Toe Pressure As A Standalone Vascular Assessment Of The Foot

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Abstract: This study aims to verify whether toe pressure (TP) or toe-brachial index (TBI) has better thresholds of sensitivity/specificity for PAD detection. A single-centre retrospective analysis was conducted of prospective data collected on 108 ambulatory patients recruited at the Complex Wound Care Clinic in Canada. Patients were included with any kind of lower limb wound without regard to any diagnosis of chronic kidney disease, diabetes, PAD or CLTI. TP with photoplethysmography (PPG) and laser Doppler flowmetry, dorsalis pedis and posterior tibialis arteries waveforms have been assessed. Of 108 patients, 43 (40%) presented with monophasic dorsalis pedis arteries (DPA) indicating insufficient vascularization on the left foot and 34 (31%) on the right foot and 55% of the patients had diabetes. According to the validation process of the toe laser pressures, the AUC results for the two measures (TBI and TP) show better threshold values for DPA waveforms than posterior tibialis arteries (PTA) waveforms. Sensitivity and specificity did not differ between TP and TBI for the established cutoffs of disease severity. For TBI measurements, there was a slight increase in sensitivity with DPA compared to TPA. Still, this difference was not significant according to the overlap of the confidence intervals (93% for DPA and 82% for TPA, similar for both feet). Both absolute systolic toe pressure measurement and toe brachial index had a stronger ROC curve AUC with the dorsalis pedis artery as the standard of comparison than the posterior tibialis artery waveform, as per the angiosome theory. In conclusion, toe pressure seems to be a standalone vascular test of the forefoot, while performing the calculation of TBI appears to be of no added values for detecting PAD, based on this study.

Key words: *peripheral artery disease, PAD detection, chronic limb-threatening ischemia, vascular assessment, toe pressure, toe-brachial index*

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Historically, the main recommendations for the management of peripheral arterial ulcers on lower limbs have focused on two primary objectives: determining if there is adequate blood flow to heal the wound and assessing for signs and symptoms of peripheral arterial disease (PAD).[1,2]

It is estimated that approximately 200 million people worldwide suffer from PAD of the lower extremities.[3] The epidemiology of PAD is likely to be similar across countries, such as the United States and the United Kingdom, and regions, such as the European Union.[4,6] Due to its numerous impacts on patients and health-care systems, as well as its socioeconomic burden, PAD demands a responsive approach to ensure both early detection with non-invasive tests and early treatment.[1,7-10] Chronic limb-threatening ischemia (CLTI) represents the end stage of PAD and is a problem of growing prevalence, increasing health-care costs around the globe, primarily associated with mortality, amputation and impaired quality of life.[8] Once at the stage of CLTI, patients may develop spontaneous ulcerations that fail to heal or that progress to gangrene and amputation processes.[8-10] According to the Global Vascular Guidelines on the Management of Chronic Limb-threatening Ischemia, all patients with suspected CLTI should be referred urgently to a vascular specialist.[8] Multiple health-care specialists are involved in the management of PAD and CLTI, yet lack of public awareness and the frequent failure to make an early diagnosis continues to be a significant obstacle to effective treatment.[8]

Current clinical guidelines recommend performing a comprehensive vascular assessment of lower limbs with the ankle-brachial index (ABI) in patients with a lower limb wound.[7,8,11,12] However, the validity of this test is known to be suboptimal in the presence of medial wall calcification of the main arteries, especially in the population with diabetes.[1,13-15] This limitation may affect the ABI with falsely elevated or normal values in patients with diabetes, chronic kidney disease or advanced age.[8] Inconclusive, distorted results and/or overestimation of the actual vascular flow is often seen in individuals with diabetes,[8,16-18] a population peculiarly affected by PAD.[19-21] To overcome false negatives results, clinical guidelines for PAD and CLTI management recommend the use of the absolute systolic toe pressure (TP) measurement or the toe-brachial index (TBI) to be more sensitive in diagnosing PAD.[1,8,13,16,22-25] As previously shown, toe pressure measurement using photoplethysmography (PPG) was well correlated ($r=0.92$, $p < 0.001$) with Laser Doppler Flowmetry (LDF).[15] This makes toe pressure an accessible first-line screening tool with PPG. Arterial Doppler waveforms can also be helpful in detecting a significant blood flow obstruction, as a monophasic waveform is abnormal and significant PAD.[26,27] Angiosomes must be considered for all these tests; otherwise, the interpretation of the vascular evaluation could be distorted.[28,29]

In the 2019 CLTI guidelines, there is no recommendation as to which test is preferred or more appropriate between TP and TBI.[8] Few studies suggest that absolute pressure may be a better ulcer healing indicator and that symptoms of arterial insufficiency correlate better with absolute pressure than the index.[30,31] As acknowledged for the ABI methods, TBI is a ratio, and calculation errors could occur. The aim of this study is to verify whether TP or TBI has better thresholds of sensitivity and specificity when compared to the arterial blood flow waveform from the dorsalis pedis arteries (DPA) and posterior tibialis arteries (PTA) for peripheral arterial disease detection. We hypothesize that there are no differences between TP and TBI measurement in the detection of PAD, especially for patients with diabetes.

Methods

For this secondary analysis of a prospective population study from a doctoral research project,[32] 108 ambulatory patients aged ≥18 years and having at least one lower limb wound were recruited between May and August 2017 by convenience sampling technique at the Complex Wound Care Clinic, a Canadian university-affiliated regional hospital clinic. Institutional and University Ethics Board approvals (CER-17-235-10.02) were obtained for this study. According to the study protocol, written informed consent was obtained and documented from every patient retained. Patients were included if they presented with any kinds of lower limb wounds without regard to any diagnosis of chronic kidney disease, diabetes, PAD or CLTI. Exclusion criteria were having any condition, not providing proper consent and having received previous hyperbaric oxygen therapy.

Toe pressure measurement is recognized as the most predictive of macrovascularization in the foot in patients with diabetes; however, its use is controversial since correlations with angiographic examinations have not been established.[24,25,33] For this present study, we did not use contrast angiography as the 'gold standard' to compare TP and TBI because of its invasive nature. As shown by Criqui and al., the posterior tibialis pulse is the best predictor of PAD of the great vessels: sensitivity of 72.5%; specificity: 91.3%; negative predictive value: 96.5%; positive predictive value: 48.7%.[34] As shown by Beaumier et al.(2020), using the same sample as this present study, DPA arterial wave measurement obtained the best results of sensitivity (80.8%), specificity (89%), negative predictive value (88%) and positive predictive value (82.4%) when compared to monophasic arterial wave of posterior tibialis artery (PTA), which obtained respectively 76.9%, 86.2%, 85.1% and 48.7%.[32] Furthermore, the hallux for TP and TBI measurement is considered within the dorsalis pedis artery (DPA) angiosome.[35,36] To our knowledge, there is currently no strong data comparing the different PAD non-invasive assessment methods to gold standard contrast angiography. However, a monophasic doppler waveform is deemed as always abnormal (a), whereas sensitivity of ABI may vary in individuals with advanced age, diabetes and non-compressible vessels (b).[1,37] Hence, the use of the monophasic arterial wave of the dorsalis pedis artery (DPA) has been chosen as the criterion measurement.

We assessed TP twice: manually, using photoplethysmography (PPG) and using Laser Doppler flowmetry (LDF). An appropriately sized mini cuff was placed around the base of the hallux and connected to the Huntleigh's DMX Digital Doppler® for the PPG, and on the PeriFlux System 5000® equipped with three PF 5010 LDPM channels and one PF 5050 Pressure from Perimed® for the laser. From laser and PPG toe pressures results, only laser results are presented since a previous study obtained similar results between the two techniques based on a high Pearson's r correlation coefficient of 0.920 ($p < 0.001$).[15] In addition, it should be noted that laser pressure values were obtained from the average of three consecutive readings for an accurate research measurement.

We then characterized whether the arterial waveform was triphasic, biphasic or monophasic, measured with the Huntleigh's DMX Digital Doppler®. A monophasic waveform indicates insufficient vascularization.[7,32,38] ROC curves were performed to assess TP and TBI sensitivity and specificity by comparing established[1] severity thresholds to monophasic DPA and PTA waveforms, as standard for insufficient vascularization. Thresholds for PAD severity was chosen, based on Wounds Canada Best Practice Recommendations for the Prevention and Management of Peripheral Arterial Ulcers,[1] as mild (TP=50-69mmHg), moderate (30-49 mmHg) and severe (<30mmHg) disease. Optimal thresholds of TP and TBI for the best sensitivity for around 70% specificity were also derived from the ROC curves. For statistical significance, p values ≤ 0.05 were considered as significative. For DPA and PTA comparisons, qualitative comparisons considering non-overlapping 95% confidence intervals were considered as clinically significative. A rough rule of thumb would be that the accuracy of tests with AUCs between 0.50 and 0.70 is low; between 0.70 and 0.90, the accuracy is moderate; for AUCs over 0.90 the accuracy is high.[39] An approximate 70% specificity threshold has been decided for the analysis to have the same comparison among the different models. Statistical analyses were performed with SAS software version 9.4. Diagnostic accuracy studies are at risk of bias due to shortcomings in design and conduct.[40] This study follows the Standards for Reporting of Diagnostic Accuracy Studies (STARD), which are internationally recognized for studies on a diagnostic accuracy test in biomedical sciences.[40,41]

Results

All patient's and group specific characteristics are summarized in Table 1. Median age was 71 for the sample, with 59% being men. Of 108 patients, 43 (40%) presented with monophasic DPA indicating insufficient vascularization on the left foot and 34 (31%) on the right foot. The percentage of insufficient vascularization measured with monophasic PTA was approximatively similar to monophasic DPA for both feet (See Table 1). In this sample, 55% of the patients had diabetes. Missing data, such as pulse waveform, TP and TBI are from patients having previous foot or toe amputation. According to the validation process of the toe laser pressures, the ROC curves AUC results for the two measures (TBI and TP) show better threshold values for DPA waveforms than PTA waveforms, without clinical differences as the confidence intervals significantly overlap (See Table 2). No statistical differences were noted either for TP or TBI ROC curves AUC, as the confidence intervals also significantly overlap.

For the left foot, at 70% specificity, TP thresholds were similar according to DPA or PTA waveforms (67 mmHg) with no clinical difference in sensitivity according to the overlap of the confidence intervals. For the right foot, at 70% specificity, TP thresholds were relatively similar between the two monophasic waveforms (78 mmHg for DPA and 74 mmHg for PTA). Still, sensitivity was clinically higher for DPA than PTA (90% for DPA and 70% for PTA). The same pattern was observed for TBI measurements. These observations confirm the choice of monophasic dorsalis pedis artery as the best criteria value for this study regarding the angiosome's concept.

Overall, as shown in Table 2, sensitivity and specificity did not differ between TP and TBI for the established cutoffs of disease severity. Sensitivity did not differ between TP and TBI for the optimal cutoff around 70% specificity either. For confirmation, all p values were not significative.

We analyzed those results according to diabetes status in Table 3.

Most of the AUCs were more accurate in patients without diabetes, except for left DPA, where AUC values were superior for patients with diabetes. In addition, the cut-off points of the TP were also always higher in patients without diabetes, ranging from 78 to 86 mmHg, compared to individuals with diabetes, ranging from 62 to 71 mmHg. The same pattern was observed for TBI measurements (0.56 to 0.63 for patients without diabetes compared to 0.47 to 0.51 for patients with diabetes).

At approximately 70% specificity, the TP sensitivity in individuals with diabetes was higher when compared to monophasic DPA than monophasic PTA for both feet (left DPA foot: 81%, left PTA: 65%, right DPA foot: 80%, right PTA: 70%). A similar pattern was observed with TBI measurements (88% for DPA and 68% for PTA, similar for both feet). However, this pattern was less clear in individuals without diabetes. For TP measurements, sensitivities were not different according to DPA or PTA (left DPA foot: 78%, left PTA: 86%, right DPA foot: 78%, right PTA: 79%). For TBI measurements, there was a slight increase in sensitivity with DPA compared to PTA. Still, this difference was not clinically significant according to the overlap of the confidence intervals (93% for DPA and 82% for PTA, similar for both feet) as shown in Table 3.

Table 1: Baseline characteristics of included patients

Variables	All patients n [%]
Women, n [%]	44 [41]
Men, n [%]	64 [59]
Characteristics	
Age, median	70.5 [59-78]
Smokers or past smokers	67 [62]
Diabetes, n [%]	59 [55]
Chronic kidney disease, n [%]	19 [18]
Amputated, n [%]	15 [14]
PPG TP (mmHG), median	85 [56-110]
PPG TBI, median	0.64 [0.4-0.81]
Laser TP (mmHG), median	76 [50-101]
Laser TBI, median	0.57 [0.37-0.76]
Left foot	
Monophasic DPA [n]	43 [40]
Multiphasic DPA [n]	60 [56]
Monophasic PTA [n]	38 [35]
Multiphasic PTA [n]	59 [55]
Right foot	
Monophasic DPA [n]	34 [31]
Multiphasic DPA [n]	66 [61]
Monophasic PTA [n]	35 [32]
Multiphasic PTA [n]	64 [59]

Table 2: TP and TBI sensitivity and specifity for mild (A), moderate (B), severe (C) and optimum ROC curve (D) cutoffs of PAD according to DPA and PTA monophasic waveforms

		AUC		Sensitivity, %	Specificity, %	Cutoffs*
DPA Dorsalis pedis artery	Left TP	0.80 [0.72-0.89]	A	79 [67-92]	67 [55-79]	70
			B	44 [28-59]	90 [82-97]	50
			C	13 [2-23]	97 [92-100]	30
			D	69 [55-84]	74 [63-85]	67
	Left TBI	0.82 [0.74-0.90]	A	85 [73-96]	64 [51-76]	0.60
			B	54 [38-69]	86 [77--95]	0.40
			C	8 [0-16]	97 [92-100]	0.20
			D	79 [67-92]	71 [59-82]	0.53
	DPA Left TP vs DPA Left TBI: p = 0.3927					
	Right TP	0.85 [0.76-0.94]	A	83 [70-97]	79 [68-89]	70
			B	60 [42-78]	92 [85-99]	50
			C	10 [0-21]	97 [92-100]	30
			D	90 [79-100]	74 [63-85]	78
	Right TBI	0.87 [0.79-0.96]	A	90 [79-100]	69 [57-80]	0.60
			B	63 [46-81]	93 [87-100]	0.40
			C	17 [3-30]	98 [95-100]	0.20
			D	90 [79-100]	77 [66-88]	0.54
	DPA Right TP vs DPA Right TBI: p = 0.0804					
PTA Posterior tibialis artery	Left TP	0.77 [0.67-0.86]	A	76 [62-91]	65 [53-77]	70
			B	38 [22-55]	89 [82-97]	50
			C	12 [1-23]	96 [92-100]	30
			D	65 [49-81]	72 [60-84]	67
	Left TBI	0.76 [0.66-0.86]	A	76 [62-91]	60 [47-72]	0.60
			B	44 [27-61]	84 [75-94]	0.40
			C	6 [0-14]	98 [95-100]	0.20
			D	71 [59-88]	70 [58-82]	0.52
	PTA Left TP vs PTA Left TBI: p = 0.8290					
	Right TP	0.76 [0.64-0.87]	A	70 [54-85]	74 [63-85]	70
			B	55 [38-72]	90 [82-97]	50
			C	9 [0-19]	95 [89-100]	30
			D	70 [54-85]	72 [61-84]	74
	Right TBI	0.77 [0.66-0.88]	A	76 [61-90]	66 [53-78]	0.60
			B	52 [34-69]	90 [82-97]	0.40
			C	12 [1-23]	97 [92-100]	0.20
			D	76 [61-90]	71 [59-82]	0.56
	PTA Right TP vs PTA Right TBI: p = 0.4617					

Table 3: Model strengths and threshold comparisons of patients with and without diabetes (TP and TBI)

Measure			AUC	Sensitivity, %	Specificity, %	Cutoffs
DPA Dorsalis pedis artery	Left TP	Cohort	0.80 [0.72-0.89]	69 [55-84]	74 [63-85]	67
		Diabetes	0.82 [0.71-0.94]	81 [64-98]	70 [54-86]	64
		Without Diabetes	0.79 [0.66-0.92]	78 [59-97]	75 [59-91]	84
	Left TBI	Cohort	0.82 [0.74-0.90]	79 [67-92]	71 [59-82]	0.53
		Diabetes	0.84 [0.73-0.94]	80 [64-98]	70 [54-86]	0.50
		Without Diabetes	0.81 [0.68-0.94]	78 [59-97]	71 [59-91]	0.61
	Right TP	Cohort	0.85 [0.76-0.94]	90 [79-100]	74 [63-85]	78
		Diabetes	0.81 [0.66-0.97]	88 [71-100]	70 [54-86]	71
		Without Diabetes	0.89 [0.80-0.99]	93 [79-100]	71 [55-87]	84
	Right TBI	Cohort	0.87 [0.79-0.96]	90 [79-100]	77 [66-88]	0.54
		Diabetes	0.84 [0.69-0.98]	88 [71-100]	70 [54-86]	0.51
		Without Diabetes	0.93 [0.86-1.00]	93 [79-100]	71 [55-87]	0.61
PTA Posterior tibialis artery	Left TP	Cohort	0.77 [0.67-0.86]	65 [49-81]	72 [60-84]	67
		Diabetes	0.72 [0.57-0.87]	65 [44-86]	70 [54-86]	62
		Without Diabetes	0.84 [0.71-0.96]	86 [67-100]	70 [53-88]	86
	Left TBI	Cohort	0.76 [0.66-0.86]	71 [59-88]	70 [58-82]	0.52
		Diabetes	0.73 [0.59-0.88]	70 [50-90]	70 [54-86]	0.47
		Without Diabetes	0.82 [0.68-0.95]	79 [57-100]	70 [53-88]	0.63
	Right TP	Cohort	0.76 [0.64-0.87]	70 [54-85]	72 [61-84]	74
		Diabetes	0.70 [0.54-0.86]	68 [49-88]	73 [56-90]	63
		Without Diabetes	0.82 [0.64-1.00]	82 [59-100]	69 [53-84]	78
	Right TBI	Cohort	0.77 [0.66-0.88]	76 [61-90]	71 [59-82]	0.56
		Diabetes	0.70 [0.54-0.85]	68 [49-88]	69 [51-87]	0.50
		Without Diabetes	0.88 [0.76-1.00]	82 [59-100]	72 [56-87]	0.56

Discussion

Measurement of TP and TBI in all patients with suspected PAD, CLTI and tissue loss is a strong recommendation from the last Global Vascular Guidelines on the Management of Chronic Limb-Threatening Ischemia.[8] The aim of this study was to verify which had better threshold of sensitivity and specificity when compared with the arterial blood flow waveform DPA and PTA for PAD detection. We hypothesized that there were no differences between TP and TBI measurement in detection of PAD, especially for patients with diabetes.

Our results show that both TP and TBI had good screening capabilities in a clinical setting. However, the ROC curves AUC were slightly lower in individuals with than without diabetes, but still with good AUC, as well as sensitivity for a specificity of 70%. According to the Global Vascular Guidelines on the Management of Chronic Limb-Threatening Ischemia,[8] TBI and TP are simple, inexpensive, quick, helpful in the presence of small-vessel artery disease, useful in noncompressible tibial arteries, provide data to predict wound healing and limb survival and are valuable to monitor the efficacy of therapeutic intervention.[8] Based on the literature, the arteries of the halluces are considered less prone to calcification and, accordingly, measuring toe pressure gives more accurate results with fewer false positive values.[24,25,33,42] This high sensitivity, simultaneously considered with the angiosome for the artery choice, can influence the best practices for toe pressure measurements.

Our study shows that the accuracy for PAD detection between TP and TBI is not significatively different. Even if the sensitivity of TBI had a slight tendency of being higher than that of TP for the same specificity, this small gain in sensitivity is not clinically relevant. TBI is more exposed to errors during ratio calculation by clinicians performing time-consuming brachial pressure measurements. In this way, promoting the measurement's use with TP could be more accessible and easier for all health-care providers.

Høyer et al. (2013) showed a sensitivity of 90% to 100% and a specificity of 65% to 100% for detecting vessel stenosis using TBI.[33] In our study, for the most critical population with diabetes, we obtained a TBI sensitivities of 80% and 88% for the left and right foot compared to DPA for a specificity of 70%, decided as a threshold of clinical significance. We obtained sensitivities of 82% and 81% respectively for TP for the same specificity of 70%. If a specificity of 65% had been preferred, higher sensitivity could've been reached. Based on these results, we recommend the use of TP as a good screening test for individuals with diabetes in the community health-care system to enable earlier referral for more complex vascular assessments. Although previous guidelines have suggested a range of toe pressure (TP) thresholds for defining limb-threatening ischemia, such thresholds must be used cautiously and considered in the clinical context because of multiple confounding factors and the lack of a precise and reliable relationship to outcomes.[8]

Our area under the curve between 0.80 and 0.87 shows good TP and TBI measurement accuracy compared to the dorsalis pedis artery monophasic waveform within a population of 108 patients. The AUC was lower with the posterior tibialis artery monophasic waveform ranging from 0.76 to 0.77. These moderate-high results confirmed the use of the dorsalis pedis artery monophasic waveform as a criteria value in respect to pedal artery angiosomes. Although natural arterial anastomosis exist between angiosomes, the angiosome theory posits that superior results can be achieved by revascularizing the vessel that directly feeds an angiosome in the area where there is tissue loss, rather than relying on an indirect flow of arteries supplying adjacent angiosomes.[43] Neville et al. retrospectively examined 52 incurable wounds in bypass patients and found that indirectly revascularized wounds were amputated in 38% of cases, compared to 9% of cases where the angiosome containing the wound was directly revascularized.[43] An analysis of 203 limbs that underwent endovascular treatment for limb salvage found that limb salvage was 86% when wound angiosomes were directly revascularized, compared to 69% for indirect revascularization.[44] A recent systematic review and meta-analysis suggest that direct revascularization of the artery of the angiosome of the wound (but also indirect revascularization via collateral flow) significantly improves wound healing rate when compared to indirect revascularization.[45] To date, the evidence supporting the angiosome concept is retrospective. Prospective trials will be needed to determine if it will be helpful in clinical practice.[46] Our data suggest the hypothesis that if the vascular area evaluated by the instruments is not the area of the angiosome where the wound is located, i.e., the less vascularized area, the measurements could contradict each other. In this sense, maintaining the clinical prediction with the monophasic wave of the dorsalis pedis artery was consistent with a measurement test with TP in its angiosomes.

This study has limitations. The secondary analysis design limits the control over the patient's characteristics and inclusion. As a result, the median age was high (71), and there were a lot of co-morbidities (e.g., 55% of patients had diabetes) which limits the generalization of our results to an older population. Since the patients were recruited in a specialized wound care clinic, patients were subject to a selection bias of having more severe diseases than the general population with PAD. Conversely, this sample has the most risk factors for screening pertinence. The use of monophasic waveform as the standard comparison criterion to assess for PAD is also a limitation of this study, as monophasic doppler waveform is a sign of more advanced disease. PAD can sometimes also be present in individuals with biphasic doppler waveform, but we did not include those individuals as having definitive PAD. This method increased the certainty of the PAD diagnosis but may have underestimated the TP and TBI thresholds and sensitivity for PAD detection. Also, since we evaluated lower limb measurements, patients with severe diseases may be underrepresented in the whole population if they underwent previous amputations. To overcome this limitation, we evaluated our results according to each foot. Aside from those limitations, our results are still interesting regarding improving the first line in wound care, as we suggest using TP instead of the ratio for easier and faster vascular assessment in respect of early detection as recommended.

Take-home Message
With similar metrologic properties between toe pressure and toe brachial index, using absolute systolic toe pressure is a standalone vascular test of the forefoot in a clinical setting for an early PAD detection, while performing the calculation of toe-brachial index appears to be of no added values for detecting PAD.

Conclusion

Absolute systolic toe pressure measurement and toe brachial index had a stronger, but not significantly clinically different, AUC with the dorsalis pedis artery than the posterior tibialis artery. This study suggests that a monophasic dorsalis pedis artery can predict better forefoot vascularization than a monophasic posterior tibialis artery. Toe pressure (TP) and Toe Brachial Index (TBI) had similar ROC curve AUC with both arteries (DPA and PTA) of the foot. Compared to the dorsal pedis artery waveform as a standard for vascularization, sensitivities and specificities for established disease severity thresholds of TP and TBI, as well as sensitivities for a 70% specificity, were also similar, between TP and TBI. Both absolute systolic toe pressure measurement and toe brachial index had slightly stronger ROC curve AUC, with the dorsalis pedis artery as the standard of comparison, than the posterior tibialis artery waveform, as per the angiosome theory. Therefore, health-care practitioners treating wounds should be aware of the angiosome concept, as well as the diagnostic properties and limits of TP and TBI when performing a lower limb vascular assessment.

In conclusion, both toe pressure and toe-brachial index seem to be standalone vascular tests of the forefoot. In patients with a lower limb wound, we suggest that performing the more tedious and time-consuming calculation of toe-brachial index appears to be of no added values for detecting PAD than assessing solely the systolic toe pressure measurement.

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