Continuous monitoring of blood pressure, an essential measure of health status, typically requires complex, costly, and invasive techniques that can expose patients to risks of complications. Continuous, cuffless, and noninvasive blood pressure monitoring methods that correlate measured pulse wave velocity (PWV) to the blood pressure via the Moens–Korteweg (MK) and Hughes Equations, offer promising alternatives. The MK Equation, however, involves two assumptions that do not hold for human arteries, and the Hughes Equation is empirical, without any theoretical basis. The results presented here establish a relation between the blood pressure P and PWV that does not rely on the Hughes Equation nor on the assumptions used in the MK Equation. This relation degenerates to the MK Equation under extremely low blood pressures, and it accurately captures the results of in vitro experiments using artificial blood vessels at comparatively high pressures. For human arteries, which are well characterized by the Fung hyperelastic model, a simple formula between P and PWV is established within the range of human blood pressures. This formula is validated by literature data as well as by experiments on human subjects, with applicability in the determination of blood pressure from PWV in continuous, cuffless, and noninvasive blood pressure monitoring systems.