

				<p>p=0.0004) of follow-up.  However, the increased risk of bleeding at 11 years was only statistically significant with mechanical prostheses in the aortic position (RR=1.93, 95% CI: 1.36, 2.74, p=0.0002).  However, the increased risk of bleeding at 11 years was only statistically significant with mechanical prostheses in the aortic position (RR=1.93, 95% CI: 1.36, 2.74, p=0.0002).</p>
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○：対比療法に対し効果を認めた △：有意な差を認めない ×：対比療法より治癒成績が悪かった ・：判断できない

(3)安全性・信頼性

(4)患者 QOL

(5)コストベネフィット

特に記載はない

#### E、その他

ヨーロッパの5つのセンターで Mosaic 生体弁の血行力学的性能の臨床評価では、術後の死亡率は 4.2%/患者・年（含心臓弁に関する死亡率 0.4%/患者・年）で、手術導入後6年の結果としては大変満足すべきものとの報告が 1 件、低温保持された弁で調節された同種移植片を受けている小児で Azathioprine は免疫反応を減少させることもなく、また同種移植片の機能にも影響を及ぼさないとするのが 1 件、自家移植片を大動脈に置換後有意進行性の拡張は見られなかったとするものが 1 件、豚の生体弁に替わる第二世代の心膜弁（Bioflo）の 11 年間長期比較評価の結果、豚の心膜弁と同等の評価を得たとの報告が 1 件、Medtronic Freestyle（stentless 弁）と Tront SPV（stentless 弁）の血行力学性能比較を 995 人の患者で臨床評価した結果、これら 2 つの弁の血行力学性能の差はなく、また LV 機能の規格化で優れた結果を提供したとする報告が 1 件あった。

#### (1) 技術摘要疾病

aortic valve diseases 5 件、mitral valve diseases 1 件であった。

#### (2) 診断・治癒能力

文献 No	評価結果	疾病名称	対比技術	治癒性
MED 7	○	aortic valve disease	human pulmonary autograft vs aortic homograft	<p>No patient in either group had aortic dilatation at any level of &gt;20% or more than mild aortic regurgitation at up to 4 years of follow-up. The aortic media was thicker in both autografts and normal donors (P: &lt;0.01), and there was a trend for the PA media to be thicker in the autograft group.</p> <p>Patients with higher preoperative PA pressures tended to have lower fragmentation scores (chi(2) P: &lt;0.01).</p> <p>The lower stiffness modulus, higher stiffness modulus, and maximum tensile strength of the aorta was 34% to 38% higher than</p>

				that of the PA (P: <0.01); however, the 4-month-old autograft appeared to show adaptation in mechanical behavior.
MED 10	○	heart valve diseases	Procine vs pericardial bioprothesis	No significant difference in survival or valve-related complications was seen between the groups. Mean (+/- SEM) survival at 11 years was 41.4 +/- 6.8% in the Bioflo group and 55.3 +/- 6.8% in the CE group (p = 0.15). There were 16 valve-related deaths (nine in the Bioflo group, seven in the CE group). At 11 years, freedom from valve-related mortality was 89.5 +/- 3.9% for the Bioflo group and 91.0 +/- 3.5% for the CE group (p = 0.4). Valve position had no impact on survival. At 11 years, freedom from structural valve deterioration was 83.9 +/- 5.4% and 87.5 +/- 4.2% in the Bioflo and CE groups, respectively (p = 0.9).
MED 19	○	aortic valve diseases	Medtronic Freestyle Valve vs Tront SPV(stentless procine valves)	Medtronic Freestyle patients were notably older than the Toronto SPV patients (70.7 +/- 8.6 vs 61.8 +/- 11.1 years, p < 0.001) and were markedly more symptomatic (p < 0.0001). In the Toronto SPV group, most patients had New York Heart Association (NYHA) Class II (41.5%) or Class III (44.7%) symptoms preoperatively, while in the Freestyle group, 61.5% were in Class III and 12.5% were in Class IV. Both devices demonstrated a meaningful decrease in mean gradient and a corresponding increase in effective orifice area (EOA). Furthermore, the indexed EOA (EOA/body surface area [BSA]) was > 1cm <sup>2</sup> /m <sup>2</sup> for all valves indicating there was no patient-prosthetic mismatch. There was a meaningful decrease in left ventricular (LV) mass as well as LV mass index (LVMI) for both devices up to 3 years postoperatively

○：対比療法に対し効果を認めた △：有意な差を認めない ×：対比療法より治癒成績が悪かった -：判断できない

(3)安全性・信頼性

(4)患者 QOL

(5)コストベネフィット

特に記載なし

### 5-3-9 Extracorporeal Circulation Apparatus (Assisted Circulation Apparatus)

MEDLINE の該当論文数は、90 件であった。そのうち、cardiopulmonary bypass における heparin-coated extracorporeal circuit (heparin bonded を含む) についての試験が 46 件と最も多かった。他には、ヘパリン以外の表面処理に関するものが 5 件、ポンプの比較に関するものが 9 件、フィルターに関する試験が 9 件、機器の比較が 4 件などである。

#### A. heparin-coated extracorporeal circuit について

##### (1) 技術適用疾病

疾病名については、coronary artery disease が大部分を占めていた。その他の疾病名については、angina pectoris, paediatric heart disease, thoracic aortic disease, heart disease が見られた。

##### (2) 診断・治療能力

46 件の論文の内、42 件が heparin-coated extracorporeal circuit と uncoated circuit との比較を行っていたが、27 件がヘパリン投与量を減らす、炎症反応のマーカー、或いはその 1 部が改善されるなどの理由から、肯定的な結論を得ていた。しかし、14 件は臨床的な差が無い等、有為な差を認めないもの、1 件 heparin coating より albumin を prime solution へ添加した方が結果が良いとするものがあった。

また、heparin coated extracorporeal circuit の Duraflo II と Carmeda を比較した論文が 2 件あったが、1 件で SC5b-9 のリリースが Carmeda の方が少ないと述べた以外は同等であった。

抄録 No	Heparin-coated ECC の評価	疾病名称	技術	治癒性
MED 2	○	coronary artery disease	heparin coated CPB vs. uncoated + heparin dose	platelet decrease was significantly less in group B and C, activation of thrombocytes was significantly decreased and postoperative bleeding was significantly reduced in group C
12	Carmeda と Duraflo II は同等で○の評価	coronary artery disease	Carmeda Bioactive Surface vs. Duraflo II	no difference in time for ventilatory support(D vs C: 1.7+/-1.3hours vs 1.6+/-1.0hours,P=0.37), amount of postoperative mediastinal drainage(D vs C:665+/-257ml vs 688+/-243ml; P=0.07), need for allogeneic blood plasma transfusion(D vs C:4.2% vs 4.4% P=0.93), mortality (D vs C:1[0.14%] vs 3[0.45%];P=0.31)
13	△	coronary artery disease	Heparin-coated circuits vs. uncoated	Clinical outcome and neurological injury seem not to be

			circuit	associated with type of heparin coating used for CPB
16	△	coronary artery disease	Heparin-coated circuits vs. uncoated circuit	the Bioline demonstrated partially improved biocompatibility in terms of leukocyte(neutrophil elastase) and complement activation(C3a), and IL-6,8 production, but not in platelet activation, coagulation, fibrinolysis cascade
17	△	angina pectoris	Heparin-coated circuits vs. uncoated circuit	heparin group had better red sell and white cell filterability (8%) p=0.0079, p=0.027 / red cell transit time was 19% slower in control group(p=0.0351) / red cell clogging rate(CR) and clogging particles(CP) were significantly lower in the heparin group(p=0.0212, p=0.0409)
20	○	coronary artery disease	Heparin-coated circuits vs. uncoated circuit	IL6 and IL10 release was significantly less in the heparin-coated group(p<0.05)
21	○	paediatric heart disease	Heparin-coated circuits vs. standard circuit	the levels of C3a, Teminal Complements Complex, and IL-6 in the heparin coated group were signifcnatly reduced (heparin group vs standard group; 851(791-959)ng/ml[median with quartiles] vs 497(476-573)ng/ml, 114(71-130) vs 35.5(28.9-51.4AU/ml, 570(203-743) vs 168(111-206)pg/ml ) (p=0.005)
22	○		Heparin-coated circuits vs. uncoated circuit	heparin coating was associated with less occult myocardial ischemic damage in patients undergoing open heart surgery
23	△	thoracic aortic disease	heparin coated CPB vs. uncouted + heparin dose	There were no statistically significant intergroup differences regarding markers of inflammation, complement activation, or coagulation activation.
24	○	paediatric artery disease	heparin bonded CPB vs. non-heparin-bonded CPB	All cytokines measured were significantly lower in the heparin-bonded group after CPB(p<0.05). There were no difereces in duration of incubation, intensive care unit stay or hospital stay, or poatoperative blood loss, but the respiratory index after CPB and body weight percent ratio 24 and 48 hours after CPB were significantly reduced in the bonded group(p<0.05, p,0.01, p<0.05)
26	○	coronary artery disease	Dufalo II heparin coated CPB vs. noncoated CPB	serum X II a factor, TAT, IL-6 were significantly higher in the control group during CPB(p<0.01), serum IL-8 was significantly higher in the control group at 24h after CPB(p<0.05),
28	△		heparin-coated CPB vs. 300U/kg heparin	no difference of thrombin-antithrombin III complexes, fibrinopeptide A,

				plasmin-alpha2 plasmin inhibitor complexes, and D-dimer at preoperative, intraoperative, and postoperative between the groups
29	○	heart trans -plantaion, heart-lung trans -plantaion	Dufalo II heparin coated CPB vs. uncoated CPB	the HC group had significantly lower levels of IL-6,8,10 at 1 hour after declamping, and cardiac troponin-1 at 12 and 24 hours after reperfusion
30	△	coronary artery disease	synthetic protein treated oxygenators vs. heparin coated circuits	postoperative clinical data did not differ between two groups, coagulation activation, hyperfibrinolysis, disseminated intravascular coaglation were similar.
31	○	coronary artery disease	heparin bonded circuits vs. nonbonded circuit	the probabily of transfusion is 50% less and the number of PRCB transfused are 1.42 units les when heparin-bonded circuits are used
32	○	coronary artery disease	heparin-coated CPB vs. uncoated but otherwise identical circuits	Pltelet levels remained significantly higher in the HCC group starting at the 10 minute following the institution of CPB until postopertive 24 hours. Mena postoperative transfusion requirements were lower in the HCC group(230+/-23c vs 320+/-25cc)
33	×	coronary artery disease	Carmeda vs. uncoated oxygenator vs. uncoated oxygenator with albumin	the albumin group had significantly lower platelet count drops(-4.8+/-7.1%)than the Cameda group(11.0+/-8.3%) and the noncoated group(20.3+/-14.5%9
35	△	coronary artery disease	heparin-coated circuits vs. prednisolone vs. aprotinin	heparin-coated circuits led to a significant IL-10 upregulation(peak at 2h,1380pg/ml) and IL-6 supression(peak at 4h,290pg/ml).
37	○	coronary artery disease	heparin coated circuit vs. conventional circuit	HCC is associated with a shorter intensive care unit and postoperative hospital stay and with a lower rate of patients having a severely impaired clinical outcome (stay in ICU for mor than 5 days or death)(relative risk 0.66,p=0.045).
44	△	coronary artery disease	heparin-coated CPB vs. uncoated CPB	complications developed in 53 patients(34%), equivalently in both group(P=0.44-0.82)
47	.	coronary artery disease	Duraflo II vs. Carmeda	The release of SC5b-9after CPB and after protamine administration was lower in group2 than group1 (p=0.0002 and p=0.006). A significant production of ctokines was detected in both groups with peak values observed within the time range of 4-6h after the start of CPB.
49	○	coronary artery disease	heparin coated extracorporeal circuit	all clinical and inflammatory mediators showed a tendency in favor of the group

			vs. noncoated circuit	with heparin-coated circuits. When analyzed on a point-by-point basis there were significant difference in postoperative central body temperature, soluble E-selectin levels, and beta-thromboglobulin levels ( $p < 0.05$ )
53	○	coronary artery disease	heparin-coated circuits vs. non-coating	tissue plasminogen activator (TPA) activity and antigen increased fivefold in the placebo group during CPB, whereas it did not double in the heparin-coated group.
58	○	Heart disease	heparin-bonded oxygenator (H) vs. nonbonded oxygenator (C)	Plasma levels of terminal complement complex were significantly higher at the end of CPB and after protamine administration in group C. Elastase levels were significantly higher 2 and 24 hours after CPB in group C. The ventilation time of patients in group H was significantly lower (H vs C: 10 (range, 3 to 24) vs 22 (7 to 24), $p < 0.01$ )
60	○	coronary artery disease	heparin-coated CPB (group H), heparin of 225 IU/kg, ACT 300 sec. vs. noncoated circuits (group C), bolus 300 IU/kg, ACT over 400 sec	the reaction of increase of the von Willebrand factor (vWF), plasminogen activator inhibitor-1 (PAI) and tissue plasminogen activator (tPA) was less evident in group H, especially in tPA (H vs C: 135% $\pm$ 9 vs 241% $\pm$ 15, $p < 0.0005$ ).
62	○	coronary artery disease	heparin-coated extracorporeal circuit vs. uncoated circuit	The generation of kallikrein-C1 inhibitor complexes was reduced by 62% ( $p = 0.06$ ) after onset of the CPB and by 43% ( $p = 0.026$ ) after the cessation of bypass in the heparin group compared with the uncoated group.
68	○	coronary artery disease	extra-corporeal circuit treated with vs. without covalent bonded heparin	There were several signs of reduced operative trauma in the study group. Hospital stay was reduced by nearly 1 day ( $P < 0.05$ ). Time on postoperative ventilatory support was approximately 4 h shorter ( $P = 0.009$ ). Chest drain blood loss was decreased both at 8 ( $P = 0.01$ ) and 24 h ( $P = 0.007$ ) postoperatively.
69	○	coronary artery disease	Duraflo II and Carmeda BioActive Surface vs. uncoated circuits	compared with the uncoated circuits, Duraflo attenuated only the lactoferrin levels, Carmeda was associated with lower levels of both endothelin-1, lactoferrin, and myeloperoxidase
70	○	coronary artery disease	a 43 microns heparin coated arterial line filter vs. no filtration	At 1, 5 and 24 hour the respective number with elevated S-100 was (control vs filter) (14 vs 9), (4 vs 0), (4 vs 0), ( $P < 0.05$ ). No patient had overt cerebral injury.
71	△	coronary artery disease	heparin treated CPB circuit vs. untreated	the use of heparin treated circuits revealed no overall changes in blood

			circuit	loss, blood use, time on ventilator, occurrence of adverse events, morbidity, mortality, and intensive care stay, no clinical or technical side effects were reported in both group
72	○	coronary artery disease	a heparin coated extracorporeal circuit vs. noncoated circuits	noncoated group induced a sharp increase in neutrophil-derived bactericidal/permeability-increasing protein(BPI), manifest directly after release of the aortic crossclamp, in the heparin group they were significantly attenuated.
73	○	coronary artery disease	CPB coated with heparin vs. uncoated circuits	Duraflo II reduces complement activation, particularly TCC formation, but not the release of specific neutrophil granule enzymes.
74	△	coronary artery disease	heparin coated CPB circuit vs. uncoated circuits	the postoperative overnight loss of hemoglobin through the drains(coated group vs uncoated group; 43.6(18.5-69.0) vs 73.0(32.2-137.7g, p=0.0015)
75	○	coronary artery disease	heparin coating vs. uncoated circuits	clinical and surgical results were similar in both groups, the heparin coated group had a reduce in the formation of the terminal SC5b-9 complement complex, and the counts of circulating leukocytes and platelets were significantly less reduced only initially of CPB.
76	△	coronary artery disease	heparin-coated ECC vs. uncoated ECC	heparin-coated ECC did not reduce perioperative blood loss and need for transfusion. But reduced maximum values of C3b/c(heparin-coated vs uncoated; 446±212nmol/L vs 632±264, p=0.0037), C4b/c(92±48nmol/L vs 172±148nmol/L, p=0.0069)
78	○	coronary artery disease	heparin-coated extracorporeal circuits vs. uncoated circuits	Adverse events, including all mortality and morbidity noticed during the five first postoperative days, occurred in 20 patients of the uncoated ECC group and in eight patients of the heparin-coated ECC group (p = 0.013). The most frequent complications were supraventricular arrhythmias that occurred in 13 patients of the uncoated ECC group and in four patients of the heparin-coated ECC group (p = 0.02).
80	△		heparin-coated extracorporeal bypass circuits vs. uncoated	Both groups had similar heparin and protamine administration, blood transfusions, postoperative alveolar-arterial oxygen gradient, time to extubation, length of intensive care unit stay, and overall morbidity and mortality.

81	○	coronary artery disease	"tip-to-tip" heparin-bonded cardiopulmonary bypass circuits vs. nonbonded	Patients treated with HBC required a shorter duration of ventilatory support (13.2 +/- 16.9 versus 23.4 +/- 50.0 hours; p = 0.04), spent less time in the surgical intensive care unit (20.7 +/- 17.4 versus 35.5 +/- 61.7 hours; p = 0.01), spent fewer days in the hospital (6.0 +/- 2.5 versus 7.3 +/- 5.2 days; p = 0.02), and had fewer postoperative complications (25.6% versus 39.3%; p = 0.03). The use of HBC with a lower anticoagulation protocol was not associated with any adverse events.
84	-	coronary artery disease	heparin-coated extracorporeal circuits vs. uncoated	Heparin-coated extracorporeal circuits significantly reduced circulating complement activation product C3b/c and soluble C5b-9 concentrations at the end of cardiopulmonary bypass and after protamine sulfate administration compared with the uncoated circuits, but not iC3, C4b/c, or C3a concentrations
85	○	coronary artery disease	heparin coated circuits vs. uncoated	In the HC group, however, the increase of neutrophil count was significantly lower compared with the UC group. Plasma concentrations of neutrophil elastase were significantly increased during and after CPB in both groups. However, the levels of elastase were significantly lower at certain time points in the HC group.
87	○	Postoperative Complications	Complete heparin-coated CPB vs. uncoated circuits and full heparin dose	Completely heparin-coated CPB can safely be performed in combination with reduced systemic heparinization. The heparin and protamine amounts could be lowered to 35% of normal doses.
88	○	coronary artery disease	heparin-coated CPB circuits, 200 IU/kg heparin vs. noncoated circuits, 350 IU/kg heparin	Myocardial infarction and hospital mortality were not seen in this study. Concerning the fear of graft occlusion in low dose heparin surgery, there was no statistical difference of graft patency in both groups
89	△		heparin-coated hollow-fiber oxygenator and circuit vs. bubble oxygenator, conventional hollow-fiber oxygenator	Heparin-coated circuits exert a protective effect on pulmonary function. However, their use did not modify the postoperative clinical course of patients with normal lung function preoperatively.
90	△		heparin-coated perfusion circuits, 300 U/kg dose of heparin. vs. uncoated	Heparin-coated circuits significantly (p < 0.001) reduced platelet adhesion and maintained platelet sensitivity to adenosine diphosphate (p = 0.015), but



				did not reduce release of beta-thromboglobulin. There were no significant differences between groups at any time for fibrinopeptide A, prothrombin fragment F1.2, or thrombin-antithrombin complex or in the markers for fibrinolysis
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○：対比療法に対し効果を認めた △：有意な差を認めない ×：対比療法より治癒成績が悪かった -：判断できない

- (3) 安全性・信頼性
- (4) 患者 QOL
- (5) コストベネフィット

特に記述がなかった。

#### B. Heparin 以外の extracorporeal circuit の表面について

Heparin 以外に extracorporeal circuit の表面について論じられたものは5件の抄録があり、うち surface modification (SMA: surface modifying additives) が3件で standard circuit と比較しており(結果良し2件、有意差認めず1件)、他には polymer-coated と uncoated circuit と比較(結果良し)、silicone-coated と heparin-coated 並びに uncoated と比較(結果良し)各1件であった。

##### (1) 技術適用疾病

いずれも coronary artery disease であった。

##### (2) 診断・治療能力

抄録 No	表面処 理の評 価	疾病 名称	技術	治癒性
MED 6	△	coronary artery disease	Surface modificaiion of ECC vs. standard PVC control	We could not show significant differences of protein S100 and neuron-specific enolase (NSE) levels between SMAR(X)T patients and the controls, but the incidence of neurological complications was exceptionally low.
14	○	coronary artery disease	surface modifying additives circuit (SMA) vs. standard circuit	SMA group had small decrease in plateletcount(SMA vs control:165 +/-9 vs 137+/-8;p<0.01), reduction in beta-thromboglobulin plasma levels, 50% less fresh frozen plasma and platelet units were administered(p<0.01)

18	○	coronary artery disease	a new polymer-coated CPB vs. uncoated circuit	the PMEA had lower levels of plasma bradyinin and percentages of CD35-positive monocytes and lower amounts of adsorbed proteins(0.30 vs 3.42 microg/cm <sup>2</sup> ), almost no IgG,IgM, C3c/d (clearly detected on the uncoated circuits)
25	○	coronary artery disease	silicone-coated oxygenator vs. heparin-coated circuit, untreated circuit	all proinflammatory markers were significantly lower in groupA (silicone coated) and B than C,especially C5b-9 and PMN-E concentrations(group A was lower than group B).
54	○	coronary artery disease	treated with surface-modifying additive vs. circuit without treatment	After CPB, platelet deposition on the CPB circuit was significantly less(p<0.05) in the SMA. Complement activation identified by C3a and terminal complex C5b-9 did not differ between the two groups, but C4a generation was less in the SMA(p<0.05).

○：対比療法に対し効果を認めた △：有意な差を認めない ×：対比療法より治癒成績が悪かった -：判断できない

(3) 安全性・信頼性

(4) 患者 QOL

(5) コストベネフィット

特に記述がなかった。

### C. ポンプに関する試験について

ポンプに関する試験については 9 件の論文があったが、全て centrifugal pump と roller pump とを比較したものであった。

(1) 技術適用疾病

coronary artery disease に関するものであった。

(2) 診断・治療能力

centrifugal pump と roller pump の比較については、1 件が CTD を減少させて輸液の必要条件を減少させるとして centrifugal pump の効果を認めているが、6 件は有為な差を認めず、2 件は elastase level 等が centrifugal pump の方が高いとしている。

抄録 No	centrifugal pump の評価	疾病名称	技術	治癒性
MED 5	△	coronary artery disease	centrifugal pump vs. roller pump	no significant difference in chest tube drainage volume(C vs R 1300+/-92 vs 1117+/-83ml p=0.14). allogeneic blood was given to C:23%, R:18% (p=0.63), the reduction in hemoglobin and platelet levels postCPB were to a similar extent in both groups

8	○		centrifugal pump vs. roller pump	The only significant predictor of decreased CTD was the use of a centrifugal pump.
36	△	coronary artery disease	centrifugal pump vs. roller pump	the centrifugal pump group releaved a lower tissue factor (TF) release compared with the roller group [5661 (696-10359) vs 12681 (6383-17538) micro × min/l; median (lower -upper quartiles):P=0.009]. In contraast , TAT and F1+2 formation did not differ between the groups,
38	×	coronary artery disease	centrifugal pump vs. roller pump	Release of SC5b-9 after stopping CPB and after protamine administration was higher in the CFP group(p=0.01 and p=0.004). Elastase level was higher after stopping CPB in the CFP group(p=0.006). Multivariate analysis confirmed fiffrences between roller pump and CFP group in complement and neutrophil activation.IL-8 levels were higher in CFP group 2 hours after starting CPB(p=0.002)
46	△	coronary artery disease	centrifugal pump vs. roller pump	Postoperative serum S10beta levels were significantly higher in both groups than preoperative levels. There was no difference in C100beta levels between the groups at any of the time points.
48	△	coronary artery disease	centrifugal pump with or without heparin-coating vs. roller pump	groupA and B did not differ in leukocyte counts and the difference between group B and C were restricted to single time points
55	×	coronary artery disease	centrifugal vortex pumps vs. roller pump	The release of IL-6 was significantly greater in the centrifugal group(p<0.05), whereas IL-8 concentration did not differ through out the study period. PLasma terminal complement, neutrophil counts, and elastase release were significantly higher in the centrifugal group(p<0.05).
57	△	coronary artery disease	centrifugal pump with or without heparin-coating vs. roller pump	None of the tested CPB systems did affect platelet count. The percentage of GMP-140-positive platelets increased slightly early during CPB, whereas it decreased significantly postoperatively; group differences were observed between B and C after protamin administration.
59	△	coronary artery disease	centrifugal pump vs. standard twin roller	Il-6 in both groups reached its peak leels at 2hours postprotamine(centrifugal vs roller; 208([98 to 411]pg/mL vs 205[60 to 327]pg/mL), before coming back to baseline at 24 hours. Plasma leukocyte elastase and Il-8 reached their maximum level 15 min. after protamine administration(centrifugal vs roler; 215(64 to 375)pg/mL vs 235(87 to 410)pg/mL, 700(90 to 5925)ng/mL vs 362(120 to 3400)ng/mL)

○ : 対比療法に対し効果を認めた △ : 有意な差を認めない × : 対比療法より治癒成績

が悪かった - : 判断できない

- (3) 安全性・信頼性
  - (4) 患者 QOL
  - (5) コストベネフィット
- 特に記述がなかった。

#### D. フィルタの試験について

フィルタについての試験は、9 件あり、うち leukocyte filtration は 7 件で、ultrafiltration が 2 件であった。

##### (1) 技術適用疾病

疾病名称は coronary artery disease と unstable angina, unstable angina with impaired left ventricular function であった。

##### (2) 診断・治療能力

leukocyte filtration の 7 件は、効果を認めたもの 5 件、有意差無しとしたもの 2 件であった。Ultrafiltration の 2 件は、効果を認めるものと認めないものが 1 件づつと分かれた。

抄録 No	filtration の評価	疾病名称	技術	治癒性
MED 10	○	Coronary artery disease	leukocyte filtration (+) vs. (-)	leukocyte filtration during reperfusion may further improve CPB by reducing myocardial damage.
11	○	Adult cardiac disease	modified ultrafiltration (+) vs. (-)	MUF group; haematocrit increase from 21.2±2.0% to 24.9±3.3%(p=0.0008), systolic blood pressure increased from 97.5±16.7mmHg to 116.5±23.9mmHg(p=0.0024), serum IL-8 reduced from 69.5±33.5 to 58.9±32.4pg/ml(p=0.0029) control group; no changes in haematocrit, blood pressure, serum IL-8
39	△	Coronary artery disease	leukocyte-specific arterial line filter vs. standard arterial line filter	White cell count, differential white cell count, malondialdehyde and C-reactive protein were not significantly different between the two groups. Plasma elastase concentration were significantly (P<=0.03) higher during and immediately after extracorporeal circulation in LG-6 (leukocyte) group.
41	△	Coronary artery disease	leukocyte filtration in the venous bypass circulation	Circulating leukocytes were reduced by 38% in the depletion group compared with the control group at the moment of cross-clamp

			vs. no leukocyte filtration	release ( $4.3 \times 10^9/L$ vs $6.8 \times 10^9/L$ , $p < 0.05$ ). Clinically there was no difference between in postoperative Pao <sub>2</sub> or pulmonary hemodynamics
45	○	Unstable angina	leukocyte filtration vs. standard arterial line filter	Preliminary results show little change in the total leukocyte count but the Troponin T and CPK/MB values were lower in the filtered group than in the control group and an increased level of total Glutathione in the filter group showed that there was less oxidated stress on the myocardium.
51	○		leucocyte-depleting blood cardioplegia vs. without the filter	The total leucocyte reduction rate through the filter was 98.1% with the passage of 2 liters of blood through the filter.
67	△	Coronary artery disease	COBE 1200 ultra-filtration vs. not using ultrafiltration	the mean 24hours postoperative blood loss (groupA vs B: $440 \pm 192ml$ vs $451 \pm 136ml$ ), the average bank blood transefusion(groupA vs B: $0.6 \pm 1.3$ units per patients vs $0.75 \pm 1.5$ )
77	○	unstable angina with impaired left ventricular function	PALL medical leukocyte filter vs. no filter	Preliminary results show little change in the total leukocyte count but the Troponin T and CPK/MB values were lower in the filtered group than in the control group and an increased level of total Glutathione in the filter group showed that there was less oxidated stress on the myocardium.
79	○		Luekocyte filter vs. no filter	Leukocyte depletion removed more than 97% of leukocytes from the retransfused blood ( $p < 0.01$ ) and significantly reduced circulating leukocytes ( $p < 0.05$ ) and granulocytes ( $p < 0.05$ ) compared with the control group.

○：対比療法に対し効果を認めた △：有意な差を認めない ×：対比療法より治癒成績が悪かった -：判断できない

(3) 安全性・信頼性

(4) 患者 QOL

特に記述がなかった。

(5) コストベネフィット

COBE 1200 ultra -filtration についての 1 件があったが、コスト上も ultra -filtration の効果が認められなかった。

抄録 No	filtration の評価	疾病名称	技術	コスト
MED	△	Coronary artery	COBE 1200 ultra -filtration vs. not	average of overall patient charges (groupA vs B: $\$33,796 \pm 8348$ per patient vs

67		disease	using ultrafiltration	\$33,041+/-7674)
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○：対比療法に対し効果を認めた △：有意な差を認めない ×：対比療法より治癒成績が悪かった -：判断できない

#### E. 機器の比較試験について

機器の比較試験については4件行われた。なお、EBM 指標分類には7件があるが、2件は

A. Heparin-coated extracorporeal circuit について で取り上げ (MED-12, 47)、1件は ECMO と重複しているため本項では除外している。

抄録 No	機器分類	試験機器	結果
MED 9	hollow fiber oxygenator, venous reservoir	three hollow fiber oxygenators with different surface area and priming volume	Group1 (:1.8 m <sup>2</sup> and 220 ml) Smallest surface area, Lowest priming volume, Highest oxygen transfer rate/m <sup>2</sup> , Least blood damage Group2 (2.2 m <sup>2</sup> and 290 ml): Highest blood activation Group3 (2.5 m <sup>2</sup> and 270 ml): Lowest oxygen transfer rate /m <sup>2</sup> , Most elevation of oxygen partial pressure, Most reduction of Carbon dioxide
15	hollow fibre membrane oxygenator	Quantum HF-6700 vs. William Harvey HF-5700	No significant differences between the two groups were found in oxygen transfer, haemolysis (plasma haptoglobin levels) or platelet function (a novel platelet activating factor (PAF)-induced platelet activation test) at any of the time points during CPB.
52	a new generation hollow-fibre membrane oxygenator	Spiral Gold vs. Univox Gold	during CPB, the Spiral had a significantly lower pressure drop(26.9+/-8.2 vs 46.7+/-16.2 mmHg,p<0.001). The Spiral had significantly lower plasma free haemoglobin levels during all time periods of CPB. Heat exchange coefficients were higher during the rewarming period in the Spiral(0.59+/-0.28 vs 0.36+/-0.19,p=0.06)
64	polypropylene fiber membrane oxygenator with a conventional single pulsatile/nonpulsatile blood pump vs. double pump system	Capiox E vs. Maxima and the Ultrox membrane oxygenators using a double pump system	Net fluid input: CapioxE vs Ultrox vs Maxima: 2932+/-562ml vs 3646+/-531ml vs 3593+/-582ml The values of the plasma free Hb: Maxima/PP:80, /NP:50, Ultrox/PP:62, /NP:48, Capiox/PP:55, /NP:48 mg/dl The FiO <sub>2</sub> : Capiox E/PP, /NP vs Maxima/PP, /NP vs Ultrox/PP, NP: 80, 50 vs 62, 48 vs 55, 48 mg/dl

#### F. その他

新しい triblock-copolymer 使用の心肺バイパス回路の試験 (結果良し)、ローラーポンプレス CPB に血液学的な効果ありとするもの、ハイポサーミア併用時の脳血流から見てポ

ンプフローレートは低いことが望ましいといった報告があった。一方、脈動的灌流、小児への aprotinin、膜式と泡式酸素加装置の比較は有意差無しとのことであった。

抄録 No	評価	疾病名称	技術	治癒性
MED 40	○	coronary artery disease	CPB circuit prepared with a triblock-copolymer vs. standard circuit	There was a progressive increase in thrombin generation only in the control group during bypass. The test surface decreased the release of tissue plasminogen activator and plasmin-alpha2-antiplasmin complex formation (p<0.006). There was an increased platelet count and a decreased platelet activation in the test group (p=0.017)
63	○	coronary artery disease	roller pumpless CPB system vs. conventional roller pump CPB	Totally roller pumpless CPB reduces hemolysis, showing lower plasma free hemoglobin levels (81.8 +/- 25.0 versus 42.0 +/- 16.3 at 30 min after CPB initiation, p < 0.05), higher plasma haptoglobin levels (37.8 +/- 36.6 versus 77.2 +/- 31.3 at 120 min after CPB, p < 0.05), and lower blood lactate dehydrogenase (LDH) levels (1391 +/- 497 versus 972 +/- 187, p < 0.01) than those of CPB with a roller pump suction with no significant difference between platelet counts
65	△	coronary artery disease	pulsatile perfusion vs. nonpulsatile perfusion	There were, however, no statistically significant differences between the PP and NP groups in the aortic-to-radial-artery gradient after CPB for either SBP, DBP, or MAP.
66	○ 1.2 L/min/m2	coronary artery disease	CPB flow rates of 2.3 L/min/m2 vs. 1.2 L/min/m2	in the context of an unchanged mean arterial pressure, the pump flow did not affect cerebral blood flow or metabolic rate during hypothermic CPB. Systemic venous oxygen saturation was also maintained during reduced flow at 27 degrees C.
82	△	heart disease	low-dose aprotinin vs. no aprotinin	In all children, significant C3 conversion and C5a generation, interleukin-6 synthesis, and myeloperoxidase, eosinophil cationic protein, and histamine liberation occurred in relation to cardiopulmonary bypass. This was not influenced by aprotinin treatment.
86	△		membrane oxygenator vs. bubble oxygenator	Thromboxane levels showed no significant changes. For all markers measured, there were no significant differences between the groups other than those already indicated.

○：対比療法に対し効果を認めた △：有意な差を認めない ×：対比療法より治癒成績が悪かった ・：判断できない

5 - 3 - 1 0 Minimally Invasive Cardiac Surgery

MEDLINE 4 件の論文がある。

(1) 技術摘要疾病

coronary artery disease に対し off-pump CABG 及び minimally invasive saphenous vein harvesting with an endoscopic approach、 single valve disease に対する minimally invasive cardiac surgery、 mitral valve operation における cryoablation therapy の適用であった。

(2) 診断・治療能力

off-pump CABG を on-pump CABG と比較して安全で同様の治癒結果を得た、側面ミニ開胸術後の痛みを減らすための寒冷剥離 cryoablation は有効であった、低侵襲の伏在静脈採取の手術による血腫は endogroup 8.7%、opengroup 27.6%と有意差が出た、という肯定的な報告が3件あった。しかし、single valve disease において従来の手術と比較してストレスを全身炎症性の反応症候群 (SIRS) で評価したが有意差が無く、傷の大きさだけが減ったとする報告もあった。

抄録 No	MICS の評価	疾病 名称	技術	治癒性, 影響性
MED 1	○	coronary artery disease	off-pump CABG vs. on-pump CABG	the mean number of distal anastomoses per patient:off-pump 2.4(SD1.0),on-pump 2.6(SD1.1), completeness of revascularization was similar in both groups, needs of blood products:off-pump3%, on-pump13%(P<0.01), release of creatine kinase muscle-brain isoenzyme:41%less in the off-pump(P<0.01), no diference in postoperation complications
2	△	single valve disease	minimally invasive cardiac surgery vs. conventional cardiac surgery	There were no significant differences in the operating times, perfusion times, or aorta clamp times between the two groups; and the mean volume of blood transfusion did not differ significantly either. There was no significant difference in the incidence of SIRS or the mean duration of SIRS between the two groups. The CRP levels did not differ significantly between the two groups.
3	○	mitral valve operation , direct coronary artery bypass	cryoablation therapy vs. intercostal application of local anesthetic agents.	Overall pain levels were significantly lower in the cryo group than in the control group (p &lt; 0.0001, GLM). According to diagnoses, pain levels were significantly lower after MIDCABG and cryo versus control; after mitral valve operation they were lower in the cryo group and almost reached significance.



		grafting		
4	○	coronary disease	minimally invasive saphenous vein harvesting with an endoscopic approach vs. conventional open technique	Relevant hematoma were found in 29 patients (27.6%) of the opengroup, whereas only nine patients (8.7%) of the endogroup revealed severe hematoma. Infection was apparent in nine patients (8.5%) after conventional vein harvesting. Two infections were found after endoscopic intervention

○：対比療法に対し効果を認めた △：有意な差を認めない ×：対比療法より治癒成績が悪かった -：判断できない

(3) 安全性・信頼性

(4) 患者QOL

(5) コストベネフィット

特に記載が無かった。

5-3-11 Multidetector CT

MEDLINE 1 件の要点を以下に記す。

(1) 技術摘要疾病

multidetector helical CT と super-high-flow venous injection による上腹部動脈の可視化についての試験である。

(2) 診断・治療能力

大動脈の96%以上、小動脈の79%以上が見える効果が得られた。

抄録 No	super-high-flow の評価	技術	診断性
MED 1	○	MDHCT, the super-high-flow injection method (Group A) vs. the conventional injection method (Group B)	In Group A, visualization of the large arteries, including the CE, SMA, HA and LGA, was possible at a rate exceeding 96%, and that of the small arteries, including the DPA, SPDA, RGA and Cyst A, was more than 79%.

○：対比療法に対し効果を認めた △：有意な差を認めない ×：対比療法より治癒成績が悪かった ・：判断できない

(3) 安全性・信頼性

(3) 患者QOL

(4) コストベネフィット

特に記載が無かった。

### 5-3-1.2 Pacemaker

Randomized Controlled Trial を条件に 1996 年以降発行された論文、MEDLINE 109 件、ACP-Journal Club 4 件、CCTR 8 件 (MEDLINE との重複を除く)、計 121 件の論文の要点を記す。

論文を技術適要疾病について大別すると A、atrial, ventricular and dual pacing について記述されたものが 36 件、B、pacing mode についてが 33 件、C、pacing therapies についてが 13 件、D、pacemaker 機器についてが 23 件、E、その他薬剤 (併用) 効果や特殊な条件、状況下の臨床評価が 16 件である。

#### A、atrial, ventricular and dual pacing (36 件)

##### (1) 技術摘要疾病

論文の内訳は、sick-sinus syndrome、hypertrophic obstructive cardiomyopathy、thromboembolism、symptomatic SSS、atrioventricular delays、thromboembolism、sinus bradycardia、paroxysmal AF refractory、atrial fibrillation、atrial flutter、Brady-Tachy Syndrome、paroxysmal atrial fibrillation、atrial arrhythmias、vasovagal、carotid sinus hypersensitivity に代表される 15 疾病名について、atrial pacing が 16 件、ventricular pacing が 8 件、両者を比較評価したものが 5 件、dual chamber pacing が 7 件である。atrial pacing は (paroxysmal) atrial fibrillation、sinus bradycardia、atrial arrhythmias に有効で、bilateral pacing や dual site atrial pacing といった新しい手法も使われているが、まだ評価は高くない。また sick-sinus syndrome に対して ventricular pacing と比較評価した 5 件についても全て atrial pacing が高い評価を得ており、congestive heart failure の発生や利尿剤消費についても評価が高い。Dual chamber pacing は hypertrophic cardiomyopathy や sick-sinus syndrome に有効で、抗不整脈利点もあり、失神や転倒を伴う carotid sinus hypersensitivity、recurrent vasovagal syncope に対しても臨床評価が高い。

##### (2) 診断・治療能力

早期診断については carotid sinus syndrome の pacing mode を cardiovascular tests で予測する試みが 1 件報告されているが、結果は良くない。

上述した sick-sinus syndrome に対して atrial pacing と ventricular pacing 比較した 5 件の内容を救命率と治癒性について表にまとめた。

文献	結果	疾病	対比技術	救命率	治癒性
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No		名称		(生存率·死亡率)	
MED 59	○	sick sinus syndrome	atrial pacing (n = 110) vs ventricular pacing (n = 115)		After 5.5 years follow-up, all-cause mortality, cardiovascular deaths, atrial fibrillation, thromboembolism, and heart failure were significantly less in the atrial group. AV block occurred in four patients in the atrial group
MED 80	○	sick sinus syndrome	atrial pacing vs ventricular pacing		ventricular pacing is associated with a higher incidence of congestive heart failure and consumption of diuretics than atrial pacing.
MED 83	○	sick sinus syndrome	atrial pacing vs ventricular pacing	At long-term follow-up, 39 patients from the atrial group had died versus 57 from the ventricular group (relative risk 0.66 [95% CI 0.44-0.99]; p=0.045). 19 patients from the atrial group and 39 patients from the ventricular group died from a cardiovascular cause (0.47 [0.27-0.82]; p=0.0065).	The cumulative incidences of atrial fibrillation and chronic atrial fibrillation were also significantly lower in the atrial group than in the ventricular group (0.54 [0.33-0.89], p=0.012 and 0.35 [0.16-0.76], p=0.004, respectively). Thromboembolic events occurred in 13 patients in the atrial group and 26 in the ventricular group (0.47 [0.24-0.92], p=0.023). Heart failure was less severe in the atrial group than in the ventricular group (p<0.05).
MED 109	○	sick sinus syndrome	atrial pacing vs ventricular pacing.	Twenty five patients died in the ventricular group compared with 21 in the atrial group (p = 0.74).	During follow-up, the frequency of atrial fibrillation was higher in the ventricular group. Thromboembolic events (stroke or peripheral arterial embolus) occurred in 20 patients in the ventricular group and in six patients in the atrial group (p = 0.008). The number of cases of heart failure did not differ between the two groups. Atrioventricular block occurred in two patients in the atrial group.
ACP-J 4	○	sick sinus syndrome	atrial pacing vs ventricular pacing	All-cause mortality were 35.5% (atrial pacing) and 49.6% (ventricular pacing), cardiovascular mortality were 17.3% and 33.9% respectively.	Analysis was by intention-to-treat. Compared with those who received ventricular pacing, patients who received atrial pacing had lower all-cause mortality (P = 0.05)†, lower cardiovascular mortality (P = 0.007)† (Table), and less severe heart failure (P < 0.05)†. Fewer patients who received atrial