Public Health Impact of Hospital-Acquired Infections on Traumatic Patients

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INTRODUCTION

Blunt traumatic injuries leading cause of death, with TBI and hemorrhage >91% of all deaths, amounting to \$37.8 billion per year. Traumatic patients are at high risk for developing infection, where infected patients are more likely to have been ventilated or have had multiple surgical procedures, exposing to ventilator-associated pneumonia and other infections. Elevated cytokine levels post-infection affect patient mortality, making it a large public health issue. Lack of data centered around gender and ethnicity confounds the impact of this disease. Large Pittsburgh hospitals with capacity >300 report worse infection ratings than US baseline measures. Risk factors for infection including age and duration of hospital stay, directly affecting severity of traumatic injury. Infection should not be viewed as a confounder impacting mortality but rather an outcome arising from trauma.

HYPOTHESIS

Traumatic injury increases susceptibility for hospital-acquired infections, causing elevated cytokine expression in infected trauma patients that correlate with health outcomes and 30-day mortality.

METHODS

Patient datasets acquired from STAAMP and PAMPer clinical studies [University of Pittsburgh site] incorporating infections was used; cytokine expression levels were measured at 0hr, 24hr, and 72hr following polytrauma (n=342). Patients were stratified by the number of infections during the 30-day outcome period to relevant distributions. Outcomes were defined with 'early-nonsurvivors' with mortality within 24 hours, 'non-resolving' is death between 24hr to 30 day, and 'resolving' is a positive outcome past 30-days. Common types of hospital-acquired infections were stratified to identify primary infections. Cytokine levels were stratified to group together various mortality outcomes with number of infections, resulting in 7 levels of comparison through K-means clustering across all patient data sets. Incidence of infection rates were stratified by prior literature based on blunt vs. penetrating traumatic mechanisms, with a great majority of patients suffering with blunt trauma. This data set is not stratified by gender or age, with a large proportion of the population with individuals over 50 years

RESULTS

Infection distribution of the patient data set reveals the highest form of infection is organ-localized infection, followed by pneumonia related infection. This is consistent with prior literature analysis as conducted by meta-findings, with worse surgical site infection incidence rates and catheter related infections rates than the average reported US rates, highlighting the need for better management of infection prevention.

Infection Prevalence per Outcome

K-means clustering reveals lower levels of TNF, IL6, IL8, IL10 noted in resolving groups with infection; cytokines normally associated with susceptibility to infections and endothelial/parenchyma cell damage leading to MODS. Higher levels of cytokines were found in inflammatory pathways which lead to septic shock following polytrauma, which causes premature death from injuries. Adult trauma cases jump 25 to 30% during summer times, with blunt trauma from elderly populations prevailing through this data set. Solutions to combat this prevailing public health issue with such high mortality rates and very limited knowledge must incorporate not only reducing polytrauma but also limiting the incidence of infection in hospitals. Techniques involving safer life style choices, but also increasing handwashing, cleaning and proper disinfection of medical tools and equipment, and minimizing contamination in the OR, as well as environmental cleanliness between patients and eliminating understaffing, are all valid choices. Understanding infection pathology in traumatically injured patients would greatly improve mortality as a public health significance.

Infection Distribution in Trauma Patients (STAAMP/PAMPer)

Early stratified data shows a higher number of non-resolvers with patients with one infection, and a greater number of resolvers with two infections. Such data indicates the higher public health hazard at hand. With 11 hospitals in Pittsburgh reporting 100% worse than baseline incidence of assisting surgical-site infections, this data shows that individuals with one infection have poor prognosis; individuals who are more likely to live past 24 hours are more likely to be exposed to more infections due to length of stay. Direct comparison of one and two or more infections reveal that there are some individuals who had multiple infections and were early non-survivors, indicating that aggressive infection within 24hrs results in higher incidence of mortality.

RESULTS

CONCLUSIONS

Polytrauma is found to increase the incidence of infections acquired within a hospital setting, as traumatically injured patients pose greater risk factors and vulnerability for pneumonia and sepsis. Greater non-resolving outcomes were found in patients with infections, with elevated cytokines supporting poor outcomes when compared to the average data set. UPMC as the number one Level I Trauma center and leader in clinical trials should seek to eradicate this impeding public health issues with solutions addressing both trauma and infection prevention.

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