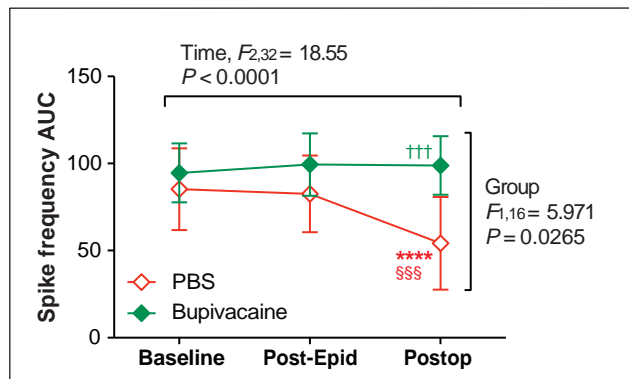
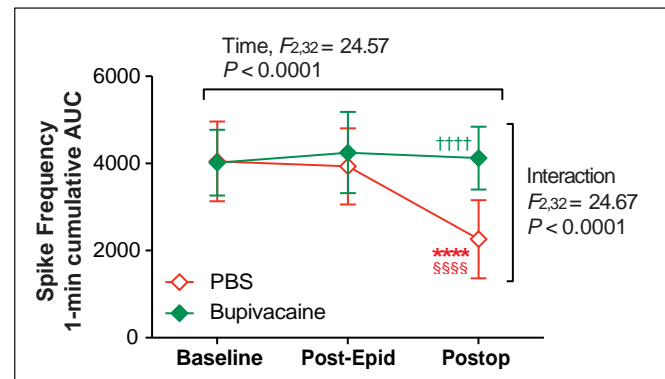


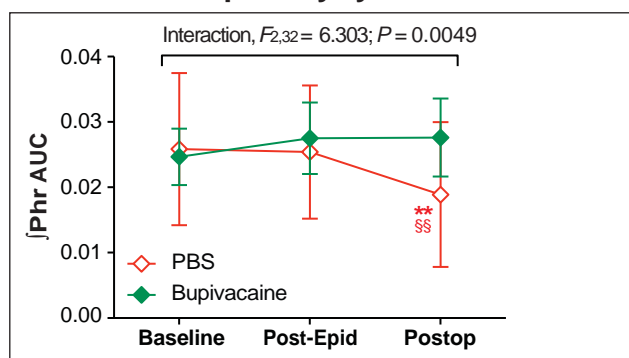
A. Spike frequency AUC/respiratory cycle



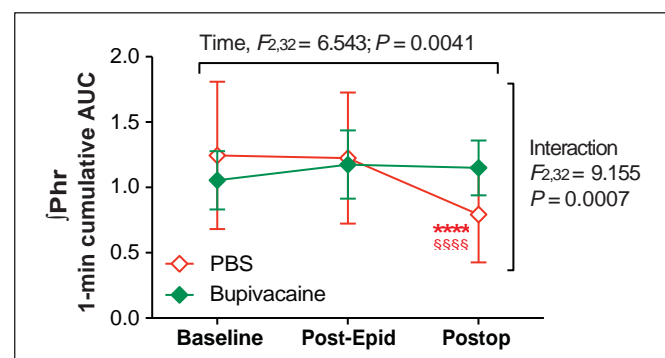
B. Spike frequency AUC/minute



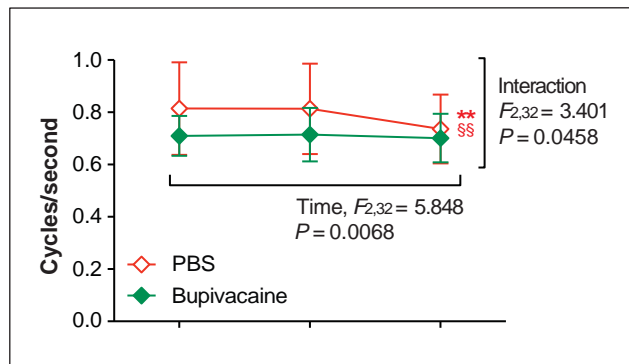
C. ∫Phr AUC/respiratory cycle



D. ∫Phr AUC/minute



E. Central respiratory rate



F. Ti:TE

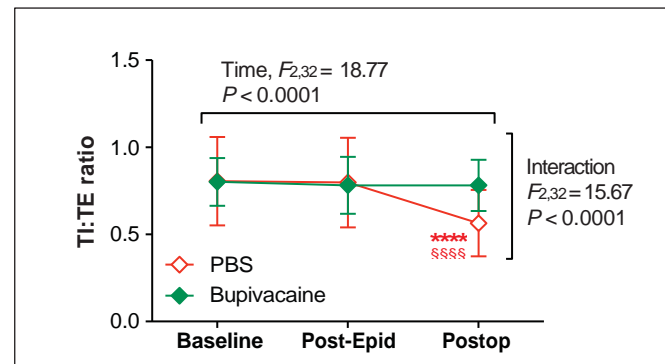


Figure S3. Raw (non-normalized) data for the Protocol D, the effect of epidural bupivacaine (“Bupivacaine” group, N = 8) vs. PBS (“PBS” group, N = 10) on efferent phrenic nerve activity before and after the upper abdominal incision. (A) One hour after the abdominal incision (Postop), spike frequency area-under-the-curve (ACU)/respiratory cycle was significantly lower than baseline in the PBS group ($P < 0.0001$); on the other hand, the mean value after the incision did not show any difference compared with baseline in the Bupivacaine group ($P = 0.4923$). After the incision, the mean spike frequency ACU/respiratory cycle of the Bupivacaine group was significantly greater than that of the PBS group ($P = 0.0002$). (B) While the spike frequency AUC/minute significantly decreased from baseline after the incision in the PBS group ($P < 0.0001$), the mean value after the incision was not significantly different from baseline in the Bupivacaine group ($P = 0.7996$). After the incision, the mean spike frequency AUC/minute of the Bupivacaine group was significantly greater than that of the PBS group ($P < 0.0001$). (C) The integrated phrenic neurogram (\int Phr) AUC/respiratory cycle significantly decreased from baseline after the abdominal incision in the PBS group ($P = 0.0026$), but not in the Bupivacaine group ($P = 0.4372$). (D) The mean \int Phr AUC/minute after the incision was significantly lower than the baseline in the PBS group ($P < 0.0001$), while the mean value after the incision was not significantly different than baseline in the Bupivacaine group ($P = 0.7175$). (E) Central respiratory rate after the incision was significantly lower than baseline in the PBS group ($P = 0.0008$); on the hand, the mean central respiratory rate after

the incision was not significantly different from baseline in the Bupivacaine group ($P = 0.9194$). (F) There was a significant decrease in inspiratory-to-expiratory duration ratio (TI:TE) from baseline after the incision in the PBS group ($P < 0.0001$), but not in the Bupivacaine group ($P = 0.8102$). Data are presented as mean \pm SD. ** $P < 0.01$; **** $P < 0.0001$ vs. Baseline, §§ $P < 0.01$; §§§§ $P < 0.0001$ vs. Post-Epidural, and ††† $P < 0.001$; †††† $P < 0.0001$ vs. PBS by two-way ANOVA with repeated measured in one factor, followed by Sidak's multiple comparison tests. Post-Epidural = Post-epidural injection.

Baseline **Post-Epid** **Postop**