Automated Pneumatic Ventilator in OHCA

A Randomized Controlled Trial

范程羿醫師
黃沛銓主任

Recent Study

Available online at ScienceDirect

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

Clinical paper

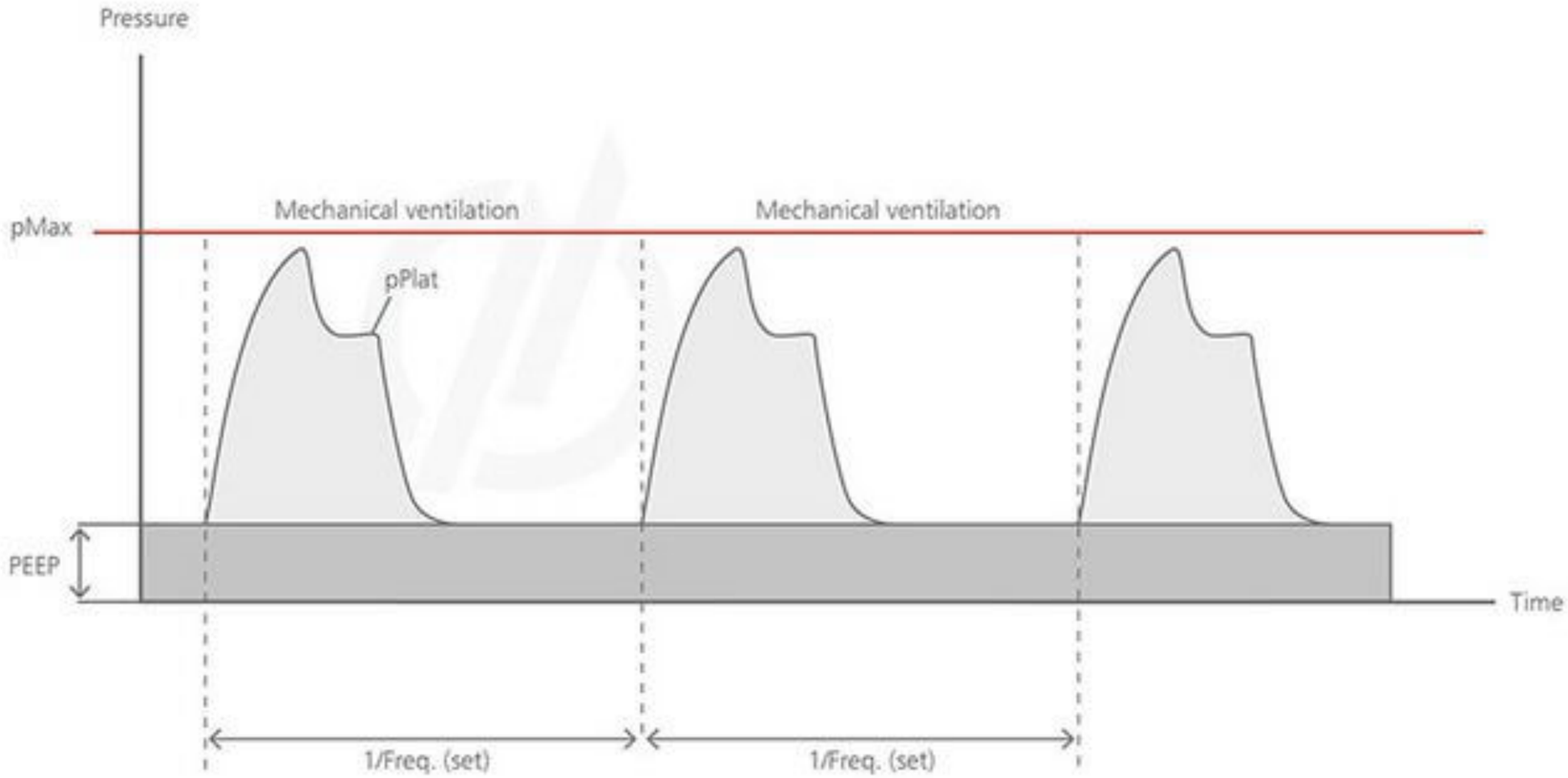
Ventilatory improvement with mechanical ventilator versus bag in non-traumatic out-of-hospital cardiac arrest: SYMEVECA study, phase 1

SYMEVECA study

- Stage 1：Comparing IPPV & BVM
- Stage 2：Comparing different ventilator mode

Intermittent positive ventilation

- Mandatory ventilation in fixed frequency and volume
- APV works the same way



Study Design

- Period：2021/4-2022/9
- Inclusion criteria: adult, nontraumatic OHCA treated by EMS
- Exclusion criteria
  - Delayed intubation (>8 minutes)
  - Early ROSC (<3 minutes after intubation)
  - Apply more than one mode of ventilation
- Group：IPPV v.s. BVM
  - Pragmatic prospective semi-experimental study

Outcomes

- Primary：blood gas analysis
- Secondary：ROSC and survival

Results

All patient: first blood gas

All Patients	IPPV (n=71)	BVM (n=79)	p
Gender (female)	18.3%	26.6%	0.23
Age (years)	65.0 ± 16.2	66.5 ± 16.3	0.58
First responder (%)	68.8%	75.0%	0.43
Rhythm			0.27
VF (%)	39.4%	27.8%	
pVT (%)	2.5%	0%	
Asystole (%)	53.5%	39.5%	
PEA (%)	7.0%	10.1%	
Response time (min)	6.87 ± 2.77	6.94 ± 3.47	0.90
pH	7.20 ± 0.14	7.13 ± 0.18	0.17
PCO2 (mmHg)	62.2 ± 20.8	56.7 ± 18.0	0.34
BE (mmol/l)	−4.5 ± 5.3	−8.7 ± 7.4	0.03
Lactate (mmol/l)	7.4 ± 4.0	8.0 ± 4.8	0.41
Glycemia (mg/dl)	179.7 ± 83.3	194.8 ± 103.6	0.33

Results

All patients：15 mins post intubation / ROSC

Arterial blood	IPPV (n=24)	BVM (n=15)	p
pH	7.00 ± 0.18	6.92 ± 0.18	0.18
pCO2 (mmHg)	67.8 ± 21.1	95.9 ± 39.0	0.006
pO2 (mmHg)	83.6 ± 71.1	124.8 ± 107.3	0.17
HCO3– (mmHg)	18.2 ± 6.5	10.3 ± 7.1	0.63
BE (mmHg)	−13.1 ± 8.7	−13.4 ± 8.7	0.92
Lactato (mmol/l)	10.7 ± 4.0	11.9 ± 3.5	0.39
K (mmol/l)	4.0 ± 0.9	4.9 ± 1.4	0.03
Ca^{2+} (mmol/l)	1.17 ± 0.10	1.20 ± 0.11	0.32

Results

All patients：15 mins post intubation / ROSC

Venous gas	IPPV (n=47)	BVM (n=64)	p
pH	7.03 ± 0.15	6.94 ± 0.17	0.005
pCO2 (mmHg)	68.1 ± 18.9	89.5 ± 26.5	< 0.001
pO2 (mmHg)	31.2 ± 20.2	35.8 ± 28.5	0.36
HCO3– (mmHg)	19.7 ± 5.7	19.4 ± 6.3	0.80
BE (mmHg)	−11.0 ± 7.4	−13.0 ± 8.0	0.20
Lactato (mmol/l)	8.6 ± 3.8	9.7 ± 3.9	0.16
K (mmol/l)	3.8 ± 1.1	4.4 ± 1.4	0.02
Ca^{2+} (mmol/l)	1.10 ± 0.20	1.17 ± 0.13	0.02

Results

Secondary outcomes

Table 4 – Association between ventilatory mode and outcome (ALL patients in SECTION A and only SHOCKABLE in SECTION B). ROSC: recovery of spontaneous circulation. CPC: Cerebral Performance Category.

SECTION A (ALL)	IPPV (n = 71)	Bag (n = 79)	p
ROSC (%)	60.3%	50.7%	0.24
Time of advanced CPR until ROSC (min)	18.5 ± 10.0	19.6 ± 9.8	0.37
Hospital survival (% out of all included patients)	21.1%	17.9%	0.63
CPC 1–2 (% out of all included patients)	15.6%	11.3%	0.44
SECTION B (SHOCKABLE)	**IPPV (n = 28)**	**Bag (n = 24)**	**p**
ROSC (%)	75.0%	58.3%	0.20
Time of advanced CPR until ROSC (min)	14.9 ± 6.5	21.7 ± 12.2	0.12
Hospital survival (% out of all included patients)	39.3%	29.2%	0.44
CPC 1–2 (% out of all included patients)	25.0%	21.7%	0.79

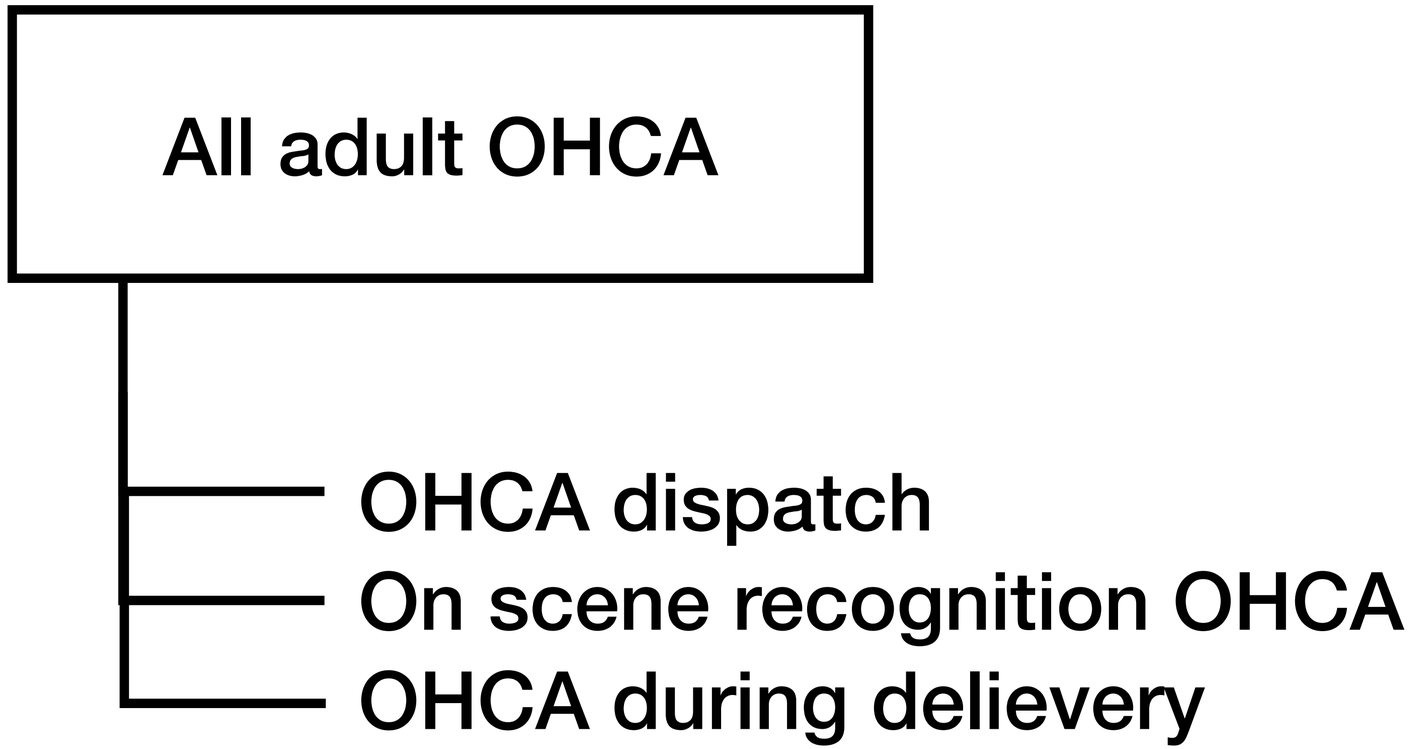
Our Hypothesis

APV can improve OHCA outcome comparing to BVM in prehospital settings

Study design

- Single center, single-blinded randomized controlled trial
- Recruiting numbers：145/145

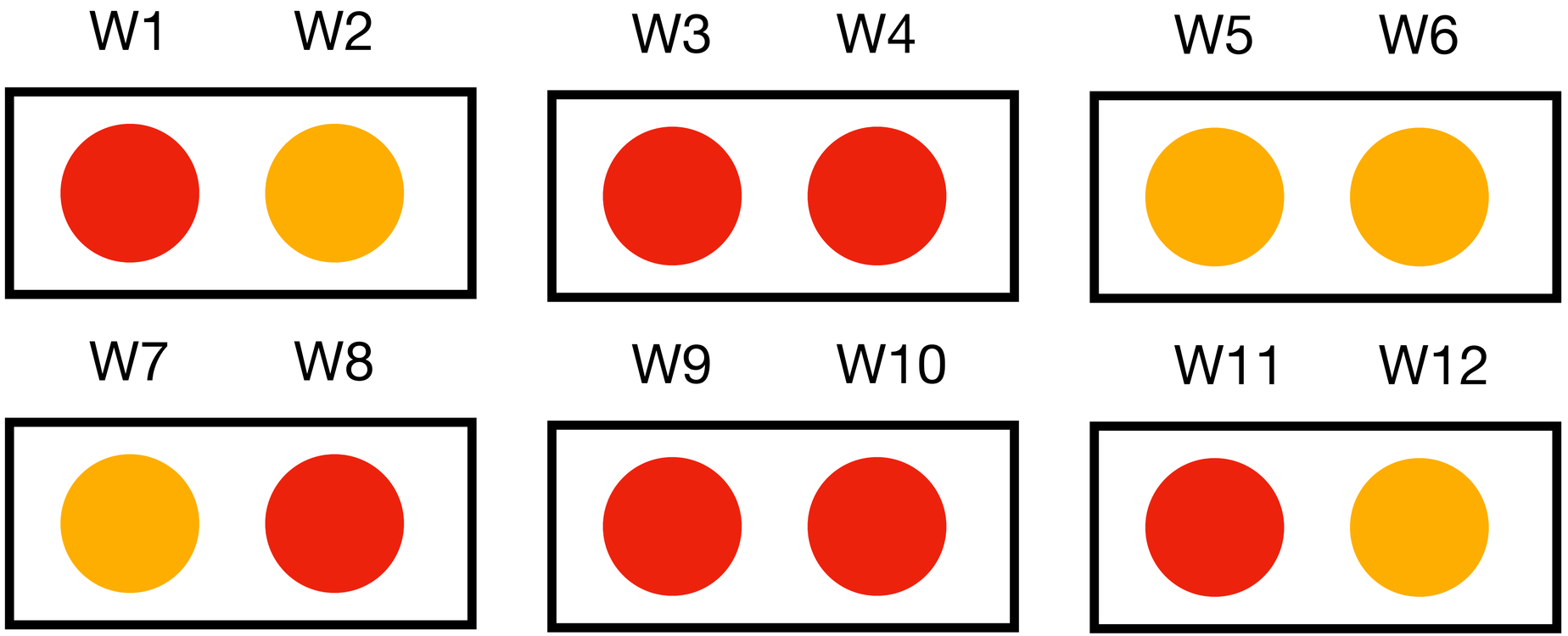
Selection criteria



Selection criteria

- **Exclusion**
    1. Trauma
    2. ROSC on scene
    3. Apparent mortem
    4. Refuse to deliver
    5. No advanced airway
    6. Pregnancy

Cluster Randomization



Scenerio

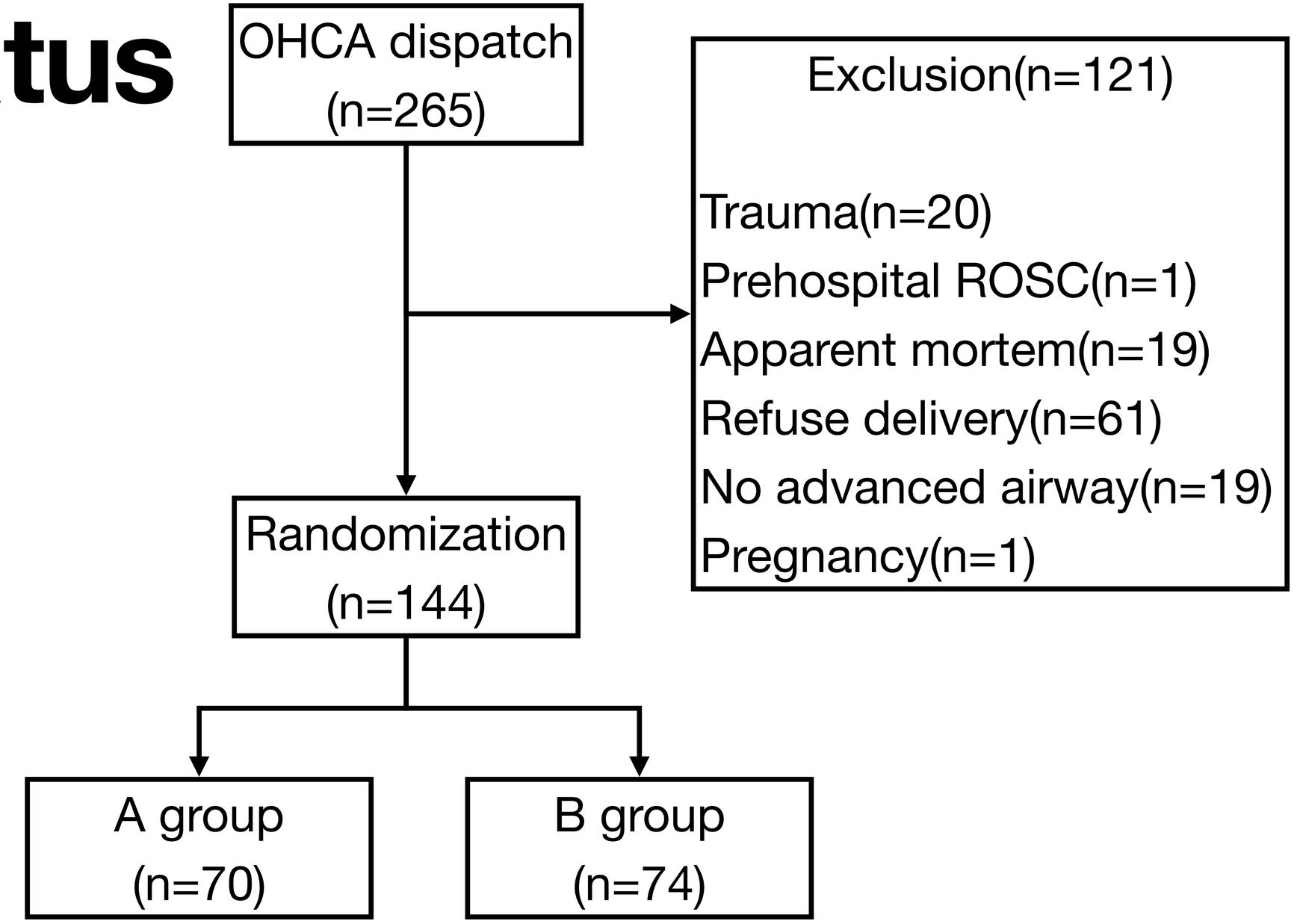
1. Announce group assignments in Line group every Friday.
2. Team members confirm equipment functionality.
3. Dispatch center assigns OHCA calls.
4. EMS Squad verifies case criteria before providing BLS or ACLS.
5. Decide on ETT or SGA based on scene situation.
6. Report any changes in equipment during rescue.

AccuVent
感測器
自動給氧機
進階呼吸道
HEPA
過濾器
ETCO2
感測器

Outcome

1. Primary：Any ROSC
2. Secondary
    1. Survival
        1. 24 hour survival
        2. Survival to discharge
    2. Ventilation quality (volume, rate)
    3. $ETCO_2$
    4. BLS/ACLS quality　(CCF, IV catheter, epinephrine, dispatch timing)

Current status (10/02-04/14)



Results

Table 2. Preshospital ROSC

(N=144)	A 組 (n=70)	B 組 (n=74)	*p*
Prehospital ROSC	7 (10.0)	10 (13.5)	0.514

Table 3. All ROSC

(N=120)	A 組 (n=56)	B 組 (n=64)	*p*
All Rosc	14 (25.0)	21 (32.8)	0.348

Table 4 Discharge

(N=108)	A 組 (n=52)	B 組 (n=54)	*p*
Discharge	0 (0)	0 (0)	0.846