# 以核磁共振影像研究糖尿病患的主動脈血流脈波傳導速率(part 1)、以核磁共振影像研究體外主動脈壁面剪應力特性(part 2)


## 郭庭榮、溫志湧 ; 楊安石

E-mail: 9609688@mail.dyu.edu.tw



**摘 要**

本論文分為兩個部份第一部份為“ 以核磁共振影像研究糖尿病患的主動脈血流脈波傳導速率 ”；第二部份為“ 以核磁共振影像研究體外主動脈壁面剪應力特性 ”。　　在第一部分的研究，主動脈的順應性是心臟負荷的重要決定因子，它也是臨床上糖尿病患與高血壓病患長期預防治療追蹤的重要預測指標，而主動脈的血流脈波傳導速率則可視為主動脈順應性的代名詞。本研究主要將以氣體動力學裡的波動理論，建構一套全新的非侵入式方法，用來預估主動脈的血流脈波傳導速率。研究中將針對健康志願者與糖尿病患者，以核磁共振儀來取得他們矢狀切面上主動脈的幾何參數與流場資訊，藉由分析胸腔主動脈軸心速率在空間與時間上的變化波型，求得主動脈的血流脈波傳導速率與順應性。研究結果顯示正常人的平均脈波傳導速率(Pulse Wave Velocity，PWV )為6.49±1.49 m/s，主動脈順應性為6.58m3s2/kg；糖尿病患者的平均PWV為12.76±0.66 m/s主動脈順應性則為 1.57 m3s2/kg。由此可知糖尿病患者的PWV值遠大於正常人，血管硬化程度嚴重。期望藉由MRI此一非侵入式方法，準確地預估主動脈順應性與血流脈波傳導速率，同時研究成果可以建立一臨床指標來評估糖尿病患心血管疾病發生的風險性，使人類生活更健康。 在第二部份的研究，壁面剪應力(Wall Shear Stress,WSS)乃心血管疾病的重要預測因子之一，因此本研究藉由核磁共振影像，取得人體主動脈模型在心臟循環狀況下流體的速度分佈，觀察壁面剪應力對主動脈的影響。實驗的進行將分為三個部份：⑴圓直管實驗；⑵體外主動脈模型穩態實驗；⑶體外主動脈模型暫態實驗。藉由圓直管實驗驗證以流體力學“ 無滑動邊界條件 ”為基礎的邊界搜尋方法是否正確；而以MRI可獲得流體速度分佈的特性，觀察流體在主動脈模型內流場的變化，與壁面剪應力在主動脈模型分佈的情形。研究顯示在主動脈弓內側壁面，有明顯的壁面剪應力變化；而在下行主動脈外側壁面亦有明顯的壁面剪應力變化發生。此研究未來可進一步應用於人體上，觀察人體主動脈的壁面剪應力變化，作為心血管疾病的預防機制，使人類生活更健康。



關鍵詞 : 順應性 ; 血流脈波傳導速率 ; 核磁共振儀 ; 糖尿病 ; 主動脈 ; 壁面剪應力 ; 主動脈弓 ; 無滑動邊界條件


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