



Dynamic skin perfusion pressure: a new measure of assessment for wound healing capacity and alternative angiosome in critical limb ischemia

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Title page

Title: Dynamic SPP~ a new measures of assessment for wound healing capacity and alternative angiosome in critical limb ischemia (CLI)

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In critical limb ischemia (CLI), the circulatory assessment includes angiography, CTA, MRA, ankle-brachial index (ABI), toe pressure, and doppler ultrasonography, while the wound assessment includes flat plate, MRI, the bleeding condition in debridement. Recently, we can utilize TcPO₂ and/or SPP^{2,3} as an objective tool of skin circulation around the wound. For a good wound healing, we have to recognize original angiosomes of the foot and find an alternative ischemic angiosome through arterial-arterial connection, because 15 percent of ischemic wounds can not heal despite the revascularization with success¹. The failure is considered due to inadequate revascularization of the wound and/or inadequate wound care. Revascularization of the directly supplying the ischemic angiosome is more successful than revascularization of the indirectly supplying one. We reported that SPP measurement would be useful for predicting wound healing in CLI³. We here would like to propose dynamic SPP as a new assessment measure.

Methods (Figure 1)

We define dynamic SPP-1 measures SPP when anterior tibial artery (ATA) is occluded manually and dynamic SPP-2 measures SPP when posterior tibial artery (PTA) is occluded manually.

Representative case

A 61-year-old male had the gangrenes (ABI; immeasurable) on his right toes and heel at both sides (Figure 2, upper) with diabetes mellitus was introduced. An angiographic finding demonstrated that his right superficial femoral artery (SFA) was occluded, the two tibial arteries showed the

chronic total occlusion and the peroneal artery came out slowly. SPP was 27mmHg at the dorsum. We performed endovascular therapy (EVT) for the SFA with nitinol stent (Smart stent 8.0mm x 80mm, Johnson & Johnson, Cordis, warren, NJ), and balloon angioplasty for the ATA. SPP was slightly elevated to 31mmHg at the dorsum and 47mmHg at the forefoot. A dynamic SPP-1 showed 25mmHg at the dorsum and 39mmHg at the forefoot. These findings demonstrated that the main flow of the sole was from ATA and the angiosome of the sole was displaced to ATA area, that is, his toes and medial heel might not had a capacity to heal. So, with another EVT of bi-directional angioplasty⁴, the PTA was successfully recanalized from the origin to the pedal arch. SPP was significantly improved to 68mmHg at the dorsum, 66mmHg at the forefoot, and 65mmHg at the heel. A dynamic SPP-1 showed 54mmHg at the dorsum, 62mmHg at the forefoot, and 65mmHg at the heel. These findings demonstrated that the main flow of the sole was changed from ATA to PTA and the angiosome of the sole was restored to its normal condition which is originally PTA area. After eleven days, a modified transmetatarsal amputation⁵ was performed, and the wound was completely healed (Figure 2, lower). His postoperative course has not been eventful for 24 months and he has walked without the help of a stick. This modified procedure is for preserving the soft tissue between the metatarsal bones including the vasculature complex with the muscles, the periosteum, and the vessels except for tendons. The soft-tissue can also cushion in walking and preserve distal circulation after wound closure.

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Figure Legends

Figure 1: The procedures of dynamic SPP measures

Upper portion; Dynamic SPP-1 measure when anterior tibial artery is occluded manually

Lower portion; Dynamic SPP-2 measure when posterior tibial artery is occluded manually.

Figure 2: A representative case, pretreatment condition (upper portion) and posttreatment condition at 7 months after the operation (lower portion)



