VI Congresso nazionale di ecocardiochirurgia
Milano, 15-17 ottobre 2012

Le complicanze della complicanza: l'insufficienza multiorgano epato-renale, turbe della coagulazione, l'infezione

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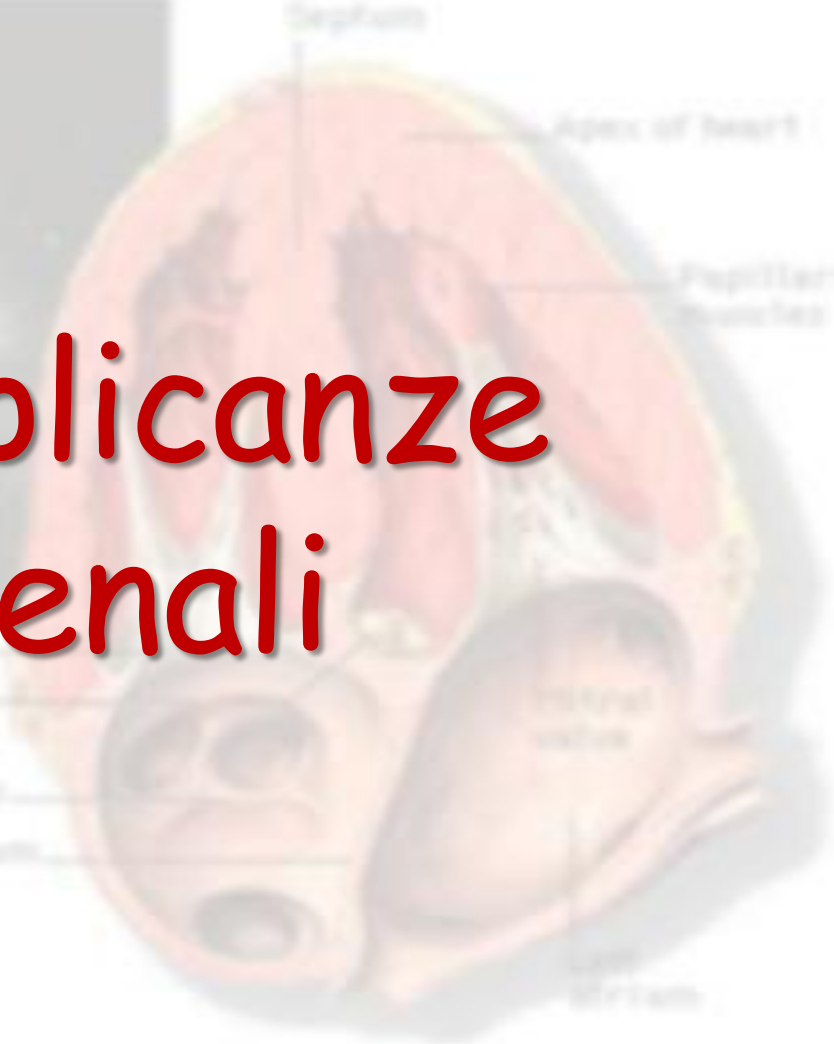
Complicanze post-cardiochirurgia:

- ✓ Renali
- ✓ Epatiche
- ✓ Coagulatorie
- ✓ Infettive



Complicanze renali

REVIEW

Acute Kidney Injury: A Relevant Complication After Cardiac Surgery

Giovanni Mariscalco, MD, PhD, Roberto Lorusso, MD, PhD, Carmelo Dominici, MD, Attilio Renzulli, MD, PhD, and Andrea Sala, MD

Department of Surgical Sciences, Cardiac Surgery Unit, Varese University Hospital, University of Insubria, Varese; Cardiac Surgery Unit, Civic Hospital, Brescia; and Cardiac Surgery Unit, Magna Graecia, University of Catanzaro, Catanzaro, Italy

(Ann Thorac Surg 2011;92:1539–47)

- Incidenza di AKI (Acute Kidney Injury) molto variabile perché non esiste una definizione univoca
- 1-30% se definita in modo ampio, 1-6% se si considerano solo i pz. che necessitano di dialisi post-op.
- E' influenzata dal tipo di intervento:
  - ✓ CABG: 2-5%
  - ✓ Interventi valvolari o combinati: fino al 30%
  - ✓ Impianto di valvola aortica transcatetere: 10%
  - ✓ Dissezione aortica: 10-50%

Table 1. Classification Systems for Acute Kidney Injury

RIFLE Classification Criteria [20][a]

Class	GFR Criteria	Urinary Output Criteria
Risk	sCr increase × 1.5 or GFR decrease >25%	<0.5 mL/kg/h × 6 hours
Injury	sCr increase × 2.0 or GFR decrease >50%	<0.5 mL/kg/h × 12 hours
Failure	sCr increase × 3.0 or GFR decrease >75% or sCr ≥4 mg/dL with an acute rise >0.5 mg/dL	<0.3 mL/kg/h × 24 hours, or anuria × 12 hours
Loss	Persistent acute renal failure (complete loss of kidney function) >4 weeks	
End-stage renal disease	End-stage renal disease >3 months	

AKIN Classification Criteria [21][b]

Classes	sCr Criteria	Urinary Output Criteria
1	sCr increase × 1.5 or sCr increase >0.3 mg/dL from baseline	<0.5 mL/kg/h >6 hours
2	sCr increase × 2 from baseline	<0.5 mL/kg/h >12 hours
3[c]	sCr increase × 3 or sCr increase >4 mg/dL with an acute increase >0.5 mg/dL	<0.5 mL/kg/h >24 hours, or anuria × 12 hours

[a] When the baseline serum creatinine is not available, and there is no history of chronic kidney disease, creatinine is calculated assuming a glomerular filtration rate (GFR) of 75 mL · min^{-1} · 1.73 m^{-2}. [b] The Acute Kidney Injury Network (AKIN) classification is defined as an abrupt reduction in kidney function, requiring at least two creatinine values within 48 hours. [c] Patients receiving renal replacement therapy are classified as stage 3.

RIFLE = risk, injury, failure, loss of kidney function, and end-stage kidney disease; sCr = serum creatinine.

Patogenesi dell'AKI postoperatoria

E' la conseguenza dell'interazione tra diversi meccanismi patofisiologici, con i fattori correlati al paziente e il by-pass cardiopolmonare (CPB) come cause principali.

Fattori di rischio correlati al paziente

Table 2. Published Clinical Series With Reference to Acute Kidney Injury Requiring Dialysis and Acute Kidney Injury Incidence and Independent Predictors

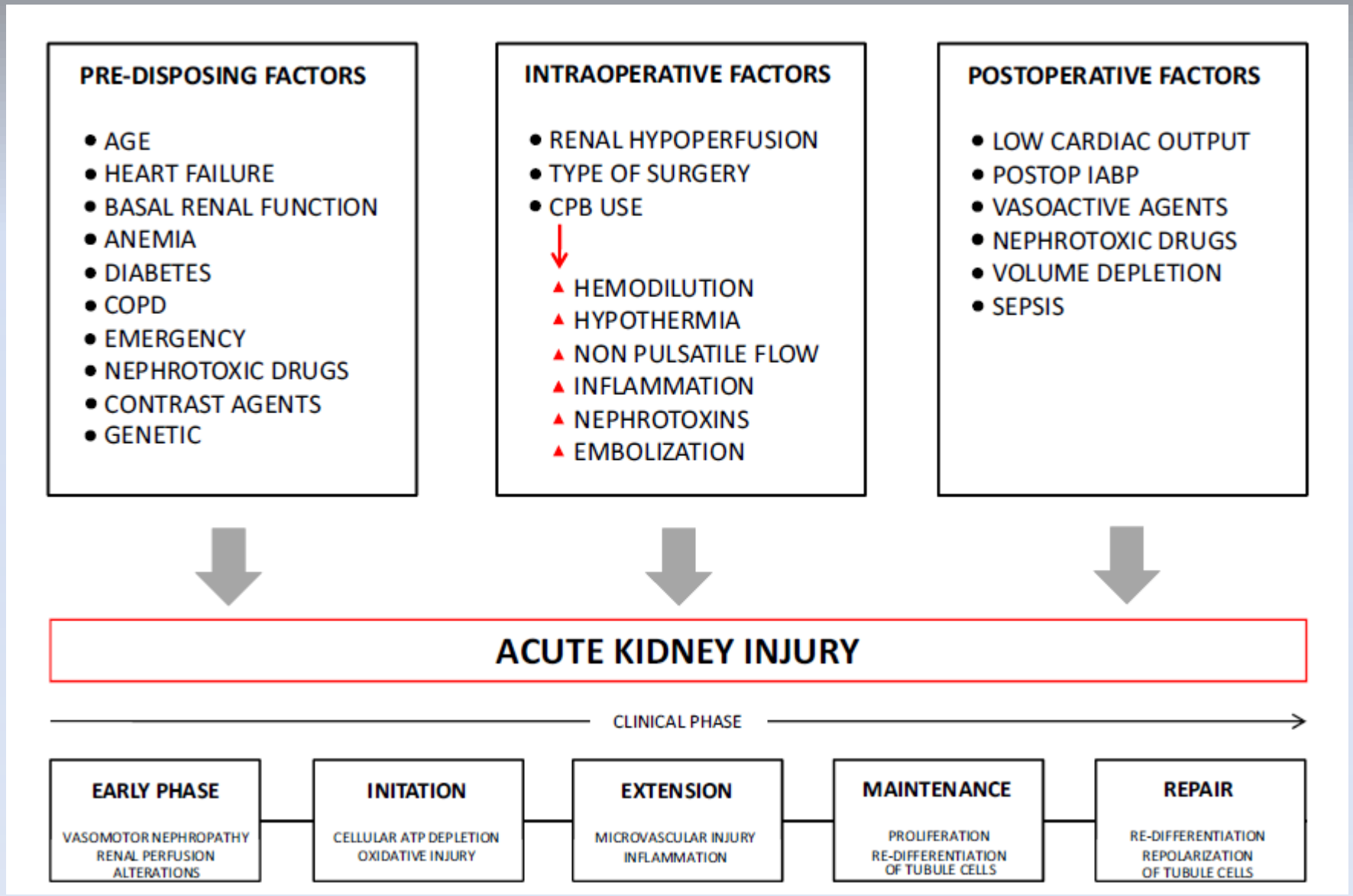
	First Author [Reference]					
	Mehta [6]	Chertow [1]	Thakar [2]	Wijeysundera [4]	Brown [7]	Palomba [8]
Year of study	2002–2004	1987–1994	1993–2002	1999–2005	2001–2005	n.a.
Number of patients	449,524	43,642	33,217[a]	20,131	8,363	603
Age, years	67 (58–74)	62 ± 9	n.a.	62 ± 12	n.a.	60 ± 13
Female, %	30.4	0.9	31.5	26	20	38
Elective surgery, %	53.6	74	n.a.	59	28	n.a.
Operation type, %						
CABG only	78.6	81.5	n.a.	65	100	53
Valve ± CABG	20.4	18.5	n.a.	35	—	47
Dialysis, n	6,451	460	269[b]	139[b]	31	11[b]
Overall, %	1.4	1.1	1.7[b]	1.3[b]	0.4	1.8[b]
CABG only, %	1.1	0.9	n.a.	n.a.	0.4	n.a.
Independent predictor for:	Dialysis	Dialysis	Dialysis	Dialysis	AKI	Dialysis
	Age	EF <35%	EF <35%	EF ≤40%	Age	Age >65 years
	Preop creat	Preop creat[c]	Preop creat	Preop eGFR	Female	Preop creat >1.2
	Diabetes	SBP	Diabetes[d]	Diabetes[d]	Diabetes	Diabetes
	Surgery type	Surgery type	Surgery type	Surgery type	PVD	Surgery type
	Shock	Preop IABP	Preop IABP	Preop IABP	Preop IABP	CPB time >120 m
	Prior AMI	Pulmonary rales	Emergency	Emergency	Hypertension	LCO
	NYHA class	NYHA class IV	NYHA class[e]	NYHA >II	NYHA class[e]	
	Reoperation	Reoperation	Reoperation	CVP >14 cm H_2O	Reoperation	
	Lung disease	COPD	COPD		WBC >12,000	
	Race	PVD	Female			
C-index for the model	0.83	0.76	0.81	0.81	0.72	0.84

Fattori di rischio correlati al CPB

Il CPB determina delle alterazioni inevitabili del flusso ematico renale causate da:

- ✓ Danno da ischemia-riperfusione
- ✓ Vasocostrizione renale
- ✓ Emodiluizione
- ✓ Perdita di flusso pulsatile
- ✓ Ipotermia
- ✓ Reazione infiammatoria sistemica
- ✓ Emolisi con rilascio di emoglobina libera
- ✓ Possibile micro-embolizzazione

Tutti questi fattori determinano un "inbalance" nel rapporto richiesta/apporto di O_2 con conseguente danno cellulare


PRE-DISPOSING FACTORS
AGE
HEART FAILURE
BASAL RENAL FUNCTION
ANEMIA
DIABETES
COPD
EMERGENCY
NEPHROTOXIC DRUGS
CONTRAST AGENTS
GENETIC
INTRAOPERATIVE FACTORS
RENAL HYPOPERFUSION
TYPE OF SURGERY
CPB USE
HEMODILUTION
HYPOTHERMIA
NON PULSATILE FLOW
INFLAMMATION
NEPHROTOXINS
EMBOLIZATION
POSTOPERATIVE FACTORS
LOW CARDIAC OUTPUT
POSTOP IABP
VASOACTIVE AGENTS
NEPHROTOXIC DRUGS
VOLUME DEPLETION
SEPSIS
ACUTE KIDNEY INJURY
CLINICAL PHASE
EARLY PHASE
VASOMOTOR NEPHROPATHY
RENAL PERFUSION
ALTERATIONS
INITATION
CELLULAR ATP DEPLETION
OXIDATIVE INJURY
EXTENSION
MICROVASCULAR INJURY
INFLAMMATION
MAINTENANCE
PROLIFERATION
RE-DIFFERENTIATION
OF TUBULE CELLS
REPAIR
RE-DIFFERENTIATION
REPOLARIZATION
OF TUBULE CELLS

Diagnosi di AKI

I biomarkers più comunemente utilizzati per definire la presenza di AKI si alterano molte ore dopo l'insorgenza del danno (urea e creatinina) o mancano di specificità (diuresi).

Due studi di coorte prospettici (ASSESS-AKI e TRIBE-AKI) sono attualmente in corso per valutare l'utilità di una serie di nuovi biomarkers (Cistatina C, NGAL, IL-6, IL -18, KIM-1, L-FABP, NAG) nell'identificazione precoce dell'insufficienza renale.

- **NGAL** (Neutrophil Gelatinase-Associated Lipocalin) è una proteina presente nel plasma in concentrazioni molto basse; nell'AKI associata a cardiochirurgia è stato dimostrato che la sua concentrazione aumenta molto precocemente (circa 2 ore dopo la chirurgia). Può essere dosata sia nel plasma che nelle urine.
- **Cistatina C** è una proteina prodotta da tutte le cellule nucleate. Essendo completamente riassorbita e non secreta a livello renale, potrebbe essere utilizzata per misurare il GFR (Glomerular Filtration Rate).
- **KIM-1** (Kidney Injury Molecule 1) è una proteina trans-membrana presente nel tubulo prossimale che è marcatamente up-regolata in presenza di ischemia acuta o esposizione a nefrotossine.

Available online at www.sciencedirect.com
SciVerse ScienceDirect

ELSEVIER

Renal dysfunction and CABG

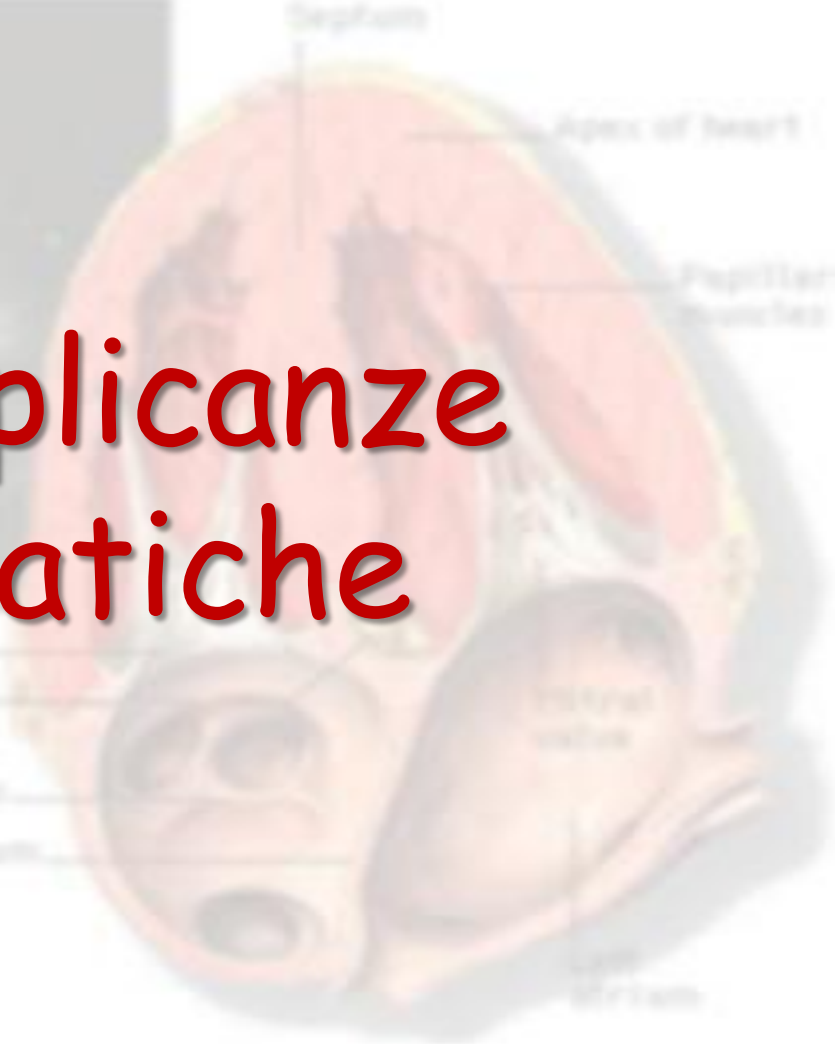
Anthony MH Ho and Simon KC Chan

Current Opinion in Pharmacology 2012, 12:181–188

Numerosi interventi sono stati proposti nel tentativo di prevenire l'AKI post cardiochirurgia; purtroppo al momento nessuno di questi si è dimostrato assolutamente efficace.

- ✓ Correzione dell'anemia preoperatoria e limitazione del numero di trasfusioni
- ✓ Fenoldopam
- ✓ Off-pump CABG
- ✓ Nesiritide
- ✓ Leucodeplezione intraoperatoria
- ✓ Precondizionamento ischemico
- ✓ Anestetici volatili
- ✓ Antagonisti dei recettori dell'Endotelina-1

Complicanze epatiche



REVIEW ARTICLE

Liver Abnormalities in Cardiac Diseases and Heart Failure

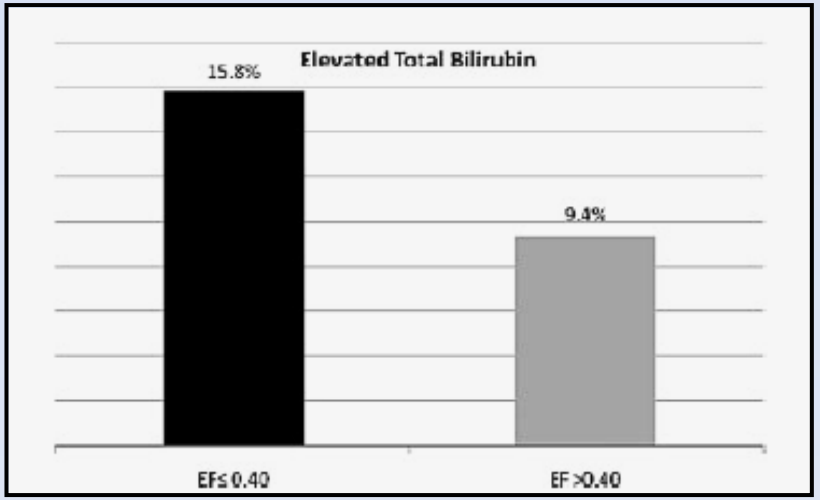
Alicia M. Alvarez, M.D.[1] and Debabrata Mukherjee, M.D., F.A.C.C.[1]

Int J Angiol 2011;20:135–142.

Le due principali cause di danno epatico in corso di patologia cardiaca e nel periodo postoperatorio sono l'aumento delle pressioni di riempimento (PVC) e la bassa portata.

Table 1 Key Laboratory Abnormalities Encountered in Patients with HF Based on the Primary Mechanism

Laboratory Parameter	Elevated Filling Pressure	Low Cardiac Output
AST	-/↑	↑↑
ALT	-/↑	↑/↑↑
Bilirubin	-/↑	↑/↑↑
GGT	↑↑	-/↑
ALP	↑/↑↑	-/↑
LDH	↑/↑↑	-/↑↑



Gen Thorac Cardiovasc Surg (2009) 57:357–362
DOI 10.1007/s11748-008-0387-8

ORIGINAL ARTICLE

Prediction of postoperative hepatic dysfunction after cardiac surgery in patients with chronic congestive heart failure

Hiroyuki Nishi, MD · Toshiki Takahashi, MD
Hajime Ichikawa, MD · Goro Matsumiya, MD
Hikaru Matsuda, MD · Yoshiki Sawa, MD

Table 4 Comparison between survivors and nonsurvivors

Parameter	Survivors ($n = 55$)	Nonsurvivors ($n = 8$)	P
Preoperative T-bil (mg/dl)	1.0 ± 0.7	1.4 ± 0.9	0.2207
Preoperative Alb (mg/dl)	3.8 ± 0.4	3.4 ± 0.5	0.0353
Preoperative ChE (IU/l)	2979 ± 930	1873 ± 559	0.0018
AST	20 ± 9	22 ± 10	0.5554
ALT	16 ± 8	17 ± 8	0.7970
Preoperative ICGR15	18 ± 12	19 ± 14	0.7623
Prothrombin time (international ratio)	1.37 ± 0.32	1.48 ± 0.36	0.3795
Child-Pugh classification			0.0797
Grade A	49	5	
Grade B	6	3	
Child-Pugh score	5.6 ± 0.8	6.4 ± 1.2	0.0203

Severe Ischemic Early Liver Injury After Cardiac Surgery

Jai S. Raman, FRACS, Kazuhiro Kochi, MD, Hiroshi Morimatsu, MD, Brian Buxton, FRACS, and Rinaldo Bellomo, MD

Departments of Cardiac Surgery, and Intensive Care and Medicine, University of Melbourne, Austin and Repatriation Medical Centre, Melbourne, Victoria, Australia

(Ann Thorac Surg 2002;74:1601–6)

- Obiettivo: identificare i fattori di rischio e la mortalità associati alla SIELI (Severe Ischemic Early Liver Injury)
- 3 gruppi:
  - Gruppo I: pz. con ALT> 500 UI/L nel periodo postoperatorio
  - Gruppo II: controlli
  - Gruppo III: pz. con AKI/shock postoperatori ma non aumento ALT

Table 2. Hemodynamic Features of Affected Subjects and Controls[a]

	SIELI (I)	Controls (II)	ARF/Shock (III)	*p* Value
Lowest cardiac index (L/min/m^2)	1.86 ± 0.28	2.35 ± 0.46	2.20 ± 0.62	*0.0035; †NS ‡NS
Highest PAOP (mm Hg)	19.1 ± 3.8	15.1 ± 4.7	22.5 ± 5.87	*0.019 †NS ‡0.01
Highest RAP (mm Hg)	16.6 ± 5.7	12.8 ± 0.3	17.1 ± 3.9	*0.009 †NS ‡0.007
Mean radial arterial pressure (mm Hg)	80.1 ± 15.7	80.2 ± 13.4	72.8 ± 9.3	*NS †NS ‡NS
Peak norepinephrine dose (μg/min)	25.4 ± 22.4	4.95 ± 10.2	34.8 ± 36.4	*0.0004 †NS ‡0.0003
Peak milrinone (μg/kg/min)	0.356 ± 0.290	0.163 ± 0.294	0.352 ± 0.156	*0.005 †NS ‡0.005

Turbe della coagulazione

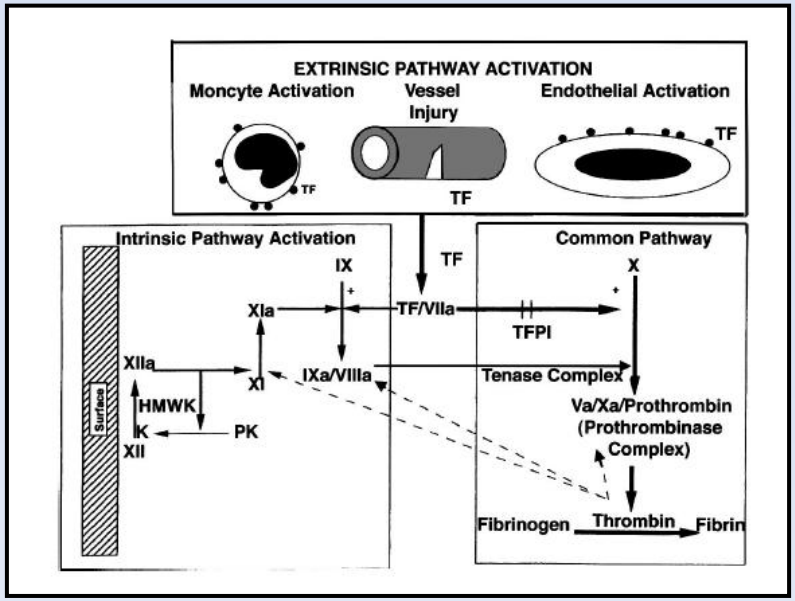
Cardiopulmonary Bypass-Associated Coagulopathies and Prophylactic Therapy

Andrew Maslow, MD
Carl Schwartz, MD

Int Anesthesiol Clin. 2004 Summer; 42(3): 103-33

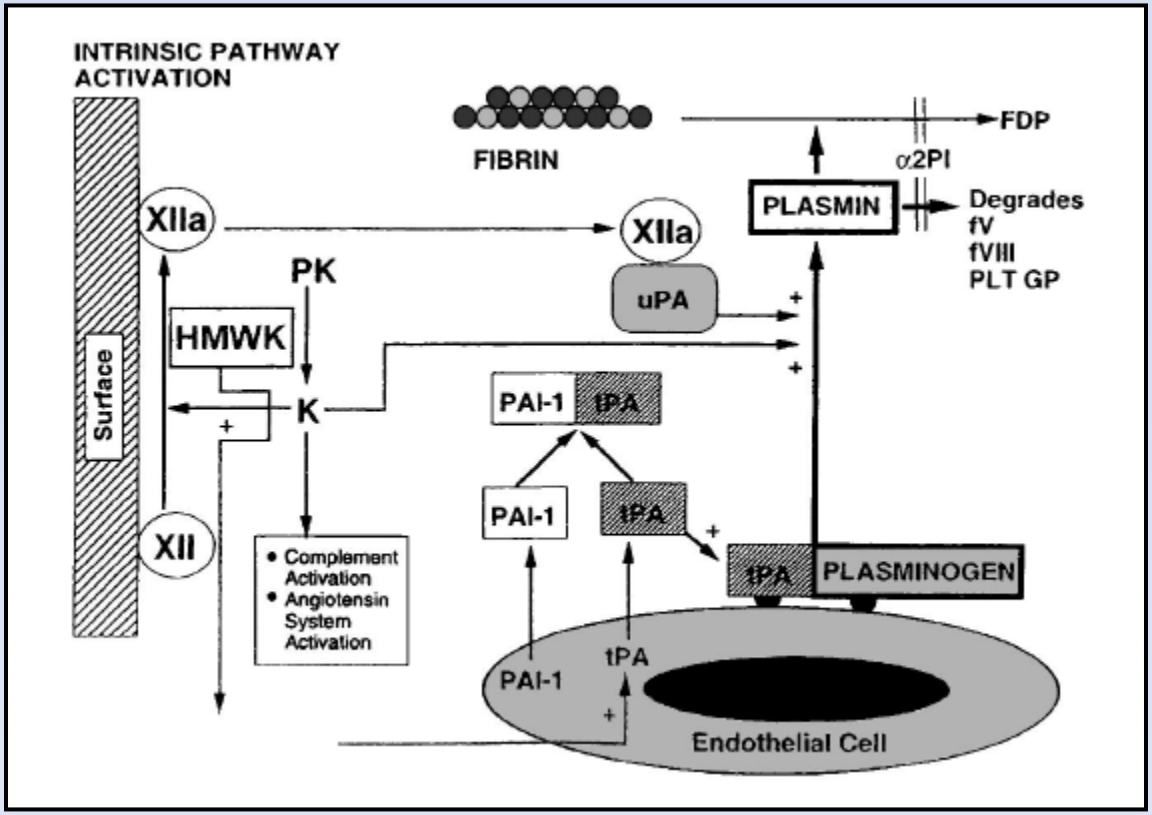
CPB: attivazione del sistema emostatico e della cascata infiammatoria

Consumo dei fattori della coagulazione e delle piastrine, attivazione del sistema fibrinolitico



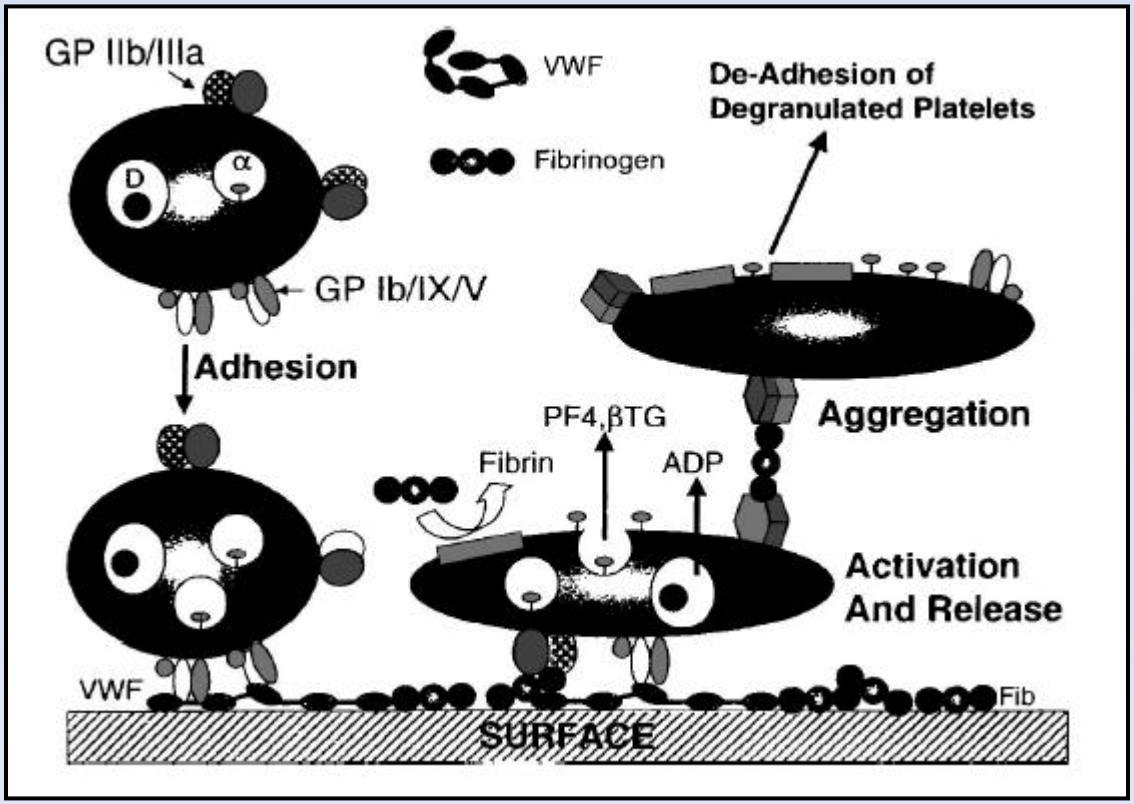
Attivazione della fibrinolisi

La presenza di coagulazione microvascolare diffusa e la produzione di trombina durante CPB portano all'attivazione della fibrinolisi con aumentata produzione e conversione di plasminogeno in plasmina.
La fibrinolisi risulta anche dall'attivazione delle cellule endoteliali con rilascio di tPA.



Piastrine e CPB

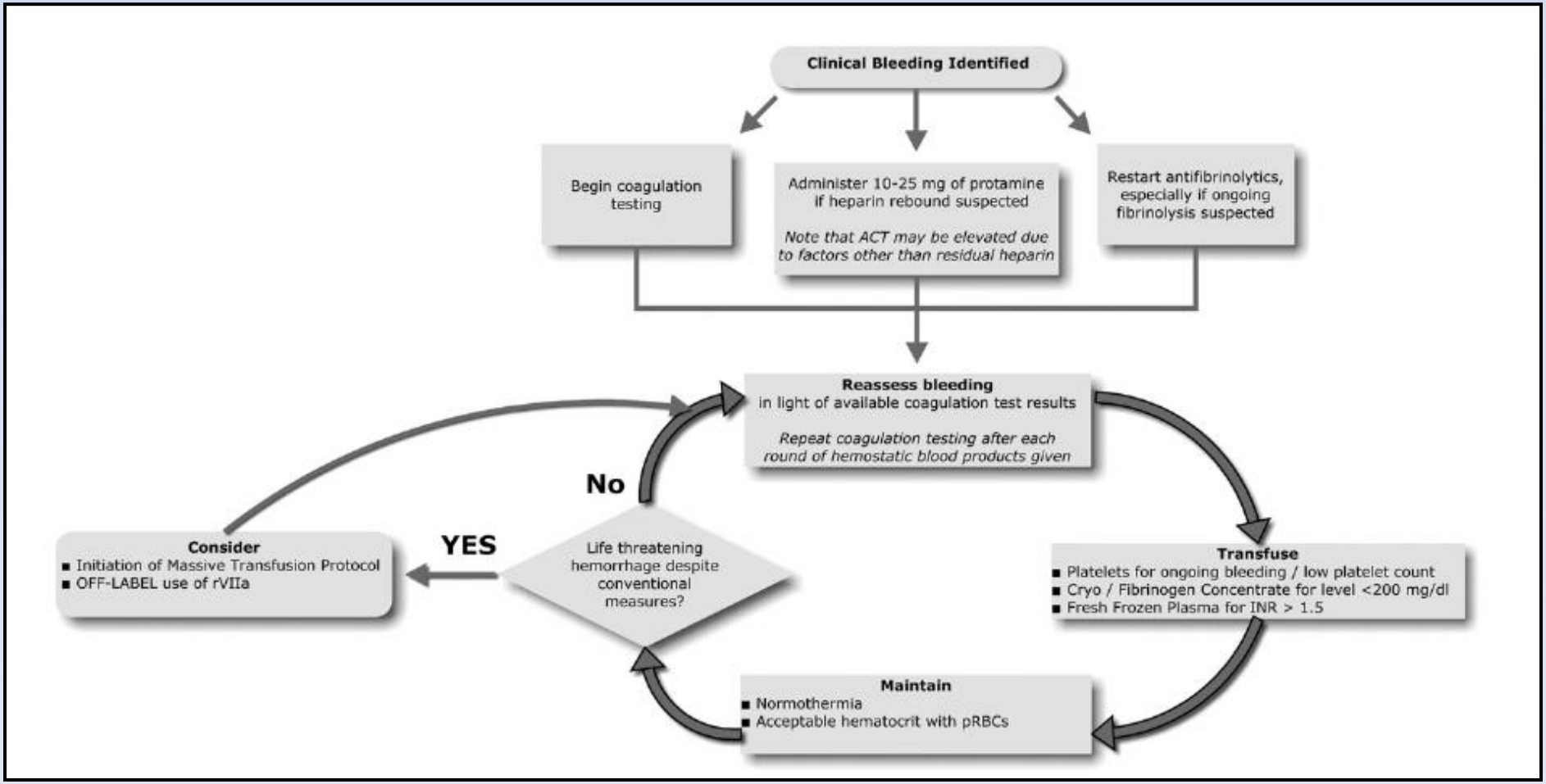
Il CPB altera sia il numero che la funzionalità delle piastrine. La disfunzione piastrinica è causata principalmente dal contatto con le superfici del circuito extracorporeo con conseguente attivazione, adesione e consumo.



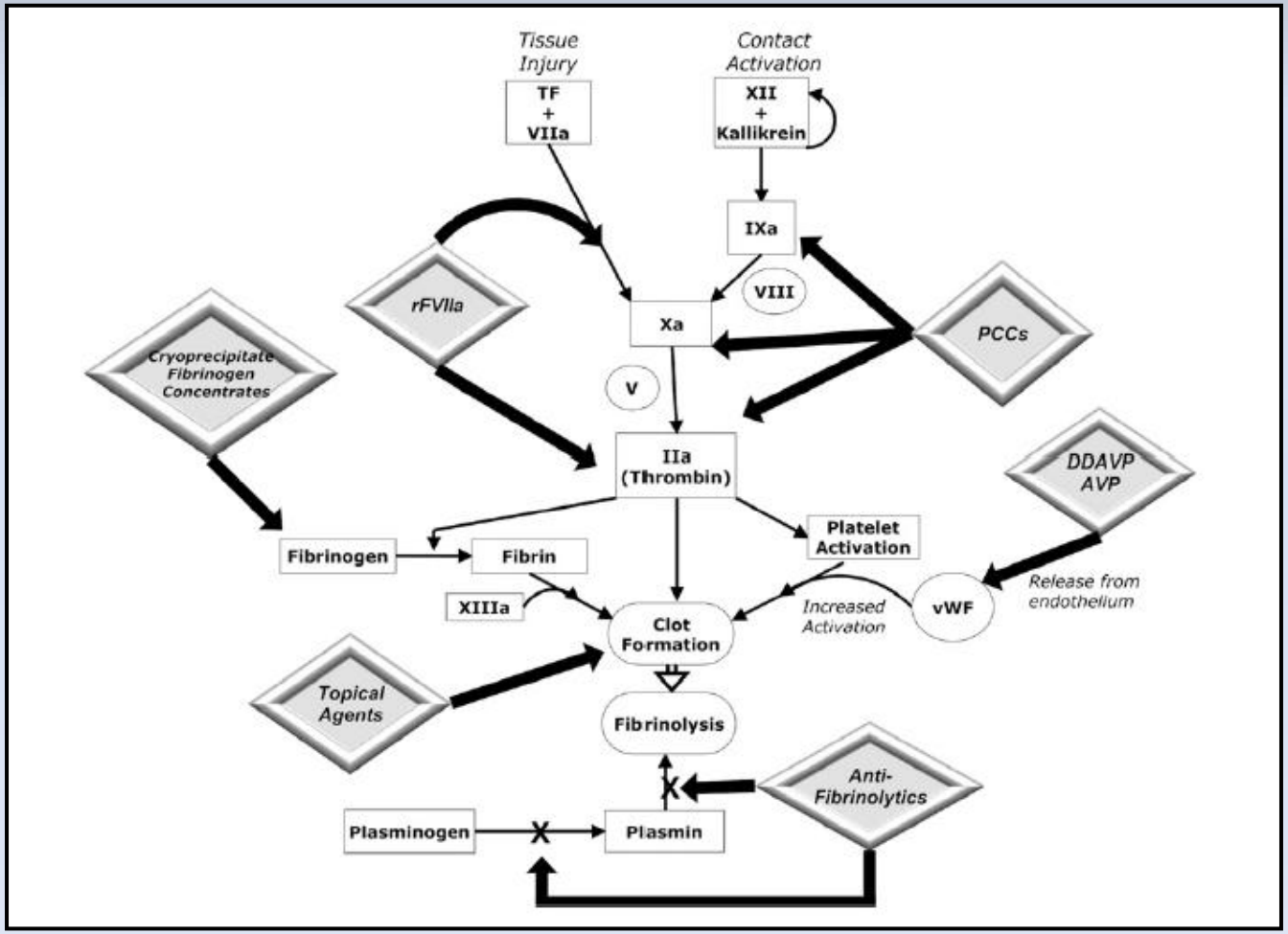
Bleeding and management of coagulopathy

Roman M. Sniecinski, MD, and Jerrold H. Levy, MD, FAHA

J Thorac Cardiovasc Surg 2011;142:662-7



Trattamento del sanguinamento postoperatorio



Complicanze infettive

Epidemiology and outcome of major postoperative infections following cardiac surgery: Risk factors and impact of pathogen type

Luke F. Chen MBBS, MPH, CIC, FRACP [a,b,*], Jean Marie Arduino ScD [c], Shubin Sheng MS [d], Lawrence H. Muhlbaier PhD [d], Zeina A. Kanafani MD, MPH [e], Anthony D. Harris MD, MPH [f], Thomas G. Fraser MD [g], Keith Allen MD [h], G. Ralph Corey MD [a,d], Vance G. Fowler Jr MD, MHS [a,d]

American Journal of Infection Control xxx (2012) 1-6

Methods: The study cohort was drawn from the Society of Thoracic Surgeon National Cardiac Database and comprised adults who underwent cardiac surgery at 5 tertiary hospitals between 2000 and 2004. We studied the incidence, microbiology, and risk factors of MPI (bloodstream or chest wound infections within 30 days after surgery), as well as 30-day mortality. We used multivariate regression analyses to evaluate the risk of MPI and mortality.

Results: MPI was identified in 341 of 10,522 patients (3.2%)

Table 1
Risk factors and outcomes of MPI

Variable	Major infection (n = 341)	No major infection (n = 10,181)	Unadjusted OR (95% CI)	*P* value	aOR (95% CI)	*P* value
Risk factors						
Caucasian	278 (81.5)	8,930 (87.7)	0.6 (0.5-0.8)	.0007	0.73 (0.54-0.97)	.03
BMI, kg/m^{2*}						
≥30 and <40	120 (35.2)	3,267 (32.1)	1.3 (1.0-1.6)		1.31 (1.03-1.66)	.028
≥40	32 (9.4)	437 (4.3)	2.5 (1.7-3.7)		2.48 (1.66-3.71)	<.0001
Emergent surgery	15 (4.4)	210 (2.1)	2.2 (1.3-3.7)	.0034	1.99 (1.13-3.48)	.017
Diabetes	154 (45.2)	3,481 (34.2)	1.6 (1.3-2.0)	<.0001	1.25 (1.00-1.58)	.063
Renal failure	54 (15.8)	550 (5.4)	3.3 (2.4-4.5)	<.0001	2.25 (1.54-3.28)	<.0001
Chronic lung disease					0.73 (0.55-0.97)	.029
Cerebrovascular accident	49 (14.4)	807 (7.9)	2.0 (1.4-2.7)	<.0001	1.57 (1.14-2.17)	.006
Peripheral vascular disease	88 (25.8)	1,640 (16.1)	1.8 (1.4-2.3)	<.0001	1.47 (1.13-1.92)	.004
Immunosuppressive treatment	22 (6.5)	284 (2.8)	2.4 (1.5-3.8)	<.0001	1.97 (1.23-3.13)	.005
Previous CABG	41 (12.0)	747 (7.3)	1.7 (1.2-2.4)	.0012	1.72 (1.22-2.43)	.002
Congestive heart failure	108 (31.7)	2,094 (20.6)	1.8 (1.4-2.3)	<.0001	1.30 (1.01-1.67)	.043
NYHA class IV	121 (35.5)	2,702 (26.5)	1.5 (1.2-1.9)	.0002	1.38 (1.09-1.74)	.007
Outcomes						
30-day mortality, n (%)	29 (8.5)	227 (2.2)		<.0001		
Postoperative LOS, days, median	15.0	6.0		<.0001		

Baseline characteristics and outcomes of MPI by pathogen type

Variable	Any *S aureus* (n = 87)	Any gram-negative bacteria (no *S aureus* infection) (n = 83)	CoNS only (n = 92)	Other pathogens (n = 79)	*P* value
Risk factors, n (%)					
BMI, kg/m^2*					
≥30 and <40	32 (36.8)	32 (38.6)	35 (38.0)	21 (26.6)	<.0001
≥40	8 (9.2)	5 (6.0)	12 (13.0)	7 (8.9)	
Emergent procedure	3 (3.5)	5 (6.0)	7 (7.6)	0 (0.0)	.0002
Diabetes	42 (48.3)	35 (42.2)	44 (47.8)	33 (41.8)	.0008
Renal failure	13 (14.9)	19 (22.9)	14 (15.2)	8 (10.1)	<.0001
Cerebrovascular accident	12 (13.9)	14 (16.9)	13 (14.1)	10 (12.7)	.0007
Peripheral vascular disease	20 (23.0)	25 (30.1)	24 (26.1)	19 (24.1)	<.0001
Immunosuppressive treatment	2 (2.3)	10 (12.1)	5 (5.4)	5 (6.3)	<.0001
Previous CABG	9 (10.3)	16 (19.3)	12 (13.0)	4 (5.1)	.0001
Myocardial infarction	47 (54.0)	50 (60.2)	50 (54.4)	41 (51.9)	<.0001
Congestive heart failure	21 (24.1)	30 (36.1)	31 (33.7)	26 (32.9)	<.0001
NYHA class IV	28 (32.2)	34 (41.0)	31 (33.7)	28 (35.4)	.0040
30-day infection type (infected patients), n (%)					
SSI only	36 (41.4)	15 (18.1)	43 (46.7)	30 (38.0)	<.0001
BSI only	36 (41.4)	59 (71.1)	47 (51.1)	44 (55.7)	
SSI and BSI	15 (17.2)	9 (10.8)	2 (2.2)	5 (6.3)	
Outcomes					
30-day mortality, n (%)	10 (11.5)	10 (12.1)	3 (3.3)	6 (7.6)	<.0001
Postoperative LOS, days, median	11.0	22.0	14.0	13.0	<.0001

Frequency, characteristics, and predictors of microbiologically documented nosocomial infections after cardiac surgery

Argyris Michalopoulos [a,b,c,*], Stefanos Geroulanos [b], Evangelos S. Rosmarakis [c], Matthew E. Falagas [c,d]

European Journal of Cardio-thoracic Surgery 29 (2006) 456–460

after open heart surgery. **Results:** One hundred and seven of 2122 (5.0%) patients developed microbiologically documented nosocomial infection after open cardiac surgery. The majority of nosocomial infections were respiratory tract infections (45.7%) and central venous catheter-related infections (25.2%). All cause hospital mortality was 16.8% in patients with nosocomial infection and 3.5% in the control group ($p = 0.005$). Out of

Site of infection	*n* (%)
Respiratory tract infection	45 (42.0)
Central venous catheter-related infection	24 (22.4)
Wound infection	18 (16.8)
Endocarditis	8 (7.5)
Urinary tract infection	8 (7.5)
Respiratory tract infection and wound infection	1 (0.9)
Respiratory tract infection and central venous catheter-related infection	3 (2.8)

Variables	*p*	OR (95% CI)
History of immunosuppression	0.03	3.6 (1.2, 11.0)
More than five red blood cell units transfused during the first postoperative day	0.01	21.2 (11.9, 37.8)
Acute renal failure the first two postoperative days	0.0001	49.9 (22.4, 111.0)

Mortality Associated with Bloodstream Infection after Coronary Artery Bypass Surgery

Margaret A. Olsen,[1] Melissa Krauss,[1] Denis Agniel,[1,a] Mario Schootman,[2,4] Clare N. Gentry,[1] Yan Yan,[2,5] Ralph J. Damiano, Jr.,[3] and Victoria J. Fraser[1]

Clinical Infectious Diseases 2008; 46:1537–46

Results. Patients with BSI had a 4.2-fold increased risk of death (95% confidence interval [CI], 3.0–5.9) 2–90 days after coronary artery bypass surgery, compared with uninfected patients. The risk of death was higher among patients with BSI due to gram-negative bacteria (hazard ratio [HR], 6.8; 95% CI, 3.9–12.0) and BSI due to *Staphylococcus aureus* (HR, 7.2; 95% CI, 3.3–15.7) and lowest among patients with BSI caused by gram-positive bacteria other than *S. aureus* (HR, 2.2; 95% CI, 1.1–4.6). The risk of death was highest among patients who developed BSI but had the lowest likelihood of infection (HR, 10.0; 95% CI, 3.5–28.8) and was lowest among patients who developed BSI but had the highest likelihood of infection (HR, 2.3; 95% CI, 1.2–4.6).

Ventilator-associat ortant risk factor for mortality after ☆☆

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Table 1 Characteristics of preoperative, intraoperative, and postoperative data for patients with and without VAP

Characteristics	Patients with VAP (n = 124)	Patients without VAP (n = 1486)	*P*
Preoperative values			
Age (y)	68.5 ± 10.03	67.8 ± 10.5	.45
Sex, male/female	46 (37.1)/ 78 (62.9)	584 (39.3)/ 902 (60.7)	.62
Underlying conditions			
Chronic renal failure	19 (15.3)	61 (4.1)	.0001
Peripheral vascular disease	6 (6.6)	1 (0.1)	.0001
Congestive heart failure	19 (15.3)	4 (0.3)	.0001
Hypertension	70 (56.5)	609 (41.0)	.001
Diabetes mellitus	36 (29.0)	440 (29.6)	.89
Malignant neoplasm	6 (4.8)	0 (0.0)	.0001
Chronic obstructive pulmonary disease	32 (25.8)	336 (22.6)	.41
Immunosuppression	12 (9.7)	31 (2.1)	.0001
Previous cardiac surgery	8 (6.5)	43 (2.9)	.03
Obesity	17 (13.7)	458 (30.8)	.0001
Intraoperative values			
Surgical procedure, valve	72 (58.1)	945 (63.6)	.22
Surgical procedure, CABG	34 (27.4)	631 (42.5)	.001
Surgical procedure, valvular + CABG	15 (12.1)	15 (1.0)	.0001
Aortic cross-clamp, (min)	83.1 ± 36.4	67.4 ± 28.0	.0001
Total CPB time (min)	115.9 ± 48.2	94.1 ± 37.2	.0001
Postoperative values			
Duration of mechanical ventilation (d)	25.2 ± 26.2	1.8 ± 7.2	.0001
Cardiac complications	57 (46.0)	39 (2.6)	.0001
Respiratory failure	89 (71.8)	79 (5.3)	.0001
Acute renal failure	79 (63.7)	25 (1.7)	.0001
Stroke	10 (8.1)	9 (0.6)	.0001
Reintervention	8 (6.5)	43 (2.9)	.03
Mediastinal bleeding ≥1000 mL	15 (12.1)	11 (0.7)	.0001
Gastrointestinal complication	16 (12.9)	3 (0.2)	.0001

Table 3 Univariate analysis of potential preoperative, intraoperative, and postoperative risk factors for in-hospital mortality after cardiac surgery

Characteristics	Nonsurvivors (n = 91)	Survivors (n = 1519)	*P*
Preoperative values			
Age (y)	69.9 ± 9.7	67.7 ± 10.6	.06
Sex, male/female	51 (56.0)/ 40 (44.0)	929 (61.2)/ 590 (38.8)	.33
Underlying conditions			
Chronic renal failure	19 (20.9)	61 (4.0)	.0001
Peripheral vascular disease	6 (6.6)	1 (0.1)	.0001
Congestive heart failure	9 (9.9)	14 (0.9)	.0001
Hypertension	50 (54.9)	629 (41.4)	.01
Diabetes mellitus	35 (38.5)	441 (29.0)	.05
Malignant neoplasm	3 (3.3)	3 (0.2)	.0001
Chronic obstructive pulmonary disease	28 (30.8)	340 (22.4)	.06
Immunosuppression	7 (7.7)	36 (2.4)	.002
Previous cardiac surgery	4 (4.4)	47 (3.1)	.49
Obesity	19 (20.9)	456 (30.0)	
Intraoperative values			
Surgical procedure, valve	58 (63.7)	959 (63.1)	
Surgical procedure, CABG	24 (26.4)	641 (42.2)	
Surgical procedure, valvular + CABG	11 (12.1)	19 (1.3)	
Aortic cross-clamp time (min) [a]	86.7 ± 34.1	67.9 ± 28.3	.0001
Total CPB time (min)	122.4 ± 46.3	94.1 ± 37.5	.0001
Postoperative values			
Duration of mechanical ventilation (h)	599.5 ± 611.1	58.8 ± 217.4	.0001
VAP	61 (67.0)	63 (4.1)	.0001
VAP appropriate antibiotic therapy	35 (38.4)	45 (2.9)	.102
Cardiac complications	35 (38.5)	61 (4.0)	.0001
Respiratory failure	57 (62.6)	111 (7.3)	.0001
Acute renal failure	49 (53.8)	55 (3.6)	.0001
Stroke	5 (5.5)	14 (0.9)	.0001
Mediastinal bleeding ≥1000 mL	7 (7.7)	19 (1.3)	.0001
Gastrointestinal complication	12 (13.2)	7 (5)	.0001

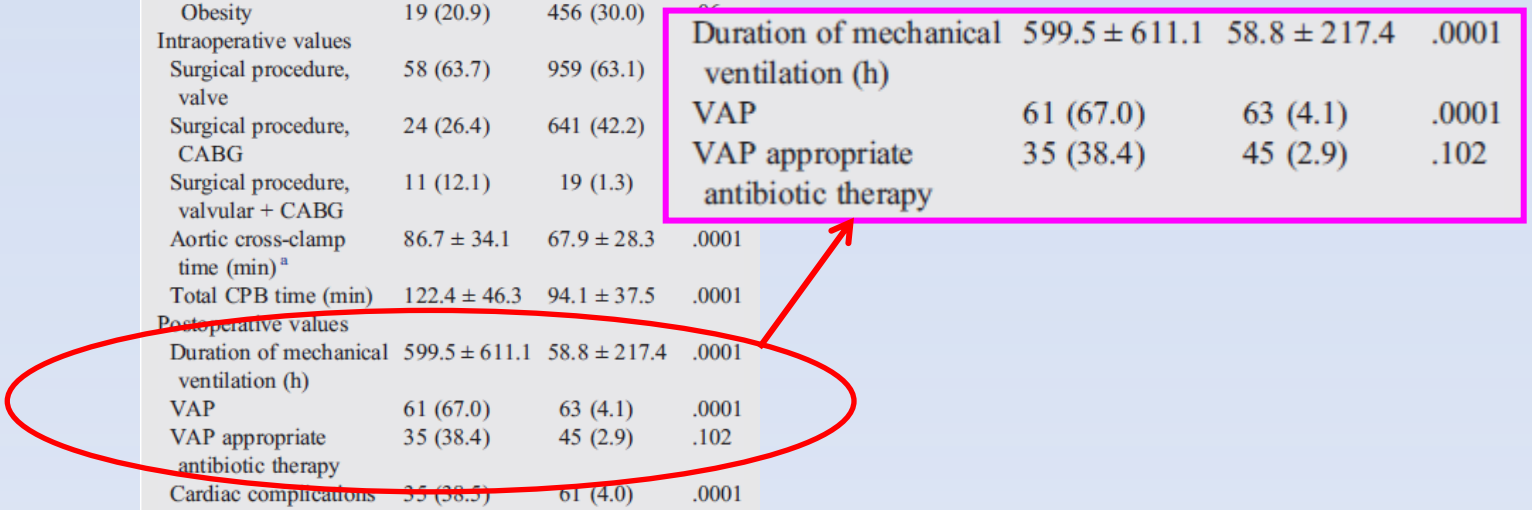
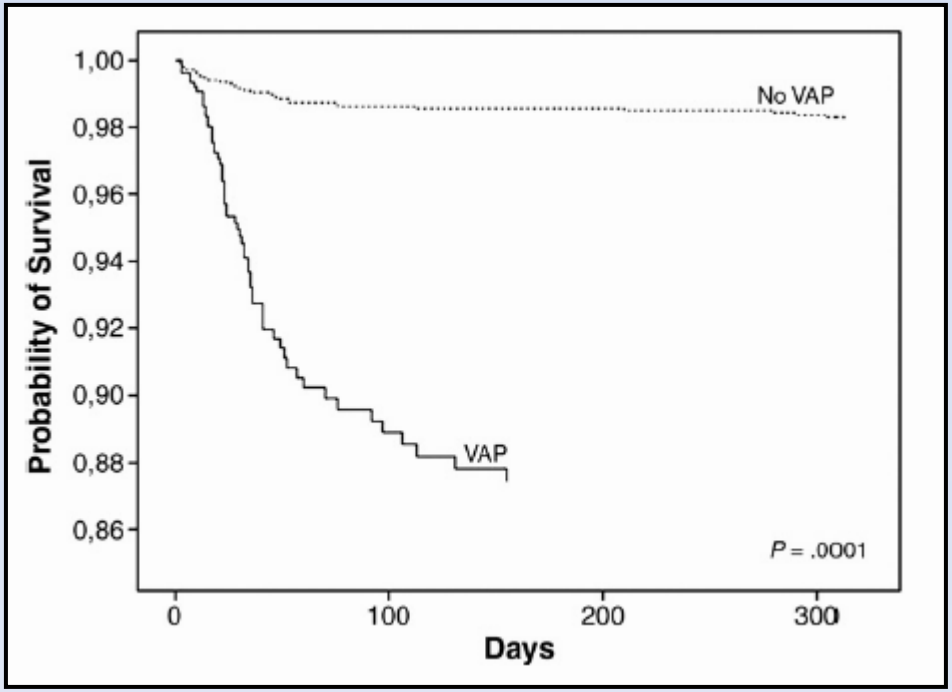


Table 5 Risk factors for in-hospital mortality in patients with VAP after cardiac surgery determined by Cox regression analysis

Characteristics	Adjusted HR	95% CI	*P*
Chronic renal failure	2.70	1.50-4.84	.001
Diabetes mellitus	2.02	1.18-3.45	.009
Acute renal failure	2.67	1.40-5.08	.003



Risk Factors for Mediastinitis After Cardiac Surgery

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(Ann Thorac Surg 2004;77:676–83)

Table 1. Risk Factors for Mediastinitis After Cardiac Surgery: Data From the Descriptive Statistical Analysis

Variables	Cases (n = 39)	Controls (n = 78)	*p* Value	Total
Average age (y)	59.3	58.4		58.8
Male patients	25 (64.1%)	59 (75.6%)		84 (71.8%)
Female patients	14 (35.9%)	19 (24.4%)	0.19	33 (28.2%)
Weight (kg)	77.7	70.8	0.011	
Height (m)	1.65	1.68	0.256	
Body mass index (kg/m^2)	29.4	25.3	0.000	
Obesity	18 (46.2%)	9 (11.5%)	0.0001	27 (23.1%)
Diabetes	17 (43.6%)	19 (24.4%)	0.034	36 (30.8%)
Smoking	11 (28.2%)	11 (14.1%)	0.066	22 (18.8%)
Hypertension	29 (74.4%)	46 (59%)	0.10	75 (64.1%)
COPD	3 (7.7%)	2 (2.6%)	0.196	5 (4.3%)
Dyslipidemia	20 (51.3%)	24 (30.8%)	0.031	44 (37.6%)
Corticoid	1 (2.6%)	1 (1.3%)	1.000	2 (1.7%)
Previous use of antibiotics	3 (7.7%)	3 (3.8%)	0.399	6 (5.1%)
Permanent pacemaker	2 (5.1%)	1 (1.3%)	0.257	3 (2.6%)
Secondary diagnosis	16 (41%)	15 (19.2%)	0.012	31 (26.5%)

Secondary diagnosis	16 (41%)	15 (19.2%)	0.012	31 (26.5%)
Renal insufficiency	5 (12.8%)	4 (5.1%)	0.158	9 (7.7%)
Previous acute myocardial infarction	16 (41%)	17 (21.8%)	0.029	33 (28.2%)
Stable angina	22 (56.4%)	23 (29.5%)	0.005	45 (38.5%)
Unstable angina	4 (10.3%)	19 (24.4%)	0.070	23 (19.7%)
Stent	1 (2.6%)	3 (3.9%)	1.000	4 (3.4%)
Ejection fraction	9 (23%)	22 (28.2%)	0.072	31 (26.5%)
Preoperative hospital stay (d)	7.51	6.45	0.403	
Functional class I, II	26 (66.7%)	53 (67.9%)	0.99	79 (67.5%)
Functional class III, IV	13 (33.3%)	25 (32.1%)	0.990	38 (32.5%)
Previous sternotomy	6 (15.4%)	7 (9%)	0.354	13 (11.1%)
Kind of surgery				
Coronary/coronary + valve	36 (92.3%)	60 (76.9%)		96 (82%)
Mitral valve	3 (7.6%)	16 (20.5%)	0.076	19 (16.2%)
Congenital	0	2 (2.5%)		2 (1.7%)
Emergency surgery[a]	0	0		0
Average length of surgery (h)	5.97	5.51	0.007	
Average length of perfusion (min)	87.2	82	0.420	
Length of aorta clamping (min)	53.7	55.24	0.687	
Mammary artery	25 (64.1%)	49 (62.6%)	0.892	74 (63.2%)
Mammary arteries:			0.765	
Zero	14 (35.9%)	29 (37.2%)		43 (36.5%)
One	23 (59%)	47 (60.3%)		70 (59.6%)
Two	2 (5.1%)	2 (2.6%)		4 (3.8%)
Received blood:	31 (79.5%)	62 (79.5%)		93 (79.5%)
Quantity (mL)	757.4	567.1	0.061	
Reoperation	7 (17.9%)	3 (3.8%)	0.015	10 (8.5%)
Use of β-adrenergic drugs	3 (7.7%)	5 (6.4%)	1.00	8 (6.8%)
Intraaortic balloon[a]	0	1 (1.3%)		1 (0.85%)
Average ICU stay (d)	4.18	2.2		
>2 d	19 (48.7%)	10 (12.8%)	0.000	29 (30.7%)
Tracheostomy[a]	0	0		0
Average length mechanical ventilation (d)	1.7	1		
Length of mechanical ventilation >1 d	8 (20.5%)	1 (1.3%)	0.001	9 (10.9%)
Inotropic drugs	23 (59%)	33 (42.3%)	0.089	56 (47.9%)
Infection at another site	10 (25.6%)	3 (3.8%)	0.001	13 (11.1%)
Deaths	9 (23%)	0	<0.001	(7.7%)

Table 3. Agents Isolated in Secretion of Surgical Wounds and Bone Fragments, Obtained Through Surgical Procedures

Isolated Agent	Incision n (%)	Bone n (%)
Total *Staphylococcus aureus*	18 (31)	9 (39)
Methicillin-sensitive *S aureus*	5 (8.6)	4 (17.4)
Methicillin-resistant *S aureus*	13 (22.4)	5 (21.7)
Enterobacter spp	14 (24.2)	5 (21.7)
Negative coagulase *Staphylococcus*	5 (8.6)	2 (8.7)
Enterococcus spp	5 (8.6)	2 (8.7)
Klebsiella spp	5 (8.6)	2 (2.7)
Pseudomonas aeruginosa	5 (8.6)	1 (4.4)
Morganella morganii	2 (3.5)	1 (4.4)
Serratia spp	2 (3.5)	1 (4.4)
Escherichia coli	2 (3.5)	0
Total	58 (100)	23 (100)

Conclusioni

- ✓ Le complicanze postoperatorie hanno un notevole impatto sia in termini di mortalità che di morbidità
- ✓ Molti fattori di rischio non sono modificabili in quanto correlati alle caratteristiche del paziente
- ✓ Tra quelli modificabili i più importanti sono sicuramente **l'ottimizzazione del CPB** soprattutto in termini di durata e la corretta gestione in terapia intensiva con particolare riguardo alla **prevenzione delle infezioni e alla riduzione dei tempi di ventilazione meccanica**