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• 中文關鍵字	頸動脈; 血管支架; 血管窄狹; 動物模型; 數值分析; 醫學影像重建		
• 英文關鍵字	Carotid artery; Stent; Stenosis; Animal model; Numerical simulation; Image reconstructure		
• 中文摘要	血管窄化是世界前兩大死因，缺血性腦血管及缺血性心血管疾病的主要原因。而血管支架植入為解決血管阻塞其中一個常用且有效的治療方式；為了解決血管支架植入後產生的後遺症，而進行「應用醫學影像與力學分析於冠狀動脈支架手術之臨床評估」的三年期研究。在第二年裡，我們與『財團法人國家實驗研究院國家實驗動物中心』合作，進行『迷你豬冠狀動脈狹窄及再狹窄模式的建立及應用』的研究。餵食迷你豬「高密度膽固醇」，縮短「冠狀動脈硬化」發展時程及增加其發生率，以 CT 電腦斷層掃描非侵入式進行動脈病狹窄診斷，同時進行醫學影像重建，可供後續流體力學數值模擬的幾何模型。目前豬隻動物試驗模式並呈現出明顯的動脈硬化病變，推論餵食時間只有五個月，還需要繼續追蹤。建構病患血管 CT 電腦斷層掃描頸動脈窄狹的醫學影像資料，擷取血管的幾何形狀、截面積，進行數值模擬，發現在血管窄狹處，發生高速血流及壁面剪應力明顯提高，同時在上游有較高壓存在，壁面剪應力及血壓升高均造成有效通血流面積縮小，加速血管窄狹，此結果與臨床觀察相符。因此病患需要血管重建手術。由於血液在植入網狀支架的血管中流動時，容易在沒有支架包覆的地方形成局部的停滯流，因此我們建議以螺旋形的支架（具開放式流場），分析其流場。探討螺旋形狀支架的線肋斷面積對流場影響外，並改變支架的線肋間距。模擬結果顯示，不論是圓形及或矩形斷面的支架，在接近支架線肋近端流場都會產生流場分離、迴流渦漩及再接觸區。壁面剪應力在緊臨線肋後緣有較低值。因此與臨床上支架植入初期，在支架接觸血管壁發生血栓。改變不同支架間距，並沒有產生有效的二次流，產生對血管壁流體清洗(wash-out)效應，減少停滯發生。		
• 英文摘要	Arterial stenosis leads to cardiac infarction and cerebral vascular infraction, which are the two main courses of death in the developed countries. Stent implantation is currently a common clinical procedure for treatment of severely occluded artery. To better understand the mechanisms leading to stent implant complications, we propose the 3-year project entitled, "the clinical assessment of stent implantation in coronary artery using combined medical imaging analysis and computational fluid dynamic analysis." At present, we have obtained a series of images from a patient man with internal carotid arterial (ICA) stenosis using Computer Tomography (CT). The image can been provided the configurations in his carotid artery with the cross-sectional area of carotid artery. A series of CFD numerical simulation of the natural artery were analyzed. It was found that in the native artery, the high velocity and wall shear stress distribution focus on the stensosis region of carotid artery. For flow in the artery with a stent implanted, a stagnation zone is formed in the section covered with the stent. We thus proposed the numerical model of a helix stent. The effects of a helical coil with two different stent strunt configurations (round and rectangular cross sections) on blood flow patterns adjacent to the vessel wall have been studied using computational flow dynamics (CFD) techniques. The flow patterns are carefully studied near the struts, including separation, regions of stagnation, recirculation and reattachment. There is low wall shear stress (WSS) distribution in the recirculation region. Clinical studies have shown that in certain stent struts, there are vessel areas covered with thrombus within a few hours or days following implantation. The designs of helical stent do not create a beneficial spiral flow to reduce turbulence or dead spots within the vessel. In vivo measurements of mini-pig animal model have been carried out on the mini-pig fed with high cholesterol diet so as to accelerate the development period of stenosis. The variation of the physiological and pathological parameters has been traced on 5 months basis. There are no plaques shown by CT image medical diagnosis now. We will continue to trace in the future.		