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Title page

Title: Preserved quality of life in octogenarians at early, mid and late follow-up intervals irrespective of cardiac procedure.

- Authors:**
- 1. Heyman Luckraz¹ FRCS, MD
 - 2. Kumaresan Nagarajan¹ MRCS
 - 3. Akis Chnaris¹ MD
 - 4. Parminderjit Kaur Jayia¹ MBBS
 - 5. Israr Muhammed¹ MRCS
 - 6. Sophia Mahboob²
 - 7. Prof Alan Nevill³ PhD

Institution: ¹Cardiothoracic Surgery, Heart & Lung Centre, Wolverhampton WV10 0QP ²Medical Student, University of Birmingham, Edgbaston, Birmingham, B15 2TT and ³Department of Statistics, University of Wolverhampton, WS1 3BD, United Kingdom

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Corresponding author:

Dr Heyman Luckraz FRCS, MD

Consultant Cardiothoracic Surgeon

Heart & Lung Centre, Wolverhampton, WV10 0QP, United Kingdom

Tel: 0044 1902694357 Fax: 0044 1902695646

Email: HeymanLuckraz@aol.com

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Glossary of abbreviations

- TAVI - Transcatheter aortic valve implantation
- SF-12v2 - Medical Outcomes Study Short Form 12 Health Survey version 2
- CABG - Coronary artery bypass surgery
- SD – Standard deviation
- SPSS – Statistical package for the social sciences
- RRT – Renal replacement therapy
- QOL – Quality of Life
- UK – United Kingdom
- CPB time - cardiopulmonary bypass time
- PVD - Peripheral vascular disease
- LV - left ventricular function
- CICU - cardiac intensive care unit
- FU - follow-up period
- LOS – length of stay

Abstract

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Objective: Cardiac surgery has become established in octogenarians over the last decade. This study assessed the quality of life and survival in patients undergoing various cardiac procedures at various time intervals post-op.

Method: Patients over 80 years old at the time of their cardiac procedure were initially included (n=427). Patients were grouped according to the time interval from their operations namely as within 3 years post-op (Group A), 3 to 5 years post-op (Group B), and over 5 years post-op (Group C). Patients who were at least 2-years post-op and who were still alive were sent the SF12v2 quality of life questionnaire (n=308).

Results: There were no significant differences in the pre-op characteristics between the groups including type of surgery and logistic Euroscore. There were also no significant differences in the immediate post-operative phase in the complications rates except for renal replacement therapy ($p < 0.01$). At follow-up, a further 20 patients had died and for those still alive 87% (61/70), 86% (86/100) and 74% (87/118) patients returned questionnaire for each group respectively. There was no significant differences in mental scores ($p = 0.3$) and physical scores ($p = 0.07$) between the groups at the various time intervals. This was irrespective of the type of surgery carried out on multi-variate analysis. Moreover, most octogenarians who had cardiac surgery had equivalent or better quality of than expected when compared to the general population of the same age and sex.

Conclusion: Quality of life in octogenarians undergoing cardiac surgery is preserved, irrespective of the time interval from and the type of procedure.

Word Count Abstract: 250

70 **Ultra mini abstract**

71 Octogenarians enjoy a good quality of life, both physical and mental performance, irrespective of the
72 time interval after surgery and the type of cardiac surgery that they have undergone. Based on this
73 data, any type of cardiac surgery should still be an option in this age group.

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91 **Introduction**

92 Approximately 18% of the United Kingdom population is 80 years of age and older with an
93 average life expectancy of 8 years [1]. As the proportion of octogenarians increases so will the
94 demand for cardiac surgery. Moreover, the availability of percutaneous valve therapy (Transcatheter
95 aortic valve implantation - TAVI) has led to a doubling in the number of octogenarians operated within
96 our services. Although several publications have documented operative results in octogenarians for
97 coronary artery surgery and aortic valve surgery, there is limited data about long term outcomes and
98 quality of life in this group including those undergoing complex cardiac surgery [2,3,4,5]. Overall, there
99 seems to be a consensus that cardiac surgery in the over 80 years-old group is associated with good
100 early and mid-term outcomes as well as a satisfactory quality of life. This study assessed whether
101 quality of life is preserved at various time intervals post cardiac surgery and the impact on the type of
102 surgery at follow-up in this age group.

103 **Materials and Methods**

104 Patients who underwent cardiac surgery at our institution during the period of 2005 to 2012
105 and who were over 80 years of age at the time of their cardiac procedure were initially included
106 (n=427). During the period 2005-2012, a total of 7397 patients underwent cardiac surgery in our Unit
107 with the octogenarians representing around 4% of the group in 2005 increasing to 7.8% in 2012.

108 Patients were grouped according to the time interval from their operations as within 3 years post-op
109 (Group A - early), 3 to 5 years post-op (Group B – mid-term), and over 5 years post-op (Group C -
110 late). Patients who were at least 2-years post-op and who were still alive were sent the Medical
111 Outcomes Study Short Form 12 Health Survey version 2 (SF-12v2, QualityMetric Health Outcomes
112 Socring Software 4.5, Optum, Lincoln, USA) quality of life questionnaire (n=308) [6]. Presumed
113 consent was assumed if patient returned the questionnaire. The initial post-op data was prospectively
114 collected on our database (PATS, Dendrite Clinical Systems, Ltd, Oxford, UK) and patient's death
115 was confirmed by contacting their general practitioner. The types of cardiac surgery were isolated
116 coronary artery bypass surgery (CABG), isolated valve surgery (aortic or mitral valve surgery) or
117 complex cardiac procedures (combined CABG & valve surgery, multiple valve surgeries, surgery on
118 the aorta and aortic dissection surgery). This study was agreed as a service evaluation within the

119 Hospital's Research and Development Department following its peer-review process. Funding was
120 provided by the local Cardiothoracic Services charitable fund.

121 **Statistics**

122 Categorical data are expressed as percentage and differences between the two groups
123 assessed using the chi square (χ^2) test of independence. Continuous variables are expressed as
124 mean (SD) or median (range) for Gaussian and skewed distributed data respectively. Likewise group
125 comparison was carried out using the t-test or non-parametric test accordingly. The tests were
126 considered significant at $p \leq 0.05$. SPSS version 16.0 (SPSS Inc. Chicago IL) was used for statistical
127 analysis. Survival was assessed using the Kaplan-Meier survival curve. Binary logistic regression
128 analysis was performed to assess the factors (type of procedure, time interval from surgery, age,
129 gender, diabetes, duration of cardiopulmonary bypass, post-operative complications - infections &
130 need for renal replacement therapy, blood transfusion within 24 hours of surgery, duration of in-
131 hospital stay and logistic EuroScore) predicting the probability or odds of patients below the median
132 value for the physical and mental scores as the dichotomous dependent variable. The model was
133 refined using backward elimination.

134 **Results**

135 There were 76 patients, 109 patients and 123 patients in Groups A, B and C respectively.
136 There were no significant differences in the pre-op characteristics between the groups including age,
137 gender, priority of surgery, left ventricular ejection fraction, type of surgery and logistic Euroscore
138 (Table1). There were also no significant differences in the immediate post-operative phase in the
139 complications rates such as infection, neurological problem, airway support, ICU re-admission and in-
140 hospital mortality, except for the need of renal replacement therapy ($p < 0.01$) (Table 2). The latter may
141 represent in a shift in our approach with the institution of renal replacement therapy (RRT) in the post-
142 op cardiac setting over time (RRT is now instituted much earlier than it was in 2005). Overall, the
143 post-op rate of stroke at discharge was low at 0.7% (2 patients).

144 The 30-day mortality was 8.8% for isolated CABG, 17.6% for isolated valve (aortic or mitral)
145 procedures and 25.3% for those patients who underwent complex operations.

146 At follow-up, a further 20 patients had died and for those still alive 87% (61/70), 86% (86/100)
147 and 74% (87/118) patients returned the questionnaire for each group respectively. Overall, when
148 compared to the general elderly population (matched age and gender), the octogenarians study group
149 performed better in their mental score in 54% of patients and the physical score were as good as or
150 better than their matched age and sex population in 65% (Figure1). There was no significant
151 differences in the mental scores ($p=0.3$) and the physical scores ($p=0.07$) between the groups at the
152 various time intervals (Figure 2). This was irrespective of the type of surgery carried out when
153 assessed on multi-variate analysis.

154 However, the type of surgery did impact on survival and is illustrated in Figure 3 ($p < 0.01$).
155 The numbers of patients at-risk as well as the percentage survival (95% confidence interval) for each
156 procedure group is detailed in the Legend for Figure 3.

157 **Discussion**

158 Cardiac surgery in octogenarians accounts for up to 10% of our yearly surgical activity, in this
159 current era. This ever increasing proportion of octogenarians undergoing cardiac surgery has been
160 partly due to the availability of the TAVI program within our Centre as the latter has led to more
161 octogenarians being referred for surgery. There are some limited reports in the literature regarding
162 long-term survival and quality of life [7]. In this study, Ghanta et al concluded that cardiac surgery in
163 this age group can be performed with low operative mortality, excellent long-term survival (actuarial
164 survival of 53% and 27% at 5 and 10-year respectively) and better quality of life when compared to
165 the general elderly population [7]. However, they only had 114 replies for their QOL questionnaires. In
166 an earlier publication, the same group confirmed that the above outcomes can be achieved even in
167 the non-elective setting [5].

168 Good quality of life using a different type of quality of life questionnaire (modified Seattle
169 Angina Questionnaire) at medium term follow-up (mean 890 days) was also reported by Huber et al in
170 120 patients undergoing cardiac surgery in Switzerland [8].

171 In a review of the literature comparing cardiac surgery in the octogenarian group to their
172 younger counterparts, Weideman et al reported that as expected operative mortality was higher in the

173 elderly group (9.1% v/s 3.4%) [9]. Interestingly from this report, mortality was highest when patients
174 underwent combined mitral valve surgery (mortality of up to 30%).

175 Results for complex cardiac procedures in octogenarians have been published and included
176 combined cardiac procedures and procedures on the aorta [7,10,11,12] with all groups reporting
177 reasonable and acceptable post-operative outcomes. This is also confirmed in the current study with
178 30-day mortality being 8.8% for isolated CABG, 17.6% for isolated valve (aortic or mitral) procedures
179 and 25.3% for those patients who underwent complex operations.

180 Any discussion regarding surgery in the octogenarian group will be incomplete if TAVI is not
181 included. Although TAVI has provided good early outcome and quality of life, it has its own set of risks
182 including in-hospital mortality (5%), need for permanent pacemaker (10-15%), vascular access injury
183 (10%) and paravalvular leak (10% more than mild) [13,14,15]. Cardiac surgery, on the other hand,
184 has a different set of complications but is also associated with a longer post-operative recovery.
185 However, the longer-term outcome of TAVI is still unknown and the durability of these valves still
186 remains to be confirmed.

187 This study also confirmed that octogenarians who had cardiac surgery and recovered well
188 thereafter, enjoy a better quality of life than their contemporaries from the general age and gender
189 matched population. This is vital information for health care providers in their decision making process
190 in terms of funding or reimbursement for this age group.

191 Finally, this data showed that the octogenarians benefit from cardiac surgery and had good
192 quality of life even in the longer term and these benefits spread across the whole gamut of cardiac
193 surgical procedures. This was also reported-on in terms of early and mid-term benefits in the literature
194 by various authors [5,7,10,11,12]. Thus octogenarians should be considered for any type of cardiac
195 surgical procedures provided the surgical assessment of risks is deemed acceptable.

196 **Conclusion**

197 Quality of life in octogenarians is preserved irrespective of the time interval after surgery and
198 irrespective of the type of surgery. Based on this evidence, surgery, even complex cardiac
199 procedures, still provides a good option especially in the long-term in this era of TAVI procedures.

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201 Limitations

202 This study is limited by the fact that it was a questionnaire design and voluntary replies from
203 octogenarians. Overall 81% of patients returned the questionnaire. The reasons for not returning the
204 questionnaire included a change of address, patient unwilling to participate and possibly some
205 patients being unwell and unable to complete the questionnaire.

206

207 **Acknowledgement**

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210 Wolverhampton, UK.

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275 **Table 1: pre- & peri-op characteristics of patients for the groups**

	Group A (<3 yr post-op)	Group B (3 to 5 yr)	Group C (>5 yr post-op)	p-Value
N	76	109	123	
Age*, years	81.9 (1.8)	82.1 (1.9)	81.5 (1.4)	0.1
CPB time*, minutes	99 (49)	101 (60)	97 (43)	0.8
Log Euroscore*	13.2 (8.8)	11.8 (7.3)	11.7 (8.8)	0.4
Female (% ,n)	40%, 30	30%, 33	39%, 48	0.3
Non-diabetic (% ,n)	72%, 55	84%, 91	84%, 104	0.09
PVD (% ,n)	25%, 19	21%, 23	24%, 29	0.7
Impaired LV (% ,n)	24%, 18	28%, 30	32%, 40	0.5
Elective (% ,n)	58%, 44	67%, 73	64%, 79	0.6
Isolated CABG (% ,n)	41%, 31	39%, 43	46%, 57	0.7
Complex op (% ,n)	40%, 30	44%, 48	36%, 44	0.7

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277 *denotes mean (SD)

278 CPB time: cardiopulmonary bypass time

279 PVD: Peripheral vascular disease

280 LV: left ventricular function

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288 **Table 2: Post-operative data**

	Group A (<3 yr post-op)	Group B (3 to 5 yr)	Group C (>5 yr post-op)	p-Value
N	76	109	123	
Airway support (% _n)	11%, 8	8%, 9	11%, 13	0.8
Chest infection (% _n)	14%, 10	10%, 11	10%, 12	0.7
Any infection (% _n)	27%, 20	16%, 17	22%, 26	0.2
Confusion (% _n)	10%, 6	11%, 12	7%, 8	0.5
RRT (% _n)	18%, 14	7%, 8	6%, 7	<0.01
CICU re-admission (% _n)	2.6%, 2	5.5%, 6	4.1%, 5	0.6
Mortality at FU (% _n)	7.9%, 6	8.3%, 9	4.1%, 5	0.4
Post-op LOS**, days	8 (4,48)	7 (4,100)	8 (4,44)	0.1

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291 ** denotes median (range)

292 Airway support includes need for CPAP ventilation, re-intubation and/or tracheostomy

293 RRT: renal replacement therapy

294 CICU: cardiac intensive care unit

295 Mortality at FU: mortality during follow-up period

296 LOS: length of stay

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300 **Figure Legends**

301 **Figure 1**

302 Percentage of sample whose (a) Physical Scores and (b) Mental Scores (SF-12) are above, at or
303 below the General Population Norm (age and gender matched)

304 (a) Physical Scores and (b) Mental Scores

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306 **Figure 2:** Mean (95% CI) for the (a) Physical Scores and (b) Mental scores for the various time
307 intervals

Time interval	<3 years post-op	3 to 5 years post-op	>5 years post-op
n	61	86	87
Physical Score	44.7 (42.5, 46.9)	41.6 (39.8, 43.4)	43.8 (42.1, 45.5)
Mental Score	52.3 (50.1, 54.5)	52.5 (50.9, 54.1)	53.7 (52.1, 55.3)

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309 **Figure 3:** Kaplan -Meier survival curve for the various types of surgery (n=427)

	Procedure						
Time (months)		0	20	40	60	80	100
	CABG						
n		171	151	131	111	91	71
Survival (95% CI)%			95 (92,98)	94 (90,98)	93 (89,97)	92 (88,96)	91 (86,96)
	Isolated Valve						
n		74	54	34	14	4	N/A
Survival (95% CI)%			91 (84,98)	86 (77,95)	82 (71,93)	52 (22,82)	N/A
	Complex operation						
n		182	162	142	122	102	82
Survival (95% CI)%			89 (84,95)	80 (74,86)	80 (74,86)	78 (72,84)	76 (69,82)

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