Pericytes in capillaries are contractile in vivo, but arterioles mediate functional hyperemia in the mouse brain.

Abstract:
Modern functional imaging techniques of the brain measure local hemodynamic responses evoked by neuronal activity. Capillary pericytes recently were suggested to mediate neurovascular coupling in brain slices, but their role in vivo remains unexplored. We used two-photon microscopy to study in real time pericytes and the dynamic changes of capillary diameter and blood flow in the cortex of anesthetized mice, as well as in brain slices. The thromboxane A(2) analog, 9,11-dideoxy-9?,11?-methanoepoxy Prostaglandin F2? (U46619), induced constrictions in the vicinity of pericytes in a fraction of capillaries, whereas others dilated. The changes in vessel diameter resulted in changes in capillary red blood cell (RBC) flow. In contrast, during brief epochs of seizure activity elicited by local administration of the GABA(A) receptor antagonist, bicuculline, capillary RBC flow increased without pericyte-induced capillary diameter changes. Precapillary arterioles were the smallest vessels to dilate, together with penetrating and pial arterioles. Our results provide in vivo evidence that pericytes can modulate capillary blood flow in the brain, which may be important under pathological conditions. However, our data suggest that precapillary and penetrating arterioles, rather than pericytes in capillaries, are responsible for the blood flow increase induced by neural activity.