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Double Jeopardy: Use of Contact Isolation in Trauma Patients is Significantly Associated with the Development of Ileus

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Abstract

Background: Trauma patients are at risk for malnutrition due to metabolic needs associated with injuries and surgery. Ileus may result in improper withholding of vital enteral nutrition. Contact isolation precautions (CI) are a set of restrictions intended to prevent spread of certain organisms. Our goal was to study a possible association between CI and development of ileus among trauma patients.

Methods: Our Level I trauma center's institutional trauma database was queried for all patients evaluated between January 1, 2011 and December 31, 2012. Data collected included demographics, comorbidities, and development of ileus. A separate infection control database was used to determine patients on CI. Unadjusted relationships were determined by chi-square. Logistic regression was then used to adjust for patient and injury characteristics.

Results: A total of 4,423 trauma patients were evaluated during the study period; of these, 4,317 (97.6%) patients had complete records and were analyzed. CI was in place for 251 (5.8%) patients; 4,066 (94.2%) were not isolated. In the CI group, 14 (5.6%) had ileus vs. 74 (1.8%) in the non-CI group ($p < 0.0001$; OR 3.19; 95% CI 1.77-5.73). Next, logistic regression was used to adjust for potential confounders. Gender, ISS, and CI were all statistically significant ($p < 0.05$) in their association with ileus.

Conclusion: The use of CI in trauma patients is significantly associated with the development of ileus. A growing body of evidence suggests that CI among this population, which is already at greater risk of malnutrition and caloric deficit, should be re-evaluated.

Keywords: Contact isolation; Ileus; Trauma; Protein calorie malnutrition

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Background

Paralytic ileus is both an important and common complication among trauma patients. The pathophysiology of ileus is complex; and its frequency among trauma patients is likely explained by a combination of pro-inflammatory factor release inherent in trauma, the use of abdominal surgery, and reliance on narcotics for pain control with major trauma [1, 2]. The complications of prolonged ileus can be devastating and include decreased protein and calorie intake, bowel ischemia, intraluminal bacterial overgrowth and even sepsis [3, 4]. Therefore, paralytic ileus frequently places patients who are already at notoriously high

risk for complications throughout their stay at further risk for devastating infectious sequelae.

The diagnosis of ileus has important ramifications for nutritional status among all hospitalized patients. Literature suggests that early oral feeding should not be withheld following surgery and some studies have suggested that early oral feeding or other techniques that stimulate the gut may actually speed functional recovery and attenuate paralytic ileus [5-7]. However, even fairly recent studies have shown that many providers continue to withhold nutrition until return of bowel function or another arbitrary threshold is met as a surrogate for the same, despite benefits of established protocols [8, 9]. Trauma patients are at

particularly high risk for protein-calorie malnutrition due to very high metabolic needs associated with traumatic wounds and surgery. Importantly, malnutrition and failure to meet target feeding goals are associated with worse outcomes among these critically ill patients, and any interruption of feedings may come at especially great cost to this patient population [10, 11].

Contact isolation is a series of precautions designed to prevent the transmission of medically important organisms in the inpatient setting. After a patient has been designated as colonized or infected with a potentially transmissible organism, typical practice in addition to standard universal precautions includes the requirement that all healthcare workers and visitors don gloves and a gown prior to entering the patient's room. Many institutions also restrict isolated patients to their room for all non-medically essential activities (including occupational and physical therapies) throughout their stay. Recently, some potentially negative side effects of contact isolation have been described [12, 13]. While most of this literature has focused on general hospital inpatients, more recent studies have begun to show that there may be an especially negative impact on surgical and trauma patients [14, 15]. Specifically in the trauma patient population, it is also clear from prior work from our group that the use of contact isolation precautions has significant implications for the morbidity of patients [16, 17]. In the current study, we aimed to investigate a possible association between the use of contact isolation precautions and ileus among trauma patients.

Methods

Our Level I trauma center collects patient, injury, and hospital stay data on all patients evaluated by its service. We queried this database for all trauma patients between and inclusive of January 1, 2011 and December 31, 2013. Data recorded included patient demographics, injury severity, and medical comorbidities for each patient. Development of ileus was a clinical diagnosis that was based on provider notes included in each patient's chart and subsequently recorded in the database. For categorical variables, the chi-square test was used to determine the equivalence of the contact precautions (exposure) and non-isolated (control) groups. For continuous variables, the Mann-Whitney U-test was used to determine the relative equivalence of exposure and control groups.

Using a unique medical record number, each patient's record included in the study was cross-referenced to an institutional infection control database that tracks contact isolation status. Any type of isolation precautions at any point during the patient's stay qualified the patient as isolated for the purposes of our current study (i.e., droplet, aerosol, and contact precautions were all recorded and treated equally). Contact isolation regularly constitutes the vast majority of our institution's isolated patients. Precautions for these patients include the requirement that all visitors and members of the healthcare team don gloves and a gown before entering the patient's room; and that the patient remains restricted to their room for all activities not deemed medically essential (including physical and occupational therapy evaluations and exercises).

Logistic regression was then performed to evaluate the association between contact isolation and ileus while considering other risk factors; such as age, injury severity, and medical comorbidities. $P < 0.05$ was taken to indicate statistical significance. All statistical analyses were performed using SAS JMP 11 (Cary, North Carolina).

Results

Of the 4,423 patients evaluated by the trauma service during the two-year study period, 4,317 (97.6%) had complete records and were included in the study. Of those included in the study, 251 (5.8%) patients were on contact isolation precautions; while 4,066 (94.2%) were not. Chi-square revealed unadjusted, statistically significant associations between contact isolation (exposure) and age, ISS, pre-existing respiratory and cardiac diseases, and ileus (outcomes, **Table 1**). The p-value for all associated outcomes was $p < 0.0001$, with the exception of pre-existing respiratory disease ($p = 0.0494$). The odds ratio of developing ileus while isolated was 3.19 with a 95% confidence interval of 1.77-5.73. Outcomes that were not statistically significant in their unadjusted association with contact isolation included gender, obesity, and history of cancer.

Logistic regression revealed that contact isolation, male gender, and ISS were all associated with ileus while adjusting for relevant confounding variables (**Table 2**). With consideration of all covariates described; age, respiratory disease, and heart disease were no longer statistically significant independent variables. Cancer and obesity remained non-significant, as well.

Conclusion

The use of contact isolation precautions was independently associated with ileus among trauma patients. Contact isolation has been associated with fewer provider contacts and increased

Table 1 Unadjusted comparison of contact isolation (exposure) vs. unisolated (control) groups.

| | Contact Isolation | Not Isolated | p-Value |
|------------------------|-------------------|--------------|-----------|
| n | 251 | 4,066 | |
| % Ileus | 5.6% | 1.8% | <0.0001* |
| Median age | 60 | 45 | < 0.0001* |
| % Male | 62.15% | 65.54% | 0.27 |
| ISS | 17 | 9 | < 0.0001* |
| % Resp Disease | 13.55% | 9.64% | 0.0494* |
| % Heart Disease | 17.53% | 8.21% | < 0.0001* |
| % Cancer | 2.39% | 1.38% | 0.17 |
| % Obesity | 8.37% | 6.17% | 0.18 |

Table 2 Logistic regression model for ileus as outcome.

| | p-Value | Odds-Ratio |
|---------------------|-----------|----------------------|
| Contact Isolation | 0.013* | 2.18 [1.13-3.92] |
| Age | 0.38 | 1.0048 [0.99-1.1015] |
| Male Gender | 0.0036* | 2.21 [1.33-3.87] |
| ISS | < 0.0001* | 1.040 [1.022-1.058] |
| Respiratory Disease | 0.87 | 1.062 [0.49-2.056] |
| Heart Disease | 0.67 | 1.17 [0.54-2.33] |
| Cancer | 0.12 | 2.59 [0.61-7.53] |
| Obesity | 0.15 | 1.68 [0.77-3.23] |

risk of complications, but this is the first such study to show a connection with ileus. Importantly, the association between contact precautions and ileus remained both significant and of considerable magnitude even when controlling for potential confounders, such as injury severity and age. Other risk factors associated with the outcome of ileus predictably included male gender and ISS. We believe that these are unsurprisingly associated with ileus, as they represent overall burden of illness as well as specific threats to feeding and ambulation. Male gender is likely to be inescapably associated with and representative of severity of injury; as the majority of severely injured trauma patients are men.

One potential mechanism for the association between contact isolation and ileus is less frequent and delayed ambulation following surgery. Although the relationship between ileus and delayed ambulation is complex and perhaps not directly causal, early ambulation has long been suggested as accelerating functional recovery after surgery, and is a critical component of current enhanced recovery after surgery (ERAS) protocols that have been demonstrated to minimize lengths of stay and improve overall outcomes [18, 19]. As the isolated patient is restricted to their room throughout ambulation trials, we believe that this policy likely discouraged early return to effective mobilization both directly (i.e., due to the small space of the hospital room) and indirectly by effecting fewer occupational and physical therapy visits. Although there should ideally be no difference in the quality or quantity of medical attention that isolated patients receive from staff, evidence has shown that these patients typically receive fewer visits of shorter duration from both nursing and physician staff throughout their stay [12]. This is likely an effect of the increased burden of each visit due to the requirement of donning a gown and gloves with each visit.

Another possible mechanism for increased risk of ileus in association with contact isolation is likely to be explained by fewer interactions with and less oversight by clinical nutritionists and other dietary staff. For both best practice and American College of Surgeons trauma center recognition, multidisciplinary trauma teams at Level I and Level II trauma centers must be staffed by nutritionists [20]. Unsurprisingly, trauma center staffing by dedicated nutritionists has been associated with a range of improved outcomes, as these critically ill patients are at great risk for both overall and protein-calorie malnutrition states. Therefore, the same burdens imposed by contact isolation that result in fewer contacts by other staff likely affect nutrition

support team staff in the same manner. As trauma patients are among the most vulnerable in the hospital, these effects can be expected to be most pronounced in their effects on these patients' outcomes. Therefore, we believe that the association between isolation and ileus is likely explained in part by this reduced attention. Importantly, it also means that these patients are also likely to be profoundly affected by the reduced attention to their nutrition goals and status.

Limitations of our current study include its retrospective design. As a consequence, only association can be inferred from the results. However, we believe that the appropriately controlled multivariable analysis increases the applicability of our results. Additionally, medical ethics and hospital policy dictate that any randomized controlled trial of a potentially harmful and costly intervention (i.e., contact isolation precautions) among healthy patients is unlikely; making observational studies such as this one the best resource available to answer such research questions.

Additionally, it is possible that the association between contact isolation precautions and ileus is due in part to the isolated group being infected or colonized with those pathogens that caused their isolation. Although we did not formally study the pathogen composition of the isolated group, we described a representative sample that was published elsewhere; revealing that the majority of patients were isolated because of a positive MRSA swab from their nares [21]. This was part of a nearly universal screening protocol for hospital inpatients, and resulted in most patients being asymptomatic carriers. This is consistent with the adopted practice of many infection control programs at other institutions, and many states now require some form of MRSA screening in hospitals. Some patients at our own institution were even isolated without any specific reason listed in their electronic medical record. Therefore, we contend that it is unlikely that colonization patterns in this group caused a durable or significant effect on the outcome studied, as the majority of patients did not have an active infection responsible for their isolation.

In summary, we believe that we have demonstrated a powerful and independent association between contact isolation precautions and ileus among trauma patients at our Level I trauma center. As evidence continues to demonstrate unintended and potentially harmful consequences of contact isolation, institutions that continue to practice particularly restrictive precautions for many patients must weigh these consequences for individual patients against potential benefits for the inpatient population as a whole.

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