Early outcomes of cardiac surgery in elderly patients

Résultats à court terme de la chirurgie cardiaque chez les sujets âgés

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RÉSUMÉ

Introduction : Avec l'augmentation de l'espérance de vie et l'incidence plus élevée des maladies cardiovasculaires, plus de sujets âgés sont adressés en chirurgie cardiaque. D'un autre côté, l'âge avancé constitue un facteur prédictif de morbi-mortalité.
L'objectif de notre étude était d'évaluer les résultats à court terme de la chirurgie cardiaque chez les sujets âgés.

Méthodes : Etude descriptive rétrospective incluant les sujets âgés ayant eu une chirurgie cardiaque de janvier 2012 au 31 décembre 2016 et suivis au sein du service de cardiologie de l'hôpital Habib Thameur.

Résultats : Notre étude a inclus 55 patients. L'âge moyen était de 72±6 ans et un sexe-ratio à 2. Quatre-vingt-cinq pour cent ont été hospitalisés pour une angine de poitrine, 18% pour une dyspnée et un patient pour une endocardite infectieuse. La fonction ventriculaire gauche moyenne était de 54±9%. L'EuroSCORE II moyen était de 1,91±1,18. Vingt-six pour cent ont eu une chirurgie urgente. La durée moyenne de circulation extracorporelle était de 77±26 min et le temps d'extubation moyen de 8±6 h. Quatre-vingt-quatre pour cent ont eu un pontage aorto-coronaire isolé, 16% un remplacement valvulaire isolé, 5% une chirurgie combinée et 4% une redux. Le séjour moyen en milieu chirurgical était de 4,6±1,2 jours. Le taux de mortalité précoce était de 2% et 74% ont présenté des complications. Vingt-six patients ont présenté une complication en péri-opératoire : quatre cas de bas débit cardiaque, deux fibrillations ventriculaires, un bloc auriculo-ventriculaire complet, 22 saignements nécessitant des transfusions, six ventilations mécaniques prolongées et un accident vasculaire cérébral. Le remplacement valvulaire isolé était significativement associé au risque de bloc auriculo-ventriculaire et d'accident vasculaire cérébral (p=0.016). L'analyse univariée n'a pas mis en évidence de facteurs prédictifs de complications.

Conclusion : La chirurgie cardiaque est possible chez les sujets âgés avec un risque acceptable en termes de mortalité et une augmentation de la morbidité en raison de leur fragilité. Une sélection prudente de patients est nécessaire pour assurer le succès de la chirurgie cardiaque chez les patients âgés.

Mots-clés
Sujets âgés, chirurgie cardiaque, mortalité, complications.

SUMMARY

Background: Due to the increase in average life expectancy and the higher incidence of cardiovascular disease, more elderly patients present for cardiac surgery nowadays. At the same time, age has been considered a predictor of morbidity and mortality.
The aim of our study was to evaluate the short-term outcomes of cardiac surgery in elderly patients.

Methods: We conducted a descriptive retrospective study including elderly patients who underwent cardiac surgery from January 2012 to 31st of December 2016. All patients were hospitalized before and after cardiac surgery in the cardiology department of Habib Thameur Hospital.

Results: Our study included 55 patients. Average age was 72±6 years old and sex-ratio was two. Eighty-five percent presented with angina, 18% with dyspnea and one patient with an aortic prosthetic valve endocarditis. Mean left ventricular function was 54 ±9 %. Mean EuroSCORE II was 1.91±1.18.Twenty-six per-cent had an urgent surgery. Mean extracorporeal circulation time was of 77±26 min and mean extubation time was 8±6 h.Eighty-four per cent had a coronary artery bybass grafting and 16% a valve replacement. Four per cent had a redux and 4% a combined surgery. Stay in surgical department varied between 3 and 10 days with average of 4.6±1.2 days. Early mortality rate was of 2% and 98% had complications. Ninety-eight complications occurred after surgery: 35 reintervention for mediastinal bleeding or tamponade, 28 bleedings requiring transfusions, eight heart rhythm disorders, an atrioventricular conduction block requiring ventricular, five atrial fibrillation, two ventricular tachycardias, a ventricular fibrillation, eight low cardiac outpout, seven prolonged mechanical ventilation and eight pneumonias.
In univariate analysis, recent myocardial infarction and chronic kidney disease were predictive of early complications.

Conclusion: Our data shows cardiac surgery is feasible in elderly patients with acceptable risk in terms of mortality and an increased morbidity due to their frailty. Careful patient selection is needed for the success of cardiac surgery in elderly patients.

Key-words
Aged patients, Cardiac surgery, Mortality, Complications.

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Demographic change has started in the last 20thcentury resulting in the increase of life expectancy [1]. The number of person 80 years of age or older is expected to increase from 6.9million in 1990 to approximately 25 million in the year 2050 in the United States [2].

On the other hand, aging is associated with cardio-vascular changes in the systemic vasculature, the heart and the coronary circulation leading to reduced physiological reserves and a higher incidence of cardiovascular disease [3]. While an age of 70 was considered a contraindication for diagnostic procedures such as coronary angiography in 1984. Nowadays, more patients that are elderly are candidates of cardiac surgery [4]. In Germany, in 2014, more than 14.2% of the patients undergoing cardiac surgery were older than 80 years old [5]. Several studies have shown that cardiac surgery in the elderly improved quality of life [6-8]. Nevertheless, aging was identified as a factor associated with higher morbidity and mortality [9].

Therefore, regarding the elderly patients, comprehensive assessment of the patient scheduled for surgery is essential and should take into account:

- Possible comorbidity, life expectancy, functional situation and the expected social support that may be available after surgery as well [10].

Another important point reported by the geriatric literature is the concept of "frailty" [11-13]. In fact, chronological age does not reflect the biological status in all the patients and may change with the "frailty" degree. Recently, Afilalo and al showed that frailty assessment in elderly patients undergoing cardiac surgery improved the operative risk assessment [14].

In Tunisia, life expectancy increased from 74.5 years old in 2008 to 75.3 in 2015 according to the World Health Organization (WHO) [1]. At the same time, cardiac heart diseases mortality rates increased by 11.8% for men and 23.8% for women between 1997 and 2009 [15]. Fortunately, there have been improvements in cardiac surgery, which affect the consideration of surgical treatment in elderly patients who in the past may not have been considered to be surgical candidates.

Small data exists on outcomes of cardiac surgery in the elderly patients. Abbes and al concluded that there is a higher risk of low cardiac output and atrial fibrillation in a retrospective study including 45 patients aged of 65years old and more undergoing cardiac surgery from 2007 to 2009 in Sfax, Tunisia.

In 2011, Ben Abdennebi and al, found an early mortality of 3 %, a morbidity of 79% among 100 patients aged of 70 years old, and older admitted in the Charles Nicole Hospital.

Therefore, the aim of our study was to evaluate in-hospital outcomes of cardiac surgery in elderly patients including mortality and peri-operative complications and to determinate factors associated with these parameters that will be explained in details in this article.

METHODS

Study design and location: We conducted a descriptive retrospective study including elderly patients who underwent cardiac surgery from January 2012 to 31st of December 2016. All patients were hospitalized before and after cardiac surgery in the cardiology department of Habib Thameur Hospital in Tunis, Tunisia.

Study population: Elderly patients who underwent cardiac surgery were included in the study. Patients who refused to be operated on or fewer than 65 years old weren't included. And lost file cases were excluded from the research. Therefore, from a total of 90 patients, only 55 were part of the study.

Data collection: After recruiting the study subjects, a structured questionnaire was used to collect data. The responses filled in based on patients' files. It consisted of information of the patients before, during and after surgery addressing short term outcomes of cardiac surgery in elderly population.

Data analysis and management: Statistical analysis was performed with SPSS software version 20.0. Continuous variables were expressed as the mean and standard deviation or the median. Discrete variables were expressed as absolute numbers and percentages. Continuous variables were compared by analysis of variance or Student *t* test, and discrete variables by $\chi 2$ corrected with Fisher's exact test when necessary.

All variables with $P \leq 0.2$ in the univariate analysis were included in a multivariate logistic regression model to investigate the determinants of postoperative complications and in-hospital mortality. Multivariable adjusted odds ratio (OR) with accompanying 95% confidence intervals (CI) were reported.

A p value of <0.05 was considered statistically significant. The survival rate was determined by the Kaplan-Meier Method. Data were then presented using pie charts, histograms and tables.

RESULTS

General characteristics of the study participants:

Average age was 72±6 years old with variations between 65 and 87 years old. Most patients were male with sex ratio was 1.9. Fifty-four per cent (n=30) had hypertension, 40% (n=22) were smokers and 36% (n=20) diabetic.

Most patients Eighty-five percent (n=47) presented with angina and only 10 for dyspnea. Types of angina are represented in figure 1.

ECG was normal for 30 patients (55%) and average left ventricular function was 54 ±9% with extremes from 30 to 75%.

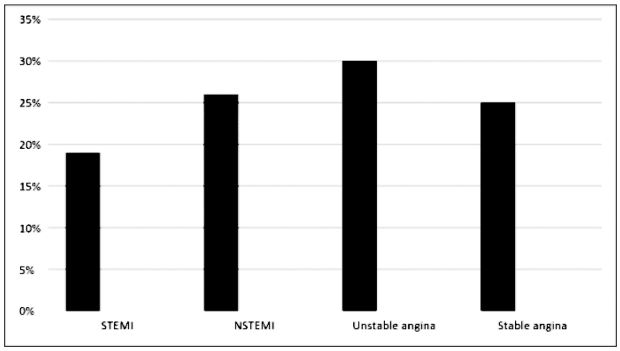

Figure 1: Types of angina

Outcomes:

Average EuroSCORE II was 1.95±1.22 (0.59 to 6.75).

Fifty-four patients underwent collateral external circulation and one had an off-pomp CABG. All patients had an aortic clamping with cardioplegia using mediane sternotomy. Twenty-six per-cent (n=14) had and urgent surgery. The rest were elective.

Average CEC time was of 77±26 min (40 to 150 min). Average aortic clamping time was of 53±24 min (26 to 120 min) and extubation lasted between 1 and 72h and with an average of 8±6 h. The early mortality rate was of 2% (One case):

The patient was 69 years-old. His CRF were diabetes and hypertension. He was admitted for a NSTEMI. His LVEF was 55% and EuroSCORE II 4.1. Preoperative assessment showed a severe right internal carotid stenosis scheduled in a second time after CABG. The patient had severe two-vessels disease and underwent urgent CABG. He presented a low cardiac output and needed postoperative IABP put by right femoral access and inotropic drugs (Adrenalin). He presented numerous ventricular fibrillations on the second post-operative day that did not respond to cardiac reanimation.

Seventy-four per cent of the patients (n= 41) had complications. Major complications were associated to the different types of surgery are shown in table I. There was a significant association between atrioventricular block, stroke and isolated valve replacement.

Mean survival time without complications was of 2.8±0.36 days (2.1 to 4.5 days).

As shown in figure 2, most of the complications occurred in day 1.

All patients were stable after surgery with clean scar and stable sternum and hemodynamics. No one had a fever. Forty-five patients (82%) had anemia after surgery in comparison to 30 before cardiac surgery. Eight patients (15%) had a biological inflammatory syndrome.

There was no significant changes in serum creatinine nor LVEF before and after cardiac surgery (67±25 vs 70±26 µmol/l, p=0.112, 54±9% vs 53±9%, p=0.124).

As shown in tables II, III and VI univariate and multivariate analysis based on patients' characteristics showed no difference between the groups with or without complications.

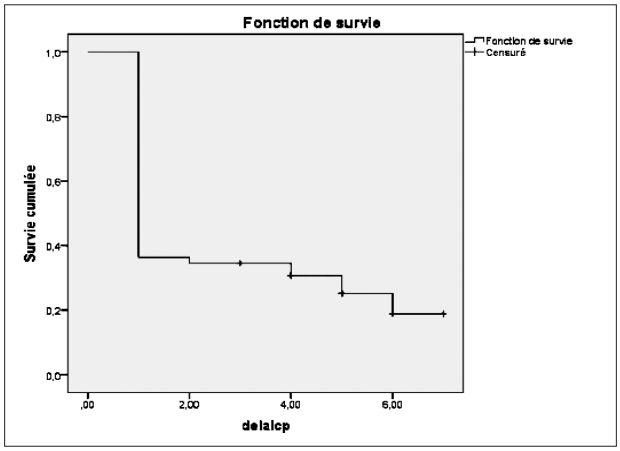

Figure 2: Survival free of complications

Table1 : Les moyens d'illustration

	Isolated CABG N=46	Isolated VR N=6	Combined surgery N=3	P
Major complications	21 (46%)	3 (50%)	2 (67%)	0.769
Death	1 (2%)	0	0	0.905
Low cardiac output	3 (6%)	1 (17%)	0	0.876
Need for mechanical ventilation	6 (13%)	0	0	0.674
Atrio-ventricular block	0	1 (17%)	0	0.016
Stroke	0	1 (17%)	0	0.016
Bleeding requiring transfusions	17 (37%)	3 (50%)	2 (67%)	0.524
Ventricular fibrillation	2 (4%)	0	0	0.849

Table 2: Univariate analysis based on patients characteristics

	No complications N=29	Complications N=26	P
Mean age (years)	72±6	71±4	0.624
Female	10 (34%)	9 (35%)	0.769
Diabetes	12 (41%)	8 (31%)	0.346
Diabetes on insulin	5 (17%)	3 (11%)	0.508
HTA	16 (55%)	14 (54%)	0.857
Obesity	2 (7%)	1 (4%)	0.542
Asthma	2 (7%)	0	0.273
Tobacco	8 (27%)	14 (54%)	0.140
Hypercholeterolemia	8 (28%)	4 (15%)	0.274
Chronic kidney disease	18 (62%)	16 (61%)	0.659
Anemia	15 (52%)	15 (56%)	0.657
Prior coronary artery disease	3 (10%)	1 (4%)	0.348
Prior cardiac surgery	0	2 (8%)	0.2
Myocardial infarction	9 (31%)	12 (46%)	0.2
Infective endocarditis	0	1 (4%)	0.286
Mean LVEF (%)	54±9	53±8	0.849
Left Ventricular dysfunction	9 (31%)	5 (19%)	0.316
Mean PAPS (mmHg)	28±7	30±10	0.479
Moderate pulmonary hypertension	4 (14%)	4 (15%)	0.585
Mean number of coronary artery disease	2.1±1	2.3±0.9	0.319
Mean EuroSCORE II (%)	1.7±0.8	2.2±1.5	0.136

Table 3 : Les moyens d'illustration

	OR	CI	p
Prior cardiac surgery	0.55	0.061-5.1	0.596
Myocardial infarction	0.39	0.2-6.9	0.749
EuroSCORE II	1.07	0.365-4.88	0.927

Table 4 : Univariate analysis based on operative data

	No complications N=29	Complications N=26	P
Mean collateral external circulation time (min)	78±26	80±28	0.711
Mean aortic cannulation time (min)	47±16	61±10	0.125
Mean number of anastomoses	2.7±0.5	2.6±0.8	0.702
Urgent surgery	5 (17%)	9 (35%)	0.122
Isolated CABG	23 (79%)	21 (81%)	0.894
AVR	3 (10%)	4 (15%)	0.463
MVR	1 (3%)	2 (8%)	0.645
Combined surgery	1 (3%)	2 (8%)	0.645
ILMA	23 (79%)	23 (88%)	0.456
Mean in-hospital stay (days)	4.7±1	5±3	0.352

DISCUSSION

Our data shows cardiac surgery is feasible in elderly patients with acceptable risk in terms of mortality and an increased morbidity due to their frailty.

An important point to underline is that different definitions of "elderly" patients are found in the literature varying from 65 to greater than 80 years old [7,16-24]. In 1966, Bowles and al defined elderly as patients that were 60 years old and more [21].

Twenty seven percent of our patients in our study had an AF. In fact, it showed as the most common disorder within the elderly [18-21].

Mean EuroSCORE II was lower compared to other studies (1.95±1.22). In Abbes and all study, 44.44% of the patients had a logistic EuroSCORE superior to six [16]. Curiel-Balsera and al found a higher logistic EuroSCORE in patients older than 75 years old compared to patients that had less than 75 years old respectively, 11.19% and 6.21%; p=.0001 [28].

Bach et al concluded the same thing using a cut off of 80 years old for the age (respectively 7,3±2,1 vs 3,4±1,9; p <0,0001) [25].

In our study, 26% of our patients had urgent surgery and there were no cases of emergency surgery. Alexander and al found that emergency surgery was a strong factor predicting the post-operative course in the elderly [9].

Intervention times were lower in our study as shown in table V. This difference may be due to the less combined surgery in our work.

Table 5: comparison of intervention times

	Year	Number of patients	Mean collateral external circulation (min)	Mean aortic cannulation time (min)
Curiel-Balsera [28]	2008-2011	882	110.91±47.86	-
Bach [36]	2008	285	85.6±20.8	-
Our study	2012-2016	55	77±26	53±24

Isolated CABG was the most performed procedure in our study (84%). In fact, myocardial revascularization is becoming more common in the elderly. Jomaa and al, found that 15% of the patients admitted for STEMI were older than 75 years from 1998 to 2013. Forty-five patients had CABG with CEC and one had an off pomp CABG. In their recent study, Durandhar and al found a rate of off pomp GABG from 8.1 to 9.7 % from 2001 to 2012 [25].

Among patients who underwent valve surgery, survival rates are the same as in a general population of age matched subjects [26-29].Chronic mitral regurgitation is the second most common reason for valve surgery inelderly adults, representing 30 to 35 percent of cases [30,31].

Early mortality rate in cardiac surgery was of 2% in our study. It was of 10.7% in López-Rodríguez et al study and 12% in Curiel Barsera and al study [24,28]. Differences between the studies can be explained by the age cut-off values that were included and the number of patients.This mortality rate decreased with techniques amelioration. In fact, Bowles et al had a 20% total mortality in 1966 but is still higher than in younger patients [21].Our complications rates were in line with literature as shown in table VI.

Table 6 : Complications rates in the literature

	Lopez-Rodriguez [24]	Curiel Barsera [28]	Our study
Reintervention	2%	5.6%	0%
Myocardial infarction	0.7%	4.8%	0%
Low Cardiac Output	7%		7%
Atrio-ventricular block	5%	0.44%	2%
Ventricular fibrillation/tachycardia	-	10.3%	4%
Respiratory complications	7.9%	16%	11%
Infectious complications	3.6%	4%	0%
Renal complications	2.9%	2.5%	0%
Neurological complications	1.4%	1.9%	2%
Multiorgan failure	-	8.1%	0%
Bleeding requiring transfusions	77%	-	40%
Non major complications	-	25%	27%

Recent literature reports an operative mortality between 2.7 and 6.4% for isolated CABG [32-34]. Magnanti et al have also noticed a decrease of post-operative complications such as stroke (5 vs 2%; p=0.003), low

cardiac output (13 vs 4%, p=0.004) and use of IABP (6.5 vs 1.9%; p=0.005) [32]. The authors explained this decrease by two factors:
-the improved perioperative care or the increased expertise and familiarity of surgeons operating on more elderly over time and the lower incidence of elderly undergoing urgent or emergent surgery over time.
Off-pomp CABG was demonstrated to be an effective surgical technique in high risk population such as elderly [33,34] because it was shown to reduce consequences of systemic inflammatory responses [35]. Thus, Dhurandhar et al concluded in their study that off pomp CABG did not offer significant advantage concerning 30-day mortality and stroke [25].
Stroke is the major complication in aortic valve surgery and its rates increased with age (0.5% in 50-55 years old vs 2% in 85-90 years old) because of extensive age-related aortic calcifications –which is associated with friable tissue- and atherosclerosis [36].
Operative mortality decreased for mitral valve replacement from 27% in 1980 to 18% in 2011 [37-40]. This high mortality rate in mitral valve surgery is explained by the fact that elderly are operated on for mitral regurgitation when most have developed severe symptoms, left ventricular dysfunction and atrial fibrillation. In our study, no differences appeared because of the small number of patients undergoing mitral valve replacement.
In-hospital mortality was associated with severe sepsis and neurological events in patients older than 75 years. Therefore, surgery for infective endocarditis in elderly patients is an option that should be considered in selected patients [41].
While comparing percutaneous coronary intervention to CABG, a recent meta-analysis in patients aged >70 years found no significant difference in all cause-mortality at 30 days nor in composite endpoint of death, nonfatal myocardial infarction, stroke, and repeat revascularization [42]. However, elderly patients are more likely to present with complex multi-vessel disease and long term anti-platelet therapy is associated with hemorrhagic risk in this patients [43,44].

Recommendations
Actual guidelines recommend transcatheter aortic valve implantation for very high risk patients and after a Heart Team decision. Percutaneous mitral valve repair technique should be reserved for inoperable patients [45].
In order to ameliorate cardiac surgery's results in the elderly, it is necessary to:

- have an agreement for the surgical indication by cardiologists and surgeons in consensus,
-to evaluate the surgical risk by validated scores such as EuroSCORE II,
-to evaluate patient's frailty, because this parameter is important in the elderly,
-and to have written consent of the patients and his family before cardiac surgery.

Limitations of the study:
Our main study limits were the small number of included patients. Thus no predictive factors of cardiac surgery was found. Its retrospective character and the absence of frailty evaluation.

CONCLUSION

Our study showed that it is possible to perform cardiac surgery in elderly patients with an acceptable outcome as found in the published literature. Preoperative factors predicting the postoperative course of elderly patients were the same as in younger patients.
Therefore, age does not constitute an isolated risk factor for cardiac surgery.
Recommendations that can be made in order to achieve successful surgical outcomes and to reduce morbidity and mortality in the elderly are:
-to discuss the surgery indication in a multidisciplinary team composed of cardiologists, cardiac surgeons and geriatric doctors,
- to identify risk factors and predictors of increased mortality and morbidity,
-to evaluate each patient's risk score,
-and to evaluate elderly's frailty by using frailty scores such as gait speed.

Competing interests
The authors declare no conflicts of interest

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