Recognition of Sepsis in the Paediatric Patient: a reflective study

Karen Allen
Faculty of Education, Health and Community
School of Nursing and Allied Health
Liverpool John Moores University

Abstract

Sepsis affects around 100,000 people in the United Kingdom annually. Early recognition of this as a critical medical emergency is vital to prevent the condition developing into a life-threatening septic shock. Paediatric mortality is between 13-34% in septic shock. Pre-hospital recognition and treatment by paramedics is inconsistent. Education of the Sepsis Six pathway for pre-hospital care providers, GPs and community care practitioners is vital for the rapid treatment and increased survival rates for the septic patient.

Keywords

Sepsis; Paramedic; Paediatric; Recognition

Please cite this article as:
Allen, K. (2016) Recognition of Sepsis in the Paediatric Patient: a reflective study. *Links to Health and Social Care 1 (1)* , pp. 4-18

Introduction

This article has been written using the model of reflection described by Gibbs (1998), commonly used amongst health care professionals to allow for descriptive analysis and evaluation of an experience in a clear, precise way. This allows the professional to embrace their new understanding of the experience to improve delivery of care and practice. The Gibbs model of reflection (1988) enables the author to describe, consider, analyse and evaluate feelings and then create an action plan to improve practice (Jones 2008).

The word sepsis comes from the Greek meaning “decay” or “to putrefy” and was first mentioned in Homer’s poems approximately 2,700 years ago (Anon. n.d.).

Sepsis is the body’s overwhelming and life-threatening response to infection (Centers for Disease Control and Prevention 2015) which can lead to tissue damage, organ failure and death. In the United Kingdom it is estimated there are at least 100,000 cases of severe sepsis each year, although the true prevalence of sepsis may be higher due to under recognition of the condition (Cronshaw et al. 2011). Mortality from severe sepsis is unacceptably high with 35% mortality in severe sepsis and 50% mortality in septic shock.

Sepsis, is a major clinical problem, its nature requires rapid diagnosis and treatment (Vincent et al. 2002). It is important to rapidly recognise Systemic Inflammatory Response (SIRS) and sepsis early to have favourable outcomes in children. Sepsis is estimated to be the 13th leading cause of death overall in patients older than 1 year of age; and for children aged 1 to 4 years, sepsis represents the ninth leading cause of

death (Anderson and Bulmer 1997).

Sepsis in pre-hospital care has only recently been highlighted within education to Paramedics in the UK. Sepsis is a time-critical medical emergency that can rapidly develop into severe sepsis and life threatening septic shock (Moore et al. 2009). Paramedics should be educated in the Sepsis Six toolbox. The toolbox is the name given to a bundle of medical therapies designed to reduce the mortality of patients with sepsis. Sepsis Six was developed in 2006 by a group of physicians and nurses (Daniels et al. 2011) working on an educational programme to raise awareness and improve treatment of patients with sepsis.

Description

The author was on duty on a rapid response car working as a solo responder attending an emergency call to a domestic address for a 5 year old male child who was unresponsive. On arrival the author was met by the mother of the child who appeared distressed and anxious. The child was lying on the sofa, his skin was white and mottled. His eyes were open but he was unresponsive to verbal stimuli. After gaining a brief history from his mother it transpired that the child had been unwell complaining of a cough/cold like symptoms for the past 36 hours. He was normally fit and well and had only visited his GP 3 hours previously. The GP had diagnosed a viral infection and had advised calpol for pain relief, pyrexia and to maintain his fluid intake. On examination his skin was cold to touch, he was tachycardic (170 beats per minute), hypotensive with a blood pressure of 75/40mmhg, tachyneic with a respiratory rate over 40 respirations a minute, oxygen saturations of 90% on room air, blood sugar reading of 9mmol/lt, capillary refill greater

than 3 seconds, a temperature of 35.2ºC and a Glasgow Coma Score of 10. The child had been given calpol and ibuprofen 2 hours previously.

Mendez and Lapus (2015) state that children with septic shock can suffer from the following: tachypnoea, bradyponea, or apnoea, prolonged capillary refill greater than 3 seconds centrally, diminished peripheral pulses, mottled extremities and altered mental status. Fever or hypothermia (especially in infants) is common and this can increase the heart rate (although tachycardia by itself is a more non-specific indicator). Mendez and Lapus (2015) also identify that adults can easily double their heart rate, children cannot because of inadequate ventricular filling time. Due to this limited cardiac reserve, as the cardio-circulatory compromise continues vasoconstriction occurs in an attempt to maintain cardiac pre load and perfusion, if cardiac pre-load and perfusion is insufficient then hypotension occurs leading to circulatory collapse. Therefore hypotension in a shocked child is a very late sign and a peri-arrest situation.

Findings

The clinical findings were alarming. Dealing with an ill child is likely to cause an increase in emotions such as fear as to the severity of the condition, lack of experience dealing with paediatrics. The author is not alone in having the routine stresses of emergency work increased when dealing with children. A study by Alexander and Klein (2001) on the impact of accident and emergency work on ambulance personnel showed that dealing with a child victim was classed as the most disturbing incident attended by the study group. Emergency work is widely recognised as stressful (Moran and Britton 1994, Young and Cooper 1995). However, in the main emergency workers have coping

mechanisms in place to maintain an emotional detachment (Bilal et al. 2007). However, as Regher, Goldberg and Hughes (2002) argue 78% of paramedics report that they are more likely to experience distress when confronted with a death of a child. Warnke and Bonnin (1992, p.81) state "Emergency Medical Technicians are people not robots" therefore they suffer with the same emotions as any one of the billions of human beings on the planet. So, we cannot be surprised if emotional attachment to a paediatric case occurs but hope that the emergency workers' own coping mechanisms are sufficient to allow them to engage with the patient and parents.

It was obvious that the child was seriously ill and in need of immediate treatment and transportation to the Accident and Emergency Department. The author recognised the vulnerability of the child and the red flag markers for sepsis. It was apparent that the child had become acutely unwell in a very short space of time and recognising this is an important factor in the successful treatment of sepsis as delaying treatment of SIRS and sepsis or not treating the condition aggressively leads to increased mortality (Vincent et al. 2002). Paediatric mortality is still around 4-10% in severe sepsis and 13-34% in septic shock despite better management and antibiotics (Mendez and Lapus 2015). Having rapidly recognised that the patient was suffering with SIRS the author was aware that the child's mother was also distressed, upset and anxious. The author had to remain cool, calm and reassure the child's mother whilst also understanding the need for urgent treatment of the child. The author continued to reassure the mother but also explained that the child was seriously ill.

Consent for treatment was obtained from the mother and the procedure of intra-venous cannulation was explained to both the mother and child. When caring for a child, a health care professional has an overriding duty to act in the best interests of the child. The child or adolescent needs to be involved as much as possible in decision making regarding their treatment but this is offset with their level of understanding. A teenager is obviously going to understand more than a toddler or a child of early school age. Legally a child under the age of 16 is not deemed to automatically be legally competent to give consent (Department of Health 2005). However the Gillick Competency (Larcher and Hutchinson 2010) can be invoked by the courts if they believe that the child has "sufficient understanding and maturity to enable them to understand fully what is proposed". Emergency treatment however can be provided without consent to save a like or prevent serious deterioration in the health of a child or young person (Department of Health 2005).

Although the child's Glasgow Coma Score was decreased the author was aware that the child may still have an awareness of his surrounding and may well feel pain as the cannulation procedure was carried out. The plan was explained in very simple terms and how this would help make him feel better. Consent and honesty when dealing with children of any age is imperative to gaining trust and understanding of why the procedure is being carried out (Bricher 1999). I have found that children are more receptive to unpleasant procedures if you explain in simple terms what is happening, why and how the procedure will help make them feel better. Honesty is the key to gaining trust from children (Bricher 1999). If the procedure is likely to be uncomfortable or hurt, the child must be told prior to undertaking the action otherwise any trust gained will be lost.

Once consent was gained, as the child's oxygen saturation levels were only 90% the author placed the child on 100% supplementary oxygen to optimize blood oxygen content and delivery to the tissues (Leach and Treacher 2002). Then using aseptic techniques he was cannulated in his right ante cubital fossa whilst talking to him throughout the procedure even though there was no verbal response. Intravenous fluids were then started to provide haemodynamic support. Management of haemodynamic support within the first hour of septic shock involves an aggressive systematic approach to resuscitation targeted to improve the physiological indicators of perfusion and vital oxygen function within the first six hours (Mendez and Lapus 2015). The first hour goals include restoring and maintaining a normal heart rate, targeting a capillary refill of below two seconds and maintaining a normal blood pressure (Mendez and Lapus 2015).

Evaluation

The author has personally experienced septic shock and was very aware of sepsis, how quickly this illness can spiral into multiple organ failure leading to long term health issues or even death. The author felt she recognised the clinical indicators of sepsis quickly, but felt exceedingly challenged by the incident. Children are often difficult to assess. Physiologically they are different in many ways to adults, they also often present with symptoms in the latter stages of illness (Royal Children's Hospital Melbourne n.d.). Perhaps this is why the patient's GP did not pick up any clinical indicators of sepsis in the hours before the author attended the child. Sepsis is often overlooked by health care professionals as a major cause of avoidable death and morbidity. The ambulance crew who responded and transported the child to hospital were aware of sepsis but did not fully

understand and recognise the need for aggressive fluid resuscitation.

In September 2014 National Health Service England issued a stage 2 safety alert on sepsis (NHS England 2014) reinforced by an announcement of intent from the Secretary of State for Health in January 2015 (Department of Health 2015). The UK Sepsis Trust has developed toolkits for various health care professionals to highlight the importance of both early recognition and the need for prompt treatment. Sepsis toolkits have been developed with the College of Paramedics for ambulance services and by the Royal College of General Practitioners for GPs. The United Kingdom Sepsis Trust recommends both GP and ambulance services should use the Sepsis Six screening tool to aid with both early recognition and prompt treatment. However, the Sepsis Six toolkits are based on data from hospital laboratories which are not available in the pre-hospital setting. Currently practitioners rely on clinical findings one of which is the use of End-tidal Carbon dioxide to help diagnosis sepsis. The Sepsis Six screening tool highlights the use of serum lactate levels which are not widely available in the pre-hospital setting. However, it is possible to screen for severe sepsis by using capnography (Hunter 2014). Capnography, the waveform measurement of exhaled end-tidal carbon dioxide (EtCO2), is a well-known tool in EMS. EtCO2 is a continuous variable determined by basal metabolic rate, cardiac output and ventilation. Thus abnormal levels may reflect derangement in perfusion, metabolism or gas exchange.

Capnography has multiple pre-hospital applications for confirmation and monitoring of correct endotracheal tube placement, and evaluating return of spontaneous circulation

during cardiopulmonary arrest (Hunter 2014). However, capnography can also be very effective when used on a conscious patient to detect conditions such as septic shock. In severe sepsis the patient has poor perfusion, leading to a build-up of serum lactate which results in metabolic acidosis (Hunter 2014). EtCO2 levels decline in the setting of both poor perfusion and metabolic acidosis. To compensate for metabolic acidosis, patients increase their minute ventilation (Hunter 2014). This increased respiratory rate "blows off" carbon dioxide and lowers EtCO2. At the same time, poor tissue perfusion decreases the amount of blood flow to the alveoli of the lungs, reducing the amount of carbon dioxide that can be exhaled-the most dramatic demonstration of this process is during cardiac arrest. Therefore, EtCO2 is inversely proportional to lactate levels as levels rise in septic patients EtCO2 levels drop (Hunter 2014).

In 2016 a new set of consensus definitions for sepsis is likely to be announced. Though still hospital derived, the new definitions are far more pragmatic than before. The current reliance on laboratory data will be removed, and a new set of criteria with which paramedics will be familiar will be introduced, namely a search for shock, tachypnoea and altered mental state in the presence of suspected infection. The author would argue that the sea of change in the international definitions validates existing efforts centring on Red Flag Sepsis. It may well be that this new focus is sufficient to stimulate the profession to act by adopting a common language, a national tool such as the prehospital toolkit, and unified desire to reduce the impact of this hidden killer (Roebuck 2015).

Conclusion

Sepsis and its recognition remains a challenge to both pre-hospital practitioners and hospital clinicians. In the past decade there has been an international effort to standardise treatment for severe sepsis (Cronshaw et al. 2011, Marik 2011). In 2002 the surviving sepsis campaign (SSC) was launched and subsequently updated successively with the primary focus on achieving a 25% reduction in the mortality of severe sepsis (Dellinger et al. 2013).

Despite education and awareness campaigns, sepsis recognition remains problematic and delayed within the United Kingdom. Daniels et al. (2011) reported that compliance to the sepsis care bundles was very poor. Recently the UK Parliamentary ombudsman published *Time to Act* (Parliamentary and Health Service Ombudsman 2013) adressing the failings in sepsis recognition and treatment. Historically there has been limited published literature on pre-hospital identification and care of sepsis (Herlitz et al. 2012) despite the fact that the ambulance service encounters large numbers of patients with sepsis. It has been estimated (Seymour et al. 2010) that ambulance services encounter sepsis more often – 3.3% of call outs - than acute myocardial infarction (2.3%) or cerebral vascular accident (2.2%). Gray et al. (2013) showed that a large proportion (88%), of severe sepsis patients arrive at hospital by ambulance. A recent pilot study exploring the accuracy of pre-hospital sepsis recogntion in the North East Ambulance Service (NEAS) (McClelland and Jones 2015) states, that when paramedics accurately identify and pre-alert severe sepsis in patients, it assists in decreasing the time of completion of the Sepsis Six assessment in hospital. Paramedic treatment of severe sepsis, when it was identified,

is still inconsistent and shows little improvement from previous studies in NEAS (McClelland and Younger 2013). Paramedic use of intravenous fluids to treat patients with severe sepsis is an area that needs further consideration. The presence of hypotension (blood pressure below 90 mm/hg) in the pre-hospital setting consistently triggers aggressive treatment by paramedics including fluids. The diagnosis of severe sepsis does not consistently trigger the same response and missed opportunities to administer intravenous fluids in severe sepsis have been reported elsewhere (Seymour et al. 2010).

On reflection of the incident the author felt challenged as a clinician. Dealing with sick children is an emotive area of ambulance work. The authors limited experience in dealing with children, the complexities of child medication, as well as difficulties with communication and consent did make me anxious. Sepsis certainly is an area within the medical profession that needs further education because this disease is life threatening and is rapid in it's onset. The child discussed within this reflection had been seen by his GP only 3 hours earlier. The GP possibly failed to recognise the subtle signs and symptoms of sepsis in its early stages. The UK Sepsis Trust website (www.sepsistrust.org) has invaluable information for a full range of health care professionals including GPs and paramedics. On reflection the author will approach all children including those who display subtle signs and symptoms with sepsis in the forefront of her mind.

Sepsis is not only life-threatening in the acute phase but can also have long term and devastating life changing effects on the patient such as amputation, cognitive impairment, low immunity following organ failure (Sepsis Alliance n.d.) As clinicians and pre-hospital care providers it is essential that more education is provided to highlight that early recognition of sepsis is key to survival (Vincent et al. 2002). The sooner sepsis is diagnosed, the better the outcome for the patient.

In the future the author would like to see paramedic clinicians being able to start sepsis care in the pre-hospital environment by being able to monitior lactate with a simple method similar to obtaining blood glucose readings, administer both intravenous paracetamol and anitbitoics to all patients who present as displaying sepsis. The author agrees with Daniels and Keep (2015) that the new 2016 Sepsis Six guidelines will become easier for clinicains to use in the pre-hospital setting to recognise the red flag sepsis symptoms.

References

Alexander, D. and Klein, S., (2001) Ambulance personnel and critical incidents: Impact of accident and emergency work on mental health and emotional well-being. *British Journal of Psychiatry,* 178(1), pp.76-81.

Anderson, M. and Bulmer, J. (1997) Advances in the therapy for sepsis in children. *Pediatric Clinics of North America,* 1 February, 44(1), pp. 179-205.
Anon. (n.d.) *www.dictionary.reference.com.* [Online]
Available at: http://dictionary.reference.com/browse/sepsis?s=t
[Accessed 2 November 2015]

Bilal, M. S., Rana, M. H., Rahim, S. and Ali, S. (2007) Psychological Trauma in a Relief Worker: A Case Report from Earthquake Struck Areas of North Pakistan. *Pre-hospital and Disaster Medicine,* 22, pp.458-461.

Bricher, G. (1999) Paediatric nurses, children and the development of trust. *Journal of Clinical Nursing,* 8, pp.451-458.
Centers for Disease Control and Prevention (2015) [Online]
Available at: http://www.cdc.gov/sepsis/basic/qa.html
[Accessed 2 March 2016].

Cronshaw, H., Daniels, R., Bleetman, A., Joynes, E. and Shiels, M. (2011) Impact of surviving sepsis; Campaign on the recognition and mangement of severe sepsis in the emergency department: are we failing? *Emergency Medicine Journal,* 28(8), pp.670-5.

Daniels, R. and Keep, J. (2015) Paramedics have a clear role to play in the management of patients with sepsis. *Journal of Paramedic Practice,* 7(9), pp.430-432.

Daniels, R., Nutbeam, T., McNamara, G. and Galvin, C. (2011) The Sepsis Six and the severe sepsis resuscitation bundle: a prospective observational cohort study. *Emergency Medicine Journal,* June, 28(6), pp.507-512.

Dellinger, R., Levy, M., Rhodes, A., Annane, D., Gerlach, H., Opal, S., Sevransky, J., Sprung, C., Douglas, I., Jaeschke, R., Osborn, T., Nunnelly, M., Townsend, S., Reinhart, K., Kleinpell, R., Angus, D., Deutschman, C., Machado, F., Rubenfeld, G., Webb, S., Beale, R., Vincent, J. and Moreno, R. (2013). Surviving Sepsis Campaign: International Guidelines for Management of Severe Sepsis and Septic Shock, 2012. *Intensive Care Medicine,* 39, pp.165-228.

Department of Health, (2005). *Mental Capacity Act.* London: HMSO.

Department of Health (2015). *New action to reduce sepsis.* [Online]
Available at: www.gov.uk/government/news/new_action_to_reduce_sepsis
[Accessed 10 October 2015]

Gibbs, G. (1988). Learning by doing: a guide to teaching and learning methods. Oxford:

Oxford Polytechnic.

Gray, A., Ward, K., Lees, F., Dewar, C., Dickie, S. and McGuffie, C. (2013). The epidemology of severe sepsis and septic shock in Scottish emergency departments. Emergency Medicine Journal, 30(5), pp.397-401

Herlitz, J., Wireklint-Sundstrom, B., Axelsson, C., Bremer, A., Hagiwara, M., Jonsson, A., Lundberg, L., Suserud, B. and Ljungstrom, L. (2012) Suspicion and treatment of severe sepsis: an overview of the prehospital chain of care. Scandinavian Journol of Trauma, Resuscitaion and Emergency Medicine, 20, p.42

Hunter, C. (2014) Use of End-tidal Carbon Dioxide to Diagnose Sepsis. JEMS: Journal of Emergency Medical Services, 37(3) [Online]
Available at: www.jems.com/articles/print/volume-39/issue-3/features/use-end-tidal-carbon-dioxide-to-diagnose-sepsis.html
[Accessed 31 October 2015]

Jones, I. (2008) Reflective practice and the learning of health care students. [Online]
Available at:
https://uhra.herts.ac.uk/dspace/bitstream/2299/3471/1/Thesis_final_copy_for_binding_v1.pdf
[Accessed 3 October 2015]

Larcher, V. and Hutchinson, A. (2010) How should paediatricians assess Gillick competence. Archives of Disease in Childhood, 95, pp.307-311

Leach, R. M. and Treacher, D. (2002). The pulmonary physician in critical care. Oxygen delivery and consumption in the critically ill. Thorax, 57, pp.170-177
Marik, P. E. (2011). Surviving sepsis: going beyond the guidelines. Annals of Intensive Care, 1(1), p.17

McClelland, G. and Jones, J. (2015) A pilot study exploring the accuracy of pre-hospital sepsis recognition in the North East Amulance Service. Journal of Paramedic Practice, 7(9), pp.459-465.

McClelland, G. and Younger, P. (2013) A Study into pre-alerts to North East hospitals for sepsis. Journal of Paramedic Practice, 5(7), pp.408-415

Mendez, D. and Lapus, R. (2015). Sepsis in Children. Journal of Emergency Medicine, Trauma and Surgical Care, 2(2), pp.10-19

Moore, L., Jones, S., Kreiner, L., McKinley, B., Sucher, J., Todd, S., Turner, K., Valdivia, A. and Moore, F. (2009) Validation of screening tool for the early identification of sepsis. Journal of Trauma Injury, Infection and Critical Care, 66(6), pp.1539-1547

Moran, C. and Britton, N. (1994) Emergency work experience and the reactions to

traumatic incidents. Journal of Traumatic Stress, 7(4), pp.575-585

NHS England (2014) Patient safety alerts - resources to support the prompt recognition of sepsis and the rapid initiation of treatment. [Online]
Available at: www.england.nhs.uk/2014/09/02/psa_sepsis
[Accessed 8 October 2015]

Parliamentary and Health Service Ombudsman (2013) Time to Act. Severe sepsis: rapid diagnosis and treatment save lives. [Online]
Available at:
http://www.ombudsman.org.uk/_data/assets/pdf_file/0004/22666/FINAL_Sepsis_Report_web.pdf
[Accessed 3 November 2015].

Regher, C., Goldberg, G. and Hughes, J. (2002) Exposure to human tragedy, empathy and trauma in ambulance paramedics. American Journal of Orthopsychiatry, 72(4), pp. 505-513

Roebuck, E. (2015) Moving sepsis care to the frontline: knowledge and views of pre-hospital clinicians. Journal of Paramedic Practice, 7(9), pp.446-457
Royal Children's Hospital Melbourne (n.d.) Student orientation. [Online]
Available at:
http://www.rch.org.au/studentorientation/5.children_and_adults/Differences_between_children_and_adults/
[Accessed 12 November 2015].

Sepsis Alliance (n.d.) Sepsis Survivors. [Online]
Available at: http://www.sepsis.org/resources/sepsis_survivors/
[Accessed 24 November 2015]

Seymour, C., Cooke, C., Mikkelsen, M., Hylton, J., Rea, T., Goss, C., Gaieski, D. and Band, R. (2010) Out of hospital fluid in severe sepsis: effect on early resuscitation in the emergency department. Prehospital Emergency Care, 14(2), pp.145-52

Vincent, J., Abraham, E., Annane, D., Bernard, G., Rivers, E. and Van den Berghe, G. (2002) Reducing Mortality in Sepsis: new directions. Critical Care, 6 (Supplement 3), pp.51-58

Warnke, W. and Bonnin, M. (1992) Direction and motivation of pre-hospital personnel to do research: how to do it better. Pre-hospital and Disaster Medicine, 7(1), pp.79-83
Young, K.M., and Cooper, C.L. (1995). Occupational stress in the ambulance service: A diagnostic study. Journal of Managerial Psychology, 10(3), pp.29–36.