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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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Glossary

AV: aortic valve

CABG: coronary artery bypass graft

COVID-19: Coronavirus disease 2019

CT: computerised tomography

MDT: multidisciplinary team

MV: mitral valve

PRC: polymerase chain reaction

PPE Personal Protective Equipment

STEMI: ST-elevation myocardial infarction

TAVI: Transcatheter aortic valve implantation

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

Central message:

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

Perspective statement:

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

40 **Abstract**

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

47 **Methods:** We mailed a web-based questionnaire to all consultant cardiac surgeons through
48 the Society for Cardiothoracic Surgery in Great Britain and Ireland (SCTS) mailing list on the
49 17th April 2020 and we pre-determined to close the survey on the 21st April 2020. This survey
50 was primarily designed to gather information on UK surgeons' opinion using 12 items. Strong
51 consensus was predefined as an opinion shared by at least 60% of responding consultants.

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

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

Introduction

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

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

Participants and methods

We mailed a web-based questionnaire to a total of 198 consultant cardiac surgeons from 35 UK cardiac centres through the Society for Cardiothoracic Surgery in Great Britain and Ireland (SCTS) mailing list on the 17th April 2020. Our aim was to receive at least 1 response from each unit to inform a national picture of practice. In view of the rapidly evolving circumstances and the need for timely outcome presentation, we pre-determined to close the survey on the

21st April 2020. This survey was primarily designed to gather information on UK surgeons' opinion on which patients should be considered for cardiac surgery under the current COVID-19 pandemic using 12 items. As at the time of the survey, there was significant variability on clinical activities across centres, the first part of the questionnaire gathered information on local factors (local resource relocation to treat COVID-19) that may have influenced surgeons' view. Strong consensus was predefined as an opinion shared by at least 60% of responding consultants [3].

Results

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

In the overall sample, strong consensus (≥60%) was achieved for the following key questions:1) before hospital admission every patient should receive nasopharyngeal swab, polymerase chain reaction (PCR) and chest computerised tomography (CT); 2) the use of full Personal Protective Equipment (PPE) should to be adopted in every case by the theatre team regardless of the 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 ad-hoc multidisciplinary team (MDT) for every patient. Although there was no strong consensus on other key questions, the majority (>50%) agreed on that: 1) patients tested COVID-19 positive before salvage surgery (i.e. dissection), should be considered for surgery only if they have no symptoms of infection and have best chances of survival (i.e. age, malperfusion); 2) aortic and mitral valve surgery could similarly be considered only in selected cases. Interestingly, opinion about who should have coronary artery bypass graft (CABG) surgery was much more varied. Although the most common answer was that CABG surgery should be considered only in selected cases (i.e. age criteria or left main disease) (41%), about a third of the responding surgeons believed that percutaneous coronary intervention (PCI) should always be the default strategy (33%). Overall, a small number of surgeons believed that urgent or elective surgery should never be performed (2% and 9% respectively). When the outcomes of the survey were stratified by resource relocation, surgeons from units where resources were not relocated (i.e. units which are carrying on as normal) showed a very strong agreement (>85%) that the risk of COVID-19 exposure for patients undergoing cardiac surgery is moderate to high and likely to increase mortality if it occurs. This group also showed the highest proportion of surgeons believing that cardiac surgery should never be performed in urgent (25%) or elective patients (38%). Finally, there was a strong consensus that this pandemic will not have an impact on surgical activities when normal operating conditions will be re-established.

Comments

We are realising that non COVID-19 infection related deaths may be an extremely important unintended consequence of the COVID-19 pandemic due to the re allocation of health resources. However, there is little direct evidence to inform the management of patients requiring cardiac surgery under the current rapidly evolving circumstances. Initial reports have suggested that non COVID-19 related cardiovascular mortality and morbidity are

likely to be significantly affected [4]. In particular, the number of cardiac surgeries has dramatically decreased as intensive care facilities and staff have been urgently redeployed to treat COVID-19 patients. Even though cardiac surgeons are still required to ensure that essential cardiac interventions are provided to the public, the risk of COVID exposure during hospital admission and its potential impact on surgical outcomes during hospital admission remains uncertain. In healthcare systems where surgeons' mortality is under public and regulatory bodies scrutiny, such as in the UK, surgeons may be reluctant to offer cardiac operations under the current circumstances. To avoid the risk of inappropriate risk adverse practice, UK regulatory bodies including the SCTS have decided to suspend surgeons' specific mortality, but national and unit outcomes remain under strict surveillance.

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

In the UK, there are rich resources of routinely clinical data, including the National Adults Cardiac Surgical Audit (NACSA) which will provide essential information on the impact of the COVID-19 pandemic on patients undergoing cardiac surgery. However, clinical observations are accumulating slowly due to drastic reduction of cardiac surgeries performed and data-driven evidence results may not be available until late spring or early fall. As a result, no firm recommendations are available for case selection and clinical decision making in patients referred to cardiac surgery. In clinical scenarios without compelling evidence, expert consensus can provide information for interim clinical recommendations. The present survey collected opinions from senior cardiac surgeons in the UK and results are consistent with recent recommendations made by the Society of Thoracic Surgery [5].

First, surgeons agreed that before hospital admission for cardiac surgery, screening needs to include nasopharyngeal swab, PCR, and chest CT for every patient during the pandemic. Screening is essential to contain the infections and avoid post-operative complications. The definite diagnosis of COVID-19 is based on the viral isolation or positive result of PCR from sputum, or nasal swab, or throat swab. However, a high false-negative rate of PCR results for COVID-19 detection has been reported [6]. The combination of multiple diagnostic tests (i.e. PCR and chest CT) reduces the risk of false negative. Although it is difficult to distinguish COVID-19 pneumonia from other viral pneumonia on CT findings alone, the utility of chest CT to detect early change of COVID-19 in cases which PCR tests show negative results has been largely emphasized [6]. Positive screening tests should lead to reconsideration of the risks and benefits of proceeding with surgery. These patients may be in the pre phase of infection and are likely at higher risk of adverse outcomes following surgery. Most surgeons and particularly those working in units currently unaffected by the pandemic, believed that the risk of COVID exposure for patients admitted for a cardiac operation is moderate to high and can have serious consequences on patient's outcome. This is likely related to the fact that after cardiac surgery patients can be particularly vulnerable to pulmonary complications caused by COVID-19. Intense screening in patients referred to cardiac surgery is desirable to improve patient's outcomes. However, if the pandemic continues for months as anticipated by some researchers [7], possible consequences of intense screening will need to be evaluated. For instance, it is unclear whether delay in treatment due to screening can result in adverse events in unstable patients and whether chest CT can be avoided in selected cases to mitigate the risk of radiation. Surgeons also agreed that the theatre team should adopt full PPE for all the procedures performed during the pandemic. While preoperative screening is desirable to minimize the risk of COVID transmission to the health care providers, the risk of false negative must always

be considered. Cardiac surgery requires uniquely skilled individuals (cardiac operating room scrub and circulators, perfusionists, cardiac anaesthesiologists, and perioperative caregivers) and the risk of exposure to COVID-19, can threaten their availability of for future more urgent procedures. However, it remains unclear whether the use of full PPE can negatively affect team performance (i.e. communication, surgical vision and dexterity and fatigue) and ultimately result in worse clinical outcomes.

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

There was no strong consensus with regards to specific types of cardiac procedures. However, the majority believed that both aortic and mitral surgery should be considered in selected cases. The role of CABG surgery during the pandemic was more controversial. Neither consensus nor majority was achieved for CABG surgery in selected cases (i.e. left main). Despite recent controversies reported by public media [8], a third of responders suggested that under the current circumstances PCI should always be the default strategy and CABG surgery should be considered only in unstable patients when PCI is not feasible. After cardiac surgery, patients are particularly vulnerable to respiratory complications and the occurrence of COVID-19 associated pneumonia after CABG surgery is likely to be associated significant morbidity and mortality. During the pandemic, PCI can represent a temporary solution for patients with complex coronary artery disease. However, no

definitive evidence exists on the superiority of PCI over CABG in case of COVID-19 exposure.

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

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

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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)

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 accouting 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%