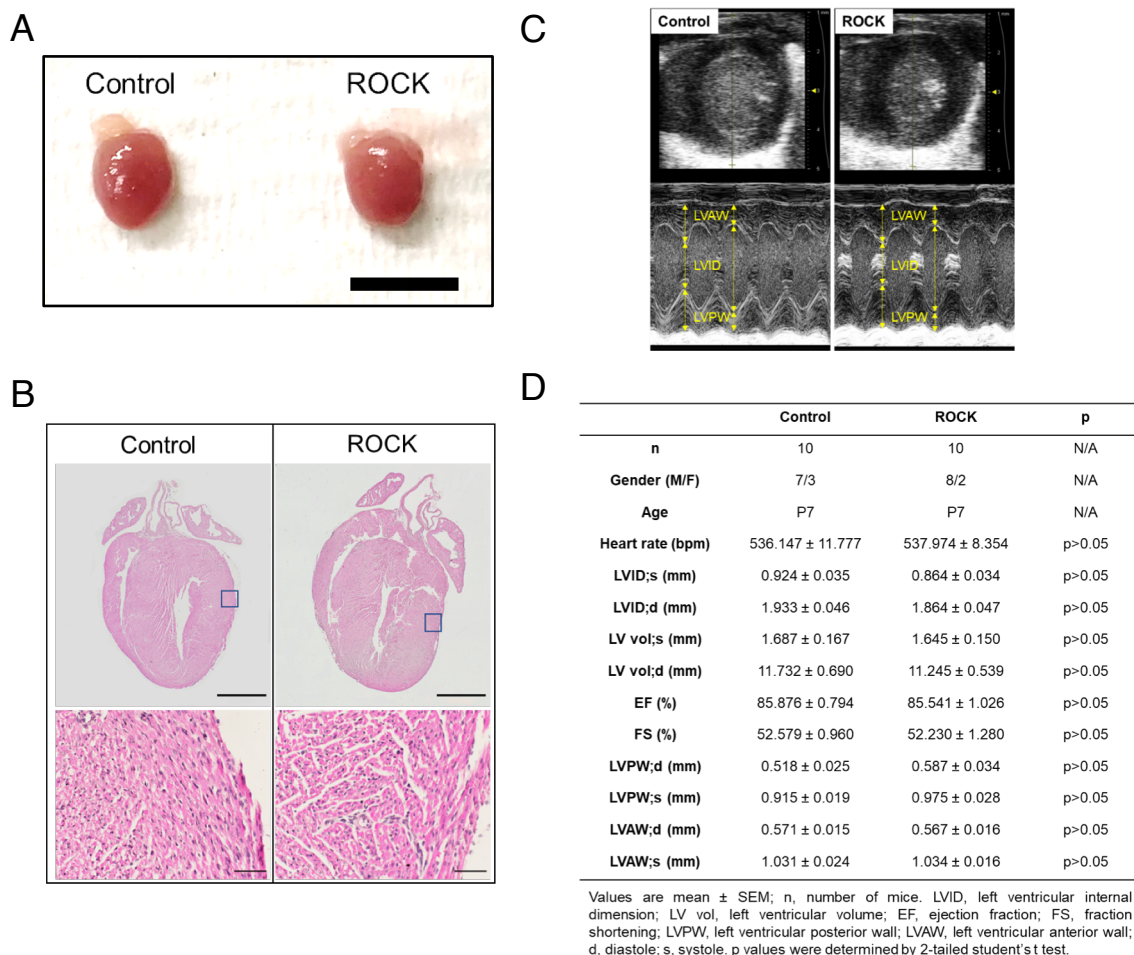
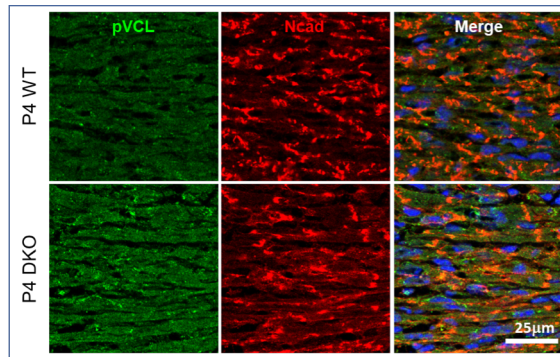


**Fig. S1. Tamoxifen administration has no effect on actomyosin contractility.** Western blot and quantitative analysis of pMLC2 and MLC2 expression in heart tissue lysates from WT C57BL/6J P7 mice with (n=4) and without (n=4) tamoxifen treatment. ns, non-significant, by two-tailed unpaired Student's t-test. Error bars represent S.E.M.



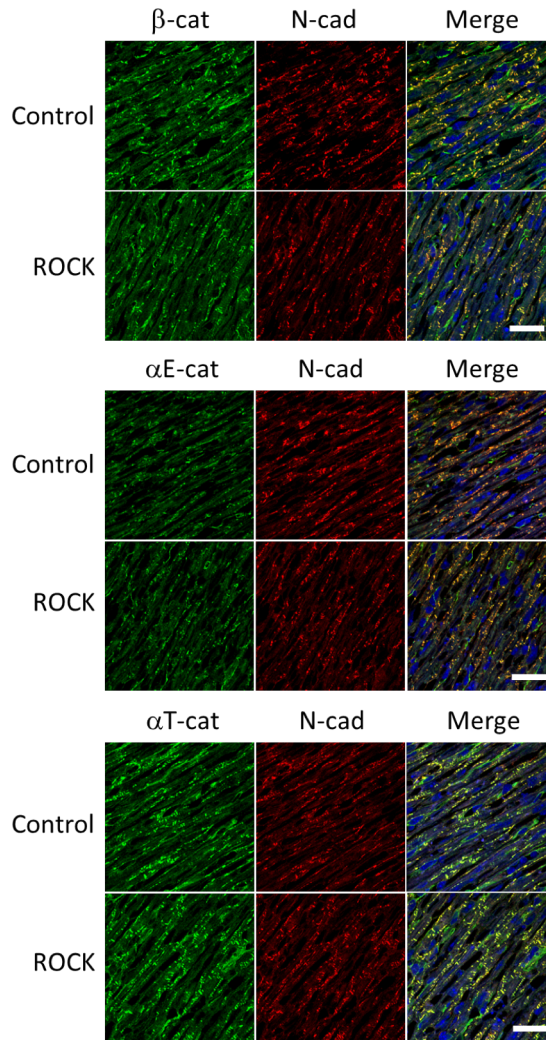
**Fig. S2. Histological and cardiac function analysis of ROCK2:ER P7 hearts.**

(A) Representative whole mount images of heart from control and ROCK P7 mice. Scale bar: 5 mm. (B) Representative H&E staining of heart sections from control and ROCK P7 mice. *Upper panel* shows the whole section images, scale bar: 1 mm. *Lower panel* shows higher magnification images of the boxed areas, scale bar: 50  $\mu$ m. (C) M-mode two-dimensional echocardiography displaying cross section view of LV chamber. (D) Echocardiographic assessment of chamber dimensions and cardiac function in control (n=10) and ROCK (n=10) mice at P7. Data represent Mean  $\pm$  S.E.M.. p value was analyzed by two tailed unpaired Student's t-test and shown in the table.



**Fig. S3. Increased VCL Y822 phosphorylation correlates with aberrant N-cadherin expression in  $\alpha E$ -/ $\alpha T$ -catenin double knockout (DKO) heart.**

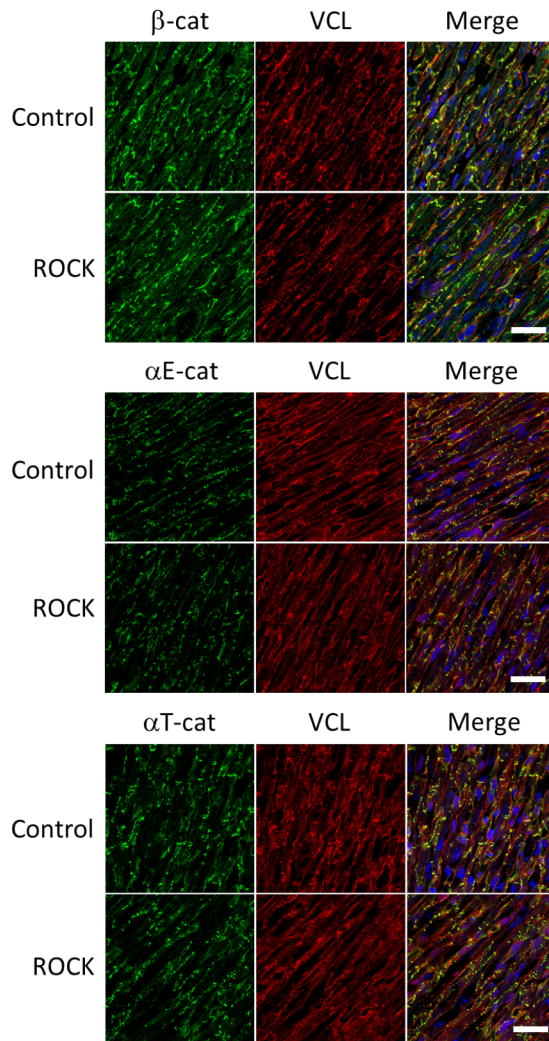
Representative immunofluorescence images of heart sections from control and  $\alpha E$ -/ $\alpha T$ -catenin DKO P4 mice co-stained for pVCL-Y822 (green) and N-cadherin (red). Similar to ROCK-activated hearts, pVCL appeared primarily diffuse throughout the cytosol.



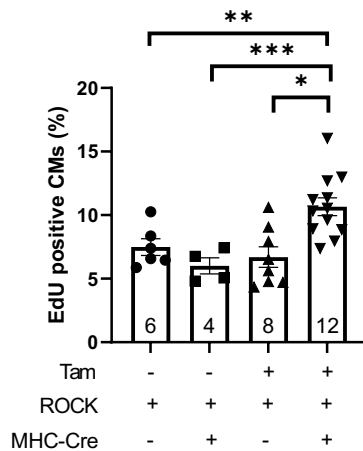
**Fig. S4. N-cadherin/catenin expression in ROCK hearts.**

Representative immunofluorescence images of P7 heart sections from control and ROCK mice co-stained with  $\beta$ -cat (green)/N-cad (red),  $\alpha$ E-cat (green)/N-cad (red), and  $\alpha$ T-cat (green)/N-cad (red). Scale bar: 25  $\mu$ m.



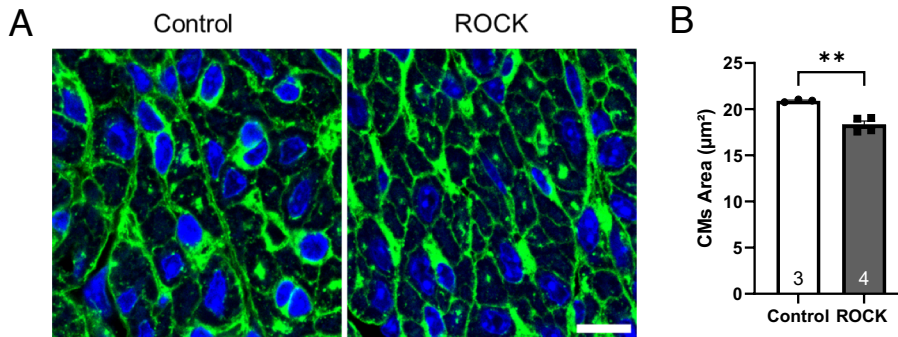


**Fig. S5. Vinculin/catenin expression in ROCK hearts.** Representative immunofluorescence images of P7 heart sections from control and ROCK co-stained with  $\beta$ -cat (green)/VCL (red),  $\alpha$ E-cat (green)/VCL (red), and  $\alpha$ T-cat (green)/VCL (red). Scale bar: 25  $\mu$ m.



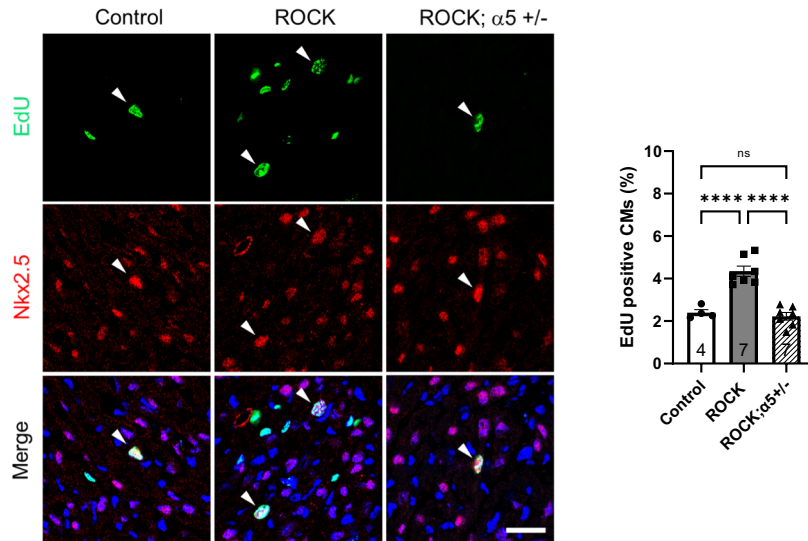
**Fig. S6. No increase in cell cycle activity in different control hearts.**

Quantitative analysis of immunofluorescent images of heart sections from ROCK and ROCK; MHC-Cre P7 mice with or without tamoxifen treatment co-stained with EdU/ $\alpha$ -actinin. ns, non-significant, \*,  $P < 0.05$ , \*\*,  $P < 0.01$  \*\*\*,  $P < 0.001$  by one-way ANOVA with Tukey's multiple comparisons. Error bars represent S.E.M..



**Fig. S7. Reduced CM cross sectional area in ROCK hearts. (A)**

Representative images of WGA (green) staining of heart sections from control and ROCK P7 mice. (B) Quantitated data from images showing average CM cross sectional area of control (n=3) and ROCK (n=4) hearts at P7. A minimum of 1500 cells from 6 different fields (40X) per heart were analyzed. \*\*  $P < 0.01$  by two tailed unpaired Student's t-test. Error bars represent S.E.M. Scale bar: 10  $\mu\text{m}$ .



**Fig. S8.  $\alpha 5$  integrin is required for increased proliferation in ROCK hearts.** Representative immunofluorescence images and quantification of heart sections from control (n=4), ROCK (n=7) and ROCK;  $\alpha 5$  +/- (n=7) P7 mice co-stained with EdU (green)/Nkx2.5 (red). Arrowheads indicate EdU +, Nkx2.5 + nuclei. ns, non-significant, \*\*\*\*,  $P < 0.0001$  by one-way ANOVA with Tukey's multiple comparisons. Error bars represent S.E.M.. Scale bar: 25  $\mu$ m.