18 A commentary on good care in NAP7


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In January 2023, the NAP7 team met in person for the first time since February 2020. We had reviewed all the cases and data and began to turn to the daunting task of writing this report. For the past 18 months we had discussed, dissected and debated everything from adrenaline doses to anaphylaxis, calcium to compression thresholds, do not attempt resuscitation (DNACPR) recommendations to diagnosis of cardiac arrest. It was easy to think that there were so many unanswered questions and lots that could just be better. However, one of the great privileges of this project and its previous iterations is the strength that comes from the team's diversity. The Royal College of Surgeons of England representative, Mr Simon Kendall, put it all in perspective, highlighting that, of the three million plus cases performed each year that anaesthetists are involved in, the fact that we are only reviewing a tiny fraction shows how safe and good anaesthesia is for the vast majority of patients. Further, within the cases we reviewed, there were countless examples of good and excellent care.

Of the 881 patients reported to have a perioperative cardiac arrest, 665 (75%) were resuscitated successfully. The anaesthetic team were effectively aided by other members of the theatre team in 83% of cases. Of these 665 patients, 660 (99.2%) were admitted to critical care for further monitoring and care.

At the point of reporting to NAP7, 60% of cases reported were either discharged from hospital (44%) or still alive in hospital (17%). For context, survival to hospital discharge after in-hospital cardiac arrest in the UK in 2021–22 was 22.7% (ICNARC 2022) and 30-day survival after out-of-hospital cardiac arrest in the UK in 2021 was 8.5% (Warwick Clinical Trials Unit 2022). A systematic review of published studies estimated survival to discharge following a cardiac arrest in intensive care was 17% (95% confidence interval, CI, 9.5–28.5%; Armstrong 2019).

Each of 881 cases of perioperative cardiac arrest received four assessments of quality of care (before the cardiac arrest, during it, after it and overall): 2274 (77%) of 2947 accessible judgements were rated good and 135 (4.5%) as poor, meaning that good care was 17 times more common than poor care. In cases where the key cause of an event was judged to be solely the patient, anaesthesia or surgery, this was judged to be due solely to patient factors (n = 219) more than four times more often than due to anaesthesia (n = 53) or surgery (n = 47), although none of these assessments indicates blame, especially as this project does not have the complete clinical information to make such judgements. Only one case was judged solely due to organisation/institutional issues.

The Care Quality Commission rates a good hospital as safe, effective, caring, responsive to people's needs and well led. NAP7 identified these in a large number of case reports where anaesthesia, leadership, supervision and team factors were commonly cited as mitigating factors in an analysis of contributory factors, with 'teamwork' and 'anaesthesia' the most frequently cited mitigating factors. Many of the other most commonly identified mitigating factors point to organisations fostering environments in which good care can be delivered.

Complications, peer review and Safety-II

In a 2013 review of NAP3 and NAP4, Moppett commented on the fact that the NAPs focus exclusively on cases in which 'complications' have occurred (Moppett 2013): 'The assumption that "poor practice" is associated with outcome is weakened by a lack of evidence of how often good outcome occurs with "poor practice"'. He recommended that 'Within the constraints of practicality, future NAPs might consider the use of good outcome controls, or review of sampled 'rescued' bad outcomes to provide some reference points.'

When the quality of care is reviewed, it is well recognised that the outcome of a case has the potential to influence the opinion regarding the quality of care delivered, with judgements of substandard care being more common when outcome is poor compared with when it is good. Caplan reported that when case details were sent to 21 pairs of matched reviewers, identical except for the outcome of the case, the expert opinion on appropriateness of care varied with outcome in 15 (71%) reviews: a rating of appropriate care decreased by 31% when the outcome was changed from temporary to permanent

harm and increased by 28% when the outcome was changed from permanent to temporary harm (Caplan 1991). Variation in medical opinion has also long been recognised, with opinions differing between groups of clinicians reviewing the same case (Posner 1996, Cook 2011a). Case review is, together with a host of other biases that reviewers bring to the process, particularly prone to outcome and hindsight bias. Finally, case review may be compromised by the tendency of groups to wish to agree internally, perhaps with a dominant or 'alpha' reviewer (Crosby 2007).

In recent years, the concept of 'Safety-II' has been promoted (Hollnagel 2015). In a white paper on the topic, the authors comment: Although the rate of harm seems stable, increasing demand for health services, and the increasing intensity and complexity of those services (people are living longer, with more complex co-morbidities, and expecting higher levels of more advanced care) imply that the number of patients harmed while receiving care will only increase, unless we find new and better ways to improve safety.' (Hollnagel 2015)

Safety-I is described by the authors as 'a state where as few things as possible go wrong ... the safety management principle is to respond when something happens ... usually by trying to eliminate causes or improve barriers, or both.' They describe this as a simplistic, rather outmoded and 'bimodal' approach of things 'working correctly or incorrectly' and suggest that things normally do go well 'because people can and do adjust what they do to match the conditions of work', particularly as systems become more complex. They introduce the concept of 'Safety II' which in turn, rather than ensuring that 'as few things as possible go wrong' (Safety-I) aims that 'as many things as possible go right' (Safety-II). They emphasise the importance of the adaptability of human performance in ensuring that success is the norm, in spite of complex, changing and highly variable work situations. Many who worked on the frontline through the COVID-19 pandemic will have a keen insight into what Safety-II means.

NAPs in the context of 'things going well'

Where then do the NAPs, and specifically NAP7, sit in this setting and in response to Moppett's report? First, the NAPs focus on rare events with the potential to harm patients, which are incompletely studied and not readily amenable to study by better methods than the NAP methodology. They include only cases with major complications, hence arguably all cases with 'poor outcomes': at first appearance a clear 'Safety-I' project.

The NAPs have several strengths in this regard. They are undertaken, in large part, by a nation's clinicians working on behalf of patients. In addition to examining complications, they examine normal practices by normal clinicians (Baseline Survey) and normal activities on a national level (Activity Survey) to provide context. The case reviews are undertaken by a wide group of practising clinicians and patient representatives. The review processes are designed to raise awareness of potential biases and to minimise their impact with small group review by multispecialty and patient representatives followed by secondary large group moderation of each case (see Chapter 6 Methods). The NAPs do not produce guidelines and our recommendations are consensus based and thus at the lowest rung of the evidence ladder, but this also enables them to be wide ranging and to focus on opportunities to both promote good care and prevent poor care in equal measure. In NAP7 specifically, there is perhaps a unique opportunity, as Moppett (2013) called for, to examine when a bad outcome (cardiac arrest) is 'rescued' (by successful resuscitation).

How might NAP7 tell us about good care?

Cardiac arrest is a terminal, life-ending event, and reversing that process is termed 'reanimation' in many counties, emphasising the challenge. To be successful, it requires rapid recognition of the crisis, rapid diagnosis of the cause and rapid, coordinated, team-based care to have a chance of reversing the cause and restoring life. These processes provide the opportunity for successful resuscitation but do not guarantee it, as the nature of the precipitating event(s) and the patient's underlying health may prevent this. As such, despite delivery of best possible care at the time of cardiac arrest, survival may ultimately not be achieved (see the two vignettes illustrating excellent care in both cases but with contrasting outcomes).

A patient underwent major pelvic surgery for malignant disease. Rapid and unexpected blood loss occurred and despite prompt transfusion of blood products and vasopressor support a hypovolaemic pulseless electrical activity (PEA) arrest ensued. Cardiac arrest management (including appropriate cardioversion and reversal of hyperkalaemia), central venous access, transfusion of blood products and surgical control of the bleeding took place concurrently. Return of spontaneous circulation (ROSC) was achieved in less than 10 minutes and the patient survived.

A patient with significant comorbidity sustained a fractured neck of femur. Surgical repair was judged to be challenging but necessary. A group of senior surgeons and anaesthetists held a multidisciplinary team meeting and counselled the patient as to the risks presented by surgery. General anaesthesia was successfully delivered and care included invasive arterial monitoring and a femoral nerve block. Preparations were made for significant blood loss. As predicted, difficult surgery led to major haemorrhage and a hypotensive PEA cardiac arrest despite concurrent transfusions and vasopressor support. A second senior anaesthetist and second surgeon were in attendance. ROSC was achieved following surgical control of the bleeding and a mid-point discussion regarding the appropriateness of continuing resuscitation. The patient was stabilised and transferred to ICU intubated and ventilated with ongoing central inotropic support. Despite this, the patient deteriorated over the next 24 hours and died.

The return of spontaneous circulation is only the first part of the process and is commonly followed by admission to ICU and organ support. As Hollnagel. (2015) commented, healthcare increasingly involves the care of people who are living longer, with more complex comorbidities, and they expect higher levels of advanced treatment. This was indeed borne out in our Activity Survey, which showed that in only a decade, there have been measurable and clinically significant changes in the complexity (increased age, comorbidity, incidence and severity of obesity) of patients presenting for surgery in the UK (see Chapter 11 Activity Survey).

What does NAP7 tell us about good care?

The departmental Baseline Survey shows excellent access to emergency services, emergency equipment and resuscitation guidelines in adult theatres and critical care units, though there is definite room for improvement in paediatric theatres and remote locations. The individual Baseline Survey shows high rates of confidence in managing perioperative cardiac arrest but suggests interruption of training, perhaps in keeping with the pandemic stresses at the time.

NAP7 received 881 reports of perioperative cardiac arrest, among more than three million anaesthetic episodes (2.71 million in the NHS and an unmeasured number in the independent sector) in 2021–22, an incidence of around 1 in 3100. Put another way, this means 3099 (99.97%) of every 3100 patients did not have a cardiac arrest.

The patients in the Activity Survey represent today's 'normal patients' and are also representative of those who did not have a cardiac arrest. Our data indicate how complex perioperative care has become compared with the rather younger, slimmer and healthier surgical patients of previous generations. Of surgical patients, 18% are aged over 75 years or younger than 5 years, 60% are overweight or obese, 27% have major comorbidities and 4% life-threatening comorbidities, 21% are frail, 19% are undergoing urgent or immediate surgery, 30% are undergoing major/complex surgery, around 15% of cases take place out of hours and 15% in isolated locations.

These older and higher-risk patients are prone to complications during surgery. In the Activity Survey of 24,172 cases, there were 1922 complications affecting 1337 patients (1 in 18), a rate which the RCoA would term 'common' (Royal College of Anaesthetists 2019). Complications were very much associated with patient complexity factors: increasing age (4% prevalence among teenagers vs 60% in those aged > 55 years); comorbidity (ASA 1 3.8% vs ASA 5 53%) and frailty (2.5% Clinical Frailty Scale, CFS, 1 vs 14% CFS 8).

In the registry phase of the project, 680 cardiac arrests during anaesthesia and surgery were reported: an incidence of approximately 1 in 4000 (rare; Royal College of Anaesthetists 2019). The ratio of cardiac arrests to complications is 1 to 220, suggesting that fewer than 1% of complications during anaesthesia and surgery progress to cardiac arrest, the rest either resolving or being successfully managed by the perioperative team. For a substantial proportion, this implies prompt recognition, diagnosis and management of these events by anaesthetists to prevent such progression. The frequency of complications therefore perhaps illustrates the intrinsically risky nature of anaesthesia and surgery, while the low rate of progression to cardiac arrest indicates the success of modern perioperative care.

Another aspect of 'things almost always going well' is the low rates of reports of complications in many areas. An example is cardiac arrests associated with supraglottic airway (SGA) use (see Chapter 21 Airway and respiratory). In NAP4, aspiration was the leading primary airway cause of death and brain damage (Cook 2011b). Prominent in these cases were patients managed with an SGA, either in inappropriate patients or associated with poor clinical care, and all but one of which were first-generation SGAs. However, in NAP7 there is only one case of aspiration associated with the use of an SGA. In the intervening 13 years since the NAP4 data collection period, the surgical population has become older, more comorbid and obesity has increased (see Chapter 11 Airway and respiratory), all factors which would be expected to increase airway complications and to increase problems with SGA use. The NAP7 Activity Survey, shows a lower rate of SGA use than in NAP4 (NAP7 45% vs NAP4 56%), with this rate decreasing in patients with a body mass index above 35 kg m^{-2} and a dramatic move from first-generation SGAs to second-generation devices (NAP7 65% vs NAP4 10%). Together, these data suggest that anaesthetists have adapted to changing patient populations (and perhaps the results of NAP4), resulting in safer care. It also highlights the importance of the

development of safer anaesthetic equipment by manufacturers, the research that underpins our knowledge of such equipment and the implementation of change based on safety.

When perioperative cardiac arrest did occur, it affected a population of patients who, compared with the overall surgical population (i.e. the NAP7 Activity Survey) were more likely to be very young or very old (33% vs 14%), more comorbid (ASA 4–5, 37% vs 4%), more frail (at least moderately frail, 28% vs 7%), more likely to be having urgent or immediate priority surgery (52% vs 19%), that was major and complex (60% vs 28%) and for this to be taking place at night (20% vs 11%).

At the time of cardiac arrest, a consultant, post-CCT or SAS doctor was present in 85% of cases, despite 42% taking place out of hours. Time to onset of full resuscitation was less than three minutes in 88% of cases and only 1% of cases reported a delay in starting resuscitation. The median number of anaesthetic staff present during resuscitation was 2 (IQR 1–3) with a maximum of 10; 15% of resuscitation efforts lasted more than 20 minutes and 30% took place outside theatres.

The positive impact of the presence of specialist expertise is also shown in the outcomes of cardiac arrests following cardiac surgery. Of 25 arrests in cardiac intensive care, 21 (84%) patients survived and the 4 who died all experienced unsurvivable events, such as a ruptured heart. This is presumably a combination of full monitoring, early detection, regular training, familiarity with cardiac interventions allied to the relative ease of access to the heart itself if necessary to correct any surgical problems.

Finally, as discussed in Chapter 20 Decisions about CPR and Chapter 28 Older frailer patients, as societal expectations evolve, medicine in general, including anaesthesia and surgery, is increasingly required to offer more for longer, including to the very frail and elderly and those coming to the end of their lives. Cardiac arrest and death in some cases may be unavoidable and in other cases may even be an acceptable event in a dying patient. Of the cases of cardiac arrest that underwent full panel review, 84% were not judged to be preventable and, of all patients who died, more than half of the deaths were felt to be wholly or partially the result of an inexorably fatal process.

All in all, the findings of NAP7 confirm the safety of anaesthesia care delivered in the UK for patients across the spectrum of clinical risk. They also reveal many instances in which anaesthetic-surgical teams deliver good care in the management of potentially life-ending events. Our data suggest that this often results from the successful interplay of anaesthetic-surgical teams and organisational cultures which foster optimal environments for the delivery of good care every day.

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