Journal Club

絶え間ない胸骨圧迫
非同期的陽圧換気
VS
30:2のCPR法

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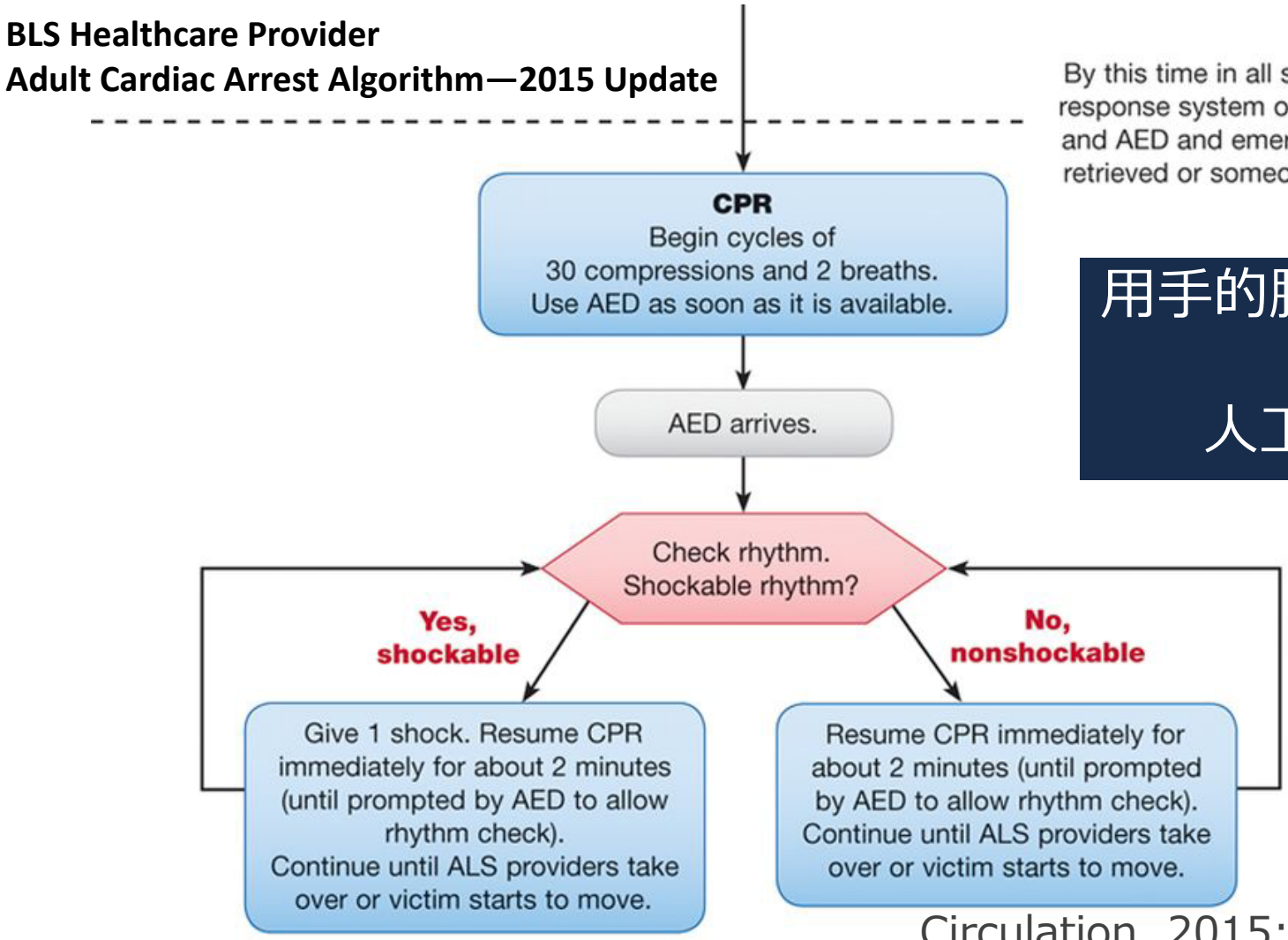
Trial of Continuous or Interrupted Chest Compressions during CPR

N Engl J Med 2015;373:2203-14.

心肺蘇生方法



用手的胸骨圧迫 30回
＋
人工呼吸 2回

Circulation. 2015; 132: S414-S435

胸骨圧迫の重要性の強調

- 訓練を受けていない市民救助者は，心停止を起こした成人傷病者に対して胸骨圧迫のみの(ハンズオンリー)CPRを実施すべき
- 訓練を受けた市民救助者が人工呼吸を行うことができるならば，30:2 の圧迫・換気比で人工呼吸を追加すべき

Highlights of the 2015 American Heart Association Guidelines Update for CPR and ECC

胸骨圧迫が強調された理論的背景

院外心肺停止患者の心肺蘇生
補助換気の際に，胸骨圧迫が一時停止

循環血流量の減少
蘇生成功率の低下
の可能性

胸骨圧迫は中断しない方がよい？

心肺停止の動物モデル

胸骨圧迫の中断により生存率↓

Circulation 2002;105:645-9.

低酸素を原因としない心停止

持続的胸骨圧迫は胸骨圧迫+補助換気と同等

Circulation 2001;104:2465-70.

持続的胸骨圧迫の方が神経学的機能良好

Circulation 2002;105:645-9.

胸骨圧迫は中断しない方がよい？

院外心停止を対象とした観察研究

持続的胸骨圧迫の方が，補助換気による中断を含む胸骨圧迫より生存率が高い

JAMA 2010;304:1447-54.
JAMA 2008;299:1158-65.

低酸素による心停止では，換気がアウトカムを改善

Circulation 2000;101:1743-8.

胸骨圧迫単独 vs 30:2のCPR法

- 多施設共同ランダム化比較試験
- 対象：通信指令員がバイスタンダーにCPRを指示した，院外心停止の18歳以上の患者
- 方法：患者を胸骨圧迫単独群と胸骨圧迫＋人工呼吸群のいずれかに無作為に割り付け
- 結果：生存退院率（胸骨圧迫単独群 12.5%，胸骨圧迫＋人工呼吸群 11.0%，P＝0.31）や，神経学的予後良好の生存患者の割合（それぞれ 14.4%，11.5%；P＝0.13）に有意差なし

N Engl J Med 2010;363:423-33.

絶え間ない胸骨圧迫
非同期的陽圧換気
VS
30:2のCPR法

アウトカムは異なるのか？

PICO

P	成人の心肺停止患者
I	持続的胸骨圧迫 +非同期での補助換気
C	30:2の同期下CPR
O	退院生存率

研究デザイン

- クラスター・クロスオーバーデザイン，ランダム化比較試験
- Resuscitation Outcomes Consortium (ROC)主導
- 北米にある8つのROC施設と114の救急隊が参加
- 倫理委員会による承認あり

患者集団/Patient Population

- 非外傷性の院外心停止
- 試験に参加した救急隊による心肺蘇生
- 一部はROC-ALPS試験にも組み入れ
- 除外基準

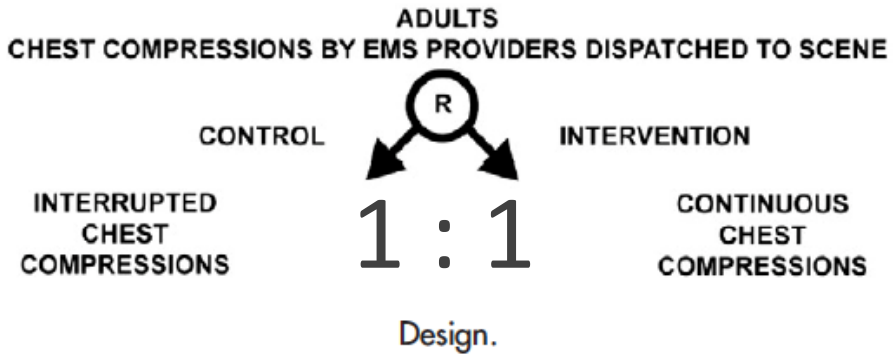
- EMS-witnessed arrest
- DNARの事前指示書あり
- 外傷
- 低酸素による心停止
- コントロール不能な出血
- 既知の妊娠
- 既存の気管開口術
- 囚人
- 試験に参加していない救急隊によるCPR
- 機械による胸骨圧迫
- 救急隊到着前の高度気道確保の施行
- 試験への不参加

介入方法/Study Interventions

・クロスオーバーデザインのクラスターランダム化比較試験

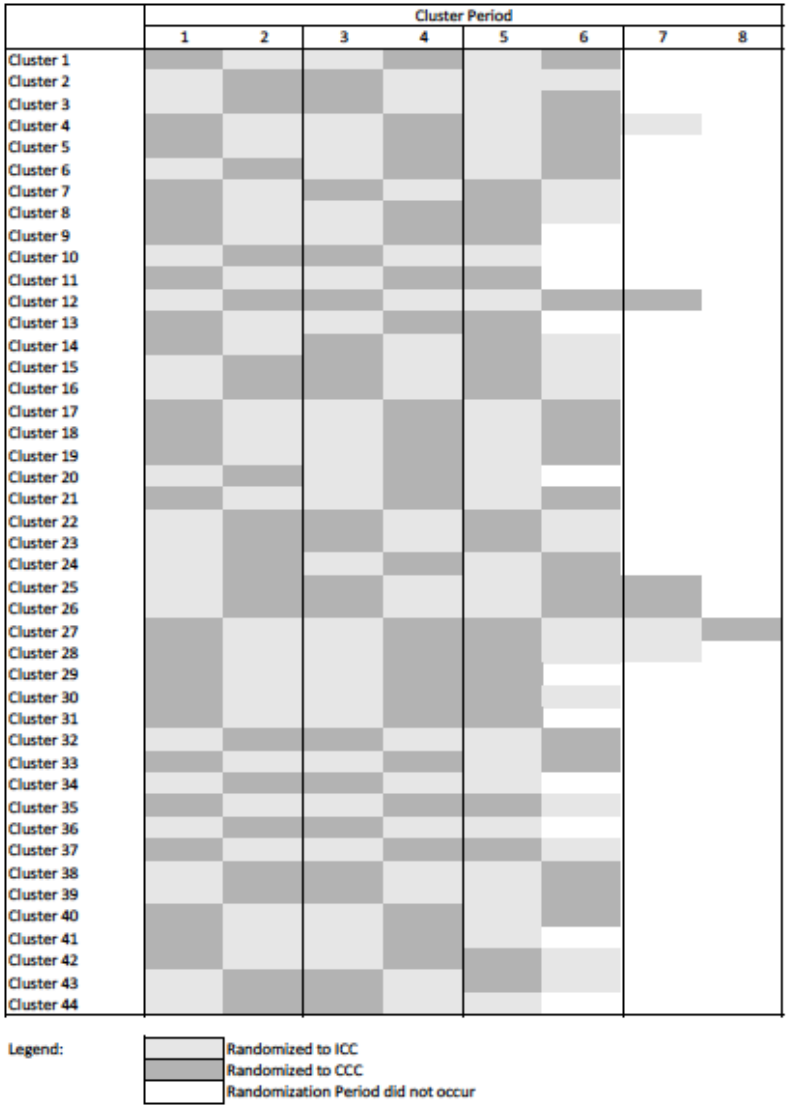
・114救急隊を47クラスターにグループ分け

・年２回のクロスオーバー



Design.

Am Heart J 2015;169:334-341.e5.



Run-in phase
Active enrollment phase

- 各クラスターはrun-in phaseから試験参加
- 一定の認定基準を満たすと，active enrollment phaseに組み込まれる

Continuous Chest Compressions(CCC)

- 胸骨圧迫100回/分 + 非同期的陽圧換気10回/分
- 換気：400-500mL，経口的陽圧換気(1-1.5秒)
- 高度気道確保：ROSCまたはリズム解析3回まで行わない

Interrupted Chest Compressions(ICC)

- 胸骨圧迫：換気 = 30:2
- 換気：1呼吸あたり400-500mL
  胸骨圧迫中断は5秒未満
- 高度気道確保：ROSCまたはリズム解析3回まで行わない

Am Heart J 2015;169:334-341.e5.

蘇生後の治療についてはモニタしたが，
標準化は行わなかった

CPR-process monitoring

- 市販のmonitor/defibrillatorsでCPRをモニタ
- 試験開始前および試験を通じて，CPRの質に関するデータを収集
- 集められたデータは，内部評価者(治療アウトカムはブラインド)が蘇生処置の適切性を評価するのに使用

Safety monitoring

- 心肺蘇生で起こりうる有害事象をモニタ
- 項目

- 肺水腫
- 循環動態不安定
- 気道出血
- 気管内挿管の合併症
- 肺炎
- 敗血症
- 脳出血
- 脳卒中
- 痙攣
- 輸血が必要，または外科的介入が必要な出血
- 再心停止
- 肋骨骨折
- 胸骨骨折
- 胸腔内，腹腔内外傷
- 神経学的異常
- 死亡

アウトカム

- 一次アウトカム：生存退院率
- 二次アウトカム：退院時のmodified Rankin scale，有害事象

modified Rankin scale score

modified Rankin Scale		参考にすべき点
0	まったく症候がない	自覚症状および他覚徴候がともにない状態である
1	症候はあっても明らかな障害はない： 日常の勤めや活動は行える	自覚症状および他覚徴候はあるが、発症以前から行っていた仕事や活動に制限はない状態である
2	軽度の障害： 発症以前の活動がすべて行えるわけではないが、自分の身の回りのことは介助なしに行える	発症以前から行っていた仕事や活動に制限はあるが、日常生活は自立している状態である
3	中等度の障害： 何らかの介助を必要とするが、歩行は介助なしに行える	買い物や公共交通機関を利用した外出などには介助*を必要とするが、通常歩行†、食事、身だしなみの維持、トイレなどには介助*を必要としない状態である
4	中等度から重度の障害： 歩行や身体的要求には介助が必要である	通常歩行†、食事、身だしなみの維持、トイレなどには介助*を必要とするが、持続的な介護は必要としない状態である
5	重度の障害： 寝たきり、失禁状態、常に介護と見守りを必要とする	常に誰かの介助*を必要とする状態である
6	死亡	

日本脳卒中ガイドライン2009

- 3点以下を「良好な神経機能」と定義

統計分析/Statistical Analysis

- サンプルサイズ：23,600人
  - ❖ αエラー5%，検出力90%
  - ❖ 退院時生存率：8.1%(ICC)，9.4%(CCC)
    ※8.1%は ROC PRIMED trialに基づく
- 中間解析：6ヶ月毎に実施
- 解析：ITT解析

per-protocol解析
post hoc per-protocol解析

- 2つのper-protocol解析でも評価
- 実際に行われたCPRがCCC/ICCそれぞれのプロトコル通りに行われたか判定する基準を設定
- その基準を満たしたCCC/ICCを受けた患者を解析の対象

per-protocol解析

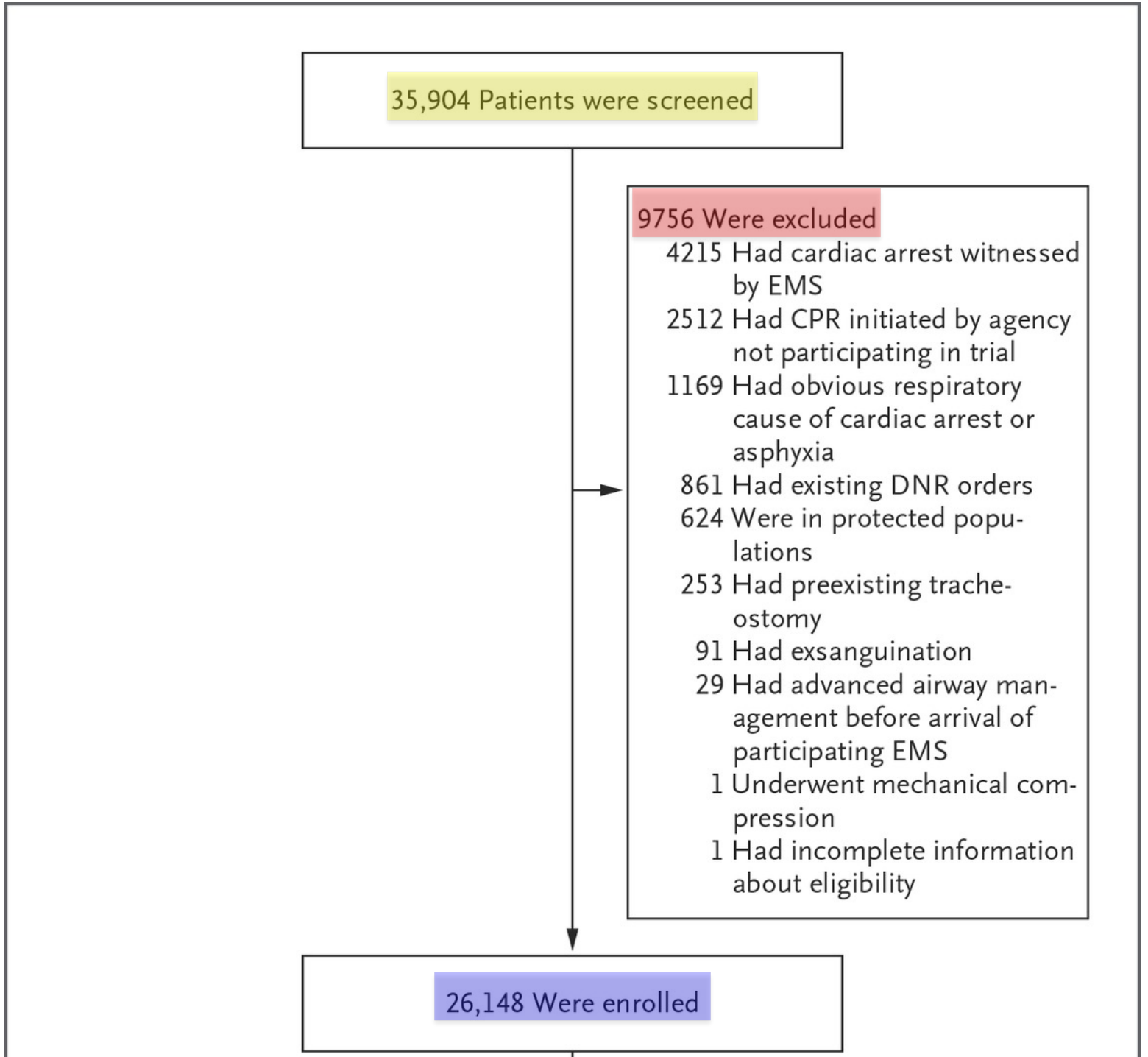
アルゴリズムに従い，機械的に判定

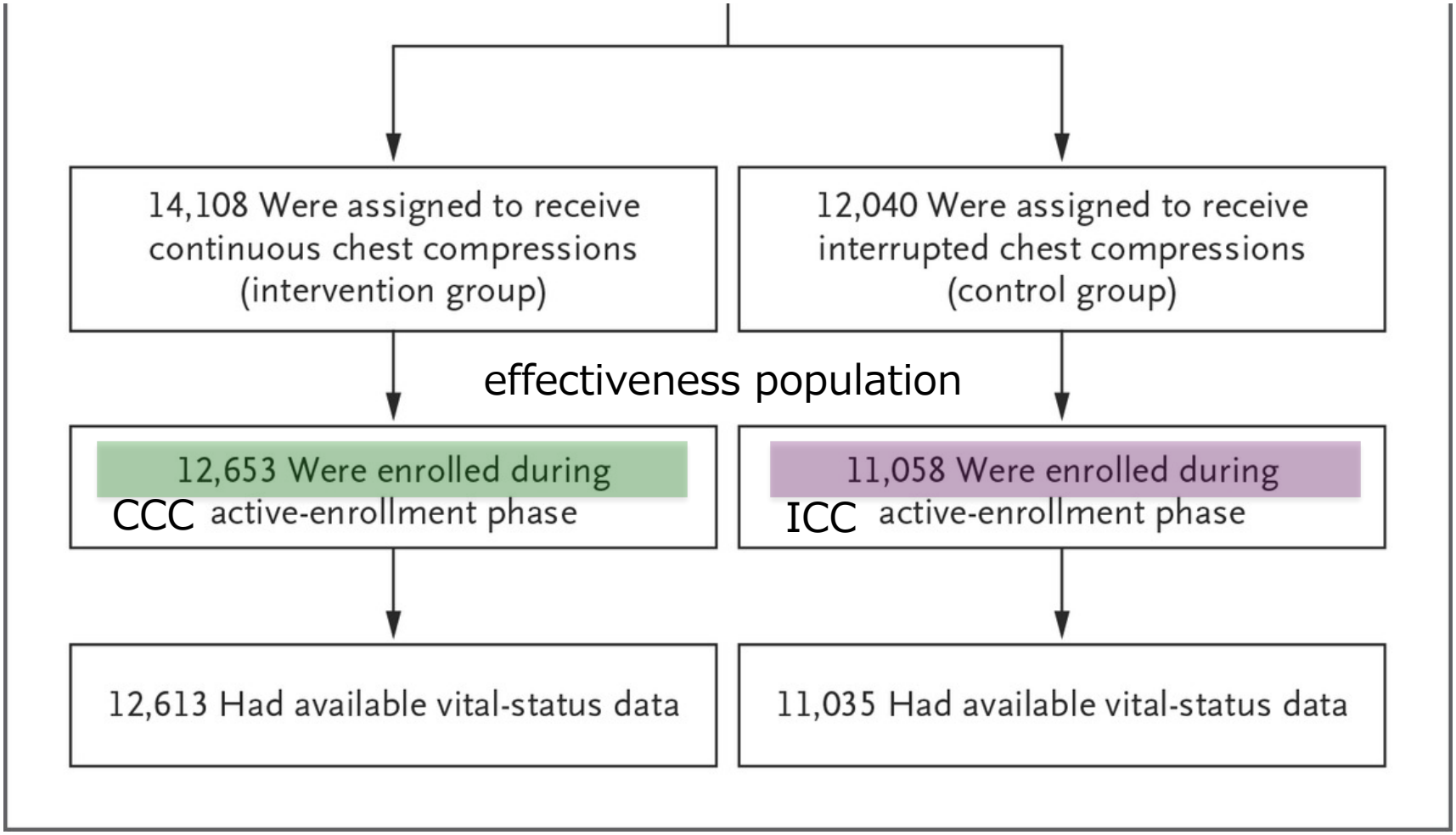
post hoc per-protocol解析

research coordinatorがCPRデータを基に判断

Measure	Criteria for continuous chest compressions	Criteria for interrupted chest compressions
Mean chest compression fraction	>0.80	0.60-0.80
Median chest compression segment length (seconds)	60-150	<20
Mean chest compression pauses (n per minute)	<1	2/4

結果


35,904 Patients were screened
9756 Were excluded
4215 Had cardiac arrest witnessed by EMS
2512 Had CPR initiated by agency not participating in trial
1169 Had obvious respiratory cause of cardiac arrest or asphyxia
861 Had existing DNR orders
624 Were in protected populations
253 Had preexisting tracheostomy
91 Had exsanguination
29 Had advanced airway management before arrival of participating EMS
1 Underwent mechanical compression
1 Had incomplete information about eligibility
26,148 Were enrolled



期間：2011年6月6日～2015年5月28日

患者特性

Table 1. Pretreatment Characteristics of the Patients Included in the Effectiveness Population.*

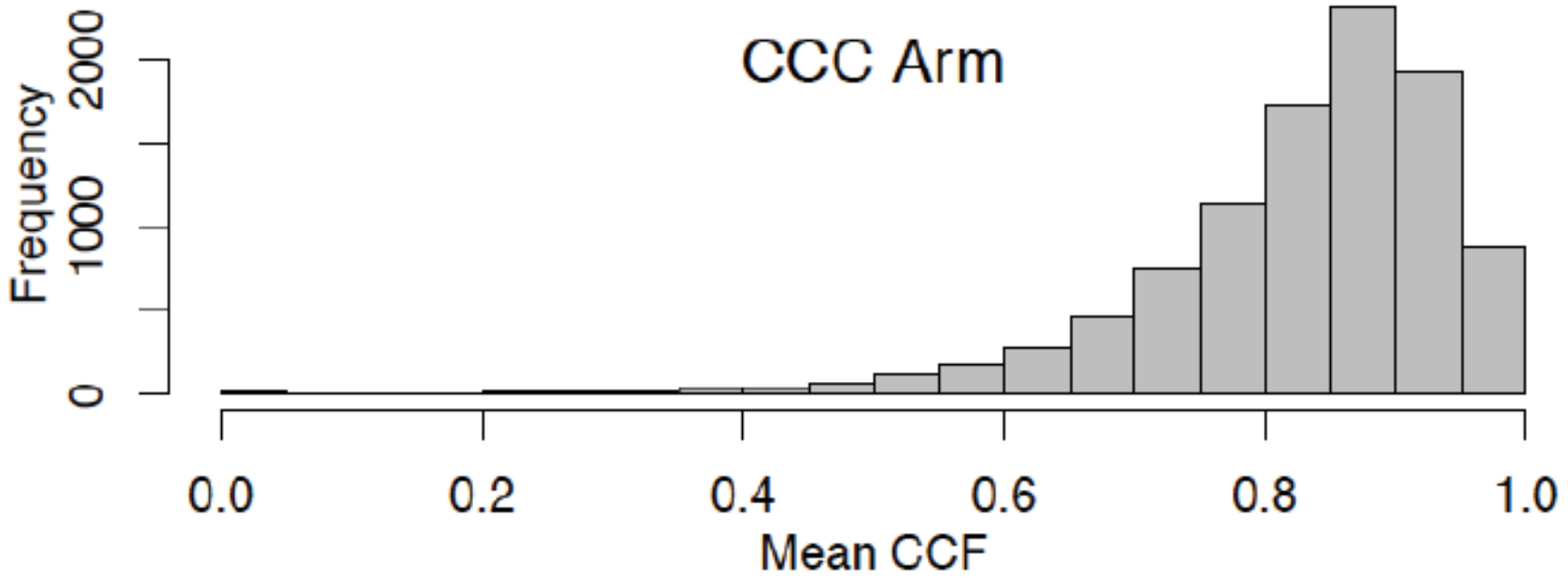
Characteristic	Intervention Group (N=12,653)	Control Group (N=11,058)
Age — yr	66.4±17.2	66.2±17.0
Male sex — no. (%)	8029 (63.5)	7126 (64.4)
Obvious cause of cardiac arrest — no./total no. (%)†	397/12,650 (3.1)	355/11,058 (3.2)
Arrest occurring in public location — no./total no. (%)	1797/12,632 (14.2)	1642/11,049 (14.8)
Witness status — no./total no. (%)		
Bystander witnessed	5179/12,318 (42.0)	4725/10,852 (43.5)
Not witnessed	7139/12,318 (58.0)	6127/10,852 (56.5)
Bystander-initiated CPR — no./total no. (%)		
Yes	5859/12,491 (46.9)	5129/10,901 (47.1)
No	6632/12,491 (53.1)	5772/10,901 (52.9)
Time from dispatch to first arrival of EMS		
Mean — min	5.9±2.5	5.9±2.6
≤4 min — no./total no. (%)	2521/12,424 (20.3)	2272/10,851 (20.9)
Advanced life support at the scene		
Receipt of advanced life support — no. (%)	12,286 (97.1)	10,741 (97.1)
Time from dispatch to first arrival of advanced life support — min	9.0±5.1	9.0±5.1

Study site — %‡		
A	47.6	52.4
B	50.7	49.3
C	56.0	44.0
D	54.9	45.1
E	51.6	48.4
F	50.4	49.6
G	55.8	44.2
H	50.5	49.5

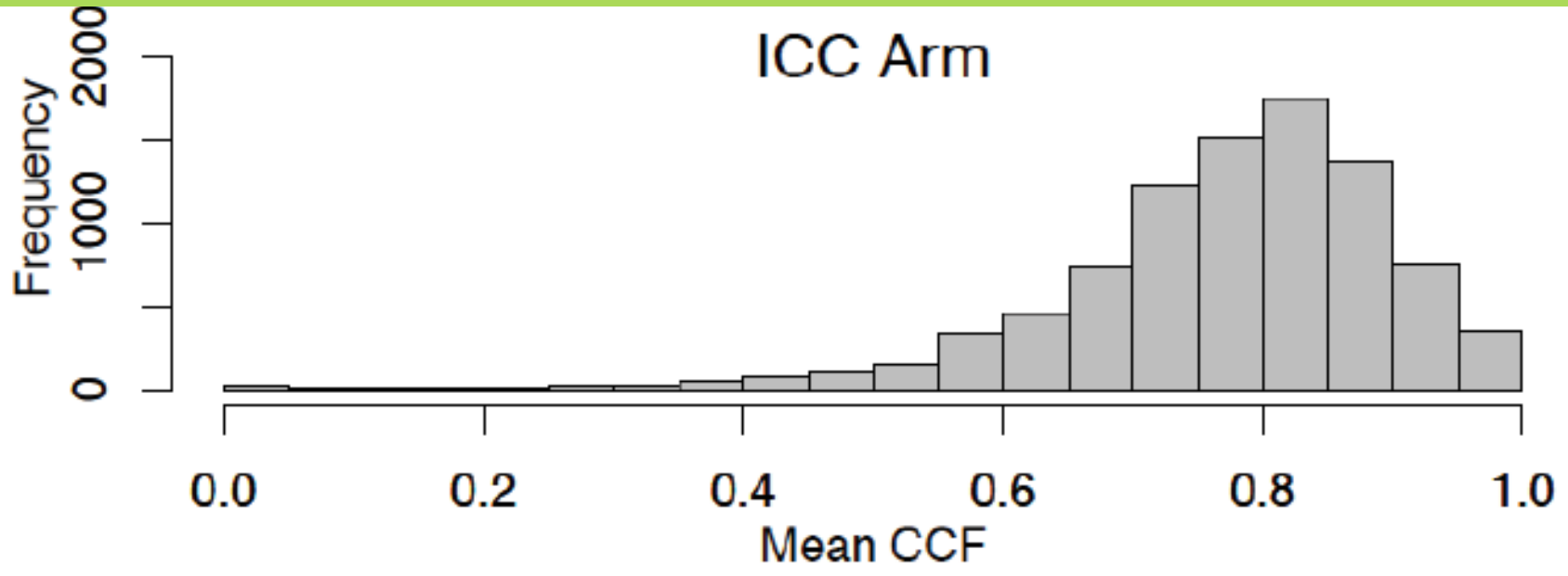
Table 2. Post-Treatment Characteristics and Treatments Received by Patients in the Effectiveness Population.*

Characteristic	Intervention Group (N=12,653)	Control Group (N=11,058)	P Value
Time between arrival of EMS and start of CPR			
Mean — min	2.4±2.1	2.4±2.2	0.33
≤10 min — no./total no. (%)	11,155/11,256 (99.1)	9880/9969 (99.1)	0.97
First rhythm — no./total no. (%)			0.71
Ventricular tachycardia, ventricular fibrillation, or shockable	2,836/12,651 (22.4)	2501/11,056 (22.6)	
Nonshockable	9,640/12,651 (76.2)	8406/11,056 (76.0)	
Unknown, could not be determined, or not available	175/12,651 (1.4)	149/11,056 (1.3)	
No. of shocks, if given	3.4±3.2	3.4±3.0	0.69
Prehospital intubation — no./total no. (%)†			
Attempted	7,195/12,653 (56.9)	6428/11,058 (58.1)	0.32
Successful	6,042/7195 (84.0)	5438/6428 (84.6)	0.35
CPR-process measures taken for ≤6 min or until return of spontaneous circulation, whichever occurred first			
Chest-compression fraction‡	0.83±0.14	0.77±0.14	<0.001
Median	0.90	0.82	
Interquartile range	0.82–0.96	0.74–0.89	
No. of pauses >2 sec	3.8±2.6	7.0±4.3	<0.001
Compression rate — no. of compressions/min	110±11	109±12	0.82
Compression depth — mm	48±12	49±12	0.03
Pause — sec			
Before shock	12±10	12±11	0.70
After shock	6±9	6±14	0.47

Drugs administered before arrival at hospital			
Epinephrine — no./total no. (%)	10,351/12,631 (81.9)	9048/11,042 (81.9)	0.99
Dose — mg§	3.8±2.0	3.8±2.1	0.92
Bicarbonate — no./total no. (%)	2,551/12,628 (20.2)	2351/11,035 (21.3)	0.37
Atropine — no./total no. (%)	503/12,628 (4.0)	389/11,035 (3.5)	0.56
Lidocaine — no./total no. (%)	246/12,629 (1.9)	229/11,034 (2.1)	0.46
Amiodarone — no./total no. (%)	561/12,629 (4.4)	541/11,034 (4.9)	0.37
Vasopressin — no./total no. (%)	164/12,630 (1.3)	187/11,038 (1.7)	0.29
Co-enrollment in ALPS study			
Enrolled — no. (%)	1228 (9.7)	1115 (10.1)	0.56
Group A — no./total no. (%)	416/1,228 (33.9)	377/1,115 (33.8)	
Group B — no./total no. (%)	410/1,228 (33.4)	370/1,115 (33.2)	
Group C — no./total no. (%)	402/1,228 (32.7)	368/1,115 (33.0)	
Not enrolled — no. (%)	11,425 (90.3)	9943 (89.9)	
Hospital procedures — no./total no. (%)¶			
Hypothermia	1,692/3108 (54.4)	1502/2860 (52.5)	0.18
Coronary catheterization <24 hr after ED arrival	916/3108 (29.5)	882/2860 (30.8)	0.20
Implantable cardioverter–defibrillator	293/3108 (9.4)	306/2860 (10.7)	0.13



Chest Compression Fraction



per-protocol解析群

	CCC per protocol	ICC per protocol	CCC not per protocol	ICC not per protocol	Incomplete CPR Process Data	P Values CCC vs ICC
Pre-Randomization Characteristics	N=6545	N=3687	N=3226	N=5113	N=5140	
Age - mean (SD) [N=]	66.3 (17.1) [6540]	66.7 (16.7) [3684]	65.9 (17.2) [3225]	65.5 (17.0) [5109]	67.1 (17.3) [5137]	0.21
Male - n (%) [N=]	4110 (62.8%) [6545]	2403 (65.2%) [3687]	2118 (65.7%) [3226]	3302 (64.6%) [5113]	3222 (62.7%) [5140]	0.02
Obvious Cause of Arrest[1] - n (%) [N=]	214 (3.3%) [6545]	116 (3.1%) [3687]	86 (2.7%) [3226]	152 (3.0%) [5113]	184 (3.6%) [5137]	0.78
Public Location - n (%) [N=]	815 (12.5%) [6545]	541 (14.7%) [3687]	567 (17.6%) [3226]	755 (14.8%) [5113]	761 (14.8%) [5140]	0.01
Witness Status - n (%) [N=]						<0.001
Bystander Witnessed	2534 (38.7%) [6545]	1565 (42.4%) [3687]	1501 (46.5%) [3226]	2196 (42.9%) [5113]	2108 (41.0%) [5139]	
Not Witnessed	3829 (58.5%) [6545]	2038 (55.3%) [3687]	1628 (50.5%) [3226]	2831 (55.4%) [5113]	2940 (57.2%) [5139]	
Bystander CPR - n (%) [N=]						0.1
Yes	3109 (48.0%) [6480]	1803 (49.7%) [3626]	1424 (45.0%) [3161]	2294 (45.4%) [5050]	2358 (46.5%) [5075]	
No	3371 (52.0%) [6480]	1823 (50.3%) [3626]	1737 (55.0%) [3161]	2756 (54.6%) [5050]	2717 (53.5%) [5075]	
Dispatch to first EMS arrival in minutes- mean (SD) [N=]	5.8 (2.5) [6466]	5.8 (2.6) [3632]	5.9 (2.7) [3151]	5.8 (2.7) [5040]	6.0 (2.5) [4986]	0.58
Dispatch to first EMS arrival ≤ 4 min - n (%)	1352 (20.9%)	763 (21.0%)	676 (21.5%)	1143 (22.7%)	859 (17.2%)	0.93
Dispatch to first ALS arrival in minutes[2] - mean (SD) [N=]	8.9 (5.1) [6333]	9.2 (5.2) [3587]	8.7 (5.1) [3124]	8.5 (5.0) [4979]	9.5 (5.2) [4966]	0.003
Treated by ALS - n (%) [N=]	6355 (97.1%) [6545]	3583 (97.2%) [3687]	3131 (97.1%) [3226]	4981 (97.4%) [5113]	4977 (96.8%)	0.86

アウトカム

Table 3. Outcomes in Patients Included in the Primary Analysis.*

Outcome	Intervention Group (N=12,653)	Control Group (N=11,058)	Adjusted Difference (95% CI)	P Value
Effectiveness population				
Primary outcome: survival to discharge — no./total no. (%)	1,129/12,613 (9.0)	1072/11,035 (9.7)	−0.7 (−1.5 to 0.1)	0.07
Transport to hospital — no. (%)	6686 (52.8)	6066 (54.9)	−2.0 (−3.6 to −0.5)	0.01
Return of spontaneous circulation at ED arrival — no./total no. (%)	3,058/12,646 (24.2)	2799/11,051 (25.3)	−1.1 (−2.4 to 0.1)	0.07
Admission to hospital — no./total no. (%)	3,108/12,653 (24.6)	2860/11,058 (25.9)	−1.3 (−2.4 to −0.2)	0.03
Survival to 24 hr — no./total no. (%)	2,816/12,614 (22.3)	2569/11,031 (23.3)	−1.0 (−2.1 to 0.2)	0.10
Hospital-free survival — days†	1.3±5.0	1.5±5.3	−0.2 (−0.3 to −0.1)	0.004
Discharge home — no./total no. (%)	844/12,[illegible] (7.[illegible])	[illegible]/11,034 (7.2)	−0.5 (−1.2 to 0.2)	0.15
Modified Rankin scale score‡				
≤3 — no./total no. (%)	883/12,560 (7.0)	844/10,995 (7.7)	−0.6 (−1.4 to 0.1)	0.09
Mean	5.63±1.29	5.60±1.35	0.04 (0.0 to 0.08)	0.04
Distribution — no./total no. (%)				
0	320/12,560 (2.5)	336/10,995 (3.1)	—	—
1	271/12,560 (2.2)	222/10,995 (2.0)	—	—
2	147/12,560 (1.2)	161/10,995 (1.5)	—	—
3	145/12,560 (1.2)	125/10,995 (1.1)	—	—
4	97/12,560 (0.8)	103/10,995 (0.9)	—	—
5	98/12,560 (0.8)	87/10,995 (0.8)	—	—
6	11,482/12,560 (91.4)	9961/10,995 (90.6)	—	—

一次アウトカム：退院時生存率

二次アウトカム：修正Rankinスケールスコア

Adjusted analyses of primary outcome				
Adjusted for study site	—	—	−0.6 (−1.3 to 0.1)	0.09
Adjusted for age	—	—	−0.7 (−1.5 to 0.1)	0.07
Adjusted for sex	—	—	−0.7 (−1.5 to 0.1)	0.07
Adjusted for public location	—	—	−0.7 (−1.4 to 0.1)	0.09
Adjusted for bystander-witnessed	—	—	−0.6 (−1.4 to 0.3)	0.18
Adjusted for bystander-initiated CPR	—	—	−0.7 (−1.5 to 0.0)	0.07
Adjusted for duration until EMS arrival	—	—	−0.7 (−1.5 to 0.0)	0.07
Adjusted for all the above covariates	—	—	−0.3 (−1.1 to 0.4)	0.38
Additional analyses of primary outcome				
Analysis including multiple imputation — %	9.0	9.8	−0.7 (−1.5 to 0.1)	0.07
Prespecified per-protocol analysis				
Treatment determined by automated algorithm — no./total no. (%)	497/6529 (7.6)	353/3678 (9.6)	−2.0 (−2.9 to −1.1)	<0.001
Adjusted analysis§	—	—	−1.3 (−2.5 to −0.1)	0.04
Post hoc per-protocol analysis: treatment determined by coordinator assessment — no./total no. (%)	834/9649 (8.6)	606/6156 (9.8)	−1.2 (−2.0 to −0.4)	<0.01
Safety population				
Total no.	14,065	12,015		
Survival to discharge — no. (%)	1273 (9.1)	1152 (9.6)	−0.5 (−1.3 to 0.2)	0.15

有害事象

	Effectiveness Population				Safety Population			
	CCC	ICC	Difference	p-value	CCC	ICC	Difference	p-value
Pre-Hospital Events								
Emesis - n (%)	1311 (10.4%)	1197 (10.8%)	-0.5% (-1.0%, 0.1%)	0.11	1487 (10.5%)	1287 (10.7%)	-0.1% (-0.7%, 0.4%)	0.62
Airway bleeding - n (%)	881 (7.0%)	765 (6.9%)	0.0% (-0.8%, 0.8%)	0.91	980 (6.9%)	808 (6.7%)	0.2% (-0.5%, 1.0%)	0.54
Airway complications - n (%)	218 (1.7%)	212 (1.9%)	-0.2% (-0.5%, 0.2%)	0.28	241 (1.7%)	239 (2.0%)	-0.3% (-0.6%, 0.1%)	0.14
ED/Hospital Events[1]								
Pulmonary edema - n (%)	1137 (9.0%)	1073 (9.7%)	-0.7% (-1.7%, 0.3%)	0.16	1267 (9.0%)	1167 (9.7%)	-0.7% (-1.6%, 0.2%)	0.13
Hypotension requiring vasopressors - n(%)	631 (5.0%)	505 (4.6%)	0.4% (-0.3%, 1.1%)	0.26	662 (4.7%)	541 (4.5%)	0.2% (-0.5%, 0.9%)	0.56
Pneumonia - n (%)	522 (4.1%)	421 (3.8%)	0.3% (-0.3%, 0.9%)	0.3	559 (4.0%)	459 (3.8%)	0.2% (-0.4%, 0.7%)	0.59
Rearrest - n (%)	320 (2.5%)	242 (2.2%)	0.3% (-0.2%, 0.9%)	0.22	338 (2.4%)	258 (2.1%)	0.3% (-0.3%, 0.8%)	0.33
Seizure - n (%)	272 (2.1%)	233 (2.1%)	0.0% (-0.4%, 0.5%)	0.84	289 (2.0%)	252 (2.1%)	0.0% (-0.5%, 0.4%)	0.83
Right main stem intubation	125 (1.0%)	116 (1.1%)	-0.1% (-0.3%, 0.2%)	0.63	137 (1.0%)	129 (1.1%)	-0.1% (-0.3%, 0.1%)	0.4
Sepsis - n (%)	157 (1.2%)	129 (1.2%)	0.1% (-0.3%, 0.4%)	0.69	166 (1.2%)	140 (1.2%)	0.0% (-0.3%, 0.4%)	0.94
Rib fracture - n (%)	135 (1.1%)	117 (1.1%)	0.0% (-0.2%, 0.2%)	0.94	149 (1.1%)	128 (1.1%)	0.0% (-0.2%, 0.2%)	0.95
Cerebral bleeding, stroke, CVA - n (%)	93 (0.7%)	83 (0.8%)	0.0% (-0.2%, 0.2%)	0.89	102 (0.7%)	89 (0.7%)	0.0% (-0.2%, 0.2%)	0.87
Bleeding requiring intervention - n (%)	86 (0.7%)	75 (0.7%)	0.0% (-0.2%, 0.3%)	0.99	92 (0.7%)	86 (0.7%)	-0.1% (-0.3%, 0.2%)	0.61
Pneumothorax - n (%)	86 (0.7%)	70 (0.6%)	0.0% (-0.2%, 0.3%)	0.69	90 (0.6%)	73 (0.6%)	0.0% (-0.2%, 0.2%)	0.77
Other adverse event - n (%)	824 (6.5%)	772 (7.0%)	-0.5% (-1.3%, 0.4%)	0.27	910 (6.5%)	837 (7.0%)	-0.5% (-1.2%, 0.2%)	0.18
Any adverse event - n (%)	6889 (54.4%)	6127 (55.4%)	-1.0% (-2.3%, 0.4%)	0.16	7637 (54.1%)	6667 (55.4%)	-1.2% (-3.2%, 0.7%)	0.21
Death - n (%)	11484 (90.8%)	9963 (90.1%)	0.7% (-0.1%, 1.4%)	0.09	12792 (90.7%)	10863 (90.2%)	0.4% (-0.3%, 1.2%)	0.22
Death or any adverse event - n (%)	12275 (97.0%)	10679 (96.6%)	0.4% (0.1%, 0.8%)	0.02	13679 (97.0%)	11632 (96.6%)	0.3% (-0.04%, 0.7%)	0.08

サブグループ解析

Subgroup	Intervention Group (N=12,653)	Control Group (N=11,058)	Difference (95% CI)	P Value
First rhythm — no./total no. (%)				0.34
Ventricular tachycardia, ventricular fibrillation, or shockable	780/2813 (27.7)	739/2487 (29.7)	−2.0 (−4.6 to 0.6)	
Nonshockable	289/9623 (3.0)	288/8397 (3.4)	−0.4 (−1.0 to 0.1)	
Unknown, could not be determined, or not available	60/177 (33.9)	45/151 (29.8)	4.1 (−6.6 to 14.8)	
Witnessed status — no./total no. (%)				0.05
Bystander witnessed	805/5153 (15.6)	812/4707 (17.3)	−1.6 (−3.4 to 0.1)	
Unwitnessed	294/7125 (4.1)	240/6122 (3.9)	0.2 (−0.4 to 0.8)	
Location of arrest — no./total no. (%)				0.77
Public	413/1777 (23.2)	395/1629 (24.2)	−1.0 (−3.9 to 1.9)	
Private	714/10,816 (6.6)	676/9397 (7.2)	−0.6 (−1.2 to 0.0)	
Cause of arrest — no./total no. (%)				0.14
Obvious	1060/12,215 (8.7)	1020/10,680 (9.6)	−0.9 (−1.6 to −0.1)	
Not obvious	69/395 (17.5)	52/355 (14.6)	2.8 (−2.3 to 7.9)	
Bystander-initiated CPR — no./total no. (%)				0.10
Administered	680/5834 (11.7)	663/5113 (13.0)	−1.3 (−2.6 to 0.0)	
Not administered	436/6617 (6.6)	390/5766 (6.8)	−0.2 (−0.9 to 0.5)	
Individual case compliance with performance benchmarks — no./total no. (%)				0.05
Compliance with all benchmarks	361/4077 (8.9)	280/2655 (10.5)	−1.7 (−2.8 to −0.6)	
Noncompliance with ≥1 benchmark	768/8536 (9.0)	792/8380 (9.5)	−0.5 (−1.3 to 0.4)	

Cluster probationary status — no./total no. (%)				0.71
Never on probation	114/785 (14.5)	115/810 (14.2)	0.3 (–2.4 to 3.0)	
On probation at some time but not suspended	984/11,372 (8.7)	928/9849 (9.4)	–0.8 (–1.6 to 0.0)	
Suspended	31/456 (6.8)	29/376 (7.7)	–0.9 (–2.6 to 0.7)	
Study site — %†				0.91
N	12.5	12.1	0.3 (–1.6 to 2.3)	
O	6.7	7.8	–1.1 (–2.4 to 0.1)	
P	18.7	18.8	–0.1 (–2.6 to 2.3)	
Q	8.6	9.0	–0.4 (–4.1 to 3.3)	
R	9.2	9.8	–0.6 (–2.6 to 1.4)	
S	8.3	10.0	–1.7 (–4.3 to 0.9)	
T	7.0	7.0	0.0 (–2.0 to 2.0)	
U	3.0	4.1	–1.1 (–5.4 to 3.2)	
Survival according to timing in treatment period — no./total no. (%)‡				0.38
First 3 mo	582/6434 (9.0)	509/5382 (9.5)	–0.4 (–1.6 to 0.7)	
Second 3 mo	547/6179 (8.9)	563/5653 (10.0)	–1.1 (–2.2 to –0.1)	

結果のまとめ

- 退院時生存率，神経学的予後に有意差なし
- CCC群では，病院移送率・入院率が低く，在宅生存期間が短かった
- per-protocol解析では，CCC群の退院時生存率は有意に低かった
- 有害事象については，ICC群で少なかった

考察

先行研究

- CCCによる生存率改善を示唆した観察研究

JAMA 2008;299:1158-65.
Am J Med 2006;119:335-40.
Circulation 2009;119:2597-605.
Ann Emerg Med 2009;54:656-662.e1.

- 今回の研究は先行研究と異なる結果
- 理由：
  CPRの質改善，CPR以外の蘇生処置の改善，
  ホーソン効果などの影響

欠点/Limitations

- per-protocol解析，post hoc per-protocol解析，いずれも多くの参加者が除外
- 特にICC群で除外され，群間差が不均衡
- その結果，退院時生存率がICC群で改善した可能性あり

Outcome	Intervention Group (N=12,653)	Control Group (N=11,058)	Adjusted Difference (95% CI)	P Value
Additional analyses of primary outcome				
Analysis including multiple imputation — %	9.0	9.8	−0.7 (−1.5 to 0.1)	0.07
Prespecified per-protocol analysis				
Treatment determined by automated algorithm — no./total no. (%)	497/6529 (7.6)	353/3678 (9.6)	−2.0 (−2.9 to −1.1)	<0.001
Adjusted analysis§	—	—	−1.3 (−2.5 to −0.1)	0.04
Post hoc per-protocol analysis: treatment determined by coordinator assessment — no./total no. (%)	834/9649 (8.6)	606/6156 (9.8)	−1.2 (−2.0 to −0.4)	<0.01

欠点/Limitations

- Chest-compression fractionの群間差が小さい

Characteristic	Intervention Group (N=12,653)	Control Group (N=11,058)	P Value
Chest-compression fraction‡	0.83±0.14	0.77±0.14	<0.001
Median	0.90	0.82	
Interquartile range	0.82–0.96	0.74–0.89	

- 介入群，対照群，それぞれに割り付けられた人数が異なり，特性も異なっていた
- 蘇生後の治療は，モニタしたがプロトコル化しなかった
- 酸素化や換気の質について評価しなかった

まとめ

非外傷性心肺停止患者

絶え間ない胸骨圧迫
非同期的陽圧換気
vs
30:2のCPR法

退院時生存率に差なし

当院としての見解

- 絶え間ない胸骨圧迫+非同期的陽圧換気では，合併症増加の傾向があり，現状では推奨できない
- 現状はガイドライン2015に則り，30:2法で心肺蘇生を行う