The Impact of Antimicrobial Stewardship on Nosocomial Clostridium Difficile (CDI) Infection.

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ABSTRACT

Background: Antimicrobial stewardship programs (ASP) have been widely implemented worldwide in an effort to decrease inappropriate antibiotic use, the risk of resistant organisms and C. difficile infection (CDI).

Objective: The objective of this study was to examine the impact of hospital-wide implementation of ASP on the incidence of hospital acquired CDI (HA-CDI).

Methods: An interrupted time series study was conducted at Sunnybrook Health Sciences Centre (SHSC) using prospectively collected SHEA defined monthly HA-CDI and community acquired-CDI (CA-CDI) incidence provided by institutional infection prevention and control, and patient population data from the SHSC ASP electronic database. The study time frame was divided into 63 monthly intervals from September 2008 to November 2013. A segmented autoregressive integrated moving average model (ARIMA) was used to evaluate the two different periods in the time series using the pre intervention period as the reference. CA-CDI was examined using the same method, to reduce the risk of bias attributable to secular trends.

Results: Compared to the pre intervention period, cumulative reduction in HA-CDI incidence of 41 per 1000 patients (27%) was observed at the end of the 37 month intervention period (study month 63) with a 95% CI between 10 (7%) and 71 (47%) per 1000 patients (P=0.006). The reduction in cumulative HA-CDI incidence did not plateau and was sustained throughout the post intervention period. Conversely, CA-CDI remained unchanged from the pre- to post-intervention period (p=0.43).

Conclusions: Our study demonstrated a sustained decrease in cumulative HA-CDI incidence following ASP implementation. These findings provide high level evidence to support the beneficial effect of ASPs on institutional incidence of CDI.

OBJECTIVES

• The objective of this study was to examine the impact of hospital wide implementation of an Antimicrobial Stewardship Program (ASP) on the incidence of hospital acquired-CDI (HA-CDI).

METHODS

Study Setting and Design

An interrupted time series study was conducted at Sunnybrook Health Sciences Centre (SHSC), a 1200 bed tertiary teaching hospital, in Toronto, Ontario, Canada.

Prospectively collected SHEA defined monthly HA-CDI and community acquired-CDI (CA-CDI) incidence was provided by institutional infection prevention and control, and patient population data was extracted from the SHSC ASP electronic database.

The study time frame was divided into 63 monthly intervals from September 2008 to November 2013. Institutional roll-out of ASP from level III critical care units to include hospital wards, using a stepped-wedge randomized design, began 1st November 2010 and was complete by 1st April 2012.

Data Analysis

Using the intervention date of 1st November 2010, a controlled interrupted segmented time series with a pre intervention period of 26 months and a post intervention period of 37 months was constructed. A segmentated autoregressive integrated moving average model (ARIMA) was used to evaluate the two different periods in the time series using the pre intervention period as the reference. The incidence of HA-CDI in each interval was standardized with respect to overall patient population during each month. CA-CDI was examined using the same method to reduce the risk of bias attributable to secular trends. The statistical analysis was conducted using R version 3.2.0 and SAS 9.2.

RESULTS

Figure 1. Incidence of Nosocomial C. difficile Infection.

Figure 2. Impact of Antimicrobial Stewardship on 6 month moving average of Hospital Acquired C. difficile Infection Incidence.

Figure 3. Impact of Antimicrobial Stewardship on reducing cumulative Nosocomial C. difficile Infection incidence.

Figure 4. Impact of Antimicrobial Stewardship on cumulative community C. difficile Infection incidence.

DISCUSSION

• Our study demonstrated a sustained decrease in cumulative HA-CDI incidence following ASP implementation.

• The stability of the 26 month pre-intervention HA-CDI levels and unchanged CA-CDI over the pre- and post-intervention period (63 months) decreases the risk that our results were due to either seasonal variations or secular trends.

• Although causation cannot be directly proven, given lack of other influencing trends, the remarkable temporal association, and the reasonable mechanistic plausibility of the effect, we believe that the two events are directly related.

• More importantly, the temporal nature of the association suggests that the effect of ASP on nosocomial CDI is sustained with time.

LIMITATIONS

• This was an ecological study restricted to one site.

• Due to the ecological nature of the study, we were unable to adjust for many factors that could have contributed, such as individual hand hygiene practices, upgrades to environmental cleaning, increased clinical education, and advances in laboratory detection.

CONCLUSIONS

• Our study demonstrated a sustained decrease in cumulative HA-CDI incidence following ASP implementation.

• These findings provide high level evidence to support the beneficial effect of ASPs on institutional incidence of CDI.

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DISCLOSURE

No author has any conflict of interest related to this study.