problems. This study aimed to develop a method to select risk variables and predict mortality after cardiac surgery by using artificial neural networks. Methods: Prospectively collected data from 18, 362 patients undergoing cardiac surgery at 128 European institutions in 1995 (the European System for Cardiac Operative Risk Evaluation database) were used. Models to predict the operative mortality were constructed using artificial neural networks. For calibration a sixfold cross-validation technique was used, and for testing a fourfold cross-testing was performed. Risk variables were ranked and minimized in number by calibrated artificial neural networks. Mortality prediction with 95% confidence limits for each patient was obtained by the bootstrap technique. The area under the receiver operating characteristics curve was used as a quantitative measure of the ability to distinguish between survivors and nonsurvivors. Subgroup analysis of surgical operation categories was performed. The results were compared with those from logistic European System for Cardiac Operative Risk Evaluation analysis. Results: The operative mortality was 4.9%. Artificial neural networks selected 34 of the total 72 risk variables as relevant for mortality prediction. The receiver operating characteristics area for artificial neural networks (0.81) was larger than the logistic European System for Cardiac Operative Risk Evaluation model (0.79; P = .0001). For different surgical operation categories, there were no differences in the discriminatory power for the artificial neural networks (P = .15) but significant differences were found for the logistic European System for Cardiac Operative Risk Evaluation (P = .0072). Conclusions: Risk factors in a ranked order contributing to the mortality prediction were identified. A minimal set of risk variables achieving a superior mortality prediction was defined. The artificial neural network model is applicable independent of the cardiac surgical procedure.

应用人工神经网络对心脏外科手术危险因素的识别和死亡率的预测

目的：人工神经网络是一种针对复杂模式认知问题的有效非线性技术。本研究的目的在于提供一种利用人工神经网络选择心脏手术后危险变量并预测死亡率的方法。方法：前瞻性收集1995年于128个欧洲机构进行心脏手术的18 362例患者的资料（欧洲心脏手术风险评估系统数据库）。应用人工神经网络建立手术死亡率的预测模型。利用6倍交叉验证技术进行校正，并用4倍交叉检验进行验证。用校正的人工神经网络对危险变量进行归类并最小化。用bootstrap技术获得各患者的死亡率预测值及其95%可信区间。以受试者操作特征曲线下面积作为区分存活者与非存活者能力的定量测定指标。依据外科手术种类进行亚组分析。将结果与欧洲心脏手术风险评估系统Logistic分析结果进行比较。结果：手术死亡率是4.9%。人工神经网络从共72个危险变量中选择了34个作为死亡率预测的相关变量。人工神经网络的受试者操作特征曲线下面积大于欧洲心脏手术风险评估系统Logistic分析模型的（0.81 *vs* 0.79，$P = 0.000\ 1$）。对于不同的手术种类，人工神经网络的识别能力无显著性差异（$P = 0.15$），但是欧洲心脏手术风险评估系统Logistic分析模型则存在显著性差异（$P = 0.007\ 2$）。结论：已识别出与死亡率预测顺序相关的危险因素，并确定了可达到较佳死亡率预测的最少危险变量。应用人工神经网络模型进行分析是可行的，且独立于心脏外科手术种类。

0769. Brain death leads to abnormal contractile properties of the human donor right ventricle

Stoica S. C. / Satchithananda D. K. / White P. A. et al. [S. R. Large, Papworth Hospital, Cambridge, United Kingdom] – J. THORAC. CARDIOVASC. SURG. 2006, 132/1 (116 – 123)

Objectives: Experimental and clinical data suggest that brain death predominantly affects the right ventricle. We aimed to investigate right ventricle function after brain death and during clinical transplantation with load-independent methods. Methods: Patients with and without brain death were enrolled. A total of 33 consecutive heart donors (5 live, "domino" donors) and 10 patients undergoing coronary surgery (coronary artery bypass graft controls) were studied with pressure-volume loops in the right ventricle. Contractile reserve was measured with dopamine stimulation. Results: Brain-dead donors had a higher mean cardiac index than coronary artery bypass graft controls (3.3 vs 2.8 L/min/m^2), but impaired load-independent indices. Despite increased right ventricle stroke volume, the ejection fraction and slope of the end-systolic pressure-volume relationship were significantly reduced in brain-dead donors compared with controls. Diastolic abnormalities were also manifest as increased end-diastolic volume index and prolonged Tau (P < .05). Dopamine improved cardiac output, but without influencing

end-systolic pressure-volume relationship, or Tau, and at the expense of further increased right ventricle end-diastolic volume. Before explantation, a significantly higher diastolic volume was also seen in hearts that developed postoperative dysfunction compared with organs without this complication(114.4 vs 77.2 mL/m², P = .02). Conclusions: Brain death leads to right ventricle dysfunction, which may go undetected with conventional techniques. Right ventricle dilatation could represent an early marker of failure. Refinement of selection criteria to include load-independent indices of performance may be desirable to help expand the donor pool.

脑死亡导致人供体心脏右室收缩功能异常

目的：实验和临床资料表明脑死亡主要影响右心室功能。本研究旨在用不受负荷影响的方法确定脑死亡后以及行临床移植过程中的右心室功能。方法：纳入了有和无脑死亡的患者。应用右心室压力－容量环对33例连续心脏供体（5例为存活者，即"domino"供体）和10例接受冠状动脉手术的患者（冠状动脉搭桥术对照者）进行研究。利用多巴胺刺激测定收缩储备能力。结果：脑死亡供体平均心脏指数高于冠状动脉搭桥术对照者[3.3 L/（min·m²）*vs* 2.8 L/（min·m²）]，但是不受负荷影响的指标受损。与对照者相比，尽管增加了右室搏出量，脑死亡供体的射血分数和收缩末压力－容积关系斜率明显降低。增加的舒张末容积指数和延长的τ还表明了舒张功能异常（$P < 0.05$）。多巴胺增加了心输出量，但是并不影响收缩末压力－容积关系或τ，而且以进一步增加右心室舒张末容积为代价。发生术后功能障碍的心脏与没有这一并发症的心脏相比，前者的移植前舒张容积明显更高（114.4 ml/m² *vs* 77.2 ml/m²，P = 0.02）。结论：脑死亡可导致右心室功能障碍，而常规技术可能难以发现。右心室扩张可作为衰竭的早期征象。改良选择标准，加入不受负荷影响的功能指标，可能有助于扩大供体库。

0770. Risk-corrected impact of mechanical versus bioprosthetic valves on long-term mortality after aortic valve replacement

Lund O. / Bland M. [Dr. O. Lund, Department of Health Sciences, University of York, York, United Kingdom] – J. THORAC. CARDIOVASC. SURG. 2006, 132/1(20 – 26. e3)

Objective: Choice of a mechanical or biologic valve in aortic valve replacement remains controversial and rotates around different complications with different time-related incidence rates. Because serious complications will always "spill over" into mortality, our aim was to perform a meta-analysis on overall mortality after aortic valve replacement from series with a maximum follow-up of at least 10 years to determine the age-and risk factor-corrected impact of currently available mechanical versus stented bioprosthetic valves. Methods: Following a formal study protocol, we performed a dedicated literature search of publications during 1989 to 2004 and included articles on adult aortic valve replacement with a mechanical or stented bioprosthetic valve if age, mortality statistics, and prevalences of well-known risk factors could be extracted. We used standard and robust regression analyses of the case series data with valve type as a fixed variable. Results: We could include 32 articles with 15 mechanical and 23 biologic valve series totaling 17, 439 patients and 101, 819 patient-years. The mechanical and biologic valve series differed in regard to mean age(58 vs 69 years), mean follow-up(6.4 vs 5.3 years), coronary artery bypass grafting(16% vs 34%), endocarditis(7% vs 2%), and overall death rate(3.99 vs 6.33 %/patient-year). Mean age of the valve series was directly related to death rate with no interaction with valve type. Death rate corrected for age, New York Heart Association classes III and IV, aortic regurgitation, and coronary artery bypass grafting left valve type with no effect. Included articles that abided by current guidelines and compared a mechanical and biologic valve found no differences in rates of thromboembolism. Conclusion: There was no difference in risk factor-corrected overall death rate between mechanical or bioprosthetic aortic valves irrespective of age. Choice of prosthetic valve should therefore not be rigorously based on age alone. Risk of bioprosthetic valve degeneration in young and middle-aged patients and in the elderly and old with a long life expectancy would be an important factor because risk of stroke may primarily be related to patient factors.

风险校正后比较应用机械瓣膜与生物瓣膜对主动脉瓣置换术后长期死亡率的影响

目的：选择机械瓣膜或生物瓣膜行主动脉瓣置换仍存在争议，且因不同并发症的时间相关发生率不同而发生转变。因为严重的并发症常增加死亡率，本研究目的是针对主动脉瓣置换术后全因死亡率进行一项荟萃分析（资料来源于最长随访时间超过10年的病例系列），以确定应用机械瓣膜与支架生物瓣膜的年龄及危险因素校正后影响。方法：利用正式的研究方案，对1989—