

Correlation of Noninvasive Compliance Data with Morphologic  
Data in a Controlled Study of Cholesterol Fed Monkeys

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Shankar et al [1] in earlier studies used Impedance Plethysmography (ZPG) to determine noninvasively the peak compliance of an arterial segment in a limb, as a measure of the arterial mechanical properties. The peak compliance was found to correlate well with the cardiovascular risk factors for atherosclerosis, for 125 human subjects. The present study was conducted for pathologic validation and was part of a larger study on B-mode ultrasound. The 26 month study involved 25 Cynomolgus monkeys on control/ cholesterol diet with/ without aortic coarctation. Prior to their sacrifice, ZPG on upper thigh and Direct Blood Pressure measurement were performed. After their sacrifice, sections of different arteries were obtained for morphometric studies. For ZPG studies, a 7 cm cuff with glued voltage electrodes was wrapped around the shaven upper thigh. The current electrodes were placed on the shaven ankles. Recordings were made at cuff pressure increments of 10 mm Hg. The largest impedance pulse recording occurs at a cuff pressure close to the mean pressure. The ratio of the corresponding arterial volume to the pulse pressure (averaged) gave the peak compliance. Morphometric studies were made on Common Iliac, External Iliac, and Femoral arteries. The site of the largest plaque was chosen and Intimal area, Mean Intimal thickness, % Intima in arterial tissue, and % Damaged Media were determined. We then averaged them. Results: Data was missing for upto 11 monkeys for different reasons. Peak Compliance was  $345 \pm 176 \mu\text{l. mm Hg}^{-1} \cdot \text{cm}^{-1}$ , while the morphometric data (the first three listed above) were respectively  $0.53 \pm 0.15 \text{ sq. mm}$ ,  $0.09 \pm 0.06 \text{ mm}$ , and  $32.4 \pm 18.4 \%$ . We determined Spearman's Rho for rank correlation. We found that there is a negative correlation between the peak compliance and the averaged % Intima in arterial tissue at a 0.10 Level of Significance (one-tailed test) for 14 monkeys. Discussion: Since the changes in the arterial mechanical properties precede the morphometric changes, and since we measured worst case morphometric data, only a rank correlation could be attempted. Peak compliance is a measure of the ratio of elastin to collagen, while the % Intima that is arterial tissue is a measure of the ratio of collagen (and smooth muscle) to the elastin. Conclusion : Our studies show that the peak compliance may be a viable early indicator of atherosclerosis. [1] Vth Int. Cong. Elect. Bio-imp., pp. 307-310, Tokyo, August 1981.