# 20 Perioperative decisions about cardiopulmonary resuscitation



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## Key findings

- The Seventh National Audit Project (NAP7) Activity Survey showed that among 20,717 adults (> 18 years) undergoing surgery, 595 (2.9%) had a 'do not attempt cardiopulmonary resuscitation' (DNACPR) recommendation preoperatively.
- The preoperative DNACPR recommendation was suspended in less than one-third of these cases.
- Eight patients (1.4%) with a DNACPR recommendation had a cardiac arrest in their perioperative period and four were resuscitated successfully.
- Of the 881 perioperative cardiac arrest reports to NAP7 that included a resuscitation attempt, 54 (6.1%) had a DNACPR recommendation made preoperatively.
- Of these case reports, 70% had a Clinical Frailty Scale (CFS) score of 5 or greater (mild to very severely frail).
- Just under 50% of these DNACPR recommendations were formally suspended at the time of anaesthesia and surgery.
- One in five of those with a DNACPR recommendation and who had a cardiac arrest survived to leave hospital.

## What we already know

The Association of Anaesthetists has published a clinical practice guideline on advance care planning in the perioperative period (Meek 2022). This guidance makes the following recommendations:

1. Organisations should provide mandatory training relating to their advance care planning and resuscitation policies and documents.
2. Organisations should put in place processes to ensure that healthcare teams are aware of the existence and content of any advance decision to refuse treatment made by a patient.
3. Clinicians should have an early discussion with a patient preoperatively to ensure a shared understanding about which perioperative treatments – including cardiopulmonary resuscitation (CPR) – would be appropriate and desired.
4. It is usually appropriate to suspend a DNACPR recommendation during the perioperative period.
5. If an anaesthetist believes they cannot facilitate a successful patient-centred outcome that satisfies the patient's wishes, further senior opinions should be sought.
6. All clinicians should consider making themselves familiar with newer processes and documents that are increasingly replacing stand-alone DNACPR forms.

The legal frameworks for DNACPR recommendations and care planning differ in England and Wales, Northern Ireland and Scotland (Meek 2022).

Patients undergoing operative procedures may have pre-existing emergency treatment plans in place and it is important for the anaesthetist to have an early discussion with the patient preoperatively so that it can be agreed which perioperative treatments, particularly chest compressions and/or defibrillation, and postoperative critical care would be appropriate and desired by the patient. Causes of unexpected perioperative cardiac arrest may be promptly reversible (eg a relative overdose of induction drug, vagotonic response to a pneumoperitoneum, sudden arrhythmia) and a witnessed and monitored intraoperative cardiac arrest is associated with better outcomes than out-of-hospital cardiac arrest or in-hospital cardiac arrest in other areas (Kalkman 2016). If this is discussed with the patient, it is likely that many would accept brief resuscitation interventions if the cardiac arrest occurred during anaesthesia, was witnessed, monitored and rapidly reversible and they were unlikely to suffer significant harm consequently.

Of note, cardiopulmonary resuscitation (CPR) is itself a potentially traumatic experience. Most commonly, chest compressions can cause rib fractures; after resuscitation from out-of-hospital cardiac arrest, several studies have documented an incidence of rib fractures of more than 70% when evaluated by computed tomography and this risk is greater in older and frailer patients (Viniol 2020, Karatasakis 2022). In addition, injuries to the viscera including liver and other intraabdominal structures may occur, although less commonly (Ram 2018).

The NAP7 Activity Survey has demonstrated that surgical patients have become older and frailer in recent years (Chapter 11 Activity survey; Kane 2023) and it is becoming increasingly important that advanced treatment plans are discussed with those patients who might be at increased risk of perioperative cardiac arrest. Even in groups of patients known to be at high risk of adverse outcomes, such as frail patients with hip fractures, there is some evidence of poor emergency treatment planning (McBrien 2013).

There is much overlap in this chapter with the issues of care discussed in Chapter 28 Older frailer patients; these two chapters might usefully be read together.

# What we found

## *Activity Survey*

The NAP7 Activity Survey showed that among adults and children (n = 24,172) 663 (3%) had a DNACPR recommendation preoperatively and it was suspended in 178 during anaesthetic care (Figure 20.1). Of the 20, 717 adults (> 18 years) undergoing surgery 595 (2.9%) had a DNACPR recommendation preoperatively and, of these, it was suspended in 175 (29.4%).

Among 1,957 patients aged over 55 years (for whom frailty data were obtained in the Activity Survey) with a CFS score of 5 or higher, 433 (22.1%) had a DNACPR recommendation preoperatively and it was suspended for 136 (31.4%) patients. Figure 20.2 shows the distribution of DNACPR recommendations by CFS score and Table 20.1 provides the detailed data.

Of the patients where there was a DNACPR recommendation in place, 98% were undergoing non-elective surgery. In contrast, for the Activity Survey cases with no DNACPR recommendation only 30% were undergoing non-elective surgery.

Of the 595 adult patients with a DNACPR recommendation, 8 (1.4%) had a cardiac arrest reported and 4 survived the event (Figure 20.3). Two patients with severe frailty had an active CPR recommendation and did not have any CPR and died, while one had CPR and also died. All the patients who had CPR had more than five chest compressions and none had a defibrillation attempt. The Activity Survey only collected data on survival of the event and not overall hospital survival.

**Figure 20.1** Proportion of patients with active DNACPR recommendations by age in the Activity Survey. Yes-suspended during anaesthetic care ■, Yes-active ■.

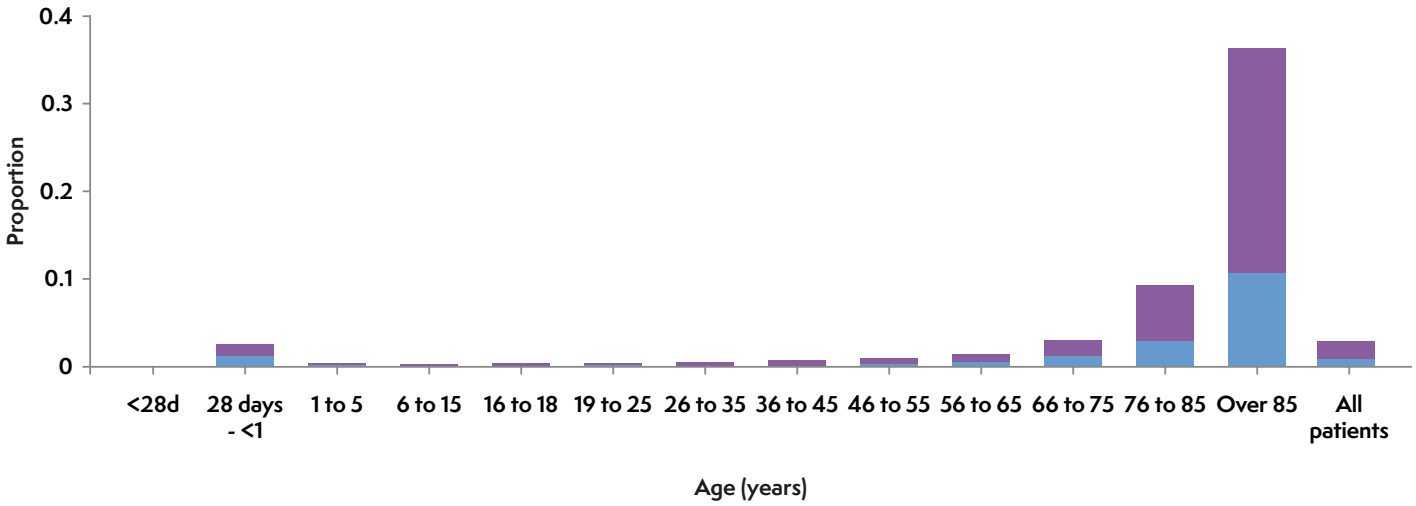



**Figure 20.2** DNACPR recommendations by Clinical Frailty Scale score in patients over 55 years in the NAP7 Activity Survey. Yes-suspended during anaesthetic care ■, Yes-active ■.

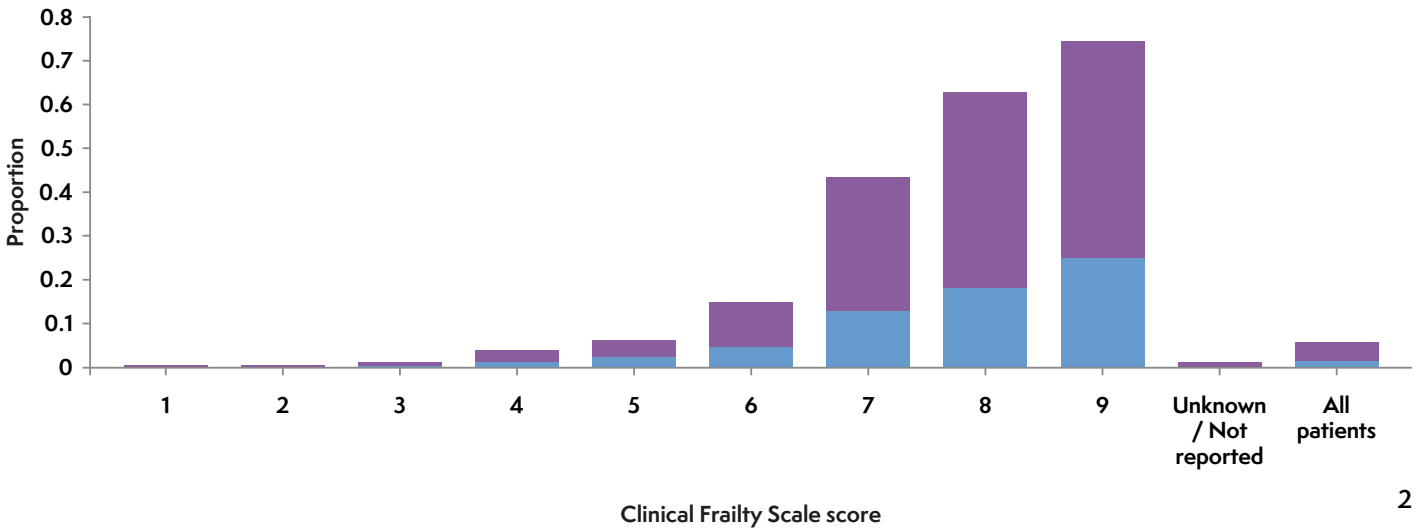
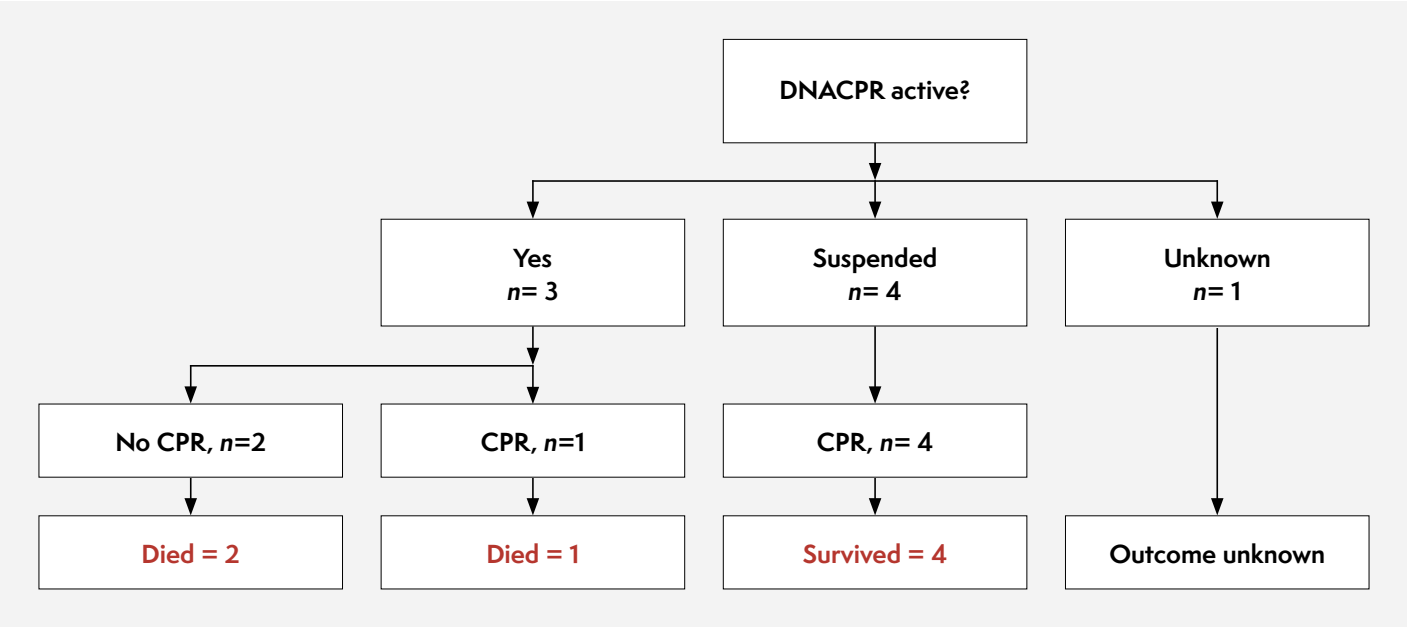


**Table 20.1** DNACPR recommendations by Clinical Frailty Scale score in patients over 55 years in the NAP7 Activity Survey. NR, not reported.

| Clinical Frailty Scale | Total | No *n* (%) | Yes – active *n* (%) | Yes – suspended *n* (%) | Unknown/NR *n* (%) |
|---|---|---|---|---|---|
| **1** | 360 | 356 (99) | 1 (0) | 1 (0) | 2 (1) |
| **2** | 2622 | 2582 (98) | 10 (0) | 3 (0) | 27 (1) |
| **3** | 3240 | 3166 (98) | 31 (1) | 13 (0) | 30 (1) |
| **4** | 1245 | 1174 (94) | 33 (3) | 17 (1) | 21 (1) |
| **5** | 605 | 552 (91) | 22 (4) | 15 (2) | 16 (3) |
| **6** | 762 | 620 (81) | 78 (10) | 37 (5) | 27 (4) |
| **7** | 480 | 249 (52) | 147 (31) | 63 (13) | 21 (4) |
| **8** | 98 | 32 (33) | 44 (45) | 18 (18) | 4 (4) |
| **9** | 12 | 2 (17) | 6 (50) | 3 (25) | 1 (8) |
| **Unknown/NR** | 242 | 56 (23) | 3 (1) | 0 (0) | 183 (76) |
| **All patients** | 9666 | 8789 (91) | 375 (4) | 170 (2) | 332 (3) |

**Figure 20.3** Patients in the NAP7 Activity Survey who had a DNACPR recommendation and cardiac arrest




## *Case reports of perioperative cardiac arrest*

Of 881 reports to NAP7, 54 (6.1%) had DNACPR recommendations made preoperatively and were then reported to NAP7 after a perioperative cardiac arrest and a resuscitation attempt. Those patients with a preoperative DNACPR recommendation that was not suspended and did not receive CPR did not meet the NAP7 case report inclusion criteria so are not reported here.

Of the cases reported, 38 (70%) had a CFS score of 5 or above (Figure 20.4), and 26 (48%) were 85 years of age or over. Most of these cases reported (*n* = 34, 65%) were orthopaedic trauma cases but included a significant number of emergency laparotomies and vascular surgery cases (Figure 20.5).

**Figure 20.4** Clinical Frailty Scale score for cases of perioperative cardiac arrest with a DNACPR recommendation

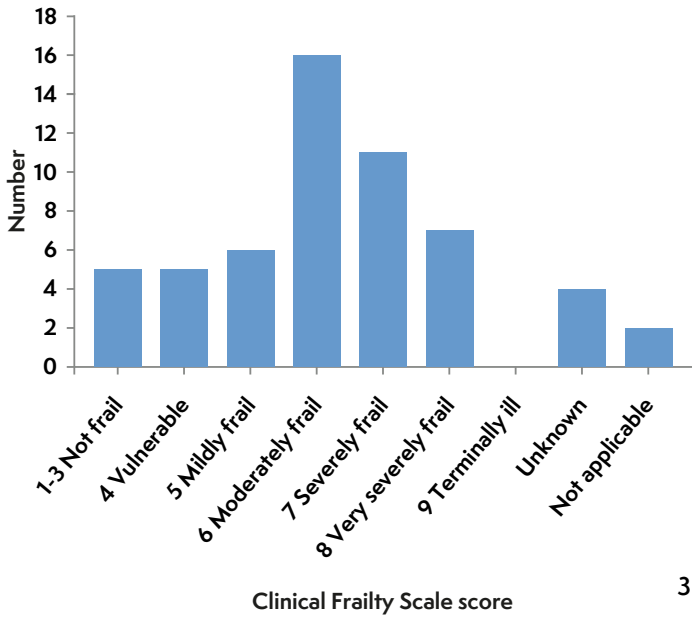
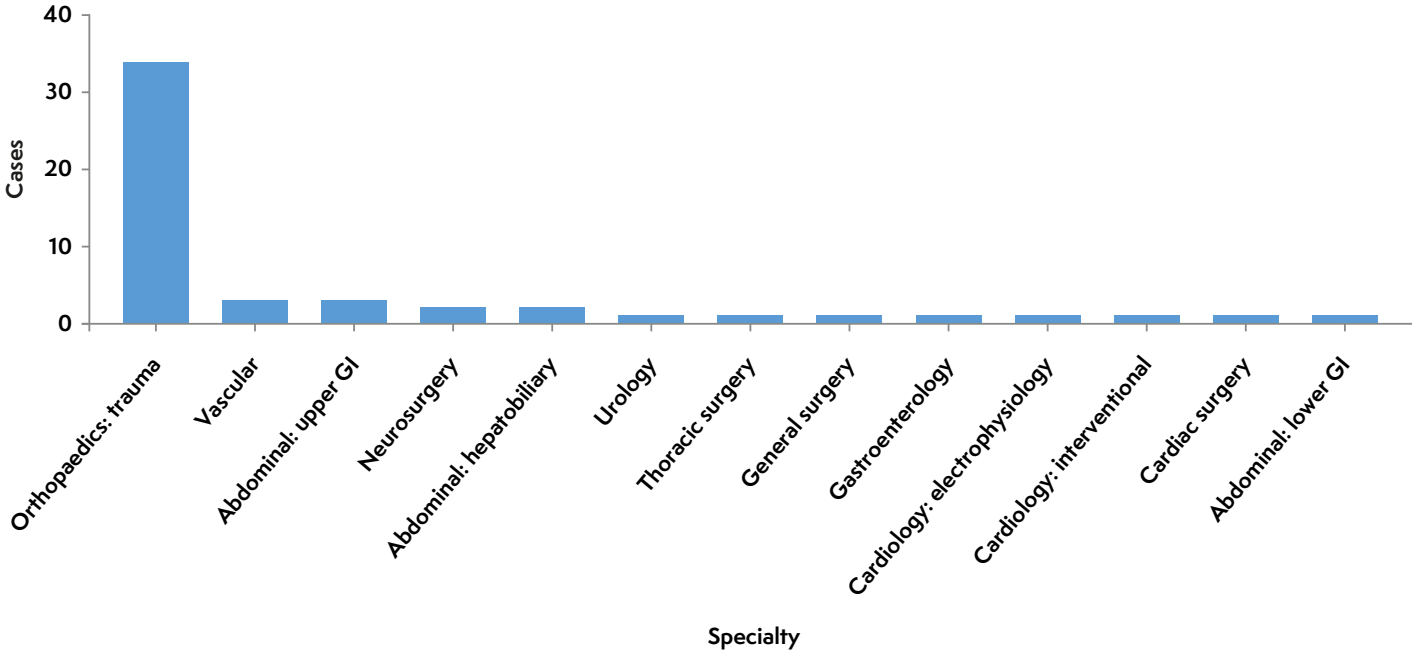


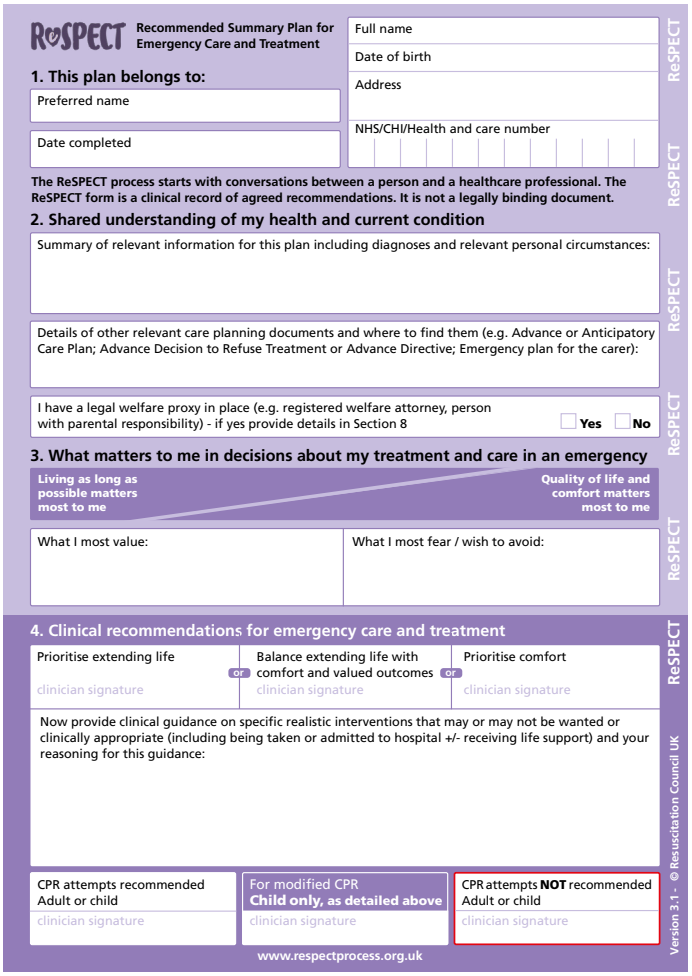
**Figure 20.5** The surgical specialty of a cases with a pre-operative DNACPR recommendation. GI, gastrointestinal.




Relative to the whole surgical population in the Activity Survey, patients with a DNACPR recommendation were older (> 75 years; 76% vs 17%), living with frailty (CFS ≥ 5; 70% vs 18%), had a higher ASA (ASA 4–5; 68% vs 5%), more likely to be undergoing non-elective surgery (100% vs 32%), major or complex surgery (62% vs 31%) and for surgery to be taking place at weekends (22% vs 9%). Sixty per cent had a modified Rankin Scale (mRS) score greater than 1 preoperatively. The only cause of cardiac arrest that was more prevalent in the group of patients with a DNACPR recommendation compared with all adult surgical cases was bone cement implantation syndrome (17% vs 2%; Chapter 28 Older frailer patients).

A total of 20 (37%) DNACPR recommendations remained active at the time of cardiac arrest, 25 (46%) were formally suspended and in 9 (17%) cases the status of the DNACPR recommendation was unknown. Most patients who received CPR with a DNACPR recommendation survived resuscitation, achieving return of spontaneous circulation (ROSC) for over 20 minutes.

A patient over 85 years and with severe frailty underwent anaesthesia for a hip fracture. The patient had a community DNACPR recommendation but after discussion with the patient and their relatives this recommendation was suspended. The patient had a pulseless electrical activity (PEA) cardiac arrest immediately after insertion of the femoral component. Chest compressions were started and adrenaline was administered. Return of spontaneous circulation was achieved after several minutes, the operation was completed and the patient admitted to a critical care unit post-operatively. The patient returned to their nursing home after a three-week stay in hospital.


ReSPECT Recommended Summary Plan for Emergency Care and Treatment

1. This plan belongs to:

Preferred name

Date completed

Full name

Date of birth

Address

NHS/CHI/Health and care number

The ReSPECT process starts with conversations between a person and a healthcare professional. The ReSPECT form is a clinical record of agreed recommendations. It is not a legally binding document.

2. Shared understanding of my health and current condition

Summary of relevant information for this plan including diagnoses and relevant personal circumstances:

Details of other relevant care planning documents and where to find them (e.g. Advance or Anticipatory Care Plan; Advance Decision to Refuse Treatment or Advance Directive; Emergency plan for the carer):

I have a legal welfare proxy in place (e.g. registered welfare attorney, person with parental responsibility) - if yes provide details in Section 8 Yes No

3. What matters to me in decisions about my treatment and care in an emergency

Living as long as possible matters most to me

Quality of life and comfort matters most to me

What I most value:

What I most fear / wish to avoid:

4. Clinical recommendations for emergency care and treatment

Prioritise extending life or Balance extending life with comfort and valued outcomes or Prioritise comfort

clinician signature

Now provide clinical guidance on specific realistic interventions that may or may not be wanted or clinically appropriate (including being taken or admitted to hospital +/- receiving life support) and your reasoning for this guidance:

CPR attempts recommended Adult or child

For modified CPR **Child only, as detailed above**

CPR attempts **NOT** recommended Adult or child

clinician signature

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Duration of CPR was only modestly less commonly prolonged in patients with a DNACPR recommendation than in the whole cohort of cases reports (> 20 minutes 17% vs 19%). The outcomes for those with perioperative DNACPR recommendations compared with the other NAP7 cases are shown in Table 20.2.

Of 10 patients surviving to hospital discharge, 7 had a functional assessment using the mRS reported on discharge. The changes in function before and after cardiac arrest are shown in the Table 20.3.

Following review of the cases, the panel comments included:

- A patient had a DNACPR recommendation and this was formally suspended and discussed with the patient and family, which we feel was good practice.
- Sometimes it is reasonable to undertake complex surgery in high-risk patients but communication with the patient and family is vitally important.

The NAP7 panel rated care before cardiac arrest as good in 32% and poor in 19%, compared with all cases, where ratings were good 48% and poor 11% (Table 20.4). Overall, care was rated as good in 22 (42%) cases good and poor in 21 (38%) and poor in 1 case (1.8%) with insufficient information to rate care in 13 cases (23%). The ratings of good care were somewhat lower than for all cases, particularly before cardiac arrest.

When care was rated poor, it most commonly reflected a lack of risk assessment, discussion about risks preoperatively or decision making as to whether proceeding with surgery was appropriate. In a few cases, the option of not proceeding to surgery appeared not to have been fully considered and an inevitable death was merely postponed to the postoperative period.

An elderly patient with very severe frailty and comorbidity and a DNACPR recommendation presented with severe sepsis and was listed for surgery. The patient had a cardiac arrest on induction and was resuscitated and surgery abandoned. End-of-life care was then started and the patient died. The panel questioned the appropriateness of surgery and resuscitation in a patient who appeared to be dying.

**Table 20.2** Outcomes for those with preoperative DNACPR recommendations. ROSC, return of spontaneous circulation.

| Outcome of event | DNACPR in place (*n*=54) | | Other cases (*n*=827) | |
|---|---|---|---|---|
| | (*n*) | (%) | (*n*) | (%) |
| **Initial:** | | | | |
| **Died** | 13 | 42 | 186 | 22 |
| **Not available** | 0 | 0 | 7 | 0.8 |
| **Survived (ROSC for > 20 minutes)** | 31 | 57 | 634 | 77 |
| **Hospital:** | | | | |
| **Alive** | 10 | 19 | 374 | 45 |
| **Dead** | 40 | 74 | 308 | 37 |
| **Still admitted** | 4 | 7.4 | 145 | 18 |

**Table 20.3** Modified Rankin Scale scores on admission and discharge of perioperative cardiac arrest survivors who had a preoperative DNACPR recommendation

| Admission | Discharge | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0 (no symptoms) | 1 (no significant disability) | 2 (slight disability) | 3 (moderate disability) | 4 (moderately severe disability) | 5 (severe disability) | Missing |
| **0 – No symptoms** | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| **1 – No significant disability** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2 – Slight disability** | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| **3 – Moderate disability** | 0 | 0 | 0 | 2 | 1 | 0 | 0 |
| **4 – Moderately severe disability** | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| **5 – Severe disability** | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| **Missing** | 0 | 0 | 0 | 0 | 0 | 0 | 2 |

**Table 20.4** Panel rating of care in patients with a preoperative DNACPR recommendation

| Period of care | Good, *n* (%) | Good and poor, *n* (%) | Poor, *n* (%) | Unclear, *n* (%) |
|---|---|---|---|---|
| **Pre-cardiac arrest** | 17 (32) | 16 (30) | 10 (19) | 10 (19) |
| **During cardiac arrest** | 42 (79) | 5 (9.4) | 0 (0) | 6 (11) |
| **Post-cardiac arrest** | 36 (69) | 3 (5.8) | 3 (5.8) | 10 (19) |
| **Overall** | 22 (42) | 20 (38) | 1 (1.9) | 9 (17) |

In some cases, interventions such as avoidance of general anaesthesia or use of invasive blood pressure monitoring appeared not to have been considered, raising concerns as to whether care delivered was as attentive as it might have been.

A frail elderly patient with limb ischaemia was deemed very high risk for surgery and surgical intervention was therefore not undertaken. When the patient was clearly dying (decreased consciousness, sepsis) a decision was made to proceed with surgery – the patient had a cardiac arrest in recovery, and resuscitation resulted in ROSC. It was then agreed that palliative care was appropriate and the patient died in recovery.

The panel's opinion was that a DNACPR recommendation should have been considered in a further 34 cases (3.9% of the 881 reports). This group were mainly older patients (71% over 75 years) with frailty (71% with a CFS score of 5 or more) and most (55%) were having orthopaedic trauma surgery. This group of patients is discussed further in Chapter 28 Older frailer patients. Perioperative cardiac arrest in the older frailer patient. Only one patient was having an elective operation. At the time of reporting, only 4 (12%) had been discharged from hospital, 7 were still in hospital (21%) and 23 had died (68%).

An older patient with severe frailty and multiple co-morbidities had hip fracture surgery. The patient had DNACPR recommendations during several previous hospital admissions, but this had not been discussed or documented during the current admission. The patient deteriorated postoperatively on the ward and had an unwitnessed cardiac arrest. The patient had more than 20 minutes of CPR before resuscitation was stopped and the patient died.

## Discussion

In a high-risk patient when there is uncertainty about whether CPR should be undertaken if there is a cardiac arrest, there are several factors to consider:

- the patient's wishes as best as they are understood at that time and in that context
- the certainty of death if CPR is not performed
- the chances of successful resuscitation and whether CPR would in fact be futile
- the possibility of harm from CPR itself, from the events that led to the cardiac arrest and from the effect on organ function from the period of cardiac arrest
- the likely outcome (eg return to pre-existing function versus not; need for intensive care) following ROSC
- the possibility of undertaking CPR for a patient who had a previously stated a preference not to have CPR.

Each of these reasons makes it very important that the possibility of cardiac arrest is discussed with any high-risk patient undergoing anaesthesia. There is no consensus on which patients should be part of this 'high-risk group' and any decisions should include the patient's own values and preferences. In-hospital cardiac arrest data show poor outcomes for older patients with frailty following CPR, (Hamlyn 2022) and a recent study has documented a strong association between higher frailty burden and increased mortality after perioperative cardiac arrest (Allen 2023). Our data and previous studies of perioperative cardiac arrest (Fielding-Singh 2020) show that there is an increased risk of perioperative cardiac arrest and death in older patients with comorbidity undergoing non-elective surgery. Based on the data we have reviewed, the highest risk group of patients would include any patient having surgery with:

- CFS score of 5 or more
- ASA score of 5
- Objective risk scoring for early mortality of more than 5%.

Such a discussion should include not just the process of CPR but also its risks and the potential consequences of the events leading to cardiac arrest and harm during resuscitation. This may include, after successful resuscitation, the physical trauma of CPR but also the risk of organ failure, critical care admission and the possibilities of survival with decreased functional capacity or death after a prolonged period in intensive care. It may be entirely appropriate to start CPR but, in view of above considerations, to limit its duration or the extent of associated interventions if ROSC is not achieved with initial resuscitation interventions.

A nursing home resident, aged over 85 years, with a CFS score of 7 and heart failure with a very low ejection fraction underwent surgery for a hip fracture. The patient had a pre-existing DNACPR recommendation, and this was suspended for the operative procedure. The operation proceeded under a low-dose spinal anaesthetic. Just after cement pressurisation the patient had a PEA cardiac arrest. After four rounds of CPR and two doses of adrenaline, a decision was made to stop resuscitation.

All the reports of perioperative cardiac arrest in adult patients with a DNACPR recommendation occurred during non-elective surgery and often out of hours. Time to speak with the patient, family members, close friends or legal proxies to ascertain the patients values and preferences is therefore often limited, and discussions may be hampered by the illness or injury requiring surgery. Even in the elective setting this is an issue for anaesthetists, who may not see the patient until shortly before an operating list starts. Any preparation that can be made well before anaesthesia and surgery is clearly advantageous when this is practical. Although the focus for NAP7 is on cardiac arrest, more generally preoperative discussions with the patient and their families should include escalation of treatment which might include, for example, admission to an intensive care unit, invasive ventilation and renal replacement therapy. Such discussions are likely to involve intensive care clinicians as well as anaesthetists. Decisions to offer surgical treatment are related to but distinct from treatment escalation planning and will often be included in these discussions.

Although DNACPR recommendations are not legally binding (they guide the clinician on what to do in an emergency; Pitcher2017), and technically do not require explicit cancellation, the Association of Anaesthetists recommends that it is usually appropriate to suspend a DNACPR recommendation during the perioperative period (Meek 2022). However, the NAP7 Baseline Survey indicates that this currently occurs in only about one-third of cases – for the remainder the decision remains active.

It is the view of the Association of Anaesthetists working party on advance care plans in the perioperative period that giving chest compressions to expedite circulation of a drug when cardiac output is likely low (as distinct from cardiac arrest) is not qualitatively the same as CPR (Meek 2022). It is also the view of the Association of Anaesthetists working party that a perioperative DNACPR recommendation would not prevent the injection of drugs to treat bradycardia, hypotension or cardiac arrhythmia, or use of defibrillation for a sudden-onset arrhythmia during anaesthesia. However, the status of a preoperative DNACPR recommendation and its implications should be discussed with the patient and their relatives so that there is an understanding of the interventions that will and will not be offered. Full documentation of such discussions will help to prevent any misunderstandings on either side.

The panel identified several examples of good practice where discussions had taken place preoperatively with patients and/or family members and agreement reached on either temporary suspension or modification of a DNACPR recommendation. In other cases identified by the panel, although a DNACPR recommendation had remained in place perioperatively, the patient underwent relatively prolonged CPR. This was considered by the panel to be poor practice.

Failure to the discuss the patient's preferences and possible suspension of a pre-existing DNACPR recommendation preoperatively may result in the patient receiving treatment that they would not have wanted. If an intraoperative cardiac arrest occurs and CPR results in ROSC, a period of organ support in the intensive care unit (ICU) may be required if the patient is to survive. Although the patient may not have wanted such interventions, if such an eventuality is not discussed preoperatively, and the cardiac arrest is considered to have an iatrogenic cause, there may be pressure to admit the patient to ICU.

A patient over 85 years with a CFS score of 7 and a community DNACPR recommendation was sedated for a surgical procedure. The DNACPR recommendation was not suspended, and there was no reported discussion with the patient and/or family preoperatively. After administration of sedation, assisted bag–mask ventilation was required, which was followed by vomiting, aspiration and PEA cardiac arrest. Resuscitation of intermediate duration was followed by ROSC. The patient was admitted to ICU and although they survived to be discharged from ICU they died later in hospital.

NAP7 did not study those cases where a decision was made not to proceed with surgery and did not study in detail those cases where a perioperative cardiac arrest cardiac arrest occurred and CPR was not started. The Activity Survey data show that only a small proportion of all cases that have a preoperative DNACPR recommendation actually have an intraoperative cardiac arrest; 8 (1.4%) of the 595 adult patients with a DNACPR recommendation had a cardiac arrest reported. Four survived the event following CPR and four died (two with no CPR). The Activity Survey did not collect data on survival to hospital discharge.

Although we cannot be certain from our data, in some cases preoperative discussions with patients and or their families about their values and preferences may have resulted in a shared decision not to proceed with the surgery. This has been highlighted by the Academy of Medical Royal Colleges in its Choosing Wisely initiative (https://www.aomrc.org.uk/choosing-wisely) and the Association of Anaesthetists in its human factors guidance for making time critical decisions (Kelly 2023). This includes using 'BRAN' to help with decision-making:

- What are the *benefits*?
- What the *risks*?
- What are the *alternatives*?
- What if I do *nothing*?

# Recommendations

## *Institutional*

- Where practical, treatment escalation plans, including but not limited to DNACPR recommendations, should be discussed and documented before arrival in the theatre complex in any patient having surgery with:
  - CFS score 5 or above
  - ASA 5
  - objective risk scoring of early mortality greater than 5%.
- When appropriate, discussion should include the anaesthetic team.
- In any patient presenting for surgery who has a CFS score of 5 or above, discussions should take place as early as possible preoperatively with involvement of an anaesthetist, so that there is a shared understanding of what treatments might be desired and offered in the event of an emergency, including cardiac arrest.
- Units should consider development of 'high-risk patient' bundles that create a person-centred approach to management of patients who are periarrest and in whom treatment may be withdrawn in the immediate postoperative period.

## *Individual*

- When discussions take place around treatment planning, the patient's current or previously known wishes should be explored regarding which outcomes they value.
- It is usually appropriate to suspend a pre-existing DNACPR recommendation in the perioperative period. These discussions and decisions should be fully documented and should be discussed at the theatre team briefing.
- If resuscitation is started, the patient's known wishes should be considered in deciding the extent of interventions undertaken (eg a patient may not wish to be in multiple organ failure on intensive care with little chance of surviving or recovering to their previous functional state).

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