

环渤海体外循环论坛

S06

The Cardiopulmonary Bypass Forum of Circum-Bohai-Sea Regions
聊城厅 Liaocheng Conf. Rm.

主席：侯晓彤
Chair:
Xiaotong Hou



副主席：武 婷
Vice-Chair:
Ting Wu



副主席：许崇恩
Vice-Chair:
Chongen Xu



2019年11月15日 星期五 13:00-17:00

时间	演讲者姓名和单位	演讲题目
主持	龙 村 侯晓彤 许崇恩 刘 宇	
13:00-13:20	黑飞龙 阜外医院	人工肺的应用和发展
13:20-13:35	史国宁 天津胸科医院	全腔镜辅助下心脏瓣膜置换的体外循环管理策略
13:35-13:50	马洪亮 河北医科大学第四医院	大血管手术体外循环的抗炎策略研究
13:50-14:05	王 春 中国医科大学附属第一医院	当体外循环遇上人工智能：精准转流是否成真？
14:05-14:20	刘 宇 北部战区总医院	双侧脑灌注联合降主动脉球囊插管灌注在胸骨上段小切口孙氏手术中的应用
14:20-14:25	讨论	
14:25-14:40	张海涛 茶歌与卫星会	理诺珐体外循环整体解决方案
14:40-14:45	理诺珐（中国）医疗科技有限公司	
主持	黑飞龙 武 婷 马洪亮 李培杰	
14:40-14:55	孙 光 中日友好医院	肺动脉内膜剥脱术体外循环及脑保护策略
14:55-15:10	郭 珊 天津泰达国际心血管病医院	delNido心肌保护液在小儿及成人应用体会
15:10-15:25	岳之峰 河北医科大学第四医院	妊娠合并主动脉夹层病例分享
15:25-15:40	曹 倩 青岛妇女儿童医院	ECMO抢救儿童重症爆发性心肌炎的单中心临床经验
15:40-15:55	江晓亮 山东威高新生医疗器械有限公司	体外循环耗材DEHP溶出风险讨论
15:55-16:10	李 旭 贵州省人民医院	贵州生物医学工程的过去、现在和未来
16:10-16:15	讨论	
16:15-17:00	赵 举 张文龙 许崇恩	ECMO实战演练



主席 侯晓彤

Email: houxiaotong-2013@163.com
 主任医师、教授、博士生导师
 首都医科大学附属北京安贞医院心脏外科危重症中心主任
 中国医师协会体外生命支持专委会主任委员
 中国生物医学工程学会体外循环分会主任委员
 中国医师协会重症医学医师分会委员会常委
 北京医学会重症医学医师分会第四届委员会常委
 亚太体外生命支持组织 (APELSO) 理事



副主席 武婷

Email: ting_ting_wu@126.com
 主任医师，硕士生导师
 天津市胸科医院灌注科
 天津市生物医学工程学会体外循环专业委员会主任委员
 中国生物医学工程学会体外循环分会副秘书长
 中国医师协会体外生命支持分会全国委员



副主席 许崇恩

Email: xcexce@sina.com
 主任医师
 山东省立医院心脏大血管外科
 山东省生物医学工程学会体外循环专业主任委员
 中国生物医学工程学会体外循环分会全国委员
 中国心胸血管麻醉学会体外生命支持分会全国委员
 山东省医师协会心力衰竭专业委员会委员
 中国医师协会心胸外科分会体外循环及体外生命支持学组全国委员

S06-01

人工肺研究应用进展

黑飞龙

中国医学科学院阜外医院

Email: heifeilong@126.com

介绍人工肺的研究进展以及在临床应用的情况，包括物理人工肺和生物人工肺。物理人工肺也称为氧合器或气体交换器，它的主要功能是在机体肺部发生病变或损伤时，在开胸手术的体外循环或体外生命支持中代替人体肺脏排出体内代谢过程中所产生的二氧化碳、同时摄取人体必需的氧气，以维持肺病患者的生命。生物人工肺主要通过组织工程的方法构建新的人工肺作为肺移植的替代治疗手段之一。人工肺还需要进一步发展，为肺部疾病的治疗和危重症的体外生命支持提供技术支撑。

The Progress in Artificial Lung Research and Application

Hei Feilong

Chinese Academy of Medical Sciences Fuwai Hospital

Objective: To introduce the research progress of artificial lung and its clinical application, including physical artificial lung and bioartificial lung. Physical artificial lung, also known as oxygenator or gas exchanger, its main function is to replace the body's lungs during the extracorporeal circulation of thoracotomy or extracorporeal life support, when the lungs are dysfunction or injured. It excludes carbon dioxide produced during metabolic processes in the body, while taking in the necessary oxygen to maintain the lives of patients with lung disease. Bioartificial lungs are mainly constructed by tissue engineering methods as one of the alternative treatments for lung transplantation. Conclusion: Artificial lungs require further development to provide technical support for the treatment of lung diseases and extracorporeal life support for critically ill patients

S06-02

全腔镜辅助下心脏瓣膜置换的体外循环管理策略

史国宁

天津市胸科医院灌注科

Email: beechnut5327@sina.com

总结全腔镜辅助下心脏瓣膜置换手术的体外循环方法，制定最优的此类手术管理策略。回顾总结我院三年间全腔镜辅助下二尖瓣置换或成形术、三尖瓣置换或成形，主动脉瓣置换，瓣膜手术后二尖瓣或主动脉瓣置换的体外循环管理策略。结果表明全腔镜辅助下心脏瓣膜手术，手术时间：401±76min，体外循环时间：197±71min，阻断时间：167±77min，术后24h引流量：411±133ml，手术时间、术后引流量优于常规手术患者，体外循环时间与常规手术无差异、阻断时间长于常规手术组。患者均顺利出院。全腔镜辅助下心脏瓣膜手术体外循环，通常采用股动脉，股静脉和颈内静脉穿刺的方法建立体外循环。心肌保护方法通常采用逆行灌注HTK康斯特保护液为主，对于部分二次手术粘连比较严重患者可采用不阻断升主动脉不停跳的方法，降低手术难度。术中常规使用辅助负压引流装置，增加硬壳式氧合器储血罐内负压，使得体外循环过程中引流量满足正常流量需要，负压引流装置调节不高于-40mmHg有助于辅助引流，是安全的。停体外循环后，对于部分患者可采用改良超滤的方法提高HCT，减轻组织水肿，改善肺功能。手术结束后，常规采用血液回收机装置处理剩余机血，和术中出血，可以减少异体库血使用量减少并发症的发生。

The Management Strategy of Cardiopulmonary Bypass for Heart Valve Replacement by Video-Assisted Thoracoscopic Surgery

Guoning Shi, Ting Wu

Department of perfusion, TianJin chest hospital

To summarize the methods of cardiopulmonary bypass (CPB) for heart valve replacement by Video-assisted thoracoscopic surgery (VATS), develop optimal management strategies for such operations. Review the patients who were carried out MVR/P, TVR/P, AVR procedure from 2016 to 2019 in TianJin chest hospital. The operation time: (401±76) min, CPB time: (197±71) min, X clamp time: (167±77) min. The operative time and postoperative drainage volume were better than those of conventional patients, the time of extracorporeal circulation was no difference from that of conventional surgery, the X clamp time was longer than that in the conventional group. All patients were discharged successfully. Cardiopulmonary bypass for heart valve replacement by VATS is usually established by femoral artery, femoral vein and internal jugular vein. The myocardial protection method usually uses HTK in antegrade perfusion. For some patients with serious adhesion in the redo operation, the method without clamping the ascending aorta could reduce the difficulty of the operation. Intraoperative routine use of negative pressure drainage device, adjustment not higher than -40mmhg

is helpful to assist drainage and safe. After extracorporeal circulation, MUF can be used to improve HCT, reduce tissue edema and improve lung function in some patients. After surgery, the use of Cell-saver machines can reduce the incidence of complications.

S06-03

大血管手术体外循环的抗炎策略研究

张思雨 马洪亮

河北医科大学第四医院

Email:820722850@qq.com

随着现代医疗技术的不断进步, 心血管手术也愈发成熟, 体外循环技术作为心血管外科手术中不可或缺的一部分, 也在不断地完善和改进。近年来, 体外循环后导致的全身炎症反应综合征也越发受到各专业人员重视, 一个个先进的设备和技术被投入临床并被证实。本文将从炎症反应的发生机制及临床上常见的防治策略进行综述。

Anti-Inflammatory Strategy of Cardiopulmonary Bypass in Large Vessel Surgery

Zhang Siyu, Ma Hongliang

The Fourth Hospital of Hebei Medical University

With the continuous advancement of modern medical technology, cardiovascular surgery has become more mature, and extracorporeal circulation technology is an indispensable part of cardiovascular surgery, and it is constantly improving and improving. In recent years, the systemic inflammatory response syndrome caused by extracorporeal circulation has also received increasing attention from various professionals, and advanced equipment and techniques have been put into clinical trials and confirmed. This article will review the mechanism of inflammatory response and clinically common prevention strategies.

S06-04

当体外循环遇上人工智能：精准转流是否成真？

王 春

中国医科大学附属第一医院心脏外科

Email:doctorchun@126.com

探讨人工智能在临床医学中应用的进展对体外循环未来的影响。综合梳理分析人工智能在医疗领域的细分应用领域, 对比目前体外循环现状, 分析人工智能在体外循环领域应用的可能性和方向, 以及具体实施面临的问题。人工智能能够帮助医生降低操作错误、决策错误, 且已经非常成熟。人工智能可以对诊疗结果预测, 提早预估风险。体外循环工作中存在大量的操作细节、实时决策, 潜在风险巨大。人工智能可以与体外循环融合, 可能实现更精准的决策和操作, 实现更安全的、更高质量的体外循环。目前仍然面临缺少高质量高价值的数据、医院间的工作模式和制度的不一致等问题, 是人工智能临床应用的主要障碍。对于体外循环人工智能来说, 一切才刚刚开始。可以看到, 目标是明确的, 前景是光明的, 人工智能也将是体外循环未来发展的重要方向之一。

When Cardiopulmonary Bypass Meets AI: Is Precise Bypass Real?

Chun Wang

Cardiac Surgery, First Affiliated Hospital of China Medical University

To explore the influence of the progress of artificial intelligence in clinical medicine on the future of cardiopulmonary bypass (CPB). Comparing the current situation of cardiopulmonary bypass, analyzing the possibility and direction of the application of artificial intelligence in the field of cardiopulmonary bypass, as well as the problems faced in the specific implementation. Artificial intelligence can help doctors reduce operational errors and decision-making errors. Artificial intelligence can predict the outcome of diagnosis and treatment, and predict the risk ahead of time. There are a lot of operational details and real-time decision-making in cardiopulmonary bypass, and the potential risk is huge. Artificial intelligence can be integrated with cardiopulmonary bypass (CPB), which may achieve more accurate decision-making and operation, and achieve safer and higher quality of CPB. At present, there are still some problems, such as lack of high quality and high value data, inconsistency of working mode and system among hospitals, which are the main obstacles to the clinical application of artificial intelligence. For CPB artificial intelligence, everything is just beginning. It can be seen that the goal is clear and the prospects are bright. Artificial intelligence will also be one of the important directions for the future development of cardiopulmonary bypass.

S06-05

双侧脑灌注联合降主动脉球囊插管灌注在胸骨上段小切口孙氏手术中的应用

刘宇

北部战区总医院心血管外科

Email:heroliu2000@sina.com

目的：探讨双侧脑灌注联合降主动脉球囊插管灌注在胸骨上段小切口孙氏手术中的应用的安全性和可行性。

方法：回顾性分析2019年1月至2019年5月间北部战区总医院心血管外科行孙氏手术的病例26例。手术入路采用单一胸骨上段小切口；体外循环方法采用浅低温短暂停循环；脑保护方法采用双侧脑灌注；双侧脑灌注及短暂单侧脑灌注流量最大值均为5ml/kg min并根据双侧脑氧饱和度适当减少脑灌流量，下半身采用气囊插管进行顺行灌注。收集患者围术期这种参数进行临床分析。

结果：26名患者全部顺利完成手术，围术期死亡2例。体外循环期间鼻咽温29.7-32.1℃，直肠温30.9-33.2℃体外循环时间162-216min，主动脉阻断时间54-101min，下半身停循环时间7-11min，双侧脑灌注时间36-54min，呼吸机辅助时间21-78h，ICU停留时间28-102h。术中通过独立泵（心肌保护灌注泵）进行双侧脑灌注，主泵进行下半身灌注。心肌保护灌注管通过Y型分支管连接无名动脉插管及左颈总动脉（通常）插管侧孔实施脑保护（流量5ml/kg min）。停循环后通过应用气囊腔静脉插管进行象鼻支架阻闭并恢复下半身灌注，从而缩短下半身停循环时间。存在的主要问题和安全隐患包括：1. Y型分支管存在打折和手术医师与灌注师配合不当等风险，因此必须连接压力监测并开启压力报警-停泵保护；2. 气囊腔静脉灌注与四分枝血管灌注转换期间存在副泵流量大于主泵流量风险，因此需要设置副泵与主泵关联以实现副泵随主泵停止功能，并通过适时开放膜肺旁路以避免出现副泵流量大于主泵流量的情况。

结论：双侧脑灌注联合降主动脉球囊插管灌注有助于浅低温短暂停循环孙氏手术的实施，同时可以准确控制脑灌注流量。对于患者围术期及远期预后的影响尚需要后续大样本量研究进行评估。

The Application of Bilateral Cerebral Perfusion Combined With Balloon Cannula to Descending Aorta in SUN' Sprocedure via Single Upper Hemisternotomy Approach

Yu Liu

Department of cardiovascular surgery, General Hospital of Northern Theater Command

Objective: To investigate the safety and feasibility of bilateral cerebral perfusion combined with balloon cannula to descending aorta in SUN' s procedure via single upper hemisternotomy approach.

Methods: 26 patients who were carried out SUN' s procedure were retrospective analysis from Nov, 2019 to May, 2019 in the cardiovascular department in General hospital of Northern Theater Command. Single upper hemisternotomy approach were selected based on mild hypothermia cardiopulmonary bypass (CPB) with bilateral cerebral perfusion and balloon cannula to antegrade perfuse descending aorta.

Results: All patients were well done the SUN' s procedure with 2 patients died perioperatively. During CPB, the nasopharyngeal temperature were between 29.7℃ and 32.1℃, while rectal temperature were between 30.9℃ and 33.2℃. The CPB time was from 162min to 216min, X clamp time was from 54min to 101min, lower body circulatory arrest time was from 7min to 11min, bilateral cerebral perfusion time was from 35min to 54min. The mechanical ventilation time was from 21h to 78h and the ICU stay time was from 28-102h.

Conclusions: Bilateral cerebral perfusion combined with balloon cannula to descending aorta is good for the implementation of SUN' s procedure based on mild hypothermia with precise flow of cerebral perfusion. Further large sample size studies are needed to evaluate the affect on patients recover.

S06-06

肺动脉内膜剥脱术体外循环及脑保护经验

孙光

中日友好医院

Email:sunguangyanjun@sina.com

目的：总结慢性血栓栓塞性肺动脉高压 (CTEPH) 患者行肺动脉内膜剥脱术 (PEA) 的体外循环及脑保护管理经验。

方法：回顾性分析中日友好医院2017年12月至2019年5月连续完成的40例因CTEPH行PEA手术患者资料，体外循环采用离心泵转流，全部患者均于深低温（核心温20℃）停循环（Deep hypothermic circulatory arrest, DHCA）下完成手术操作。术中体外循环采用精确温度控制策略，缓慢、均匀降温及复温，即输入温度和核心温度（膀胱/肛温）差不超过10℃，最低温度不低于17℃，降温的速度大约是每5分钟1℃，整个降温时间不低于1小时。停循环过程中实时监测脑氧饱和度（rSO2），单次停循环时间限定为20min，如期间rSO2下降超基线水平40%，或rSO2<40%超过5min则立即恢复循环。恢复循环期需保障双侧rSO2恢复至患者停循环前基线水平。停循环期间确保BIS值始终为0。

结果：40例患者均顺利完成手术，1例患者因术后感染死亡。平均转机时间为400.1±62.3 min，阻断时间为190.5±41.9 min，DHCA总时间71.7±17.5 min，平衡降温及复温时间分别为86.5±13.5 min及129.6±9.1 min。术后患者肺动脉压力较术前明

显改善 48.4 ± 10.5 mmHg vs. 23.8 ± 7.2 mmHg, ($p < 0.001$) ; 肺血管阻力也出现显著下降 1006.8 ± 385.8 dyn•s/cm-5 vs. 371.4 ± 175.2 dyn•s/cm-5, ($p < 0.001$) 。术后 4 例患者出现神经损害表现, 均为可逆性, 3 例患者出院前康复, 1 例患者术后 3 个月康复。全部患者术前及术后出院前分别行 MMSE 及 MoCA 精神量表评分, 得分均无显著差异。

单因素分析显示 rSO₂<40% 持续时间 ($p=0.037$) 及 rSO₂ 较基线最大下降率 ($p=0.049$) 与术后出现神经系统损害显著相关; 而总停循环时间、术前 PVR、mPAP 等因素与神经系统损害之间无显著相关。多因素分析显示仅 rSO₂<40% 持续时间与术后神经系统损害显著相关。此外, 多因素分析显示 rSO₂ 最大下降率及停循环总时间与术后患者清醒时间显著相关 ($p=0.025$) 。

结论: 体外循环管理是 PEA 手术中的重要环节, 而 DHCA 技术是手术成功的关键。DHCA 期间需采取严密的脑保护策略, 实时监测 rSO₂, 并严格控制停循环时间。对于复杂病变, 适当增加停循环总时间并不增加神经系统损害的风险, 不建议延长单次停循环时间。

CPB and Cerebral Protection Experience in Pulmonary Endarterectomy Surgery

Guang Sun

Cardiovascular department, China-japan hospital

Objective: To summarize the experience of cardiopulmonary bypass and cerebral protective management in patients with chronic thromboembolic pulmonary hypertension (CTEPH) undergoing pulmonic endarterectomy (PEA).

Methods: The data of 40 patients who underwent PEA surgery due to CTEPH from December 2017 to May 2019 in china-japan friendship hospital were retrospectively analyzed. Centrifugal pump was used for extracorporeal circulation, and all patients underwent Deep hypothermic circulatory arrest (DHCA) (core temperature 20 °C). Intraoperative extracorporeal circulation adopts precise temperature control strategy, slow and uniform cooling and rewarming, that is, the difference between input temperature and core temperature (bladder/anal temperature) is not more than 10 °C , the minimum temperature is not less than 17°C , the cooling rate is about 1°C every 5 minutes, and the whole cooling time is not less than 1 hour. Cerebral oxygen saturation (rSO₂) was monitored in real time in the process of circulation arrest, and the single stopping time was limited to 20min. During this period, if rSO₂ dropped more 40% of the baseline level, or rSO₂<40% exceeded 5min, the circulation was immediately resumed. It is necessary to ensure that the bilateral rSO₂ is restored to the baseline level before the next circulation arrest. Ensure that the BIS value is always 0 during the circulation arrest

Results: All the 40 patients successfully completed the operation, and 1 patient died of postoperative infection. The average CPB time was 400.1 ± 62.3 min, the blocking time was 190.5 ± 41.9 min, the total DHCA time was 71.7 ± 17.5 min, the equilibrium cooling and reheating time was 86.5 ± 13.5 min and 129.6 ± 9.1 min, respectively. Pulmonary artery pressure was significantly improved after surgery compared with that before surgery: 48.4 ± 10.5 mmhg vs. 23.8 ± 7.2 mmhg ($p < 0.001$). Pulmonary vascular resistance also decreased significantly 1006.8 ± 385.8 dyn•s/cm-5 vs. 371.4 ± 175.2 dyn•s/cm-5 ($p < 0.001$). After surgery, 4 patients showed neurological damage, all of which were reversible. 3 patients recovered before discharge, and 1 patient recovered 3 months after surgery. All patients received MMSE and MoCA psychiatric scale scores before and after the operation, respectively, with no significant difference in scores.

Univariate analysis showed that rSO₂<40% duration ($p=0.037$) and rSO₂ maximum reduction rate ($p=0.049$) were significantly correlated with postoperative neurological damage. However, there was no significant correlation between total DHCA time, preoperative PVR, mPAP and neurological damage. Multivariate analysis showed that only rSO₂<40% duration was significantly correlated with postoperative neurological damage. In addition, multivariate analysis showed that the maximum decrease rate of rSO₂ and total time of DHCA were significantly correlated with postoperative awake time ($p=0.025$).

Conclusion: Extracorporeal circulation management is an important link in PEA operation, and DHCA technology is the key to the success of the operation. During DHCA, a strict brain protection strategy should be adopted to monitor rSO₂ in real time and strictly control the circulation arrest time. For complex lesions, appropriately increasing the total time of DHCA does not increase the risk of nervous system damage, however, it is not recommended to extend the time of single stopping circulation.

S06-07

del Nido 心肌保护液在成人的应用

郭 珊

泰达国际心血管病医院体外循环科

Email:privateconversa@sina.com

目的：心脏手术中，心肌停跳液良好的保护效果有利于术后心功能的恢复。del Nido 停跳液是一种含有利多卡因超级化保护作用的细胞外液型停跳液，本文就 del Nido 停跳液相比于 4:1 普通含血停跳液的保护效果进行评价。

方法：本文为回顾性研究，选取 2017 年 1 月至 2019 年 1 月，泰达国际心血管病医院成人患者（瓣膜置换或成型、粘液瘤、成人先心病、大血管）使用 del Nido 心肌保护液共 363 例，对照 2014 年 1 月至 2016 年 1 月，使用普通 4:1 含血停跳液成人患者 226 例，观察两组患者转机时间、阻断时间、自动复跳率，停机前血糖水平及术中悬浮红细胞用量；记录患者年龄、性别、体重、心功能分级、术前诊断及手术方式等基本信息。

结果：筛除不合格患者（诊断不符、麻醉及术中发生意外事件的）后，两组患者转机时间、阻断时间及术中悬浮红细胞用量无显著差异 ($P > 0.05$)；DN 组停机前血糖低于 4:1 血停跳液组 ($P < 0.05$)，且 DN 组的心脏自动复跳率显著高于血停跳液组 (92.0%/78.3%)。

结论：del Nido 停跳液管理简便，可提供稳定的心脏停搏，在成人心脏手术应用中，近期疗效好，心肌保护效果较 4:1 普通含血停跳液更为优越。其在心肌肥厚、冠脉狭窄、严重心功能不全等高危患者的使用情况有待进一步研究。

Application of Del Nido Myocardial Protective Fluid in Adults

Shan Guo

Department of Extracorporeal circulation, TEDA international, cardiovascular disease hospital

Objective: Good protective effect of cardiac arrest fluid is beneficial to the recovery of cardiac function after cardiac surgery. del Nido cardiac arrest fluid is an extracellular stop-action liquid containing lidocaine super protective effect. This paper evaluated the protective effect of del Nido cardiac arrest fluid compared with 4:1 blood-containing cardiac arrest fluid.

.Methods: In this paper, for the retrospective study, to choose between January 2017 and January 2019, the adults in TEDA international cardiovascular hospital with cardiovascular disease (valve replacement or forming, myxoma, congenital heart disease in adults, and great vessels diseases) A total of 363 cases of using the del Nido myocardial protection, comparison between January 2014 and January 2016, using normal 4:1 blood-containing cardiac arrest fluid, A total of 226 cases in adult patients, observe the two groups of patients with extracorporeal circulation time, cross clamp time, the rate of automatic cardiac restart, blood sugar level before wean form ECC and dosage of suspended red blood cell intraoperative s; Patients' age, gender, weight, cardiac function classification, preoperative diagnosis and surgical methods were recorded.

Results: There were no significant differences between the two groups in ECC time, cross clamp time, and the dosage of suspended red blood cell ($P > 0.05$) after getting rid of the unqualified patients (diagnosis inconsistent, anesthesia and intraoperative accidents). Blood glucose before wean from ECC was lower in the DN group than in 4:1 blood-containing group ($P < 0.05$), and the rate of automatic cardiac restart in the DN group was significantly higher than that in the 4:1 blood-containing group (92.00% /78.3%).

Conclusion: del Nido cardioplegia is simple to manage and can provide stable cardiac arrest. In the application of adult cardiac surgery, the short-term efficacy is good, and the myocardial protection effect is superior to that of 4:1 blood-containing group. Its use in high-risk patients such as myocardial hypertrophy, coronary stenosis and severe cardiac insufficiency needs further study.

S06-08

妊娠合并 Stanfrod A 型主动脉夹层病例分享

马洪亮

河北医科大学第四医院

Email:yuezhifeng1989@126.com

目的：总结妊娠中晚期急性 Stanford A 型主动脉夹层 (acute type A aortic dissection, AAAD) 患者的诊治经验。

方法：回顾性分析 2017 年 4 月至 2018 年 1 月河北医科大学附属第四医院 2 例妊娠期 AAAD 患者（年龄分别为：32 岁、37 岁 孕周分别为 38 周、25 周）经手术治疗的临床资料。第 1 例全麻剖宫产行子宫 B-lynch 缝合术及双侧髂内动脉结扎，后即刻在浅低温中流量下行升主动脉置换+半弓置换。第 2 例在在深低温停循环+选择性顺行性脑灌注下行 Sun's 手术(全主动脉弓置换+降主动脉支架置入手术)，术中为保证子宫及胎儿耐缺血缺氧时间尽量延长，使红细胞压积维持在 30% 以上，停循环期间肛温维持在 18℃ 水平。

结果：病例 1 产妇顺利恢复，胎儿生长发育正常。后 6 个月进行随访，CT (computerized tomographic) 检查提示主动脉夹层假腔血栓机化形成。病例 2 孕妇术后第二天床旁 B 超及胎心监护显示胎儿存活，生命体征正常。病人及家属强烈要求继续妊娠，顺利恢复后出院。

3 周因颈部人工血管吻合口瘘再次入院，行介入手术，术后于行剖宫产术，成功娩出一女婴，Apgar 评分 8 分，安全度过围产期后出院。4 周后，产妇再次发生颈部人工血管吻合口瘘，于当地医院抢救无效死亡，婴儿至今存活且发育正常。

结论：妊娠期 AAAD 的治疗原则为：首先及时准确地诊断至关重要；其次不同孕期阶段术式选择可能不同，必要时多学科合作进行术前评估和术后护理。孕中期孕妇接受 Stanford A 型主动脉夹层手术对胎儿可能是安全的。最后，多种方法联合应用对保证母体及胎儿的良好预后非常重要。

Cases of Pregnancy With Stanford Type A Aortic Dissection

Hongliang Ma, Zhifeng Yue

Department of anesthesia, Fourth hospital of Hebei medical university

Objective: To summarize the diagnosis and treatment experience of patients with acute Stanford type A aortic dissection (AAAD) in middle and late pregnancy.

Methods: The clinical data of two pregnant AAAD patients (age: 32 years old, age: 37 years old, 38 weeks old, 25 weeks old) who underwent surgical treatment from April 2017 to January 2018 in the fourth affiliated hospital of Hebei medical university were retrospectively analyzed. In the first case, uterine b-lynch suture and bilateral internal iliac artery ligation were performed in cesarean section under general anesthesia, followed by ascending aorta replacement and hemiarch replacement at low temperature immediately. In the second case, Sun's surgery (total aortic arch replacement + descending aorta stent implantation) was performed under deep hypothermic circulation arrest + selective antegrade cerebral perfusion. In order to ensure that the duration of tolerance to ischemia and hypoxia of the uterus and fetus was extended as far as possible, the HCT was maintained at more than 30%, and the anal temperature was maintained at 18°C during circulation suspension.

Results: Case 1 the parturient woman recovered successfully and the fetal growth and development were normal. At a follow-up of 6 months, CT (computerized tomographic) examination suggested a computerized formation of a prosthetic aortic dissection. Case 2 the second day after the operation of the pregnant woman, bedside b-mode ultrasound and fetal heart monitoring showed that the fetus survived with normal vital signs. The patient and his family strongly request to continue the pregnancy, successfully recovered after discharge. Three weeks later, the patient was re-admitted to the hospital due to anastomotic fistula of artificial blood vessels in the neck, and a cesarean section followed after that, delivered a baby girl successfully, Apgar score was 8, and was discharged after passing the perinatal period safely. After 4 weeks, the patient again suffered from anastomotic fistula of artificial blood vessels in the neck, and died in the local hospital. The child is still alive and developing normally.

Conclusions: The treatment principle of AAAD in pregnancy is: first, timely and accurate diagnosis is crucial; Secondly, surgical selection may be different in different stages of pregnancy, and when necessary, multidisciplinary cooperation for preoperative evaluation and postoperative care. Stanford type A aortic dissection in the second trimester may be safe for the fetus. Finally, the combination of multiple methods is very important to ensure a good prognosis of the mother and the fetus.

S06-09

ECMO 抢救儿童暴发性心肌炎的单中心临床经验

曹倩

青岛市妇女儿童医院心脏中心

Email:18505321080@163.com

目的：总结 ECMO 危重症抢救的临床经验，提高 ECMO 辅助质量。

方法：2017 年 8 月～2019 年 8 月，独立开展非心外儿童心脏 ECMO 辅助技术 6 例：儿童暴发性心肌炎 5 例，吉兰-巴雷综合征 1 例。其中中心源性休克 4 例，恶性心律失常型 2 例。年龄 3～14 (8.3±3.8) 岁，体重 15～60 (35.5±18.2) kg。5 例 A-V ECMO，1 例 A-V-V。普通体外插管 2 例。颈总动脉置管 5 例，颈内静脉 3 例，余为股动脉和股静脉置管。术前神经系统症状 2 例，ECPR 2 例。

结果：辅助时间 50～146 (100.3±35.7) 小时，顺利成功撤机 5 例。辅助期间口鼻咽部出血 3 例，伤口血肿 1 例，下肢动脉血栓 1 例，下肢肿胀 2 例。康复出院 3 例，家属放弃辅助 1 例，术后 4 个月后放弃治疗 1 例，在院康复 1 例。

结论：本中心团队特点更推荐儿童颈部插管。

Single-Center Clinical Experience of ECMO Assistance for Fulminant Myocarditis in Children.

Qian Cao

Heart Center of Qingdao Women & Children's Hospital, Qingdao

Objective: To summarize retrospectively the clinical experience of ECMO assistance and improve the quality of ECMO

assistance.

Methods: From August 2017 to August 2019, six children were independently carried out ECMO, of those five cases were fulminant myocarditis and 1 case Guillain-Barre syndrome. Four cases occurred cardiac shock and 2 cases malignant arrhythmia. Age were from 3 years to 14 years old(average 8.3 ± 3.8 years), and body weight from 15 kg to 60kg(average 35.5 ± 18.2 kg). Five cases were carried out AV-ECMO and 1 case VAV-ECMO. Five cases were intubated in common carotid artery, 3 cases in internal jugular vein catheterization, and the rest in femoral artery and femoral vein. There were two cases with neurological symptoms before ECMO and two cases with ECPR.

Results: The ECMO duration was 50-146 (100.3 ± 35.7) hours. Five cases weaned successfully from ECMO and three cases survived to discharge. Three cases occurred oropharyngeal hemorrhage, one case wound hematoma, one case lower limb arterial thrombosis, and two cases lower limb swelling. One case gave up treatment four months after ECMO, and 1 case rehabilitation in hospital.

Conclusions: Our team recommended cervical intubation of ECMO in children.

S06-10

贵州省生物医学工程的过去、现状与未来

李旭

贵州省人民医院

Email:1004412352@qq.com

贵州省常住人口 3580 万人，2018 年贵州 GDP 全国排名 21 位，虽增速较快，但总体任属于落后状态。1975-1977 年，贵州省人民医院、贵阳医学院附属医院及遵义医学院附属医院，均在积极开展体外循环动物实验，1978 年，贵州省人民医院成功开展房间隔、室间隔缺损修补术及二尖瓣置换术，1979 年“贵州省心血管病研究所”在贵州省人民医院成立，体外循环内心直视手术得以常规开展。一直以来，因为地域环境、经济基础及交通状况等因素的制约，贵州省生物医学工程，尤其是体外循环这一基本技术未能与发达地区同步发展，从而制约了临床工作的进步，因此，贵州省生物医学工程在相当长的时间内还需要补课。随着贵州省经济的高速发展，交通得以革命性的改善，心血管疾病、呼吸重症疾病以及各种意外急救患者的增多，各大医疗单位都在积极向发达地区学习。至此，贵州省体外循环年手术量突破 3000 台，ECMO 应用 50 余台，这与发达地区比存在非常大的差距，但贵州的生物医学工作者正在全力跟进。

Past, Present and Future of Guizhou Biomedical Engineering

Li Xu

Guizhou Provincial People's Hospital

Abstract: The resident population of Guizhou Province is 35.8 million. In 2018, Guizhou's GDP ranks 21st. Although the growth rate is relatively fast, the overall position is backward. From 1975 to 1977, Guizhou Provincial People's Hospital, Affiliated Hospital of Guiyang Medical College and Affiliated Hospital of Zunyi Medical College were actively conducting animal experiment of cardiopulmonary bypass. In 1978, Guizhou Provincial People's Hospital successfully performed atrial septal and ventricular septal defect repair and two. Incisor replacement, in 1979, "Guizhou Provincial Institute of Cardiovascular Diseases" was established in Guizhou Provincial People's Hospital, and open heart surgery for cardiopulmonary bypass was routinely carried out.

For a long time, due to the constraints of regional environment, Eco economic base and traffic conditions, the basic technology of biomedical engineering in Guizhou Province, especially the extracorporeal circulation, has not developed in parallel with the developed regions, thus restricting the progress of clinical work. Therefore, Guizhou Provincial biomedical engineering needs to be replenished for a considerable period of time.

With the rapid development of Guizhou's economy, transportation has been revolutionized, cardiovascular diseases, respiratory severe diseases and various accidental emergency patients have increased, and major medical units are actively learning from developed regions. At this point, Guizhou Province has exceeded 3,000 operations for extracorporeal al circulation and more than 50 ECMO applications. This is a very large gap compared with developed regions, but biomedical workers in Guizhou are fully following up.

S06-OR01**大血管手术体外循环的抗炎研究**

张思雨

河北医科大学第四医院

【目的】综合现有的临床抗炎策略，汇总分析，然后结合我院的抗炎方法。供其他医院参考。【方法】综述【结论】CPB后全身炎症反应形成机制复杂，临床大多技术目前尚在实验当中。虽然都取得了喜人的收效，但是尚有不足之处。相信随着技术的不断进步，更多针对性的药物投入临床。防治大血管手术CPB后的全身炎症反应将不再是难题

【关键词】体外循环（CPB）；全身炎症反应综合征（SIRS）；疾病防治

S06-OR02**人工肺研究应用进展**

黑飞龙

中国医学科学院阜外医院

【目的】介绍人工肺的研究进展以及在临床应用的情况，包括物理人工肺和生物人工肺。物理人工肺也称为氧合器或气体交换器，它的主要功能是当机体肺部发生病变或损伤时，在开胸手术的体外循环或体外生命支持中代替人体肺脏排出体内代谢过程中所产生的二氧化碳、同时摄取人体必需的氧气，以维持肺病患者的生命。生物人工肺主要通过组织工程的方法构建新的人工肺作为肺移植的替代治疗手段之一。

【方法】综述【结果】进展【结论】人工肺还需要进一步发展，为肺部疾病的治疗和危重症的体外生命支持提供技术支撑。

【关键词】人工肺；体外生命支持；组织工程

S06-OR03**全腹腔镜辅助下心脏瓣膜置换的体外循环管理策略**

史国宁

天津市胸科医院

【目的】总结全腹腔镜辅助（video-assisted thoracic surgery VATS）与传统开胸心脏外科手术的体外循环管理差异，制定腹腔镜微创手术体外循环管理策略。【方法】回顾2018年至今体外循环下心外科瓣膜手术、继发孔房间隔缺损修补术，心脏粘液瘤摘除术共计1391例，其中开放式手术1117例，VATS手术274例。【结果】与传统开胸手术相比较腹腔镜微创手术在术中失血（腹腔镜组：256.5±50.3ml，开胸组：412.3±66.8ml），RBC用量（腹腔镜组：0，开胸组：3.1±2.8u），术后24h引流量（腹腔镜组：114±46.7ml，开胸组：477.7±173.4ml），平均住院天数（腹腔镜组：9.5±5.2d，开胸组：11.4±3.9d）有明显优势；ICU停留时间，呼吸机辅助时间无差异；体外循环时间，心肌阻断时间腹腔镜微创长于传统开胸手术。腹腔镜微创手术术中均采用外周体外循环插管和负压静脉辅助引流的体外循环方法。【结论】腹腔镜微创手术对比传统开胸手术，有着突出的优势。包括，切口隐蔽美观，手术创伤小，出血量以及相关并发症少，缩短住院时间等方面。随着心脏外科体外循环所使用的器械、耗材、设备的进步，采用外周血管股动脉、股静脉和（或）颈内静脉插管配合负压辅助静脉引流的体外循环方法，在心脏外科手术中起到了重要作用。根据不同的手术方式，患者病理生理特点，选择正确的插管部位、管径、方式；体外循环过程中使用合适的负压辅助静脉引流，在腹腔镜微创手术中是安全有效的。

【关键词】微创心脏外科；电视胸腔镜辅助；体外循环

S06-OR04**ECMO抢救儿童重症暴发性心肌炎的单中心临床经验**

曹倩

青岛市妇女儿童医院

【目的】总结和探讨ECMO技术辅助抢救儿童暴发性心肌炎的临床经验，探讨非心外儿童插管问题，认识和预防严重并发症，有助于缩短或优化基层医院ECMO危重症抢救的学习曲线。【方法】2017年8月~2019年8月，本单位独立开展非心外儿童心脏ECMO辅助技术6例：儿童重症暴发性心肌炎5例，吉兰-巴雷综合征1例。其中心源性休克4例，恶性心律失常型2例。女5例，男1例，年龄3~14（8.3±3.8）岁，体重15~60（35.5±18.2）kg。马奎ECMO机器，均为床旁置管，5例A-V ECMO，1例A-V-V。普通体外插管2例。颈总动脉置管5例，颈内静脉3例，余为股动脉和股动脉置管。经皮穿刺置管4例。院前转运2例，术前神经系统症状2例，ECPR 2例。NIRS监测脑部或下肢血氧饱和度。凝血监测以床旁ACT为主，辅以血栓弹力图。【结果】辅助时间50~146（100.3±35.7）小时，顺利成功撤机5例。辅助期间口鼻咽部出血3例，伤口血肿1例，下肢动脉血栓1例，下肢肿胀2例，指端末梢青紫1例，轻中度溶血2例，高钠血症1例。联合人工肾超滤1例。康复出院3例，家属放弃辅助1例，术后4个月后放弃治疗1例，在院康复1例。【结论】ECMO辅助预后与原发疾病已有的神经系统并发症、启用时机密切相关。置管是ECMO顺利进行的重要前提，插管的部位、型号、位置的选择既要考虑团队特点，又要受限于耗材库存，本团队推荐优选颈部置动脉插管。

【关键词】ECMO暴发性心肌炎 儿童

S06-OR05

肺动脉内膜剥脱术中体外循环及脑保护经验

孙光

中日医院

【目的】总结慢性血栓栓塞性肺动脉高压 (CTEPH) 患者行肺动脉内膜剥脱术 (PEA) 的体外循环及脑保护管理经验。【方法】回顾性分析中日友好医院 40 例因 CTEPH 行 PEA 手术患者资料, 体外循环采用离心泵转流, 全部患者均于深低温 (核心温 20℃) 停循环 (DHCA) 下完成手术操作。术中体外循环采用精确温度控制策略, 缓慢、均匀降温及复温, 即输入温度和核心温度 (膀胱 / 肛温) 差不超过 10℃, 最低温度不高于 17℃, 降温的速度大约是每 5 分钟 1℃, 整个降温时间不低于 1 小时。停循环过程中实时监测脑氧饱和度 (rSO₂), 单次停循环时间限定为 20min, 如期间 rSO₂ 下降超基线水平 40%, 或 rSO₂<40% 超过 5min 则立即恢复循环。恢复循环期需保障双侧 rSO₂ 恢复至患者停循环前基线水平。停循环期间确保 BIS 值始终为 0。【结果】40 例患者均顺利完成手术, 1 例患者因术后感染死亡。平均转机时间为 400.1±62.3 min, 阻断时间为 190.5±41.9 min, DHCA 总时间 71.7±17.5 min, 平衡降温及复温时间分别为 86.5±13.5 min 及 129.6±9.1 min。术后患者肺动脉压力较术前明显改善 48.4±10.5 mmHg vs. 23.8±7.2 mmHg, (p<0.001); 肺血管阻力也出现显著下降 1006.8±385.8 dyn•s/cm-5 vs. 371.4±175.2 dyn•s/cm-5, (p<0.001)。术后 4 例患者出现神经损害表现, 均为可逆性, 3 例患者出院前康复, 1 例患者术后 3 个月康复。全部患者术前及术后出院前分别行 MMSE 及 MoCA 精神量表评分, 得分均无显著差异。单因素分析显示 rSO₂<40% 持续时间 (p=0.037) 及 rSO₂ 较基线最大下降率 (p=0.049) 与术后出现神经系统损害显著相关; 而总停循环时间、术前 PVR、mPAP 等因素与神经系统损害之间无显著相关。多因素分析显示仅 rSO₂<40% 持续时间与术后神经系统损害显著相关。此外, 多因素分析显示 rSO₂ 最大下降率及停循环总时间与术后患者清醒时间显著相关 (p=0.025)。

【结论】体外循环管理是 PEA 手术中的重要环节, 而 DHCA 技术是手术成功的关键。DHCA 期间需采取严密的脑保护策略, 实时监测 rSO₂, 并严格控制停循环时间。对于复杂病变, 适当增加停循环总时间并不增加神经系统损害的风险, 不建议延长单次停循环时间。

【关键词】肺动脉内膜剥脱术; 深低温停循环; 脑保护

S06-OR06

妊娠合并主动脉夹层病例分享

岳之峰

河北医科大学第四医院

【目的】总结妊娠中晚期急性 Stanford A 型主动脉夹层 (acute type A aortic dissection, AAAD) 患者的诊治经验。【方法】回顾性分析 2017 年 4 月至 2018 年 1 月河北医科大学附属第四医院 2 例妊娠期 AAAD 患者 (年龄分别为: 32 岁、37 岁 孕周分别为 38 周、25 周) 经手术治疗的临床资料。第 1 例全麻剖宫产行子宫 B-lynch 缝合术及双侧髂内动脉结扎, 后即刻在浅低温中流量下行升主动脉置换 + 半弓置换。第 2 例在在深低温停循环 + 选择性逆行性脑灌注下行 Sun's 手术 (全主动脉弓置换 + 降主动脉支架置入手术), 术中为保证子宫及胎儿对缺血缺氧的耐受时间尽量延长, 使红细胞压积维持在 30% 以上, 停循环期间肛温维持在 18℃ 水平。【结果】病例 1 产妇顺利恢复, 胎儿生长发育正常。后 6 个月进行随访, CT (computerized tomographic) 检查提示主动脉夹层假腔血栓机化形成。病例 2 孕妇术后第二天床旁 B 超及胎心监护显示胎儿存活, 生命体征正常。病人及家属强烈要求继续妊娠, 顺利恢复后出院。2 周因颈部人工血管吻合口瘘再次入院, 行介入手术, 术后顺利出院。妊娠第 35 周再次来我院行剖宫产术, 成功娩出一女婴, Apgar 评分 8 分, 安全度过围产期后出院。4 周后, 产妇再次发生颈部人工血管吻合口瘘, 于当地医院抢救无效死亡, 胎儿至今存活且发育正常。【结论】妊娠期 AAAD 的治疗原则为: 首先及时准确地诊断至关重要; 其次不同孕期阶段术式选择可能不同, 必要时多学科合作进行术前评估和术后护理。孕中期孕妇接受 Stanford A 型主动脉夹层手术对胎儿可能是安全的。最后, 多种方法联合应用对保证母体及胎儿的良好预后非常重要。

【关键词】妊娠 剖宫产 StanfordA 型主动脉夹层 安全性

S06-OR07

del Nido 心肌保护液在体外循环的应用

郭珊

泰达国际心血管病医院

【目的】心脏手术中, 心肌停跳液良好的保护效果有利于术后心功能的恢复。del Nido 停跳液是一种含有利多卡因超级化保护作用的细胞外液型停跳液, 本文就 delNido 停跳液相比于 4:1 普通含血停跳液的保护效果进行评价。【方法】本文为回顾性研究, 选取 2017 年 1 月至 2019 年 1 月, 泰达国际心血管病医院成人患者 (瓣膜置换或成型、粘液瘤、成人先心病、大血管) 使用 del Nido 心肌保护液共 363 例, 对照 2014 年 1 月至 2016 年 1 月, 使用普通 4:1 含血停跳液成人患者 226 例, 观察两组患者转机时间、阻断时间、自动复跳率, 停机前血糖水平及术中悬浮红细胞用量; 记录患者年龄、性别、体重、心功能分级、术前诊断及手术方式等基本信息。【结果】剔除不合格患者 (诊断不符、麻醉及术中发生意外事件) 后, 两组患者转机时间、阻断时间及术中悬浮红细胞用量无显著差异 (P >0.05); DN 组停机前血糖低于 4:1 血停跳液组 (P< 0.05), 且 DN 组的心脏自动复跳率显著高于血停跳液组 (92.0%/78.3%)。【结论】del Nido 停跳液管理简便, 可提供稳定的心脏停搏, 在成人瓣膜置换手术应用中, 近期疗效好, 心肌保护效果较 4:1 普通含血停跳液更为优越。其在心肌肥厚、冠脉狭窄、严重心功能不全等高危患者的使用情况有待进一步研究。

【关键词】del Nido 心肌保护 体外循环

S06-OR08**贵州省生物医学工程的过去、现状与未来**

李 旭

贵州省人民医院

【目的】贵州省常住人口 3580 万人,2018 年贵州 GDP 全国排名 21 位,但增速 9.1%,总体属于落后状态。1975-1977 年,贵州省人民医院、贵阳医学院附属医院及遵义医学院附属医院,均在积极开展体外循环动物实验,1978 年,贵州省人民医院成功开展房间隔、室间隔缺损修补术及二尖瓣置换术,1979 年“贵州省心血管病研究所”在贵州省人民医院成立,体外循环心内直视手术得以常规开展。【方法】一直以来,因为地域环境、经济基础及交通状况等因素的制约,贵州省生物医学工程,尤其是体外循环这一基本技术未能与发达地区同步发展,从而制约了临床工作的进步,因此,贵州省生物医学工程在相当长的时间内还需要补课。【结果】随着贵州省经济的高速发展,交通得以革命性的改善,心血管疾病、呼吸重症疾病以及各种意外急救患者的增多,各大医疗单位都在积极向发达地区学习。至此,贵州省体外循环年手术量突破 3000 台,ECMO 应用 50 余台,这与发达地区比存在非常大的差距,但贵州的生物医学工作者正在全力跟进。国家医保局 8 月 1 号举行治理高值耗材改革方案为:一是降价,二是防滥用,三是严监管,四是促发展。【结论】因此,在国家政策的指引,贵州生物医学工程事业一定能持续发展

【关键词】 贵州生物医学; 心脏外科; 体外生命支持