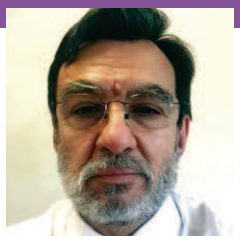
22 Critical care



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Key findings

- Critical care was not a prominent source of reports of anaphylaxis but was a common location for their management.
- Two thirds of patients who were admitted required brief Level 3 care and half required catecholamine infusions.
- No patient required an increase in level of care after their admission.
- No recrudescence of anaphylaxis while in critical care was reported.
- Length of stay was generally short, with rapid establishment of a good outcome.
- More than 95% of patients survived to hospital discharge.
- This suggests highly effective use of resources.

What we already know

Intensive Care is defined by the Faculty of Intensive Care Medicine as follows:

> "An Intensive Care Unit (ICU) is a specially staffed and equipped, separate and self-contained area of a hospital dedicated to the management and monitoring of patients with life-threatening conditions. It provides special expertise and the facilities for the support of vital functions and uses the skills of medical, nursing and other personnel experienced in the management of these problems. It encompasses all areas that provide Level 2 (high-dependency) and/or Level 3 (intensive care) care as defined by the Intensive Care Society document 'Levels of Critical Care for Adult Patients' (2009) (FICM 2015)".

Level 2 and Level 3 care are commonly provided in critical care units, and the requirement for this level of care is the leading indication for critical care admission (ICS 2009). In essence, Level 2 care includes single-organ support, and Level 3 care either advanced respiratory support or multi-organ support.

Management in critical care (ie. in an ICU or a high-dependency unit – HDU) of the patient experiencing an allergic reaction remains a relatively uncommon event, and therefore not well quantified. This is perhaps surprising, given the nature of critically ill patients, and the plethora of pharmacological agents (including blood and blood products) to which they are exposed. It is likely that the prevalence of allergic reactions treated in critical care is often underestimated, possibly due to failure to recognise such episodes. Nevertheless, the principles of managing severe anaphylactic reactions are similar to those of managing other catastrophic shock states and this management is therefore probably best delivered in the critical care environment (Kanji 2010).

In addition to anaphylactic reactions, involving multiple organ systems and potentially causing death (Sampson 2005), critical care may be of value in treating skin reactions, particularly the Stevens–Johnson syndrome, respiratory reactions, hypersensitivity vasculitis and angio-oedema. A number of guidelines and algorithms are used, but all share a common 'ABC' approach and rely on adrenaline as the treatment mainstay.

Consequently, we have attempted to extract from the NAP6 dataset estimates both of the prevalence of perioperative anaphylactic reactions requiring critical care admission, and factors which identify which patients are most likely to require this level of support.

Numerical analysis

It was our intention to capture any cases of anaphylaxis that occurred in critical care during general anaesthesia. The NAP6 case report form included the question "If the event occurred in HDU/ICU/ED, was the patient undergoing an interventional procedure (not resuscitation) under general anaesthesia, administered by an anaesthetist?" Twelve responses to this question were 'yes'. However, in these cases the location of the event was subsequently recorded as:

- 10 in theatre/anaesthetic room
- 1 during transfer
- 1 unknown.

None of the accompanying narratives indicated that the case originated in critical care or the emergency department. While it is possible that up to twelve patients may have sustained their primary anaphylactic reaction in a critical care or emergency department unit, this appeared unlikely. It is possible that such cases were under-reported. Consequently, no further analysis of this subgroup of patients has been attempted, and they have been grouped with other patients transferred to critical care following a reaction.

In the following analyses, where odds ratios (OR) are presented, these are followed by 95% confidence limits.

In total, 144 (54%) of patients with Grade 3 and Grade 4 anaphylaxis were subsequently transferred/admitted to critical care. One patient, requiring vasopressor support (noradrenaline), was not admitted due to bed unavailability. A further patient was transferred to a coronary care unit, and ten (7%) patients were transferred to critical care units in another hospital or facility. Of those admitted to a critical care unit, 117 (81%) were admitted solely because of anaphylaxis (ie. no other reason for admission coexisted).

The highest level of support received was:

- Level 3 93 (65%)
- Level 2 37 (26%)
- Other/unknown 14 (10%).

Among the 261 patients who survived the initial anaphylactic event:

- 78 patients (30%) received an adrenaline infusion
- 12 (5%) patients received an adrenaline infusion without admission to critical care
- 47 (18%) patients received a noradrenaline infusion
- 6 (3%) patients received noradrenaline outside critical care.

Once admitted, no patients required an increase in their level of care. No cases consistent with recrudescence of anaphylaxis were reported.

This resulted in an additional (unplanned) burden of critical care days of:

- Level 3
  - Mode 1 Median 1 Mean 1.1 (SD1.9)
- Level 2
  - Mode 1 Median 1 Mean 1.3 (SD 2.38).

The mode is a useful indication of the typical duration of critical care stay and is useful as a description of patient experience. The median gives a non-parametric average of length of stay, whereas the mean is useful for estimating total resource use/costs.

For the entire study population this equates to a total of 115 extra Level 3 bed-days (ie. over and above what could otherwise have been expected for routine care). Similarly, the excess of high-dependency days, or total extra Level 2 days, was 151. While the study was not designed to collect health economic data, it is perhaps useful to give very rough estimates of the associated additional critical care-related healthcare costs. Using the standard cost of a bed-day for Level 2 or Level 3 care (based on estimates of critical care costs in 'Guidelines for the Provision of Intensive Care Medicine') (FICM 2016), the estimated cost for the entire cohort is £438,102.

Of those who died, where the place of death is known, five patients died in or following critical care. Five patients died without reaching critical care (see Chapter 12, Deaths, cardiac arrest and profound hypotension).

Resultant harm

NAP6 classified harm as 'none', 'mild', 'moderate' or 'severe' (see Chapter 5, Methods). Comparing those admitted to critical care with those not requiring admission, the rate of harm (described here as moderate/severe harm) was similar:

Comparing the groups there is no significant difference, P=0.62, Fisher exact test

	Moderate/ severe harm	Mild/ no harm
Critical care admission	25	119
No critical care admission	18	104

Risk factors for critical care admission

Risk factors for critical care admission and harm (moderate/severe) were further explored using backward stepwise logistic regression. Patient factors examined as covariates included age band, gender, and ASA status. The resulting model was predictive for critical care admission (P=0.0034):

- Age 65–75 OR 2.0 (1.1–3.7)
- Age 75–85 OR 2.4 (0.9–6.6)
- ASA 2 OR 0.54 (0.32–0.89).

However, when the model was explored for harm as an outcome, none of the above was identified as an independent risk factor.

Initial resuscitation may have had an impact on the requirement for subsequent critical care admission (P=0.0006). Patients requiring an adrenaline infusion had an odds ratio for critical care admission of 2.7 (1.0 – 7.4). However, the risk for critical care admission was reduced by administration of crystalloid in the first hour, OR 0.49 (0.25 – 0.93) for each litre administered. The confidence intervals for the odds ratios are wide, so the apparent 'effect' may be a statistical artefact. Similarly, subsequent fluids, and other pharmacological agents, failed to reach statistical significance as risk factors. These results suggest that there is scope for studying optimal fluid management prior to critical care admission, as this appears to be a potential modifying factor for the requirement for critical care. However, this could only be done using very large registry data to garner sufficient numbers for statistical power.

Discussion

Duration of admission to intensive care was generally short, although the immediate severity of illness necessitating admission was high. It therefore follows that critical care admission should be prioritised for patients who have suffered significant anaphylactic events in theatre or elsewhere. Some patients were successfully managed in recovery rooms and other areas, but there are insufficient data to point to whether this leads to better or worse outcomes.

There is considerable benefit to be gained even from short critical care admissions, as despite high levels of acuity at admission, in general the outcomes were good, and therefore the use of critical care resource represents 'good value' and is easily justified. Although not investigated in this report, it is likely that transfer to the critical care unit, in addition to providing a higher level of resource, also introduces additional clinical input which may be more objective and emotionally detached, with implied patient benefit.

Secondary or relapsing reactions did not seem to be a feature in the current dataset, although this remains a theoretical possibility and therefore intensive care admission is justified for a short period of monitoring even in those patients whose reactions are already resolving.

Before NAP6, relatively few data had been published on the critical care implications of perioperative anaphylactic reactions. The most recent major study covers a 4-year period 2005–2009 (Gibbison 2012). This study extracted data from three key UK national critical care databases, the Intensive Care National Audit and Research Centre's Case Mix Programme, the Scottish Intensive Care Society Audit Group, and PICANet (a national clinical audit of paediatric critical care). The study collected data on 1,269 adult and 81 paediatric anaphylaxis-related admissions. Inclusion was by clinician diagnosis as recorded in the databases and accounted for 0.3% of adult and 0.1% of paediatric critical care admissions. Gibbison's study therefore differs from NAP6 in that all grades of severity were included, whereas only Grade 3 and 4 reactions were included in NAP6. Moreover, in NAP6, inclusion was based on more stringent diagnostic criteria. When cases admitted from wards and the emergency department in Gibbison's paper are stripped out, the numbers are similar to ours, suggesting that cases 'missed' in either study were similar and few.

Gibbison reported a 91.9% survival rate to hospital discharge in adults, again, very similar to our data (137/142, 96.5%). The mean length of stay in Gibbison's paper was 1.2 days for survivors and 2.1 days for non-survivors, compared with NAP6 data of an overall (combined) mean length of stay of 1.1 days (Level 3 care) or 1.3 days (Level 2 care). It is likely that any small differences can be explained by organisational factors such as ward-round timings and discharge pathways.

Overall, our data support the previous critical care data. This is important, as the methodologies differ, approaching the problem from opposite directions, yet the outcomes are remarkably similar. Further work could focus on combining the methodologies with the existing data sets. The similarities between our data and Gibbison's could be further explored by cross-tabulating the critical care databases, using their methodology with our data for the same time-period. This would allow validation of outcomes, and might allow research into pre-admission resuscitation factors as outcome modifiers.

Recommendations

Institutional

- Patients with severe anaphylaxis should be admitted to critical care (HDU/ICU).

References

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