

Community EM

Door-to-antibiotic time for pneumonia in a rural emergency department

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ABSTRACT

Objective: The Joint Commission on Accreditation of Healthcare Organizations recommends that patients admitted to hospital with pneumonia receive their first dose of antibiotics within 6 hours of presenting to the emergency department (ED). Previous research in the United States indicates that rural hospitals may be better at achieving this benchmark than urban centres. This particular quality indicator has not yet been evaluated in Canada. The purpose of this study was to determine whether the target door-to-antibiotic (DTA) time of 6 hours or less could be met in a rural ED.

Methods: We conducted a retrospective chart review of patients admitted to hospital with a diagnosis of pneumonia. Descriptive data for each case was collected, including demographic and timeline information. We analyzed DTA time, antibiotic type, route of administration, hospital length of stay and disposition at discharge.

Results: We reviewed a total of 320 charts from Apr. 1, 2003, to Mar. 31, 2008. The final sample consisted of 143 patients (50.3% women) whose median age was 79 years. The median DTA time was 151 minutes and 81.8% of patients received their first dose of antibiotics within 6 hours. Patients received antibiotics either orally (47.6%), intravenously (47.6%) or both (4.8%). Single-agent respiratory fluoroquinolones were used 71.4% of the time. Median length of hospital stay was 4 days; most patients were discharged home (79.7%), 11 died, 11 were transferred and 7 were discharged to a nursing home.

Conclusion: A DTA time of 6 hours or less is achievable in a rural ED.

Keywords: community-acquired pneumonia, rural ED, door-to-antibiotic time

RÉSUMÉ

Objectif : La Commission mixte d'agrément des établissements hospitaliers recommande que les patients hospitalisés pour une pneumonie reçoivent leur première dose d'antibiotiques dans les 6 heures suivant leur arrivée à l'urgence. Selon

des études réalisées antérieurement aux États-Unis, les hôpitaux ruraux réussiraient mieux à atteindre cet objectif que les hôpitaux en milieu urbain. Cet indicateur de qualité n'a pas encore été évalué au Canada. Le but de cette étude était de déterminer s'il était possible d'atteindre le délai de 6 heures ou moins « entre l'arrivée à l'urgence et l'administration d'antibiotiques » (délai AA) dans un service d'urgence en milieu rural.

Méthodes : Nous avons effectué une étude rétrospective des dossiers de patients hospitalisés avec un diagnostic de pneumonie. Nous avons recueilli des données descriptives pour chaque cas, y compris des données démographiques et sur les délais. Nous avons analysé les délais AA, le type d'antibiotiques administré, la voie d'administration, la durée de séjour et le devenir des patients au congé.

Résultats : Nous avons examiné au total 320 dossiers entre le 1^{er} avril 2003 et le 31 mars 2008. L'échantillon final était composé de 143 patients (50,3 % de femmes) dont l'âge médian était de 79 ans. Le délai AA médian était de 151 minutes, et 81,8 % des patients ont reçu leur première dose d'antibiotiques dans les 6 heures suivant leur arrivée à l'urgence. Les patients ont reçu des antibiotiques par voie orale (47,6 %), par voie intraveineuse (47,6 %), ou les deux (4,8 %). On a administré comme agent unique des fluoroquinolones respiratoires dans 71,4 % des cas. La durée médiane d'hospitalisation était de 4 jours; la plupart des patients ont regagné leur domicile (79,7 %), 11 sont morts, 11 ont été transférés et 7 ont été admis dans un foyer de soins de longue durée.

Conclusion : Il est possible de respecter un délai de 6 heures ou moins entre l'arrivée à l'urgence et l'administration d'antibiotiques dans un service d'urgence en milieu rural.

INTRODUCTION

Pneumonia is the most frequent infectious cause of death in North America. It accounts for a substantial number of hospital admissions every year.^{1,2} The literature has reported overall mortality rates due to community-acquired pneumonia (CAP) of up to 7% in hospital and

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12% 30 days after admission.³ Therefore, it is not surprising that the in-hospital process of diagnosis and treatment of CAP has been thoroughly examined in an effort to identify ways to improve patient outcomes.

In 1997, Meehan and colleagues⁴ were the first to conduct a major study examining the timing of antibiotic administration. They demonstrated that administration of antibiotics within 8 hours of presentation led to a 15% reduction in 30-day mortality rates of patients aged 65 years and older compared with those with more than an 8-hour delay in antibiotic administration. Battelman and coauthors⁵ examined 700 cases of CAP admitted through the emergency department (ED) and showed that a delay of more than 8 hours was associated with a prolonged inpatient stay. Houck and coworkers³ found that administration of antibiotics within 4 hours was associated with lower 30-day mortality rates.

In response to these findings, The Joint Commission on Accreditation of Healthcare Organizations published best practice guidelines for the treatment of patients presenting to the ED with CAP.⁶ One of these guidelines recommends that CAP patients receive their first dose of antibiotics within 6 hours of presenting to the ED. Similar recommendations have been made for Canadian hospitals, as the literature has demonstrated the strong relationship between timing of initial antibiotics and patient health outcomes.^{7,8}

Previous research from the United States indicates that rural hospitals may be better at achieving this 6-hour benchmark than urban centres.⁹ The purpose of this study was to determine whether the target door-to-antibiotic (DTA) time of 6 hours or less could be met in a rural Canadian ED.

METHODS

Design and setting

We conducted a retrospective chart review at the South Huron Hospital (SHH) in Exeter, Ont. The SHH provides 24-hour ED care using on-call emergency physicians (EPs). The on-call EP is not required to remain on site but must remain within 15 minutes' travel of the ED when on shift. This facility has a local population of 4000 and experiences an annual ED patient volume of approximately 10 000 patients. We obtained ethics approval from the South Huron Hospital Medical Advisory Committee.

Data collection and analysis

One of the authors conducted the retrospective chart review of patients admitted to the SHH with a diagnosis of pneumonia. The chart review was conducted using the guidelines outlined by Gilbert and colleagues.¹⁰ Specifically, this author was trained in abstraction and the use of standardized abstraction forms. A second investigator monitored abstraction performance weekly through meetings, random revision of 15% of the included charts and verification that the correct data were used for statistical analysis.

All charts of patients discharged between Apr. 1, 2003, and Mar. 31, 2008, that were coded as unspecified pneumonia (International Diagnostic Classification of Diseases, 10th Revision [ICD-10] code J18.9) were obtained for potential inclusion. Cases were excluded if

- the diagnosis of pneumonia was given after admission to hospital
- admission was not through the ED but directly from another hospital
- the patient was returning to the ED after a previous diagnosis of pneumonia and antibiotic prescription
- the patient was already taking antibiotics
- the patient was under 18 years of age
- the time to antibiotic administration was not recorded in the chart

Data collected from each chart included patients' age, sex and Canadian Emergency Department Triage and Acuity Scale (CTAS) score at ED nurse triage. Timeline data for each ED visit was also collected and included the time the patient was triaged, seen by the EP, first administered antibiotics and admitted. Additionally, the type of antibiotic, route of administration, duration of antibiotic treatment, hospital length of stay (LOS) and disposition at discharge were recorded.

The visit timeline data was used to calculate the following timeline intervals: triage to EP assessment (door-to-physician [DTP]), triage to first antibiotic dose (DTA), triage to admission (ED LOS) and admission to discharge (hospital LOS). Summary descriptive statistics were calculated using MedCalc for Windows, version 9.2.0.0 (MedCalc Software).

RESULTS

A total of 320 charts for patients who were admitted to hospital with a diagnosis of pneumonia between Apr. 1, 2003, and Mar. 31, 2008, were obtained from SHH medical records for review (Fig. 1). Of these patients,

143 were eligible for inclusion. Of the 177 patients excluded, 30 were transferred to SHH from another hospital, 84 were diagnosed as inpatients, 8 developed pneumonia in hospital, 36 were already on antibiotics for pneumonia or respiratory illness, 1 patient was palliative and did not receive antibiotics, 1 patient was admitted as “rule-out pneumonia” and did not receive antibiotics until the following day, 8 charts were missing antibiotic time, 2 patients were younger than 18 years and 7 charts were missing.

The median age of included patients was 79 years, and 50.3% were female. Additional data concerning CTAS score at triage, as well as DTP and DTA times, ED LOS and hospital LOS are provided in Table 1.

The majority of patients (81.8%) received their first dose of antibiotics within 6 hours. The median DTA time was 151 minutes (95% CI 132.3–182.4). Oral and intravenous antibiotics were administered equally as often (47.6% of patients), whereas the remaining 4.8% were administered a combination of both. Single-agent respiratory fluoroquinolones were the most commonly used antibiotic (71.4%). Following hospital admission, the majority of patients (79.7%) were discharged home.

Of the remaining 29 patients, 11 (7.7%) died, 11 (7.7%) were transferred and 7 (4.9%) were discharged to a nursing home.

DISCUSSION

The goal of the present study was to determine whether a DTA time of 6 hours or less could be met in a small rural Ontario ED. The median DTA time was 151 minutes (2 h and 31 min), indicating that this benchmark was met. Several factors may have contributed to this positive result.

In Canada, CTAS guidelines are in place to ensure the timely care of ED patients. The median CTAS score of patients in this study was level III (urgent), which indicates that EP assessment of these patients should occur within 30 minutes of triage.¹¹ A previous study conducted at SHH indicated that CTAS times are routinely exceeded, wherein patients triaged as CTAS level III were seen, on average, in 24 minutes.¹² In the current study, the median time to EP assessment was 20 minutes, and this may have contributed to the timely diagnosis of pneumonia and administration of antibiotics. It should also be noted that the provincial median time to EP assessment of CTAS level III patients is just less than 60 minutes.¹³

In an American study by Lutfiyya and colleagues⁹ it was suggested that rural hospitals may provide better quality care than urban hospitals when treating patients with pneumonia. In particular, over 81% of pneumonia patients presenting to rural EDs were administered antibiotics within 4 hours, compared with 69% in urban EDs. Additionally, rural hospitals performed slightly better in providing pneumococcal vaccination and performed similarly on measures of oxygen saturation

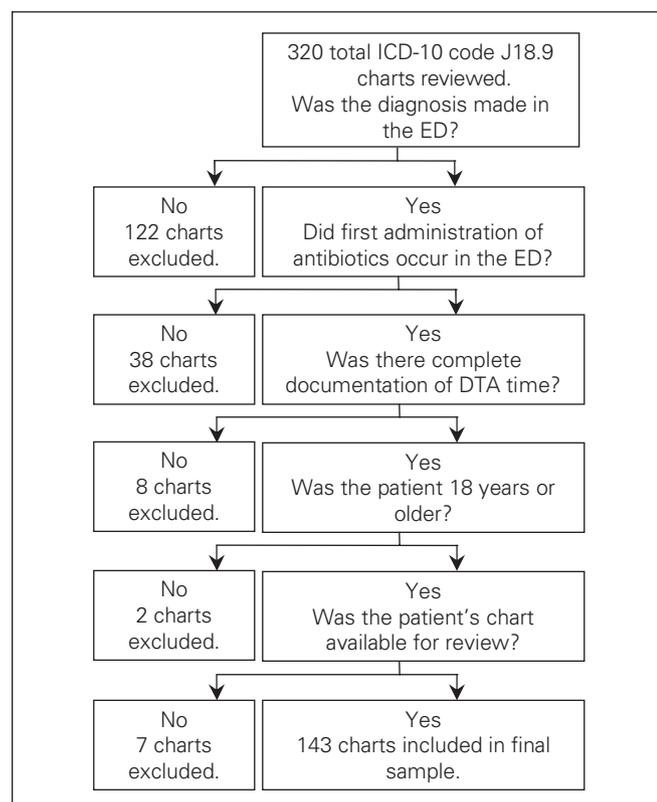


Fig. 1. Derivation of final sample. DTA = door-to-antibiotic; ED = emergency department; ICD-10 = International Classification of Diseases, 10th Revision.

Table 1. Patients’ age, Canadian Emergency Department Triage and Acuity Scale score and visit timeline

Variable	No. of patients	Time, h:min*		
		Minimum	Maximum	Median
Age, yr	143	34	100	79
CTAS score	142†	1	5	3
DTP	129†	0:00	5:30	0:20
DTA	143	0:20	16:50	2:31
ED LOS	143	0:00	9:40	2:20
Hospital LOS, d	143	1	46	4

CTAS = Canadian Emergency Department Triage and Acuity Scale; DTP = door-to-physician; DTA = door-to-antibiotic; ED = emergency department; LOS = length of stay.
 *Unless otherwise indicated.
 †CTAS score and time to physician assessment were missing from some charts.

assessment and smoking cessation counselling. The main reason provided for the difference in antibiotic timing was that rural hospitals experience lower patient volume than urban hospitals, allowing greater opportunity to evaluate and treat patients while adhering to quality measures. Moreover, they felt that because rural hospitals transfer pneumonia patients less frequently than patients with some other conditions (e.g., those with cardiac conditions), they have greater opportunity to develop good quality care of pneumonia patients. Both of these factors may have played a role in the timely administration of antibiotics in this rural Ontario hospital.

According to the Canadian guidelines for the initial management of CAP,^{14,15} the recommended first choice of therapy for patients being admitted to hospital is a single-agent fluoroquinolone. Alternatively, a second-, third- or fourth-generation cephalosporin plus a macrolide can be administered in lieu of a fluoroquinolone. Additionally, the guidelines state that oral agents may be considered if the patient is hemodynamically stable and does not require intensive care. The results from this study are in accordance with these guidelines, as the majority (71.4%) of patients received monotherapy with a fluoroquinolone. An equal percentage of patients received oral or intravenous antibiotic therapy (47.6% each), whereas the remainder (4.8%) received a combination of both. These results may be indicative of the severity of the patients' condition or merely the treatment options available.

In determining DTA guidelines, one of the important patient health outcomes considered was hospital LOS. Currently, the Ontario Ministry of Health allows 4-day funding for hospital-admitted CAP patients.¹⁶ The median LOS for CAP patients in this study was 4 days, indicating that this rural hospital has LOS values on par with those of other Ontario hospitals. Additionally, this result is in accordance with those from Houck and coworkers,³ who found that CAP patients with a DTA time of 6 hours or less had a median LOS of 5 days.

Another outcome central to the determination of the DTA recommendation was patient mortality. Houck and coworkers³ reported an in-hospital mortality rate of 6.3%–7.4% for CAP patients with a DTA time of 6 hours or less. We observed a similar mortality rate in this study, wherein 7.7% of admitted CAP patients died in hospital. After conducting a subgroup analysis of these patients, we found that they had a median age of 76 years, CTAS score of 3, DTP time of 25 minutes and DTA time of 126 minutes, values quite similar to those of the sample population as a whole. As there were no major differences

in demographics or timeline data between patients who died and those who did not, it is likely that these patients were the most ill. However, this subgroup analysis is limited in its ability to develop any significant conclusions, as it consists of a very small number of patients.

The 2 key studies prompting the development of the 6-hour DTA benchmark used 30-day mortality rates as a main outcome measure.^{3,4} These studies were retrospective in nature and each reviewed the charts of nearly 14 000 CAP patients aged 65 years and older. Both of these reviews demonstrated a 15% reduction in 30-day mortality rates following a DTA time of less than 8⁴ and 4 hours,³ indicating DTA time as a significant quality of care indicator and an important benchmark for improved patient outcomes.

As we were not looking to qualify the validity of administering antibiotics within 6 hours, we did not collect 30-day mortality data on the patients included in our study. Although this may be a limitation, our small sample size of 143 would not have been large enough to make any powerful conclusions concerning this outcome measure. However, because the goal of antibiotic administration within 6 hours was met and the median patient age was 79 years, we could reasonably expect to see a similar decrease in mortality rates within this sample.

Limitations

This study was limited by its small sample size ($n = 143$) and single site location at a rural hospital in southwestern Ontario. Further researchers may want to analyze DTA time data from several rural hospitals across Ontario and Canada. As discussed previously, we did not investigate 30-day mortality rates. However, this measure was unnecessary because of the small number of patients included in the study.

Additionally, this study is limited by sources of error common to all chart reviews and retrospective analyses.¹⁰ Some of the errors most relevant to the present study include, but may not be limited to, errors in data from recording data from the chart into the database.

CONCLUSION

This study demonstrated that a DTA time of 6 hours or less is achievable in a rural ED.

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Competing interests: None declared.

REFERENCES

- Canadian Institute for Health Information. *Respiratory diseases in Canada*. Ottawa (ON): The Institute; 2001. Available: www.phac-aspc.gc.ca/publicat/rdc-mrc01/pdf/rdc0901e.pdf (accessed 2009 Jan. 19).
- Seymann GB. Community-acquired pneumonia: defining quality care. *J Hosp Med* 2006;1:344-53.
- Houck PM, Bratzler DW, Nsa W, et al. Timing of antibiotic administration and outcomes for Medicare patients hospitalized with community-acquired pneumonia. *Arch Intern Med* 2004;164:637-44.
- Meehan TP, Fine MJ, Krumholz HM, et al. Quality of care, process, and outcomes in elderly patients with pneumonia. *JAMA* 1997;278:2080-4.
- Battleman DS, Callahan M, Thaler HT. Rapid antibiotic delivery and appropriate antibiotic selection reduce length of hospital stay of patients with community-acquired pneumonia: link between quality of care and resource utilization. *Arch Intern Med* 2002;162:682-8.
- Specifications manual for national hospital quality measures, version 2.3*. Oakbrook Terrace (IL): The Joint Commission/Centers for Medicare & Medicaid Services; 2007. File 2zb_PN5abc.pdf. Available: www.qualitynet.org/dcs/ContentServer?c=Page&pagename=QnetPublic%2FPage%2FQnetTier3&cid=1163010419895 (accessed 2009 Jan. 19).
- Ziss DR, Stowers A, Field C. Community-acquired pneumonia: compliance with centers for Medicare and Medicaid services, national guidelines, and factors associated with outcome. *South Med J* 2003;96:949-59.
- Beneson R, Magalski A, Cavanaugh S, et al. Effects of a pneumonia clinical pathway on time to antibiotic treatment, length of stay, and mortality. *Acad Emerg Med* 1999;6:1243-8.
- Lutfiyya MN, Bhat DK, Gandhi SR, et al. A comparison of quality of care indicators in urban acute care hospitals and rural critical access hospitals in the United States. *Int J Qual Health Care* 2007;19:141-9.
- Gilbert EH, Lowenstein SR, Koziol-McLain J, et al. Chart reviews in emergency medicine research: Where are the methods? *Ann Emerg Med* 1996;27:305-8.
- Beveridge R, Clarke B, Janes L, et al. Canadian Emergency Department Triage and Acuity Scale: implementation guidelines. *CJEM* 1999;1:S3-S32.
- Vlahaki D, Milne WK. Rural hospital CTAS times [abstract]. *CJEM* 2007;9:207.
- Canadian Institute for Health Information. *Understanding emergency department wait times. Who is using the emergency department and how long are they waiting?* Ottawa (ON): The Institute; 2005.
- Mandell LA, Thomas JM, Grossman RF, et al. Summary of Canadian guidelines for the initial management of community-acquired pneumonia: an evidence-based update by the Canadian Infectious Disease Society and the Canadian Thoracic Society. *Can J Infect Dis* 2000;11:237-48.
- Mandell LA, Marrie TJ, Grossman RF, et al. Canadian guidelines for the initial management of community-acquired pneumonia: an evidence-based update by the Canadian Infectious Diseases Society and the Canadian Thoracic Society. *Clin Infect Dis* 2000;31:383-421.
- Canadian Institute for Health Information. *DAD resource intensity weights and expected length of stay for CMG*. Ottawa (ON): The Institute; 2005.

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