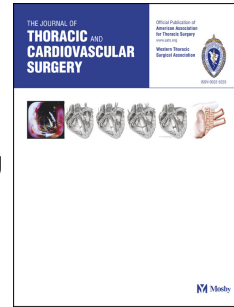


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A Nationwide Survey of UK cardiac surgeons' view on clinical decision making during the COVID-19 pandemic

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1 **A Nationwide Survey of UK cardiac surgeons' view on clinical decision making during**
2 **the COVID-19 pandemic**

3

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7

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16 **Glossary**

17 AV: aortic valve

18 CABG: coronary artery bypass graft

19 COVID-19: Coronavirus disease 2019

20 CT: computerised tomography

21 MDT: multidisciplinary team

22 MV: mitral valve

23 PRC: polymerase chain reaction

24 PPE Personal Protective Equipment

25 STEMI: ST-elevation myocardial infarction

26 TAVI: Transcatheter aortic valve implantation

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- 27 **Central picture:** Distribution of 86 consultants who responded to the survey across macro-
28 areas in the United Kingdom (UK)

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29 Central message:

30 No firm recommendations are currently available to guide decision making for patients
31 requiring cardiac surgery during the pandemic. This can translate into significant variation in
32 clinical practice and patient outcomes. A systematic appraisal of senior surgeons'
33 consensus can represent a rapid and efficient instrument to inform health policy makers
34 and stakeholders to make interim recommendations until data from clinical observations
35 will become available.

36 Perspective statement:

37 Systematic appraisal of senior surgeons' consensus can be used to generate interim
38 recommendations for patients undergoing cardiac surgery during COVID-19 pandemic
39 until data from clinical observations will become available.

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Abstract

Background: No firm recommendations are currently available to guide decision making for patients requiring cardiac surgery during the COVID-19 pandemic. Systematic appraisal of senior surgeons' consensus can be used to generate interim recommendations until data from clinical observations will become available. Hence, we aimed to collect and quantitatively appraise nationwide UK consultants' opinion on clinical decision making for patients requiring cardiac surgery during the COVID-19 pandemic.

Methods: We mailed a web-based questionnaire to all consultant cardiac surgeons through the Society for Cardiothoracic Surgery in Great Britain and Ireland (SCTS) mailing list on the 17th April 2020 and we pre-determined to close the survey on the 21st April 2020. This survey was primarily designed to gather information on UK surgeons' opinion using 12 items. Strong consensus was predefined as an opinion shared by at least 60% of responding consultants.

Results: A total of 86 consultant surgeons undertook the survey. All UK cardiac units were represented by at least one consultant. Strong consensus was achieved for the following key questions: 1) before any hospital admission for cardiac surgery, nasopharyngeal swab, r-PCR and chest CT should be performed; 2) the use of full PPE should be adopted in every case by the theatre team regardless patient's COVID-19 status; 3) the risk of COVID-19 exposure for patients undergoing heart surgery should be considered moderate to high and likely to increase mortality if it occurs; 4) cardiac procedure should be decided based on a rapidly convened multidisciplinary team discussion for every patient. The majority believed that both aortic and mitral surgery should be considered in selected cases. The role of coronary artery bypass graft surgery during the pandemic was controversial.

63 **Conclusions:** In this unprecedented pandemic period, this survey provides information
64 for generating interim recommendations until data from clinical observations will
65 become available.

66 **Introduction**

67 The Coronavirus disease 2019 (COVID-19) pandemic has had an unprecedented impact on
68 healthcare globally, including on the delivery of cardiac surgical care [1-2]. Cardiac surgery
69 is the single largest user of intensive care unit beds [1-2]. The re-allocation of ICU capacity to
70 treat COVID-19 patients has adversely affected the provision of routine cardiac surgery in the
71 United Kingdom and worldwide. Urgent and emergency cardiac surgical procedures are still
72 required by the public during the pandemic. There remain several areas of uncertainty., These
73 include the risks incurred by patients with pre-existing cardiac conditions, who may suffer
74 fatal events if surgery is delayed by several weeks, the impact of acquiring COVID-19 during
75 the pandemic and the and the anecdotal evidence that post-operative COVID-19 infection
76 may be fatal.

77 No firm recommendations are currently available to guide decision making for patients
78 requiring cardiac surgery during the pandemic. This can translate into significant variability
79 in clinical practice and patients' outcomes across cardiac units. In these circumstances,
80 consensus among senior surgeons nationally or globally can provide interim guidance for
81 healthcare policy makers, for clinicians' daily practice and for patients [3]. We aimed to
82 collect and quantitatively appraise nationwide UK senior surgeons' opinion on clinical
83 decision making for patients requiring cardiac surgery during the COVID-19 pandemic.

84 **Participants and methods**

85 We mailed a web-based questionnaire to a total of 198 consultant cardiac surgeons from 35
86 UK cardiac centres through the Society for Cardiothoracic Surgery in Great Britain and

87 Ireland (SCTS) mailing list on the 17th April 2020. Our aim was to receive at least 1 response
88 from each unit to inform a national picture of practice. In view of the rapidly evolving
89 circumstances and the need for timely outcome presentation, we pre-determined to close the
90 survey on the 21st April 2020. This survey was primarily designed to gather information on
91 UK surgeons' opinion on which patients should be considered for cardiac surgery under the
92 current COVID-19 pandemic using 12 items. As at the time of the survey, there was
93 significant variability on clinical activities across centres, the first part of the questionnaire
94 gathered information on local factors (local resource relocation to treat COVID-19) that may
95 have influenced surgeons' view. Strong consensus was predefined as an opinion shared by at
96 least 60% of responding consultants [3].

97 **Results**

98 A total of 86 consultant surgeons undertook the survey. There was at least one senior surgeon
99 who took part to the survey from each of the 35 cardiac units. Figure 1 shows the distribution
100 of responding consultants across different regions and the proportion of consultant stratified
101 by local resource relocation. Geographical regions with the highest number of responding
102 consultants were London, North West and Northern regions. Most consultants were from
103 units where resources were only partially redirected to treat COVID-19 (n=63, 73%)
104 followed by consultants working in units entirely relocated (n=17, 18%) and only nine
105 consultants were from in units where resources were not redirected (10%). Table 1 shows the
106 results of the survey in the overall sample and in groups stratified by working in units with
107 resource relocation.

108 In the overall sample, strong consensus ($\geq 60\%$) was achieved for the following key
109 questions: 1) before hospital admission every patient should receive nasopharyngeal swab,
110 polymerase chain reaction (PCR) and chest computerised tomography (CT); 2) the use of full

111 Personal Protective Equipment (PPE) should to be adopted in every case by the theatre team
112 regardless of the patient's COVID-19 status; 3) the risk of COVID-19 exposure for patients
113 undergoing heart surgery should be considered moderate to high and likely to increase
114 mortality if it occurs; 4) cardiac procedure should be decided based on ad-hoc
115 multidisciplinary team (MDT) for every patient. Although there was no strong consensus on
116 other key questions, the majority (>50%) agreed on that: 1) patients tested COVID-19
117 positive before salvage surgery (i.e. dissection), should be considered for surgery only if they
118 have no symptoms of infection and have best chances of survival (i.e. age, malperfusion); 2)
119 aortic and mitral valve surgery could similarly be considered only in selected cases.
120 Interestingly, opinion about who should have coronary artery bypass graft (CABG) surgery
121 was much more varied. Although the most common answer was that CABG surgery should
122 be considered only in selected cases (i.e. age criteria or left main disease) (41%), about a
123 third of the responding surgeons believed that percutaneous coronary intervention (PCI)
124 should always be the default strategy (33%). Overall, a small number of surgeons believed
125 that urgent or elective surgery should never be performed (2% and 9% respectively). When
126 the outcomes of the survey were stratified by resource relocation, surgeons from units where
127 resources were not relocated (i.e. units which are carrying on as normal) showed a very
128 strong agreement (>85%) that the risk of COVID-19 exposure for patients undergoing cardiac
129 surgery is moderate to high and likely to increase mortality if it occurs. This group also
130 showed the highest proportion of surgeons believing that cardiac surgery should never be
131 performed in urgent (25%) or elective patients (38%). Finally, there was a strong consensus
132 that this pandemic will not have an impact on surgical activities when normal operating
133 conditions will be re-established.

134 **Comments**

135 We are realising that non COVID-19 infection related deaths may be an extremely
136 important unintended consequence of the COVID-19 pandemic due to the re allocation
137 of health resources. However, there is little direct evidence to inform the management of
138 patients requiring cardiac surgery under the current rapidly evolving circumstances. Initial
139 reports have suggested that non COVID-19 related cardiovascular mortality and
140 morbidity are likely to be significantly affected [4]. In particular, the number of cardiac
141 surgeries has dramatically decreased as intensive care facilities and staff have been
142 urgently redeployed to treat COVID-19 patients. Even though cardiac surgeons are still
143 required to ensure that essential cardiac interventions are provided to the public, the risk
144 of COVID exposure during hospital admission and its potential impact on surgical
145 outcomes during hospital admission remains uncertain. In healthcare systems where
146 surgeons' mortality is under public and regulatory bodies scrutiny, such as in the UK,
147 surgeons may be reluctant to offer cardiac operations under the current circumstances.
148 To avoid the risk of inappropriate risk adverse practice, UK regulatory bodies including
149 the SCTS have decided to suspend surgeons' specific mortality, but national and unit
150 outcomes remain under strict surveillance.

151 Anecdotal evidence that patients are reluctant to go to a hospital during the COVID-19
152 outbreak [4]. Patient's counselling is particularly challenging as risk stratification
153 methods available do not account for COVID-19 exposure and it takes more time and
154 empathy than ever to help a patient give consent for their cardiac surgery.

155 In the UK, there are rich resources of routinely clinical data, including the National Adults
156 Cardiac Surgical Audit (NACSA) which will provide essential information on the impact of
157 the COVID-19 pandemic on patients undergoing cardiac surgery. However, clinical
158 observations are accumulating slowly due to drastic reduction of cardiac surgeries performed
159 and data-driven evidence results may not be available until late spring or early fall. As a

160 result, no firm recommendations are available for case selection and clinical decision
161 making in patients referred to cardiac surgery. In clinical scenarios without compelling
162 evidence, expert consensus can provide information for interim clinical
163 recommendations. The present survey collected opinions from senior cardiac surgeons in
164 the UK and results are consistent with recent recommendations made by the Society of
165 Thoracic Surgery [5].

166 First, surgeons agreed that before hospital admission for cardiac surgery, screening needs
167 to include nasopharyngeal swab, PCR, and chest CT for every patient during the
168 pandemic. Screening is essential to contain the infections and avoid post-operative
169 complications. The definite diagnosis of COVID-19 is based on the viral isolation or
170 positive result of PCR from sputum, or nasal swab, or throat swab. However, a high
171 false-negative rate of PCR results for COVID-19 detection has been reported [6]. The
172 combination of multiple diagnostic tests (i.e. PCR and chest CT) reduces the risk of false
173 negative. Although it is difficult to distinguish COVID-19 pneumonia from other viral
174 pneumonia on CT findings alone, the utility of chest CT to detect early change of COVID-
175 19 in cases which PCR tests show negative results has been largely emphasized [6]. Positive
176 screening tests should lead to reconsideration of the risks and benefits of proceeding with
177 surgery. These patients may be in the pre phase of infection and are likely at higher risk
178 of adverse outcomes following surgery. Most surgeons and particularly those working in
179 units currently unaffected by the pandemic, believed that the risk of COVID exposure for
180 patients admitted for a cardiac operation is moderate to high and can have serious
181 consequences on patient's outcome. This is likely related to the fact that after cardiac
182 surgery patients can be particularly vulnerable to pulmonary complications caused by
183 COVID-19. Intense screening in patients referred to cardiac surgery is desirable to
184 improve patient's outcomes. However, if the pandemic continues for months as

185 anticipated by some researchers [7], possible consequences of intense screening will
186 need to be evaluated. For instance, it is unclear whether delay in treatment due to
187 screening can result in adverse events in unstable patients and whether chest CT can be
188 avoided in selected cases to mitigate the risk of radiation. Surgeons also agreed that the
189 theatre team should adopt full PPE for all the procedures performed during the pandemic.
190 While preoperative screening is desirable to minimize the risk of COVID transmission to
191 the health care providers, the risk of false negative must always be considered. Cardiac
192 surgery requires uniquely skilled individuals (cardiac operating room scrub and
193 circulators, perfusionists, cardiac anaesthesiologists, and perioperative caregivers) and
194 the risk of exposure to COVID-19, can threaten their availability of for future more
195 urgent procedures. However, it remains unclear whether the use of full PPE can
196 negatively affect team performance (i.e. communication, surgical vision and dexterity
197 and fatigue) and ultimately result in worse clinical outcomes.

198 There was strong consensus that each surgical case requires ad-hoc multidisciplinary
199 team decision and patient's selection at surgeon's discretion under the current
200 circumstances was believed to be acceptable only by a very small number of responders.
201 Clearly, multidisciplinary team discussion for each patient requires flexible approaches
202 such as conference call discussions or emails exchanges, and consideration must be
203 given to sensitive data protection and confidentiality and the need of maintaining clinical
204 documentation standards.

205 There was no strong consensus with regards to specific types of cardiac procedures.
206 However, the majority believed that both aortic and mitral surgery should be considered
207 in selected cases. The role of CABG surgery during the pandemic was more
208 controversial. Neither consensus nor majority was achieved for CABG surgery in
209 selected cases (i.e. left main). Despite recent controversies reported by public media [8],

210 a third of responders suggested that under the current circumstances PCI should always
211 be the default strategy and CABG surgery should be considered only in unstable patients
212 when PCI is not feasible. After cardiac surgery, patients are particularly vulnerable to
213 respiratory complications and the occurrence of COVID-19 associated pneumonia after
214 CABG surgery is likely to be associated significant morbidity and mortality. During the
215 pandemic, PCI can represent a temporary solution for patients with complex coronary
216 artery disease. However, no definitive evidence exists on the superiority of PCI over
217 CABG in case of COVID-19 exposure.

218 Finally, despite surgeons' view on the role of cardiac surgery during the pandemic more
219 controversial, there was a strong agreement that cardiac surgery activities will be entirely
220 re-established at the end of the pandemic. Compelling evidence has recently proven that
221 cardiac surgery remains the best treatment for many patients with cardiac disease despite
222 new technologies and improvement in transcatheter and percutaneous interventions
223 [9,10].

224 In conclusion, during the COVID-19 pandemic, healthcare policy makers and hospitals
225 not only need to consider methods for containing and treating these infections but how
226 infection outbreaks may affect systems of care beyond the immediate infection. Clinical
227 decision making for patients requiring cardiac surgery is particularly challenging under
228 the COVID-19 pandemic as data-driven evidence is still scarce. Worldwide and in the
229 UK, the lack of firm recommendations for the management of patients requiring cardiac
230 surgery can translate into unwarranted variation in clinical practice and patients' clinical
231 outcomes across units. In the current unprecedented scenario, systematic appraisal of
232 consensus from senior surgeons at national or international level, can represent a rapid
233 and efficient instrument to provide support to health policy makers and other stakeholders

234 in generating interim recommendations to guide and support clinicians in decision
235 making process.

236 **Acknowledgement**

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239

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Figure Legend

Figure 1. Distribution of 86 consultants who responded to the survey across macro-areas in the United Kingdom (UK) (left). Proportion of responders stratified based on whether they worked in units with resources relocated to treat Coronavirus disease 19 (COVID-19)

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Table 1. Results of the survey among 86 consultant cardiac surgeons (at least one from each UK unit) in the overall sample and stratified by resource relocation to treat COVID-19. (strong consensus highlighted in yellow, majority in bold; COVID-19: Coronavirus disease 2019; PRC: polymerase chain reaction; CT computerised tomography; PPE Personal Protective Equipment; MDT: multidisciplinary team; STEMI: ST-elevation myocardial infarction; CABG: coronary artery bypass graft; AV: aortic valve; MV: mitral valve; TAVI: Transcatheter aortic valve implantation)

Screening for COVID-19 before patient's admission for non-salvage cardiac surgery should consist of:	Total	Resource relocated		
		No	Partially	Entirely
I do not know	1.2%	0.0%	1.6%	0.0%
nasopharyngeal swab and PCR for suspected cases only	1.2%	12.5%	0.0%	0.0%
nasopharyngeal swab, PCR and chest CT for every patient	60.5%	62.5%	65.1%	40.0%
nasopharyngeal swab, PCR and chest CT for suspected case only	5.8%	0.0%	6.3%	6.7%
nasopharyngeal swab, PCR for every patient.	31.4%	25.0%	27.0%	53.3%
During this pandemic, full PPE should be adopted by the theatre team:				
I don't know	1.2%	0.0%	1.6%	0.0%
In every case regardless patient COVID-19 status	60.5%	62.5%	54.0%	86.7%
Only in a confirmed COVID-19 case or in all cases where COVID-19 screening was not performed	17.4%	12.5%	22.2%	0.0%
Only in a confirmed or suspect COVID-19 case	20.9%	25.0%	22.2%	13.3%
During this pandemic, the risk of COVID-19 exposure for patients undergoing cardiac surgery is:				
I don't know	3.5%	0.0%	3.2%	6.7%
Low but likely to increase mortality if it occurs	25.6%	12.5%	28.6%	20.0%
Moderate to high and likely to increase mortality if it occurs	69.8%	87.5%	66.7%	73.3%
Moderate to high but unlikely to increase mortality if it occurs	1.2%	0.0%	1.6%	0.0%
During this pandemic, cardiac surgery operations should be performed:				
As usual following standard recommendations	9.3%	0.0%	11.1%	6.7%
At surgeons' discretions	12.8%	12.5%	12.7%	13.3%

I don't know	1.2%	0.0%	1.6%	0.0%
Only after ad-hoc MDT for every case	64.0%	50.0%	65.1%	66.7%
Surgery should never be performed unless strictly necessary (i.e. dissection)	12.8%	37.5%	9.5%	13.3%
a patient confirmed or suspected COVID-19 positive presenting with acute type A dissection should be operated on:				
I don't know	2.3%	12.5%	0.0%	6.7%
Only if he/she has no symptoms of infection (i.e. no fever, normal blood cell count, normal chest CT)	22.1%	12.5%	23.8%	20.0%
Only if he/she has no symptoms of infection and has best chances of survival (i.e. age)	53.5%	50.0%	60.3%	26.7%
Should be considered for surgery only if he/she is unstable (i.e. cardiac tamponade)	17.4%	12.5%	15.9%	26.7%
Surgery should never be attempted	4.7%	12.5%	0.0%	20.0%
During this pandemic elective surgery for non-COVID patients should be performed:				
All elective cases with priority (i.e. symptoms) to be considered for TAVI or PCI and surgery to be performed only if strictly necessary	40.7%	0.0%	42.9%	53.3%
As usual following standard recommendations	2.3%	0.0%	3.2%	0.0%
Only in cases with priority (i.e. symptoms)	47.7%	62.5%	46.0%	46.7%
Surgery should never be performed	9.3%	37.5%	7.9%	0.0%
During this pandemic, surgery for non-COVID inpatients should be performed:				
All inpatients to considered for TAVI or PCI and surgery to be performed only if strictly necessary	40.7%	12.5%	39.7%	60.0%
As usual following standard recommendations	11.6%	12.5%	14.3%	0.0%
Only in selected cases (age criteria, anatomy)	45.3%	50.0%	46.0%	40.0%
Surgery should never be performed	2.3%	25.0%	0.0%	0.0%
During this pandemic, CABG surgery for non-COVID patients should be performed:				
As usual following standard recommendations	4.7%	12.5%	4.8%	0.0%
Neither CABG nor PCI should be performed unless strictly necessary (i.e. STEMI, unstable angina)	22.1%	12.5%	22.2%	26.7%
Only in selected cases (i.e. age criteria, left main disease)	40.7%	50.0%	44.4%	20.0%
PCI should always be the default strategy and CABG should be considered only in unstable patients when PCI is not feasible	32.6%	25.0%	28.6%	53.3%
During this pandemic AV surgery for non-COVID patients should be performed:				
Following standard recommendations	5.8%	12.5%	4.8%	6.7%
Neither AV surgery nor TAVI should be performed unless strictly necessary (unstable or very symptomatic patients)	30.2%	25.0%	31.7%	26.7%
Only in selected cases (i.e. age criteria, bicuspid valve)	51.2%	62.5%	54.0%	33.3%
TAVI should always be the default strategy and AV surgery should be considered only in unstable patients when TAVI is not feasible	12.8%	0.0%	9.5%	33.3%

During this pandemic MV surgery for non-COVID patients should be performed:

Following standard recommendations	3.5%	12.5%	3.2%	0.0%
I don't know	2.3%	0.0%	0.0%	13.3%
MV surgery should never be performed unless strictly necessary (unstable or very symptomatic patients)	41.9%	37.5%	38.1%	60.0%
Only in selected cases (i.e. age criteria, very symptomatic)	52.3%	50.0%	58.7%	26.7%

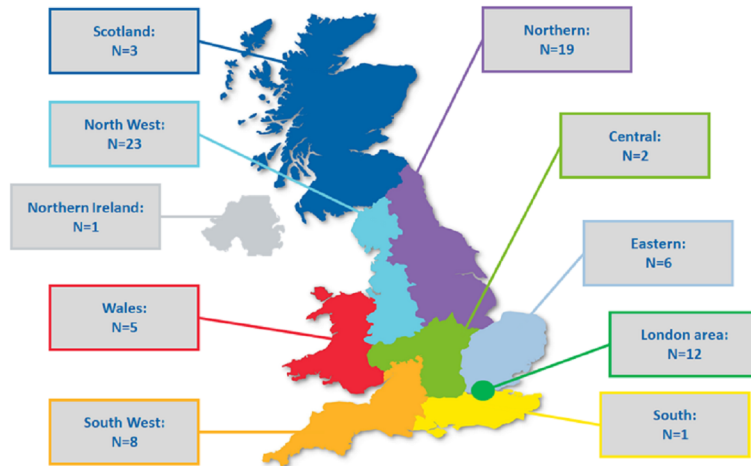
After this pandemic, which of the following sentence will be true?

Cardiac surgery activities will be significantly reduced in favour of interventional procedures (i.e. TAVI, PCI)	10.5%	12.5%	9.5%	13.3%
Cardiac surgery activities will go back to normal	65.1%	62.5%	65.1%	66.7%
I don't know	24.4%	25.0%	25.4%	20.0%

After this pandemic, future indications need be revised accounting for other factors (i.e. ICU beds utilization)

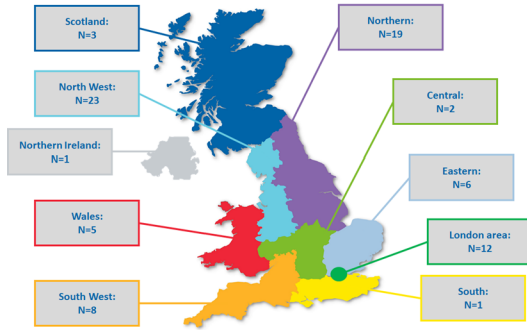
I don't know	8.1%	12.5%	7.9%	6.7%
No	68.6%	75.0%	66.7%	73.3%
Yes	23.3%	12.5%	25.4%	20.0%

86 consultant cardiac surgeons from all UK units distributed by areas

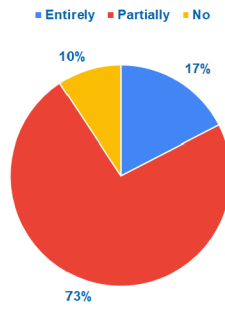


*Unit not disclosed by 6 consultants

86 consultant cardiac surgeons
from all UK units distributed by areas



Working in unit with resources
relocated to treat COVID-19



*Unit not disclosed by 6 consultants

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