR first (≥1 min and <3 min)	1,140 / 6,404	(17.8%)	Reference	
Shock first (≥1 min and <3 min)	49 / 267	(18.4%)	1.04	(0.76–1.42)
Undetermined (<1 min)	272 / 1,402	(19.4%)	1.11	(0.96–1.29)
Delayed (≥3 min) defibrillation	512 / 3,764	(13.6%)	0.73	(0.65–0.81)
Delayed (≥3 min) CPR	10 / 97	(10.3%)	0.53	(0.27–1.02)

Overall Outcomes by Intervention Sequence

Call-to-Response Interval <5 min					Call-to-Response Interval ≥5 min				
	No. / Total	(%)	OR	(95% CI)		No. / Total	(%)	OR	(95% CI)
One-month survival	959 / 2,724	(35.2%)			2,166 / 9,217	(23.5%)			
CPR first (≥1 min and <3 min)	885 / 1,488	(59.5%)	Reference		1,225 / 4,919	(24.9%)	Reference		
Shock first (≥1 min and <3 min)	16 / 54	(29.6%)	0.71	(0.39–1.28)	50 / 213	(23.5%)	0.95	(0.67–1.28)	
Undetermined (<1 min)	111 / 265	(38.9%)	1.07	(0.83–1.39)	279 / 1,119	(24.9%)	1.00	(0.86–1.16)	
Delayed (≥3 min) defibrillation	274 / 888	(30.9%)	0.75	(0.63–0.90)	594 / 2,678	(20.6%)	0.78	(0.70–0.88)	
Delayed (≥3 min) CPR	3 / 9	(33.3%)	0.84	(0.21–3.37)	18 / 88	(20.5%)	0.78	(0.46–1.31)	
Neurologically favorable one-month survival	666 / 2,724	(24.4%)			1,317 / 9,210	(14.3%)			
CPR first (≥1 min and <3 min)	388 / 1,488	(26.1%)	Reference		752 / 4,916	(15.2%)	Reference		
Shock first (≥1 min and <3 min)	14 / 54	(25.9%)	0.99	(0.55–1.84)	35 / 213	(16.4%)	1.09	(0.75–1.58)	
Undetermined (<1 min)	85 / 265	(29.8%)	1.20	(0.91–1.59)	187 / 1,117	(16.7%)	1.11	(0.95–1.33)	
Delayed (≥3 min) defibrillation	177 / 888	(19.9%)	0.71	(0.58–0.86)	335 / 2,676	(11.6%)	0.73	(0.64–0.84)	
Delayed (≥3 min) CPR	2 / 9	(22.2%)	0.81	(0.17–3.92)	8 / 88	(9.1%)	0.55	(0.27–1.15)	

TABLE 3. Logistic Regression Model on One-Month Survival

Call-to-Response Interval, Total					Call-to-Response Interval <5 min					Call-to-Response Interval ≥5 min				
	OR	(95% CI)	p-Value		OR	(95% CI)	p-Value			OR	(95% CI)	p-Value		
Survey year														
2006	Reference				Reference					Reference				
2007	1.24	(1.11–1.38)	<0.001		1.26	(1.03–1.54)	0.02			1.23	(1.08–1.40)	<0.001		
2008	1.31	(1.18–1.45)	<0.001		1.37	(1.12–1.67)	<0.001			1.29	(1.14–1.45)	<0.001		
Gender														
Male	Reference				Reference					Reference				
Female	1.24	(1.11–1.37)	<0.001		1.25	(1.01–1.53)	0.04			1.23	(1.09–1.40)	<0.001		
Age	0.98	(0.98–0.98)	<0.001		0.98	(0.98–0.99)	<0.001			0.98	(0.98–0.98)	<0.001		
Bystander CPR														
Without bystander CPR	Reference				Reference					Reference				
With bystander CPR	1.36	(1.25–1.49)	<0.001		1.26	(1.06–1.48)	0.01			1.40	(1.26–1.55)	<0.001		
Intubation														
No intubation	Reference				Reference					Reference				
Intubation	0.53	(0.49–0.58)	<0.001		0.40	(0.34–0.47)	<0.001			0.59	(0.53–0.65)	<0.001		
Call-to-response interval CPR/defibrillation														
CPR first (≥1 min and <3 min)	0.84	(0.70–1.00)	0.03		0.70	(0.58–1.30)	0.26			1.04	(0.74–1.44)	0.84		
Shock first (≥1 min and <3 min)	1.03	(0.80–1.36)	0.63		0.99	(0.76–1.30)	0.96			1.04	(0.86–1.22)	0.60		
Undetermined (<1 min)	0.77	(0.70–0.85)	<0.001		0.73	(0.61–0.88)	<0.001			0.79	(0.71–0.89)	<0.001		
Delayed (≥3 min) defibrillation														
Delayed (≥3 min) CPR	0.88	(0.53–1.46)	0.63		0.81	(0.19–3.24)	0.77			0.91	(0.53–1.57)	0.74		

CI = confidence interval; CPR = cardiopulmonary resuscitation; OR = odds ratio (adjusted).

TABLE 4. Logistic Regression Model on Neurologically Favorable One-Month Survival

	Call-to-Response Interval, Total			Call-to-Response Interval <5 min			Call-to-Response Interval ≥5 min		
	OR	(95% CI)	p-Value	OR	(95% CI)	p-Value	OR	(95% CI)	p-Value
Survey year									
2006	Reference			Reference			Reference		
2007	1.51	(1.33-1.73)	< 0.001	1.50	(1.19-1.89)	< 0.001	1.52	(1.30-1.79)	< 0.001
2008	1.60	(1.41-1.82)	< 0.001	1.64	(1.31-2.06)	< 0.001	1.59	(1.37-1.86)	< 0.001
Gender									
Male	Reference			Reference			Reference		
Female	1.22	(1.07-1.38)	< 0.001	1.16	(0.92-1.47)	0.21	1.24	(1.06-1.45)	0.01
Age	0.97	(0.97-0.98)	< 0.001	0.98	(0.97-0.98)	< 0.001	0.97	(0.97-0.98)	< 0.001
Bystander CPR									
Without bystander CPR	Reference			Reference			Reference		
With bystander CPR	1.78	(1.60-1.98)	< 0.001	1.54	(1.28-1.86)	< 0.001	1.91	(1.68-2.17)	< 0.001
Intubation									
No intubation	Reference			Reference			Reference		
Intubation	0.38	(0.34-0.42)	< 0.001	0.36	(0.30-0.44)	< 0.001	0.38	(0.34-0.44)	< 0.001
Call-to-response interval									
CPR/defibrillation									
CPR first (≥1 min and <3 min)	1.22	(0.87-1.71)	0.24	0.99	(0.52-1.92)	0.99	1.33	(0.90-1.98)	0.15
Shock first (≥1 min and <3 min)	1.15	(0.99-1.38)	0.07	1.11	(0.82-1.48)	0.51	1.17	(0.97-1.41)	0.10
Undetermined (<1 min)	0.72	(0.64-0.81)	< 0.001	0.68	(0.55-0.84)	< 0.001	0.74	(0.64-0.85)	< 0.001
Delayed (≥3 min) CPR	0.64	(0.53-0.77)	< 0.001	0.78	(0.15-3.94)	0.76	0.62	(0.29-1.33)	0.22

CI = confidence interval; CPR = cardiopulmonary resuscitation; OR = odds ratio (adjusted).

DISCUSSION

- Previous studies have shown...
- with successful defibrillation, survival rates following VF are decreased by approximately 7–10% with every minute that defibrillation is delayed

- Another study reported that the effect of defibrillation response intervals on survival showed a steep decrease in the first 5 minutes, and then leveled off gradually at longer intervals.
- A study of VF patients proposed that an increasing time interval may decrease survival reciprocally as time proceeds.

- In the current study, **the shorter the call-to-response interval was**, the better the one-month survival and neurologically favorable outcome were.

- In the present study, we did not detect any significant difference in either one-month survival or neurologically favorable one-month survival in OHCA patients who received CPR prior to defibrillation

LIMITATIONS

- This study was nonrandomized for intervention..
- The distribution of the participants receiving CPR first and shock first was not balanced
- The allocation criteria were not very clear as to why certain patients received particular interventions (CPR first or shock first).
- The database contained no information on the hospitals to which the patients were transferred.
- Transportation to critical care medical centers results in a better outcome for OHCA patients in Japan

- Recording an accurate time in the EMS system is still a challenge.
- EMS teams whose clocks (control center, emergency medical technician's watch, and emergency transport care and defibrillator) were synchronized every day increased from 39% in December 2005 to 43% in July 2007.
- In addition, as time is recorded in units of minutes

- Further studies are required to determine whether CPR prior to attempted defibrillation has a positive outcome...

CONCLUSIONS

- In our study, CPR prior to attempted defibrillation did not present a significantly different outcome compared with shock first ...
- in either one-month survival or neurologically favorable one-month survival
- .. after adjusting for potential confounders.
- Further studies are needed before consideration is given to revision of the current guidelines, and for evaluation of the advantage of shock first over CPR first.

Thank you !