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Risk Factors For Unplanned Readmission In Older Adult Trauma Patients In Our Institute

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Abstract
Objective- *To determine the unplanned admissions after hospitalization for trauma and risk factors for this readmissions and identifying the most common cause for the same.*
Material and Methods- *This retrospective cohort study includes all cohort patients ages 55 and above who got admitted in Krishna Institute of Medical Sciences, Karad between September 2014 to November 2016. Data is entered for all patients who have traumatic diagnosis ICD-9.*
Results- *The ICD-9 diagnosis codes that were recorded for the readmissions in this study were compiled, and the 3 codes that were noted most commonly used were the same for all readmission end points; atrial fibrillation, anemia ("post-hemorrhagic" or "other/ unspecified"), and congestive heart failure ("acute on chronic" or "unspecified"). These diagnoses accounted for a mean of 13%, 13%, and 11% of readmission diagnoses, respectively.*
Conclusion- *Our study shows post traumatic unplanned readmissions in older adult causes huge health care burden even after a year of discharge especially in patients who had history of falls, severe head trauma, admission in ICU or those who could not be discharged home independently.*
Keywords- *unplanned readmissions, older trauma adults, ICD-9.*

INTRODUCTION

Ageing of population in most countries increases demand on social and healthcare services. Trauma is one of the indicator of this increased consumption of resources in hospital admission and readmission. Elderly patients are overly represented in trauma population and often predicts inferior outcome after trauma both in morbidity and mortality[1,2,3,4]. Factors that might contribute to poor outcomes include co-morbidities, increased severity of injury[7,8] and lack of physiological reserve[9].

Older adult trauma places a burden in healthcare system that is increasing relevant and private funders recognise an attempt to curtail the increasing cost of medical care. Hospital readmission is a substantial contributor to this financial strain[10,11].

Factors that contribute to readmission have been studied extensively in certain medical population[13.14,15]. However surgical patients (including trauma patients) have not received the same level of attention[16,17,18]. We undertook this study with aims to determine the unplanned admissions after hospitalisations for trauma and

risk factors for this readmissions and identifying the most common cause for the same.

METHODOLOGY

This retrospective cohort study includes all cohort patients ages 55 and above who got admitted in Krishna Institute of Medical Sciences, Karad between September 2014 to November 2016. Data is entered for all patients who have traumatic diagnosis ICD 9 (diagnosis codes 800-904, 910-915, 994.1, 994.7 or 994.8).

Patients with only hip or femoral neck fracture and patients only with burns were not included in this study. Patients who survived their index trauma admission and at risk of readmission were included in this study. There is a record providing patients an injury characteristics and features of index trauma admissions. Previous literature is not same with respect to strata used for age when examining older adult injury[9,17,19]. Hence this study uses this strata:- 55-64, 65-74, 75-84 and 85+ of age.

Readmission data maintained in trauma registry CHARS only 1st non-elective readmissions after index trauma hospitalisation was included to maintain focus on unexpected re- hospitalisations.

Readmission rates were then calculated for 30 days, 6 months and 1 year after discharge from index hospitalisations. CHARS also provide ICD 9 codes for readmission of subjects.

Due to use of competing risk analysis we were interested in deaths that occurred outside hospital without readmission of patients. So we calculated cumulative numbers of readmissions/deaths occurred without readmissions/people who survived without readmission.

Primary outcome of study is the cumulative percentage of patients with unplanned readmi-ssions by each of the study time points as well as the risk factors for death without readmissions

Statistical Analysis

Study population described according to patients, injury and index hospitalisation. Characteristic factors associated with increased risk of readmission was identified using multi variable competing risk regression model. We assumed that outside hospital death after trauma would be more in this population. Hence using competing risk regression with time specific readmissions as outcome of interest and death without earlier hospitalisation as competing event.

To keep a track on frequency of outside hospital death we used reverse model in which death without earlier readmission were outcomes of interest. Readmission was competing event. This reverse model can explain factors associated with readmission[21]. At the time of index hospitalisation following variables are determined.

Age, sex, Charlson comorbidity index, mechanism of injury, injury severity score, and maximum head abbreviated injury score. Trauma centre level, ICU admission, modified functional independence measure score at index discharge and discharge disposition location[22,23].

Approximately 11% of values for modified values FIM were missing and were therefore imputed before regression using chained equation with total of 5 imputations[24,25].

Relative risk of readmissions between groups at any moment in a given time is indicated by competing risk regression report sub hazard ratios. (CSHR)

SHR-1 indicated no difference of risk of readmissions of groups.All statistical analysis were performed using Stata version 12.0. Statistical significance for an SHR was defined as 95% CI of the SHR excluding 1.0.

RESULTS

In 2014-2016, there were 1712 adult patients, of which 878 (51.30%) were aged 55 years and older. The 815 patients who survived their index trauma hospitalization were the population of interest in this study. At 30 days from index hospitalization discharge, 44 patients had already had an unplanned readmission (5.4%), with 87 (10.7%) being readmitted by 6 months and 124 (15.2%) being readmitted by 1 year.

The multivariable competing risk regression model identified several factors that placed patients at significantly increased risk for readmission by each of the 3 study time points.

For mechanism of injury, falls were a risk factor for readmission (30 day SHR ¼ 1.1; 95% CI, 1.011.45; 6-month SHR ¼ 1.20; 95% CI, 1.151.48; 1-year SHR ¼ 1.29; 95% CI, 1.161.43). Severe head injury (indicated by a maximum head AIS >3) was strongly predictive of readmission at all end points (30-day SHR ¼ 1.24; 95% CI, 1.041.73; 6- month SHR ¼ 1.31; 95% CI, 1.181.70; 1-year SHR ¼ 1.37; 95% CI, 1.241.73). Likewise, admission to the ICU was a risk factor for rehospitalisation, although the magnitude of this risk decreased with time (30-day SHR ¼ 1.12; 95% CI, 1.111.58; 6-month SHR ¼ 1.05; 95% CI, 1.111.40; 1-year SHR ¼ 1.16; 95% CI, 1.051.28). Patients who had their index admission to a Level III/IV/V trauma centre were less likely to be readmitted than those who were at Level I or II centres (30-day SHR ¼ 0.58; 95% CI, 0.680.89; 6-month SHR ¼ 0.71; 95% CI, 0.740.88; 1-year SHR ¼ 0.69; 95% CI, 0.730.85).

As compared to being discharged at home independently after index trauma admission, patients who were discharged home with help or to skilled nursing facilities (SNFs) were more likely to be readmitted in the follow-up period, particularly those discharged to SNFs (30-day SHR ¼ 1.22; 95% CI, 1.201.73; 6-month SHR ¼ 1.39; 95% CI, 1.411.79; 1-year SHR ¼ 1.34; 95% CI, 1.391.71). Other variables examined either did not increase or decrease the risk of readmission, or did so variably by time end point.

As compared to the multivariable analysis of death without first having been readmitted (readmission being the competing event), the risk factors at all 3 time end points were older age, male sex, falls as mechanism of injury, functional impairment (modified FIM scores of 10), and disposition to home with helper to rehabilitation.

The ICD-9 diagnosis codes that were recorded for the readmissions in this study were compiled (up to 20 per readmission), and the 3 codes that were noted most commonly used were the same for all readmission end points; atrial fibrillation, anemia ("post-hemorrhagic" or "other/ unspecified"), and congestive heart failure ("acute on chronic" or "unspecified"). These diagnoses accounted for a mean of 13%, 13%, and 11% of readmission diagnoses, respectively.

DISCUSSION

Older patients have high risk of readmission after trauma and the risk maintains years after index admission. This study used competing risk regression and shows that patients with the high risk of readmission in year after injury were those who had falls/severe head injury/ index ICU admission.

Previous studies shown that 30-day readmission rates after trauma range from 4.2% to 13.3% [17, 18, 26]. Spector and colleagues[17] focused on older adults, finding a 30-day readmission rate which was higher than current study (13.3% vs 7.9%) [17]. This difference may be accounted for by the fact that their study cohort was older (65 years and older) so more prone to rehospitalisation.

SNF discharge was the strongest independent predictor of readmission in this study, in terms of magnitude of SHR, which is important, considering that 45% of the patients were discharged to an SNF. Previous data suggests that SNF shows an increased risk of both hospital readmission and post-hospital death in all-age trauma patients[2] as well as older trauma patients[27].

Despite being developed to predict poor outcomes in terms of in-hospital mortality, [28] patients with high Injury Severity Scores (ISS) were less likely to be readmitted compared to those with mild injury (ISS ¼ 0 to 8). Other studies have similarly suggests ISS has been an inconsistent predictor of longer-term outcomes after trauma[2,29]. On the other hand, the apparent "protective" effect of increasing ISS can be seen in a population where number of patients experiencing the competing event is high[20,21]. This is understood by examining the reverse competing risk model of death without readmission. Patients with high ISS scores were at increased risk of out hospital death, possibly eliminating any increased risk of readmission from a statistical point of view[21].

Multivariable model shows that patients functionally severely dependent who were on index discharge (modified FIM scores of 3 to 7)

were less likely to be readmitted as compared to completely independent (modified FIM scores of 11 to 12). High risk of mortality seen with severe functional impairment because there is high risk of death in first admission itself.

Patients admitted had most common medical diagnosis than surgical. Although the use of the CHARS database did not allow differentiation of the primary diagnosis for each readmission from all other diagnoses, it is interesting to note that the most common diagnosis were largely medical rather than surgical in nature. Similarly, Jencks colleagues[13] found that >70% of 30-day readmissions in a mixed surgical population were due to medical causes.

Several interventions proven benefit in improving in hospital outcomes of injured elderly patients which include co management by geriatricians and surgeons and creation of formal geriatric trauma consultation services[31,32]. This lead to the creation of geriatric trauma centres, with specialized personnel (including full-time geriatrician coverage), practice standards for conditions common in older populations, and close ties with post-acute care facilities[33]. The effect of these efforts to reduce unplanned readmissions has not been examined in older adult trauma patients; but in view of the most common readmission diagnoses in the current study, it is possible that similar steps would have an impact.

Due to current health care related financial constraints, there is a increasing focus on value-based health care, the premise of which is to improve health care quality, outcomes and costs. By keeping a check on payments to hospitals for additional readmissions, the Centres for Medicare and Medical aid Services is hoping to promote improvements in patient health and reduce expenses. The use of these monetary penalties for hospitals with excess readmissions is dependent on two foregrounds: first is that readmission is indicator of quality of care, and the second is that hospitals have the ability to keep a check on proportion of readmissions. Regrettably, the relationship between quality of care throughout an index admission and subsequent readmission is inconsistent[12, 16, 34, 35]. Likewise, the evidence for the avoid ability of readmissions is also flexible,[36] which might be due to the subjectivity that is characteristic in determining preventability[37].

This study is based on the use of competing risk analysis, explaining the frequency with which death without an earlier readmission happened. Many studies that scrutinise readmissions using survival analysis techniques censor patients who die without having being readmitted. But, in present study populations where death is comparatively common, it is more appropriately dealt as a competing event (one that precludes future results of interest). Studies have presented that in cases in which standard survival analysis is used and competing events are not treated suitably from a statistical stance, risk of the results of interest can be meaningfully overestimated[21]. Competing risk analysis was selected in this study to reduce the prospect of overestimating the relative risk of readmission amongst groups, based on the co-variants of concern.

Moreover, earlier studies have depicted that readmissions occur at hospitals other than the index establishment[26]. The detail of the CHARS database also allowed exclusion of elective readmissions, hence targeting unplanned rehospitalisation.

The study has a number of restrictions, the first of which is its retrospective nature. Retrospective studies like this can be restricted in their documentation of patient co morbidities, likely a vital contributor to readmission risk. This is shown by the fact that huge majority of our older adult patients had a Charlson Comorbidity Index Score of 0, showing no comorbidities. Furthermore, the readmissions that were taken in this study did not comprise visits to the emergency department, admissions under observation status, thus underestimating the health care use burden. Lastly, the CHARS database does not depict the primary admitting diagnosis, with obvious consequences for assessing the inevitability of readmissions in this study.

CONCLUSION

Our study shows post traumatic unplanned readmissions in older adult causes huge health care burden even after a year of discharge especially in patients who had history of falls, severe head trauma, admission in ICU or those who could not be discharged home independently. The cause for readmission were likely multifactorial but most of them are medical comorbidities suggesting that targeting high risk populations with optimisations of such conditions as well as ensuring adequate communication of care plans with patients care provider can reduce preventable readmissions.

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