

Short-Term Outcomes of Treatment of Open Fracture of Long Bone Using Surgical Implant Generation Network Nail at Kumi Orthopaedic Center, Uganda

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ABSTRACT

Background: The SIGN (Surgical Implant Generation Network) intramedullary nail is commonly used to treat fractures of long bones i.e.; femur, tibia and humerus. This study was undertaken to evaluate the short-term outcomes of treatment of open fracture of long bone using SIGN nail at Kumi Orthopaedic Center, Uganda.

Methods: We retrospectively reviewed 564 surgical cases of patients who had been treated with SIGN nail at Kumi Orthopaedic Center using the SIGN Online Surgical Database (SOSD) from 2010 to March 2018. We extracted data on patients who had been treated with SIGN nail for open fractures of long bones with at least one follow-up. Extracted data was analyzed using SPSS and prevalence was calculated as the percentage of cases with open fractures of long bones divided by the total number cases treated using SIGN nail at Kumi Orthopaedic Center.

Results: A total of 55 open fractures of long bones were extracted from the SOSD. 35 cases met the inclusion criteria for this study. Prevalence of long bone open fractures was 9.4%. 74.3% of these cases were male while 25.7% were female. Their mean age was 34.7 years. 60% of the open fractures were Gustilo IIIa, 14.3% were Gustilo I, 14.3% were Gustilo II while 11.4% were Gustilo III. The mostly affected bone was the tibia at 51.4% with the femur taking up 48.6%. Mean time of skin closure was 11.5 days. 88.6% had no infection while 11.4% contracted infections. 2.9% of the cases resulted in non-union. 85.7% of the cases had knee flexion greater than 90 degrees whereas 14.3% could not flex the affected knees beyond 90 degrees. There were no deformities in 100% of the cases.

Conclusion: Treating open fractures of long bones using SIGN nail has relatively good short-term outcomes.

Key words

Fracture; intramedullary; nailing; outcomes; Uganda.

Abbreviations:

SIGN: Surgical Implant Generation Network; SOSD: SIGN Online Surgical Database; IM: Intramedullary; KOC: Kumi Orthopaedic Center.

Introduction

Musculoskeletal injuries are among the commonest conditions treated in hospital settings found in developing countries. Fractures of long bones (femur and tibia) are some of the musculoskeletal injuries [1-3] that are treated in many health facilities in Uganda. Long bone fractures can cause disability in affected individuals if left untreated. One study [4] noted that Ugandan patients often

are unable to access quick medical attention for fractures because they cannot afford the services provided by healthcare facilities. This leads to delays in getting treatment for fractures hence being neglected over long periods of time. It has been reported that young people between the ages of 21 to 30 years are most affected by long bone open fractures with males at highest risk [2]. In Uganda, majority of the bread winners are male and are likely to fall in this age group. This age group is the most productive, contributing to national economic growth and development. Individuals impaired by neglected long bone fractures are likely to become disabled which hinders their capability to work [5]. This leads to increased levels of poverty among affected families since in most cases, the bread winners fail to earn a living necessary to provide for their dependents because of the newly acquired disability.

The SIGN (Surgical Implant Generation Network) nail is an intramedullary nail system used to treat fractures of long bones (femur, tibia and humerus) without the necessity for a C-arm [3]. SIGN Fracture Care International manufactures and distributes SIGN IM nailing system to developing countries where power equipment and real-time imaging are not available at no cost. Kumi Orthopaedic Center located in Kumi district, eastern Uganda, East Africa, is a SIGN center with more than seven years of experience using SIGN nail to treat long bone fractures. SIGN Surgeons are required to record case reports and follow-ups in the SIGN Online Surgical Database (SOSD) by SIGN Fracture Care International. The purpose of this study therefore is to investigate the short-term outcomes of open fracture of long bones using SIGN nail in Kumi Orthopaedic Center located in Kumi district, Eastern Uganda, East Africa.

Materials and methods

This study was approved by Mildmay Uganda Research Ethics Committee and the Uganda National Council of Science and Technology.

All patients who had been treated using SIGN nail at Kumi Orthopaedic Center from January 2010 to March 2018 were identified using the SIGN Online Surgical Database (SOSD). The procedures were performed by two Orthopaedic Surgeons working at Kumi Orthopaedic Center. Open fractures were classified using the Gustilo-Anderson classification system [6]. Patient information was de-identified during this study.

Cases with other types of fractures below 18 years, other conditions and without follow-up were excluded from this study. Patients with at least one follow-up visit were considered for this study. Data of cases that met the inclusion criteria was extracted from the SOSD and entered in a Microsoft Excel spreadsheet. The extracted data was then analyzed using IBM SPSS for Windows. Categorical variables were compared using the Chi-square test whereas continuous variables contrasted using univariate regression analysis. Basing on the characteristics of univariate analysis, the data was then analyzed using multivariate logistic regression analysis. Prevalence was calculated as the percentage of

cases with open fractures of long bones divided by the total number cases treated using SIGN nail at Kumi Orthopaedic Center.

Results

At the time of this study, 564 cases were found in the SOSD reported for Kumi Orthopaedic Center. Of these, 53 cases were treated using SIGN nail for long bone open fractures. 35 of these cases met the inclusion criteria. Cases without follow up were excluded from this study.

The prevalence of open fractures of long bones at Kumi Orthopaedic center was 9.4%. Of the 35 cases with follow-up, 26 (74.3%) were male whereas 9 (25.7%) were female. Their mean age was 34.37 with the youngest patient being 17 years old and the oldest, 76 years old at the time of surgery (Figure 1).

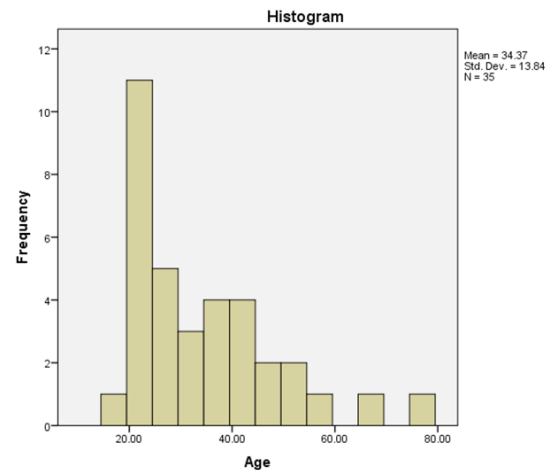


Figure 1: Age range for open fracture cases treated with SIGN nail at Kumi Orthopaedic Center was between 17-76 years old.

The most affected long bone was the tibia at 51.4% while 48.6% were femur open fractures. There were no humerus fractures operated upon using SIGN nail at Kumi Orthopaedic Center (KOC). The commonest type of open fractures was Gustilo grade IIIa with 21 (60%) treated using SIGN nail at KOC (Figure 2). This was closely followed by Gustilo grade I and II open fractures with each type having 5 (14.3%) cases. 4 (11.4%) cases were treated for Gustilo grade IIIb open fractures.

Upon first follow-up, the mean time of skin closure was 11.5 days (Table 1) whereas mean time of injury to debridement was 0.58 days. Out of the 35 cases, 4 (11.4%) acquired infections (Figure 4). Only 1 case (2.89%) resulted in non-union after surgery (Figure 3). 30 (85.7%) of the cases had knee flexion greater than 90 degrees during the first follow-up visit while 5 (14.3%) patients failed to flex their knees beyond 90 degrees (Table 2). There were no reported deformities in this study.

Chi square tests revealed no significant association between type of open fracture and time of skin closure ($p > 0.05$). In addition, infection was not significantly associated to type of open fracture ($p > 0.05$). However, the type of open fracture was significantly associated to the affected bone ($X^2 (3, N=54) = 11.82, p=0.008; p < 0.05$).

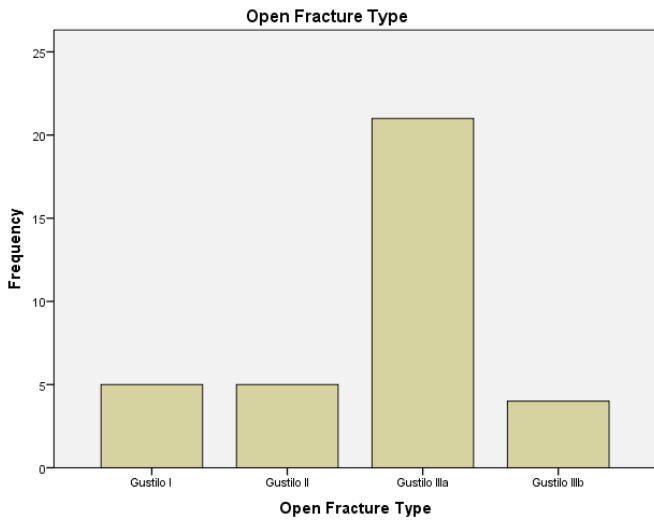


Figure 2: Gustilo grade IIIa were the commonest type of open fractures treated using SIGN nail at Kumi Orthopaedic Center.

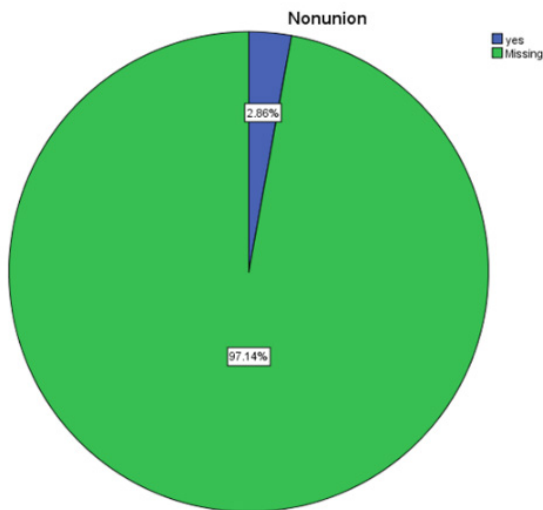


Figure 3: Cases with non-union after surgery was low (2.98%).

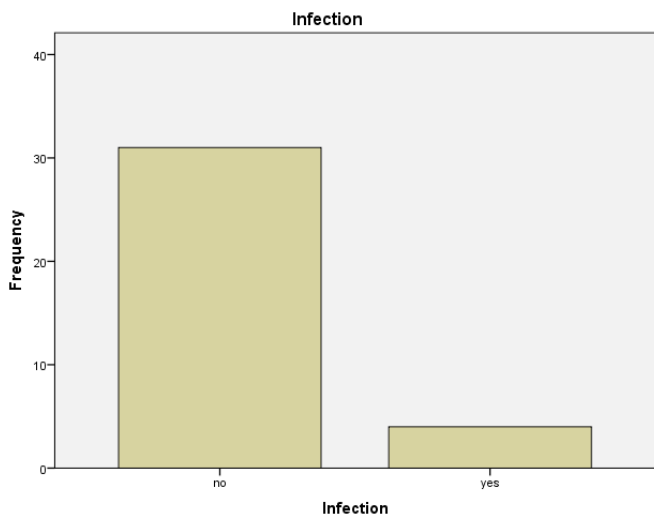


Figure 4: Four cases acquired infections post-operation.

Discussion

According to the World Health Organization (WHO, 2018), 1.25 million people lose their lives to road traffic accidents. Between 20-50 million people acquire non-fatal injuries that may eventually develop into disability. It has been highlighted that majority of road traffic injuries experienced in developing countries are long bone fractures with particularly bad outcomes for open fractures [3]. Noteworthy is the fact that this study has demonstrated that using SIGN nail to treat open fractures of long bones in a low-income setting is most likely to result in good outcomes.

Often, many patients in developing countries do not return to health facilities after operations (Zirkle, 2008). Another study agrees with this notion stating that in the SIGN Online Database, there is limited clinical follow up data on cases reported by surgeons [7]. This is evidenced in this study where out of the 53 cases identified, only 35 (66%) had follow-up information. This could be attributed to the long distance that patients would have to travel from their homesteads to the hospital for review. Furthermore, majority of the patients seen at Kumi Orthopaedic Center hail from rural areas. Obtaining resources for healthcare is usually a family practice with mobilization from relatives and close friends. Once the money is spent on surgery, it is difficult for individuals to solicit for more funds to attend a postoperative review. This makes it hard for patients to frequently return to hospitals for follow-up visits.

The average age of patients operated on at Kumi Orthopaedic Center was 34.37 years with 74.3% being male. This finding supports the speculations that youth (18-35 years) and male individuals, who are the common bread winners in developing countries [2] are most affected by open fractures of long bones. More research needs to be carried out to find out the risk factors exposing young men to open fractures in order to mitigate the social economic burden laid on families when their breadwinners become injured.

Infection rates in this study (11.4%) were slightly higher than those reported by other studies [3, 8]. This is likely associated to the adherence of patients to wound care instructions given to them by health workers prior to leaving the hospital. Moreover, since patients are discharged shortly after their surgery because they may not be able to pay for increased hospital stay, the home environment where patients return to may expose the surgical wounds to further infection.

The rate of nonunion was 2.89% which is comparable to those reported in several studies [9-12]. Open fractures have previously been linked to nonunion attributed to damage of local blood supply [12]. Despite our findings, we recommend SIGN intramedullary nailing system as a suitable technique for promoting complete healing of long bones with open fractures since it is less likely for patients' fractures to result in nonunion.

The limitations of this study are that a small number of cases were included in this study because of the low patient turn up at KOC

during the targeted study duration. This could be a consequence of the fact that KOC is a private hospital with majority of patients being requested to pay for services being rendered out of pocket. This necessitates further research including larger numbers of patients who are followed up for longer periods of time while collecting prospective data.

Statistics

Time of injury to skin closure		
N	Valid	16
	Missing	19
Mean		11.5000
Std. Deviation		21.05232
Minimum		1.00
Maximum		90.00
Percentiles	25	6.0000
	50	7.0000
	75	7.0000

Table 1: The mean time of injury to skin closure was 11.5 days.

knee flexion greater than 90 degrees

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid no	5	14.3	14.3	14.3
yes	30	85.7	85.7	100.0
Total	35	100.0	100.0	

Table 2: 30 cases had knee flexion greater than 90 degrees after surgery.

Conclusion

The findings of this study reveal that using SIGN nail for treatment of long bone fractures in resource limited settings such as Uganda can produce good outcomes thereby contributing to restoration of quality of life for affected individual and their families.

Acknowledgements

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