Retrospective Chart Review of Antibiotic Administration in Sepsis at Selkirk General Hospital Emergency Department

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Introduction

Sepsis is a potentially life-threatening complication from a bacterial infection, which the presence of pathogenic organisms, or their toxins, in the bloodstream of an individual. Sepsis is currently an important topic in health care due to its significant impact on patient mortality, as well as its controversy in diagnosis and treatment. In 2011, one of every 18 deaths in Canada involved sepsis, and in the years 2009-2011, sepsis contributed to more than half of the deaths involving infectious diseases (Navaneelan et al., 2016). This review will use the systemic inflammatory response syndrome (SIRS) approach to the diagnosis of sepsis; although a simplistic approach, SIRS criteria values are readily available during triage evaluations and include standard blood work in the patients’ charts. SIRS is considered when adult patients have two or more of the following on assessment: (1) a temperature of greater than 38.3°C or less than 36°C, (2) heart rate greater than 90 beats/minute, (3) a mean respiratory rate greater than 20 breaths/minute or a Paco2 less than 32 mmHg, or (4) Leukocyte count greater than 12,000/mm³, or less than 4000/mm³, or more than 10% immature (band) forms (Tintinalli et al., 2011). The diagnosis of sepsis is considered when SIRS criteria is met in addition to a clinically suspected infection. When determining if a patient has a suspected infection, a physician must use a combination of clinical and laboratory findings. These can include:

- Fever
- Chills
- Fatigue
- Tachypnea (>20)
- Change in mental status
- >38.3 or <36
- Tachycardic (>90)'
- Hypotension (<90 mmHg or decrease of >40)
- High blood sugar
- Significant fluid overload
- Lab findings: WBC >12,000 c/mm³ OR WBC <4000 c/mm³, OR normal WBC with >10% immature cells and an elevated CRP
- An elevated (1-2μg/L) PCT (plasma procalcitonin) can be a specific marker for bacteria infections
- Hyperlactemia (>1 mmol/L) and lactic acidosis
- Signs of cyanosis
- The following are findings of organ dysfunction specifically:
  - Arterial hypoxemia (PaO2/FiO2 <300)
  - Acute oliguria (<0.5 mL/kg/hr for 2 hours despite fluids)
  - Creatinine >1.5 mg/Dl
  - INR >1.5
  - aPTT >60 seconds
  - Thrombocytopenia <100,000 cells/mm³
  - Hyperbilirubinemia
Current guidelines for sepsis management recommend the collection of a blood culture, followed by the administering of IV antibiotics within the first hour of recognizing sepsis. A broad spectrum antibiotic is recommended at first, but should be changed to a narrow spectrum treatment once the organism and susceptibility is known from the blood culture. Management also includes 30 ml/kg of crystalloids as the fluid treatment, and norepinephrine as a vasopressor (Dellinger et al., 2013).

Since bacterial infections are a frequent cause of illness requiring hospitalization and the importance of early administration of antibiotics is becoming more clearly understood, it is important to review local practices in order to improve patient care (Osmon et al., 2003). The purpose of this retrospective chart review is to identify the quality of initial sepsis management at the Emergency Department of the Selkirk General Hospital by analyzing the amount of time that elapses from presentation of sepsis to administering antibiotics.

Methods

This study reviewed all cases of sepsis entering the Selkirk General Hospital via the emergency department during 2014 and 2015. Cases of sepsis that did not pass through the emergency department or cases resulting after admission were not included in the study. Charts were selected for review if they had been coded by medical records as containing a diagnosis of sepsis during 2014 or 2015. The electronic time record of triage was used as the start time for the patient presentation with sepsis. The time of antibiotic administration was considered to have occurred at the time the nursing staff manually recorded in the integrated progress notes, the scheduled medications form, or the non-scheduled medication form.

Results

The study reviewed 30 charts of sepsis presenting to the Selkirk and District General Hospital Emergency Department from 2014 and 2015. Nine charts were excluded from the study as they did not meet the criteria for a sepsis diagnosis, despite being coded as such by medical records. One additional chart was removed from the study as it was not representative of sepsis presentations and had extended time before antibiotics could be delivered due to severe allergies. The average time to receive antibiotics from triage presentation was three hours and seven minutes. The study found that the 70% of patients waited longer than 60 minutes to receive antibiotics, while only 30% of patients received antibiotics between 30 minutes and 60 minutes (Figure 1). No patients received antibiotics in under 30 minutes. Note that all patients with sepsis did receive antibiotics.

Patients who received antibiotics greater than 60 minutes after presentation had a 15% mortality rate, while those who received antibiotics between 30 to 60 had a 12.5% mortality rate (Figure 2). Of the patients who received antibiotics within 30 to 60 minutes, only 75% were admitted to hospital compared to 85% who waited over 60 minutes before receiving antibiotics; note that transfers were considered as admissions since patients were being admitted to the receiving facility (Figure 2). After receiving treatment in the emergency department, 12.5% of patients who had antibiotics within 30 to 60 minutes were discharged; only 10% of those who received antibiotics in greater than 60 minutes were discharged from the emergency department (Figure 2).
The study found that antibiotics were delivered on average two hours sooner if the patient met the SIRS Criteria (Figure 3). Median time values for delivery of antibiotics based on whether or not the patient met the SIRS Criteria also showed a one hour, twenty minutes sooner administration of antibiotics in patients that met SIRS Criteria. Patients who met the SIRS criteria had a mean time of 3.45 hours until antibiotics were administered.

The study also reviewed various procedures of initial sepsis management. This included obtaining a blood culture, sourcing the infection, appropriate administration of fluids, and appropriate documentation. According to the cases in the Selkirk ER from 2014-2015, 94% of patients had a blood culture done, 81% had appropriate documentation and infectious source determined, and 84% were given appropriate fluids (Figure 4).

**Figure 1. Timing of Antibiotics.** The study determined 30% patients presenting with sepsis received antibiotics within 30 to 60 minutes, while 70% of patients received antibiotics in greater than 60 minutes. No patients presenting with sepsis received antibiotics in less than 30 minutes. All patients with sepsis did receive antibiotics.
Figure 2. Comparison of Antibiotic Treatment Time to Patient Outcome. Cases where antibiotics were administered between 30 to 60 minutes, a greater proportion of patients could be discharged from the emergency department and fewer patients died or were admitted to hospital; the opposite effect was observed when administration of antibiotics took greater than 60 minutes.
Figure 3. Time of Triage to Antibiotics Administration. Comparison of the average and mean timing of antibiotic administration based on whether or not patients met the SIRS Criteria.
Figure 4. Proportion of patients that received various procedures of sepsis management. Patient cases were analyzed to determine if proper sepsis management had taken place. This included the collection of blood culture, determination of infectious source, administration of fluids, and appropriate documentation.
Discussion

Many steps are required between the patient’s initial presentation at triage to the final administration of antibiotics. Given the complexity of recognizing sepsis, then taking the proper steps in administering antibiotics it is no surprise that inefficiencies exist. Of these areas we have identified, which could be targeted to reduce time to administration include reducing delay:

1. Patient is seen by physician
2. For lab work to be drawn
3. For labs to be read by physician
4. Between physician ordering antibiotics and being administered by nurse
5. Physician recognizes antibiotics

In most cases patients with sepsis are triaged at a high enough severity that physicians perform their initial Hx & Px in an urgent manner. With this being said nurses should better be made aware of the urgency in treating sepsis and notify physicians of new cases with this potential comorbidity. After the patient is seen by the physician, blood work is often ordered. A triage system should be made in order of urgency, so that blood work is drawn and sent for testing without delay. When lab results come back, the nurse often reports this to the physician, but there are occasions when this doesn’t occur immediately upon becoming available. Lastly one of the inefficiencies, which we found most common was a delay between the physician ordering the antibiotic & the actual administration of the antibiotic by the nurse. Whether this is due to a miscommunication between the physician or nurse, or the nurse became busy with another task, more emphasis needs to be given in this step to ensure timely delivery of antibiotics in situations of septic shock.

Figure 4. General process taken from initial presentation to administration of antibiotics.
Limitations
A small sample size is a significant limitation to the study. All cases of sepsis entering Selkirk General Hospital during 2014 and 2015 were reviewed and included in this study with the exception of patients who had died during 2014. These charts of the deceased were inaccessible to students as they were moved off-site for long-term storage. As a result, death resulting from sepsis could not be analysed during 2014 in the review. Medical records staffing is responsible for coding the diagnosis on charts entering the facility; inappropriate coding would make charts inaccessible for review. Although the time of initial patient contact was recorded electronically at triage, the time of antibiotic administration is dependent on nursing staff manually recording the time making it susceptible to error.

In this retrospective chart review of patients presenting with sepsis to the Emergency Department of the Selkirk and District General Hospital it was found that patients who met the SIRS criteria received antibiotics sooner and had better clinical outcomes.

Conclusion
In conclusion, the timeline for antibiotic administration to patients presenting with sepsis did not meet the current guidelines for management in the Selkirk General Hospital Emergency Department from the years 2014-2015. Failure to reach administration within an hour could be due to several reasons, including failure to diagnose, miscommunication between hospital staff, or misunderstanding of current guidelines.

References


