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

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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 upon which jurisdiction a patient is geographically located within at the time of their complaint.

Methods
The current Clinical Practice Guidelines (CPGs) of each 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
Nine services provide antibiotics for meningococcal septicaemia, with dosage ranging from 1 – 4 grams. Five services provide antibiotics for non-meningococcal sepsis (three under doctor approval), with choice of antibiotic including Ceftriaxone, Benzylpenicillin, Amoxicillin, and Gentamicin. Three services provide antipyretics, one provides corticosteroids under doctor approval, and all provide fluids (with dosage ranging from 20 – 60 ml/kg). ICPs are allowed to provide adrenaline infusions in nine services, noradrenaline in three services (one requiring doctor approval), and metaraminol in three services. Two additional services restrict metaraminol to specialist paramedics, with one of these requiring doctor approval. Two services perform phlebotomy and one takes lactate. Paramedics perform unassisted intubation in one service, with nine restricting this to ICPs. Facilitated or Ketamine-only intubation is performed by ICPs in one service. Rapid or delayed sequence induction is performed by ICPs in six services, and restricted to specialists in two services.

Conclusion
The domestic jurisdictional ambulance services 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:
Australasia; emergency medical technician; guideline; paramedic; scope of practice; sepsis

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Introduction

Australia and New Zealand (Australasia) are serviced by ten 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 paper is 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). CPGs 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 content was updated in August 2021, prior to publication.

This series is endorsed by the Australasian College of Paramedicine’s Clinical Practice Guideline Special Interest Group (ACP CPG SIG).

Results

The results are presented as outlined in the introductory paper in this series (1). The results of the comparison of CPGs as they specifically relate to adult sepsis are shown in Tables 1 to 10 of this article.

Limitations

This article 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 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.

Discussion

All JASs provide fluid and oxygen as basic cares; beyond this, treatment varies significantly between jurisdictions. Pharmacology varies in the choice of antibiotic, when antibiotics may be administered, use of an antipyretic, and use of vasopressors. Interventions vary in the taking of blood samples prior to administration of antibiotics, and in the use of endotracheal intubation (unassisted, facilitated or via ketamine only, or via rapid or delayed sequence induction).

Two JASs provide amoxicillin, clavulanic acid, and gentamicin to all septic patients with transport times over 30 minutes. Three JASs provide ceftriaxone under medical consult where prolonged transport times (defined variously as greater than 30 or 60 minutes) are anticipated. Nine JASs provide antibiotics for meningococcal septicaemia. One service does not carry antibiotics. Three JASs allow the provision of paracetamol as an antipyretic to febrile septic patients. One service provides dexamethasone under medical consult. All services administer oxygen, however, peripheral saturation targets range from a minimum of 92% to a minimum of 94% and upper targets rang from 96% to 98%. All services administer fluids, however, dosages vary significantly between 20 – 60 ml/kg for weight based dosing and 250 ml to 1 L for bolus dosing.

All JASs have vasopressor / inotropic agents available to intensive care paramedics. Adrenaline is used in nine cases, with one of these restricted to bradycardia and another restricted to hypotension, and initial dosing varying from 2 – 8.3 mcg/minute. Noradrenaline is used by specialist paramedics in...
three services, with one of these requiring doctor approval. Metaraminol is used by ICPs in three services and restricted to specialist paramedics in two services, with one of these requiring doctor approval.

One JAS allow pre-hospital blood samples to be taken by paramedics, while a second is restricted to specialist paramedics with additional training. One service allows paramedics to take lactate measurements, with a second service having capability but use not indicated for sepsis and restricted to specialist paramedics. Endotracheal intubation unassisted 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 is authorised by one service. Rapid or delayed sequence induction is available to ICPs in six services, restricted to specialist ICPs in two services, and not available in two services.

Conclusion

This paper reviews and summarises the existing paramedic management for adult sepsis provided by Australasian JASs. The different JASs in Australasia have each created unique CPGs for the treatment of sepsis in adult patients. There are high levels of similarity in the use of antibiotics for meningococcal septicemia, adrenaline as a vasopressor, and oxygen. There are significant variations in the choice of antibiotic, when to administer antibiotics, if consultation is required for administration of antibiotics, use of paracetamol as an antipyretic, use of corticosteroids, use of additional vasopressors, dosage of vasopressors, ability to perform phlebotomy, ability to take lactate measurements, and endotracheal intubation (unassisted, facilitated or by ketamine only, and rapid or delayed sequence induction).

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.

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Competing interests

All three authors are members of the Australasian College of Paramedicine Clinical Practice Guideline Special Interest Group, who have endorsed the creation of this series. This includes the Chair (Sonja Maria) and Vice-Chair (Marc Colbeck). Each author 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/ajp.18.914
| JAS | Year relevant guideline within the 2021 CPGs was last updated | Pharmacology | Intervention |
|-----|-------------------------------------------------------------|--------------|--------------|
|     |                                                              | Ceftriaxone (IM/IV) | Benzylpenicillin (IM/IV) | Amoxicillin, clavulanic acid, +/- gentamicin (IV) | Paracetamol (per oral) | Dexamethasone | Sodium chloride 0.9% (IV) | Sodium lactate (IV) | Adrenaline (infusion) | Noradrenaline (infusion) | Metaraminol (IV) | Phlebotomy | Lactate measurement | Endotracheal (ETT) unassisted | ETT – KOBI & IFS | ETT – DSI & RSI |
| Australian Capital Territory (ACTAS) | 2020 | ✓ (3) | ✓ | ✓ | ✓ | ✓ | ✓ (12) | ICP | Restricted (11) | ICP |
| New South Wales (NSWA) | 2018 | ✓ (3) | ✓ (7) | ✓ | ICP |
| New Zealand (SJNZ) | 2019 | ✓ (3) | ✓ (7) | ✓ | ICP |
| New Zealand (WFA) | 2019 | ✓ (3) | ✓ (7) | ✓ | ICP |
| Northern Territory (SJNT) | 2013 (1) | ✓ (3) | ✓ | ✓ ICP (13) | Restricted (4,8) | Restricted (10) | (10,14) | ICP | Restricted (10) |
| Queensland (QAS) | 2021 | ✓ (3) or (4,5) | ✓ | ✓ | Restricted (4,8) | Restricted (10) | (10,14) | ICP | Restricted (10) |
| South Australia (SAAS) | 2021 | ✓ (3) | ✓ (15) | (15) | Restricted (9) | Restricted (4,9) | Restricted (9) | ICP |
| Tasmania (AT) | 2015 | ✓ (3) or (4,6) | ✓ (4,6) | ✓ | ICP |
| Victoria (AV) | 2010 (1,2) | ✓ (3) or (4,5) | ✓ | Restricted (8) | ICP |
| Western Australia (SJWA) | 2017 | ✓ | ICP | ✓ | ICP |

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

(1) Guidelines currently undergoing review
(2) AV have advised their guideline review has been intentionally delayed to allow completion of the PASS Clinical Trial (ACTRN12618000199213)
(3) Meningococcal septicaemia only
(4) Medical consult required
(5) Transport time over 60 minutes
(6) ‘Prolonged’ transport time
(7) Transport time over 30 minutes
(8) ICP – Flight Paramedic only
(9) ICP – Retrievalist Flight Paramedic only
(10) ICP - High Acuity Response Unit only
(11) Additional training required
(12) Not indicated for sepsis specifically; however, indicated for bradycardia
(13) Not a true infusion; repeated intravenous boluses
(14) Use of lactate measurement is available but not indicated on sepsis CPG
(15) Only if systolic blood pressure <100 mmHg
| JAS          | Year relevant guideline within the 2021 CPGs was last updated | Diagnosis | Temperature (°C) | Respiratory rate (minutely) | Systolic BP (mmHg) | Heart rate (minutely) | Cognition | SpO₂ | Lactate (mmol/L) | Age (years) | Urine | Immune system | Blood glucose level (mmol/L) | Skin | Other criteria                                                                 |
|-------------|-------------------------------------------------------------|-----------|-----------------|----------------------------|-------------------|----------------------|------------|------|-----------------|-------------|------|----------------|--------------------------------|------|-----------------------------------------------------------------------------|
| Australian Capital Territory (ACTAS) | 2020 | **Sepsis** | >22             | <100                     |                  | Altered from baseline |             |      |                 |             |      |                |                                |      | Nuchal rigidity, headache, recent history of fever / rigors, abdominal pain / distension, diarrhoea, cough, dyspnoea, pneumonia, recent surgery or invasive procedure, indwelling medical device, cellulitis, septic arthritis, wound infection |
|             | 2018 | **Severe sepsis** | <22             | <90                     |                  |                       |             |      |                 |             |      |                |                                |      | Mottled or cold peripheries, capillary refill >3 seconds, purpuric rash       |
| New South Wales (NSWA) | 2018 | **Either** | Two of: <35.5 or >38.5 | 5-10 or 25-30 | 90-100 or 180-200 | 40-50 or 120-140 | Voice or pain |      |                 |             |      |                |                                |      | <4                                                                         |
|             |      | Or one of: | <5 or >30       | <90 or >200            | <40 or >140      | Unresponsive          |             |      |                 |             |      |                |                                |      | <4 with decreased consciousness                                             |
|             |      | Plus any one of: |                  |                          |                  |                       |             |      |                 |             |      |                |                                |      | Pre-presentation within 48 hours of medical care, indwelling device, recent surgery or wound, fall |
|             |      | To determine a new infection look for: | Fever                  |                         |                  |                       |             |      |                 |             |      |                |                                |      | Rigor, cough, sputum, dyspnoea, abdominal pain or distension, peritonism, line associated infection / redness / swelling / pain |

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| Location                  | Duration | Temperature | Pulse | Signs of infection | Trauma, surgery, or invasive procedure in 12 weeks |
|---------------------------|----------|-------------|-------|--------------------|---------------------------------------------------|
| New Zealand (SJNZ) 2019   | Medium risk | <36 | 21-24 | 91-100 | 91-130 or new dysrhythmia | Hx of altered or deterioration from family / carer | Anuria in 12-18 hours or <0.5 ml/kg/hr if catheterised | Impaired (including steroids) | Signs of infection | Trauma, surgery, or invasive procedure in 12 weeks |
| High risk                 | >25      | <90 or drop of >40 | >130 | Altered from baseline | >92 requires oxygen (>88 for COPD) | Anuria in 18 hours or <0.5 ml/kg/hr if catheterised | Neutropenia | Petechiae, purpura, mottled, ashen, cyanotic |
| New Zealand (WFA) 2019    | Medium risk | <36 | 21-24 | 91-100 | 91-130 or new dysrhythmia | History of altered or deterioration from family / carer | Anuria in 12-18 hours or <0.5 ml/kg/hr if catheterised | Impaired (including steroids) | Signs of infection | Trauma, surgery or invasive procedure in 12 weeks |
| High risk                 | >25      | <90 or drop of >40 | >130 | Altered from baseline | <92 requires oxygen (=<88 for COPD) | Anuria in 18 hours or <0.5 ml/kg/hr if catheterised | Neutropenia | Petechiae, purpura, mottled, ashen, cyanotic |
| Northern Territory (SJNT) 2013 | Sepsis | <36 or >38 | >20 | >90 | Source of infection, pulmonary oedema, dyspnoea |
| Septic shock              |          |             |      |       | Reduced urine output | Mottled | |
| Queensland (QAS) 2021     | Moderate risk | <35.5 or >38.4 | 21-24 | 90-99 | 90-130 or new dysrhythmia | Deterioration in functional abilities | Anuria in 12-18 hours or reduced urine output | Impaired (including steroids) | Signs of infection | Trauma, surgery, or invasive procedure in 12 weeks |
| High risk                 | >25      | <90 or drop of >40 | >130 | Altered from baseline | <92 requires oxygen | Anuria in 18 hours or reduced urine output | Recent chemotherapy | Non-blanching rash, mottled, ashen, cyanotic |
| Red flags                |          |             |      |       | >65 | Immunocompromised, asplenia, neutropenia, unimmunised | Re-presentation within 48 hours, recent trauma / surgery / invasive procedure / wound within 6 weeks, indwelling device, Indigenous Australian background, family or carer concern |
| State                          | Year | Condition          | Temperature | Pulse | BP | Immune Compromised | Symptoms                                                                 |
|-------------------------------|------|--------------------|-------------|-------|----|-------------------|--------------------------------------------------------------------------|
| South Australia (SAAS)        | 2021 | Infection          | >22         | <100  |    |                   | Sepsis, Pneumonia, UTI, abdominal pain / distension, meningitis, indwelling medical device, cellulitis, infected wound |
| Tasmania (AT)                 | 2015 | Sepsis             | <36 or >38  | >20   | <90| >90               | Evidence of infection, haemodynamic instability, dysrhythmia, MODS, DIC, DIC |
| Victoria (AV)                 | 2010 | Sepsis             | <36 or >38  | >20   | <90| >90               | Infection or major insult                                                |
| Western Australia (SJWA)      | 2017 | Septic shock       | >20         | <100  |    |                   | Altered                                                                  |

DIC: Disseminated Intravascular Coagulation
MODS: Multiorgan Dysfunction Syndrome
Table 3. Number of JASs providing each treatment (10 services total)

| Treatment          | Paramedic | Intensive Care Paramedic | Restricted | Not used |
|--------------------|-----------|--------------------------|------------|----------|
| Antibiotic*        | 5         |                          | 5          |          |
| Antipyretic        | 3         |                          | 7          |          |
| Corticosteroid     | 1         |                          | 9          |          |
| Adrenaline         |           |                          | 1          |          |
| Noradrenaline      |           |                          | 3          | 7        |
| Metaraminol        |           |                          | 2          | 5        |
| Phlebotomy         | 1         |                          | 1          | 8        |
| Lactate            |           |                          | 1          |          |
| ETT unassisted     | 1         |                          | 9          |          |
| ETT facilitated    |           |                          | 1          | 9        |
| ETT RSI            | 6         |                          | 2          | 2        |

*Excluding meningococcal meningitis, which all services except one allow paramedics to administer antibiotics for*

Table 4. Antibiotics for sepsis comparison

|                      | Australian Capital Territory (ACTAS) | Northern Territory (SJNT) | Queensland (QAS) | Tasmania (AT) | Victoria (AV) | New South Wales (NSWA) | New Zealand (WFA) | New Zealand (SJNZ) | South Australia (SAAS) | Western Australia (SJWA) |
|----------------------|--------------------------------------|---------------------------|-------------------|--------------|--------------|-------------------------|--------------------|----------------------|-------------------------|--------------------------|
|                      | Ceftriaxone (meningococcal septicaemia only), 50 mg/kg, maximum 2 g | Ceftriaxone (meningococcal septicaemia only), 4 g | Ceftriaxone, 2 g | Not carried | Benzylpenicillin (meningococcal septicaemia only), 1.2 g | Benzylpenicillin (meningococcal septicaemia only), 2.4 g | Amoxicillin, clavulanic acid (sepsis – soft tissue, joint, thoracic), 1.2 g | Amoxicillin, clavulanic acid, gentamicin (sepsis – urinary, peritoneal), 1.2 g amoxicillin, 240 – 400 mg gentamicin depending on weight | Ceftriaxone (meningococcal septicaemia), 2 g | Not carried |

Table 5. Paracetamol for sepsis comparison

|                      | Queensland (QAS) | New South Wales (NSWA) | Northern Territory (SJNT) | Australian Capital Territory (ACTAS) | New Zealand (WFA) | New Zealand (SJNZ) | South Australia (SAAS) | Tasmania (AT) | Victoria (AV) | Western Australia (SJWA) |
|----------------------|------------------|------------------------|---------------------------|--------------------------------------|--------------------|---------------------|-------------------------|--------------|--------------|--------------------------|
|                      | 500 mg - 1 g     |                        |                           | Not indicated                        |                    |                     |                         |              |              |                          |

Table 6. Fluids for sepsis comparison

|                      | Australian Capital Territory (ACTAS) | Queensland (QAS) | New South Wales (NSWA) | New Zealand (WFA) | New Zealand (SJNZ) | Northern Territory (SJNT) | South Australia (SAAS) | Tasmania (AT) | Victoria (AV) | Western Australia (SJWA) |
|----------------------|--------------------------------------|------------------|------------------------|-------------------|---------------------|---------------------------|-------------------------|--------------|--------------|--------------------------|
|                      | 20 ml/kg, target systolic blood pressure >90 mmHg, repeat PRN, no maximum | PRN, reassessed every 250-500 mL | 20 mL/kg, repeat PRN, no maximum | 1 L, maximum 2 L | 1 L, maximum 2 L | 250-500 mL, repeat PRN, maximum 40 mL/kg | 1250 ml boluses, maximum 20 ml/kg (ICP maximum 30 ml/kg) | 20 mL/kg (ICP maximum 40 mL/kg) | 20 mL/kg over 30 minutes (ICP maximum 60 mL/kg) | 250 mL boluses, maximum 2 L (small adult, elderly maximum 1 L) |
### Table 7. Adrenaline for sepsis comparison

| Location               | Dosage                                      |
|------------------------|---------------------------------------------|
| Australian Capital Territory (ACTAS) | 2 mcg/min, titrated to response             |
| Queensland (QAS)       | 20-50 mcg bolus, then 10-50 mcg/min         |
| New South Wales (NSWA) | 5 mcg/min, titrated to response, no maximum |
| South Australia (SAAS) |                                             |
| Victoria (AV)          |                                             |
| New Zealand (WFA)      | 8.3 mcg/min, titrated to response           |
| New Zealand (SJNZ)     |                                             |
| Northern Territory (SJNT) | 20 mcg boluses, repeat every 1 minute, no maximum |
| Tasmania (AT)          | 5 mcg/min, titrated to response, maximum 50 mcg/min |
| Western Australia (SJWA) | Not indicated                              |

### Table 8. Noradrenaline for sepsis comparison

| Location               | Dosage                                      |
|------------------------|---------------------------------------------|
| Queensland (QAS)       | 5 mcg/min, increasing by 1-2 mcg/min every 3-5 minutes |
| Victoria (AV)          | 5 mcg/min, maximum 25 mcg/min               |
| Australian Capital Territory (ACTAS) | 5 mcg/min, maximum 25 mcg/min               |
| New South Wales (NSWA) |                                             |
| New Zealand (WFA)      |                                             |
| New Zealand (SJNZ)     |                                             |
| Northern Territory (SJNT) |                                             |
| Tasmania (AT)          |                                             |
| Western Australia (SJWA) | Not carried                                 |

*Not a strict protocol

### Table 9. Metaraminol for sepsis comparison

| Location               | Dosage                                      |
|------------------------|---------------------------------------------|
| Queensland (QAS)       | 500 mcg, repeat every 1 minute              |
| New Zealand (WFA)      | 500 mcg – 1 mg bolus, then 2 mg/hr titrated to response |
| New Zealand (SJNZ)     |                                             |
| Tasmania (AT)          | 500 mcg – 1 mg bolus, then titrated to response |
| Western Australia (SJWA) | 500 mcg – 1 mg, repeat at 3 minutes         |
| Australian Capital Territory (ACTAS) |                                             |
| Northern Territory (SJNT) |                                             |
| New South Wales (NSWA) |                                             |
| Victoria (AV)          |                                             |

*Not a strict protocol

### Table 10. Oxygen for sepsis comparison

| Location               | Dosage                                      |
|------------------------|---------------------------------------------|
| Australian Capital Territory (ACTAS) | Target Sp0₂ above 94%  |
| New South Wales (NSWA) |                                             |
| Northern Territory (SJNT) |                                             |
| South Australia (SAAS) |                                             |
| Tasmania (AT)          |                                             |
| Western Australia (SJWA) |                                             |
| New Zealand (WFA)      | Target Sp0₂ 94-98%                         |
| New Zealand (SJNZ)     |                                             |
| Queensland (QAS)       | Target Sp0₂ 94-98%                         |
| Victoria (AV)          | 100% oxygen at 10-15 L/m until haemodynamically stable, then target Sp0₂ 92-96% |