**Supplementary Appendix**

This appendix has been provided by the authors to give readers additional information about their work.

**Precision implementation of** **early ambulation in elderly patients underwent** **off-pump coronary artery bypass graft surgery: a randomized controlled clinical trial**

Zhaomei Cui 1#, Na Li 3#, Yiou Fan4, Xin Zhuang1, Jing Liu1, Jie Zhang1, Qi Tan1,2**\***

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***Study eligibility criteria***

Diagnosis and main criteria for inclusion, exclusion and withdrawal criteria:

Primary inclusion criteria:

(I) age ≥ 60 years; (II) received OPCAPG surgery; (III) had cardiac function between Grade I ~ III based on the NYHA classification; (IV) removed the tracheal intubation within 12h after OPCABG surgery; (V) had normal cognition and expression ability; (VI) joined this research program voluntarily.

Primary exclusion criteria:

(I) had acute myocardial infarction one week before operation; (II) had comorbidity of severe lung diseases, such as chronic obstructive pulmonary disease, bronchiectasis, etc.; (III) received antibiotic treatment for pneumonia recently; (IV) suffered from mental illness or refused to cooperate; (V) had abnormalities in movement due to central nervous system disease or limb lesions; (VI) participated in other clinical trials.

Primary withdrawal criteria:

(I) could not complete this study due to the occurrence of sudden events **,** shown in **Table S2,** such as unpredictable emergencies; (II) HB <70g/L or drainage volume more than 1000ml within 12h after surgery; (III) individual willing to withdraw; (IV) could not complete the study due to serious organ dysfunction, such as cerebral infarction, cerebral hemorrhage, renal failure and so on.

***Rehabilitation measure***

Except different ambulation protocols, patients in PEA and Control group shared similar ERAS procedures. Preoperative measurements included preoperative assessment, education and psychological counselling, respiratory exercise, and antibiotic prophylaxis within half an hour of anesthesia. Intraoperative measurements included lung protection strategy, blood conservation measurements, cerebral oxygen saturation monitoring, Swan-Ganz monitoring and insulation intervention. Postoperative measurements included analgesia, nausea and vomiting prevention, inspiratory muscle training, early oral intake and early removal of drainage tube. The precondition for ambulation in two groups were shown as follows: 1) patients with clear consciousness, emotional stability, and could accurately answer open questions; 2) electrocardiograph monitoring: blood pressure 90-160/60-100mmHg, heart rate≥50 beats /min, and pulse oxygen saturation ( SpO2)>92%, Partial pressure O2 (PaO2) >50mmHg; 3) drainage volume <200ml within 4 h before getting out of bed; 4) muscle strength assessment≥3 [[17](#_ENREF_17)]; 5) administration of dopamine≤2μg/kg·min.

***PTSD Checklist-Civilian screening scale (PCL-C)***

PCL-C included 17 items, each item had five levels, and the total score was 85. The criteria for the PCL-C scores was shown as follows: 17~37 points: normal, no obvious symptoms of PTSD; 38~49 points: mild, a certain degree of PTSD symptoms; 50~85 points: moderate/severe, obvious symptoms of PTSD.

**Table S1.** Withdraw criteria for adverse events.

|  |  |
| --- | --- |
| **HR** | **SpO2 and RR** |
| Ventricular arrhythmia or Conduction block>Grade II Decreased compared to resting state>20%<40 beats per min (bpm) or >130 bpm | Decreased SpO2 compared to resting state>6% SpO2<88%  RR>40 times/min |
| **BP** | **Mental State** |
| Systolic pressure (SP)>180mmHg | RASS score<-3 or >2 |
| Drop of Systolic/diastolic pressure (SP/DBP)>20%  | Exertional dyspnea Unable to tolerate activity |
| Orthostatic hypotension |  |
| Dopamine dosage>5µg/kg·min |  |

Note: **HR:** Heart Rate; **SpO2：**pulse oxygen saturation; **RR:** Respiratory Rate; **BP:** Blood Pressure; **RASS :** [Richmond Agitation-Sedation Scale](http://www.baidu.com/link?url=CbmRzMktzRdUK-n8ARCcE3RetBq-GHIri7n_3seN3VH3ao3H3IJj5u6kB_mW7_aHET3iXAbMEqRvo-w1qLLzihKt4K7A1hmMjfxJVq7iM0G);

**Table S2.** The formula of APMHR and VO2max for patients in the PEA group.

|  |  |
| --- | --- |
| Items | a Calculation |
| The maximal exercise HR on the first day (% MHR) | 0.64×10+37≈43% |
| The maximal exercise HR on the second day (% MHR) | 0.64×20＋37≈50% |
| The maximal exercise HR on the third day (% MHR) | 0.64×30＋37≈56% |
| HRR (bpm) | 205.8－0.685×60≈165  |
| 47% of APMHR a (bpm) | 165×43%＋50≈121  |
| 50% of APMHR (bpm) | 165×50%＋50≈132  |
| 56% of APMHR (bpm) | 165×56%＋50≈142  |

Note: VO2max was setting as 10% on the first day, 20% on the second day and 30% on the third day after surgery.

a Formula[6]:

%MHR = 0.64 × %VO2max+ 37; HRmax=205.8-0.685×age;

HRR=HRmax-RHR; X% APMHR=HRR×X%+RHR

*Abbreviation in the above formula:*

APMHR: Age predictive maximum heart rate; SpO2: Surplus pulse O2;

%MHR: Maximum exercise heart rate; %VO2max: Maximum oxygen uptake;

HRmax: Maximum heart rate; HRR: Heart rate reserved;

RHR: Resting Heart Rate.

**Table S3**. Laboratory tests of patients in PEA and Control groups.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | PEA group(n=89) | Control group(n=89) | P-value | PW | Pg | Pi |
| **TNI (ng/ml)** |  |  |  |
| Before surgery | 0.04(0.02,0.06) | 0.04(0.03,0.06) | 0.634 |  |  |  |
|  |  |  |  | 0.002 | 0.599 | 0.601 |
| 1st day after surgery | 0.38(0.25,0.88) | 0.48 (0.31,0.86) | 0.207 |  |  |  |
| 2nd day after surgery | 0.30(0.16,0.51) | 0.31 (0.18,0.60) | 0.515 |  |  |  |
| 3rd day after surgery | 0.12(0.07,0.33) a | 0.16 (0.09,0.39)b | 0.295 |  |  |  |
| **CK-MB (ng/ml)** |  |  |  |
| Before surgery | 1.10(0.50,1.50) | 1.0(0.50,1.30) | 0.215 |  |  |  |
|  |  |  |  | 0.000 | 0.415 | 0.608 |
| 1st day after surgery | 4.07(3.00,6.35) | 4.61 (3.21,6.77) | 0.348 |  |  |  |
| 2nd day after surgery | 2.55(1.74,4.98) | 3.15 (1.78,5.06) | 0.482 |  |  |  |
| 3rd day after surgery | 1.93(1.15,3.09) c | 1.81 (1.25,3.29)d | 0.903 |  |  |  |
| **PO2(mmHg)** |  |  |  |
| Before surgery | 76.5±10.0 | 75.9±7.5 | 0.559 |  |  |  |
|  |  |  |  | 0.000 | 0.001 | 0.063 |
| 1st day after surgery | 90.5±20.1 | 84.4±21.7 | 0.055 |  |  |  |
| 2nd day after surgery | 79.6±19.5 | 75.3±18.2 | 0.048 |  |  |  |
| 3rd day after surgery | 84.8±20.2 | 78.2±14.9 | 0.010 |  |  |  |
| **PCO2(mmHg)** |  |  |  |
| Before surgery | 38.4±4.0 | 37.7±3.4 | 0.183 |  |  |  |
|  |  |  |  | 0.000 | 0.102 | 0.785 |
| 1st day after surgery | 38.7±4.1 | 38.0±3.4 | 0.121 |  |  |  |
| 2nd day after surgery | 39.2±4.0 | 38.4±4.2 | 0.114 |  |  |  |
| 3rd day after surgery | 37.3±4.9 | 36.8±4.2 | 0.475 |  |  |  |

Note: Data were presented as the Mean ± SD and median (range) or in parameter counts (n). Mann-Whitney U tests were used to compare TNI and CK-MB, while Student’s t-test was used to compare PO2 and PCO2 at same time point. TNI, CK-MB, PO2 and PCO2 at 3 different time points (1st day after surgery, 2nd day after surgery and 3rd day after surgery) were analyzed by repeated-Measures Analysis of Variance.

aday1 vs. day3 p=0.000; b day1 vs. day3 p=0.000; c day1 vs. day3 p=0.000; d day1 vs. day3 p=0.000.

**Table S4.** Univariate analysis of association between baseline variables and early discharge.

Any value with p < 0.1 was incorporated into a multivariate logistic regression model.

|  |  |  |  |
| --- | --- | --- | --- |
| Variable | Early discharge: YES (n=65) | Early discharge: NO (n=113) | *P* value |
| Age (months) | 64.31±4.31 | 66.44±4.60 | 0.003 |
| Female sex-no. (%) | 15(22.7%) | 36(32.1%) | 0.180 |
| BMI, kg/m2 | 25.59±2.76 | 25.94±2.98 | 0.442 |
| Randomization to PEA | 41(62.1) | 48(42.9) | 0.013 |
| Hypertension (%) | 19(28.8) | 30(26.8) | 0.773 |
| Diabetes (%) | 14(21.2) | 20(17.9) | 0.582 |
| Renal insufficiency (%) | 1(1.5) | 6(5.4) | 0.203 |
| Cerebral infarction (%) | 2(3.0) | 14(12.5) | 0.033 |
| Smoking (%) | 17(25.8) | 39(34.8) | 0.208 |
| Preoperative ejection fraction (%) | 59.43±2.89 | 58.76±3.80 | 0.187 |
| Number of heart bypass | 4.11±0.44 | 4.10±0.45 | 0.983 |
| Euro Score | 4.02±1.62 | 4.87±1.77 | 0.002 |

Data are means ± standard deviation (SD), and number of subjects (n) and percentage (%) for categorical variables.

BMI: body mass index; PEA: precision early ambulation

**Table S5.** Comparison of PTSD score in patients of the PEA and Control group.

|  |  |  |  |
| --- | --- | --- | --- |
| Number of patients (%) | PEA Group (n=89) | Control Group (n=89) | *P-*value |
| Total score | 27.72±9.34 | 40.44±12.55 | 0.000 |
| Normal  | 70 (78.7%) | 56 (62.9%) |  |
| Mild  | 16 (20.0%) | 26 (29.2%) |  |
| Moderate/Severe  | 3 (3.4%) | 7 (7.9%) |  |

Note: Data were presented as the Mean ± SD or N (%).