

SUPPLEMENTARY

Table S1 Anesthesia Protocol

Anesthesia was induced with a standardized regimen of propofol, sufentanil, and rocuronium. The anesthesia maintenance drugs included: propofol, remifentanil, rocuronium, and sevoflurane. The entropy index was maintained between 40 and 60 during surgery. Patients who cannot be monitored for depth of anesthesia by entropy index due to the location of the surgical incision will be monitored by maintaining systolic blood pressure values at baseline values $-20\% \sim +20\%$. After surgery, all patients were transferred to the intensive care unit with tracheal intubation for observation, and the intensive care unit physicians decided to extubate and transfer them back to the wards based on their condition.

Table S2 Perioperative Sleep Patterns Associated with Postoperative Delirium Based on Main Effect

	No postoperative delirium						Postoperative delirium						Time effect	Group effect
	Day (-3)	Day (-2)	Day (-1)	Day (1)	Day (2)	Day (3)	Day (-3)	Day (-2)	Day (-1)	Day (1)	Day (2)	Day (3)	<i>P</i>	<i>P</i>
N	62	57	58	63	60	58	20	19	22	20	21	20		
Total sleep duration, min													0.014	0.353
Mean	403.9	400.3	397.4	413.3	396.7	397.0	405.8	380.7	388.0	398.6	390.7	388.6		
95% CI	396.0-411.7	390.0-410.7	387.0-407.8	401.8-424.9	387.7-405.6	387.3-406.7	388.3-423.3	357.5-404.0	370.0-405.9	366.9-430.3	369.1-412.3	367.0-410.1		
Deep sleep duration, min													<0.001	0.126
Mean	69.4	64.3	66.6	65.4	69.1	77.2	59.9	57.7	54.0	60.0	64.5	67.3		
95% CI	62.8-76.0	57.9-70.8	58.3-74.8	59.6-71.1	63.0-75.1	70.8-83.5	47.3-72.4	44.4-71.0	44.7-63.3	49.4-70.5	53.7-75.4	53.0-81.6		
Light sleep duration, min													<0.001	0.841
Mean	242.8	242.1	244.2	256.3	236.2	229.8	258.0	238.1	250.2	252.6	230.0	230.0		
95% CI	236.0-249.5	235.2-248.9	237.0-251.4	249.7-262.9	227.8-244.6	223.4-236.3	240.3-275.6	220.6-255.5	236.3-264.0	232.8-272.3	213.9-246.2	215.3-244.7		
Rapid eye movement phase duration, min													0.545	0.415
Mean	91.0	94.9	89.8	91.8	90.1	89.5	87.9	85.7	83.7	88.4	92.5	92.3		
95% CI	86.7-95.2	90.0-99.8	85.1-94.4	86.7-97.0	84.9-95.3	84.6-94.4	79.6-96.2	76.5-95.0	76.6-90.7	77.4-99.3	84.4-100.6	81.3-103.3		
Sleep efficiency, %													0.166	0.114
Mean	82.7	82.0	80.8	81.0	81.8	81.9	80.7	79.7	80.4	80.2	78.1	80.6		
95% CI	81.9-83.6	80.8-83.1	79.6-82.0	79.7-82.4	80.7-82.8	80.8-83.1	77.9-83.5	76.9-82.5	78.5-82.2	77.6-82.8	75.2-81.0	78.3-82.8		
Sleep latency, min													0.017	0.018

Mean	27.5	24.9	28.7	23.7	22.3	22.9	33.4	35.3	37.7	36.1	30.7	29.7		
95% CI	23.5-	21.2-	24.6-	20.5-	19.2-	19.4-	24.4-	25.6-	27.5-	27.5-	23.4-	21.2-		
	31.6	28.6	32.7	27.0	25.5	26.5	42.4	44.9	47.9	44.6	37.9	38.1		
Apnea-hypopnea index													<0.001	0.013
Mean	13.5	12.7	12.8	24.6	16.9	14.8	12.6	15.3	17.1	27.1	20.8	19.5		
95% CI	12.0-	10.9-	11.0-	22.4-	14.7-	13.0-	9.9-15.2	12.5-	14.8-	22.0-	17.2-	16.5-		
	15.0	14.4	14.7	26.8	19.1	16.7		18.1	19.4	32.1	24.3	22.4		
Frequency of awakenings													<0.001	0.020
Mean	4.4	3.7	5.1	4.7	4.2	3.2	4.7	4.4	6.5	4.9	4.4	4.9		
95% CI	4.0-4.8	3.2-4.2	4.5-5.7	4.1-5.2	3.6-4.7	2.7-3.7	3.8-5.6	3.6-5.3	5.7-7.4	4.1-5.6	3.7-5.0	4.0-5.8		

Notes: Data are presented as estimated mean (95% CI). These analyses were performed using generalized estimating equations.

Table S3 Perioperative Sleep Patterns Associated with Postoperative Delirium Based on Group-by-Time Interaction

	No postoperative delirium	Postoperative delirium	Mean difference (%)	95% CI	<i>P</i>
Sleep latency, mean (95% CI)					
Day (-3)	27.5 (23.5–31.6)	33.4 (24.4–42.4)	-5.9 (17.7)	(-15.8-4.0)	0.245
Day (-2)	24.9 (21.2–28.6)	35.3 (25.6–44.9)	-10.4 (29.5)	(-20.7–0)	0.050
Day (-1)	28.7 (24.6–32.7)	37.7 (27.5–47.9)	-9.0 (23.9)	(-19.9–2.0)	0.108
Day (1)	23.7 (20.5–27.0)	36.1 (27.5–44.6)	-12.3 (34.1)	(-21.4– -3.2)	0.008
Day (2)	22.3 (19.2–25.5)	30.7 (23.4–37.9)	-8.4 (27.4)	(-16.3– -0.4)	0.038
Day (3)	22.9 (19.4–26.5)	29.7 (21.2–38.1)	-6.7 (22.6)	(-15.9–2.4)	0.150
Deep sleep duration, mean (95% CI)					
Day (-3)	69.4 (62.8–76.0)	59.9 (47.3–72.4)	9.5 (15.9)	(-4.7–23.7)	0.189
Day (-2)	64.3 (57.9–70.8)	57.7 (44.4–71.0)	6.6 (11.4)	(-8.1–21.4)	0.378
Day (-1)	66.6 (58.3–74.8)	54.0 (44.7–63.3)	12.6 (23.3)	(0.1–25.0)	0.047
Day (1)	65.4 (59.6–71.1)	60.0 (49.4–70.5)	5.4 (9.0)	(-6.6–17.4)	0.376
Day (2)	69.1 (63.0–75.1)	64.5 (53.7–75.4)	4.5 (7.0)	(-7.9–16.9)	0.473
Day (3)	77.2 (70.8–83.5)	67.3 (53.0–81.6)	9.8 (14.6)	(-5.8–25.5)	0.216
Frequency of awakenings, mean (95% CI)					
Day (-3)	4.4 (4.0–4.8)	4.7 (3.8–5.6)	-0.3 (6.4)	(-1.3–0.7)	0.585
Day (-2)	3.7 (3.2–4.2)	4.4 (3.6–5.3)	-0.7 (15.9)	(-1.7–0.3)	0.162
Day (-1)	5.1 (4.5–5.7)	6.5 (5.7–7.4)	-1.4 (21.5)	(-2.4– -0.4)	0.006
Day (1)	4.7 (4.1–5.2)	4.9 (4.1–5.6)	-0.2 (4.1)	(-1.2–0.8)	0.711
Day (2)	4.2 (3.6–4.7)	4.4 (3.7–5.0)	-0.2 (4.5)	(-1.1–0.6)	0.593
Day (3)	3.2 (2.7–3.7)	4.9 (4.0–5.8)	-1.7 (34.7)	(-2.7– -0.7)	0.001
Apnea-hypopnea index, mean (95% CI)					
Day (-3)	13.5 (12.0–15.0)	12.6 (9.9–15.2)	1.0 (7.9)	(-2.1–4.1)	0.533
Day (-2)	12.7 (10.9–14.4)	15.3 (12.5–18.1)	-2.6 (17.0)	(-5.9–0.7)	0.126

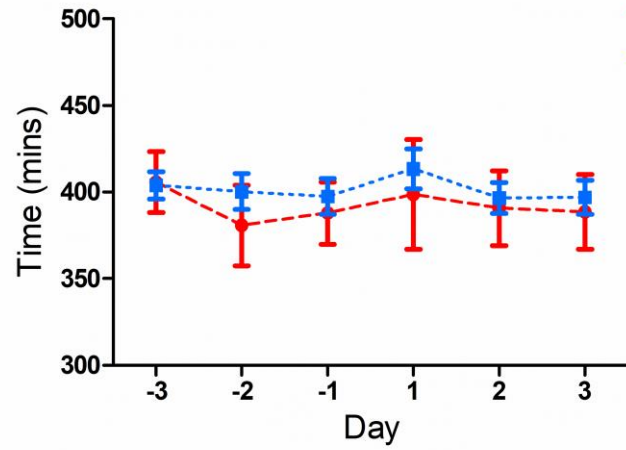
	Day (-1)	12.8 (11.0–14.7)	17.1 (14.8–19.4)	-4.2 (24.6)	(-7.2– -1.3)	0.005
	Day (1)	24.6 (22.4–26.8)	27.1 (22.0–32.1)	-2.4 (8.9)	(-8.0–3.1)	0.388
	Day (2)	16.9 (14.7–19.1)	20.8 (17.2–24.3)	-3.9 (18.8)	(-8.1–0.3)	0.071
	Day (3)	14.8 (13.0–16.7)	19.5 (16.5–22.4)	-4.6 (23.6)	(-8.1– -1.1)	0.010
Sleep efficiency, mean (95% CI)						
	Day (-3)	82.7 (81.9–83.6)	80.7 (77.9–83.5)	2.0 (2.5)	(-0.9–5.0)	0.179
	Day (-2)	82.0 (80.8–83.1)	79.7 (76.9–82.5)	2.3 (2.9)	(-0.8–5.3)	0.143
	Day (-1)	80.8 (79.6–82.0)	80.4 (78.5–82.2)	0.4 (0.5)	(-1.8–2.7)	0.706
	Day (1)	81.0 (79.7–82.4)	80.2 (77.6–82.8)	0.8 (1.0)	(-2.1–3.7)	0.574
	Day (2)	81.8 (80.7–82.8)	78.1 (75.2–81.0)	3.7 (4.7)	(0.6–6.8)	0.021
	Day (3)	81.9 (80.8–83.1)	80.6 (78.3–82.8)	1.4 (1.7)	(-1.2–4.0)	0.286
Total sleep duration, mean (95% CI)						
	Day (-3)	403.9 (396.0–411.7)	405.8 (388.3–423.3)	-1.9 (0.5)	(-21.1–17.2)	0.842
	Day (-2)	400.3 (390.0–410.7)	380.7 (357.5–404.0)	19.6 (5.1)	(-5.9–45.1)	0.132
	Day (-1)	397.4 (387.0–407.8)	388.0 (370.0–405.9)	9.4 (2.4)	(-11.3–30.2)	0.373
	Day (1)	413.3 (401.8–424.9)	398.6 (366.9–430.3)	14.7 (3.7)	(-19.0– 48.5)	0.392
	Day (2)	396.7 (387.7–405.6)	390.7 (369.1–412.3)	5.9 (1.5)	(-17.5– 29.3)	0.619
	Day (3)	397.0 (387.3–406.7)	388.6 (367.0–410.1)	8.4 (2.2)	(-15.2–32.0)	0.483
Light sleep duration, mean (95% CI)						
	Day (-3)	242.8 (236.0–249.5)	258.0 (240.3–275.6)	-15.2 (5.9)	(-34.1–3.7)	0.115
	Day (-2)	242.1 (235.2–248.9)	238.1 (220.6–255.5)	4.0 (1.7)	(-14.7–22.7)	0.675
	Day (-1)	244.2 (237.0–251.4)	250.2 (236.3–264.0)	-6.0 (2.4)	(-21.6–9.6)	0.453
	Day (1)	256.3 (249.7–262.9)	252.6 (232.8–272.3)	3.8 (1.5)	(-17.0–24.6)	0.723
	Day (2)	236.2 (227.8–244.6)	230.0 (213.9–246.2)	6.2 (2.7)	(-12.1–24.4)	0.508
	Day (3)	229.8 (223.4–236.3)	230.0 (215.3–244.7)	-0.2 (0.1)	(-16.2–15.9)	0.983
Rapid eye movement phase duration, mean (95% CI)						

Day (-3)	91.0 (86.7–95.2)	87.9 (79.6–96.2)	3.1 (3.5)	(-6.2–12.4)	0.517
Day (-2)	94.9 (90.0–99.8)	85.7 (76.5–95.0)	9.2 (10.7)	(-1.3–19.6)	0.085
Day (-1)	89.8 (85.1–94.4)	83.7 (76.6–90.7)	6.1 (7.3)	(-2.4–14.5)	0.159
Day (1)	91.8 (86.7–97.0)	88.4 (77.4–99.3)	3.5 (4.0)	(-8.6–15.6)	0.571
Day (2)	90.1 (84.9–95.3)	92.5 (84.4–100.6)	-2.4 (2.6)	(-12.1–7.2)	0.619
Day (3)	89.5 (84.6–94.4)	92.3 (81.3–103.3)	-2.8 (3.0)	(-14.8–9.2)	0.649

Notes: Data are presented as estimated mean (95% CI). These analyses were performed using generalized estimating equations.

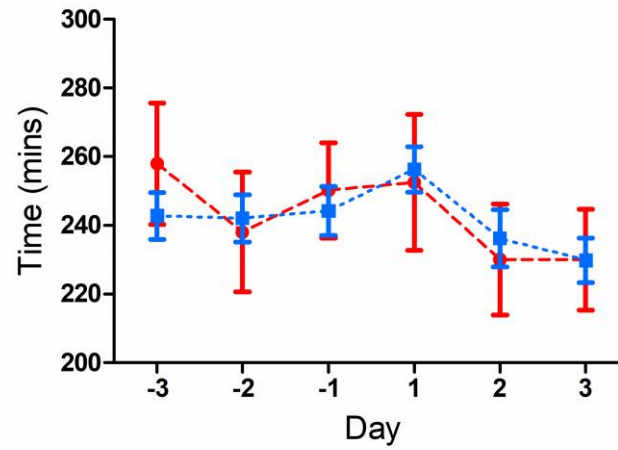
(A)

Total sleep duration



(B)

Light sleep duration



(C)

Rapid eye movement phase duration

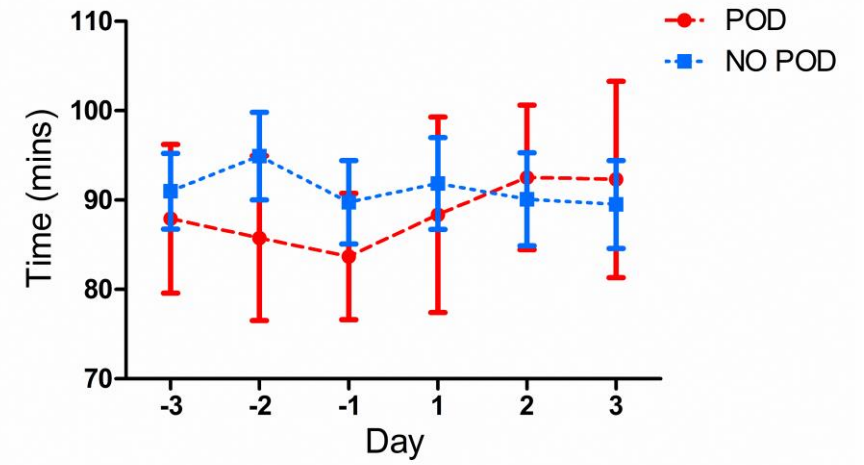


Figure S1 Parameters of perioperative sleep patterns in patients with and without POD (A: Total sleep duration; B: Light sleep duration; C: Rapid eye movement phase duration).

Notes: These analyses were performed using analysis of generalized estimating equations(* $P < 0.05$). Patients with POD: n=22; Patients without POD: n=65.

Estimated mean and 95% CI are plotted for each group for each day.

Abbreviations: POD: Postoperative delirium.

Barthel Index Scoring Form

Patient Name: _____ Rater Name: _____ Date: _____

FEEDING

0 = unable
5 = needs help cutting, spreading butter, etc., or requires modified diet
10 = independent

BATHING

0 = dependent
5 = independent (or in shower)

GROOMING

0 = needs to help with personal care
5 = independent face/hair/teeth/shaving (implements provided)

DRESSING

0 = dependent
5 = needs help but can do about half unaided
10 = independent (including buttons, zips, laces, etc.)

BOWELS

0 = incontinent (or needs to be given enemas)
5 = occasional accident
10 = continent

BLADDER

0 = incontinent, or catheterized and unable to manage alone
5 = occasional accident
10 = continent

TOILET USE

0 = dependent
5 = needs some help, but can do something alone
10 = independent (on and off, dressing, wiping)

TRANSFERS (BED TO CHAIR AND BACK)

0 = unable, no sitting balance
5 = major help (one or two people, physical), can sit
10 = minor help (verbal or physical)
15 = independent

MOBILITY (ON LEVEL SURFACES)

0 = immobile or < 50 yards
5 = wheelchair independent, including corners, > 50 yards
10 = walks with help of one person (verbal or physical) > 50 yards
15 = independent (but may use any aid; for example, stick) > 50 yards

STAIRS

0 = unable
5 = needs help (verbal, physical, carrying aid)
10 = independent

TOTAL SCORE= _____

The Barthel ADL Index: Guidelines

1. The index should be used as a record of what a patient does, not as a record of what a patient could do.
2. The main aim is to establish degree of independence from any help, physical or verbal, however minor and for whatever reason.
3. The need for supervision renders the patient not independent.
4. A patient's performance should be established using the best available evidence. Asking the patient, friends/relatives and nurses are the usual sources, but direct observation and common sense are also important. However direct testing is not needed.
5. Usually the patient's performance over the preceding 24-48 hours is important, but occasionally longer periods will be relevant.
6. Middle categories imply that the patient supplies over 50 per cent of the effort.
7. Use of aids to be independent is allowed.

References

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Gresham GE, Phillips TF, Labi ML. "ADL status in stroke: relative merits of three standard indexes." [Arch Phys Med Rehabil.1980;61:355-358.](#)

Collin C, Wade DT, Davies S, Horne V. "The Barthel ADL Index: a reliability study." [Int Disability Study.1988;10:61-63.](#)

Date created: 1/2000

Last reviewed: 8/2004

Reviewed/Approved by: L. Schwamm, M.D. / Acute Stroke Team



EORTC QLQ-C30 (version 3)

We are interested in some things about you and your health. Please answer all of the questions yourself by circling the number that best applies to you. There are no "right" or "wrong" answers. The information that you provide will remain strictly confidential.

Please fill in your initials:

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Your birthdate (Day, Month, Year):

--	--	--	--	--	--	--	--	--	--

Today's date (Day, Month, Year):

31

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	Not at All	A Little	Quite a Bit	Very Much
1. Do you have any trouble doing strenuous activities, like carrying a heavy shopping bag or a suitcase?	1	2	3	4
2. Do you have any trouble taking a <u>long</u> walk?	1	2	3	4
3. Do you have any trouble taking a <u>short</u> walk outside of the house?	1	2	3	4
4. Do you need to stay in bed or a chair during the day?	1	2	3	4
5. Do you need help with eating, dressing, washing yourself or using the toilet?	1	2	3	4

During the past week:

	Not at All	A Little	Quite a Bit	Very Much
6. Were you limited in doing either your work or other daily activities?	1	2	3	4
7. Were you limited in pursuing your hobbies or other leisure time activities?	1	2	3	4
8. Were you short of breath?	1	2	3	4
9. Have you had pain?	1	2	3	4
10. Did you need to rest?	1	2	3	4
11. Have you had trouble sleeping?	1	2	3	4
12. Have you felt weak?	1	2	3	4
13. Have you lacked appetite?	1	2	3	4
14. Have you felt nauseated?	1	2	3	4
15. Have you vomited?	1	2	3	4
16. Have you been constipated?	1	2	3	4

Please go on to the next page

During the past week:

	Not at All	A Little	Quite a Bit	Very Much
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- | | | | | |
|--|---|---|---|---|
| 17. Have you had diarrhea? | 1 | 2 | 3 | 4 |
| 18. Were you tired? | 1 | 2 | 3 | 4 |
| 19. Did pain interfere with your daily activities? | 1 | 2 | 3 | 4 |
| 20. Have you had difficulty in concentrating on things, like reading a newspaper or watching television? | 1 | 2 | 3 | 4 |
| 21. Did you feel tense? | 1 | 2 | 3 | 4 |
| 22. Did you worry? | 1 | 2 | 3 | 4 |
| 23. Did you feel irritable? | 1 | 2 | 3 | 4 |
| 24. Did you feel depressed? | 1 | 2 | 3 | 4 |
| 25. Have you had difficulty remembering things? | 1 | 2 | 3 | 4 |
| 26. Has your physical condition or medical treatment interfered with your <u>family</u> life? | 1 | 2 | 3 | 4 |
| 27. Has your physical condition or medical treatment interfered with your <u>social</u> activities? | 1 | 2 | 3 | 4 |
| 28. Has your physical condition or medical treatment caused you financial difficulties? | 1 | 2 | 3 | 4 |

For the following questions please circle the number between 1 and 7 that best applies to you

29. How would you rate your overall health during the past week?

1 2 3 4 5 6 7

Very poor

Excellent

30. How would you rate your overall quality of life during the past week?

1 2 3 4 5 6 7

Very poor

Excellent