

行政院國家科學委員會補助專題研究計畫成果報告

糖尿病病患末稍動脈物理性質之研究(3/3)

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計畫編號：NSC — 90 — 2314 — B — 002 — 407

執行期間： 90 年 8 月 1 日至 91 年 7 月 31 日

計畫主持人：王崇禮

共同主持人：

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- 國際合作研究計畫國外研究報告書一份

執行單位：台灣大學醫學院骨科

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Abstract

This study aimed to evaluate the hemodynamic change of the dorsalis pedis artery and/or posterior tibial artery through three different stages of the Charcot foot patients with spectrum analysis of ultrasound. Six Charcot foot patients, 3 male and 3 female and aged from 22 to 70 years, were enrolled in this study. Color Doppler examination of dorsalis pedis artery and/or posterior tibial artery was performed when the patient was first diagnosed. Follow up of plain roentgenography and ultrasound was performed at an interval of one month till fractured bone consolidated. The correlation between clinical findings, X-ray examination and ultrasonography was compared. In 5 cases classified in fragmentation stage, monophasic pattern on spectrum analysis of Doppler examination was noted. Three cases returned to triphasic

pattern on spectrum average of 3.2 months, when plain X-ray revealed consolidation of the fracture. Spectrum analysis of Doppler examination would provide another reliable, accurate and convenient indicator for immobilization.

Keywords: Hemodynamics, Charcot foot, Diabetes Mellitus, ultrasound

Diabetic osteopathy is also known as Charcot joint or Charcot neuroarthropathy. It was first described by Charcot et al in 1868 and Jordan in 1936 reported occurrence of Charcot foot in diabetic patients. Diabetic osteopathy is a chronic, progressive and degenerative disease of one or more joints characterized by swelling, instability of the joint, hemorrhage, heat, and atrophic and hypertrophic changes in the bone. Its incidence was estimated to be 0.15 ~ 2.5% of diabetic population. Eichenholtz classified it into three

stages: destruction, coalescence and consolidation respectively. Goals of treatment is to achieve 3rd stage of bony healing without soft tissue breakdown & ulcerations. Conservative treatment with total contact cast and non-weight bearing was commonly recommended for the early stage patients. This study aimed to evaluate the hemodynamic change of the dorsalis pedis artery and/or posterior tibial artery through three different stages of the Charcot foot patients with spectrum analysis of ultrasound.

#### Materials and Methods

Six Charcot foot patients, 3 male and 3 female and aged from 22 to 70 years, were enrolled in this study. They all had had diabetes for more than 15 years, with 2 IDDM and 4 NIDDM. The diagnosis was based on history, physical examination, and plain roentgenography. MRI and bone scan examination were performed in 5 of them. The period from symptoms first appeared to diagnosis were 3 months in average. No one had

skin ulceration at the time of diagnosis and one had previous toe amputation at the same foot.

All of them receive cast immobilization initially. Color Doppler examination of dorsalis pedis artery and/or posterior tibial artery was performed when the patient was first diagnosed. The spectrum analysis of the Doppler examination of the peripheral arteries was recorded bilaterally. Follow up of plain roentgenography and ultrasound was performed at an interval of one month till fractured bone consolidated. The correlation between clinical findings, X-ray examination and ultrasonography was compared.

#### Results

All the six cases revealed triphasic pattern of blood flow on spectrum analysis of Doppler examination at the peripheral arteries of the healthy foot since the beginning (Fig. 1). However, in 5 cases classified in fragmentation stage, monophasic pattern on spectrum analysis of Doppler

examination (Fig. 2), along with clinical findings of swelling, local heat or redness was noted. One of these 5 patients shifted to arthrodesis later because of total dislocation of the subtalar joint. Three in the other 4 returned to triphasic pattern on spectrum analysis of Doppler examination at an average of 3.2 months, when clinical examination showed swelling of the foot subsided, local skin temperature went down and plain X-ray revealed consolidation of the fracture. The remaining one case is still under follow up at this moment.

#### Discussion

The pathophysiology of diabetic osteopathy has not been fully understood. However, neurotraumatic theory based on cumulative mechanical trauma and insensitive to proprioception & pain, and neurovascular theory based on vasomotor dysfunction, bone resorption and ligamentous weakening had been advocated. Although Charcot foot was commonly believed to be caused by increased local blood flow though A-V

shunting resulted from a sympathetic diabetic neuropathy, duplex color Doppler ultrasound were not able to detect this hemodynamic change in the diabetic foot without arthroosteopathy.

Monophasic pattern on spectrum analysis of Doppler examination means the presence of blood flow in the diastolic phase, indicating a decreased after-load hemodynamically. This hemodynamic change should be explained by the fracture of the foot bones under repairing. Once the fracture healed, the spectrum analysis of Doppler examination returned to triphasic pattern again.

How long should be the Charcot foot immobilized? Evidence of union of the fractured bone on the X-ray or local skin temperature returned to be within 2 degree in Celsius of difference compared with the sound side has ever been advocated. Here, we found that spectrum analysis of Doppler examination would provide another reliable, accurate and convenient indicator for immobilization. The

immobilization could be terminated when monophasic pattern on spectrum analysis returned to triphasic pattern again.

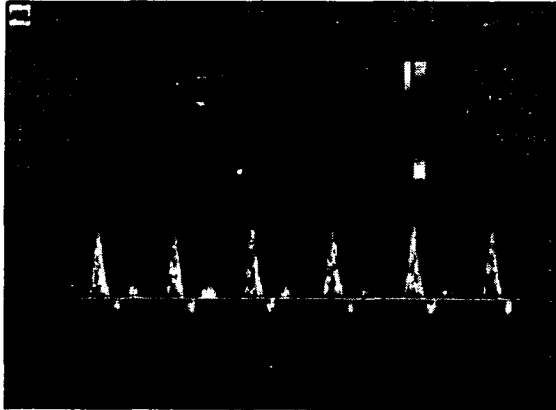


Fig. 1: Triphasic pattern on spectrum analysis.

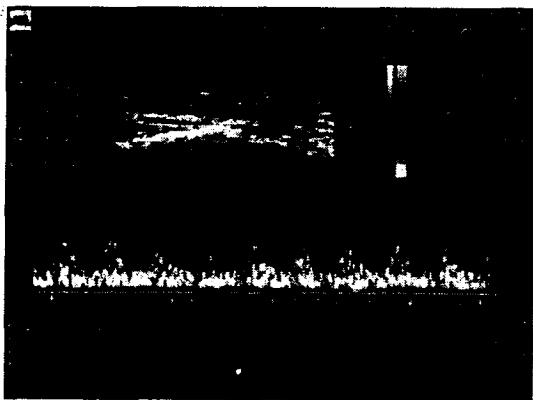


Fig. 2: Monophasic pattern.

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