

**SPECIAL THEME – MENINGOCOCCAL DISEASE**

Pre-hospital paramedic administration of Ceftriaxone for suspected meningococcal septicaemia in Victoria, Australia.

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**Abstract:**

Meningococcal septicaemia is not common in Australia. The disease does however have a rapid onset and relatively high levels of mortality and morbidity, particularly in children and adolescents. An effective vaccine has been introduced to protect against Group C disease, however no commercially available vaccine exists to protect against Group B which accounts for the majority of cases in Australia.

Australian authorities recommend the early administration of antibiotics to cases of suspected meningococcal septicaemia. Ambulance services are important providers of primary healthcare with strong clinical governance processes. They are well placed to assist in meeting the goal of early antibiotic therapy particularly in rural and remote areas where there may be prolonged ambulance transport times and variable access to medical practitioners and other primary healthcare providers.

In late 2003 Rural Ambulance Victoria introduced clinical practice guidelines which authorised ambulance and intensive care paramedics to administer the antibiotic Ceftriaxone in cases of suspected meningococcal septicaemia. This paper reviews meningococcal disease in Australia, explores the drivers and processes leading to the development of these guidelines, outlines experiences with the program to date, and identifies the need for further research in this area.

**Key Words:** *meningococcal disease; meningococcal septicaemia; paramedics; pre-hospital; Ceftriaxone; primary healthcare*

**Introduction**

Meningococcal disease is caused by the bacterium *Neisseria meningitidis* and based on 2003 figures affects approximately 500 Australians each year with about 20% of these cases occurring in Victoria.<sup>1</sup> The disease mainly affects those under 5 years of age, adolescents and young adults and tends to be seasonal with cases peaking in winter.<sup>1</sup> Thirteen serogroups of *Neisseria meningitidis* exist throughout the world with serogroup B and C predominant in Australia. Group B accounts for the majority of Australian cases, particularly in the under 5 age group, whilst adolescents and young adults tend to be infected with serogroup C.<sup>1</sup> An effective vaccine to prevent group C disease was introduced as part of the national childhood

immunisation program in early 2003, however no commercially vaccine against group B currently exists in Australia.<sup>2,3</sup>

Meningococcal septicaemia is a potentially life-threatening complication of infection with *Neisseria meningitidis* characterised by a typical non-blanching petechial or purpuric rash, fever, vomiting and drowsiness.<sup>4</sup> Mortality for this condition may be as high as 40%<sup>5</sup> and death can occur within several hours of symptoms occurring, particularly in children.<sup>6,7</sup> In addition up to 19% of survivors may suffer significant complications including hearing loss, neurologic disability and limb loss.<sup>8</sup> This significant mortality and morbidity is a result of vasomotor collapse, multiple organ failure and disseminated intravascular coagulation resulting from the marked release of a potent bacterial endotoxin into the bloodstream.<sup>6,9,10,11</sup> Given the rapid onset of the disease any patient presenting with a petechial rash and fever should be assumed to have meningococcal septicaemia until proven otherwise.<sup>5,12</sup>

### **Antibiotic therapy for suspected meningococcal septicaemia**

The life-saving effect of early antibiotic administration in cases of suspected meningococcal septicaemia is well documented,<sup>4,5,13,14</sup> although evidence supporting its use in the pre-hospital setting is inconclusive.<sup>7,15</sup> A study published in 1992 which combined data from three UK observational studies demonstrated that those not given pre-hospital antibiotics were twice as likely to die compared to those who were,<sup>16</sup> although a subsequent Danish study in 1998 identified an increased mortality associated with pre-hospital administration.<sup>17</sup> It has been suggested that this increase in mortality may be due to antibiotic mediated release of bacterial fragments.<sup>11</sup> The lack of research evidence that examines this theory requires clinicians to carefully consider the benefit of administration against the potential of a more harmful response resulting from increased bacterial multiplication where antibiotics are delayed.<sup>6</sup> Whilst the UK studies are now more than 10 years old they still form the basis of current recommendations for the management of suspected meningococcal septicaemia.<sup>4,15</sup> No randomised controlled trials have been conducted into the pre-hospital administration of antibiotics for suspected meningococcal septicaemia nor are they likely to occur for ethical reasons given that the current evidence in support of antibiotics is largely supportive and the risk of harm is low.<sup>6,15</sup> Despite the inconclusive evidence, the early administration of antibiotics for patients with suspected meningococcal septicaemia is an accepted standard of care recommended by a number of Australian and international authorities.<sup>4,14,18</sup>

### **Pre-hospital administration of antibiotics by ambulance personnel**

The recognition of suspected Meningococcal septicaemia is based on assessing a characteristic pattern of signs and symptoms, with initial pre-hospital management focused on the administration a single dose of an intravenous or intramuscular antibiotic.<sup>4,14</sup> The ambulance service is a first point of entry into the healthcare system and ambulance paramedics are trained to recognise patterns of some illness and injury and can administer a range of intramuscular and intravenous medications in accordance with medically-approved and supervised clinical practice guidelines and their approved scope of practice.<sup>19</sup> This environment provides the opportunity for ambulance services to consider the value of implementing clinical practice guidelines which allow the early ambulance administration of antibiotics for cases of suspected meningococcal septicaemia which inturn has the potential to lessen burden associated with this disease. This is particularly important in rural and remote areas where treatment with antibiotics may be delayed due to long ambulance transport times and variable access to medical practitioners and other primary healthcare providers

The administration of antibiotics by ambulance personnel is not without risk of complications, including the potential for anaphylaxis and vasomotor collapse. In addition there are costs associated with the introduction of antibiotics into ambulance clinical practice, including training and assessment and the initial purchase and ongoing replacement of antibiotics on all ambulance vehicles. Ambulance services therefore need to carefully consider the costs and benefits of introducing antibiotics for meningococcal septicaemia, particular taking into account current call-to-needle times for antibiotics in their respective jurisdictions in reaching a position on this issue.

The United Kingdom has previously introduced national clinical protocols which allow paramedics to administer pre-hospital benzyl penicillin in cases of suspected meningococcal septicaemia.<sup>18</sup> This issue was considered at a national level by the Convention of Australian Ambulance Authorities Clinical Committee in 2002, and whilst the Committee did not go as far as endorsing the wide spread introduction of antibiotics, it did recognise that this may be an appropriate strategy in more remote locations where access to antibiotics may be delayed. This led Rural Ambulance Victoria (RAV) to develop and introduce clinical practice guidelines in 2003 which allow ambulance personnel to administer Ceftriaxone for suspected cases of meningococcal septicaemia.

### **Guideline Development and Implementation**

Following in-principle endorsement by the RAV Medical Standards Committee draft adult and paediatric clinical practice guidelines were developed based on the pre-hospital treatment guidelines for meningococcal septicaemia published by the Commonwealth Department of Health and Aged Care and the Victorian Department of Human Services.<sup>4,14</sup> Ceftriaxone was selected as the preferred antibiotic due to concerns of not being able to treat those with a Penicillin sensitivity, with Lignocaine 1% chosen as the diluent for intramuscular injections to reduce the pain associated this route of administration.

The guidelines allow accredited paramedics to administer IM or IV Ceftriaxone (*Adult 1 gram and Children 50 mg per kg up to 1 gram*) to patients who present with the characteristic signs and symptoms of meningococcal septicaemia, namely a typical purpuric rash and evidence of septicaemia (i.e. signs of headache, fever, joint pain, altered conscious state, photophobia, hypotension and/or tachycardia).<sup>19</sup> Consideration was given to requiring paramedics to obtain a blood sample prior to intravenous administration of Ceftriaxone to aid in hospital diagnosis, however this was subsequently discounted on the basis that it added another unnecessary level of complexity to the management given that microbiological diagnosis can be still be made via other non-culture methods.<sup>4,9,13</sup>

Rural Ambulance Victoria intensive care paramedics are all trained and accredited in adult and paediatric intravenous cannulation and the administration of intramuscular injections and intravenous Adrenaline in anaphylaxis. At present approximately 55% of all ambulance paramedics are trained and accredited in adult intravenous cannulation (IV), with the majority of Ambulance Paramedics accredited in intramuscular injection (IM) and the use of IM Adrenaline in anaphylaxis. Given this diverse range of competencies amongst treating staff, and the potential issues in obtaining intravenous cannulation in the shocked patient, the guideline was designed to allow for the administration of an antibiotic by either the IV or IM route, with IV administration being preferable wherever practicable.

Final draft guidelines and a Ceftriaxone pharmacology sheet were developed and distributed widely for comment to various internal and external stakeholders throughout Victoria. These included ambulance and intensive care paramedics, paramedic education providers,

emergency physicians, intensivists, professional colleges, the Divisions of General Practice and the Victorian Department of Human Services. Feedback received was largely supportive with no particular concerns or issues raised. Following consultation the guidelines were considered and approved at a joint meeting of the respective Rural Ambulance Victoria and Metropolitan Ambulance Service Medical Standards Committees in August 2003 (Figure 1 and 2).

A training program on the recognition and management of meningococcal disease was developed by the RAV Clinical and Education Services Department and delivered in late 2003 with a review session conducted in the first half of 2004<sup>20</sup>. The program consisted of a workbook, 2-hour didactic training session involving PowerPoint presentation and case studies, and a post-training competency assessment completed with a Clinical Educator. Training was also incorporated into the undergraduate student paramedic curriculum at both Victorian universities.

### **Clinical Review**

Each case where Ceftriaxone is administered is subject to a retrospective clinical review by an ambulance clinical manager (a senior intensive care paramedic) and an ambulance area medical officer operating under the clinical governance auspices of the RAV Medical Standards Committee. As of December 2004 Ceftriaxone had been administered by ambulance paramedics in RAV on four separate occasions, to an 8 year old male, 12 year old male, female in her mid 20s and a 58 yo male. Each case was in excess of 30 minutes transport time to the nearest hospital and was deemed on review to have been managed appropriately in accordance with the approved clinical practice guideline. On follow-up all cases were found to have been positive for meningococcus and the patients discharged from hospital without sequale.

The most critical of these cases involved a 58 year old male in a small rural community approximately 50 minutes from the nearest hospital. He had gone to bed the previous evening complaining of flu-like symptoms and was unable to be roused the next morning by his friends. Two ambulance paramedics attended and found the patient to be unconscious with a Glasgow Coma Score of 6, tachycardia (rate 120), no recordable blood pressure and a diffuse purpuric rash which did not fade with a glass blanch test. The crew provided airway care and oxygen and administered intravenous Ceftriaxone in accordance with the Rural Ambulance Victoria Clinical Practice Guideline. The patient was subsequently intubated by an intensive care flight paramedic and flown by helicopter to a Regional Base Hospital where he remained ventilated for three days, but made a full recovery.

### **Conclusion**

Ambulance services are an integral part of the healthcare system and the controlled introduction of antibiotics into paramedic clinical practice for suspected meningococcal septicaemia can allow early access to a recommended standard of care for patients with this illness where delays in treatment may result in further harm. This is particularly important in rural and remote areas where access to antibiotics may be delayed due to long ambulance transport times and variable access to medical practitioners and other primary healthcare providers.

RAV successfully developed and implemented clinical practice guidelines in late 2003 which allow ambulance personnel to administer intravenous or intramuscular Ceftriaxone in cases

of suspected meningococcal septicaemia. To date these guidelines have been applied on four separate occasions with all patients being discharged from hospital without sequelae.

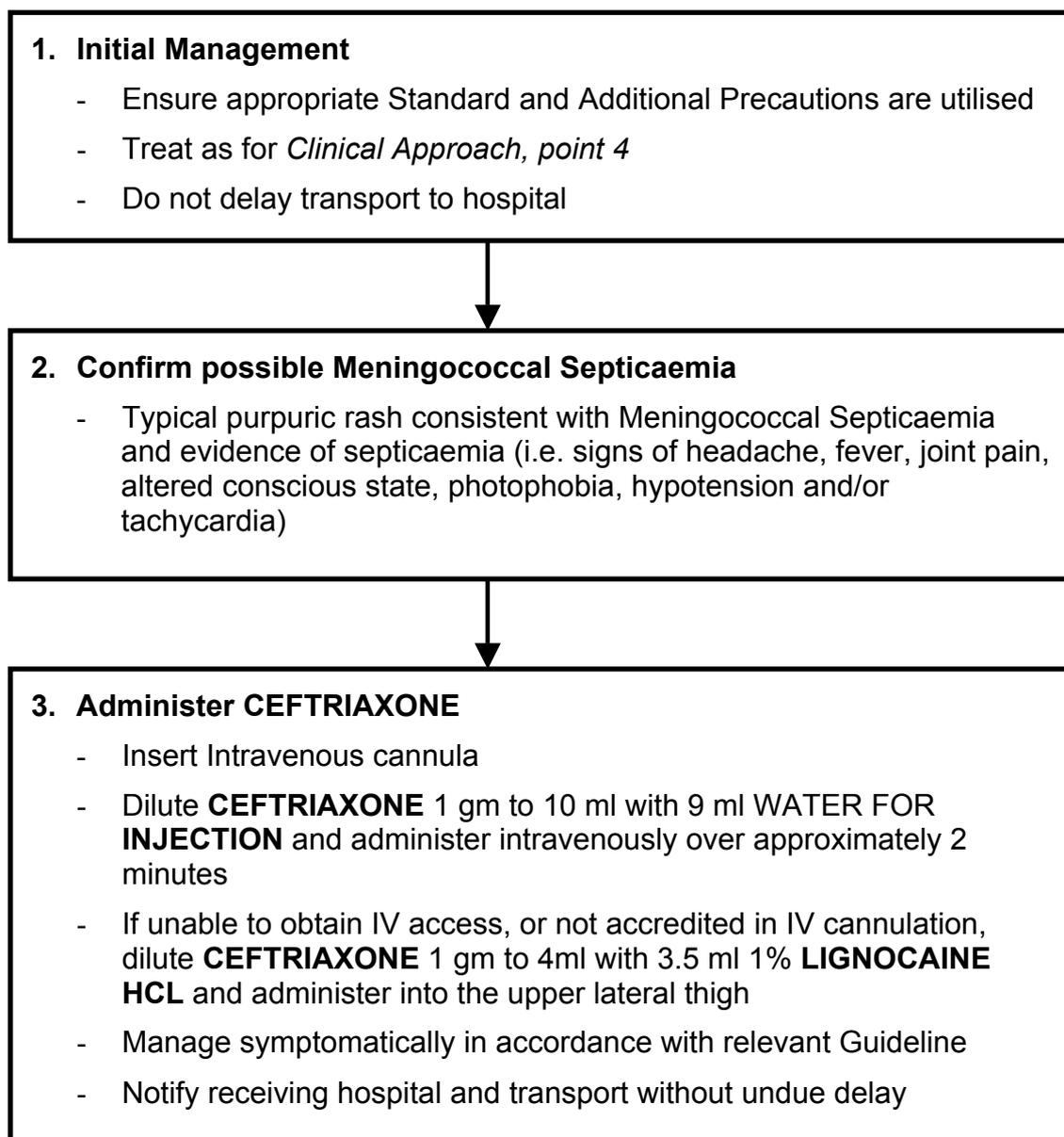
There is however a lack of evidence to support the routine use of antibiotics in the pre-hospital care setting. The evidence that exists is inconclusive, and other factors such as costs and potential complications associated with their introduction and administration specific to the pre-hospital setting need to be explored. Further research into these issues and the health outcomes of patients receiving antibiotic therapy by ambulance personnel in this cohort of patients is warranted.

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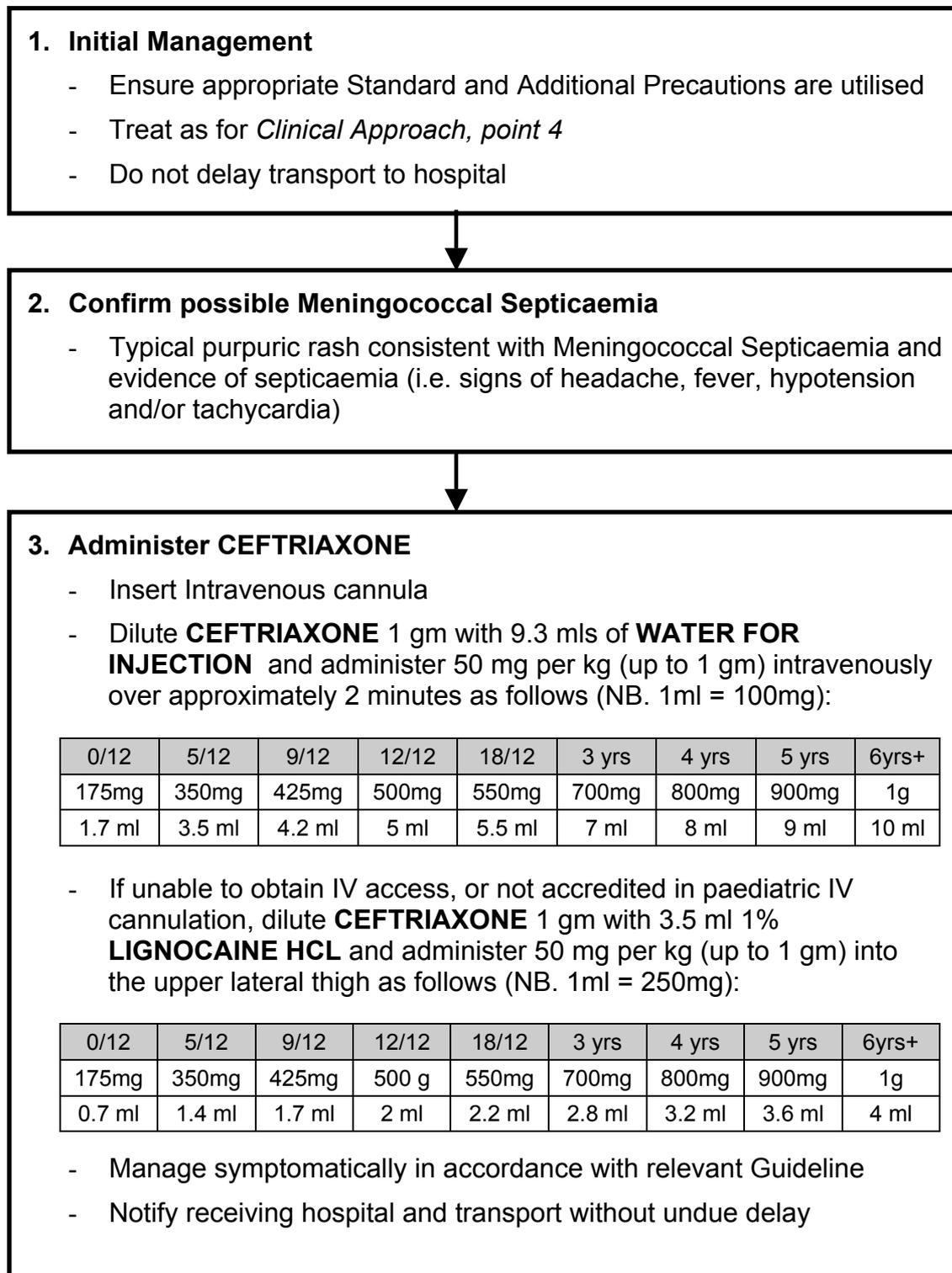
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**Figure 1**  
**Rural Ambulance Victoria Adult Meningococcal Septicaemia Clinical Practice Guideline**



**Figure 2**  
**Rural Ambulance Victoria Meningococcal Septicaemia (Paediatric <14 years) Clinical Practice Guideline**



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**Author Disclosure**

The Author has no financial, personal or honorary affiliations with any commercial organization directly involved or discussed in this study