



**Who should perform an emergency surgical front of neck airway: Head & Neck Surgeon, General Surgeon or Anaesthetist?**

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3 1 **Who should perform an emergency surgical front of neck airway: Head & Neck Surgeon, General**  
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5 2 **Surgeon or Anaesthetist?**  
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40 23 **Running Title**

41  
42 24 Who is best to perform a surgical cricothyroidotomy?  
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45 26 **Keywords**

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47 27 Airway obstruction

48 28 Surgical Training

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50 29 High-fidelity simulation training

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52 30 Surgical cricothyroidotomy

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3 34 **Abstract**  
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8 36 BACKGROUND The “Can’t Intubate Can’t Oxygenate” (CICO) emergency requires urgent front of neck  
9 37 airway access to prevent death. In cases reported to the 4<sup>th</sup> National Audit Project, the most  
10 38 successful front of neck airway (FONA) was a surgical technique, almost all of which were performed  
11 39 by surgeons. Subsequently, UK guidelines adopted surgical cricothyroidotomy as the preferred  
12 40 emergency surgical FONA technique. Despite regular skills-based training, anaesthetists may still be  
13 41 unwilling to perform an emergency surgical FONA.  
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18 42 AIM To compare consultant anaesthetists, head and neck surgeons and general surgeons in a high-  
19 43 fidelity simulated emergency. We hypothesised that head and neck surgeons would successfully  
20 44 execute emergency surgical FONA faster than anaesthetists and general surgeons.  
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24 45 METHODS We recruited 15 consultants from each specialty (total 45). All agreed to participate in an  
25 46 in-situ hi-fidelity simulation of an ‘anaesthetic emergency’. Participants were not told in advance  
26 47 that this would be a CICO scenario.  
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30 48 RESULTS There was no significant difference in total time to successful ventilation between the three  
31 49 groups (median 86 vs. 98 vs. 126.5 seconds,  $p=0.078$ ). However, anaesthetists completed the  
32 50 emergency surgical FONA procedure significantly faster than general surgeons (median 50 vs. 86  
33 51 seconds,  $p=0.018$ ). Despite this strong performance, qualitative data suggested some anaesthetists  
34 52 still believed ‘surgeons’ best placed to perform emergency surgical FONA in a genuine CICO  
35 53 situation.  
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42 55 CONCLUSION Anaesthetists regularly trained in emergency-~~emergency~~ surgical FONA function at  
43 56 levels comparable to head and neck surgeons and should feel empowered to lead this procedure in  
44 57 the event of a CICO emergency.  
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3 **60 Introduction:**  
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7 **62** The “Can’t Intubate Can’t Oxygenate” (CICO) emergency is an acute life-threatening event. An  
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9 **63** emergency front of neck airway (FONA) is employed as a life-saving procedure in this situation with  
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11 **64** multiple methods described. The 4<sup>th</sup> National Audit Project (NAP4) <sup>1</sup> demonstrated low success rates  
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13 **65** for needle cricothyroidotomy (4/11) compared to emergency surgical FONA, which were all  
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15 **66** successful when performed by a surgeon (44/44) <sup>2</sup>. that emergency surgical FONA had higher  
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17 **67** success rates (44/44) compared to needle cricothyroidotomy techniques (4/11) for patients in  
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19 **68** recorded CICO events <sup>2</sup>. Subsequently, surgical cricothyroidotomy was recommended as the optimal  
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21 **69** emergency surgical FONA procedure for CICO events by the Difficult Airway Society (DAS)<sup>3</sup>. However,  
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23 **70** in NAP4 almost all emergency surgical FONA’s were performed by surgeons rather than  
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25 **71** anaesthetists<sup>2</sup> such that it is currently unclear if the improved procedural success is related to the  
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27 **72** procedure or the operator.  
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29 **73** However, in NAP4 all 44 emergency surgical FONA’s were performed by surgeons rather than  
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31 **74** anaesthetists<sup>2</sup> such that it is currently unclear if the improved outcome is related to the procedure  
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33 **75** or the operator.  
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35 **76**

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37 **77** In 2016, UK anaesthetists and head and neck surgeons adopted a unified approach to the CICO  
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39 **78** emergency, advocating surgical cricothyroidotomy as the optimal FONA technique <sup>4,5</sup>. This  
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41 **79** recommendation emphasises a structured multidisciplinary approach, inclusive of anaesthetists,  
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43 **80** operating department practitioner’s, theatre nurses and surgeons to prevent cerebral hypoxia and  
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45 **81** death <sup>4,5</sup>. Subsequently, a survey of anaesthetists and surgeons demonstrated superior knowledge  
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47 **82** and training in surgical cricothyroidotomy amongst anaesthetists compared to their surgical  
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49 **83** colleagues <sup>6</sup>. Success of emergency surgical cricothyroidotomy depends on both procedure simplicity  
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51 **84** and regular rehearsal <sup>7-9</sup>. Anaesthetists are encouraged to undertake regular CICO and surgical  
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53 **85** cricothyroidotomy training ideally as part of multidisciplinary team simulation training <sup>1,3-5</sup>. Regular  
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55 **86** training may improve anaesthetists performance compared to surgeons who may not have access to  
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57 **87** these courses, but this is not yet supported by evidence <sup>10</sup>.  
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89 Our aim was to compare the performance and knowledge of anaesthetists, specialist head and neck  
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91 surgeons and general surgeons in an in-situ, high-fidelity simulated emergency CICO scenario. We  
hypothesised that head and neck surgeons, some of whom regularly perform surgical

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3 92 tracheostomies, would demonstrate superior performance compared to both anaesthetists and  
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5 93 general surgeons.  
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For Peer Review

**95 METHODS****96 Participants**

97 This study was conducted at Aintree University Hospital National Health Service Foundation Trust, a  
98 tertiary referral centre for head and neck surgery and a regional trauma centre. Aintree University  
99 Hospital has implemented biannual surgical cricothyroidotomy skills and multidisciplinary team  
100 CICO training for anaesthetic consultants and trainees in line with recommendations <sup>1, 3-5</sup>. Three  
101 groups of participants were recruited; anaesthetists, specialist head and neck surgeons (inclusive of  
102 both ear, nose and throat and maxillofacial surgeons) and general surgeons. All participants were  
103 employed as consultants at Aintree University Hospital -with active General Medical Council  
104 specialist registration. To avoid selection bias, we employed a random sampling method by listing  
105 alphabetically all consultants for each specialty. We then employed GraphPad Prism  
106 (<https://www.graphpad.com/scientific-software/prism/>) to randomize these potential participants  
107 who were then approached in list order by email. The only exclusion criterion was participant  
108 refusal. The study was reviewed and approved by National Health Service's Health Research  
109 Authority (18/HRA/0122) and Health Education England Research Governance (North West Office).

110  
111 All participants were consented to participate in an 'anaesthetic' emergency simulation. Full  
112 disclosure about the nature of the emergency was not offered at enrollment to avoid potential  
113 confounders (e.g. preparation or discussion) that could affect performance in the CICO simulation.  
114 We used a robust standardised high-fidelity scenario to simulate a CICO emergency (Figure 1). This  
115 scenario had been developed in a previous study that investigated surgical cricothyroidotomy  
116 performance <sup>11</sup> and focused on the induction of anaesthesia in an obese but otherwise healthy  
117 simulated adult patient with a normal airway assessment. Full details of the standardised simulation  
118 and debrief are provided in the supplemental data (Figures S1 and S2).

**120 [FIGURE 1]**

121  
122 The scenario was performed in situ (operational anaesthetic room) with an operating department  
123 practitioner. The scenario facilitators (L.S, N.H & S.P) used a standardised approved script to ensure  
124 identical conditions across each simulation. The same scenario facilitator controlled and filmed the  
125 scenarios. A TruCorp® TruMan Trauma X (TruCorp® Ltd, Belfast) manikin was used with  
126 incorporation of a prosthetic bleeding neck to mimic a patient with an impalpable cricothyroid  
127 membrane <sup>12</sup>. DAS guidelines recommend a midline vertical incision in this situation <sup>3</sup>. Monitoring  
128 was displayed on a tablet device (iPad) and controlled remotely with SimMon (Castle+Andersen

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3 129 ApS). Figure 2 demonstrates the orientation of the monitoring relative to the manikin and the  
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5 130 bleeding neck prosthesis.

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8 132 **[FIGURE 2]**

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11 134 All participants consented to take part between cases on one of their normal working days in  
12 135 theatre. Participants were called from the theatre coffee room or office by either L.S, N.H or S.P and  
13 136 briefed on the nature of the scenario: A senior anaesthetist, P.G, was struggling to intubate the  
14 137 trachea of a patient and had called for help. P.G is the Aintree University Hospital -trust airway lead  
15 138 and senior head and neck anaesthetist. P.G. assumed the simulated consultant anaesthetic role to  
16 139 improve the credibility that DAS algorithm plans A-C were performed competently and to discourage  
17 140 participants from 'taking over' these steps. The simulation was filmed (with consent) to facilitate  
18 141 quantitative assessment. Participants were directed not to discuss the nature of the simulation with  
19 142 colleagues. All participants were sent an email request to contact J.B. (qualitative researcher) by  
20 143 telephone and arrange a mutually convenient time for a semi-structured telephone interview.

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23 145 The primary outcome was time to achieve ventilation of the manikin's lungs after declaration of the  
24 146 CICO emergency. We hypothesized that anaesthetists and general surgeons would be significantly  
25 147 slower compared to head and neck surgeons. The secondary outcomes included the method of  
26 148 emergency surgical FONA, prior knowledge of guidelines for CICO management and qualitative  
27 149 enquiry to determine attitudes toward the simulation and perceptions of who is best placed to  
28 150 perform an emergency surgical FONA. We employed data from published work that investigated  
29 151 emergency surgical FONA performance on the same manikin, neck prosthesis and simulation scenario  
30 152 to power this study <sup>11</sup>. We used a baseline hypothetical 'gold standard' time of 150 seconds to  
31 153 detect a 30 second difference between specialties from declaration of CICO to completion of the  
32 154 emergency surgical FONA. Based on three groups, significance at a p value of 0.05 and power of  
33 155 80%, we calculated that 15 subjects per group would be required to demonstrate this difference. For  
34 156 each simulation we timed three phases of emergency surgical FONA performance:

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- 36 158 1. **Deliberation time:** *Time from declaration of a CICO scenario to initiation of the emergency*  
37 159 *surgical FONA*  
38 160 2. **Surgical time:** *Time from initiation of the emergency surgical FONA to completion*  
39 161 3. **Total time:** *Time from declaration of a CICO scenario to completion of the emergency*  
40 162 *surgical FONA*

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5 164 'CICO' deliberation time commenced when P.G declared his inability to oxygenate the patient, via  
6 165 intubation, supraglottic airway device or bag-mask technique with the standardised phrase "you  
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8 166 have to do emergency front of neck access" (Figure 1). Completion of emergency surgical FONA was  
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10 167 defined as confirmation of chest expansion following manikin intubation via the neck incision. Time  
11 168 to completion was calculated from the video recording for all participants. As a confirmatory  
12 169 measure, correct tracheal placement was also confirmed after the scenario before the model was  
13 170 dis-assembled. All data were analysed using STATA 13.1 (Statacorp, USA). Data were tested for  
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15 171 normality (Shapiro-Wilk test) and appropriate statistical tests employed to determine differences  
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17 172 between consultant groups. Specifically, we identified here non-parametric data distributions were  
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19 identified were used the Kruskal-Wallis test to test differences across the three groups and used  
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22 174 Dunn's test to correct for multiple comparisons. For categorical data we used Chi-squared tests to  
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24 175 examine for differences. We considered that a p value of <0.05 demonstrated a significant  
25 176 difference between comparison groups as is convention.  
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#### 179 **Qualitative Data:**

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31 180 After the simulation, study participants were asked to take part in an audio recorded telephone  
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33 181 semi-structured interview with a member of the research team (JB, a non-clinician with expertise in  
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35 182 postgraduate medical education). Full details of the telephone interview are provided in the  
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37 183 supplemental data (Figure S3). Verbal consent was confirmed prior to the start of each  
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39 184 interview. Each audio recording was transcribed for analysis. A thematic framework was devised by  
40 185 JB after initial reading of the transcripts and deliberations with the research team<sup>13</sup>. Construction of  
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42 186 codes and thematic categories was cross checked by two independent raters (JB and JS) for inter-  
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44 187 rater reliability<sup>14</sup>. This process identified areas of agreement to minimize any potential for bias in  
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46 188 interpretation. Data analysis activities were recorded so the interpretation of qualitative data could  
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48 189 be tracked, ensuring auditability. A number was allocated to each interviewee in order of  
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50 190 participation. This number appears after each quotation in the results section along with the  
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52 191 participant's specialty.  
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3 197 **RESULTS**  
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7 199 Forty-five consultants were recruited to this study, 15 anaesthetists, 15 head & neck surgeons (10  
8 oral maxillofacial surgeons and 5 ear, nose and throat surgeons) and 15 general surgeons and  
9 200 median number of years since completion of clinical training was 5 years (IQR: 1-14) for  
10 201 anaesthetists, 12 years (IQR: 2-18) for head and neck surgeons and 11 years (IQR: 7-15) for general  
11 202 surgeons. All anaesthetists (15/15), 10/15 head and neck and 11/15 general surgeons had previously  
12 203 been trained in emergency surgical FONA. 15 (100%) of anaesthetic consultants had participated in  
13 204 local departmental training and one had also performed surgical cricothyroidotomy on a porcine  
14 205 cadaveric model. Eleven general surgeons (73%) had previously been trained in the performance of  
15 206 emergency FONA: one during a Royal College of Surgeons course, seven during Advanced Trauma  
16 207 Life Support courses and three did not specify. Ten head and neck surgeons (67%) had previously  
17 208 received emergency FONA training: one during a Royal College of Surgeons course, seven during  
18 209 Advanced Trauma Life Support courses and two on a human cadaveric course. The time elapsed  
19 210 since emergency surgical FONA training differed between specialties: all anaesthetic consultants had  
20 211 participated in training in the previous six months while the median time since training for head and  
21 212 neck surgeons was 2.5 years (IQR: 1-10) and 14 years (IQR: 4-20) for general surgeons,  $p < 0.001$ .  
22 213 Anaesthetic participants were more likely to be aware of Difficult Airway Society Guidelines for CICO  
23 214 compared (15/15) to head and neck surgeons (5/15) and general surgeons (0/15,  $\chi^2 [2, n=45] = 31.5$ ,  
24 215  $p < 0.001$ ).

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38 217 Forty-four participants successfully completed an emergency surgical FONA. One participant  
39 218 (general surgeon) declined to attempt an emergency surgical FONA in the emergency  
40 219 scenario stating that this was outside of their training expertise. There was no significant  
41 220 difference in total time to complete a successful emergency surgical FONA across the three  
42 221 groups: anaesthetists (median 86s, IQR 69-135s), head and neck surgeons (median 98s,  
43 222 IQR 67-151s), and general surgeons (n=14, median 126.5s, IQR 93-187s),  $p = 0.078$  (~~Kruskal~~  
44 223 ~~Wallis~~). Figure 3 displays box and whisker plots for deliberation time, surgical time and total time for  
45 224 each specialty. There were no significant differences in deliberation time between the groups:  
46 225 median 30s (IQR: 24-43) anaesthetists vs 31s (IQR: 16-38) head and neck vs. 23s (IQR: 14-45) general  
47 226 surgeons,  $p = 0.665$  (~~Kruskal~~ ~~Wallis~~). However, surgical time was significantly different between the  
48 227 three groups: median 50s (IQR 45-80) anaesthetists vs. 74s (IQR: 42-127) head and neck vs. 86s  
49 228 (IQR: 76-163) general surgeons,  $p = 0.018$  (~~Kruskal~~ ~~Wallis~~). When compared directly, anaesthetists  
50 229 completed the procedure significantly quicker than general surgeons,  $p = 0.0144$  (~~Dunn's test~~) but  
51 230 not head and neck surgeons,  $p = 0.4022$  (~~Dunn's test~~).

231

232 **[FIGURE 3]**

233 Different techniques were used to complete the emergency surgical FONA between specialties  
 234 (Table 1). The time taken to successfully complete an emergency surgical FONA was significantly  
 235 impacted by procedural choice: vertical incision cricothyroidotomy (median 87.5s, IQR: 68-135),  
 236 transverse stab incision cricothyroidotomy (median 115s, IQR: 90-161) and classical tracheostomy  
 237 (median 131.5s, IQR: 113-185),  $p=0.05$ . ~~All anaesthetists (15/15), 10/15 head and neck and 11/15~~  
 238 ~~general surgeons had previously been trained in emergency surgical FONA. 15 (100%) of anaesthetic~~  
 239 ~~consultants had participated in local departmental training and one had also performed surgical~~  
 240 ~~cricothyroidotomy on a porcine cadaveric model. Eleven general surgeons (73%) had previously~~  
 241 ~~been trained in the performance of emergency FONA: one during a Royal College of Surgeons~~  
 242 ~~course, seven during Advanced Trauma Life Support courses and three did not specify. Ten head~~  
 243 ~~and neck surgeons (67%) had previously received emergency FONA training: one during a Royal~~  
 244 ~~College of Surgeons course, seven during Advanced Trauma Life Support courses and two on a~~  
 245 ~~human cadaveric course. The time elapsed since emergency surgical FONA training differed~~  
 246 ~~between specialties: all anaesthetic consultants had participated in training in the previous six~~  
 247 ~~months while the median time since training for head and neck surgeons was 2.5 years (IQR: 1-10)~~  
 248 ~~and 14 years (IQR: 4-20) for general surgeons,  $p<0.001$ . Anaesthetic participants were more likely to~~  
 249 ~~be aware of Difficult Airway Society Guidelines for CICO compared (15/15) to head and neck~~  
 250 ~~surgeons (5/15) and general surgeons (0/15,  $\chi^2 [2, n=45] = 31.5, p<0.001$ ).~~

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252 **[TABLE 1]**

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254 **Qualitative Findings**

255 Twenty (44%) participants volunteered to be interviewed and were included in the analysis. Ten  
 256 anaesthetists and 10 head & neck surgeons. Nine (45%) interviewees had real life experience of [a](#)  
 257 [can't intubate can't oxygenate scenario](#) emergency FONA (1 [a](#) Anaesthetist and, 8 [h](#) Head and neck  
 258 [surgeons](#)&N). Five of these had performed an emergency surgical FONA (1 anaesthetist, 4 head and  
 259 neck surgeons). Fourteen (70%) had previously experienced high-fidelity simulated emergency  
 260 procedures. Six (30%) had participated in an emergency procedure on a cadaveric course (or on  
 261 animals).

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3 263 We found that the simulated scenario acted as a trigger for consultants to reflect on how they would  
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5 264 perform when faced with this emergency situation:

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8 266 *So, I think the most useful aspect for anybody is actually just making people think about*  
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10 267 *what they would do in that situation. (5, Head and neck surgeon)*

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13 269 During the interviews, participants considered who should perform emergency surgical FONA in real  
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15 270 life. A number of influential factors were listed including confidence levels, skillsets, clinical setting,  
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17 271 experience, seniority of consultants, specialty and willingness to take the lead:

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20 273 *And so, depending on who the surgeon was, their seniority and their specialty versus who the*  
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22 274 *anaesthetist was, their seniority and which areas they practiced in, it would determine who*  
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24 275 *would be the best person in any one given circumstance. (14, Anaesthetist)*

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27 277 *There comes a point that the airway is actually lost and anaesthetists have a tendency to*  
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29 278 *want to keep control, to want to keep trying- (5, Head and neck surgeon)*

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33 281 Head and neck surgeons perceived themselves to be the most appropriate person to lead on the  
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35 282 basis that they operate on the neck regularly but suggested that the anaesthetist may be best if  
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37 283 other surgical specialties were present:

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40 285 *I am one of the specialties that performs surgery in the head and neck so I feel that in that*  
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42 286 *particular scenario, that I would probably be the best person to do that. I think if I was a*  
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44 287 *surgeon who didn't practice in the head and neck, I think an anaesthetist or a surgeon would*  
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46 288 *be equally placed, possibly the anaesthetist would be better placed because of the familiarity*  
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48 289 *of airway anatomy- (4, Head and neck surgeon)*

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50 291 *I know the anaesthetists are good at subcutaneous access, but I don't think, well, I would be*  
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52 292 *surprised if they had the confidence to make an incision in the neck. (20, Head and neck*  
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54 293 *surgeon)*

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57 295 Anaesthetists had varied views on who should take the lead. One anaesthetist explained why they  
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59 296 thought a surgeon was best placed to take the lead.

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*It may be that the surgeon is the best person to do it if they're an experienced surgeon in the*

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*field because with the best will in the world, I'm not a surgeon and I feel even though I've*

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*done tracheostomies and cricothyroidotomies on manikins and I've done tracheostomies on*

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*patients, in a controlled situation I still don't have the confidence to be able to say with*

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*certainty yes, I'm doing the right thing, I know what I'm doing surgically whereas a surgeon*

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*would have that benefit. (6, Anaesthetist)*

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Other anaesthetists felt that a head and neck surgeon may be more appropriate to take the lead but

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if other surgical specialties were present it should be a member of the Anaesthetic team:

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21 308

*I think if you're up in B theatres with maxillofacial surgeons and ear, nose and throat*

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*surgeons, they're probably best equipped 'cause they're more familiar with performing*

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*practical procedures and surgical procedures. I think in other areas of the hospital, you know,*

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*general surgeons, orthopaedic surgeons, although they do surgery, they're maybe not that*

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*familiar with—I'm not sure that they'd be familiar with the guidelines, and it may be that the*

26 313

*anaesthetist would be best placed. (7, Anaesthetist)*

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*If it is an ear nose and throat surgeon who does trachies [sic] then I think they're best*

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*equipped. If it was just a non-ear nose and throat or head and neck surgeon, then I think it*

30 317

*would be the anaesthetist. (10, Anaesthetist)*

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Other anaesthetists explained why they saw themselves as the Consultant Lead:

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34 321

*I think the person who's best practiced at doing it. It seems that we, I think anaesthetists are*

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*more familiar with emergency scenarios like that and I get the impression that surgeons*

36 323

*don't regularly do drills like that so whilst they have the, in theory, the better technical skills,*

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*I think in a scenario like that where it's very time-sensitive, I think at the moment*

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*anaesthetists are probably better equipped. But that's not to say that if surgeons had regular*

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*front of neck access training, that they, I would imagine they would become the most*

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*appropriate person to do it. (13, Anaesthetist)*

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3 329 Some of the head and neck surgeons explained the challenges they faced during the emergency  
4 surgical FONA-emergency scenario when they were effectively forced to only use the equipment  
5 330 they had in front of them.  
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10 333 *I'm an ear nose and throat surgeon, but I specialize in airway difficulty, so I would have got*  
11 334 *my rigid laryngoscope and done an assessment from the top, because I know I have that*  
12 335 *equipment there. It was in the theatre next door, but no one would go and get it for me. I*  
13 336 *kind of went along with it. So that's what I found difficult. I know it's kind of high fidelity, but*  
14 337 *it's also not exactly the way I would have done it in that setting, if that makes sense. (3,*  
15 338 *Head and neck surgeon)*  
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21 340 *They said this is all encompassing, and you should do it with a scalpel with a bougie and a*  
22 341 *fixed tube and nothing else, were as in my previous experience I have done a lot of surgical*  
23 342 *airway management in emergency and non-emergency and I've had a much bigger range of*  
24 343 *equipment. So, my first thought on the sim was I know what I'm doing here so can I have a*  
25 344 *dish tray, a trachea tray open blah and I was looking for instruments and they said no you*  
26 345 *only have this and I was flummoxed by that, so I was confident to do it my way and I wasn't*  
27 346 *confident to do it their way obviously. (4, Head and neck surgeon)*  
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3 349 **DISCUSSION**

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6 351 We found that anaesthetists performed the procedural component of an emergency surgical  
7 ~~(initiation to completion)~~ FONA significantly faster than general surgeons in a high-fidelity simulated  
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9 353 emergency can't intubate can't oxygenate scenario. There was no significant difference in  
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11 354 performance between anaesthetists and head and neck surgeons. Qualitative data suggests that  
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13 355 despite this strong performance, some anaesthetists still perceived that 'surgeons' would be best  
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15 356 placed to perform emergency surgical FONA in a genuine can't intubate, can't oxygenate situation.  
16  
17 357 This study demonstrates that anaesthetists regularly trained and drilled to perform surgical  
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19 358 cricothyroidotomy function at comparable levels to head and neck surgeons and should feel  
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21 359 confident to lead this procedure in the event of a CICO emergency.

22 360

23 361 The CICO situation is a rare but acutely life-threatening event estimated to occur, on average, once  
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25 362 in an anaesthetic career<sup>11</sup>. This frequency is likely to be increased for anaesthetists working in high  
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27 363 risk areas such as head and neck cancer, trauma and critical care. Evidence from NAP4 suggests that  
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29 364 emergency surgical FONA was more successful than needle-based techniques but all of these  
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31 365 procedures were performed by surgeons<sup>1,2</sup>. Following on from the NAP4 audit, the Royal College of  
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33 366 Anaesthetists, Association of Anaesthetists of Great Britain and Ireland, the Difficult Airway Society  
34  
35 367 and the UK's ear nose and throat and oral maxillofacial surgeons adopted surgical cricothyroidotomy  
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37 368 as the most simple and expedient method for emergency front of neck airway access<sup>3-5</sup>. Both  
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39 369 surgeons and anaesthetists may lack the skills and confidence to perform an emergency surgical  
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41 370 FONA<sup>11,15-18</sup>. Robust training on emergency front of neck airway access is vital to improve  
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43 371 competence and confidence<sup>8-11,16-19</sup>. In this study, all anaesthetists we aware of guidelines new and  
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45 372 regularly practiced in the management the a CICO emergency and y and performing an  
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47 373 emergency surgical FONA according to current guidelines. This is reflected in our results, where  
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49 374 anaesthetists more often correctly performed a vertical incision which was associated with improved  
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51 375 speed. There is increasing evidence that structured training programmes for surgical  
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53 376 cricothyroidotomy improve clinical performance for emergency FONA in both military deployment<sup>8,</sup>  
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55 377 <sup>18,20</sup> and civilian environments<sup>7,9</sup>. As a tertiary healthcare centre, we compared anaesthetists with  
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57 378 expert head and neck surgeons (some of whom regularly perform elective tracheostomies) and  
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59 379 general surgeons. Our results, demonstrating superior performance in anaesthetists compared to  
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380 general surgeons, indicate that for general hospitals, without tertiary head and neck expertise, the  
381 trained anaesthetist may be best placed to perform the emergency surgical cricothyroidotomy  
382 procedure.

383

384 Our qualitative investigation identified variations in perception of roles amongst the anaesthetists  
385 and surgeons during FONA emergencies. These differing perceptions also related to the equipment  
386 available at the emergency; head and neck surgeons often requested a specialized laryngoscope or a  
387 tray of tracheostomy instruments. Anaesthetists may be in a more advantageous position compared  
388 to surgeons as they have more regular specific training on a single surgical cricothyroidotomy  
389 technique. Surgeons with a higher skill base may exercise greater procedural autonomy but this may  
390 increase complexity and time to successful tracheal cannulation in an emergency 'situation/event  
391 scenario'. However, this potential advantage should be offset against the sense of personal failure  
392 that anaesthetists may experience if their conventional airway management techniques have failed  
393 (9). As one of the head and Neck surgeons said at interview; "There comes a point that the airway is  
394 actually lost and anaesthetists have a tendency to want to keep control, to want to keep trying".  
395 Surgeons may be less likely to carry the emotional baggage of airway failure that may increase  
396 deliberation times (see above quote: "5, Head and neck surgeon"). However, no difference in  
397 deliberation time between specialties was observed in this study. As there are multiple factors that  
398 can influence performance, we recommend that roles should be agreed within theatre teams at the  
399 WHO team briefing. We also recommend multidisciplinary team training to facilitate the rehearsal of  
400 guidelines and prospective assignment of roles and responsibilities.

401

402 We choose to use in situ, high-fidelity simulation as a pragmatic tool to measure emergency surgical  
403 FONA performance. Our simulation was developed and refined during a previous study that  
404 examined optimal training tools to teach surgical cricothyroidotomy for anaesthetic trainees<sup>11</sup>. We  
405 incorporated a neck prosthesis within our manikin that made palpation of the laryngeal and cricoid  
406 cartilages impossible. In this circumstance, DAS guidelines recommend a vertical incision surgical  
407 cricothyroidotomy<sup>3</sup>. We observed that 13/15 anaesthetists, 7/15 head and neck and 6/14 general  
408 surgeons adopted this approach and successfully completed the procedure significantly faster than  
409 alternative techniques (horizontal incision or tracheostomy). Limited surgical training in a defined  
410 procedure may have been advantageous for anaesthetists in this respect. We deliberately did not  
411 inform clinicians of scenario specifics prior to their involvement and qualitative data suggests that  
412 participants did not discuss their experiences with one another. Our qualitative data demonstrates  
413 that clinicians strongly engaged with the scenario and that simulation information was not shared  
414 during the study. Participants were requested not to discuss the scenario with colleagues as part of  
415 the consent procedure. A potential limitation of the study is that different levels of exposure to  
416 simulation training between anaesthetists and surgeons may have impacted on performance<sup>21</sup>. The

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3 417 duration between last training episode and the emergency simulation was longer for surgeons. We  
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5 418 noted that deliberation times were short in our investigation this is likely because participants were  
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7 419 exposed to protocolised airway management and then instructed to perform emergency FONA.  
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9 420 Potentially, participants may have had prior knowledge of the scenario, however, our methodology  
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11 421 was designed to prevent this eventuality and our post-procedural qualitative data suggests that  
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13 422 inter-participant communication did not occur. Another limitation to the study is the lack of  
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15 423 qualitative data from general surgeons. In addition, surgeons were less likely to be aware of  
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17 424 recommendations and guidelines for the management of CICO situations compared to anaesthetists.  
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19 425 These factors may have impacted on performance for general surgeons who rarely perform  
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21 426 tracheostomy during routine clinical practice compared to head and neck surgeons. Further,  
22  
23 427 subspecialisation of head and neck surgeons and resultant deskilling in the ability to perform an  
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25 428 emergency surgical FONA has been previously described<sup>22</sup>. From a qualitative methodological point  
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27 429 of view some participant opinions may have been better measured by asking some key closed  
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29 430 questions at the start of each interview.  
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33 432 In conclusion, we have demonstrated that anaesthetists perform an emergency surgical FONA  
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35 433 comparably to expert head and neck surgeons in an emergency simulated CICO situation. In  
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37 434 addition, anaesthetists successfully completed an emergency surgical FONA faster than general  
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39 435 surgeons. This study demonstrates that, in a unit with regular multidisciplinary CICO training and  
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41 436 rehearsal, anaesthetists are well placed to perform an emergency **emergency** surgical FONA.  
42  
43 437 However, there were varied perceptions on who should perform an emergency surgical FONA  
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45 438 amongst the study participants if a genuine CICO event were to arise. We recommend regular  
46  
47 439 multidisciplinary CICO training and drills for anaesthetists and surgeons. We also recommend  
48  
49 440 prospective discussion between individual anaesthetists, surgeons and the multidisciplinary team to  
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51 441 assign roles, responsibilities and planned procedures in the event of a CICO 'situation/event'  
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53 442 **scenario**.  
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3 447 **Authors' Contributions and Authorship:**

4 448 **P.G.:** Study Design and Concept; Design of Data Collection Method; Participant Recruitment;  
5  
6 449 Simulation design and running; Data Collection; Data Analysis; Writing First Draft of Manuscript,  
7  
8 450 Revising the Manuscript

9  
10 451 **L.S.:** Simulation design and running; Data Collection; Data Analysis; Writing Manuscript, Revising the  
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12 452 Manuscript

13 453 **N.H.:** Simulation design and running; Data Collection; Data analysis; Writing Manuscript, Revising the  
14  
15 454 manuscript

16 455 **S.P.:** Simulation design and running; Data Collection; Data analysis; Writing Manuscript, Revising the  
17  
18 456 manuscript

19  
20 457 **J.B.:** Design of Data Collection Method; Data Collection; Data Analysis; Revising the Manuscript

21  
22 458 **J.S.:** Design of Data Collection Method; Data Analysis; Revising the Manuscript

23 459 **B.M.:** Study Design and concept; Design of Data Collection Method; Statistical Analysis, Revising the  
24  
25 460 Manuscript

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27 461

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46  
47 472 Health.

47 473

48 474 **Declaration of Interests**

49  
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52 476 **L.S.:** None Declared

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54 477 **N.H.:** None Declared

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56 478 **S.P.:** None Declared

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58 479 **J.B.:** None Declared

59  
60 480 **J.S.:** None Declared

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3 481 **B.M.:** None Declared  
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For Peer Review

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5 579 **TABLES:**

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8 581 **[TABLE 1]**9  
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	<b>Front of Neck Airway Technique Employed</b>			
	Vertical surgical cricothyroidotomy	Transverse surgical cricothyroidotomy	Tracheostomy	Refused
<b>Head &amp; Neck Surgeon</b>	7	5	3	0
<b>General Surgeon</b>	6	3	5	1
<b>Anaesthetist</b>	13	2	0	0

34 583 **Table 1: Emergency surgical front of neck airway technique by specialty.** Table describes the surgical technique used  
 35 584 according to specialty. Techniques include vertical incision surgical cricothyroidotomy, transverse incision surgical  
 36 585 cricothyroidotomy, classical tracheostomy and refused to perform procedure. Chi<sup>2</sup> analysis demonstrated no significant  
 37 586 difference in technique between specialties:  $\chi^2 (6, n=45) = 11.46, p=0.075$ .

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#### LEGENDS TO ILLUSTRATIONS:

**Figure 1: Standardised can't intubate can't oxygenate high-fidelity simulation scenario sequence of events.** This simulation scenario was delivered in an operational theatre anaesthetic room by a consultant anaesthetist and regular operating department staff. Each participant was exposed to an identical scripted scenario during this study. [SAD: supraglottic airway device; ODP: operating department practitioner; LMA: laryngeal mask airway.](#)

**Figure 2:** Figure shows the orientation of the tablet (iPad) monitor relative to the manikin in the anaesthetic room (2a). The close up shows how the manikin's neck prosthesis was adapted to bleed when incised (2b).

**Figure 3: Deliberation, surgical and total time to successful emergency surgical front of neck airway according to specialty.** Figure demonstrates box and whisker plots (median, interquartile and range) of deliberation, surgical and total time to an emergency surgical FONA by clinician specialty. The Kruskal-Wallis test was used to determine if there was a difference across the three groups. The [Dunn's correctionMann-Whitney-U](#) test was used to determine difference between anaesthetists and general surgeons.

#### LEGENDS TO SUPPLEMENTAL FIGURES FOR ON LINE PUBLICATION ONLY:

**Supplemental Figure S1:** Can't Intubate Can't Oxygenate Scenario Simulation

**Supplemental Figure S2:** Structure of Post Simulation Debrief

**Supplemental Figure S3:** Semi-structured interview schedule

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For Peer Review

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# DAS ALGORITHM

# SIMULATION SEQUENCE

**PLAN A:  
Facemask Ventilation & Tracheal Intubation**

- Participant finds anaesthetist, ODP with simulated patient
- Difficult airway trolley in use
- Participant informed Plan A has failed 3 + 1 times (including videolaryngoscopy by an airway expert)

**FAILED INTUBATION DECLARED**

**PLAN B:  
Maintaining oxygenation: SAD Insertion**

- Participant witnesses Plan B attempted in real time:
- Size 4 iGel, size 3 iGel and finally a size 3 LMA Classic ALL FAIL

**FAILED SUPRAGLOTTIC AIRWAY DEVICE DECLARED**

**PLAN C:  
Facemask Ventilation**

- Participant witnesses Plan C attempted in real time:
- Face mask ventilation with Guedel then nasopharyngeal airway fails
- 2 person technique fails

**CAN'T INTUBATE CAN'T OXYGENATE DECLARED**

**PLAN D:  
Emergency Front of Neck Access**

- Participant told **"You have to do emergency front of neck access"**
- Shown contents of difficult airway trolley:
- Size 10 scalpel, bougie a size 6.0 Endotracheal Tube and 1L bag of saline (shoulder roll)

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Figure 2

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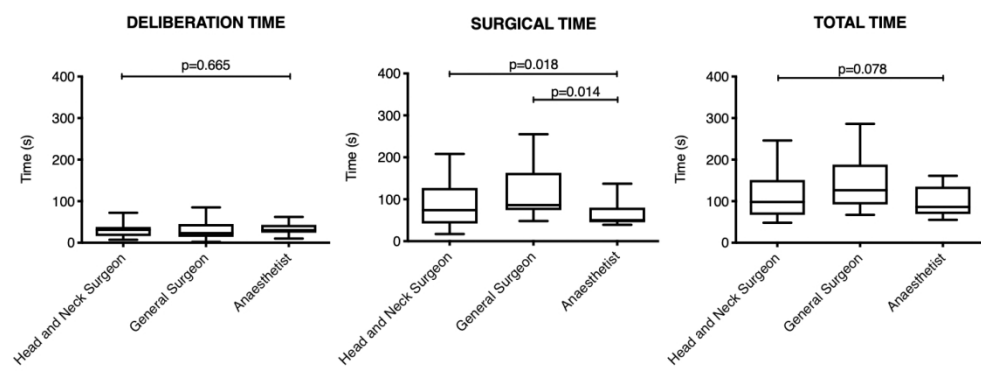


Figure 3

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