INTRODUCTION

Length of hospital stay (LOHS) can be defined as the total length of time a patient stays in the hospital for the purpose of treatment, measured as the interval (usually in days) from admission to discharge. In the Orthopaedic discipline, specifically complex polytrauma related morbidities, is on the rise. In this regard, LOHS can have important effects on the cost of treatment, rate of infection, risk of bed sore and other co-morbidities, specifically amongst the orthopaedic inpatients.

Various studies conducted far and wide have reported fairly varied ranges of LOHS in these patients. In two separate studies conducted in Canada and the USA, average LOHS as high as 9.4 days and as low as 4.3 days were reported with significant associations with age, gender, co-morbidities and insurance status. In two other studies conducted in Iranian population, mean LOHS of 5.4±6.1 days and 6.8±8 days were reported. In the context of Nepal, Mishra et al. observed that the average LOHS among orthopaedic inpatients was 10.5 days and was associated with age, gender, mode of payment and type of cases (traumatic/non traumatic). There is paucity of literature regarding LOHS and associated factors to influence the LOHS in our context. So, this study was undertaken to find out the LOHS among the orthopaedic inpatients in a tertiary care teaching hospital and variables affecting it.

METHODS

This was a retrospective study conducted in the department of orthopaedic surgery at College of Medical Sciences and Teaching Hospital (COMS-TH), Bharatpur, Chitwan, Nepal. After obtaining ethical clearance from the Institutional Review Committee of COMS-TH (COMSTH-IRC) (Ref No: 2020-041), clinical records of the patients were extracted from the medical record section of the hospital.

Various socio-demographic and clinical information of the patients who were admitted and treated as inpatients in the hospital from January to December 2019 were retrieved. Patients who left the hospital against medical advice (LAMA), those with incomplete data, and those who expired during treatment in the hospital were excluded. A total record of 1248 patients were selected for the final analysis.
Data was obtained from the details entered into the admission and treatment charts of the inpatients. The different socio-demographic variables collected included age, gender, occupation, address, length of hospital stay. Similarly, the clinical variables were type of cases (traumatic/non-traumatic), infective cases, type of fracture (open/closed/ combination of open and close), associated injuries, complications, co-morbidities, treatment modality (conservative/operative/both) and mode of payment (self/third party/health insurance). Age of the patients was discretized into five quintiles and LOHS into two categories (LOHS ≤7 days / > 7 days).

The collected data were first entered into the Microsoft Excel (Microsoft Office 2010). After preliminary cleaning, data was entered into SPSS (Statistical Package for Social Sciences), version 16.0 software for final data analysis. The various categorical variables were described as frequency and percentage using appropriate tables. Next, the distribution of the primary variable of interest, LOHS was tested for normality. As the distribution was found to be skewed, it was described using median (inter-quartile interval). To test the association between LOHS (as a continuous variable) and various categorical variables, non-parametric tests like Mann-Whitney and Kruskal-Wallis H tests were utilized. Similarly, Chi-squared test was used to test the association between two categories of LOHS and other categorical variables. Statistical significance was defined as p< 0.05 at 95% confidence interval (CI).

RESULTS

In the present study, out of the total patients (n=1248), males constituted the majority, i.e. 72.4%, (n=904). The mean age of the patients was 33.8 years ± 18.7 years, the median age was 30.0 years (range 9 months- 95 years). Regarding occupation, most of the patients were students (34.9%, n=435), and homemakers were the least common (15.3%, n=191). Likewise, majority of the patients were from outside Chitwan (62.5%, n=780).

Table 1: Distribution of the patients based on socio-demographic characteristics

| Variables     | Frequency (%) |
|---------------|---------------|
| Gender        |               |
| Female        | 344 (27.6%)   |
| Male          | 904 (72.4%)   |
| Occupation    |               |
| Student       | 435 (34.9%)   |
| Homemaker     | 191 (15.3%)   |
| Farmer        | 283 (22.7%)   |
| Miscellaneous | 339 (27.2%)   |
| Address       |               |
| Within Chitwan| 468 (37.5%)   |
| Outside Chitwan| 780 (62.5%)  |

Table 2: Demographics, injury details and treatment modality

| Variables                | Frequency(%) |
|--------------------------|--------------|
| Type of cases            |              |
| Traumatic                | 1027 (82.3%) |
| Non trauma               | 221(17.7%)   |
| Infective cases          |              |
| Yes                      | 114 (9.1%)   |
| No                       | 1134 (90.9%) |
| Type of fracture         |              |
| Open                     | 177 (25.0%)  |
| Closed                   | 520 (73.3%)  |
| Both                     | 12 (1.7%)    |
| Associated injury        |              |
| Yes                      | 89 (8.7%)    |
| No                       | 938 (91.3%)  |
| Complication             |              |
| Yes                      | 76 (6.1%)    |
| No                       | 1172 (93.9%) |
| Co-morbidity             |              |
| Yes                      | 152 (12.2%)  |
| No                       | 1096 (87.8%) |
| Mode of payment          |              |
| Self                     | 697 (55.8%)  |
| Third party              | 401 (32.1%)  |
| Health Insurance         | 150 (12.1%)  |
| Treatment modality       |              |
| Conservative             | 423 (33.9%)  |
| Operative                | 784 (62.8%)  |
| Both                     | 41 (3.3%)    |

The median length of hospital stay was 5.0 days (range: 1.0 -104.0 days).

Table 3: Comparison of LOHS according to socio-demographic characteristics

| Variables                     | LOHS Median (Q1-Q3) days | Statistical Test |
|-------------------------------|--------------------------|------------------|
| Gender                        |                          |                  |
| Female (n= 344)               | 5.0(3.0-9.0)             | Z=-0.927; p=0.345*|
| Male (n= 904)                 | 5.0(3.0-10.0)            |                  |
| Age-Quintiles                 |                          |                  |
| First                         | 4.0(2.0-7.0)             |                |
| Second                        | 6.0(3.0-12.0)            |                |
| Third                         | 5.0(3.0-11.3)            |                |
| Fourth                        | 6.0(3.0-10.0)            |                |
| Fifth                         | 6.0(3.0-10.0)            |                |
| Occupation                    |                          |                  |
| Student (n=435)               | 4.0(2.0-9.0)             |                |
| Homemaker (n=191)            | 4.0(3.0-9.0)             |                |
| Farmer (n=283)                | 5.0(3.0-10.0)            |                |
| Miscellaneous (n=339)         | 6.0(3.0-11.0)            |                |
| Address                       |                          |                  |
| Within Parsa (n=468)          | 5.0(2.0-9.0)             | Z=-2.655; p=0.008*|
| Outside Parsa (n=780)         | 5.0(3.0-11.0)            |                |

The LOHS was significantly greater in cases with trauma...
(p=0.001), with infection (p<0.001), with presence of associated injury (p<0.001), and with complication (p<0.001) than those without the above conditions. Moreover, there was significant difference in LOHS among various fracture types, mode of payment and treatment modality (p<0.001). However, LOHS did not differ significantly between patients with or without co-morbidity (p=0.763).

Table 4: Comparison of LOHS according to clinical characteristics and mode of payment

| Variables                        | LOHS Median (Q1-Q3) days | Statistical test |
|----------------------------------|--------------------------|------------------|
| Type of cases                    |                          |                  |
| Traumatic (n=1027)               | 5.0(2.0-11.0)            | Z=-3.345; p=0.001*|
| Non trauma (n=221)               | 4.0(3.0-7.0)             | Z=-7.009; p<0.001*|
| Infective Cases                  |                          |                  |
| Yes (n=114)                      | 9.0(5.0-21.75)           | Z=-7.009; p<0.001*|
| No (n=1134)                      | 5.0(2.0-9.0)             | Z=-7.009; p<0.001*|
| Type of Fracture                 |                          |                  |
| Open (n=177)                     | 10.0(5.0-18.0)           |                  |
| Closed (n=520)                   | 5.0(2.0-10.0)            | \(\chi^2 = 57.123 \); p < 0.001** |
| Both (n=12)                      | 21.5(14.5-29.5)          |                  |
| Associated Injury                |                          |                  |
| Yes (n=89)                       | 15.0(8.0-24.5)           | Z=-8.797; p<0.001*|
| No (n=938)                       | 5.0(3.0-9.0)             | Z=-8.797; p<0.001*|
| Complication                     |                          |                  |
| Yes (n=76)                       | 13.5(7.0-28.75)          | Z=-7.415; p<0.001*|
| No (n=1172)                      | 5.0(3.0-9.0)             | Z=-7.415; p<0.001*|
| Comorbidity                      |                          |                  |
| Yes (n=152)                      | 5.0(3.0-9.0)             | Z=-0.301; p=0.763*|
| No (n=1096)                      | 5.0(3.0-10.0)            | Z=-0.301; p=0.763*|
| Mode of Payment                  |                          |                  |
| Self (n=697)                     | 5.0(2.0-8.5)             |                  |
| Third party (n=401)              | 8.0(3.0-17.0)            | \(\chi^2 = 60.901 \); p < 0.001** |
| Health Insurance (n=150)         | 4.0(2.0-7.0)             |                  |
| Treatment Modality               |                          |                  |
| Conservative (n=423)             | 3.0(1.0-5.0)             | \(\chi^2 = 237.326 \); p < 0.001** |
| Operative (n=784)                | 7.0(4.0-12.0)            |                  |
| Both (n=41)                      | 10.0(6.0-17.0)           |                  |

*Mann-Whitney Test, **Kruskal-Wallis H Test

The LOHS of the patients were categorized into (a) ≤ 7 days and (b) > 7 days. Proportions of patients with LOHS greater than 7 days did not differ significantly across the gender, and presence/absence of comorbidity (p>0.05). LOHS was significantly different across the various age quintiles (p=0.003). Across the various occupations, the proportion was the greatest in miscellaneous groups followed by farmer, homemaker and students. The overall difference was statistically significant (p=0.018). Similarly, the proportion was statistically greater in patients from outside Chitwan (p=0.002), patients with traumatic injuries (p<0.001), infection (p<0.001), associated injuries (p<0.001), and complications (p<0.001). Similarly, the proportion of patients staying for more than 7 days in the hospital was significantly different across type of fracture, mode of payment and treatment modality (p<0.001). However, there was no significant association between co-morbidity and LOHS (p=0.05).

Table 5: Distribution of patients between those with LOHS ≤7 days and > 7 days, for different categories of socio-demographic and clinical characteristics

| Variables                        | Categories of LOHS (days) | \(\chi^2\) | p-value |
|----------------------------------|---------------------------|------------|---------|
|                                 | ≤ 7 Days                  | > 7 Days   |         |
| Gender                          | Female 230 (66.9%)        | 114(33.1%) | 0.56    | 0.454  |
|                                 | Male 584(64.6%)           | 320(35.4%) |         |        |
| Age-Quintiles                   | First 197 (75.5%)         | 64 (24.5%) |         |        |
|                                 | Second 145 (60.7%)        | 94(39.3%)  | 15.906  | 0.003* |
|                                 | Third 160 (64.0%)         | 90 (36.0%) |         |        |
|                                 | Fourth 168 (62.7%)        | 100 (37.3%)|         |        |
|                                 | Fifth 144 (62.6%)         | 86 (37.4%) |         |        |
| Occupation                      | Student 303(69.7%)        | 132(30.3%) | 10.116  | 0.018* |
|                                 | Homemaker 129(67.5%)      | 62(32.5%)  |         |        |
|                                 | Farmer 182(64.3%)         | 101(35.7%) |         |        |
|                                 | Miscellaneous 200(59.0%)  | 139(41.0%) |         |        |
| Address                         | Within Chitwan 331(70.7%) | 137(29.3%) | 9.994   | 0.002* |
|                                 | Outside Chitwan 483(61.9%)| 297(38.1%) |         |        |
| Type of Cases                   | Non traumatic 182(82.4%)  | 39(17.6%)  | 34.737  | <0.001*|
|                                 | Traumatic 632(61.5%)      | 395(38.5%) |         |        |
| Infective Cases                 | Yes 48(42.1%)             | 66 (57.9%) | 29.564  | <0.001*|
|                                 | No 766(67.5%)             | 368(32.5%) |         |        |
| Type of Fracture                | Open 68(38.4%)            | 109(61.6%) | 115.999 | <0.001*|
|                                 | Closed 323(62.1%)         | 197(37.9%) |         |        |
|                                 | Both 1(8.3%)              | 11(91.7%)  |         |        |
| Associated Injury               | Yes 19(21.3%)             | 70 (78.7%) | 81.338  | <0.001*|
|                                 | No 795(68.6%)             | 364(31.4%) |         |        |
| Comorbidity                     | Yes 104(68.4%)            | 48(31.6%)  | 43.61   | <0.001*|
|                                 | No 791(67.5%)             | 381(32.5%) |         |        |
| Mode of Payment                 | Self 495(71.0%)           | 202(29.0%) | 67.77   | <0.001*|
|                                 | Third party 199(49.6%)    | 202(50.4%) |         |        |
|                                 | Health Insurance 120(80.0%)| 30(20.0%)  |         |        |
| Treatment Modality              | Conservative 363(85.8%)   | 60(14.2%)  | 134.354 | <0.001*|
|                                 | Operative 440(56.1%)      | 344(43.9%) |         |        |
|                                 | Both 11(26.8%)            | 30(73.2%)  |         |        |
DISCUSSION

Length of hospital stay can have significant effect on the various aspects of hospital care in any inpatient and orthopaedic inpatients in particular. Apart from the increased cost of treatment, extended LOHS in these patients can have substantial consequences in utilization of limited resources. Several clinico-demographic factors account for variability in the LOHS. The current study showed the median length of hospital stay of 5.0 days (range: 1.0-104.0 days) with significant association with age quintiles, occupation, address, nature of injury, complications, mode of payment and treatment modality.

Both male and female patients had comparable LOHS with no statistically significant difference (p=0.345). When comparing LOHS between >7 days and <7 days, male had higher prevalence of LOHS, but it was not significantly significant (p=0.454). Study done by Mishra et al. observed that the LOHS was significantly longer for male patient, and prevalence of LOHS>7 days differed significantly across different modes of injury, complications, mode of payment and treatment modality. Wu et al. observed that people staying in rural area with fall related injury had shorter median LOHS and also the higher prevalence of LOHS>7 days compared to those without trauma (p<0.05). Comparable finding was also observed by Mishra et al. who reported that the average LOHS was longer in patients with trauma (11 days) compared to those without trauma (8 days).

Patients presenting with trauma had significantly greater median LOHS (25% more than nontrauma) as well as the prevalence of LOHS>7 days, than those without trauma (p<0.05). Comparable finding was also observed by Mishra et al who reported that the average LOHS was longer in patients with trauma (11 days) compared to those without trauma (8 days).

Patients with infection also had significantly higher median LOHS and prevalence of LOHS>7 days than those without infection (p<0.05). This finding was consistent with many other studies. Glance et al. found that the median LOHS was about double among patients with hospital acquired infection compared to those without infection. Similarly, Mitchell et al. reported the median LOHS to be significantly higher in patients with healthcare associated urinary tract infection compared to patients without infection (p<0.001). Moreover, as per the study of Kashkooie et al., infected patients had 4.4 times increased chance of stay in the hospital compared to those without infection (p<0.001).

Traumatic patients presenting with a combination of open and closed fracture stayed the longest as compared to those with either open or closed fracture. This accounted for the highly significant overall difference in median LOHS as well as prevalence rates of LOHS>7 days across various fracture types (p<0.05). In another study, Smith et al. reported a contrasting finding suggesting no significant difference between LOHS for open and closed tibia fracture treated surgically with intramedullary nail (p>0.05).

Patients with associated injuries (head, chest, abdomen, urogenital) had significantly greater median LOHS and higher prevalence of LOHS>7 days than those without such injuries (p<0.05). Wu et al. observed that patients with traumatic spinal cord injury with associated injuries had significantly longer LOHS (p<0.05). Similarly, Wurdemann et al. also observed that traumatic patients with associated injuries had significantly longer mean LOHS compared to patients without such injuries (p<0.001).

We observed that patients with complications had significantly greater median LOHS and higher prevalence of LOHS>7 days than those without any complications (p<0.05). Ristic et al. reported that the average LOHS of surgically treated ankle fracture patients was more in those with complications (p<0.01). Krell et al. on the other hand, reported that extended LOHS was weakly associated with the development of complications (p<0.001).

In our study, we did not find any significant difference of LOHS and prevalence of LOHS>7 days between the patients with and without co-morbidities (p=0.05). In contrast, Brotemarkle et al. and Gholson et al. found that the mean LOHS was longest for retired patients and shortest for students (p<0.01).

Patients from outside Chitwan had significantly higher median LOHS and also the higher prevalence of LOHS>7 days than those residing within Chitwan (p<0.05). This could be due to tendency for asking early discharge for the patients residing near the hospital. Wu et al. observed that the LOHS was significantly associated with geographic location of the hospital and was greater in suburban compared to urban patients (p<0.05). Sukumar et al., on the other hand, observed that people staying in rural area with fall related injury had shorter median LOHS compared to people staying in urban area (p<0.05).

Patients presenting with trauma had significantly greater median LOHS (25% more than nontrauma) as well as the prevalence of LOHS>7 days, than those without trauma (p<0.05). Comparable finding was also observed by Mishra et al who reported that the average LOHS was longer in patients with trauma (11 days) compared to those without trauma (8 days).

Patients with infection also had significantly higher median LOHS and prevalence of LOHS>7 days than those without infection (p<0.05). This finding was consistent with many other studies. Glance et al. found that the median LOHS was about double among patients with hospital acquired infection compared to those without infection. Similarly, Mitchell et al. reported the median LOHS to be significantly higher in patients with healthcare associated urinary tract infection compared to patients without infection (p<0.001). Moreover, as per the study of Kashkooie et al., infected patients had 4.4 times increased chance of stay in the hospital compared to those without infection (p<0.001).

Traumatic patients presenting with a combination of open and closed fracture stayed the longest as compared to those with either open or closed fracture. This accounted for the highly significant overall difference in median LOHS as well as prevalence rates of LOHS>7 days across various fracture types (p<0.05). In another study, Smith et al. reported a contrasting finding suggesting no significant difference between LOHS for open and closed tibia fracture treated surgically with intramedullary nail (p>0.05).

Patients with associated injuries (head, chest, abdomen, urogenital) had significantly greater median LOHS and higher prevalence of LOHS>7 days than those without such injuries (p<0.05). Wu et al. observed that patients with traumatic spinal cord injury with associated injuries had significantly longer LOHS (p<0.05). Similarly, Wurdemann et al. also observed that traumatic patients with associated injuries had significantly longer mean LOHS compared to patients without such injuries (p<0.001).

We observed that patients with complications had significantly greater median LOHS and higher prevalence of LOHS>7 days than those without any complications (p<0.05). Ristic et al. reported that the average LOHS of surgically treated ankle fracture patients was more in those with complications (p<0.01). Krell et al. on the other hand, reported that extended LOHS was weakly associated with the development of complications (p<0.001).

In our study, we did not find any significant difference of LOHS and prevalence of LOHS>7 days between the patients with and without co-morbidities (p=0.05). In contrast, Brotemarkle et al. and Gholson et al. found that the mean LOHS was longest for retired patients and shortest for students (p<0.01).
of payment (p<0.001) with highest LOHS and prevalence of LOHS>7 days amongst the patients who had the third party payment. Patients with health insurance as paying party had significantly lower mean LOHS than those treated conservatively. This finding is in accordance with the study done by Kashkooe et al\textsuperscript{3} according to which, surgically treated patients were more likely to get admitted resulting in increased LOHS (p<0.001). In contrast, however, Tan et al\textsuperscript{4} observed that the surgically treated hip fracture patients had significantly lower mean LOHS compared to patients treated by conservative means (P<0.001). Similarly, Khorasavizadeh et al\textsuperscript{5} also reported lower mean LOHS in surgically treated patients.

Limitations of the current study was retrospective chart review nature of the study which might limit the extraction of every variables such as ICU admissions, malnutrition, depression, etc as they might influence the LOHS. Secondly, there is lack of generalizability of the result since it is a single institution-based study. The strength of this study is its sufficient sample size of one year duration thus enabling the samples with all possible spectrums of orthopaedic conditions across all seasons of the year.

CONCLUSION

This study identified statistically significant positive correlation of LOHS with age, occupation, address, type of cases, type of fracture, associated injuries, nature of treatment, complication and mode of payment. Further studies such as multi-centric studies may be needed to validate its result.

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