

How to develop a simply frailty score for predicting postoperative morbidity in cardiac surgery

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Abstract

Introduction: Ageing and elderly people have greater risk. Physical state and frailty status represent an important risk and must be considered before cardiac surgery. More than one third of current surgeries are performed in patients older than 70 years. This is a factor to keep on mind in our routine evaluation. Currently an accepted definition for frailty is not well established. It has been considered as a physiological decline in multiple organ systems, decreasing the patient's capacity to withstand the stresses of surgery and disease. The aim of our study was to determinate a correlation between preoperative features and the morbidity after cardiac surgery in aortic valve replacement population.

Methods: We selected the 70 years old patients or older who underwent an elective aortic valve replacement. We collected prospectively all preoperative features and frailty traits (Barthel Test; Gait Speed test, Handgrip) also taking into account blood parameters like albumin level and hematocrit previous to the surgery, hospital admissions within 6 months, and we analyze the demographics and medical history of the patients. We compare patients who undergo to stented prosthesis, sutureless or Transcatheter prostheses (TAVI) procedure and follow up.

Results: Two hundred patients were enrolled. The mean age was 78 years all. The predicted mortality with Logistic euroScore I was 12,8% with a real mortality lower than expected (3,5%). Pre-surgery frailty in our population was associated with a Gait Speed higher of 7 seconds, Barthel less of 90%, anemia with Hematocrit <32%, albumin level < 3,4g/dl, chronic renal failure, preoperative re-admission and artery disease. The TAVI group had higher morbidity, no differences statistically significant between Stented and sutureless prosthesis group. Frail individuals had longer hospital stays, readmissions and respiratory/ infectious complications. The mortality at 6 months /one year follow up was 4,1 % /0 % respectively; and morbidity (pacemaker implant, respiratory events, readmission); at 6 months /one year of follow up was 13,47 % to 3%.

Conclusions: Elderly and frailty population present more complications after a cardiac surgery. A simple frailty score must be considered in cardiac population to avoid increased morbidity.

Introduction

The aortic valve disease is common and its prevalence increases with age. The prevalence of aortic stenosis is near of 3 % in the population over 75 years [1]. Due to poor prognosis of medical treatment in case of severe symptomatic aortic stenosis (Ao St.), it requires often a surgical or interventional action. The associated perioperative mortality does not exceed 2.5% [2-4].

When valve surgery is required, it's necessary to answer which is

the most appropriate procedure for the patient; Frailty is one of the challenges that appears in medical society with ageing of the population. And it's associated with a greater degree of dependence, institutionalization, morbidity and mortality. However, despite increase in interest of its use in pre-operative risk scales, there is still no clear consensus about its definition and the factors that should be included in its assessment [5-8].

Actually, the ageing of the population, new emergent techniques

and increase of high risk profile patients referred to cardiac surgery, are the scene for cardiac surgery nowadays. With the emergence of new surgical techniques (ministernotomy approach, sutureless prostheses, transcatheter prostheses, (transapical, transaortic or transfemoral); in addition to the current economical situation, it's necessary to get the best alternative for each patient [9-10]. Currently, only medical surgical sessions, with the clinical criteria of the referring physician, as well as use of risk scales (euroScore I and II and STS Score/ Barthel test; Pfeiffer); are the tools used to refer the patient from moderate-high risk to a therapeutic alternative or another.

Frailty is the most problematic expression of population ageing, which is a decreased physiological reserve across multiple organ system with impaired homeostatic reserve, reduced capacity to withstand stress and resultant adverse health outcomes. However, most surgical risk scores do not include measures of frailty [11-13]. To incorporate frailty screening in the risk assessment, it's essential to validate frailty instruments, and related with its ability to predict mortality, functional status.

Materials and methods

Study performed from April 2014 to December 2016. Preoperative, operative and hospital discharge data were collected from patients. Patients were followed up according to our institutional protocol and it was performed a clinical follow up at 6 months and one year.

Statistic analysis

A descriptive analysis of the demographic, clinical and echocardiographic data of all patients was performed. For qualitative variables absolute frequencies and percentages were calculated. Quantitative variables were described by median and standard deviation. We performed an univariate and multivariate analysis.

Results

200 patients (mean age 78,2 DE 4,6 years, 44,5% female. EuroSCORE I 12,84 ± 38,5%; Mortality 3,5 %. The patients were discharged: ICU 3,1 ± 6,4 and hospitalization 12,9 ± 8 days. Surgery was performed via full sternotomy 65 %. And minimal approach in 35 %. At the time of surgery only 5,5 % had additional coronary procedures. The implanted prostheses were 80 Stented; 98 Sutureless and 22 TAVI. The mean cross clamp time was 49,13 ± 26,42 min, CPB 67,47 ± 36,05. **Table 1.**

	Tipoprotesis	M	SD	
CPB	stented	83,488	32,8009	pns
	Sutureless	69,541	23,2739	
Cross Clamp	stented	63,813	23,8800	.04
	Sutureless	48,173	15,5630	
IOT	stented	8,266	12,5123	.03
	Sutureless	5,378	5,1102	

CPB Cardiopulmonary bypass; IOT Orotracheal intubation;

At 6 months follow up 95,8 % survival, there were 8 deaths non cardiac cause (COPD evolution, subdural hematoma and oncological diagnosis de novo); and there were no mortality at one year follow up.

There were 4% neurological complications, 3 neurological postoperative events (transient vascular accident); 4 delirium and 1 comitial crisis; and only one patient required a pacemaker implantation [14]. There were difference between preoperative parameters and morbidity; Kidney disease, anemia, STS, Barthel or gait speed higher than 7 seconds are more related with morbidity in univariate test. **Table 2.**

	Morbidity NO	Morbidity Yes	P
AGE	77,88 DE 4,92	78,67 DE 4,35	,17
IMC	28,35 DE 4,6	28,99 DE 5,01	,85
HTA	98 (92 %)	94 (92,5%)	,597
DM	28 (26,4%)	34 (36,17)	,091
DLP	67 (63,02 %)	61 (64,8 %)	,46
COPD	28 (27,4 %)	36 (38,2%)	,102
Kidney disease	11 (10,3%)	21 (22,3%)	,017
Artery disease	26 (24,5 %)	34 (36,17%)	,051
LIVER Disease	3 (2,8%)	1 (1,0%)	,357
IABVD	13 (12,2 %)	22 (23,4 %)	,030
Depression treatment	11 (10,3 %)	8 (8,5 %)	,35
Admissions in last 6 months	56 (52,8%)	56 (52,8 %)	,207
Anemia < 32	21 (19,8%)	33 (31,1 %)	,011
Alb < 34 mg/dL	9 (8,4 %)	13 (13,8 %)	,164
Gender	49 female/57 male	39 female/55 male	,298
Barthel	95,23 DE 6,7	92,23 DE 8,6	,005
Gait Speed	7,123 DE 1,7	7,8 DE 2,7	,014
Handgrip	20,019 DE 7,9	18,3 DE 8,04	,69
EuroScore n	7,74 DE 1,97	7,91 DE 2,07	,309

(HTA hypertension, DM diabetes mellitus, COPD Pulmonary obstructive disease, IRC Kidney disease, DLP dyslipidemia, IADL Independence activities daily living).

In multivariate test only Gait Speed, Barthel and STS score were related with morbidity.

Discussion

The use of prostheses and biological ones, is the gold standard in the replacement in patients over 65 years old. The current risk models predict outcomes for patients undergoing cardiac surgery, providing an objective assessment of mortality and morbidity on the basis of specific preoperative variables. It's known the accuracy of these models for the prediction of operative mortality [15-17]. In case of TAVI, the risk models should reliably identify patients at excessive risk for conventional AVR and predicted mortality.

However, the current risk models, don't collect features related with frailty, which have been shown to impact operative mortality [18-19]. Frailty is a geriatric syndrome, is the result of deterioration multiple physiological system, that impacts over resiliency to recover. But, there's is not yet a gold standard definition to measure frailty.

There is a consensus that promotes a definition based on a specific phenotype of frailty with five features (unintentional weight loss, weakness (measured by grip strenght), fatigue, slowness (measured by five metre gait); We identify in this study as an independent predictor of adverse short and long term outcomes after AVR and TAVI procedures : slowness (Gait Speed higher 7 seconds), BArthel and STS score [20].

The 5 m gait speed test is a validated and reliable implanted test, which is relacionated with frailty [21]. The group of Afilalo, has demonstrated recently that gait speed is an independent predictor of adverse outcomes after cardiac surgery. So as slow as you become, with each 0,1 m/s decreases, increase your risk of mortality [22-23].

In our study a gait speed higher than 7 seconds was involved with more morbidity after cardiac surgery. Although we identify in multivariant test these three ítems, by themselves aren't able to predict risk in these patients. Gait speed is a reasonable screeing tool, it's feasible, self reported mobility, and is an indirect marker of disability and nutritional status, too. To sum up , Gait speed and frailty scales can be good scales to evaluate preoperative assessment of people who underwent to cardiac surgery; Additional features like gait, can be useful in combination with ohter risk profile in the preoperative assessment of these patients [24,25].

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References

1. Walther T, Blumenstein J, van Linden A, Kempfert J (2012) Contemporary management of aortic stenosis: surgical aortic valve replacement remains the gold standard. *Heart (British Cardiac Society)* 98: 23-29.
2. Kodali SK, Williams MR, Smith CR, Svensson LG, Webb JG, et al. (2012) Two-year outcomes after transcatheter or surgical aortic-valve replacement. *N Engl J Med* 366: 1686-1695.
3. Mack MJ, Leon MB, Smith CR, Miller DC, Moses JW, et al. (2015) 5-year outcomes of transcatheter aortic valve replacement or surgical aortic valve replacement for high surgical risk patients with aortic stenosis (PARTNER 1): A randomised controlled trial. *The Lancet* 385: 2477-2484.
4. Makkar RR, Fontana GP, Jilaihawi H, Kapadia S, Pichard AD, et al. (2012) Transcatheter aortic-valve replacement for inoperable severe aortic stenosis. *N Engl J Med* 366: 1696-1704.
5. García-García FJ, Carcaillon L, Fernandez-Tresguerres J3, Alfaro A4, Larrion JL5, et al. (2014) A new operational definition of frailty: the Frailty Trait Scale. *J Am Med Dir Assoc* 15: 371.
6. Fried LP, Tangen CM, Walston J, Newman AB, Hirsch C, et al. (2001) Frailty in Older Adults: Evidence for a Phenotype. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 56: 146-157.
7. Ruan Q, Yu Z, Chen M, Bao Z, Li J, et al. (2015) Cognitive frailty, a novel target for the prevention of elderly dependency. *Ageing Res Rev* 20: 1-10.
8. Brown CH, Max L, Laffam A, Kirk L, Gross A, et al. (2016) The Association between Preoperative Frailty and Postoperative Delirium after Cardiac Surgery. *Anesthesia and Analgesia* 123: 430-435.
9. Muneretto C, Bisleri G, Moggi A, Di Bacco L, Tespili M, et al. (2015) Treating the patients in the “grey-zone” with aortic valve disease: A comparison among conventional surgery, sutureless valves and transcatheter aortic valve replacement. *Interactive Cardiovascular and Thoracic Surgery* 20: 90-95.
10. Sündermann S, Dademasch A, Praetorius J, Kempfert J, Dewey T, et al. (2011) Comprehensive assessment of frailty for elderly high-risk patients undergoing cardiac surgery. *European Journal of Cardio-Thoracic Surgery : Official Journal of the European Association for Cardio-Thoracic Surgery* 39: 33-37.
11. Edwards FH, Cohen DJ, O'Brien SM, Peterson ED, Mack MJ, et al. (2016) Steering Committee of the Society of Thoracic Surgeons/American College of Cardiology Transcatheter Valve Therapy Registry. Development and Validation of a Risk Prediction Model for In-Hospital Mortality After Transcatheter Aortic Valve Replacement. *JAMA Cardiology* 1: 46-52.
12. Jin R, Furnary AP, Fine SC, Blackstone EH, Grunkemeier GL (2010) Using Society of Thoracic Surgeons risk models for risk-adjusting cardiac surgery results. *Ann Thorac Surg* 89: 677-682.
13. Brennan JM, Holmes DR, Sherwood MW, Edwards FH, Carroll JD, et al. (2014) The association of transcatheter aortic valve replacement availability and hospital aortic valve replacement volume and mortality in the United States. *Annals of Thoracic Surgery* 98: 2016-2022.
14. Svensson LG, Blackstone EH, Rajeswaran J, Brozzi N, Leon MB, et al. (2014) Comprehensive analysis of mortality among patients undergoing TAVR: Results of the PARTNER trial. *Journal of the American College of Cardiology* 64: 158-168.
15. Melby SJ, Zierer A, Kaiser SP, Guthrie TJ, Keune JD, et al. (2007) Aortic valve replacement in octogenarians: risk factors for early and late mortality. *Ann Thorac Surg* 83: 1651-1656.
16. Ambler G, Omar RZ, Royston P, Kinsman R, Keogh BE, et al. (2005) Generic, simple risk stratification model for heart valve surgery. *Circulation* 112: 224-231.
17. Sedaghat A, Sinning JM, Vasa-Nicotera M, Ghanem A, Hammerstingl C, et al. (2013) The revised EuroSCORE II for the prediction of mortality in patients undergoing transcatheter aortic valve implantation. *Clinical Research in Cardiology : Official Journal of the German Cardiac Society* 102: 821-829.
18. Sepehri A, Beggs T, Hassan A, Rigatto C, Shaw-Daigle C, et al. (2014) The impact of frailty on outcomes after cardiac surgery: a systematic review. *J Thorac Cardiovasc Surg* 148: 3110-3117.
19. Bagnall NM, Faiz O, Darzi A, Athanasiou T (2013) What is the utility of preoperative frailty assessment for risk stratification in cardiac surgery? *Interact Cardiovasc Thorac Surg* 17: 398-402.
20. Drey M, Pfeifer K, Sieber CC, Bauer JM (2010) The fried frailty criteria as inclusion criteria for a randomized controlled trial: Personal experience and literature review. *Gerontology* 57: 11-18.
21. Buurman BM, Hoogerduijn JG, de Haan RJ, Abu-Hanna

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- A, Lagaay AM, et al. (2011) Geriatric conditions in acutely hospitalized older patients: Prevalence and One-Year survival and functional decline. functional status. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences* 58:1049-1054.
22. Afilalo J, Kim S, O'Brien S, Brennan JM, Edwards FH, et al. (2016) Gait Speed and Operative Mortality in Older Adults Following Cardiac Surgery. *JAMA Cardiol* 1: 314-321.
 23. Afilalo J, Eisenberg MJ, Morin JF, Bergman H, Monette J, et al. (2010) Gait Speed as an Incremental Predictor of Mortality and Major Morbidity in Elderly Patients Undergoing Cardiac Surgery. *Journal of the American College of Cardiology* 56: 1668-1676.
 24. Afilalo J, Mottillo S, Eisenberg MJ, Alexander KP, Noiseux N, et al. (2012) Addition of frailty and disability to cardiac surgery risk scores identifies elderly patients at high risk of mortality or major morbidity. *Circulation: Cardiovascular Quality and Outcomes* 5: 222-228.
 25. Thourani VH, Li C, Devireddy C, Jensen HA, Kilgo P, et al. (2015) High-risk patients with inoperative aortic stenosis: Use of transapical, transaortic, and transcrotid techniques. *Annals of Thoracic Surgery* 99: 817-825.

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