北京航空航天大学四年级博士生和五年级直博生
学校奖学金申报表

（请按填表说明填写，本表填写的内容必须为非涉密可公开!）

姓　名	杨贤达	学　号	BY1510105	指导教师	李淑宇
类　别	√ 三年级博士生　□ 四年级直博生			学科/专业	生物医学工程
承担科研任务情况	**项目名称**		**课题来源**	**课题负责人**	**本人承担的具体工作**
	前交叉韧带重建术后移植体力学属性的演变与下肢运动模式相互影响的生物力学研究		06 国家自然科学基金	姚杰	参与课题
	主动脉瓣二瓣畸形患者主动脉扩张的血流动力学研究		06 国家自然科学基金	王振泽	参与课题
已取得研究成果（论文、专利、获奖等）	**论文题目**		**本人排名**	**发表年月**	**期刊（会议）名称** / **被检索类型**
	An In Vitro Feasibility Study of the Influence of Configurations and Leaflet Thickness on the Hydrodynamics of Deformed Transcatheter Aortic Valve		第二（第一作者非导师，不满足毕业条件的成果）	2017年8月	ARTIFICIAL ORGANS / 1 SCI源
	An in vitro study of the influence of monocusp patch size on the hemodynamics for reconstructing Right Ventricular Outflow Tract in tetralogy of Fallot		第三	2017年7月	39TH ANNUAL INTERNATIONAL CONFERENCE OF THE IEEE ENGINEERING IN MEDICINE AND BIOLOGY SOCIETY (EMBC) / 1 SCI源

<table>
<tr><td rowspan="5"></td><td>In Vitro Hydrodynamics Evaluation of Transcatheter Heart Valve with Variable Geometric Configuration</td><td>第一</td><td>2017年8月</td><td>8th WACBE World Congress on Bioengineering</td><td>99 其他</td></tr>
<tr><td>专利名称</td><td>本人排名</td><td>发布年月</td><td>专利号</td><td>专利类型</td></tr>
<tr><td>一种具有新型卡口结构的脉动流测试模块</td><td>第一</td><td>2017 年 10 月</td><td>ZL201410720634 4</td><td>1 发明专利</td></tr>
<tr><td>获科技成果奖励名称</td><td>本人排名</td><td>获奖年月</td><td>证书编号</td><td>奖励级别</td></tr>
<tr><td>2015-2016 北京航空航天大学研究生优秀科技创新团队奖学金（校长奖学金）</td><td>第五</td><td>2016 年 11 月</td><td>无</td><td>60 学校级</td></tr>
<tr><td>本人
承诺</td><td colspan="5">本人所填写的以上内容均为真实情况。
本人签字：_____
年 月 日</td></tr>
<tr><td>导师
意见</td><td colspan="5">同意 / 不同意 该同学申报学校奖学金。
导师签字：_____
年 月 日</td></tr>
<tr><td>学院学位评定分委员会意见</td><td colspan="5">同意 / 不同意 该同学获得学校奖学金。
签字：_____ （学院代盖）
年 月 日</td></tr>
</table>

Artificial Organs

An In Vitro Feasibility Study of the Influence of Configurations and Leaflet Thickness on the Hydrodynamics of Deformed Transcatheter Aortic Valve

*†Wentao Feng, *†Xianda Yang, *†Yang Liu, and *†‡Yubo Fan

*Key Laboratory for Biomechanics and Mechanobiology of Ministry of Education, School of Biological Science and Medical Engineering, International Research Center for Implantable and Interventional Medical Devices, Beihang University; †Beijing Key Laboratory for Optimal Design and Evaluation Technology of Implantable & Interventional Medical Devices and ‡National Research Center for Rehabilitation Technical Aids, Beijing, China

Abstract: Clinically, the percutaneous transcatheter aortic valve (TAV) has been reported to be deformed in a noncircular configuration after its implant. The deformation is universal and various, and it leads to serious leakage and durability problems. Even in the same deformation, the leaflets made in different tissue thicknesses may cause different hydrodynamic performances. Simulating the left heart cardiac conditions by a pulse duplicator system, the present study investigated the effects of the aortic annulus deformation and the leaflet tissue thickness on the hydrodynamics of the TAV. Three 22 mm self-expanding TAV samples were fabricated with three different leaflet thicknesses (0.25, 0.4, 0.55 mm). Every sample was successively deformed to be elliptical, triangular, and undersized circular shapes. The hydrodynamics of the TAV were assessed through a quasi-physiological artery pulsatile flow duplicator system. The transvalvular pressure difference, effective orifice area, and regurgitation flow were determined. High-speed video recordings were taken to investigate the leaflet kinematics. The results showed that the triangular deformation produced the poorest valve function while the elliptical deformation led to the slightest difference from the nominal. With increasing leaflet thickness, the effect of configuration deformation on the regurgitation increased. The thinner leaflets were better than the thicker ones in adapting to the deformation but had a higher risk of deterioration. **Key Words:** Aortic valve stenosis—Heart valve prosthesis—Transcatheter aortic valve implantation—In vitro study.

Currently, percutaneous transcatheter aortic valve implantation (TAVI) has been considered to be an effective and safe therapy for aortic valve replacement (AVR) (1–3). With the rapid increase in applications, it poses various challenges because of the unique disease treatment mechanism of TAVI. Compared to traditional AVR therapy, TAVI does not excise the native aortic valve even if it is heavily calcified. For instance, the heavy calcium deposition on the valve leaflets and the aortic root can cause distortion of TAV, resulting in a valve of a noncircular geometry instead of a nominal circular shape (4–6). As reported in the clinical studies of TAV (4,7–9), the noncircular deformation is universal and leads to serious leakage and durability problems. A noncircular geometry may affect leaflet coaptation and cause valve regurgitation (5). Without proper leaflet apposition, uneven distribution of stress on the leaflets may also affect long-term valve durability (10).

Up till now, studies on the effect of noncircular deformed implant have focused on paravalvular leakage between the expanded valve and the calcified native valve (11,12), flow characteristics (13) and the TAV leaflet stress and strain distribution (14,15). However, the hydrodynamic performance of these deformed configurations with different leaflet material properties remains unknown. This

doi: 10.1111/aor.12833

Received March 2016; revised June 2016; accepted July 2016.

Address correspondence and reprint requests to Yubo Fan, School of Biological Science and Medical Engineering, Beihang University, No.37 Xueyuan Road, Haidian District, Beijing 100191, China. E-mail: Yubofan@buaa.edu.cn

An in vitro study of the influence of monocusp patch size on the hemodynamics for reconstructing Right Ventricular Outflow Tract in tetralogy of Fallot *

Wentao Feng, Jie Yao, Xianda Yang, Zhaowei Chu, Meng Guo, Lizhen Wang, and Yubo Fan

Abstract— **For relief of right ventricular outflow tract obstruction in the operative treatment of tetralogy of Fallot and other complex congenital heart disease, it is often necessary to perform transannular monocusp patch to prevent right ventricular pressure overload and reduce pulmonary regurgitation. But the the geometric relationship between a monocusp patch length and the size of RVOT is not well defined. Five 20 mm sized monocusp patches were tested in simulated RVOTs which sized from 18 mm to 22 mm at 1 mm interval, respectively. The hydrodynamics of the patches were assessed through a quasi-physiological artery pulsatile flow duplicator system. The transvalvular pressure difference, effective orifice area and regurgitation flow were determined. The results showed that the regurgitation fraction increased with the diameter of RVOT increased (from 6.25% at 18 mm RVOT to 26.63% at 22 mm RVOT). Implant an oversized monocusp patch in RVOT reconstruction can effectively decrease the regurgitation but increase the transvalvular pressure and may reduce the longevity of leaflet.**

I. Introduction

Right ventricular outflow tract (RVOT) obstruction is a common issue in tetralogy of Fallot and other complex congenital heart diseases. Using a transannular patch to enlarge RVOT is one of the most distinctive surgical procedures, but it leads to transvalvular regurgitation. Acute pulmonary valve regurgitation can lead to right ventricular (RV) dilatation and failure, tricuspid regurgitation, impaired exercise performance and arrhythmias [1-3], and seems to be associated with increased perioperative mortality [4]. To prevent pulmonary regurgitation, various techniques have been applied such as valved homograft patch or monocusp patch with different results [5-13]. Theoretically, a monocusp patch can reduce patch-related pulmonary regurgitation, but the long-term result is unsatisfactory, especially in younger children.

For young children, their RVOT can still be enlarged after surgery because the residual vessel wall of RVOT may continue grow. In that circumstances, the leaflet of monocusp patch which was implanted at the reconstructing surgery would be undersized since the sectional area of RVOT was enlarged. Up till now, the geometric relationship between a monocusp patch length and the size of RVOT is not well defined in previous study. It is necessary to obtain the influence of monocusp patch size on the hemodynamics function of the reconstructed RVOT. This study tested the hemodynamics performance of the fixed size monocusp implanted in different size of RVOTs with a pulse duplicator system to simulate right heart cardiac conditions.

*Research supported by Grants-in-Aid from the National Natural Science Foundation of China (NSFC No.11572029, 11421202), National key research and development program in China (No.2016YFC1100704, 2016YFC 1102202, 2016YFC1101100), National Science& Technology Pillar Program of China (2014BAI11B02， 2014BAI11B03); Beijing Science and Technology Plan (Z131100002713018)

All authors are with the Key Laboratory for Biomechanics and Mechanobiology of Ministry of Education, Beihang University, Beijing 100191, China.

Yubo Fan is also with the National Research Center for Rehabilitation Technical Aids, Beijing 100176, China. (Corresponding author, phone/Fax: (+86)1082339428, e-mail: yubofan@buaa.edu.cn)

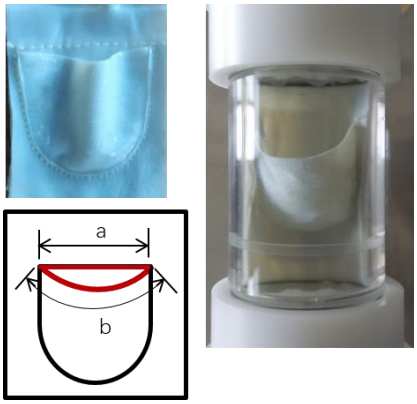
II. Materials and Methods

A. Monocusp Patch and RVOT

The commercially clinical use 20 mm sized monocusp patches (Fig. 1) were provide by Balance Medical Corporation (Balance Medical Corp., Beijing, China). The patches were made from bovine pericardium material. The length “a” is 25.13 mm and the length “b” is 37.7 mm, the circumference of “a” and “b” is 62.83 mm which is the same with the circumference of a 20 mm diameter tube.

The RVOTs were simulated by rigid, straight tubes which were made form transparency organic glass (Fig. 1). The internal diameter of the tubes was from 18 mm to 22 mm at 1 mm interval. The 20 mm tube was the same size with the monocusp patch while the 18 mm and 19 mm tubes were adapted to simulate the condition that the larger monocusp patch implanted in small RVOT and the 21 mm and 22 mm tubes were adapted to simulate the situation that the section area of RVOT enlarged.

Figure 1. Monocusp patch and test section. *(upper left: 20 mm sized monocusp patch; buttom left: schematic depiction of monocusp patch; right: monocusp patch fixed in test section)*



In Vitro Hydrodynamics Evaluation of Transcatheter Heart Valve with Variable Geometric Configuration

Xianda Yang[1], Wentao Feng[1], Yang Liu[1], Lizhen Wang[1], Yubo Fan[1, 2, *]

[1] *School of Biological Science and Medical Engineering, Key Laboratory for Biomechanics and Mechanobiology of Ministry of Education, International Research Center for Implantable and Interventional Medical Devices, Beihang University, Beijing, China*
[2] *National Research Center for Rehabilitation Technical Aids, Beijing, China*

Keywords: heart valve prosthesis, in vitro study, TAVI

** corresponding author: yubofan@buaa.edu.cn*

INTRODUCTION

Clinically, transcatheter aortic valve (TAV) implantation (TAVI) has evolved into a safe, effective therapy for aortic valve stenosis. Recently, TAV encountered situations of deformation after implanted which impaired its functional performance. The calcified native aortic valve acted as a scaffold that buttresses the stented TAV within the aortic annulus once the valve is deployed. However, the shapes of the calcified valve were not all perfect for the deployment which caused the change of the valve's geometric configuration, and it may be responsible for complications such as coronary obstruction or perivalvular leakage. The present study was designed to investigate the in vitro hydrodynamics behavior of a TAV with different deformations types based on the three kinds of thickness of the valve leaflet.

METHODS

Three 22mm self-expanding TAV samples with three different leaflet thick-nesses (0.25, 0.4, 0.55mm) were used. They were deformed to different geometries deformations including the nominal, elliptical, triangular, and undersized shapes. Hydrodynamics were assessed by a pulse duplicator. The regurgitant fraction, transvalvular pressure gradient (TVG) and effective orifice area (EOA) were recorded, meanwhile, a high-speed camera was used for recording the morphological characteristics of the valve's open and close.

RESULTS AND DISCUSSION

The result indicated that the triangular deformation had the worst hydrodynamics performance with higher level of regurgitation fraction and lower level of EOA but the better level of TVG, the valve function of elliptical deformation was not much difference with the nominal. The valve with leaflet thickness of 0.55mm had smaller regurgitation than the valves with the other two leaflet thickness. The level of the EOA of 0.4mm is higher than the valves with the leaflet thickness of 0.25mm and 0.55mm. The three kinds of valves had the similar TVGs.

It can be demonstrated that the configuration deformations of the stent and the thickness of leaflets could both affect the hydrodynamic performance of TAVs. Unsynchronized leaflets closing were happened at all deformed conditions, especially at the unsymmetrical deformation.

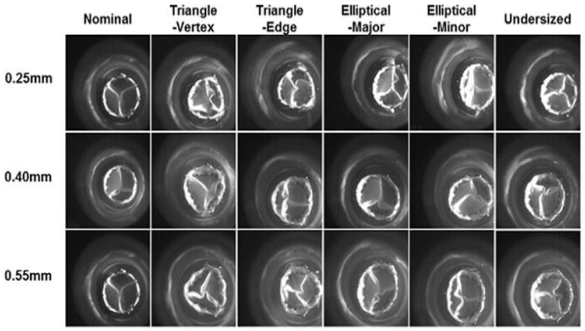


Fig. 1 –Intuitional observed by the high-speed video recordings, the valves with different leaflet thick-nesses were deformed to different geometries deformations.

ACKNOWLEDGEMENT

The project was supported by the National Natural Science Foundation of China (11421202, 11572029, 81372013). State's Key Project of Research and Development Plan (2016YFC1102203).

REFERENCES

1. Zegdi et al., *Journal of the American College of Cardiology* 51(5): 579-584.
2. Young et al., *Artificial Organs* 35(12): 1151-1159.
3. Webb et al., *Circulation* 113(6): 842-850.

证书号第2663307号

北京市海淀区地方税务局 印花税 代扣专用章 国家知识产权局

发明专利证书

发明名称：一种具有卡口结构的脉动流测试模块

发明人：樊瑜波;杨贤达;冯文韬;刘洋;王丽珍

专利号：ZL 2014 1 0720634.4

专利申请日：2014年12月02日

专利权人：北京航空航天大学

授权公告日：2017年10月20日

本发明经过本局依照中华人民共和国专利法进行审查，决定授予专利权，颁发本证书并在专利登记簿上予以登记。专利权自授权公告之日起生效。

本专利的专利权期限为二十年，自申请日起算。专利权人应当依照专利法及其实施细则规定缴纳年费。本专利的年费应当在每年12月02日前缴纳。未按照规定缴纳年费的，专利权自应当缴纳年费期满之日起终止。

专利证书记载专利权登记时的法律状况。专利权的转移、质押、无效、终止、恢复和专利权人的姓名或名称、国籍、地址变更等事项记载在专利登记簿上。

局长
申长雨

中华人民共和国国家知识产权局

2017年10月20日

2015-2016年度 “研究生优秀科技创新团队奖学金”获奖结果公示

日期： 2016-11-11 审核人： 浏览次数：1286

根据《北京航空航天大学优秀研究生校长奖学金评选办法（试行）》，经学院推荐、学校评审领导小组评审，以下团队获得2015-2016年度研究生优秀科技创新团队奖学金。

获奖团队	团队成员
航空材料与性能教育部重点实验室能源材料小组	梁伟涛 耿慧芳 常肖文
新型航空替代燃料研制及全生命周期评价团队	赵兵伟 郭放 唐晓寒 阿鲁斯 石泽
北航仿生自主飞行系统创新团队	王晓华 罗琪楠 邱华鑫 李晗
骨和心血管损伤及修复材料创新研究团队	徐鹏 田丰 黄云飞 冯成龙 杨贤达

公示日期为2016年11月11日—2016年11月15日。如对评定结果有异议，请在公示期内联系研究生院综合管理处。联系电话：82338852，邮箱：gradjiangzhu@buaa.edu.cn。

上一条：研究生人文与科学素养系列讲座预告（11.14-11.20）
下一条：研究生人文与科学素养系列讲座预告（11.07-11.13）