Corso di Ecocardiochirurgia
a numero chiuso

IL PERCORSO CLINICO
DEL PAZIENTE CON PROTESI
VALVOLARE, VALVOLE
ARTIFICIALI PERCUTANEE
ED ENDOCARDITE SU PROTESI

MILANO, Atahotel Executive

28 – 29 Ottobre 2010

ECOCARDIOCHIRURGIA.it

Il ruolo del rianimatore nell'assistenza alla sostituzione per via percutanea

Emanuele Catena

Struttura di Cardioanestesia
e Rianimazione
Ospedale di Lecco

Trattamento percutaneo della stenosi aortica

TAVI: transcatheter aortic valve implantation

Età avanzata e comorbidità multiple

(disfunzione renale, polmonare, cerebrovascolare, ecc…)

rischio operatorio di SVAo per via chirurgica tradizionale troppo elevato.

Criteria for TAVI (1)

- High operative risk score
  EuroScore > 20, STS PROM > 10 → Excessive risk of operative mortality
- Severe lung disease → Excessive risk of prolonged VAM
- Denied surgery by at least 2 cardiac surgeons → Sufficient consensus
- Previous sternotomy with functional coronary artery bypass grafts → Significant risk of coronary artery damage

Fassl J. J Cardiothoracic Vasc Anesthe 2010;24(4):691-699

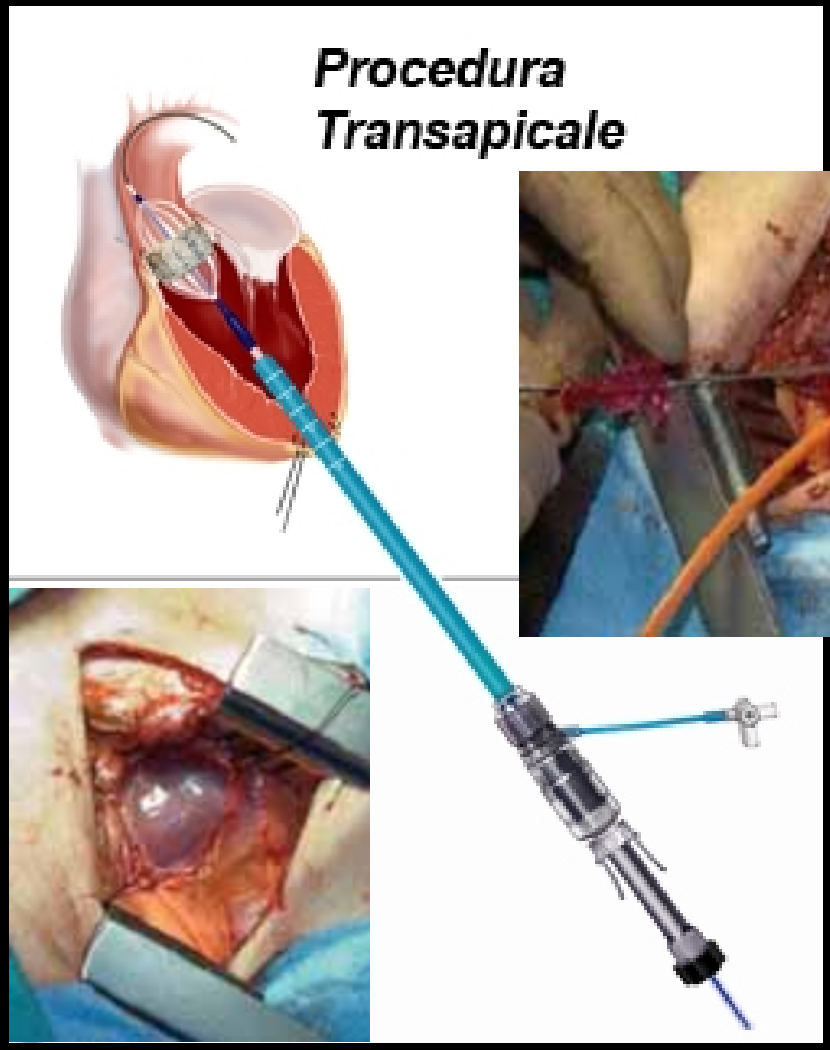
Criteria for TAVI (2)

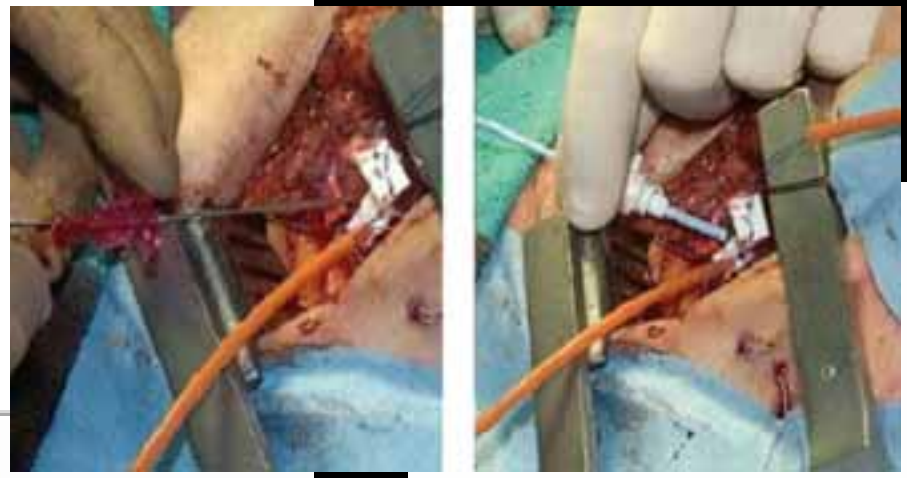
- Age > 70 years
- Severe SAo from degenerative origin
- Symptomatic
- Valve area < 0.7 cm^2
- Adequate diameters

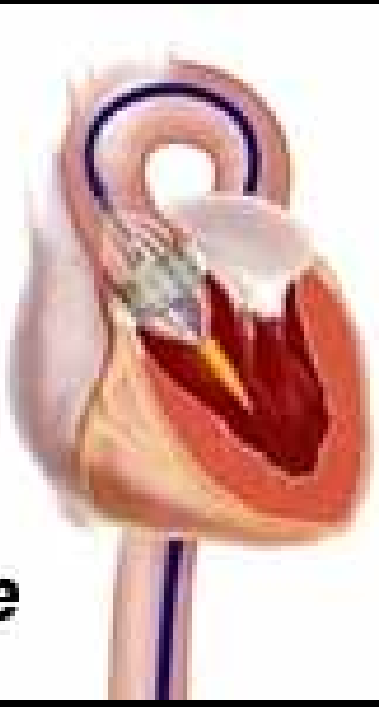
  annulus >18mm ≤ 25 mm, femoro-iliac axes > 8 mm

- Alternative criteria: porcelain aorta, radiation of the sternum

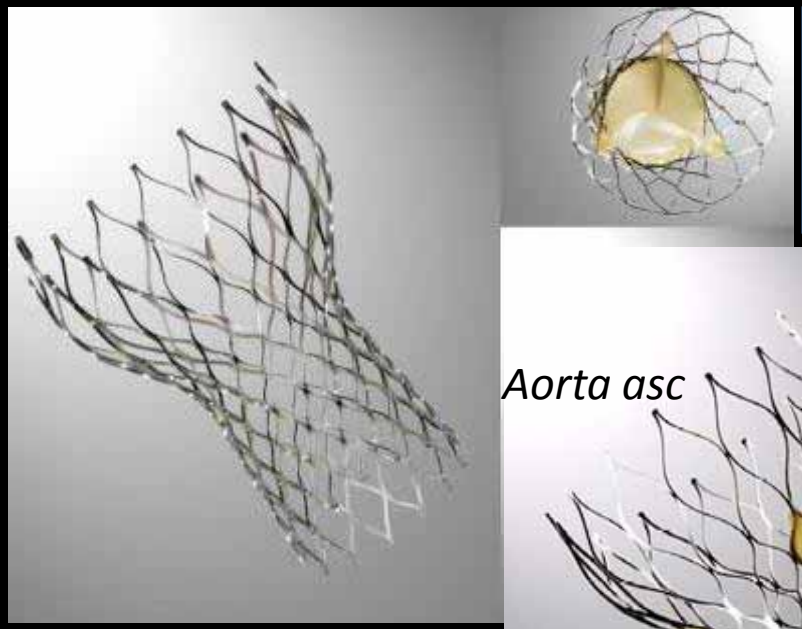
Trattamento percutaneo della stenosi aortica

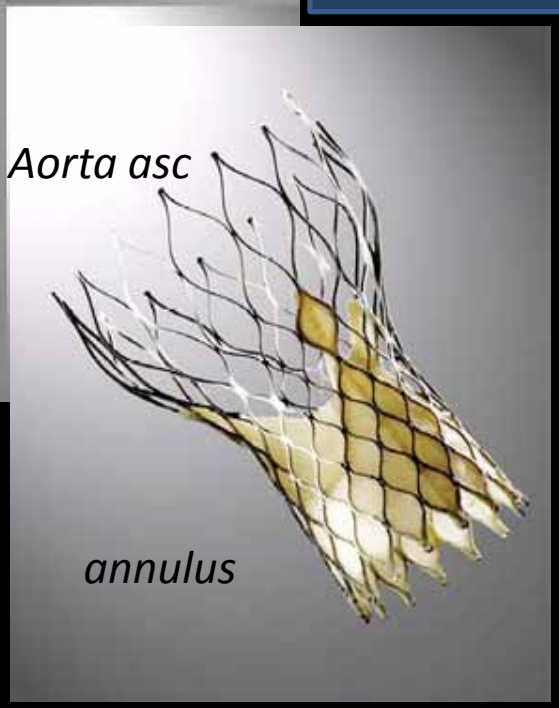






CoreValve





Valvola tricuspide di pericardio porcino montata su una struttura di nitinolo auto espandibile

La protesi viene caricata e compressa in un catetere 18 French (diametro esterno) e dopo aver raggiunto la valvola aortica per via retrograda è rilasciata nell'annulus aortico

Only one valve stent size available for patients with annulus size 19 to 22 mm

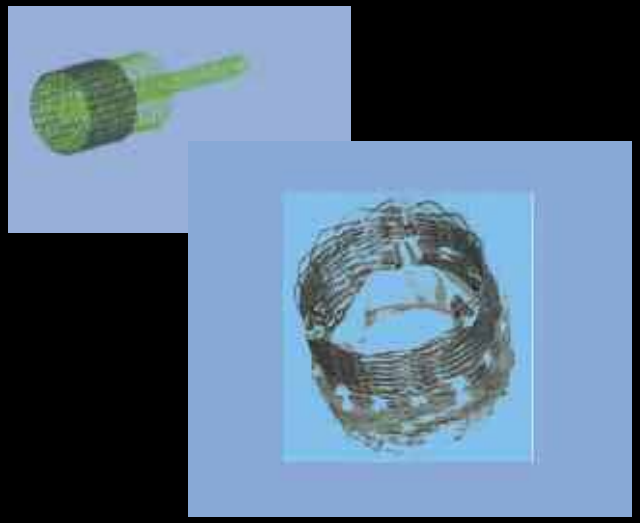
Edward's Sapien

La valvola è costituita da uno stent di forma tubulare e in acciaio inossidabile, che monta una valvola tricuspide di pericardio bovino

Prima dell'impianto il device viene "crimpato" su un pallone per valvuloplastica aortica

- Only two available valve sizes:
  23 mm and 26 mm requiring sheath 22 Fr and 24 Fr
- Patients annulus size from 17 to 25 mm

Altre valvole percutanee…



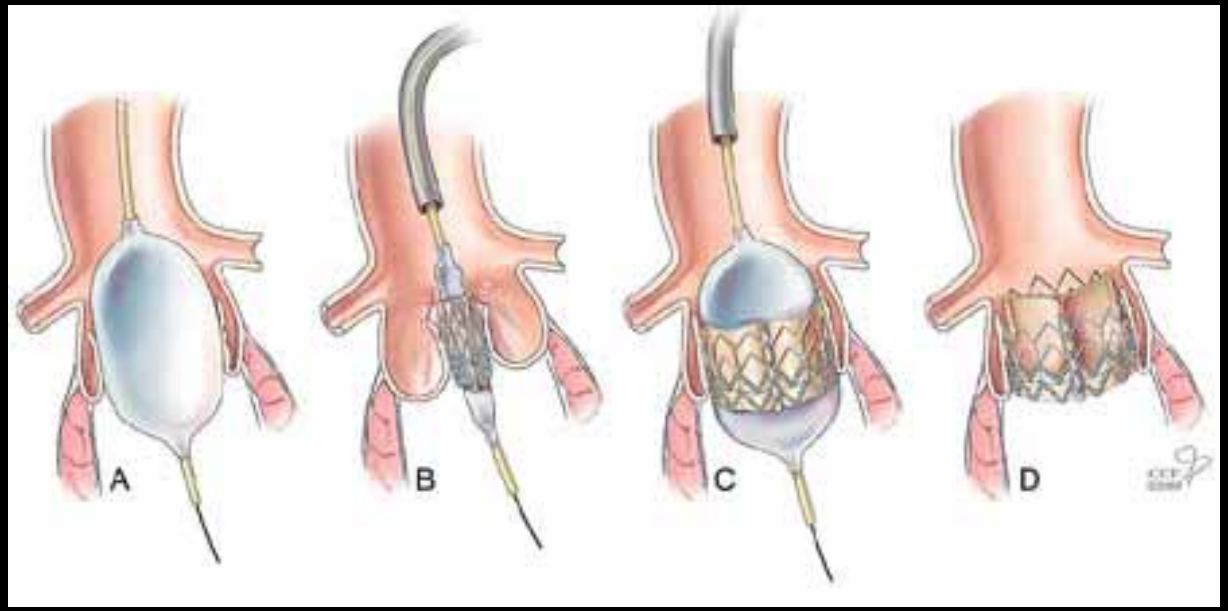
Lotus Valve (Sadra Medical, Ca)

“Direct Flow” (Direct Flow medical)

E montata su una struttura non metallica costituita da due anelli sopra e sottovalvolari che vengono inizialmente riempiti con una soluzione di mezzo di contrasto e successivamente con materiale plastico liquido

Technical aspects in any TAVR can be divided into key steps:

- Obtaining surgical access
- Native aortic valve valvuloplasty
- Prosthesis positioning
- Deployment of the prosthesis
- Surgical closure



1) Surgical access: both femoral arteries and one femoral vein are used

- Femoral vessels can be accessed percutaneously or by a direct vascular cut-down
- A pigtail catheter is inserted via the controlateral femoral artery into the ascending aorta to perform contrast aortogram
- Pacing lead is introduced through the femoral vein for rapid ventricular pacing

The vessel should be at least 8 mm in diameter to permit the insertion and passage of the delivering system

Tortuous iliac and femoral arteries: patient not suitable for the transfemoral procedure

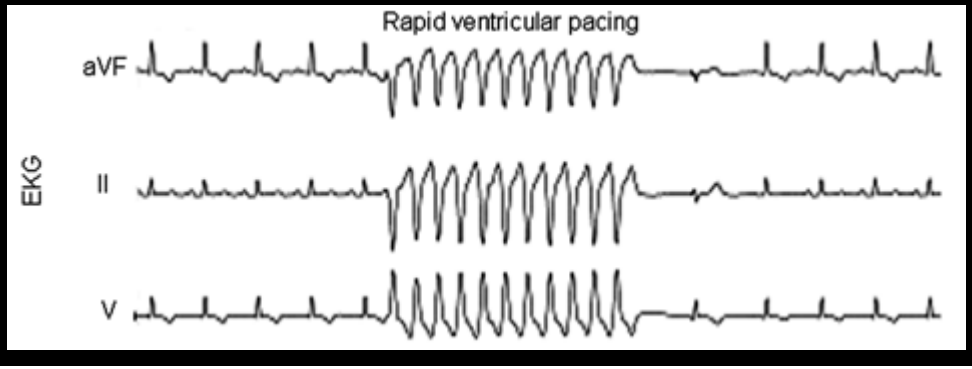
Atherosclerosis of the arch, descending and abdominal aorta

2) Native aortic valve valvuloplasty

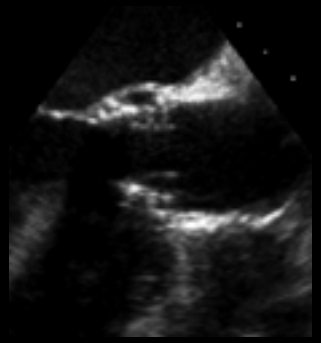
The severe stenotic aortic valve requires predilatation by balloon valvuloplasty before prosthesis positioning and deployment

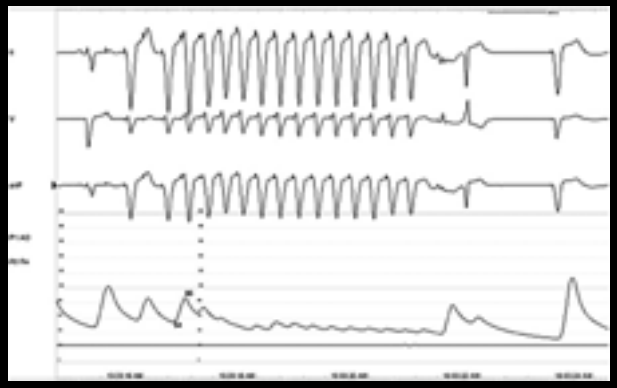
Valvuloplasty allows easier passage of the prosthesis through the severely stenotic native aortic valve

Rapid ventricular pacing is maintained during the balloon valvuloplasty to minimize cardiac output and possible slippage of the balloon



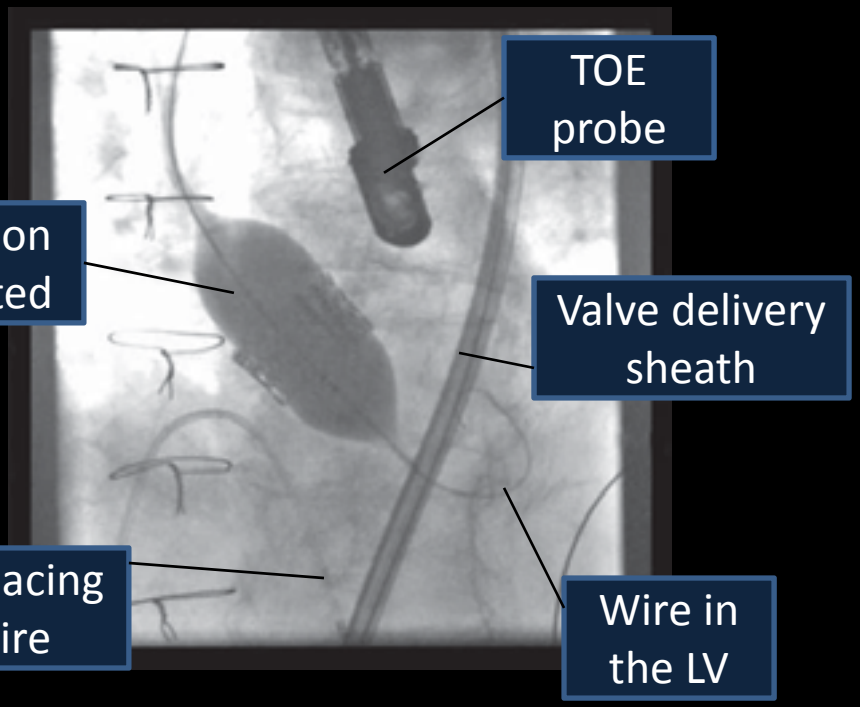
3) Prosthesis positioning and device deployment

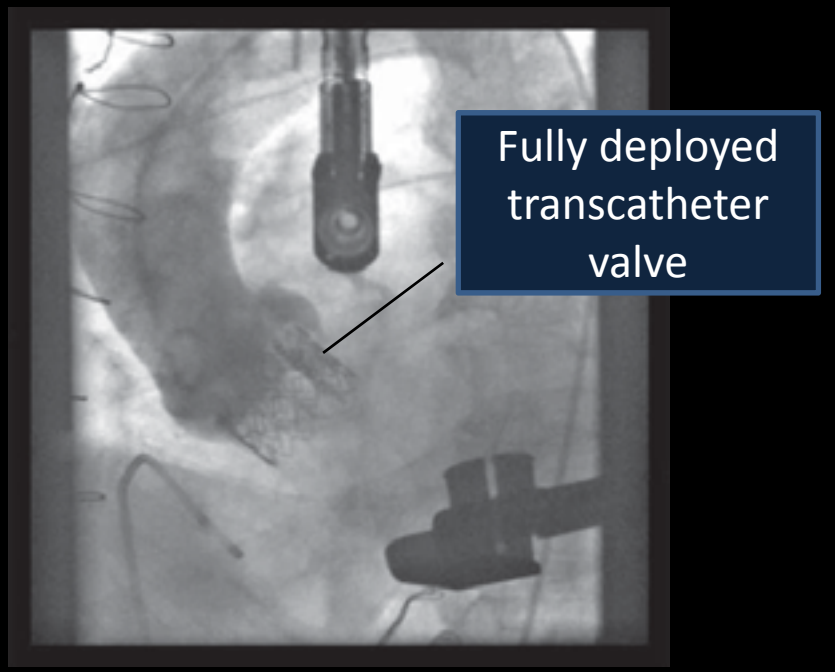




Rapid RV pacing at a rate of 160 to 220 bpm to decrease cardiac output

Systolic AP < 50 mmHg





Contraindications

- Bicuspid aortic valve (risk of incomplete deployment of the prosthesis)
- Asymmetric heavy valvular calcification (it may compress the coronary arteries during TAVI)
- Annular dimension: annulus < 20 or > 27 for self-expandible devices
- Presence of apical LV or LA thrombus

- Previous mechanical AVR
- Endocarditis
- Recent MI
- Recent cerebrovascular accident
- Severe IM and/or Itr

Complications of TAVI

- ***VASCULAR ACCESS DAMAGE***: dissection of the femoral vessels, rupture, hemorrhage, retroperitonel hematoma

- ***EMBOLIZATION*** of calcification particles or air during balloon valvuloplasty: stroke, myocardial infarction.

- ***POOR RECOVERY of CARDIAC FUNCTION*** after ventricular pacing: inotropic support, CPB

- ***DEVICE EMBOLIZATION*** with coronary flow impairment or mitral regurgitation

- ***PARAVALVULAR REGURGITATION***
- Complete ***HEART BLOCK***
- ***CARDIAC TAMPONADE*** perforation of the RA or RV with intravenous pacing wires

Il ruolo del rianimatore nella assistenza alla sostituzione per via percutanea

…Venerdì c'è una TAVI…

…c'è qualcuno di voi che può venire a fare "qualcosina" di sedazione… magari 2 o 3 cc di Diprivan?

Ruolo del cardioanestesista nell'assitenza ad una procedura da considerare ad alto rischio

CARATTERISTICHE DEL PAZIENTE

SCENARIO DELL'INTERVENTO

- Attori: operatori, infermieri, tecnici di sala
- Durata della procedura (curva di apprendimento)
- Luogo, logistica e attrezzature

Prevenire le complicanze

Scelta della tecnica anestesiologica (e dell'anestesista)

Preoperative patient characteristics:

Table 1
Preoperative patient characteristics

Patients		n = 40	(100%)
Age (yr)		81 ± 8	—
Female gender		15	(38%)
Body mass index (kg/m^2)		27 ± 6	—
Hypertension		23	(58%)
Diabetes mellitus		9	(23%)
Coronary artery disease		28	(70%)
Severe chronic obstructive lung disease		15	(38%)
History of cerebral ischemic event		3	(8%)
Peripheral vascular disease		8	(20%)
Atrial fibrillation		15	(38%)
Smoking	Current	5	(13%)
	Ex-smoker	16	(40%)
	Never smoked	19	(48%)
Estimated GFR <60 mL/min/1.73 m^2		20	(50%)
Permanent pacemaker		7	(18%)
Aortic calcification		15	(38%)
Prior thoracotomy		14	(35%)
Symptoms	NYHA 3 or 4	37	(93%)
	Angina	16	(40%)
	Syncope	3	(8%)
Aortic valve area (cm^2)		0.6 ± 0.2	—
Aortic mean gradient (mm Hg)		46 ± 18	—
Mitral regurgitation Grade 3 or 4		18	(45%)
Ejection fraction <50%		9	(23%)
Logistic EuroSCORE (%)		25 ± 15	—
	≥20	23	(58%)

Cheung A, Ree R. Anesthesiology Clin 2008;26:465-479

Preoperative patient characteristics:

Table 1. Demographic Data, Comorbidities, Chronic Drug Therapy, and Preprocedural Echocardiographic Data

	Overall (n = 90)	Transfemoral TAVI (n = 62)	Transapical TAVI (n = 28)	*p* Value
Age (y)	81 ± 8	81 ± 7	80 ± 10	0.9
Female sex (%)	40 (44)	29 (47)	11 (39)	0.4
ASA				0.6
3	48 (53)	34 (55)	14 (50)	
4	42 (47)	28 (45)	14 (50)	
NYHA class				0.2
II	8 (9)	4 (6)	4 (14)	
III	49 (54)	34 (55)	15 (54)	
IV	33 (37)	24 (39)	9 (32)	
Hypertension (%)	48 (53)	35 (56)	13 (46)	0.3
Atrial fibrillation (%)	40 (44)	30 (48)	10 (35)	0.4
Diabetes mellitus (%)	18 (20)	9 (15)	9 (32)	0.05
Dyslipidemia (%)	51 (57)	29 (47)	22 (79)	0.05
Peripheral vascular disease (%)	16 (18)	5 (8)	11 (39)	<0.01
Cerebrovascular disease (%)	34 (38)	20 (33)	14 (50)	0.1
History of stroke (%)	12 (13)	9 (15)	3 (11)	0.6
Porcelain aorta	14 (16)	6 (10)	8 (28)	0.02
Coronary artery disease (%)	59 (66)	34 (55)	25 (90)	
Previous MI	21 (23)	8 (13)	13 (46)	<0.01
Previous PCI	20 (22)	11 (18)	9 (32)	0.1
Previous CABG	28 (31)	14 (23)	14 (50)	0.09
Renal failure (CrCl <60 mL/min with the MDRD equation[19]) (%)	43 (48)	28 (44)	15 (54)	0.4
COPD (%)	31 (34)	24 (39)	7 (25)	0.2
History of cancer (%)	29 (32)	20 (32)	9 (32)	0.9
Logistic EuroSCORE (%)	24 (16-32)	23 (15-31)	25 (17-34)	0.4
STS-PROM (%)	15 (11-23)	15 (11-20)	16 (11-24)	0.5
Aortic valve area (cm^2/m^2)	0.37 ± 0.09	0.36 ± 0.10	0.37 ± 0.09	0.8
Mean gradient (mmHg)	49 ± 16	51 ± 16	43 ± 14	0.02
LVEF (%)	51 ± 14	52 ± 15	50 ± 14	0.2
Patients with LVEF <0.5	34 (38)	21 (34)	13 (46)	0.6
Patients with LVEF <0.3	6 (7)	5 (8)	1 (4)	0.6
SPAP ≥ 60 mmHg	19 (25)	14 (26)	5 (24)	0.7

Guinot PG, J Cardiothorac Vasc Anesth 2010;5 (October):752-761

Overestimation of aortic valve replacement risk by EuroScore: implications for percutaneous valve replacement

Osswald BR, Eur Heart J 2009;30:74-80

overestimation of risk of AVR is substantial, especially at high level of risk

1594 patients

Observed 30-day mortality in high risk group was 3.6%

Logistic EuroScore predicted mortality 14.8%

- The EuroScore is based on data from 1995 and has not as yet been recalibrated
- The majority of the patients were treated for CAD

EuroScore and STS omit important risk factors, such as severe thoracic aorta calcification, previous chest wall radiation, or liver cirrhosis

The magnitude of the reduction in expected surgical risk may even be in the wrong direction (higher risk than conventional surgery)

EuroScore is unsuitable for assessing the risk reduction of percutaneous AVR

Actual operative mortality in patients undergoing AVR is significantly lower than that predicted by the logistic EuroScore

1421 patients underwent AVR:

In the group "high risk" with EuroScore > 20: predicted operative mortality 38.8%

observed mortality 11.4%

Kalavrouziotis D, J Cardiothorac Surg 2009;4:1-8

In "high risk" patients undergoing isolated aortic valve replacement the EuroScore highly overstimates mortality, whereas the STS score seems to be actually more suitable in assessing perioperative mortality for these patients

In patients at "high risk" with EuroScore > 20 (52/645 patients):

EuroScore predicted mortality: 28.5%

STS PROM predicted mortality 10.1%

Observed mortality 3.9%

Wendt D, Ann Thorac Surg 2009;88(2):468-74

Come stabilire quali pazienti hanno un rischio proibitivo per la chirurgia tradizionale e possono avere un vantaggio dall'approccio transcutaneo?

GIUDIZIO CLINICO

"team valve": cardiologo, anestesista, chirurgo

+

VALUTAZIONE DI ELEMENTI QUANTITATIVI

Mortalità attesa > 20% con il Logistic EuroScore

Mortalità attesa > 10% con l'STS Score

Operative (30-day) mortality in octogenarians undergoing surgical AVR

Kohl et al	2001	AVR	70	82.8 ± 2.4 yr	**8.5%**
Chiappini et al	2004	AVR 62.1% AVR+CABG 37.9%	115	82.3 ± 2.1	**8.5%**
Melby et al	2007	AVR 42.8% AVR+CABG 57.1%	245	83.6 ±2.9	**10%** (AVR)
Thourani et al	2008	AVR	515	60-69 yr 206 pt 70-79 yr 221 pt 80-89 yr 88 pt	**3.4%** **4.1%** **5.7%**
Kolh et al	2007	AVR + CABG AVR	220	82.8	**13%** **9%**
Folkmann et al	2010	AVR AVR+CABG	154	82.9 ± 2.5	**6.8%** **8.8%**

Age (years)	82.9±2.5
Female gender	66.2%
Concomitant CABG	53.9%
COPD	54.9%
Diabetes	30.3%
Renal insufficiency	38.7%
Cerebrovascular disease	15.1%
Peripheral vascular disease	14.7%
Logistic EuroSCORE, mean	12.7%

Long-Term Outcomes After Isolated Aortic Valve Replacement in Octogenarians: A Modern Perspective

Thourani et al. Ann Thorac Surg 2008;86:1458-65

Table 3. Short-Term Postoperative Outcomes for Each Age Group

Outcomes	Ages 60–69 (n = 206)	Ages 70–79 (n = 221)	Ages 80–89 (n = 88)
MI	4 (1.9)	1 (0.5)	0 (0)
CVA	3 (1.5)	12 (5.4)	3 (3.4)
Re-exploration for bleeding	8 (3.9)	16 (7.2)	6 (6.8)
Mediastinitis	1 (0.5)	5 (2.3)	2 (2.3)
AF	55 (26.7)	83 (37.6)	30 (34.1)
Renal failure	7 (3.4)	8 (3.6)	4 (4.6)
Dialysis	4 (1.9)	3 (1.4)	1 (1.1)
Heart block requiring pacemaker	1 (0.5%)	9 (4.1%)	2 (2.3%)
GI bleeding or complications	3 (1.5)	6 (2.7)	3 (3.4)
Postoperative ventilator (hours) (mean ± SD)	20.4 ± 66.8 (median: 6.0)	30.3 ± 88.3 (median: 8.0)	36.6 ± 82.0 (median: 11.0)
Total ICU stay (hours) (mean ± SD)	66.4 ± 162 (median: 24.9)	74.0 ± 129 (median: 27.0)	107 ± 242 (median: 48.0)
Postoperative LOS (days) (mean ± SD)	7.7 ± 9.1 (median: 5.5)	8.0 ± 6.3 (median: 6.0)	9.8 ± 10.7 (median: 7.0)
Discharged to non-home facility (survivors)	7 (3.5%)	10 (4.7%)	10 (12.0%)
In-hospital mortality	7 (3.4%)	9 (4.1%)	5 (5.7%)

AF = atrial fibrillation; CVA = cerebrovascular accident; GI = gastrointestinal; ICU = intensive care unit; LOS = length of stay
myocardial infarction.

Significant independent preoperative predictors for in-hospital survival include ***stroke, chronic lung disease***, *and* ***renal failure***

Long-Term Outcomes After Isolated Aortic Valve Replacement in Octogenarians: A Modern Perspective

Thourani et al. Ann Thorac Surg 2008;86:1458-65

Table 1. Preoperative Demographics for Each Age Group

Demographic	Ages 60–69 (n = 206)	Ages 70–79 (n = 221)	Ages 80–89 (n = 88)	*p* Value
Age (mean ± SD)	64.1 ± 2.9	74.1 ± 2.8	82.8 ± 2.4	<0.001
Status				
Elective	192 (93.2%)	209 (94.6%)	80 (90.9%)	0.51
Urgent	13 (6.3%)	11 (5.0%)	8 (9.1%)	
Emergent	1 (0.5%)	1 (0.5%)	0	
Female gender	84 (40.8%)	115 (52.0%)	47 (53.4%)	0.03
Ejection fraction (mean ± SD)	0.554 ± 0.129	0.546 ± 0.13	0.525 ± 0.122	0.29
Caucasian	164 (81.2%)	179 (83.3%)	71 (84.5%)	0.75
CCS class 4	4 (2.0%)	9 (4.3%)	3 (3.6%)	0.42
NYHA class 4	17 (12.8%)	19 (13.3%)	12 (21.1%)	0.29
Congestive heart failure	89 (43.2%)	99 (44.8%)	46 (52.3%)	0.35
Previous myocardial infarction	12 (5.8%)	28 (12.7%)	7 (8.0%)	0.05
Angina	46 (22.3%)	50 (22.6%)	27 (30.7%)	0.26
Preoperative CVA	12 (5.8%)	19 (8.6%)	9 (10.2%)	0.36
Cerebrovascular disease	23 (11.2%)	31 (14.0%)	15 (17.1%)	0.37
Peripheral vascular disease	6 (2.9%)	8 (3.6%)	3 (3.4%)	0.92
Chronic lung disease	30 (14.6%)	36 (16.3%)	10 (11.4%)	0.54
Current smoker	26 (12.6)	21 (9.5)	0 (0)	0.003
Diabetes mellitus	52 (25.2%)	57 (25.8%)	15 (17.1%)	0.24
Hypertension	139 (67.5%)	172 (77.8%)	62 (70.5%)	0.05
Infectious endocarditis	7 (3.4%)	0 (0)	3 (3.4%)	0.02
Last creatinine level (mean ± SD)	1.37 ± 1.4	1.31 ± 1.3	1.31 ± 1.0	0.90
Renal failure	24 (11.7%)	13 (5.9%)	7 (8.0%)	0.10
Dialysis	11 (5.3%)	4 (1.8%)	2 (2.3%)	0.10

CCS = Canadian Cardiovascular Society classification; CVA = cerebrovascular accident; NYHA = New York Heart Association.

HEART

What is the impact of providing a transcatheter aortic valve implantation service on conventional aortic valve surgical activity: patient risk factors and outcomes in the first 2?years

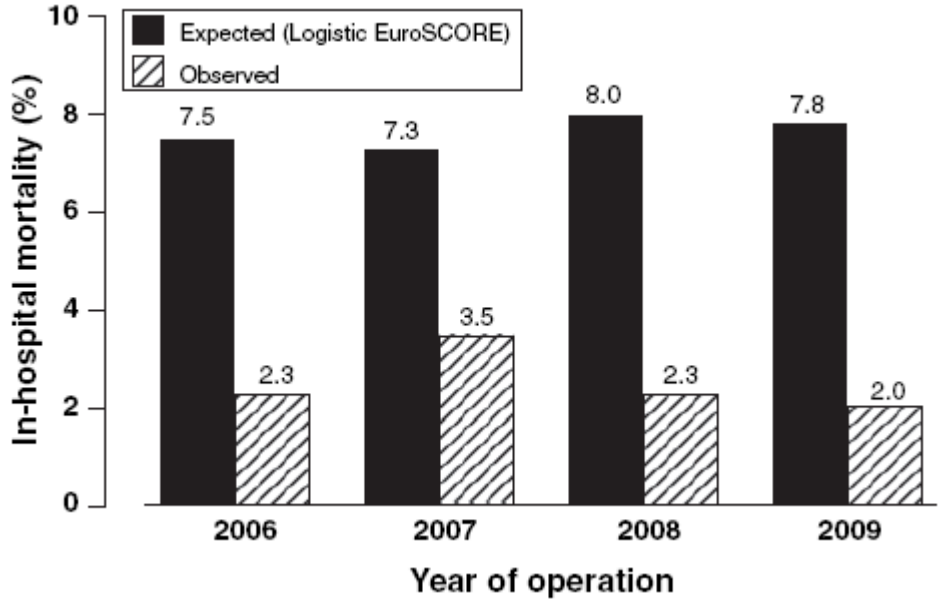
S W Grant, M P Devbhandari, A D Grayson,

Heart 2010 96: 1633-1637

	Conventional AVR
Age (years)	72 (63–78)
Female	189/471 (40.1%)
Diabetes	67/471 (14.2%)
Renal dysfunction	12/471 (2.5%)
Respiratory disease	83/471 (17.6%)
Neurological disease	14/471 (3%)
Peripheral vascular disease	43/471 (9.1%)
Previous CVA	14/471 (3.0%)
Hypertension	271/471 (57.5%)
Hyperlipidaemia	278/471 (59.0%)
Fair left ventricular function	97/471 (20.6%)
Poor left ventricular function	31/471 (6.6%)
Previous MI	79/471 (16.8%)
Preoperative arrhythmia	69/471 (14.7%)
Angina grade (CCS ≥3)	51/471 (10.8%)
Dyspnoea grade (NYHA ≥3)	257/471 (54.6%)
Coronary artery disease	241/471 (51.2%)
Aortic valve gradient (mm Hg)	73 (50–90)

815 patients undergoing isolated AVR or CABG + AVR (2006-2009)

50 patients undregoing TAVI (2008-2009)



Manchester Hospital, UK

Ospedale di Lecco

AVR + BPAC: 91 pazienti

(dal 11 Gennaio 2010 ad oggi)

- **Età media: 72.8** ± 13.5 anni Mediana 76.9 anni
- **Età ≥ 80 anni: 27.5% dei pazienti**, maschi 58%

EuroScore Additivo 7

EuroScore Logistico media 9.8 ± 8.4, mediana 6.7

EuroScore Log > 20 in 14 pazienti

MORTALITA' 2.2 % (CI 0.6-7.7)

2 DECESSI: 15 EuroScore, 28 EuroScore

Potential advantages of TAVI

- No need for sternotomy or re-sternotomy
- Reduced ICU and hospital stay
- No need for CPB:
  - reduced neurological complications (?)
  - no activation of coagulation cascade
  - reduced release of vasoactive substances
  - no need for cross-clamp
- Reduced use of resources

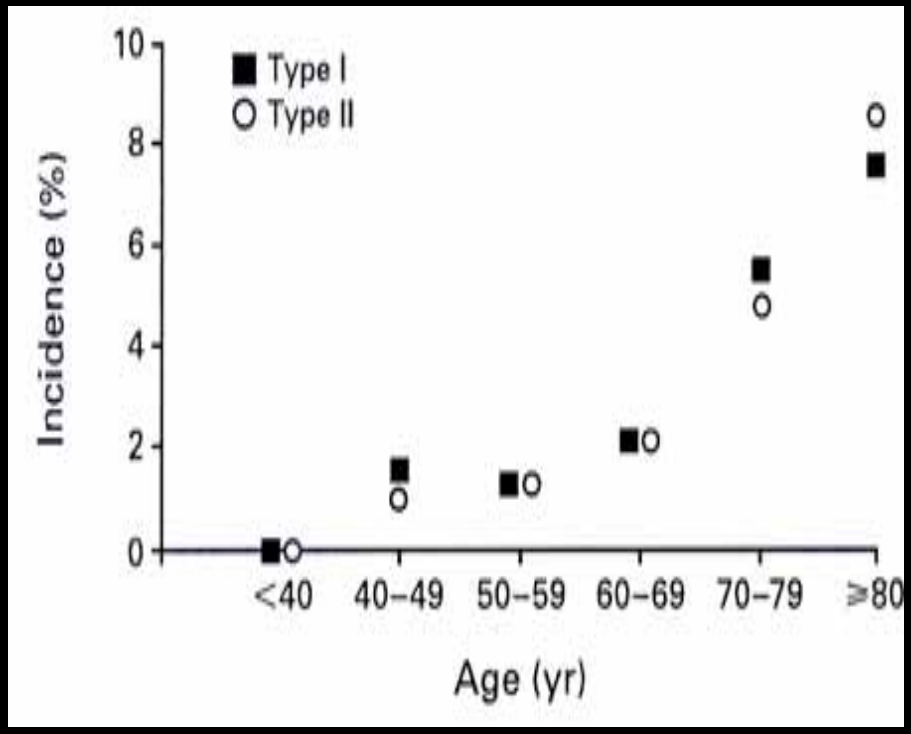
Klein AA. Br J Anaesth 2009;103:792-9.

The New England Journal of Medicine

VOLUME 335 DECEMBER 19, 1996 NUMBER 25

ADVERSE CEREBRAL OUTCOMES AFTER CORONARY BYPASS SURGERY

GARY W. ROACH, M.D., MARC KANCHUGER, M.D., CHRISTINA MORA MANGANO, M.D., MARK NEWMAN, M.D., NANCY NUSSMEIER, M.D., RICHARD WOLMAN, M.D., ANIL AGGARWAL, M.D., KATHERINE MARSCHALL, M.D., STEVEN H. GRAHAM, M.D., PH.D., CATHERINE LEY, PH.D., GERARD OZANNE, M.D., AND DENNIS T. MANGANO, PH.D., M.D., FOR THE MULTICENTER STUDY OF PERIOPERATIVE ISCHEMIA RESEARCH GROUP AND THE ISCHEMIA RESEARCH AND EDUCATION FOUNDATION INVESTIGATORS*



Type I: fatal cerebral injury and nonfatal strokes

Type II: new deterioration in intellectual function, memory deficit, new onset of seizures

Cognitive dysfunction

(memory, concentration, language,social integration, comprehension)

- The incidence of early postoperative cognitive decline is 60%.

Slater et al., Ann Thorac Surg 2009;87:36-45.

- Early cognitive impairment (53% at discharge) is a harbinger of later cognitive impairment (42% at five years)

Newman et al., NEJM 2001

Sex, Aging, and Preexisting Cerebral Ischemic Disease in Patients With Aortic Stenosis

Ping Wang, PhD, Michael A. Acker, MD, Michel Bilello, MD, PhD, Elias R. Melhem, MD, PhD, Elizabeth Stambrook, BS, Sarah J. Ratcliffe, PhD, and Thomas F. Floyd, MD; for the DENOVO (Determining Neurologic Outcomes from Valve Operations) Investigators*

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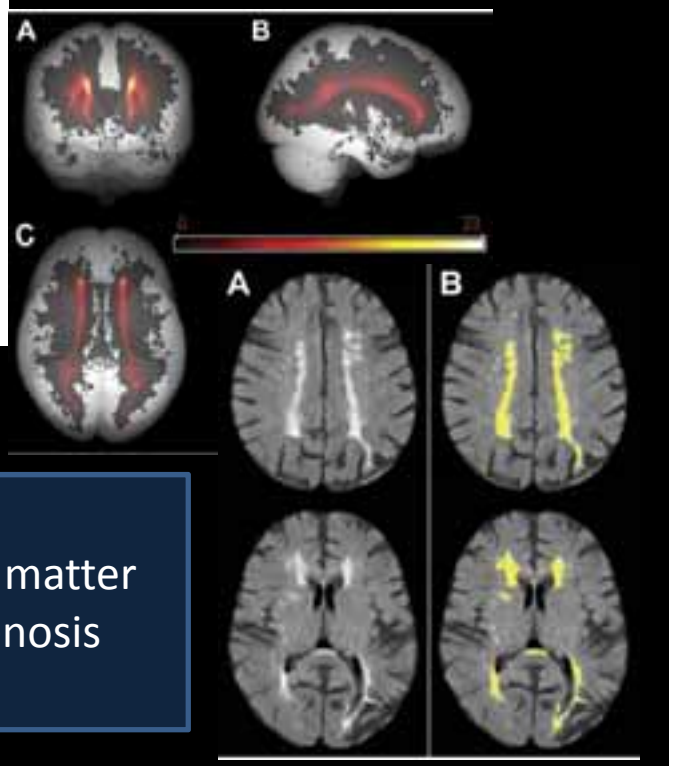


95 patients, mean age 76 years: MRI

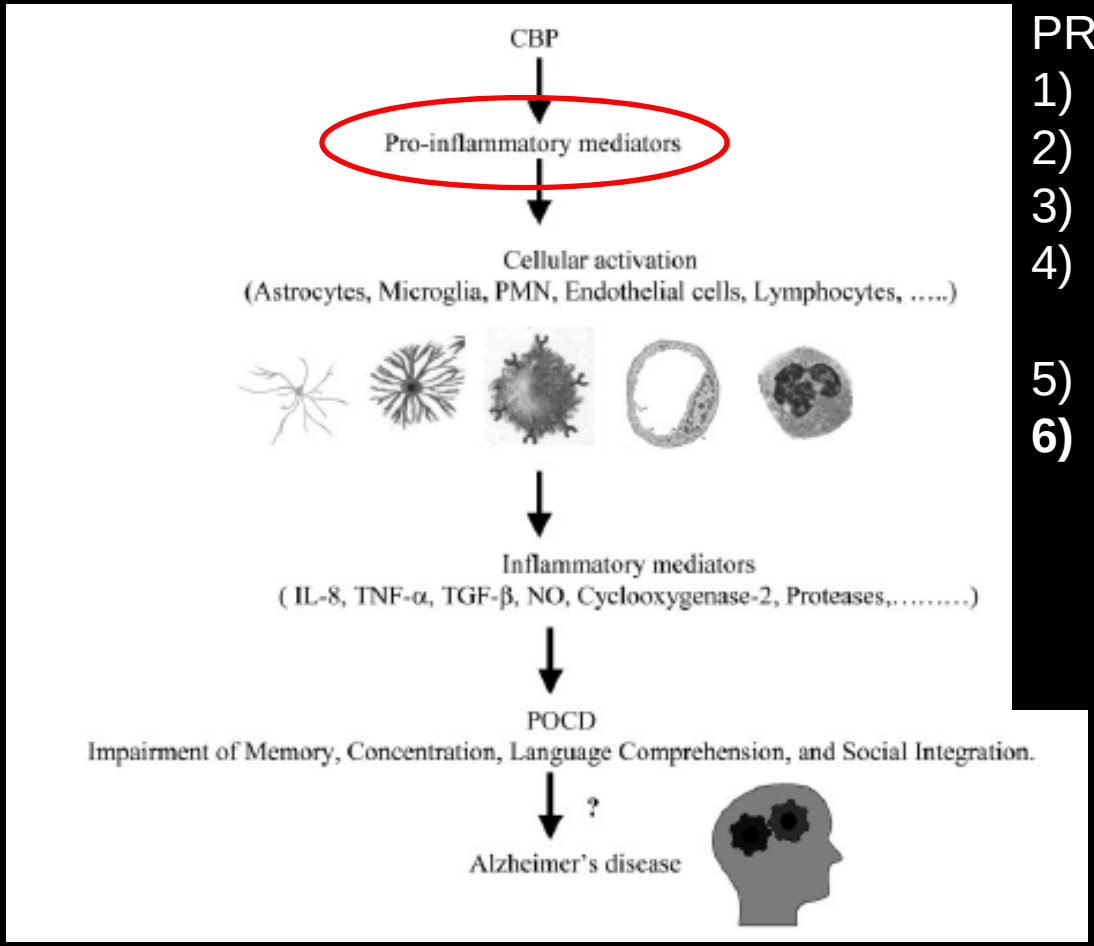
A strong correlation between aging, female sex, and white matter and ischemia-like lesion volume in patient with aortic stenosis

white matter and ischemia-like lesion volume is noted to increase by nearly 30% as aortic stenosis severity progresses to the severe critical range

Women and those of advanced age presenting for aortic valve replacement for AS may incur a particularly high risk for postoperative neurologic sequelae due to an exceptional preexisting burden of cerebral ischemic disease.

Ann Thorac Surg 2010;90:1230–6)

The incidence of POCD is higher after cardiac than noncardiac surgery, and the risk increases with age.



PREVENTION

1) Hemodynamic stability
2) Temperature
3) Filters
4) Steroid pretreatment before CPB was
5) Time of procedure
6) **Steroid pretreatment** before CPB was recommended recently to inhibit ischemia-reperfusion injury as well as the inflammatory response associated with CPB.

Gao L. CHEST 2005;128:3664-3670

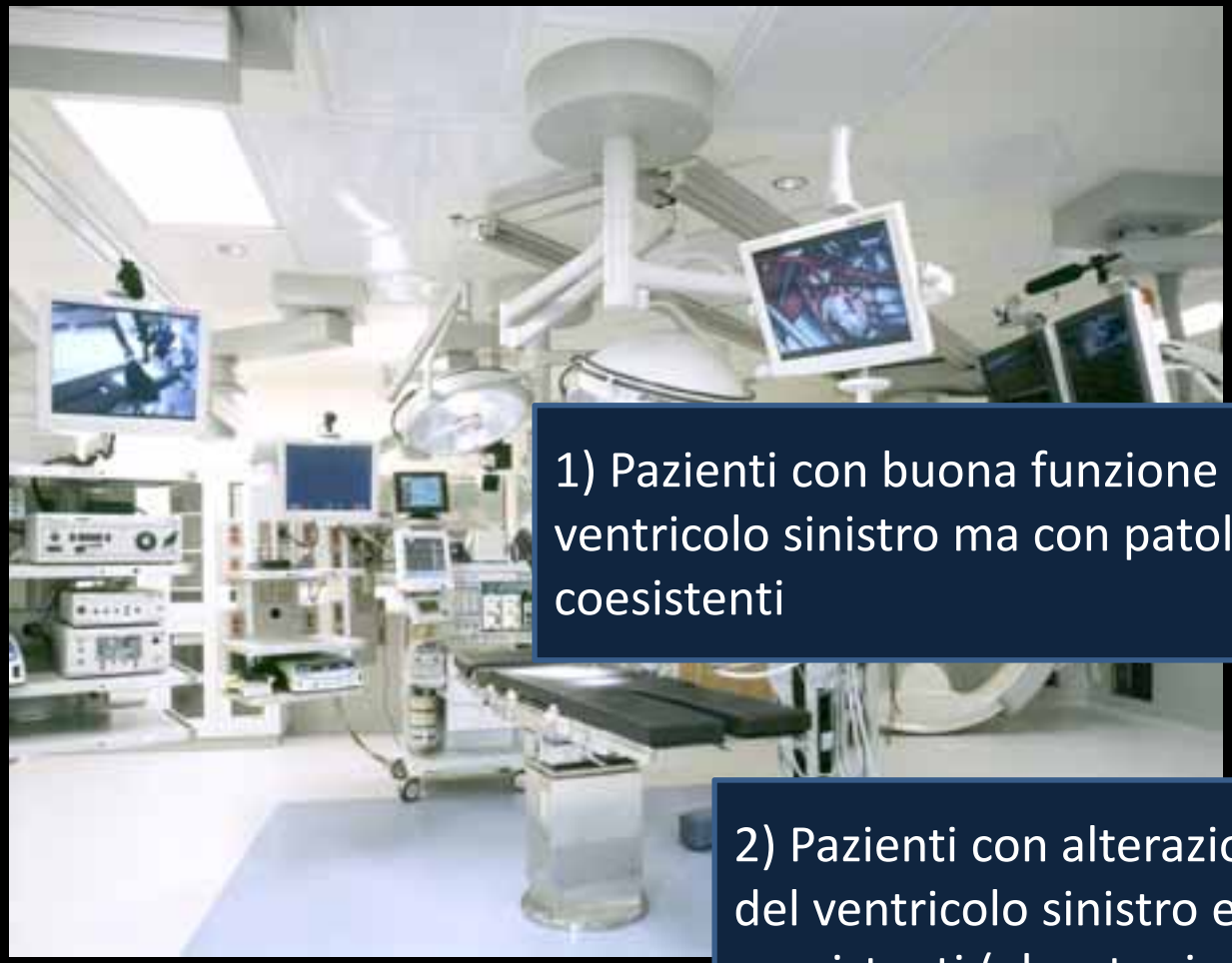
Il ruolo dell'anestesista-rianimatore nella assistenza al paziente sottoposto a TAVI

1) Valutazione preoperatoria

2) Assistenza durante l'intervento

3) Sorveglianza nel postoperatorio

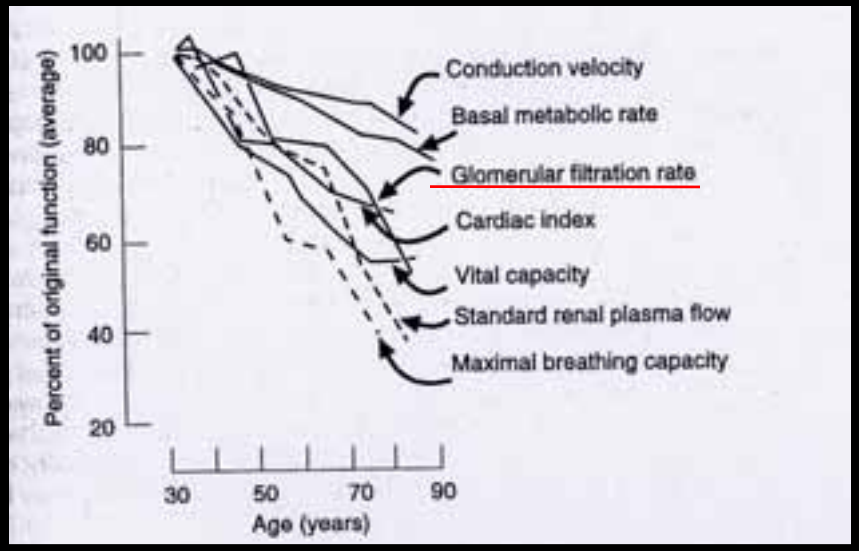
Categorie di pazienti sottoposti a TAVI



1) Pazienti con buona funzione del ventricolo sinistro ma con patologie coesistenti

2) Pazienti con alterazione della funzione del ventricolo sinistro e con patologie coesistenti (elevato rischio)

Challenges of the anesthesiologist on the basis of age-related changes in organ function



Systems lose approximately 1% of their function for year , beginning at around 30 years

Ageing organ systems may not have the functional reserve to meet increased perioperative oxygen demands .

1) Minimizzare la domanda di ossigeno miocardico

2) Mantenere una pressione arteriosa sistemica tale da assicurare la perfusione coronarica e degli organi

Obiettivi anestesiologici

Stabilità cardiovascolare

1) Precarico adeguato per un VS ipertrofico
2) Evitare la tachicardia
3) Mantenere un ritmo sinusale

- Antibiotico-profilassi
- Terapia antiaggregante con clopidogrel e aspirina (**pre-procedura**)
- Eparina (ACT >250")

Obiettivi anestesiologici

Adeguare il precarico per un VS ipertrofico

Good ventricular filling

Adequate Cardiac Output

Small hyperthrophic left ventricles concentric geometries identifies patients with increased risk of early postoperative mortality after AVR

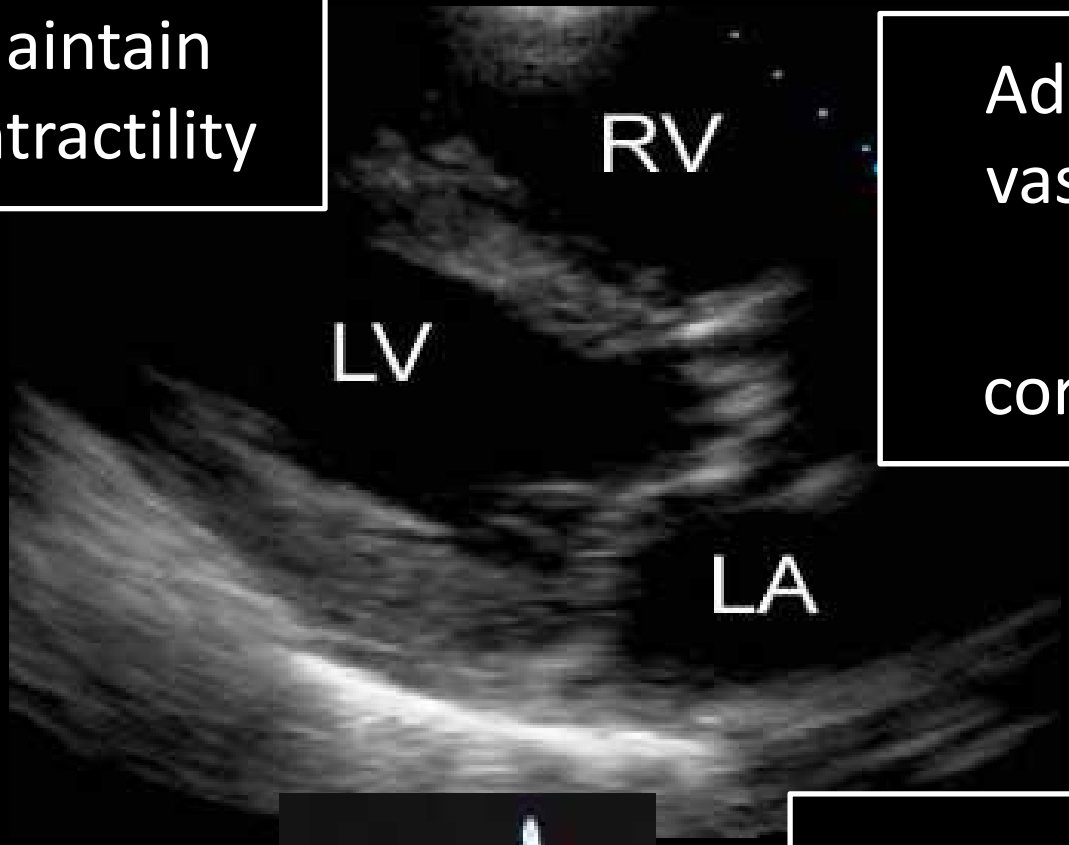
systolic AP 65-70 mmHg
CVP 10-11 mmHg

systolic AP 95-100 mmHg
CVP 14-15 mmHg, LAP 20

Ann Thorac Surg 2008;85:2030-9

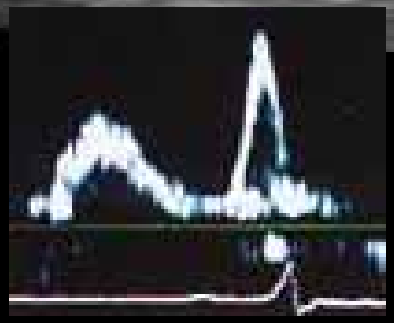
Obiettivi anestesiologici

Maintain contractility



Adequate systemic vascular resistance
(Vasoconstrictors)

coronary perfusion



Sinus rhythm
normal heart rate

Hemodynamic monitoring

- 12-lead electrocardiogram
- Pulse oximetry, NIRS (?)
- Invasive arterial blood pressure
- Central catheter
- Large bore i.v. access
- Urinary catheterization
- Patient warming and fluids warming

Klein AA. Br J Anaesth 2009;103:792-9.

Anesthetic management

TABLE II Anesthetic management and intraoperative characteristics

Patients		$n = 40$	(100%)
Type of anesthetic	Monitored anesthesia care*	4	(10%)
	General anesthesia	36	(90%)
Duration	< 2 hr†	2	(5%)
	2–3 hr	7	(18%)
	3–4 hr	16	(40%)
	4–5 hr	10	(25%)
	> 5 hr	5	(13%)
Vasopressors used	Phenylephrine	30	(75%)
	Ephedrine	12	(30%)
	Dopamine	1	(3%)
	Epinephrine‡	3	(8%)
	Calcium chloride‡	2	(5%)
Minimum intraoperative systolic blood pressure§	70–79 mmHg	3	(8%)
	80–89 mmHg	3	(35%)
	90–99 mmHg	14	(35%)
	100–109 mmHg	3	(8%)
	110–119 mmHg	3	(8%)
	> 119 mmHg	3	(8%)
Intraoperative transfusion	1 U packed red blood cells	1	(3%)
	2 U packed red blood cells	2	(5%)
	3 U packed red blood cells	1	(3%)
	> 3 U packed red blood cells	1	(3%)

The most common complications:

- arrhythmia
- Hemorrhage from ilio-femoral artery
- Myocardial ischemia

30-day mortality 13%

Ree R. Can J Anesth 2008;55:761-768

Anesthetic management

Table 3. Anesthesia-Related Outcomes

	Overall (n = 90)	Transfemoral TAVI (n = 62)	Transapical TAVI (n = 28)	*p* Value
Duration of anesthesia (min) (General Anesth)	190 (160-230)	200 (160-241)	180 (155-210)	0.04
Duration of procedure (min)	100 (80-130)	120 (90-147)	97 (70-105)	<0.001
Tracheal extubation in the catheterization laboratory	55 (63)	48 (81)	7 (25)	<0.001
Duration of mechanical ventilation (min)	245 (180-420)	220 (178-301)	505 (240-630)	<0.001
Length of stay in the critical care unit (d)	3 (2-6)	3 (2-5)	4 (3-9)	0.06
Creatinine (μmol/L)				
Preoperative value	100 (78-122)	99 (75.5-121.2)	104.5 (82.7-122.7)	0.3
Postoperative value	95 (68.7-111.2)	94 (69.7-113)	100 (64.7-109)	0.8
Delta (post-pre)	−13 (−23 to 4.25)	−9.5 (−23 to 3.5)	−16 (−26.25 to 10)	0.5
Creatinine clearance (mL/min/m²)				
Preoperative value	61 (45.3-76.8)	63 (44.7-80.4)	58.8 (51.7-71.8)	0.72
Postoperative value	63 (46.1-85.8)	62.9 (47.4-77.4)	63 (43.1-87.1)	0.75
Troponin Ic (ng/mL)	1.9 (0.7-8)	0.98 (0.5-2.1)	8.7 (3.2-13.1)	<0.001

Table 5. Nonlethal Complications

	Overall (n = 90)	Transfemoral TAVI (n = 62)	Transapical TAVI (n = 28)	*p* Value
Procedural success	83 (92)	56 (90)	27 (96)	0.3
Emergent cardiac surgery	0	0	0	
Cardiac complications				
Heart failure	18 (20)	10 (16)	8 (29)	0.1
Tamponade	5 (6)	2 (3)	3 (11)	0.1
Atrioventricular block	14 (16)	12 (19)	2 (7)	0.1
Requiring pacemaker	5 (6)	4 (7)	1 (4)	0.5
Other	9 (10)	8 (12)	1 (4)	0.1
Other heart block	7 (8)	6 (10)	1 (4)	0.3
Atrial fibrillation	7 (8)	4 (6)	3 (11)	0.4
Ventricular fibrillation	1 (1)	0	1 (4)	0.3
Deep vein thrombosis	2 (2)	1 (2)	1 (4)	0.5
Vascular complications	26 (29)	22 (36)	4 (14)	
Major*	9 (10)	7 (11)	2 (7)	0.2
Minor*	3 (3)	3 (5)	0	0.2
Other (arteriovenous fistula, catheter insertion bleeding, etc)	14 (16)	12 (19)	2 (7)	0.02
Aortic dissection	0	0	0	
Pleural effusion	6 (7)	1 (2)	5 (18)	0.04
Neurologic complications	11 (12)	5 (8)	6 (21)	
Stroke	3 (3)	3 (5)	0	0.3
Confusion	8 (9)	2 (3)	6 (21)	0.05
Acute renal failure	6 (7)	3 (5)	3 (11)	0.3
Sepsis	14 (16)	8 (13)	6 (21)	0.3
Pulmonary	7 (8)	4 (6)	3 (11)	0.4
Urinary tract infection	6 (7)	4 (6)	2 (7)	0.8
Staphylococcus aureus septicemia	1 (1)	0	1 (4)	

30-day mortality: 11%

Heart failure: 20%
A-V block 16% (PM 6%)
Vascular complication: 26%

Guinot PG, J Cardiothorac Vasc Anesth 2010;5 (October):752-761

General anesthesia

Advantages

- TEE guidance
- Painless cannullation apnea during procedure
- No patient movements
- Faster bleeding intervention
- No need for rapid intubation

Disadvantages

- Hemodynamic instability
- Need of inotropes
- Altered T°C management
- No neurologic assessment
- Complications associated with VAM

Sedation + Local Anesthesia

(spontaneous breathing)

Advantages

- Faster preparation time
- Neurologic assessment
- More stable hemodynamic conditions
- Faster recovery time
- Shorter ICU stay

Disadvantages

- No TEE giudance
- Patient movements
- Discomfort for catheters placements

Fassl J. Emerging technology review. J CardioThorac Vasc Anesth 2010;24:691-699

Behan M. Catheter Cardiovasc Interv 2008;72:1012-1015

Monitoraggio post procedura

- Ricovero in terapia intensiva
- Elettrostimolatore endocavitario VD in situ per pacing temporaneo
- Monitoraggio invasivo PA
- Monitoraggio continuo PVC
- Diuresi oraria, bilancio idrico, idratazione
- Funzione renale

What is the impact of providing a transcatheter aortic valve implantation service on conventional aortic valve surgical activity: patient risk factors and outcomes in the first 2?years

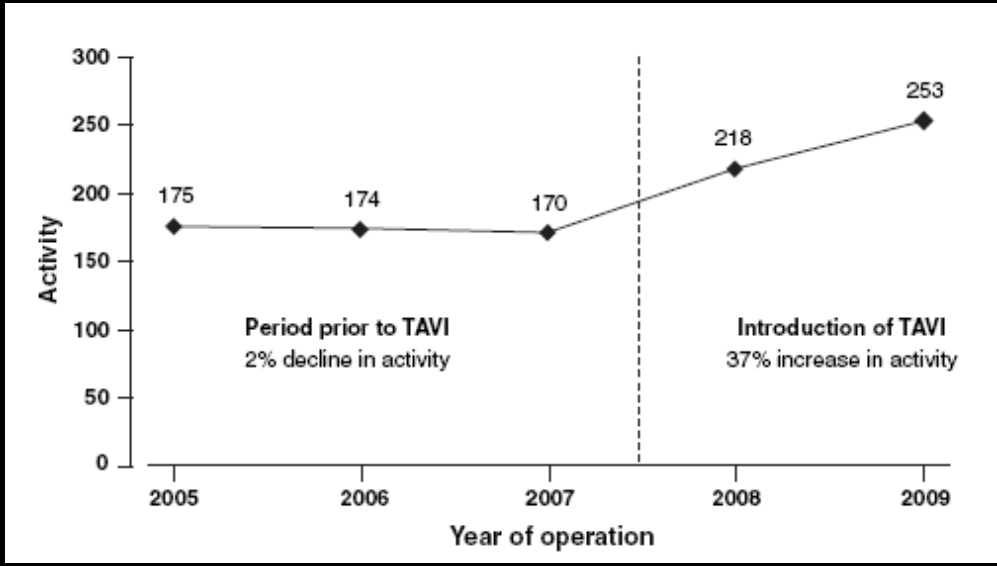
S W Grant, M P Devbhandari, A D Grayson, et al.

Heart 2010 96: 1633-1637

Offering a TAVI service has a positive impact on the volume of conventional AVR surgical activity:

815 patients undergoing isolated AVR ± CABG (2006-2009)

50 patients undregoing TAVI (2008-2009)



Heart 2010;96:1633-1637

Cardiochirurgo

Direttore Sanitario

Cardiologo interventista

grazie

Cardiac surgery in octogenarians

Peri-operative outcome and long-term results

P. Kolh[1], A. Kerzmann[1], L. Lahaye[1], P. Gerard[2] and R. Limet[1]

Eur Heart J 2001;22:1235-1243.

Table 2 Operative results

AVR alone 8.5%

Variable	AVR (n=100)* No. of patients	CABG (n=70) No. of patients (%)	MVR (n=12) No. of patients (%)
Deaths	14	7 (10)	3 (25)
Cerebrovascular accident	2	2 (3)	1 (8)
Myocardial infarction	7	7 (10)	2 (16)
Pneumonia	15	4 (6)	—
Prolonged mechanical ventilation (>48 h)	24	11 (16)	1 (8)
Permanent pacing	5	—	2 (16)
Dialysis	4	2 (3)	3 (25)
Arrhythmias	24	17 (24)	3 (25)
Reoperation for bleeding	5	2 (3)	—
Reoperation for sternal instability	1	2 (3)	—
Pericardial drainage	4	—	—
Hospital stay (days)	19·6 ± 11·4	17·8 ± 10·5	16·6 ± 8·9
Prolonged hospital stay (>14 days)	46	41 (58)	5 (42)
ICU stay (days)	7·8 ± 9·5	5·8 ± 5·2	7·6 ± 9·8

Abbreviations as for Table 1.
*In the aortic valve replacement group, n=100 (obtained by adding 70 patients with aortic valve replacement alone and 30 patients with aortic valve replacement+CABG). Therefore, all absolute numbers are also percentages.

Pre-operative risk factors associated with operative mortality were NYHA functional class IV, **prolonged CBP time**, and urgent procedure

Outcome After Aortic Valve Replacement in Octogenarians

Bruno Chiappini, MD, Nicola Camurri, MD, Antonio Loforte, MD, Luca Di Marco, MD, Roberto Di Bartolomeo, MD, and Giuseppe Marinelli, MD

Ann Thorac Surg 2004;78:85-9.

AVR 62.1% **AVR+CABG 37.9%**	**115 patients**	**82.3 ± 2.1 years**	**8.5%**

10 patients died:

- **4 myocardial infarction**
- **3 cardiac failure**
- **2 pneumonia**
- **1 stroke**

Table 4. Postoperative Complications

Variable	n (%)
AF	20 (17.3)
Mechanical ventilation > 24 hours	6 (5.2)
Stroke	1 (0.8)
Atrioventricular block (pacemaker)	4 (3.4)
Low cardiac output	1 (0.8)
AMI	4 (3.8)

AF = atrial fibrillation; AMI = acute myocardial infarction.

The mean EF 35% was the determining preoperative factor of in-hospital mortality

All early deaths occurred in patients whose admission was classified as urgent

Risk factors for adverse cerebral outcome:

TYPE I

- Proximal aortic atherosclerosis
- History of neurologic disease
- Use of IABP
- Diabetes mellitus
- History of hypertension
- History of pulmonary disease
- History of unstable angina
- age

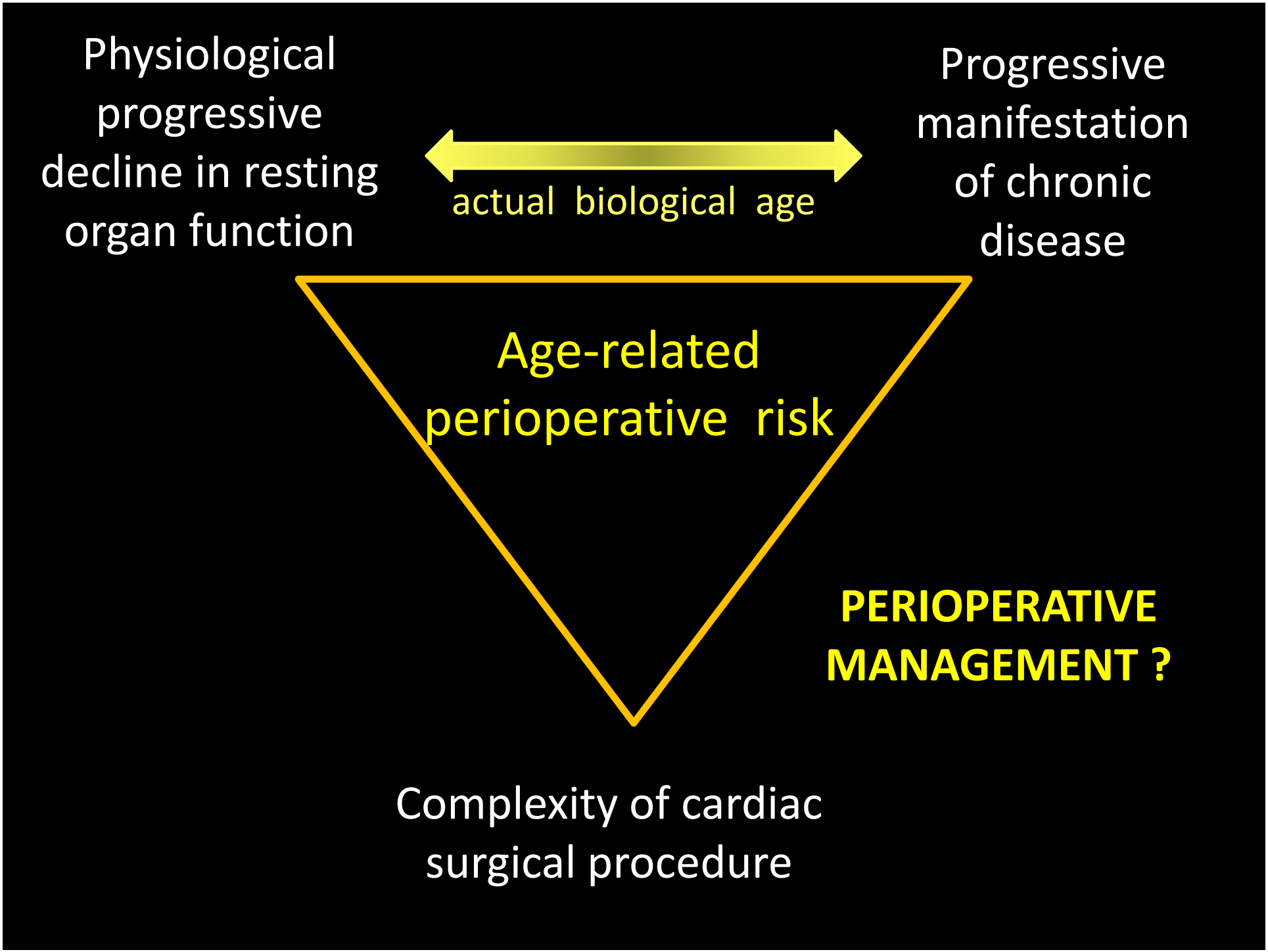
TYPE II

- Age
- Systolic blood pressure > 180 mmHg
- History of alcohol consumption
- History of CABG
- Dysrhythmia on day of surgery
- Antihtpertensive therapy

Adverse cerebral outcomes occurred in 129 /2108 patients (6.1%)

- **3.1 % had type I** (8 died if cerebral injury, 55 had nonfatal strokes, 2 TIA, 1 stupor)
- 3.0% had type II (55 deterioration intellectual function, 8 seizures)

Roach et al., NEJM 1996


Physiological progressive decline in resting organ function
Progressive manifestation of chronic disease
actual biological age
Age-related perioperative risk
PERIOPERATIVE MANAGEMENT ?
Complexity of cardiac surgical procedure

Il ruolo dell'anestesista-rianimatore nella assistenza al paziente destinato a chirurgia

1) Valutazione preoperatoria

2) Assistenza durante l'intervento

3) Sorveglianza nel postoperatorio