A comparison of Australasian jurisdictional ambulance services’ paramedic clinical practice guidelines series: Adult anaphylaxis

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https://doi.org/10.33151/ajp.18.915

Abstract

Introduction
This article forms part of a series that seeks to identify interjurisdictional differences in the scope of paramedic practice and, consequently, differences in patient treatment based on which jurisdiction a patient is geographically located within at the time of their complaint.

Methods
The current Clinical Practice Guidelines of each Australasian domestic jurisdictional ambulance service (JAS) were accessed during June 2020 and updated in August 2021. Content was extracted and verified by 18 paramedics or managers representing all 10 JASs.

Results
All JASs use intramuscular adrenaline as a first-line agent for adult anaphylaxis. Beyond this, significant differences exist in all treatments: five services provide nebulised adrenaline; 10 services provide adrenaline infusions (one requires doctor approval; one provides repeat boluses); six services provide nebulised salbutamol; two services provide salbutamol infusions (one requires doctor approval; one provides repeat boluses); five services provide nebulised ipratropium bromide; eight services provide corticosteroids (two restricted to intensive care paramedics (ICPs)); five services provide antihistamines for non-anaphylactic or post-anaphylactic reactions; four services provide glucagon (one requires doctor approval); magnesium is infused by ICPs in two services; 10 services allow unassisted intubation in anaphylactic arrest; one service allows ICPs to provide sedation-facilitated intubation or ketamine-only breathing intubation; eight services allow rapid sequence induction (two restricted to specialist roles).

Conclusion
The JASs in Australasia have each created unique treatment clinical practice guidelines that are heterogeneous in their treatments and scopes of practice. A review of the evidence underlying each intervention is appropriate to determining best practice.

Keywords:
anaphylaxis; Australasia; emergency medical technician; guideline; paramedic; scope of practice

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Introduction

Australia and New Zealand (Australasia) are serviced by 10 domestic jurisdictional ambulance services (JASs), each of which is sponsored by the corresponding state or territory government of their jurisdiction (in Australia) or their district health boards (in New Zealand). This article forms part of a series providing a comparison of current Australasian paramedic clinical practice guidelines (CPGs) for the treatment of common conditions. A comparison of the different JASs' paramedic CPGs is likely to be of benefit in identifying variations in practice, and consequently highlighting areas for consideration or review by each JAS. Additionally, as a summary of the current scope of practice of the profession in general, a review is likely to be of interest to paramedics not employed by a JAS, other external bodies such as healthcare services and educational institutions.

Methods

The methods are as outlined in the introductory article in this series (1). Clinical practice guidelines were accessed during June 2020, and content extracted by three registered paramedics. A copy of this paper was provided to each service for verification and optional feedback on 30 July 2020. Seven services formally verified the content – in six cases by a manager, and in one case by a paramedic. In addition, four paramedics employed by three of these services also informally verified content. Three services did not have capacity to formally review the paper. For each of these three services, a paramedic employed by the service informally verified content. Cumulatively, 18 paramedics or managers, including employees of all 10 JASs, provided verification of content. The contact was updated in August 2021 before publication.

Results

The overall results of the comparison of current Australasian paramedic clinical practice guidelines for the treatment of common conditions are presented in the introductory article in this series (1). The results of the comparison of CPGs as they specifically relate to adult anaphylaxis are shown in Tables 1 to 10 of this article. Although antihistamines are not directly used for anaphylaxis treatment by any JAS, they have been listed here to capture their use for post-anaphylactic symptoms in some services.

Discussion

All CPGs utilise intramuscular adrenaline as the first-line agent for anaphylaxis, and this forms the centerpiece of treatment in all services – in all guidelines, all other treatments are secondary to intramuscular adrenaline administration. Beyond this, treatments vary significantly between services.

Nebulised adrenaline is authorised for paramedics by five services, restricted to non-anaphylactic reactions in three, and not authorised in two. Adrenaline infusions are authorised for ICPs by all 10 services, with one service allowing ICP administration only after direct medical approval. One service does not authorise infusions, instead allowing ICPs to deliver repeat boluses intravenously.

Salbutamol by metered dose inhaler is authorised for paramedics in seven services, restricted to a specialist unit in one service, and not carried in two services. Nebulised salbutamol is authorised for paramedics by six services. The remaining four do not provide it for anaphylaxis. Salbutamol infusions are authorised for specialist paramedics by one only after direct medical approval. A second service does not authorise intravenous infusions, but does allow ICPs to deliver repeat boluses intravenously. Ipratropium bromide is authorised for paramedics in five services. The remaining five services do not use it for anaphylaxis.

For patients experiencing anaphylaxis, corticosteroids are authorised for paramedics in six services, for ICPs in two services, and are not available in the remaining two services. Three services have specific warnings stating that steroids have no role in the acute treatment of anaphylaxis. Antihistamines are authorised for paramedics for non-anaphylactic reactions in three services, for post-anaphylactic itch in two services, and is not available in the remaining five services. Three services have specific warnings stating that antihistamines have no role in the acute treatment of anaphylaxis.

Glucagon is authorised for paramedics in three services and authorised for paramedics after medical consultation in one more service. Magnesium is administered via infusion by ICPs in two services. Volume filler solutions are available in all services. Nine use sodium chloride 0.9%, with one service using sodium lactate. The doses and targets vary significantly, with weight-based doses ranging from 20 mL/kg to 60 mL/kg, bolus doses ranging from 250 mL to 1 L, and other services having full clinician discretion with no guide provided.

Endotracheal intubation unassisted (ie. without pharmacological assistance) is available to paramedics in one service and restricted to ICPs in the remaining nine services. Intubation facilitated by sedation or ketamine-only breathing intubation are authorised by one service. Rapid sequence induction or delayed sequence intubation are available to ICPs in six services, restricted to specialist ICPs in two services, and not available in two services.

Limitations

This paper is a descriptive analysis and comparison of a specific and discrete cluster of primary sources. This comparison does not review the peer-reviewed, published literature to determine current best practice in treatment, nor conduct causal comparisons or Grading of Recommendations Assessment, Development and Evaluation (GRADE) analysis. Consequently,
no CPG is inferred to be superior or inferior to any other, nor that the most common treatment is necessarily optimal. It is highly likely that differences between services will always be necessary due to regional variations in geography, demographics, and organisational budgets. The purpose of this review is to make the community aware of differences in the current scope of practice of Australasian paramedics and to present variations between the CPGs of the JASs that may warrant further investigation.

We have attempted to present data accurately by accessing current CPGs and by verifying content with paramedics from each service. However, due to the fluidity of these organisations, changes to the CPGs between data extraction and publication remain possible.

Each CPG is presented in a way that is unique to each JAS, and an experienced paramedic in that service may accurately infer implications from that presentation that an unfamiliar viewer could remain unaware of. We have attempted to correct for this by verifying our interpretation of the CPG with paramedics from each service and providing a copy of the completed paper to each JAS for review prior to submission for publication; however, some mistaken interpretation remains possible. Similarly, common cultural practices in a JAS that are understood but not explicitly stated in the CPG could result in different interpretations between unfamiliar and experienced users of that CPG. Finally, paramedics may not necessarily adhere to their guidelines; actual treatment may vary from that published here.

Conclusion

This article reviews and summarises the existing paramedic management for adult anaphylaxis provided by Australasian JASs. The different JASs in Australasia have each created unique CPGs for the treatment of anaphylaxis in adult patients. Although there is some degree of overlap, there remains significant variations in CPGs between the different JASs for all treatments except intramuscular adrenaline – with conflict regarding the use of anticholinergics, corticosteroids, antihistamines, glucagon, magnesium and endotracheal intubation.

It would be appropriate for further research to be undertaken comparing each of these interventions against best available evidence, and additionally for the guideline development groups of each service to liaise directly to compare the evidence informing their decisions.

Acknowledgements

Thanks to each of the services who provided copies of their current clinical practice guidelines, and to the managers and paramedics from each service who kindly volunteered their time to discuss their CPGs. Thanks to the journal’s peer reviewers for their generous time and feedback. This series has been endorsed by the Australasian College of Paramedicine’s Clinical Practice Guideline Special Interest Group.

Funding

The authors have not received funding to produce this manuscript.

Competing interests

The authors declare no competing interests. Each author of this paper has completed the ICMJE conflict of interest statement.

Reference

1. Wilkinson-Stokes M, Maria S, Colbeck M. A comparison of Australasian jurisdictional ambulance services’ clinical practice guidelines series: an introduction. Australasian Journal of Paramedicine 2021;18. doi.org/10.33151/apj.18.914
Table 1. Summary of the scope of practice for Australasian paramedics working in jurisdictional ambulance services

| JAS | Year relevant guideline within the 2021 CPGs was last updated | Adrenergic | Pharmacology | Intervention |
|-----|---------------------------------------------------------------|-----------|--------------|--------------|
|     |                                                               | Adrenaline (intramuscular) | Adrenaline (nebulised) | Adrenaline (infusion) | Salbutamol (MDI) | Salbutamol (nebulised) | Salbutamol (infusion) | Ipratropium Bromide (MDI) | Ipratropium Bromide (nebulised) | Hydrocortisone | Dexamethasone | Prednisolone | Fexofenadine | Loratadine | Glucagon | Magnesium | Sodium lactate (Ringer’s lactate, Hartmann’s solution) | Endotracheal intubation (ETT) unassisted | ETT – KOBI & IFS | ETT – DSI & RSI |
| Australian Capital Territory (ACTAS) | 2016 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ICP | ICP |
| New South Wales (NSWA) | 2020 | ✓ | ✓ | ICP | Restricted (1) | ✓ | ✓ | ✓ | ✓ | (3) | ✓ | ✓ | ✓ | ✓ | ICP | ICP |
| New Zealand (SJNZ) | 2019 | ✓ | (3) | ICP | ✓ | ✓ | ✓ | ✓ | (5) | ✓ | ✓ | ✓ | ICP | ICP |
| New Zealand (WFA) | 2019 | ✓ | (3) | ICP | ✓ | ✓ | ✓ | ✓ | (5) | ✓ | ✓ | ✓ | ICP | ICP |
| Northern Territory (SJNT) | 2013 | ✓ | (3) | ICP | (7) | ✓ | ✓ | ✓ | ✓ | (3) | ✓ | ✓ | ✓ | ICP | ICP |
| Queensland (QAS) | 2021 | ✓ | ✓ | ICP | (9) | (9,10) | (9,10) | Restricted (11,12) | (13) | ICP | (9,10) | ✓ | ✓ | (9,14) | ICP | Restricted (15) |
| South Australia (SAAS) | 2020 | ✓ | ✓ | ICP | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ICP | Restricted (16) |
| Tasmania (AT) | 2018 | ✓ | ✓ | ICP | ✓ | ✓ | ICP | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ICP | ICP |
| Victoria (AV) | 2020 | ✓ | ✓ | ICP | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ICP | ICP |
| Western Australia (SJWA) | 2017 | ✓ | ✓ | ICP | (12) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ICP |

DSI = Delayed sequence intubation IFS = Intubation facilitated by sedation KOBI = Ketamine-only breathing intubation MDI = Metered dose inhaler RSI = Rapid sequence induction

(1) Special Operations Team paramedic only, where nebulised salbutamol is unavailable (2) Only if wheeze persists after administration of salbutamol (3) Indicated for non-anaphylactic reactions or non-life-threatening symptoms (4) In patients on beta blockers who are hypotensive after sodium lactate (5) Indicated for post-anaphylactic itch/rash (6) Not currently carried, however approved for use if available (7) Not a true infusion; repeated intravenous boluses unavailable (8) Introduced during SARS-CoV2 pandemic (9) Indicated for patients refractory to three IM adrenaline injections (10) Indicated for unresolved wheeze (11) Flight Paramedic only (12) Medical consultation required (13) Not listed on the Anaphylaxis CPG; however, indicated on the relevant drug protocol for bronchospasm (14) Indicated for ongoing hypotension / shock (15) ICP - High Acuity Response Unit only (16) ICP – Retrievalist Flight Paramedic only under medical consultation
### Table 2. Number of JASs providing each treatment (10 services total)

| Treatment                  | Paramedic | ICP | Restricted | Not used |
|----------------------------|-----------|-----|------------|----------|
| Adrenaline (intramuscular) | 10        |     |            |          |
| Adrenaline (nebulised)     | 5         |     | 5          |          |
| Adrenaline (infusion)      |           | 10  |            |          |
| Salbutamol (MDI)           | 7         | 1   | 2          |          |
| Salbutamol (nebulised)     | 6         |     | 4          |          |
| Salbutamol (infusion)      |           | 1   | 1          | 8        |
| Ipratropium bromide (MDI)  | 2         |     |            |          |
| Ipratropium bromide (nebulised) |  |   | 5          |          |
| Corticosteroid             | 6         | 2   | 2          |          |
| Antihistamine              | 2         |     |            |          |
| Glucagon                   | 4         |     | 6          |          |
| Magnesium                  |           | 2   | 8          |          |
| Endotracheal unassisted    | 1         |     | 9          |          |
| Endotracheal facilitated   | 1         | 1   | 2          | 2        |
| Endotracheal RSI           | 6         | 2   | 2          |          |

### Table 3. Adrenaline for anaphylaxis CPG comparison

#### Australian Capital Territory (ACTAS)
- **Intramuscular**: 500 mcg, repeat PRN, max 1.5 mg
- **Nebulised**: Not indicated for adults
- **Infusion**: 2 mcg/min, titrated to response

#### New South Wales (NSWA)
- **Intramuscular**: 500 mcg, repeat at 5 minutes, no maximum
- **Nebulised**: 5 mg, repeat at 30 minutes, no maximum
- **Infusion**: 5 mcg/min, titrated to response

#### New Zealand (SJNZ, WFA)
- **Intramuscular**: 500 mcg, repeat at 5 minutes if deteriorating (10 minutes if not improving), no maximum
- **Nebulised**: Not indicated
- **Infusion**: 8 mcg/min, titrated to response

#### Northern Territory (SJNT)
- **Intramuscular**: 500 mcg, repeat at 5 minutes, no maximum
- **Nebulised**: 5 mg, single dose only
- **Intravenous**: 20-50 mcg, repeat at 1 minute, no maximum

#### Queensland (QAS)
- **Intramuscular**: 500 mcg, repeat at 5 minutes, no maximum
- **Nebulised**: 5 mg, single dose only
- **Infusion**: 20-50 mcg bolus, then 10-50 mcg/min

#### South Australia (SAAS)
- **Intramuscular**: 10 mcg/kg up to 500 mcg, repeat at 5 minutes, no maximum
- **Nebulised**: 5 mg, single dose only
- **Infusion**: 5-20 mcg/min

#### Tasmania (AT)
- **Intramuscular**: 500 mcg, repeat at 5 minutes, no maximum
- **Nebulised**: 5 mg, single dose only
- **Infusion**: 10 mcg/min, titrated to response

#### Victoria (AV)
- **Intramuscular**: 500 mcg, repeat at 5 minutes, no maximum
- **Nebulised**: 5 mg, consult for repeat
- **Infusion**: 10 mcg/min, titrated to response, no maximum

#### Western Australia (SJWA)
- **Intramuscular**: 500 mcg, repeat at 5 minutes, no maximum (300 mcg if pregnant)
- **Nebulised**: Not indicated
- **Infusion**: Consultation required
**Table 4. Salbutamol for anaphylaxis CPG comparison**

| Location                          | MDI                  | Nebulised             | Infusion              |
|-----------------------------------|----------------------|-----------------------|-----------------------|
| **Australian Capital Territory (ACTAS)** | 1.2 mg, repeat at 20 min, no maximum | Not carried           | Not carried           |
| **New South Wales (NSWA)**        | 1.2 mg, repeat PRN, no maximum | 5 mg, repeat PRN, no maximum | Route not allowed     |
| **New Zealand (SJNZ, WFA)**       | Not carried           | Not indicated         | Route not allowed     |
| **Northern Territory (SJNT)**     | Introduced for SARS-CoV2, protocol not available | 5 mg, repeat PRN, no maximum | Route not allowed     |
| **Queensland (QAS)**              | 1.2 mg, repeat at 10 min, no maximum | 5 mg, repeat PRN, no maximum | Route not allowed     |
| **South Australia (SAAS)**        | 1.2 mg, repeat PRN, no maximum | 5-15 mg, repeat PRN, no maximum | Route not allowed     |
| **Tasmania (AT)**                 | 600 mcg, repeat at 5 min, no maximum | 10 mg, repeat 5 mg at 5 min, no maximum | Route not allowed     |
| **Victoria (AV)**                 | 400 mcg - 1.2 mg, repeat at 20 min, no maximum | 5 mg, repeat at 20 min, no maximum | Route not allowed     |
| **Western Australia (SJWA)**      | 400 mcg, repeat at 4 min, no maximum | 5-10 mg, repeat PRN, no maximum | Route not allowed     |

**MDI = metered dose inhaler**

**Table 5. Ipratropium bromide for anaphylaxis CPG comparison**

| Location                          | MDI                  | Nebulised             | Infusion              |
|-----------------------------------|----------------------|-----------------------|-----------------------|
| **Australian Capital Territory (ACTAS)** | 168 mcg, repeat once at 20 min | Not carried           |                       |
| **Northern Territory (SJNT)**     | Not carried           |                       |                       |
| **Queensland (QAS)**              | Not carried           | 500 mcg, single dose only |                       |
| **South Australia (SAAS)**        | Not carried           | 500 mcg, repeat at 20 min, maximum 1.5 mg |                       |
| **Tasmania (AT)**                 | 168 mcg, single dose only | 500 mcg, repeat at 20 min, maximum 1.5 mg |                       |
| **Victoria (AV)**                 | 168 mcg*, single dose only | 500 mcg, single dose only |                       |
| **New South Wales (NSWA)**        | Not indicated         |                       |                       |
| **New Zealand (SJNZ, WFA)**       |                       |                       |                       |
| **Western Australia (SJWA)**      |                       |                       |                       |

**MDI = Metered dose inhaler**

*Not carried, however authorised for use if available*
### Table 6. Corticosteroids for anaphylaxis CPG comparison

| Territory                  | Route | Dosage                  |
|----------------------------|-------|-------------------------|
| Australian Capital Territory (ACTAS) |       | Contraindicated: “Antihistamines and steroids have no role in treating anaphylaxis in the pre-hospital setting” |
| New South Wales (NSWA)     | IV, IM| Hydrocortisone 100 mg single dose only |
| New Zealand (SJNZ, WFA)    |       | Contraindicated: “Antihistamines and steroids have no role in the acute treatment of anaphylaxis”. Note: for prominent rash associated with anaphylaxis, provided all systemic signs of anaphylaxis have resolved, administer prednisolone 40 mg single dose only orally |
| Northern Territory (SJNT)  | IV, IM| Dexamethasone 8 mg single dose only |
| Tasmania (AT)              |       | Hydrocortisone 200 mg single dose only |
| South Australia (SAAS)     | IV, IM| Hydrocortisone 250 mg single dose only |
|                             | Oral  | Prednisolone 50 mg single dose only |
| Victoria (AV)              | IV per oral | Dexamethasone 8 mg single dose only |
| Western Australia (SJWA)   |       | Not indicated |

*IV = intravenous, IM = intramuscular*

### Table 7. Antihistamines for anaphylaxis CPG comparison

| Territory                  | Route | Dosage                  |
|----------------------------|-------|-------------------------|
| Australian Capital Territory (ACTAS) |       | Contraindicated: “Antihistamines and steroids have no role in treating anaphylaxis in the pre-hospital setting” |
| New South Wales (NSWA)     |       | Not indicated. For non-anaphylactic localised reactions, administer fexofenadine 180 mg single dose only orally |
| New Zealand (SJNZ, WFA)    |       | Contraindicated: “Antihistamines and steroids have no role in the acute treatment of anaphylaxis”. Note: for prominent itch associated with anaphylaxis, provided all systemic signs of anaphylaxis have resolved, administer loratadine 10 mg single dose only orally |
| Queensland (QAS)           |       | Not indicated. Note: for non-anaphylactic urticaria, administer loratadine 10 mg single dose only orally |
| South Australia (SAAS)     |       | Not indicated. Note: for mild/moderate non-anaphylactic allergy only, administer fexofenadine 180 mg single dose only orally |
| Tasmania (AT)              |       | Not carried |
| Victoria (AV)              |       |                        |
| Northern Territory (SJNT)  |       |                        |
| Western Australia (SJWA)   |       |                        |
### Table 8. Glucagon for anaphylaxis comparison

| State/Country | Route | Dose | Notes                        |
|---------------|-------|------|------------------------------|
| New South Wales (NSWA) | IV    | 2 mg | single dose only            |
| Queensland (QAS)        | IV, IM| 1 mg | single dose only            |
| Tasmania (AT)           | IV, IM| 1-2 mg | single dose only        |
| Victoria (AV)           | IV, IM| 1 mg | repeat once at 5 minutes    |
| Tasmania (ACTAS)        |       |      |                              |
| New Zealand (SJNZ, WFA) |       |      |                              |
| Northern Territory (SJNT)|      |      |                              |
| South Australia (SAA)   |       |      |                              |
| Western Australia (SJWA)|       |      |                              |

*IV = intravenous, IM = intramuscular*

### Table 9. Magnesium for anaphylaxis comparison

| State/Country | Route  | Dose            | Notes                        |
|---------------|--------|-----------------|------------------------------|
| South Australia (SAAS) | Infusion | 2.47 g | single dose only         |
| Tasmania (AT) |        |                |                              |
| Australian Capital Territory (ACTAS) |        | Not indicated |                          |
| New South Wales (NSWA) |        |                |                              |
| New Zealand (SJNZ, WFA) |        |                |                              |
| Northern Territory (SJNT) |        |                |                              |
| Queensland (QAS) |        |                |                              |
| Victoria (AV) |        |                |                              |
| Western Australia (SJWA) |        |                |                              |
| Region                          | Route | Fluid Administration |
|-------------------------------|-------|-----------------------|
| **Australian Capital Territory (ACTAS)** | IV    | 250-500 mL, repeat PRN |
| **New South Wales (NSWA)***   | IV    | 20 mL/kg, repeat PRN, target SBP >90 mmHg |
| **New Zealand (SJNZ, WFA)**   | IV    | 1 L, repeat PRN, no maximum |
| **Northern Territory (SJNT)** | IV    | 250-500 mL, repeat PRN, maximum 40 mL/kg |
| **Queensland (QAS)**          | IV    | PRN, no maximum |
| **South Australia (SAAS)**    | IV    | 10 mL/kg, reassessed every 250 mL, repeat PRN, maximum 30 mL/kg (consult for further) |
| **Tasmania (AT)**             | IV    | 20 mL/kg, repeat PRN, maximum 50 mL/kg |
| **Victoria (AV)**             | IV    | 40 mL/kg, consult for further. If consult unavailable, 20 mL/kg |
| **Western Australia (SJWA)**  | IV    | 250 mL, repeat PRN, maximum 2 L (small, elderly maximum 1 L) |

*NSWA use sodium lactate, other services use sodium chloride  IV = intravenous