SUPPLEMENTARY MATERIAL

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Supplementary Text. Methods for estimation of B-MEPS preoperative emotional stress scores.

The B-MEPS responses were collected using a Finnish translation of the original 15-item questionnaire described by Caumo et al. (2016). Individual preoperative emotional stress scores were estimated using a generalized partial credit model, with the item discrimination and threshold parameters fixed at the values reported by Schiavo et al. (2022). Scores were estimated using the empirical Bayes method implemented in the ltm package (version 1.2-0) in R version 4.5.0 (R Foundation for Statistical Computing, Vienna, Austria), assuming a standard normal distribution for the latent trait. For participants with incomplete item responses, scores were estimated from the available responses under the assumption that the missing responses were missing at random.

To align the administered 15-item questionnaire with the current 12-item B-MEPS, items 11 (“When I leave the hospital my life will be”), 12 (“I feel my life to be”), and 13 (“I think about my future with”) were excluded from the scoring. In the administered questionnaire, items 9 (“Do you feel unhappy?”) and 10 (“Do you have feelings of discomfort in the stomach?”) each had three response categories, whereas the corresponding items in the current B-MEPS have two. Therefore, response categories 2 and 3 were combined for both items before score estimation. Longitudinal models included all available postoperative pain assessments within each observation window, without imputation of missing pain scores.

Supplementary Table S1. B-MEPS items included in score estimation and response categories used.

Item	Statement	Response categories used
1	I am jittery	4
2	I feel indecisive	4
3	I am worried	4
4	I feel confused	3
5	I feel like a failure	3
6	I worry too much over something that really does not matter	3
7	I take disappointments so personally that I cannot get them out of my mind	3
8	I get in a state of tension or turmoil as I think over my recent concerns and interests	3
9	Do you feel unhappy?	2*
10	Do you have feelings of discomfort in the stomach?	2*
14	How do you react when you are unhappy?	2
15	How do you describe your depressed mood?	3

*Originally administered with three response categories; categories 2 and 3 were combined to match the current B-MEPS scoring structure.

Supplementary Table S2A. Full mixed-effects logistic regression models for severe postoperative pain at rest (NRSR ≥7) during the first 24, 48, and 72 postoperative hours. ORs correspond to a one-unit increase in standardized preoperative emotional stress.

Variable*	NRSR (4-24h)		NRSR (4-48h)		NRSR (4-72h)	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Baseline odds (intercept)	0.03 (0.01, 0.23)	<0.001	0.04 (0.01, 0.22)	<0.001	0.04 (0.01, 0.19)	<0.001
Preoperative emotional stress	2.68 (1.02-7.02)	0.046	2.73 (1.16-6.40)	0.021	2.73 (1.20-6.24)	0.017
Age	1.04 (0.98-1.10)	0.244	1.04 (0.98-1.10)	0.18	1.03 (0.98-1.09)	0.243
Sex	0.33 (0.07-1.53)	0.158	0.29 (0.07-1.19)	0.085	0.34 (0.09-1.29)	0.112
Preoperative NRSR pain	1.13 (0.79-1.61)	0.499	1.12 (0.81-1.55)	0.496	1.19 (0.86-1.64)	0.292
Time: 8 h	3.30 (0.79-13.82)	0.102	3.19 (0.79-12.81)	0.103	3.29 (0.81-13.37)	0.097
Time: 24 h	2.78 (0.66-11.72)	0.164	2.70 (0.66-10.99)	0.166	2.78 (0.67-11.46)	0.158
Time: 48 h			0.53 (0.08-3.46)	0.505	0.54 (0.08-3.67)	0.527
Time: 72 h					0.82 (0.15-4.52)	0.823
Model fit statistics						
Random intercept SD	1.63		1.4		1.45	
Number of observations	265		344		425	
AIC	143.53		159.41		181.2	
BIC	172.17		193.98		221.72	

*Age and preoperative pain were centered at the median. Sex was coded as 0 = female and 1 = male; odds ratios therefore represent the odds in males relative to females.

AIC, Akaike information criteria; BIC, Bayesian information criteria; CI, confidence interval; NRSR, Numerical rating scale (pain at rest); OR, odds ratio

Supplementary Table S2B. Full mixed-effects logistic regression models for severe postoperative pain during movement (NRSM ≥7) during the first 24, 48, and 72 postoperative hours. ORs correspond to a one-unit increase in standardized preoperative emotional stress.

Variable*	NRSM (4-24h)		NRSM (4-48h)		NRSM (4-72h)	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Baseline odds (intercept)	0.41 (0.16, 1.03)	0.057	0.42 (0.15, 1.13)	0.087	0.42 (0.16, 1.07)	0.07
Preoperative emotional stress	2.00 (1.03, 3.91)	0.041	2.44 (1.18, 5.06)	0.017	2.52 (1.29, 4.92)	0.007
Age	0.98 (0.94, 1.02)	0.398	0.98 (0.93, 1.02)	0.309	0.98 (0.94, 1.03)	0.449
Sex	0.52 (0.19, 1.38)	0.188	0.40 (0.14, 1.16)	0.093	0.46 (0.17, 1.22)	0.12
Preoperative NRSM pain	0.96 (0.76, 1.21)	0.737	0.97 (0.75, 1.25)	0.804	0.96 (0.76, 1.22)	0.759
Time: 8 h	3.43 (1.45, 8.13)	0.005	3.97 (1.62, 9.75)	0.003	3.75 (1.58, 8.93)	0.003
Time: 24 h	4.83 (1.97, 11.80)	<0.001	5.71 (2.27, 14.36)	<0.001	5.36 (2.21, 12.98)	<0.001
Time: 48 h			1.41 (0.58, 3.45)	0.448	1.39 (0.58, 3.32	0.455
Time: 72 h					0.29 (0.11, 0.78)	0.014
Model fit statistics						
Random intercept SD	1.55		1.88		1.76	
Number of observations	241		322		403	
AIC	306.79		379.67		436.72	
BIC	334.79		413.64		476.71	

*Age and preoperative pain were centered at the median. Sex was coded as 0 = female and 1 = male; odds ratios therefore represent the odds in males relative to females. AIC, Akaike information criteria; BIC, Bayesian information criteria; CI, confidence interval; NRSM, Numerical rating scale (movement-evoked pain); OR, odds ratio

Supplementary Table S3. Sensitivity analyses of the associations between preoperative emotional stress and severe postoperative pain using prespecified postoperative observation windows.

Outcome	Observation window	OR	95% CI	p
NRSR ≥7	4-24	2.68	(1.02-7.02)	0.046
NRSR ≥7	4-48	2.73	(1.16-6.40)	0.021
NRSR ≥7	4-72	2.73	(1.20-6.24)	0.017
NRSM ≥7	4-24	2.00	(1.03, 3.91)	0.041
NRSM ≥7	4-48	2.44	(1.18, 5.06)	0.017
NRSM ≥7	4-72	2.52	(1.29, 4.92)	0.007

Odds ratios represent the effect of a one-unit increase in the standardized latent preoperative emotional stress score.

Supplementary Table S4. Unadjusted, ketamine-adjusted, and fully adjusted linear regression models for cumulative 24-hour oxycodone consumption.

Variable	Unadjusted			Ketamine adjusted			Fully adjusted		
	β (95% CI)	SE	p	β (95 % CI)	SE	p	β (95 % CI)	SE	p
Preoperative emotional stress	3.63 (-5.68, 12.95)	4.75	0.446	4.43 (-4.56, 13.43)	4.59	0.336	4.58 (-4.37, 13.53)	4.57	0.319
S-ketamine exposure				0.45 (0.14, 0.76)	0.16	0.005	0.32 (0.02, 0.62))	0.15	0.038
Age							−1.22 (-1.79, -0.64)	0.29	<0.001
Sex							14.29 (-0.07, 28.65)	7.33	0.055
Preoperative NRSR							3.14 (-0.36, 6.63)	1.78	0.082
Chronic pain							-1.46 (-20.94, 18.01)	9.94	0.883
Preoperative opioid use							-13.91 (-50.79, 22.96)	18.8	0.462
Preoperative gabapentinoid use							7.87 (-11.77, 27.51)	10	0.435
BMI							0.63 (-1.07, 2.32)	0.87	0.47
Model fit statistics									
N obs	97			97			88		
AIC	973.79			967.58			868.77		
BIC	981.51			977.88			896.02		
multiple R^2	0.006			0.087			0.34		
adjusted R^2	-0.004			0.067			0.264		

*Age and preoperative pain were centered at the median. Binary variables were coded as follows: sex (0 = female, 1 = male), chronic pain (0 = no, 1 = yes), preoperative opioid use (0 = no, 1 = yes), and preoperative gabapentinoid use (0 = no, 1 = yes).

AIC, Akaike information criteria; BIC, Bayesian information criteria; CI, confidence interval; NRSM, Numerical rating scale (movement-evoked pain); OR, odds ratio

Supplementary Table S5. Associations between preoperative emotional stress, baseline patient characteristics, and patient satisfaction with patient-controlled analgesia.

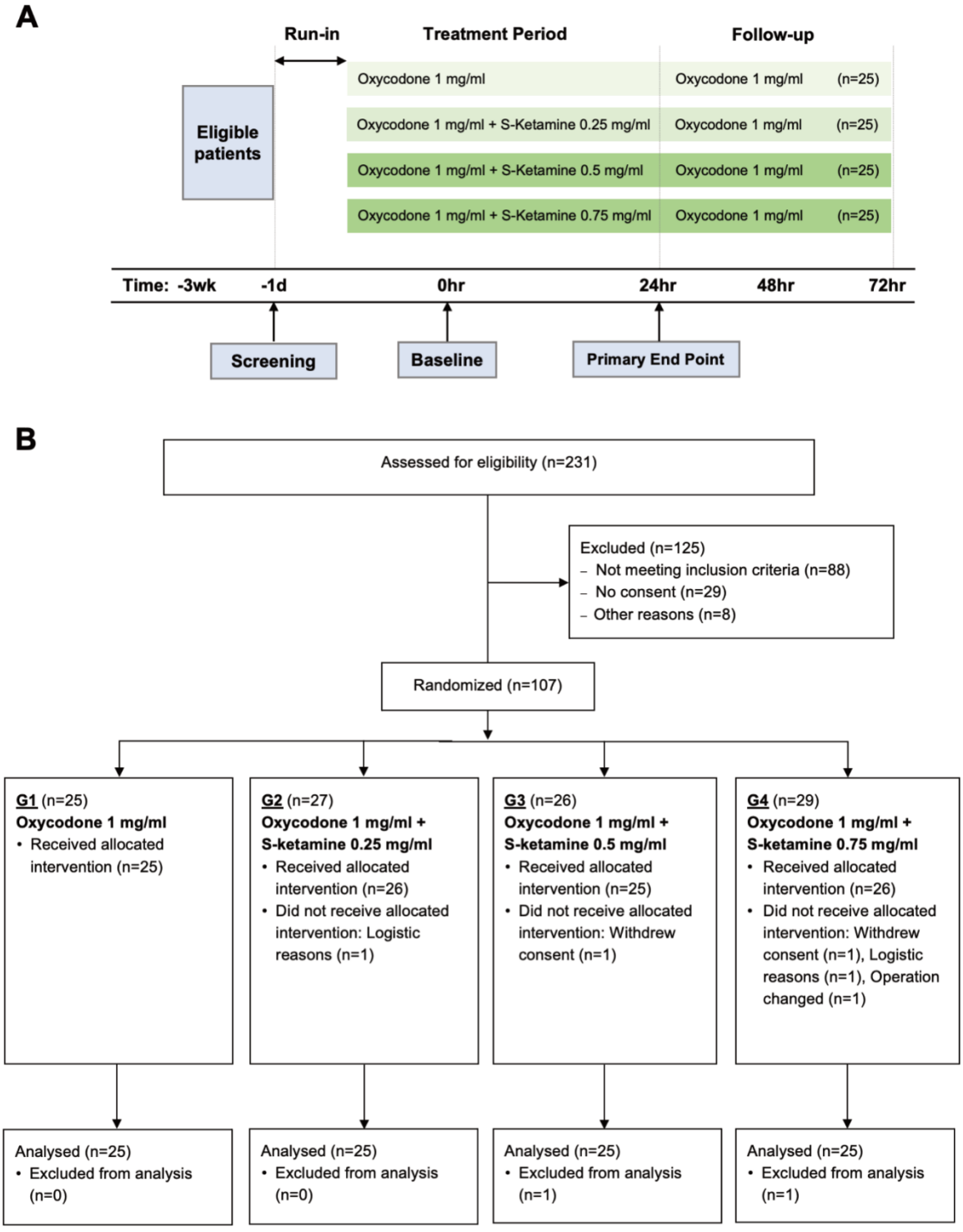
Variable	Preoperative stress	p-value	n
Age	0.02	0.866[1]	98
BMI	0.03	0.781[2]	98
Preoperative NRSR	0.08	0.475[1]	89
Preoperative NRSM	0.11	0.309[1]	89
Sex[4]	0.13	0.404[3]	98
Smoking	-0.35	0.195[3]	98
Chronic pain (yes/no)	0.09	0.668[3]	98
Preoperative opioid use	-0.17	0.628[3]	98
Preoperative gabapentin use	0.1	0.613[3]	98
Diabetes	-0.39	0.199[3]	98
ASA-status	-	0.88[3]	98
PCA satisfied 24h	-0.40	0.074[3]	98
PCA satisfied 48h	-0.24	0.34[3]	90
PCA satisfied 72h	-0.58	0.026[3]	87

[1]Spearman's correlation, [2]Pearson correlation, [3]Difference between group means, One way ANOVA/t-test

[4]Sex was coded as 0 = female and 1 = male

ASA, American Society of Anesthesiologists; BMI, Body mass index; NRSM, numerical rating scale (movement-evoked pain); NRSR, numerical rating scale (pain at rest); PCA, patient-controlled analgesia

Supplementary Figure S1: CONSORT flow diagram of the parent DoseRespKeta trial [16]



Supplementary Figure S2 Forest plot of the associations between preoperative emotional stress and severe postoperative pain at rest and during movement across the predefined postoperative observation windows. Odds ratios (ORs) for severe postoperative pain at rest (NRSR ≥7) and during movement (NRSM ≥7) within three postoperative time periods are shown. Error bars represent 95% confidence intervals (CI).

