Descriptive Distribution of Toe Pressures with Non-Invasive Vascular Testing in an Urban In-patient Population

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Statement of Purpose and Literature Review

Measurement of absolute toe pressures and associated plethysmosgraphic waveforms represent a common clinical parameter utilized for the assessment of healing potential in diabetic foot disease. For example, Apelqvist et al found consistent healing of wounds and partial foot amputations with a toe pressure measurement of greater than 45mmHg [1]. Some also consider digital pressures to be relatively more reliable than the ankle-brachial index (ABI) as digital arteries are thought to be spared from medial arterial calcific sclerosis leading to non-compressibility and falsely elevated readings [2-4].

The primary purpose of this investigation was to collect an epidemiologic description of the distribution of toe pressures recorded from consecutive patients undergoing non-invasive vascular testing at a large, urban tertiary care hospital.

Methodology

A retrospective review of 100 consecutive patients undergoing non-invasive vascular testing at an urban, Level-1, tertiary care center was performed. We recorded whether the test was performed unilaterally or bilaterally, which digit the pressure was recorded from, and the absolute digital pressure.

First a statistical description of the data distribution from toe pressure measurements is provided in terms of the mean, standard deviation and range. Second, data was graphically depicted on both a histogram and normal Q-Q plot to help determine the parametric vs. non-parametric nature of the data. Finally, a frequency count was performed of any data measurement reported a non-compressible or greater than 140mmHg.

Results

Sixty-nine percent of subjects were male with an average age of 61.8 years. Measurements were recorded from both limbs in 77 patients, from the right-side only in 9 patients, and from the left-side only in 14 patients. Quantitative toe pressure measurements were obtained from only 63.5% of available limbs (n=127). 97.7% of these 127 were recorded from the hallux as opposed to another lesser digit. 17.3% of these toe pressures were recorded as greater than 140mmHg or specifically as "non-compressible".

The mean ± standard deviation (range) of recorded pressures was 87.7 ± 44.0mmHg (0-196). A histogram and normal Q-Q plot line demonstrated a roughly parametric data distribution with a skewness of 0.076 and a kurtosis of -0.669. Taken together, these characteristics (mean/standard deviation/range; bell-shaped histogram; skewness/kurtosis with a range of -1 to 1, and close adherence to the normal line of the Q-Q plot) indicate that the measurement of toe pressures is likely to represent a parametric data distribution.

Table 1: Descriptive statistics of the primary outcome (toe pressure measurement) are presented in this table. A measurement of skewness and kurtosis also indicates that the data distribution is likely parametric.

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
		Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Toe pressure	127	196.00	.00	196.00	87.6614	44.04583	.076	.215	-.669	.427

Figure 1: This histogram of toe pressure measurements demonstrates a roughly bell-shaped data distribution.

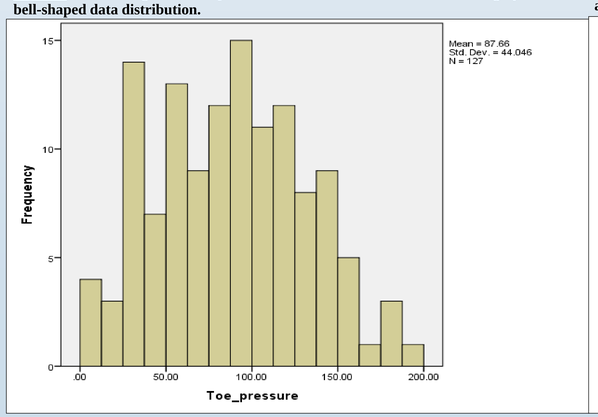
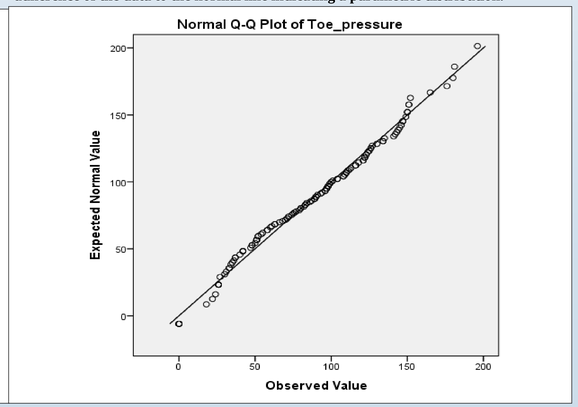


Figure 2: This normal Q-Q plot of toe pressure measurements demonstrates close adherence of the data to the normal line indicating a parametric distribution.



Discussion

As with any scientific investigation, critical readers are encouraged to review the study design and specific results in order to reach their own conclusions, while the following represents our conclusions based on the data. As scientists, we also never consider data to be definitive, but do think that these results are worthy of attention and future investigation:

These results provide some original information with respect to a relatively commonly ordered diagnostic and prognostic test with respect to diabetic foot disease:

-First, these results indicate that caution might be needed when considering toe pressures as a reliable clinical marker for the assessment of healing potential in diabetic foot disease. Toe pressures might be unavailable in a substantial subset of patients and we observed a rate of false elevation or non-compressibility of 17.3%. This prevalence rate would likely be considered a unique finding of this investigation.

-Second, it appears reasonable to consider the measurement of toe pressures as coming from a normally distributed population when considering these descriptive statistics.

References

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