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Oral Presentation Abstracts

MYOCARDIAL PROTECTION RELATED TO MAGNESIUM CONTENT OF COOL BLOOD HYPERKALEMIC CARDIOPLEGIC SOLUTIONS IN CABG

To investigate whether the addition of magnesium to a hyperkalemic cardioplegic solutions containing 1.2-1.5 mmol/L ionized calcium improves myocardial protection.

27 coronary artery disease(CAD) patients underwent coronary artery bridge grafting(CABG) were divided into three groups randomly: hyperkalemic(20-22mmol/L potassium) cardioplegic solutions containing 1.2–1.5 mmol/L ionized calcium, Group A(9 cases) received 3–4 mmol/L magnesium cool blood cardioplegia(4°C), Group B (9 cases) received 8-10mmol/L magnesium cool blood cardioplegia(4°C). The effect of myocardium protection of the three kinds of cardioplegic solutions were evaluated by clinical outcome, cTnI and CK-Mbmass. Serial venous blood samples were obtained before induction, after cardiopulmonary bypass(CB), postoperative 6 hrs, 24hrs, 72 hrs and 6^{th} day, respectively.

The percentage of myocardial auto-resuscitation in group B(1005%) was significantly higher than that in group A(77.8%), and C(66.7%). One case in group A and two cases in group C need the interim pacemaker, but no cases in group B. The period of postoperative mechanical ventilate and ICU staying in group B was shorter than the other two groups obviously(2). The level of cTnI and CK-Mbmass increased from postoperative 6hrs($p<0.05$), reached peak in 24 hrs-72hrs and recovered postoperative 6^{th} day. Compared with group A and C, the plasma concentration of cTnI and CK-Mbmass in group B were significantly lower at 6hrs, 24hrs and 72 hrs($p<0.01$).

8–10mmol/L magnesium cool blood cardioplegia provide more myocardium protection than the other two groups in CABG patients.

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BALANCE ULTRAFILTRATION, MODIVIED ULTFAFILTRATION AND BALANCE ULTRAFILTRATION WITH MODIFIED ULTRAFILTRATION IN PEDIATRIC CARDIOPULMONARY BYPASS

To evaluate the effect of Balance ultrafiltration, modified ultrafiltration and balance ultrafiltration with modified ultrafiltration on inflammatory mediate in children's open-heart surgery.

80 children with congenital heart disease were randomly divided into 4 groups, control. Group(C group), balance ultrafiltration group (BUF group), modified ultrafiltration group (MUF group) and balance ultrafiltration with modified ultrafiltration group (B+M group). Clinical data of these groups were similar. TNF, IL-8 and E-selectin were measured at the beginning of CPB, 30 minutes later, the cessation of CPB, the cessation of MUF (MUF group and B+M group) and 2 hours postoperatively.

During CPB, the concentrations of TNF, IL-8 and E-selectin increased significantly in C and MUF groups and didn't change significantly in BUF and B+M groups. In the period of MUF, TNF and IL-8 increased whereas E-selectin didn't change. Conclusion: The study shows that ultrafiltration can filter out the inflammatory mediate, but only BUIF can decrease the concentrations of them. And MUF only can concentrate blood. Combining both techniques has both effect, but the effect of BUF was offset by MUF.

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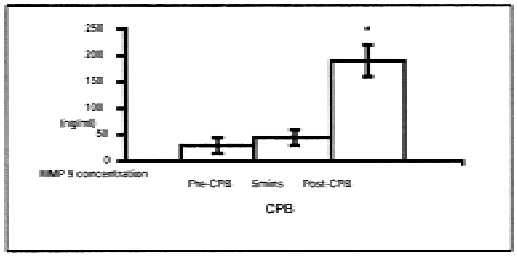
EVIDENCE OF INCREASED MATRIX METALLOPROTEINASE-9 CONCENTRATION AND ACTIVITY IN PATIENTS FOLLOWING CARDIOPULMONARY BYPASS

Cardiopulmonary bypass (CPB) is associated with a systemic inflammatory response which can result in acute lung injury known as "postperfusion syndrome". Neutrophil activation with concomitant serine protease release has been implicated in the pathogenesis of "postperfusion syndrome". While increased plasma levels of neutrophil elastase have already been demonstrated in patients undergoing CPB, it is known that both neutrophil elastase (NE) and matrix metalloproteinase-9 (MMP-9) have a synergistic role in pulmonary injury. We hypothesized that plasma levels of MMP would be elevated in patients after CPB.

Human plasma was obtained after informed consent from 8 patients undergoing CPB. Plasma was collected at the start of CPB, 5 minutes after the initiation of CPB, and at the termination of CPB(156 Å 17 mins). All samples were then analyzed by standard ELISA testing for concentration of MMP-9 (free and total enzyme). Additionally, gelatin zymography was performed to determine MMP-9 activity. Data was expressed as means ÅSE and assessed by Anova.



MMP-9 concentration was significantly increased at the end of CPB as compared to both the start of CPB and 5 minutes after the initiation of CPB. Increases in MMP-9 activity correlated with increased MMP-9 concentrations in the plasma.

Patients undergoing CPB show an increase in serum MMP-9 levels and activity. Prior studies utilizing an animal model of "postperfusion syndrome" have shown that inhibition of MMP-9 and NE prevented pulmonary injury following CPB. The results of the current study suggest that such an approach may also have merit in the clinical setting of cardiopulmonary bypass.

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AN EXPERIMENTAL STUDY ON MYOCARDIAL PROTECTION OF IMMATURE RABBITS WITH ATP-SENSITIVE K+ CHANNLES OPENER PINACIDIL

The purpose of this study is to investigate the effectiveness of pinacidil, an opener of ATP-sensitive K+ channels, in protecting myocardium of immature rabbit hearts from ischemic reperfusion injury. Methods: On Langendorff apparatus the hearts underwent 30 minutes of global normothermic ischemia followed by 30 minutes of reperfusion. 52 isolated hearts of 3–4 weeks old immature rabbits were divided into four groups randomly. During ischemia, three different cardioplegic solutions were administered intermittently by infusion every 15 minutes (20–25 ml every time) Group I control (n=13),; Group II: K-H solution with potassium (16 mmol/L) (n=13) ; Group III: K-H solution with potassium (16 mmol/L) and pinacidil (50μmol/L) (n=13); Group IV: K-H solution with potassium (16 mmol/L), pinacidil(50μmol/L) and glibenclamide (10 μmol/L) (n=13). The pre and postischemic myocardial function were assessed by the percentage recovery of left ventricular developed pressure (LVDP), left ventricular end-diastolic pressure (LVEDP), both positive and negative peak first derivative of left ventricular pressures(± dp/ptmax), coronary flow(CF), CK, LDH, AST in coronary sinus venous effluent and by myocardial ultrastructural changes. Results: Before myocardial ischemia, there were no significant difference in all above mentioned parameters in four groups. Postischemic recovery of LVDP, LVEDP, ± dp/dtmax, CF, the level of CK, LDH, AST and myocardial ultrastructural changes were better in group III than that in three other groups.

As a new and effective composition, pinacidil can significantly improve the myocardial protection effect of cardioplegia for immature rabbit hearts.

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ARTERIAL TEMPERATURE MEASUREMENT INACCURACIES IN THE EXTRACORPOREAL CIRCUIT

Arterial blood temperature greater than 37°C during the rewarming phase of cardiopulmonary is associated with post-operative cerebral vascular injury and cognitive dysfunction. The purpose of this study was to determine the accuracy of temperature measurements at various points in the arterial line of the extracorporeal circuit.

An in-vitro circuit consisting of a heater-cooler, roller pump, membrane oxygenator, arterial line filter and A-V loop was primed with crystalloid solution. Backpressure on the arterial line was maintained at 150 mmHg. Temperatures were monitored at the following sites: arterial outlet of the membrane oxygenator (coupling site), CDI 500 arterial blood gas shunt sensor, four feet distal to the arterial line filter utilizing a myocardial temperature probe, heater-cooler water, and room air. Water temperatures (25 to 41°C), pump flows (2.5 to 5.5 l/min), and room air (55 to 85F) were varied. Because the temperature probe of the distal site was in direct contact with the prime, that site was considered the actual temperature. Data analysis demonstrated a positive correlation between the oxygenator, CDI and distal temperatures. However, the distal temperatures read higher than the oxygenator and CDI temperatures ($p<0.001$) with an average difference of 0.99°C and 0.98°C, respectively. In addition, the oxygenator temperature error was correlated with room temperature ($p<0.05$).

In conclusion, the distal temperature is higher than the arterial membrane oxygenator reading. Therefore, the oxygenator arterial temperature reading should not exceed 36C.

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REPRODUCIBILITY AND COMPARABILITY OF EIGHT POINT OF CARE ACT DEVICES

It is generally accepted that different ACT devices do not produce equivalent results. Despite this generality, there have been no studies comparing all machines. Therefore, we investigated the reproducibility and the comparability of commonly used ACT devices.

With IRB approval, blood samples from 17 CPB patients were collected at six time points during surgery. All tests were performed in duplicate on 8 different ACT devices (ACTalyke, Gem, HMS, Hemochron 801, Response, Jr. Signature, Rapidpoint, and Sonoclot) and analyzed for anti Xa activity (STA Rotochrom Heparin assay). Duplicate samples from each machine were compared to determine reproducibility. The average of the duplicate samples was used for comparison between machines and to the anti Xa results. Unpaired students T-test and linear regression was performed. Data is presented as Mean ± the SD. Reproducibility for all devices produced a range from 3.7 ± 5.3 to 20.6 ± 27.3 s for unheparinized samples with the HMS and the Rapidpoint being the most and least reproducible respectively. For heparinized samples, the range was 16.0 ± 16.8 to 69.7 ± 81.2 s with the Rapidpoint and the Sonoclot being the most and least reproducible respectively. The Rapidpoint was the most consistently reproducible at all time points. Comparison between machines of unheparinized samples demonstrated a range of ACT values from 107.1 ± 34.4 to 136.4 ± 14.2 s with the Rapidpoint and the Response having the lowest and highest values respectively. Heparinized samples had a range from 451.1 ± 117.5 to 633.5 ± 158.3 s with the Rapidpoint and Hemochron 801 having the lowest and highest values respectively. The difference between the highest and lowest unheparinzed results were 29 s (27%) and for heparinized results, 182 s (40%). Correlation of results to anti Xa activity (1.1 to 5.75 IU/ml) for each device produced a range of r = .071 to .502.

Overall, heparinized samples had the poorest reproducibility. The HMS was the most reproducible and the Sonoclot was the least reproducible. For unheparinized samples, the Rapidpoint and Sonoclot were significantly shorter than all other machines. For heparinized samples, the ACTalyke, Rapidpoint, and Sonoclot were significantly shorter while the Hemochron 801 and Response were significantly longer than most other machines. No device correlated with the laboratory anti Xa data.

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THE EFFECT OF SODIUM NITROSOGLUTATHIONE ON PLATELET FUNCTION AND SYSTEMIC VASCULAR RESISTANCE DURING CARDIOPULMONARY BYPASS

Hemodynamic instability and post-operative bleeding are common after cardiopulmonary bypass (CPBP) frequently as a result of decreased platelet number and function. Nitric oxide (NO) is the endothelium derived relaxation factor having a significant vasodilatory role as well as a significant platelet inhibitory effect. CPBP has been shown to alter the production of NO.

The main objective of this research is to determine if augmented NO by infusion of S-Nitrosoglutathione (GSNO), a NO donor, will have a significant effect on platelet function during CPBP. It is hypothesized that GSNO will temporarily inhibit platelet function during CPBP without significantly effecting systemic vascular resistance (SVR).

Canines were placed on CPBP for 1 hour and maintained at normothermia. GSNO was infused at a rate of 1,2,and 4nmol/kg/min. Tests were performed for platelet number and function as well as calculations for SVR, and PVR. Hollow fibers from the membrane oxygenator and oxygenator inlet tubing were examined using scanning electron microscopy to determine the amount of platelet adhesion to the surfaces.

The results show that GSNO had an inhibitory effect on platelet function during CPBP without effecting SVR. Platelet function was found to decrease from a pre-bypass platelet function of 79%, to 35% at 2nmol/kg/min, to 15% at a 4nmol/kg/min infusion. As the GSNO infusion was reduced to 1nmol/kg/min, platelet function returned to 23%. Platelet function returned to 50% of normal 55 minutes post bypass. Thus platelet function decreased as the dosage of GSNO increased. Platelet adhesions to the membrane oxygenator and PVC tubing were also reduced. The application of NO in the form of NO gas or GSNO may function to reduce the occurrence of platelet dysfunction, adhesion, and post-operative bleeding associated with the activation of platelets during CPBP.

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REPRODUCIBILITY, COMPARABILITY AND CORRELATION OF FIVE POINT OF CARE PT/PTT DEVICES

It is generally accepted that different POC PT/PTT devices do not produce equivalent results. Despite this generality, there have been no studies comparing all devices. Therefore, we investigated the reproducibility, comparability and correlation of commonly used POC PT/PTT devices.

With IRB approval, blood samples from 17 CPB patients were collected before heparin and after protamine. Tests were performed in duplicate on 5 different PT/PTT devices (Gem, Hemochron 801, Response, Jr. Signature and Rapidpoint) and analyzed by standard laboratory methods. Duplicate samples from each device were compared to determine reproducibility. The average of the duplicate samples was used for comparison between devices and correlation to the laboratory results. Unpaired students T-test and linear regression was performed. Data is presented as Mean ± the SD. Table displays ranges for all variables.

	Pre heparin	Post protamine
PT reproducibility (INR)	0.0±0.0 - 0.3±.03	0.0±0.1 - 0.3±0.3
PT comparability (INR)	1.0±0.0 - 1.3±0.1	1.0±0.1 - 1.7±0.2 †
PT correlation to lab (r)	0.0 - 0.6	0.1 -0 .7
PTT reproducability (s)	1.5±1.7 - 2.9±6.3	1.2±1.2 - 6.2±11.0
PTT comparability (s)	30.5±8.1-38.7±7.0	27.6±5.0-40.0 ±7.6
PTT correlation to lab (r)	0.3 - 0.8	0.0 - 0.7

While statistically significant differences were found, pre heparin PT and PTT results from all devices were not considered clinically different. For post protamine samples, the PTT result of the Response and the Rapidpoint¥, and the PT results of the Response and the Gem† were statistically and clinically different.

Computations of mathematical correlations suggest that several devices have little correlation to laboratory values, however due to the limited range of investigation, interpretations of the r values are not meaningful. Most machines performed clinically similar with regard to reproducibility and comparability.

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THE EFFECT OF ELECTROLYTE IMBALANCE ON WEANING FROM CARDIOPULMONARY BYPASS

An imbalance in electrolyte concentration during separation from cardiopulmonary bypass (CPB) may lead to a disruption in excitation-contraction coupling resulting in a failure to wean. The etiology of myocardial dysfunction is multifactorial, and includes alterations in acid-base balance, glucose metabolism and cellular function. The purpose of this study was to assess the effect of hyperkalemia on myocardial function during separation from CPB.

A porcine model (n=5) of hypothermic (32°C) CPB was utilized where hyperkalemia (K+ [6.5±0.5]) was created prior to weaning. A three-minute weaning process was initiated once normothermia was achieved. Mixed venous and arterial samples were obtained during CPB, throughout the weaning period, and for the first 10 minutes postbypass. Samples were assayed for [K+], [Ca++], glucose, pH, CPK-MB, and lactic acid levels.

Hyperkalemia resulted in the generation of severe arrhythmias in all animals which included superventricular tachycardia and ventricular fibrillation. During the immediate prewean period there was a significant correlation between venous [K+] and venous pH ($p<0.01$, $r^2=.891$). Arterial pH did not change during weaning or in the post-CPB period, while venous pH declined significantly throughout the same period (7.35±0.75 to 7.20±0.17, $p<0.05$). No other measured variables correlated with hyperkalemia.

In summary, hyperkalemia caused a significant decline in venous pH evidenced in the early separation period, but had no effect on other variables. Therefore, measurement of venous pH may be an early marker indicating myocardial dysfunction and dysrhythmia.

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CLINICAL EVALUATION OF THE DADE BEHRING PFA-100 PLATELET FUNCTION ANALYZER FOR ASSESSMENT OF PLATELET FUNCTION IN PATIENTS UNDERGOING CARDIOPULMONARY BYPASS PROCEDURES.

This study was designed to evaluate the utility of the Dade Behring PFA-100 Platelet Function Analyzer in assessing cardiopulmonary bypass (CPB) mediated derangements in platelet function. The PFA-100 is a novel *in-vitro* system for the detection of platelet related primary hemostasis dysfunction in anticoagulated whole blood.

Institutional Review Board approval and informed consent were obtained to prospectively evaluate fifty (50) patients undergoing primary cardiac surgical repair utilizing CPB. Preoperative (baseline) response time to platelet plug formation or "closure time" was significantly different ($p < 0.05$) than non-cardiopulmonary bypass controls. Heparinization prior to CPB (350–450 u/kg) lengthened closure times, but was not significantly different from baseline ($p > 0.05$). After 20 minutes of CPB there was a highly significant lengthening ($p < 0.0001$) of closure times. At one (1) hour CPB the platelet response was not significantly lengthened when compared to 20 minutes CPB ($p > 0.1$). Post CPB administration of protamine sulfate produced platelet closure times that were significantly elevated when compared to baseline values ($p = 0.006$). By twenty minutes post protamine there were no significant differences in response time as compared to baseline. ($p > 0.1$)

Data analysis suggest abnormal platelet closure times preoperatively may be a predictive risk factor for platelet dysfunction and hemostatic sequelae postoperatively.

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EFFECT OF AUTOTRANSFUSION ON FIBRINOLYSIS, PLATELET AND LEUKOCYTE CELL ACTIVATION DURING OPEN HEART SURGERY

Autotransfusion has been a method used routinely to reduce the amount of homologous donor blood transfusion in open heart surgery. Randomly 24 patients were involved in this study to evaluate the activation of autotransfusion on fibrinolysis, platelet and leukocyte cell. Group I consists of 11 patients, who underwent open heart surgery with extracorporeal circulation (ECC) and received salvaged blood; group II consists of 13 patients, served as control without receiving autotransfusion. Blood samples were taken preoperatively, three hours after operation and 12 hours after operation; fibrinogen and D-dimer were measured at each time point. TXA2, IL-6, IL-8, platelet counts were measured preoperatively, before red cell washing, after red cell washing, and three hours after operation. PH value, PO_2 and potassium ion concentration were measured before and after red cell washings. Pared-T tests were used to analyze the data at different points within the two groups, and independent T tests were used to analyze data at the same time point between groups.

There is a statistically significant difference of fibrinogen between both the preoperative value (group I=246.85mg/dl; group II= 250.96 mg/dl) and that in 12 hours after operation (group I=202.35 mg/dl; group II=294.9 mg/dl) Vs 3 hours after operation (group I= 319.98 mg/dl; group II= 209.17 mg/dl) ($P< 0.05$). The two groups showed the same diagram about D-dimer, 3 hours (group I= 0.8527 mg/l; group II=1.0539 mg/l) and 12 hours after operation (group I= 0.9544 mg/l; group II =1.17185 mg/l). These data showed significant increase than that of the preoperative group (group I=0.3855 mg/l; group II = 0.4961 mg/l)($p<0.05$), however, there is no statistical significance at each time point between the two groups. In the group given salvaged blood (group1) TXA2 showed a significant increase before red cell washing (group1 TXA2 = 1157.49pg/ml) compared to preoperative (group I TXA2=349.87 pg/ml) and 3 hours after operation(group ITXA2=538.93 pg/ml)($P<0.05$); no statistical difference was observed between two groups 3 hours after operation; after red cell washing, platelet counts(group I=28.0G/L) had a significant lower value than that before red cell washing(group I=116.73G/L). The group given salvaged blood, IL-6 and IL-8 indicate a significant difference between preoperative (group1 IL-6=92.63 pg/ml group1 IL-8=111.86 pg/ml) and before red cell washing (group I IL-6=177.47 pg/ml) IL-8group I IL-8=149.50 pg/ml ($P<0.05$); 3 hours after operation the data obtained in the two groups were of no significant difference. In Group1 the pH value has no significant difference before and after red cell washing. PO2 and potassium ion concentration were of significant difference at two time points ($p<0.05$).

We concluded that fibrinolytic pathway, platelet, leukocyte were activated by ECC and autotransfusion, but no further activation effect was induced by autotransfusion alone; autotransfusion did not increase postoperative blood loss. Autotransfusion is safe for patients requiring complete blood washing in cardiac surgery, and this blood does provide volume and oxygen-carrying capacity that is crucial during the immediate post-operative period.

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THE EFFECTS OF INCREASING FiO_2 ON VENOUS SATURATION DURING CARDIOPULMONARY BYPASS IN THE SWINE MODEL

Adequacy of perfusion during cardiopulmonary bypass (CPB) is dependent on nutrient delivery and uptake by the tissue. A recent study showed that over 75% of cardiovascular perfusion is completed with continuous venous saturation (S_VO_2) monitoring. The purpose of this study was to determine the effect of changing FiO_2 concentration on S_VO_2.

A total of eight mixed gender 45 kg swine were placed on CPB under moderate hypothermic conditions. Animals were divided evenly into 2 groups: Experimental, where FiO_2 was increased to 100% and blood flow decreased to an S_VO_2 level of pre-change in FiO_2, and Control, where the same condition was created except there was no change in the blood flow. Variables measured included hemodynamic, blood gas, intra-myocardial pH, and lactic acid concentrations.

In the experimental group, % change of blood flow was decreased from baseline 28.4±12.5 % ($p<0.005$) as well as % change of oxygen delivery 23.9±14.7 % ($p<0.005$). Systemic venous saturation % change was increased in both the experimental 14.4 ± 6.8 % ($p<0.05$) and control 11.2±7.1 % ($p<0.05$) groups. Jugular venous saturation % change was decreased in the experimental group to 17.7±11.1% ($p<0.005$), but not in the control animals. Myocardial venous saturation % change decreased in the experimental group 3.73 %±8.34 % ($p<0.004$). Experimental manipulation, however did not significantly change jugular lactic acid concentrations or intra-myocardial pH values.

In conclusion, decreased blood flow adjusting for increased S_VO_2 associated with high P_aO_2 did not result in significant reduction of adequacy of perfusion markers.

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THE EFFECT OF APROTININ ADMINISTRATION THROUGH CARDIOTOMY SUCTION DURING CARDIOPULMONARY BYPASS

Cardiotomy suction has been shown to enhance inflammation and reduce hemostatic function during cardiopulmonary bypass (CPB). The serine protease inhibitor aprotinin is a powerful antifibrinolytic agent with antiinflammatory potential. The purpose of this study was to evaluate the effect of aprotinin administration through aspiration in cardiotomy suction during CPB.

A swine model of mild hypothermic CPB was utilized which included 8 animals evenly divided into a control (n=4) and treatment (n=4) groups. In the treatment group aprotinin was administered via an infusion pump (3000 KIU/min), while in the control group the same volume of physiological saline was infused. Measured endpoints included D-dimer levels, platelet count, and IL-8 levels were analyzed at several time periods from both the systemic circulation and cardiotomy suction fluid.

Aprotinin significantly suppressed the increase in both systemic D-dimer levels (470.6±96.8 vs. 1350.8±203.2 ng/mL, $p<0.05$) and in the cardiotomy suction fluid (471.2±198.2 vs. 1910.0±302.4 ng/mL, $p<0.05$). Platelet count fell significantly in both groups during CPB, although the reduction was more pronounced in the control group (83.9±12.1 vs. 52.1±6.8, $p<0.05$). In addition, IL-8 levels in the suction solution were significantly lower in the Aprotinin (142.3±14.3 vs. 65.2±12.1 ng/mL, $p<0.05$).

In conclusion, this study has shown that aprotinin treatment of blood aspirated into the cardiotomy suction may reduce fibrinolysis and inflammation associated with CPB.

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EFFECTS OF APROTININ ON THE RHEOLOGICAL BEHAVIOR OF BLOOD CELSS IN CARDIOPULMONARY BYPASS PERIOPERATIVE PERIOD

To study the dynamical changes of rheological behavior of blood cells in Cardiopulmonary Bypass (CPB) perioperative period , and investigate the blood protective effects of aprotinin.

Twenty patients undergoing coronary artery bypass grafting (CABG) were randomly divided into control group(n=10)and experimental group(n=10),the latter received aprotinin. administeration. By Bradford microscopy-TV system with high amplification and variable projection, the rheological behavior and counts of peripheral blood cells were observed at before anesthesia, 30 minutes after CPB,10 minutes after open aortic clamp ,the 1^{st} , 2^{nd}, 4^{th} and 7^{th} day postoperative, respectively. Simultaneously, the arterial oxygen saturation (SaO2) and complications were noted.

After 30 minutes of CPB, the rheological behavior abnormalities of blood cells were notable , the changes reached the peak in the 1–2 day postoperative , and recovered from the 7^{th} day . Compared with the control group, the ratio of platelet aggregation increased significantly(26.7±4.52% vs.14.2±3.1%,$p<0.01$),white blood cell activation (22.5±4.7% vs 30±5.63%,$p<0.05$)and aggregation (26.3±4.87% vs 40.5±8.8%, $p<0.01$) decreased in the experimental group, the platelet count had no significant change (87.5×10^9/L vs. 92.0×10^9/L)between two groups. The duration of intubation was 17.8±8.89hrs to26.6±10.2hrs($p<0.05$),and the volume of cavity drainage within 24hrs was 425.5±145.8ml vs 544.5±137.6ml($p<0.05$), there was 3(3/10) cases SaO2 < 95% in control group.

In the perioperative period of CPB , the rheological behavior changes of white blood cell and platelet were notably abnormal which may be responsible for postoperative bleeding tendency and pulmonary dysfunction, whereas ,the aprotinin had better protective effect.

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AN IN-VITRO CPB MODEL OF INFLAMMATION TO ASSESS DRUG INTERVENTIONS

Excessive activation of the inflammatory cascades in response to cardiopulmonary bypass (CPB) can result in acute respiratory distress syndrome (ARDS), also known as post-pump syndrome (PPS). We hypothesized that an in-vitro model could be developed to activate these cascades and used to test the effectiveness of pharmacological agents. We investigated the effects of a promising new drug, chemically modified tetracycline (CMT-3), and aprotinin on suppressing inflammation generated in our in-vitro model.

Yorkshire pigs were exsanguinated and the blood of one animal was split between four identical in-vitro CPB circuits: control A, control B, CMT-3 (5 mcg/ml), and aprotinin (300 KIU/ml). Circuits were run for 180 minutes. Live neutrophils were tested for superoxide release at the beginning and end of the time period. The following cytokines were assayed every 30 minutes; TNF∝, IL-8, and IL-10.

Preliminary data suggest that neutrophils from the CMT-3 treated blood have less superoxide release at time 0 and 180 minutes than controls and aprotinin. There were no differences in IL-10 (the anti-inflammatory cytokine) levels at 0 and 30 minutes of circulation. From 60 – 180 minutes, CMT-3 treatment had higher levels of IL-10 than aprotinin or controls. No conclusive differences between CMT-3 and control B (CMT's solvent) could be detected in TNF∝ and IL-8 levels at all time points.

An in-vitro CPB inflammatory model may be useful in ascertaining the effects of drug interventions on the inflammatory response. Based on this model, CMT-3 may attenuate the inflammatory response to CPB.

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CLINICAL USE OF THE ABIOMED BVS 5000 AS A "PULSATILE ECMO" UNIT

To describe the clinical use of the Abiomed BVS 5000 as a "Pulsatile ECMO" system. Animal laboratory studies using the Abiomed BVS 5000 in conjunction with an in-line oxygenator as a "Pulsatile ECMO" system has been previously presented. The results of these studies suggested that this method is capable of providing short-term support for acute shock states.

Two cases of acute cardiac and respiratory failure requiring combined cardiopulmonary support were managed with a variety of cannulation strategies using the Abiomed BVS 5000 and a hollow fiber membrane oxygenator. Case #1 was postcardiotomy shock following coronary artery bypass grafting (CABG). Case #2 was cardiogenic shock following acute myocardial infarction (AMI). Case #1 was managed with a right atrial (RA) drainage cannula to the BVS bloodpump followed by an in-line oxygenator spliced into the outflow tubing to the pulmonary artery (PA) cannula. Case #2 was managed with standard left ventricular assist device (LVAD) cannulation and an in-line oxygenator spliced into the outflow tubing of a standard right ventricular assist device (RVAD) configuration. A continuous heparin infusion was used to achieve an Activated Clotting Time (ACT) of over 400 seconds.

The VAD flows were 3–4 L/min on the circuit with the oxygenator. Arterial blood gas (ABG) analysis showed satisfactory oxygenation and carbon dioxide removal. Hemodynamics were maintained within an acceptable range with the combination of mechanical and inotropic support. Significant bleeding occurred in both patients requiring sternal re-entry in both cases. The "Pulsatile ECMO" unit was successfully removed from Case #1 after 3 days of support. The "Pulsatile ECMO" circuit could not be removed in Case #2. Both patients ultimately expired of multiple organ system failure (MOSF).

The clinical application of a "pulsatile ECMO" system using the Abiomed BVS 5000 and an oxygenator is possible, but subject to unacceptable mortality and morbidity. Strategies to reduce complications need to be defined.

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CEREBRAL OXIMETRY DURING CARDIOPULMONARY BYPASS

Neurological damage is a significant and serious outcome of patients undergoing cardiopulmonary bypass. Many factors can contribute to cerebral hypoxia and ischemia. Monitoring cerebral oxygen content may aid in reducing the incidence of cerebral injury associated with cardiopulmonary bypass. The Somanetics INVOS® 4100 Cerebral Oximeter is a trending monitor that uses near-infrared spectroscopy to measure changes in the balance between oxygen supply and demand in the brain.

This study, performed on canines, was done to determine the capability of the cerebral oximeter to continuously monitor regional oxygen saturations (rSO2) and the ability to identify periods of ischemia and hypoxia in the brain. These recordings were taken continuously during a time period of 60 minutes +/- 10 minutes. The flow indices on bypass were changed every ten minutes, ranging from 20cc/kg/min to 120cc/kg/min. Following 10-minutes at each index, a blood sample from a jugular venous catheter, an arterial sample, and a venous sample were taken. The mean arterial pressure, temperature, blood to gas flow ratio, and mixed venous saturations were all noted and the rSO2 recording was reported.

Results show that as the mean arterial pressures increase and decrease, rSO2 values increase and decrease, respectively. At the higher flow indices, the rSO2 readings increase, where at low flow indices, the rSO2 values decrease. The jugular venous samples show a direct correlation with the rSO2 recordings, although the values are not identical. When compared to the mixed venous oxygen saturations of the pump, the rSO2 recordings of the brain were lower. Monitoring cerebral oximetry may help identify periods of hypoxia and reduce the incidence of neurological morbidity.

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LEPIRUDIN THERAPY AND ECARIN CLOTTING TIME MANAGEMENT IN CARDIAC SURGERY: FOUR PATIENTS EXPERIENCE

Lepirudin is currently the only approved agent for treatment of heparin-induced thrombocytopenia. For patients undergoing cardiopulmonary bypass, monitoring and managing with activated clotting time or activated partial thromboplastin time is not feasible as there is loss of linearity at the required higher levels of the anticoagulant. Ecarin clotting time has been approved as a Humanitarian Device Exemption for use during cardiopulmonary bypass procedures. Ecarin clotting time has not yet been approved for use in lower levels of lepirudin therapy such as acute coronary syndrome deep vein thrombosis, or cardiac or vascular surgery without cardiopulmonary bypass.

Four patients presenting with clinical symptoms of heparin-induced thrombocytopenia and in need of coronary bypass grafting were managed with lepirudin. One of the four was managed off bypass with lepirudin, partial thromboplastin time, and activated clotting time. The other three patients were managed on cardiopulmonary bypass with lepirudin and ecarin clotting time. Hypercoagulability via thromboelastograph was observed preoperatively in three of the four patients. The first two cardiopulmonary bypass patients did well. Two of the hypercoagulable patients (one off pump and one on pump) initially did well after what were deemed successful surgeries but died later—one of thromboses and one of right ventricular failure of unknown etiology and arrhythmias.

Lepirudin anticoagulation management may be managed successfully with ecarin clotting time, but more research of the coagulation situations with which these patients present is necessary.

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CLINICAL APPLICATION OF RETROGRADE CEREBRAL PERFUSION FOR BRAIN PROTECTION DURING THE SURGERY OF ASCENDING AORTIC ANEURYSM: 50 CASE REPORTS

271 surgery of ascending aortic aneurysm had been done during the past 15 years. Among which 65 patients the dissection aneurysm was expanded to aortic arch or right arch. To protect the brain, deep hypothermic circulatory arrest (DHCA) combined with retrograde cerebral perfusion (RCP) through superior vena cava (n=50) and simple DHCA (n=15) were used during the procedure. Blood samples for lactic acid level from the jugular vein were compared in both groups at different phase, and perfusion blood distribution and oxygen content difference between the perfused and returned blood were measured in some cases of RCP patients.

The DHCA time was 35.86±18.81min (10~63) and DHCA+RCP time was 45.5±17.21 min (16~81). The resuscitation time was 7.11±1.59 h (4.4~9.4) in DHCA patients and 5.43±2.15 h (2~9) in RCP patients. The operation death was 3/15 in DHCA group and 1/50 in RCP patients. Central nervous complication existed in 3/12 of DHCA patients and 1/49 of RCP patients ($P<0.01$). The over survival ratio was 96% (RCP) vs 67% (DHCA), the central nervous system dysfunction was 20% in DHCA vs 2% in RCP ($P\pm0.001$). The blood lactic acid level increased significantly after reperfusion in DHCA than that in RCP. The blood distribution measurement indicated approximate to 20% of the perfused blood returned from arch vessels, oxygen content between perfused and returned blood showed that the oxygen uptake was adequate in RCP group.

The application of RCP could prolong the safety duration of circulation arrest, continuous cerebral perfusion may maintain the brain cool and flush out particulate and air embolism, open anastomosis of the aortic arch to the prosthesis can be safely performed. RCP is an acceptable method for brain protection in our clinical practices.

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THE PROTECTIVE EFFECT OF POTASSIUM CHANNEL OPENER ON THE RELEASE OF ENDOTHELIUM-DERIVED HYPERPOLARIZING FACTOR IN PORCINE BY COLD STORAGE WITH HYPERKALEMIC SOLUTION

Hyperkalemic solution is widely used to protect myocardial during open heart surgery and preserve donor heart. Its inhibitory effect on the release of endothelium-derived hyperpolarizing factor (EDHF) of coronary after storage of deep hypothermia has been studied. However, whether existing a protective effect if potassium channel opener added to after cold storage has not been identified. This study was especially designed to examine this effect.

Porcine coronary artery rings were studied in organ chambers. Relaxation in response to the EDHFs stimuli A23187 in U46619(30nmol/L)-induced precontraction after incubation with hyperkalemic solution(20mmol/L) with nicorandil (10umol/L)(either at 37°C in the oxygenated organ chamber or at 4°C in a refrigerator for 4 hours) was compared with the control.

There was no significant relaxation between hyperkalemia group and hyperkalemia combined with nicorandil group under normothermia ($p>0.05$). The difference relaxation between normothermia and hypothermi*a* was significant in the same solutions. After hyperkalemic solution or with nicorandil exposure, the A23187-induced relaxation was 32.8%±9.1% and 72.6%±16.9%, respectively. ($n=8$, $p<0.01$).

After cold storage, potassium channel opener can attenuate inhibitory effect of hyperkalemic solution on the release of EDHF.

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IS PEDIATRIC PERFUSION EDUCATION ADEQUATE? – 2000 SURVEY RESULTS

Perfusion program directors (PD), recent graduates (RG) and pediatric cardiac anesthesiologists (PCA) were surveyed to assess the current levels of training related to pediatric perfusion education. Respondents were asked a variety of questions regarding didactic and clinical education.

The PD survey (n=22) was executed directly via telephone. The survey of RG (n=61) and PCA (n=5) was carried out via phone and mailed surveys. Didactically, only 36% of the PD surveyed said they had a dedicated pediatric course in their curriculum. RG rated their overall pediatric didactic training a 3.7, (1=poor, 5=comprehensive). Clinically, RG performed an average of 17 pediatric patients as students (of these, 10 pts <10 kg). Several common questions were asked all groups to evaluate overall impressions of pediatric training (see Table).

Common Questions	PD	RG	PCA
Are graduates less prepared to perform pediatric perfusion than adult perfusion?	Yes - 95% No - 5%	Yes - 69% No - 31%	NA
Are the Essentials and Guidelines for pediatric clinical activity to low?	Yes - 55% No - 45%	Yes - 73% No - 27%	Yes – 60% No – 40%
Should there be sub-specialzation and/or certification in pediatric perfusion?	Yes –14% No-86%	Yes-43% No-57%	Yes-100%
Would a post-graduate program in infant perfusion be a benefit to the community?	Yes - 77% No - 23%	Yes - 82% No - 18%	Yes – 100%

Finally, 64% of the RG indicated that, if available, they would have considered a post-graduate program in infant perfusion at graduation.

Our results indicate that there are limitations in current pediatric training. The data from within the perfusion field and from an outside, related field suggests that there may be a need for a post-graduate pediatric training programs for those wishing to specialize in pediatric perfusion.

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DYNAMIC CHANGES OF PERIOPERATVIE PLASMA ET AND CGRP IN CONGENTIAL HEART DISEASE AND THE RELATION WITH PULMONARY HYPERTENSION

To evaluate the pathophysiological significance of dynamic changes of perioperative plasma endothelin(ET) and calcitonin gene-related peptide(CGRP) in pulmonary hypertension(PH) associated with congenital heart defects(CHD), we measured the plasma levels(RIA), analyzed the correlation between ET, CGRP and the preoperative hemodynamic factors, characterized the time course of ET and CGRP in plasma, and elucidated the relation of ET, CGRP concentration with PH. Thirty-three children were divided into two groups, those with a mild pulmonary hypertension(group A, 20 cases), and those with a middle of severe pulmonary hypertension(group B, 13 cases, the PP/PS ratio is ≥ 0.5 by using the right cardiac catheterization). Thirty healthy children were taken as control group.

Blood samples from control group were drawn from peripheral vein, while blood samples from patients' group were drawn from right atrium during operation and from femoral vein at 3, 24, 72 hours after operation. Additionally, the pulmonary artery pressure, the pressure in cardiac cavities, and the oxygen saturation were measured repeatedly by cardiac catheterization in 13 cases of severe PH. QP/QS ratio were computed according to the Fick's formulae.

There is a significant difference in ET concentration between groups, the plasma level of ET in group B is much higher than that in group A and controls. Whereas no significant difference in the plasma CGRP levels was observed between groups ($p > 0.05$). (2) Dynamic changes of plasma levels of ET, CGRP after bypass operation: in group A, the plasma levels of ET significantly increased after operation immediately, decreased slightly at 3 hours postoperation (q test $p > 0.001$). Plasma levels of CGRP in both group A and B significantly increased after operation immediately, reached the peak levels at 24 hours operation(q test, $p<0.001$), slightly decreased but higher than the preoperative levels at 72 hours operation, however, no significant difference was observed at 72 hours(q test, $p > 0.05$). (3) In patients with severe PH (group B), increasing plasma levels of ET was positively correlated with the ratio of PP/PS, and the pulmonary resistance ($r=0.683$, 0.698 respectively, $p < 0.05$and <0.01 respectively),. The plasma CGRP levels showed significant negative correlation with plasma ET levels ($r=0.701$, $p < 0.01$). Conclusions: (1) Patients with PH exist an imbalance between plasma levels of ET and CGRP. (2) the pulmonary vessels may be of a trend to spasm at 72 hours postoperation. (3) The overproduction of endogenous CGRP after bypass is able to supply the pulmonary vessel to resist the constriction, and be beneficial to the recovery of cardiac function. The measurement of the plasma levels of ET, CGRP and the ratio of ET/CGRP after CPB operation will be of clinical significance for the predicting the outcome, however, a further study is needed.

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CARDIAC TROPONIN T — CHANGE DURING CARDIOVASCULAR SURGERY AND SIGNIFICANCE IN DIAGNOSIS OF PERIOPERATIVE MYOCARDIAL INFARCTION

Cardiac Troponin T (cTnT) is one of the contractile modulatory proteins of the myocardium. Its release into the circulation indicates various degrees of myocardial cell damage. Troponin T may be measured in serum with a recently developed enzyme immunoassay (ELISA). This immunoassay can be used to evaluate the perioperative myocardial cell damage in patients undergoing cardiovascular surgery, and it is compared with conventional assays of creatine kinase (CK) and CK-MB isoenzyme activity and mass. The purpose of this study was to observe the change of cardiac troponin T during perioperative period in patients undergoing cardiovascular surgery, and evaluate its significance in diagnosis of perioperative myocardial infarction (PMI).

Eighteen adults undergoing CABG (group I) and fifteen adults undergoing BVR (group II) were divided into two subgroup according to ECG (new Q wave and/or ST-T segment alterations), respectively: subgroup A (with change of ECG) and subgroup B (without change of ECG). Eight infants with PDA were taken as non-heart surgery control group (group III). Serial plasma levels of cTnT and the serumal activity of CK and CK-MB were measured at immediately after induction of anesthesia, and immediately, 6 hour, 24 hour, 48 hour after operation in all patients.

cTnT — Remarkable rises after operation were detected in both group I and II, whereas was not found in group III. Higher postoperative plasma level of cTnT was remained and reached a peak (1.74mg/L) at 6 hour after operation in subgroup IA, and was more notable than that in subgroup IB. A similar phenomenon was detected in subgroup IIA except the peak (0.80mg/L) at immediately after operation. Also the plasma level of cTnT in subgroup IIB was higher significantly than that in subgroup IB at immediately and 6 hour after operation. (2) CK — Remarkable rises after operation were detected and the plasma level after operation exceeded normal value (200IU/L) in all groups. Also its plasma level in subgroup IA was significantly higher than that in subgroup IB at immediately, 6 and 24 hour after operation. (3) CK-MB — Remarkable rises after operation were detected and the plasma level after operation exceeded normal value (20IU/L) in all groups. An obvious increase between subgroup IA and IB at 24 hour and 48 hour after operation, and between subgroup IIA and IIB at 48 hour after operation, was discovered, respectively. Only at immediately after operation, the plasma level in subgroup IIB was significantly higher than that in subgroup IB.

Both the sensitivity and the specificity of cTnT in diagnosis of perioperative myocardial injury in heart surgery are better than those of CK and CK-MB. The measurement of cTnT is helpful to the evaluation of operative effect and diagnosis of perioperative myocardial infarction.

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THE ASSESSMENT OF BRAIN INJURY WITH MEASUREMENT OF CALCIUM FLUORESCENT INTENSITY OF VITAL BRAIN SLICE

During recent explorative research on the mechanism of cerebral injury, it has been proved that intracellular calcium ion overload is one of the basic factors of this condition. In our clinical practices as a means of cerebral protection during the surgery of thoracic aneurysms which involve the aortic arch, retrograde cerebral perfusion (RCP) through superior vena cava has achieved superior results to deep hypothermic circulation arrest (DHCA) in recent years. To explore the cerebral protection mechanism of RCP, the calcium fluorescent intensity of vital brain slice was examined with Laser Confocal Scanning Microscope (LCSM) in the two different groups of animals.

Sixteen healthy young pigs were divided into two groups randomly. Conventional cardiopulmonary bypass (CPB) was established and CPB was discontinued when the animals were cooled to attain a nasopharyngeal temperature of 18°C and rectal temperature of 20°C. One group of animals maintained DHCA, while RCP was applied in another group. 90 minutes later, CPB was re-established and the animals were rewarmed for 120 minutes to attain normal body temperature. All the animals were weaned off CPB. Cerebellar hemisphere tissue (300~500mg) was obtained after craniotomy through tentorium of cerebellum. Retina was also procured after enucleation of eyeball and dissection. Vital brain slice was prepared. The calcium fluorescent intensity was examined With LCSM and quantitative analysis was made with Laser Confocal Scanning imaging system. The results indicated that significantly lower calcium fluorescent intensity of vital brain slice was detected in RCP group than that in DHCA group.

LCSM is used for the first time in this study to measure the calcium fluorescent intensity of vital brain slice directly. It demonstrates that intracellular calcium overload contributes to the cerebral injury after DHCA, while RCP is able to attenuate neuronal calcium overload to protect the brain.

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CONTRIBUTING FACTORS OF CEREBRAL SATURATION DURING CARDIOPULMONARY BYPASS IN INFANTS

Cerebral oxygen saturation (ScO_2) measured by near-infrared spectroscopy can indicate directly the status of oxygen supply and demand in regional cerebral tissue.

To examine the contributing factors of ScO_2 during cardiopulmonary bypass (CPB), twenty infants (8–60 month, 5.5–18 kg, 16 males and 4 females) undergoing cardiac surgery were studied. ScO_2, mean arterial pressure (MAP), blood oxygen saturation of superior and inferior vena ($SvsO_2$ and $SviO_2$), nasopharyngeal temperature (NPT), pump flow rate were recorded every five minutes during CPB. A linear correlation analysis was performed between ScO_2 and each of the above-mentioned. Thus, a good linear correlation between ScO_2 and MAP ($r = 0.66$) and $SvsO_2$ ($r = 0.71$) was found, and there was a negative correlation between ScO_2 and NPT ($r = -0.42$), whereas ScO_2 was unaffected by pump flow rate ($r = 0.03$).

These data suggest that oxygen supply in brain depend on MAP during hypothermic CPB in infants, and cerebral autoregulation is disturbed during CPB. Hypothermia can decrease oxygen demand in brain, and $SvsO_2$ seems to have the competence to mirror ScO_2.

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THE EFFECT OF VOLUME REPLACEMENT ON SERUM PROTEIN CONCENTRATION DURING CARDIOPULMONARY BYPASS

Although controversy exists concerning the optimal total protein and colloid osmotic pressure to maintain during cardiopulmonary bypass (CPB), the primary volume expanders remain albumin and 6% Hetastarch. The purpose of this study was to quantify the effect of adding boluses of both agents under various conditions, to maintain total serum protein (SP) values within desired ranges during CPB in an animal model.

A standard CPB circuit was utilized in eight 45 kg swine that had a priming volume (physiologic saline solution (PSS)) of 2,233±211mL. Volumetric alterations occurred throughout the CPB period by the addition of combinations of PSS, 6% Hetastarch or 5% swine albumin. Pre and post administration samples were assayed for total serum protein (SP), albumin, and hematocrit (Hct) throughout the CPB period.

There was a significant decline in SP with the initiation of CPB (6.14±0.49 vs. 3.40±0.43, $p<.0001$). During CPB additional volume administration resulted in a dilutional factor of 1.17. However, the addition of albumin and 6% Hetastarch maintained the SP within 96% of target concentrations. Addition of 12.5g of albumin (n=5) increased SP significantly when compared to 500mL of 6% Hetastarch (n=6) (12.4±6.3% vs. 3.3±2.1%, $p<.005$). Boluses of PSS reduced SP by the following amounts: 250–450mL (7.4±4.5%), 451–650mL (9.6±5.6%), 651–1050mL (−19.4±4.0%).

In summary, knowledge of SP concentration and estimated circulating blood volume can be used to guide albumin administration following hemodilution with PSS. Such quantification will serve as a predictive aid in maintaining colloid osmotic pressure during CPB.

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IS THE USE OF MODIFIED ULTRAFILTRATION BENEFITIAL TO ALL PEDIATRIC PATIENTS WITH CONGENITAL HEART DISEASE?

Although modified ultrafiltration (MUF) has been shown to be an effective modality for decreasing the morbidity associated with pediatric cardiac surgery, it remains unclear whether or not it is more beneficial in specific congenital cardiac lesions. The purpose of this study was to assess the efficacy of MUF in improving outcomes in patients undergoing surgery for the following: ventricular septal defect, Tetralogy of Fallot, atrioventricular canal (AVC), complex single ventricle (CSV) and transposition of great arteries (TGA).

A retrospective double cohort study was designed that utilized pediatric patients (n=241, <15kg) undergoing cardiac surgery from 1995 through 1999 at our institution. Postoperative endpoints were inotropic use, pulmonary function, hemodynamic stability, hemostatic function, intubation time, and length of ICU and hospital stay.

The MUF group had significantly higher postoperative hematocrit (36.2±7.1% vs. 29.0±4.4%, $p<0.01$), improved $PaCO_2$ (33.1±7.4mmHg vs. 36.8±6.0mmHg, $p<0.05$), and lower glucose levels (155.7±56.2mg/dL vs. 169.7±59.9mg/dL, $p<0.05$) when compared to equally matched non-MUF patients. Patients with AVC, CSV and TGA receiving MUF had shorter intubation and hospital stay times when compared to matched cohorts without MUF. However, no significant changes were observed in the platelet count, one hour postoperative arterial systolic pressure, inotropic use, or arterial oxygenation.

In conclusion, modified ultrafiltration is an effective way to improve postoperative outcome in patients with complex congenital heart lesions, but may not demonstrate the same efficacy in acyanotic lesions.

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Poster Presentation Abstracts

FUNDUS MICROVASCULAR FLOW MONITORING DURING RETROGRADE CEREBRAL PERFUSION FOLLOWING DEEP HYPOTHERMIC CIRCULATION ARREST: AN EXPERIMENTAL STUDY

Retrograde cerebral perfusion(RCP) through the superior vena cava was clinically introduced as a supportive technique to protect the brain during deep hypothermic circulation arrest. This study was assigned to search for an approach for the direct monitor of cerebral blood flow to evaluate the effect of cerebral perfusion.

Six piglets retinal microvascular perfusions were studied by using fundus fluorescein angiography(FFA) and color Doppler sonography before cardiopulmonary bypass and retrograde cerebral perfusion during deep hypothermic circulation arrest.

FFA showed initial development of the fundus venae in 2.5 minutes, and complete development in 4.5 minutes with partial development of the arteriae; the latter development completed in 8 minutes, and all of the arteriae and venae developed from 15 to 17 minutes. Color Doppler sonography showed that the flow signals could be detected in all of the fundus vessels during RCP. In conclusion, FFA and Color Doppler sonography were the direct and sensitive methods to observe cerebral blood flow and assess of the effect of cerebral perfusion.

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IMPELLA: A MINIATURISED CARDIAC SUPPORT SYSTEM IN AN ERA OF MINIMAL INVASIVE CARDIAC SURGERY

In modern coronary bypass surgery, new objectives have been set which are based upon a minimal invasive approach : beating heart surgery is the new trend to follow, although this might not be feasable in more complex cases. In these cases, the beating heart could be supported by a mechanical device , preferably a device with minimal invasive features to fit in this new approach of minimal invasiveness.

For this purpose, 2 intravascular bloodpumps were developed : the Intracardiac Pump LV 6.4 for left ventricular support and the Intracardiac Pump RV 6.4 for right ventricular support. The Impella pumps are rotary bloodpumps of the axial flow type and produce 4.2 l/min at physiological pressure differences and a rotational speed of 32 500 rotations/min.

These micropumps can widen the indications of beating heart surgery by sustaining haemodynamic stability and protecting the heart from warm ischaemia. The current concept is aimed at bridging a procedure. Therefore the proof of safe duration of usage has not been extended beyond 6 hours.

However, the same technology can be upgraded for longer use, allowing the terminology ‘mechanical support for heart failure’.

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EXPANDING PERFUSION SERVICES THROUGH MOBILE POINT-OF-CARE COAGULATION MONITORING

Current trends in cardiac surgery have challenged perfusionists to seek diversification of services. Hemostatic dysfunction continues to be a leading cause of morbidity and mortality in the post cardiotomy period. The utilization of point-of-care coagulation monitoring (POCM) represents of desirable area of perfusion service expansion. The purpose of the study was to create a series of hemostatic conditions to assess the functionality of POCM to identify specific coagulopathies with identifiable profiles for algorithm development.

Fresh (< 4hrs) bovine blood anticoagulated with acid citrate dextrose was adjusted to a hematocrit of 30.0±2.0%. Hypofibrinogenemia and thrombocytopenia were both created via separation through centrifugation with target levels of 90 mg/dL and 70,000/μL respectively. Thrombocytosis was induced by adding 850 μg/mL of nitroglycerin. Five distinct POCM were used to evaluate activated clotting time, thrombin time, fibrinogen, platelet function, prothrombin time, activated partial thromboplastin time and thrombelastograph. Results are reported as percent change from control for each test.

Device	Hypofibrinogenemia	Thrombocytopenia	Thrombocytosis
TEG Index	(-)146% p<0.05	(-)82% p<0.05	(-)388% p<0.05
ACT	41% p<0.05	13% p=ns	77% p<0.05
Thrombin Time	11% p=ns	(-)7% p=ns	15% p=ns
Fibrinogen	(-)42% p<0.05	(-)10% p=ns	(-)2% p=ns
Platelet function	No result	(-)18% p<0.05	No result

Each test performed showed specificity and sensitivity for certain coagulopathies, however variability amongst monitors was encountered. In conclusion, the development of a mobile cart incorporating POCM with knowledge of specific coagulopathic conditions may expand perfusion service.

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QUANTIFICATION OF THE EFFECT OF ALTERING HEMATOCRIT AND TEMPERATURE ON BLOOD VISCOSITY

Rheological changes occurring with the conduct of cardiopulmonary bypass effect the distribution of blood throughout the cardiovascular system. Methods for optimizing perfusion must incorporate the physical changes associated with altering viscosity as affected by temperature and hemodilution. The purpose of this study was to evaluate the effects of changing physical characteristics of fluid on the dynamics of blood flow in an *in vitro* model.

An extracorporeal model simulating coronary vessel constriction was designed that consisted of tubing with varying internal diameters. Tubing sizes were selected as percent reductions (11, 33, 56 and 78%) of a normal sized (3.6 mm) coronary artery. Flow rates were randomly varied between 150 and 300 mL/min, temperatures of 6 and 37°C, and hematocrits (Hct) of 0, 20, and 38%. Measured endpoints included viscosity, pressure drop, and volume distribution downstream of the simulated vessel constriction.

As temperature fell from 37 to 6°C, viscosity increased with hematocrit as follows: 192% at 0% Hct, 225% at 20% Hct, and 250% at 38% Hct, $p<0.001$. Pressure drop increased significantly across each tubing size ranging from 173 to 351%, $p<0.01$, as fluid was cooled from 37 to 6°C. However, intra-conduit statistical differences in volumetric distribution of flow were not achieved. Hypothermia resulted in increases in resistance, but statistical significance was only seen in the smallest lumen conduit.

In conclusion, the effects of changing temperature in an *in vitro* model for fluid distribution exerts a profound influence on flow secondary to changing blood viscosity. Knowledge of such flow alterations may influence perfusion strategies where vessel constrictions are encountered.

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CARDIOPULMONARY BYPASS IN CHINA: CURRENT STATUS AND FUTURE

In order to know the present situation and problem of CPB work in China, twenty representative hospitals were inquired to complete an investigation form and report about their status of CPB in 1998.

There were 142 perfusionists in 20 hospitals. Professional post was chief doctor (18.3%), attending doctor (49.3%), and technician (32.4%). 62.7% of the perfusionists had articles publication in periodicals. Perfusionists belong to surgical department in 14 hospitals, to anesthesia department in 3 hospitals, independent division in 3 hospitals. 13274 CPB cases were performed in 20 hospitals in 1998. Three hospitals performed 1224~2686 cases of CPB in 1998. The main diseases of operation, emergency CPB, CPB for non-cardiac surgery were analyzed. Methods of CPB included mild hypothermia CPB, low flow plus deep hypothermia, DHCA, selected cerebral perfusion, left heart bypass, assisted circulation, normalthermia beating heart surgery. Prime content, equipment and appliance of CPB, monitoring data, myocardial protection method, and blood gas test were analyzed and described.

For future tasks of CPB in China we should pay more attention to personal cultivation, rules and regulations construction, standardization construction and continuous technique innovation.

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DEVELOPMENT OF A CARDIOPULMONARY BYPASS SYSTEM WITH ULTRA-LOW PRIMING VOLUME FOR PEDIATRIC OPEN HEART SURGERY

When considering pediatric open heart surgery without homologous blood transfusion, the initial priming volume of the pump system is important. The purpose of this study was to develop an ultra-low priming volume system for pediatric open heart surgery.

In order to minimize the priming volume, the length of the tubing circuit was critical. To minimize the distance between the surgical field and the heart lung machine, a specially designed sterile barrier sheet was used to separate them. A heart lung machine with separated pump heads was used by which the layout of the system was freely modified. The smallest available oxygenator and arterial filter were selected according to the patients' body weight. Between Dec. 1999 and Oct. 2000, this system was used for 28 cases with the age of 5 months to 6 yrs. (average 1.5±1.4yrs.), and the body weight of 5.2 to 17.3 kg(average 8.9±3.9 kg).

The priming volume for patients under 6.5kg was 168 ml (136ml without an arterial filter), 190ml for patients weighing 6 to 9kg, and 220ml for patients weighing 9.5 to 17kg. The average hematocrit was 33.1 ± 4.6% prebypass, 21.4 ± 4.2% during bypass, and 29.6 ± 5.0% post bypass. By calculation, even for a baby with body weight of 3 kg without anemia, this system is applicable safely with minimum hematocrit of 20%.

Newly developed ultra-low priming volume system minimized the hemodilution for lower weight patients and broadened the application of bloodless pediatric open heart surgery.

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LEFT VENTRICULAR ASSIST UTILIZATION IN A NEONATE FOLLOWING NORWOOD PALLIATION OF HYPOPLASTIC LEFT HEART SYNDROME: A CASE REPORT

Ventricular support mechanisms are frequently employed for adult post cardiotomy shock syndromes. Utilization of ventricular support devices in the neonatal populations, however, is not well documented.

The focus of this case report is a 6 day old, 3.7 kg neonate presenting with Hypoplastic Left Heart Syndrome (HLHS) undergoing a Phase I (Norwood) surgical correction. The immediate postoperative period was characterized by low cardiac output necessitating placement of a left ventricular assist device (LVAD).

Details of patient indications, circuit composition, component selection, cannulation sites, anticoagulation management, LVAD management, along with a brief comparison to Veno-Arterial ECMO will be displayed.

In conclusion, utilization of a LVAD may be a viable option for pediatric patients exhibiting temporarily depressed left ventricular function with normal pulmonary function.

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IN VITRO CARDIOPULMONARY BYPASS ACTIVATION OF MATRIX METTALLOPROTEINASES

The purpose of this study was to determine if blood exposed to an extracorporeal cardiopulmonary bypass (CPB) circuit results in the activation of matrix mettalloproteinases (MMP). MMP's are proteolytic enzymes reported as involved and associated with tissue remodeling. Left ventricular (LV) dysfunction occurs with changes in LV fibrillar collagen structure and resultant LV geometry changes. MMP's selectively degrade extracellular proteins such as fibrillar collagens, and are therefore implicated in directly contributing to LV tissue remodeling.

Blood collected from 3 healthy, mature, heparinized (600mg/kg) Yorkshire pigs was added to a reservoir via an angio-catheter. This blood was then used in vitro to prime a pediatric CPB system typical of that used routinely by our hospital. The prime volume was held constant for all in vitro circuits at 350cc's. Recirculation flow and temperature were also held constant at 800 ml's/minute and 37 degrees. Total recirculation time was 120 minutes. Baseline and at 30 minute intervals up to 120 minutes, blood samples were collected from the CPB circuit and split for assay by Ellisa protocol to measure MMP levels. Aseptic technique was utilized throughout the study. Results from the split samples were pooled for each individual time point.

Preliminary results demonstrate a mean 19.5±. 05% decrease of MMP levels in blood exposed to 120 minutes of CPB. The decreases in MMP levels reflect the activation and consumption for these enzymes in blood exposed to an in vitro CPB circuit. Although this decrease in MMP levels of 3 subjects at 120 minutes, as compared to baseline, is not statistically significant, it is believed that at the completion of the study with n=6 the alpha level will be obtained.

MMP activation due to blood exposure to the components of a CPB circuit is a molecular mechanism that could lead to further deleterious affects such as post CPB LV dysfunction.

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A RETROSPECTIVE ANALYSIS OF CARDIAC SURGERY PATIENT DEMOGRAPHICS AND OUTCOMES IN A UNIVERSITY HOSPITAL SETTING

The purpose of this investigation was to examine patient demographics, clinical practices and procedures, as well as outcomes, in order to establish a historical precedent for outcomes based improvement. Institutional approval was obtained to review medical records of fifty-three (53) randomly selected patients undergoing cardiopulmonary bypass procedures from the period of February 2000 – June 2000. Data evaluated was stratified with regard to patient postoperative risk, and recommendations made for early identification of morbidity markers. Implementation of clinical outcome improvement processes are a primary tool for self-evaluation, with the goal of continuous quality improvement. We will present our investigational findings and define our institutional plan for implementing changes to current practices.

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VENTRICULAR FUNCTION DETERMINATION DURING EXTRACORPOREAL MEMBRANE OXYGENATION (ECMO) FOLLOWING NORWOOD OPERATION

ECMO has been used successfully to support pulmonary and cardiac function following Stage I Norwood operation. Determination of the return of native cardiac and pulmonary function can be easily accomplished due to the single ventricle physiology. The pulmonary function can be assessed by capping off the membrane oxygenator, allowing evaluation of native pulmonary gas exchange through the modified Blalock-Taussig shunt. Cardiac output can be calculated with the following oxygen delivery equation: Total oxygen delivery = ECMO oxygen delivery + Ventricular oxygen delivery. The ventricular O_2 saturation used in the formula for oxygen delivery is the same as the mixed venous saturation returning to the ECMO circuit due to the large interatrial communication following the Norwood operation.

A 3.2 kilogram infant was placed on a pediatric ECMO heparin-bonded circuit utilizing a centrifugal pump and hollow fiber membrane oxygenator after failure to wean from cardiopulmonary bypass due to low oxygen saturation and poor ventricular function. On day 1 of support, the systemic arterial saturation was 100% and matched the ECMO arterial oxygen saturation. On day 2 of support, the patient's arterial O_2 saturation decreased to 96% and the ECMO mixed venous O_2 saturation was 87%. Using the oxygen delivery formula, the ventricular cardiac output was calculated to be 175 ml/min. with an ECMO flow of 400 ml/min. for a total cardiac output of 575 ml/min. The native ventricular function was therefore 30% of the total cardiac output. Calculation of the cardiac output using this method would require a left ventricular sample in a patient with normal biventricular circulation.

Single ventricle physiology in the postoperative Norwood patient makes this calculation a useful tool for assessing the return of ventricular function in this patient population on ECMO support.

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CARDIOPULMONARY BYPASS WITH MILD HYPOTHERMIA AND BEATING HEART

The cardiopulmonary bypass of cardiac surgery with mild hypothermia and beating heart is different from the traditional cardiopulmonary bypass. This article reported the clinical evaluation of cardiopulmonary bypass of cardiac surgery with mild hypothermia and beating heart. From Nov. 1999 to Aug. 2000, the cardiopulmonary bypass of cardiac surgery with mild hypothermia and beating heart was used in 23 patients in Shanghai Chest Hospital. They were 59±17 years old and their body surface was 1.76±0.24 M^2. They were all male and accepted coronary artery bypass grafting. The hematocrit was maintained between 16%–22% and the naso-pharyngeal temperature was kept between 30°C-34°C during cardiopulmonary bypass. The aorta was not cross-clamped and the cardioplegia was not perfused. These surgeries were operated when the hearts were beating slowly (HR: 60/min). 3.8±0.8 bypasses were completed in each patient. The cardiopulmonary bypass duration was 156±42 minutes. All patients went back to ICU safely. These patients' ICU time and death rate decreased evidently than those of the contrary group patients. The cardiopulmonary bypass of cardiac surgery with mild hypothermia and beating heart was simple and convenient to be operated. Moreover the clinical effect was satisfied. So this technique was worth of being spread.

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ALTERNATIVE METHODS FOR ANTICOAGULATION MONITORING IN PEDIATRIC PATIENTS WITH APPLICABILITY TO A PATIENT WITH SEVERE HEMOPHILIA A AND CIRCULATING INHIBITOR

Monitoring pediatric patients can be problematic due to the immaturity of the coagulation system in this population. In addition, the hemodilution required to place a small patient on bypass can also interfere with standard monitoring methods. In this institution, the Hemochron Jr. ACT+ assay has been the standard of care for anticoagulation monitoring since 1997. This assay, with a target ACT of 400 seconds for initiating bypass, was compared to both the Medtronic HMS system (N=7) and the Hemochron HiTT assay (N=6) in pediatric patients. All three assays were then employed to monitor a pediatric Hemophilia A patient (Factor VIII <1%) with high inhibitor titer.

Heparin dosing for all patients was based upon standard empirical calculations (initial bolus 300 units/kg) with subsequent heparin doses given when the ACT+ was below 400 seconds. Data collected in all studies included clotting times for ACT+ and HiTT and heparin level and recommended dose for HMS at baseline, post-bolus, every 30 minutes on bypass and post-protamine. Both the HiTT clotting time and the HMS heparin level showed statistically significant correlation to the ACT+ (HiTT, N=24, r = 0.761; HMS, N=31, r = 0.818). Using a HMS target heparin level of 1.5 mg/kg and a HiTT target clotting time of 180 seconds were found to be clinically equivalent to the 400 second ACT+ as indicators of the need for additional heparin.

When a 7 year old male with severe Hemophilia A and high inhibitor titer required tricuspid valve replacement, all three assays were used to ensure appropriate anticoagulation management. During bypass, this patients ACT+ remained out of range (>1005 seconds). The HiTT was maintained at >180 seconds and the HMS heparin level at >2.0 mg/kg. Heparin was administered when any single parameter was below the cutoff value. The use of the combination of three distinct monitoring assays for this patient allowed the surgical team an added level of confidence that appropriate anticoagulation had been maintained.

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CLINICAL ESTIMATION OF FD MEMBRANE OXYGENATOR

The FD membrane oxygenator is made by YanSheng Medical Instrument Co. Ltd. (FuDan University, China). The clinical experience of FD membrane oxygenator was reported in this article. From Sep. 1994 to Aug. 2000, there were 840 patients who used FD membrane oxygenators in Shanghai Chest Hospital. They included 511 males and 329 females. Their age ranged from 1.5 to 44 years old and body weighed 7-51 kg. The surgery included ASD and VSD repairment, MVR, and complex deformation correction. Maintain hematocrit between 15% and 20% during bypass. Monitor the ECG, AMP, CVP, blood gas, dielectric and so on timely. The CPB periods of these patients ranged from 19 to 89 minutes. The aortas were cross clamped for 8–51 minut4es. The hearts were arrested for 8–52 minutes. The cardiac spontaneous defibrillation rate was 95% during cardiopulmonary bypass. FD membrane oxygenator has stable performance and good ability of gas exchanging. It is economical and practical. The blood is destroyed slightly. So it is worth being spread widely as a kind of membrane oxygenator made in China.

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EFFECTS OF ULTRAFILTRATION ON AMINOCAPROIC ACID

Blood conservation strategies have become a standard of practice in cardiac surgery. The use of antifibrinolytic agents and ultrafiltration are two popular techniques. The purpose of this study was to evaluate the effects of continuous ultrafiltration on e-aminocaproic acid (EACA) utilizing functional coagulation analysis.

A fibrinolytic assay was developed to detect EACA utilizing the thromboelastograph (TEG) and urokinase (0.138 units 0.360 mL^{-1}). Fresh bovine blood (23±1% hematocrit) was pumped (100 mL min^{-1}) through an ultrafiltrator (HPH 400) at 37°C with a transmembrane pressure of 280 mmHg. EACA (0.065 mg mL^{-1}) was circulated for 10 minutes prior to initiating ultrafiltration. Samples (pre and post-ultrafiltrator) were obtained at baseline, 5, and 10 minutes of ultrafiltration.

Coagulation profiles significantly declined from 0.065 mg to 0.0325 mg of EACA per mL blood (maximum amplitude MA, 75.4±4.0 vs. 63.3±2.9, $p<0.05$, TEG index 5.4±0.7 vs. 4.0±0.3, $p<0.05$). Fibrinolysis at 30 minutes increased as EACA concentrations declined (0.065 mg, 0% vs. 0.032 mg, 16.4±2.8%, $p<0.05$). During ultrafiltration the MA increased significantly from baseline to 10 minutes post-ultrafiltrator (68.2±3.0 vs. 75.8±10.0, $p<0.05$) and from 5 minutes pre to 10 minutes post-ultrafiltrator (69.7±4.2 vs. 75.8±10.0, $p<0.05$). The TEG index showed no significant change and no fibrinolysis was detected at 30 minutes from any data point during ultrafiltration.

In conclusion, this study demonstrates that the antifibrinolytic properties of EACA are maintained during ultrafiltration and is not appreciably removed after 10 minutes of continuous flow.

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CARDIOPULMONARY BYPASS WITH DEEP HYPOTHERMIC CIRCULATORY ARREST FOR A PATIENT WITH SICKLE CELL ANEMIA: A CASE REPORT

44 year old sickle cell anemia patient undergoing a pulmonary thromboendarectomy required the use of cardiopulmonary bypass incorporating deep hypothermic circulatory arrest. Being aware of reported incidences of sickling crisis, a team of the surgeon, anesthesiologist, hematologist, and perfusionist met to devise a plan of treatment. Treatment included preoperative and intraoperative exchange transfusion, optimal blood gas management, and increased blood flows during bypass.

The surgical procedure was performed and was successful in reducing pulmonary hypertension incorporating a team approach and utilizing these techniques no incidence of adverse sickling events was observed during this procedure.

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CORONARY ARTERIOVENOUS FISTULA: A CLINICAL REVIEW & CASE REPORT

A coronary arteriovenous (AV) fistula is a direct abnormal communication through which coronary artery blood flow is shunted into one of the four cardiac chambers, great vessels or any other vascular structure without passing through the myocardial capillary bed. The incidence of coronary AV fistula is 0.1–0.2% in patients undergoing coronary arteriograms; however, it is the second most common congenital anomaly of coronary arteries after anomalous origin of coronary arteries. Patients with coronary AV fistula often experience angina, a continuous murmur, and chamber enlargement. "Coronary steal" results in myocardial ischemia in some patients. These fistulas are often associated with other cardiac anomalies and can be congenital or traumatic in origin. Patients catheterized following cardiac transplantation have been found to have a forty-fold increase in coronary fistula incidence. There is a distinction between the coronary arteries involved and there are also several sites for fistula connection. The right coronary artery is involved in 55% of cases, the left in 35%, and both coronary arteries in about 5% of reported cases. Untreated coronary AV fistulas can increase in size, produce heart failure, and have a tendency for the development of bacterial endocarditis. The mortality and morbidity rates for these patients are very low when surgical repair is performed, 2% and 3.6% respectively. Since the incidence, characteristics, and etiology of coronary AV fistulas are not well defined, the purpose of this presentation is to analyze the clinical aspects of these fistulas and the course of treatment for these patients. To enhance this review, a case report will be presented to aid in the discussion of this uncommon patient population.

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THE INTRODUCTION OF A NEW KIND OF MEMBRANE OXYGENATOR

Xijian-1 membrane oxygenator is a new kind of membrane oxygenator which was made by Xijing Medical Instrument Co,. Ltd. the clinical experience of Xijian-1 membrane oxygenator was reported in this article. From Jun. 1998 to Mar. 2000, there were 212 patients with Xijian-1 membrane oxygenator in Shanghai Chest Hospital. They included 126 males and 86 females. Their age ranged from 7 to 66 years old and body weighted 21.5–92 kg. The surgery included ASD and VSD repairment, MVR, AVR and complex deformation correction. Maintain hematocrit between 15% and 20% during cardiopulmonary bypass. Monitor the ECG, AMP, CVP, blood gas, dielectric and so on timely. The CPB periods of these patients ranged from 20 to 156 minutes. The aortas were cross clamped for 15–124 minutes. The hearts were arrested for 18–126 minutes. The cardiac spontaneous defibrillation rate was 93%. Xijian-1 membrane oxygenator has stable performance and good ability of O_2 and CO_2 exchange. It is economical and practical. The blood is destroyed slightly. So it is worth being spreaded widely as a kind of membrane oxygenator made in China.

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FIRST EXPERIENCE AND RESULTS WITH SUCTION BLOOD SEPARATION USING THE D970™RESERVOIR FOR CORONARY ARTERY BYPASS OPERATIONS

Conventional cardiopulmonary bypass setups using open suction systems result in an activation of the coagulation cascade due to the blood contact with non vascular surfaces. By application of the veno-cardiotomy reservoir D970 (Sorin biomedica) suction blood is withdrawn for separation while the vent blood is redirected in the venous part (circulation). We questioned whether suction blood separation is advantage us with regard to the activation of the coagulation system.

24 patients undergoing myocardial revascularization in moderate hypothermia (32°–34°C) were prospectively randomized assigned to two groups. In group I the connection between cardiotomy and venous part was and the suction blood was separated and processed by cell saver. In group II the suction blood was directly drained from the cardiotomy part into the venous part (circulation) by open connection. Besides the routine laboratory parameter assessment various factors of the coagulation cascade (TAT-complex, α2 antiplasmin, plasminogen) were analyzed.

In the suction blood separation group (I) an average of 1146 ml blood (550–2000 ml) was separated and directed to cell saving with a hemoglobin 2,5 g/dl resulting in an erythrocyte volume of 249 ml. In 5 of 12 cases (group I) there was not a complete filling from the cell saver and the blood was rejected. There was a significant lower coagulation cascade activation in group I applying suction blood separation.(table: median concentration TAT, α2 antiplasmin, plasminogen, fHb-free plasma hemoglobin)

	TAT gr.I	TAT gr.II	fHb gr.I	fHb gr.II	α2 Antipl. gr.I	α2 Antipl. gr.II	Plas min. gr.I	Plas min. gr.II
unit	mcg /l	mcg /l	µmol /l	µmol /l	%	%	%	%
MP1 prae EKZ	0,1	0,1	3,98	4,57	101,3	95	83,8	83,3
MP2 post OP	4,61	9,73*	4,47	14,76 *	128,8*	84,2	55*	41,3
MP3 6h post OP	3,45	14,95 *	6,32	8,78	122*	91	72*	56
MP4 24h post OP	2,4	12,27 *	4,56	5,69	101	92,8	69	63,5
MP5 48h post OP	2,33	10,93 *	3,6	3,9	99,5	95,8	88,3*	71,8

The cardiotomy suction blood separation prevents an augmented activation of the coagulation/fibrinolyse system and reduces hemolysis. The implementation of this setup is simple and safe and further application on a routine basis seems indicative in our opinion, especially because patient risk and costs are therefore reduced. With regard to bypass techniques types of perfusion this setup can be used for all.

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PRO-THROMBOTIC MARKERS IN TWO-MONTHS FOLLOW-UP OF CORONARY BYPASS SURGERY

We assessed the haemostatic/thrombotic profile of patients undergoing coronary artery bypass surgery (CABG) with the use of cardiopulmonary bypass(CPB) during relatively long-term(2 months) follow-up.

Sixteen patients (age range 50-75) with no renal or liver disease were selected. Blood sampling was performed before intervention and at day 4 and 7 and every 15 days up to two months after CABG.

During the first week after CABG levels of fibrinogen (determined by a functional method), antigenic levels of prothrombin fragment F1+2, thrombin-antithrombin complex and D-dimer were significantly elevated compared to the pre-operative state. Also, tissue factor, the initiator of cellular coagulation, determined by clotting assay of mononuclear cells was found elevated up to one week after CABG. Fibrinogen, and F1+2 returned to normal within 30 days, while D-dimer and TAT returned to normal at 60days. No change of factor VII during the overall study was recorded.

These data indicate sensible activation of the haemostatic/thrombotic system one week after CABG lasting for at least one-two months after surgery. This increase in prothrombotic risk suggest more aggressive anticoagulant therapies in the early follow-up of CABG patients.

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CLINICAL EXPERIENCE OF AUTOLOGOUS BLOOD RECOVERY TECHNIQUE

The experience of autologous blood recovery in 2467 patients during cardiovascular surgery or other operations through 1995 to Nov 2000 is reviewed. We used Cell Saver-5 system for 95 patients, Chinese ZITI-2000 system for 2372 patients. 55% to 64% of all the cardiovascular surgical patients were used this technique during the last three years. The patient body weight was 11~108Kg, mean 64Kg. Heparin must be dropped into the blood shed from the surgical field when the patient was not heparinized or the protamine had been given to neutralize the heparin. The blood from surgical field and residual in the oxygenator was collected and processed in a centrifuge bowl, cleaned with normal saline, concentrated to be the packed RBCs which was returned to the patient after surgery. 1574541ml washed, concentrated RBCs (HCT 0.4~0.5) were returned to patients, the average was 638ml (150~27010ml) for each patient. There were more than 1000ml packed autologous RBCs (mean 1532ml) returned to each of 314 patients. The average amount of recovered RBCs was 645~967ml for each patient in valve surgery, great artery surgery, re-operation, complicated congenital heart surgery.

Autologous blood recovery system is able to salvage shed blood during or after cardiac operation, decrease bloods loss during operation, decrease bank blood transfusion, and decrease disease transmission risk. This technique should be used actively in the cardiac surgery in which a lot of blood loss is estimated.

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VENO-VENOUS EXTRACORPOREAL SUPPORT DURING BILATERAL PULMONARY LAVAGE FOR PULMONARY ALVEOLAR PROTEINOSIS

Pulmonary alveolar proteinosis (PAP) is a rare pulmonary disease associated with accumulation of thick proteinacous material within the alveolar spaces which compromises oxygenation. Bronchopulmonary lavage has been shown to improve symptoms. Previous reports document the use of extracorporeal support for patients with severe PAP undergoing bronchopulmonary lavage. This case report describes a 53 year-old female with severe PAP requiring veno-venous extracorporeal support (v-vECMO) during lavage.

Oxygenation was significantly improved post-operatively and the patient was discharged seven days later. A search of the literature revealed that this report is the first to utilize v-vECMO during bilateral sequential pulmonary lavage. Total time on v-vECMO was 203 minutes compared to previous reported cases where minimum support time was six hours.

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THE CLINICAL APPLICATION OF INTRA-AORTIC BALLOON PUMP DURING THE OPEN HEART SURGERY

The intra-aortic balloon pump(IABP) is an important way to save the life of patient with pump failure. The clinical experience of IABP was reported in this article. From Jan 1990 to Jul 2000, 142 patients with pump failure during open heart surgery accepted IABP in Shanghai Chest Hospital. They included 81 males and 61 females. Their age ranged from 16 to 74 years old and body weight 34–88 kg. There were 89 valve replacements, 50 CABGs and 3 complex malformation corrections. 21 Datascope cannulas and 121 Arrow cannulas were used. Datasdcope-83, 95, 97 instruments were used as power. Monitor the AMP, LAP/PCWP, blood gas and so on timely. The time of IABP ranged from 2-288 hours (186 ±20 hrs). 91 patients survived and 51 patients died. The survival rate was 64.1% IABP should be used timely when the following conditions appeared: (1) EF< 2.0L/min/m2; (2) The patient could not wean from cardiopulmonary bypass; (3) Serious arrhythmia; (4) Two or over two kinds of positively inotropism drugs were used together.

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