

# Evaluation of Infection in Nylon and Staple Sutured Wounds in Surgeries of Intertrochanteric Femoral Fractures

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**Submitted:** 2022-01-17; **Accepted:** 2022-03-02; **Doi:** <https://doi.org/10.22037/jcpr.v7i2.38835>

## Abstract

**Introduction:** Infection of surgical wounds is an important complication that delays recovery and the length of hospital admission. This study aimed to determine the infection rate in intertrochanteric femoral fracture surgeries by two methods of closure with nylon thread or staple. **Materials & Methods:** This retrospective cross-sectional study was conducted on 123 male and 77 female patients in Kosar Hospital, Semnan, Iran. In this study, patients who underwent intertrochanteric femoral fracture surgery via the dynamic hip screw (DHS) technique between 2017 and 2019 were participated voluntarily. Demographic information, surgical complications, and infection history were extracted from the files and recorded in the data collection form. Data were analyzed by sing SPSS<sub>20</sub> software through by chi-square, Fisher's exact test, 2-tailed t-test, and logistic regression. **Results:** in this study 61.5% of patients were male and 38.5% were female. The type of suture in 100 patients (50%) was a staple and in 100 patients (50%) was a nylon thread. A surgical complication was observed in 51 patients (25.5%) as inflammation, in 1 patient (0.5%) as serous secretion, and 3 patients (1.5%) as inflammation and serous secretion simultaneously, while 145 patients (72.5%) developed no complications. There was no significant difference between gender, age, and underlying disease with suture type (staple and nylon suture) ( $P > 0.05$ ). The incidence of complications in the nylon group was 20% compared to the staple group (35%). There was a statistically significant difference between surgical complications with patients' suture type ( $P < 0.05$ ). **Conclusion:** Nylon thread sutures as a technique for surgical site wound closure in intertrochanteric femoral fracture surgeries, have more favorable results compared to staples due to lower complication rate and surgical site infection.

**Keywords:** Fracture; Intertrochanteric Femur Fracture; Staple; Suture; Wound Infection

**Please cite this paper as:** Manafi Rasi A, Hajikarimloo B, Mirbehbehbani SM, Broutkoub M. Evaluation of Infection in Nylon and Staple Sutured Wounds in Surgeries of Intertrochanteric Femoral Fractures. J Clin Physio Res. 2021; 7(2): e60. Doi: <https://doi.org/10.22037/jcpr.v7i2.38835>

## Introduction

One of the most common and dangerous complications in hospitalized patients is healthcare-associated infections (HAIs) that increase mortality rate, length of hospitalization, and diagnostic and therapeutic care which lead to an increase in hospital costs, absenteeism, and long-term away from family (1, 2).

One type of HAIs is surgical site infection (SSI), which occurs after surgery. In another words, it has been defined as the occurrence of any infection in the tissue or opened organ and the cavity manipulated during surgery (3). One of the complications which occurs after surgery is a post-operative

infection that sometimes leads to the failure of surgical goals and irreparable damage (4, 5).

Among SSI cases, those related to orthopedic surgery tend to be more severe. In these surgeries, using implant tools usually increase the risk of infection (6, 7). There are different statistics for the incidence of SSI which is caused by different conditions of surgical procedures, the expertise of surgeons, hospitals facilities, and patients characteristics' (8).

Many external and internal factors such as the patient's clinical condition, duration of surgery, length of hospitalization, preparation of the skin, methods of hand disinfection by the surgery team, operating room conditions, and type of implant have been accepted to cause infection (9,

**Table 1** The Relationship between underlying disease and suture type

| Underlying disease     | Staple (n) | Nylon (n) | P-value (chi2) |
|------------------------|------------|-----------|----------------|
| No                     | 75         | 78        | 0.617          |
| Yes                    |            |           |                |
| hypertension           | 16         | 19        |                |
| Cardiac                | 7          | 2         |                |
| Hypertension & Cardiac | 2          | 1         |                |
| Total                  | 100        | 100       |                |

10). In many cases, however, the etiology of the infection is not well known (11).

Surgical site infection is defined as occurrence of the infection with infectious discharge within one month after surgery (12).

Nylon sutures and skin staples are the two most commonly used techniques for wound closure in orthopedic surgeries. Many studies assessed the efficacy and complications of wound closure techniques but the results are controversial. Some studies demonstrated a higher risk of infection with staples, however, several studies suggested that there is no difference between staples and sutures (13, 14).

Due to the high prevalence of orthopedic surgical site infections, this study aimed to comparing the rate of infection in two types of sutures and staples to identify a better method of surgery and play a crucial role in reducing post-operative infections for improving the health of the community.

## Materials and Methods

This cross-sectional study was performed in Kosar Hospital, Semnan, Iran. The ethics committee of Semnan University of medical sciences (IR.SEMUMS.REC.1399.083) approved the study. Inclusion criteria were as follows; age over 60 years (similar healing condition), intertrochanteric fracture, absence of multiple fractures, and recording of required information in the patient's medical records. Patients with antibiotics administration other than those required for surgery, corticosteroids, smoking, rheumatologic disorders, and diabetes were excluded from the study.

The demographic information recorded in the file, as well as the patient's medical history of the fracture, was extracted; including age, underlying conditions such as hypertension, and gender. Patient's files were compared based on whether nylon thread was used to repair and sew the suture site or the stapler was divided into two groups.

**Table 2.** Relationship between surgical complication and suture type in patients

| Complication                    | Staple (n) | Nylon (n) | P-value (chi2) |
|---------------------------------|------------|-----------|----------------|
| No                              | 65         | 79        | 0.027*         |
| Inflammation                    | 32         | 19        |                |
| Serous secretion                | -          | 1         |                |
| Yes                             |            |           |                |
| Infection                       | -          | -         |                |
| Inflammation & Serous secretion | 3          | -         |                |
| Total                           | 100        | 100       |                |

\* $P \leq 0.05$

In this study, all patients received intravenous Cefazolin and subcutaneous tissue was sutured with a Vicryl thread. All of the surgeries were performed by one experienced surgeon

### Statistical analysis

Chi-Square test or Fisher's exact test and t-test was used to compare the relationship between qualitative variables and analysis of variance was used to investigate quantitative variables among groups. The significance level was considered  $\leq 0.05$ . The data were analyzed using IBM SPSS version 20.0 (SPSS<sub>20</sub>).

## Results

Totally 200 patients who underwent dynamic hip screw (DHS) placement surgery due to intertrochanteric femoral fracture from 2017 to 2019 were participated in this study voluntarily. Out of 200 studied patients, 123 (61.5%) were male and 77 (38.5%) were female. Most patients (76.5%) did not have any underlying diseases. 47 patients had the underlying disease, mostly hypertension with a frequency of 35 patients (17.5%). 145 patients (72.5%) did not have any complications subsequent to the surgery. 55 patients (27.5%) developed surgical complications, of which 51 patients (25.5%) had inflammation, 3 patients (1.5%) had simultaneous inflammation and serous secretion and 1 patient had serous secretion.

In 100 patients (50%) the type of suture was Staple and in 100 patients (50%) it was through nylon thread. There were 57 female patients in the nylon suture group and 66 male patients in the staple suture group, which was not statistically significant by gender ( $P=0.191$ ). The mean $\pm$ SD age of patients in the staple group was  $64.4 \pm 3.1$  and in the nylon, suture group was  $64.7 \pm 3.4$  years respectively that the t-test showed no statistically significant difference between the two groups by age ( $P \leq 0.05$ ).

In the staple suture group, 16 patients (16%) had underlying hypertension, and (7%) of patients had underlying heart disease. In the nylon suture group, 19 patients (19%) had underlying hypertension and 2 patients (2%) had underlying heart disease (Table 1).

In the group of patients with a suture through the staple, 32 patients (32%) with inflammatory complications and 3 patients (3%) with simultaneous complication of inflammation and serous secretion were observed. In the group of patients with a suture through nylon thread, 19 patients (19%) with developing inflammation were observed with surgical complications and 1 patient (1%) was observed with serous secretion complication (Table 2). It could be concluded that total surgical complications were significantly lower in nylon group than staple group ( $P=0.027$ ).

## Discussion

One of the main factors that increase the burden on the health care system, length of hospitalization, and costs in the setting of orthopedic surgeries are wound complications. SSIs are a serious complication of orthopedic surgeries and lead to prolonged hospitalization, increased economic and psychological burden on patients, and increased mortality rate too (15, 16).

Nylon sutures and staples are the two most common surgical site wound closure techniques in orthopedic surgeries. Wound closure and SSI play a crucial role in post-operative success. Efficacy, infection rate, rate of complication, and cosmetic outcomes remained controversial in the literature (17). Features that play a crucial role in choosing the preferred technique are rapid healing, acceptable scar, and low complication development (18).

In this study, short-term post-operative complications by two methods of wound healing (staple vs. nylon thread) in intertrochanteric femoral fractures were investigated. The results of our study demonstrated that the incidence of complications in the staple group is significantly higher than in the nylon thread group.

Shetty *et al.* (19) showed that the incidence of staple complications, mainly infections, was more frequent in the suture thread group, which was similar to the results of the present study. The results of the Badres *et al.* (20) study were similar to our results in which both demonstrated that the incidence of complications, infectious discharge, and the length of hospitalization are higher in the staple group in those who underwent intertrochanteric femoral fractures surgeries (8).

Previous studies exhibited that the superficial infection rate, prolonged wound discharge, and length of hospitalization were lower correlated with suture application, deep infection, abscess formation, wound dehiscence, patient satisfaction, allergic reaction, and inflammation. (21-23). Rui *et al.* (24) divided patients who underwent primary unilateral total hip arthroplasty into staple and suture groups. No one in the suture group developed a post-operative superficial infection, while 2 of the staple group showed some grade of infection. In addition to, time to dry surgical incision and length of post-operative hospitalization were lower in the suture group. Van de kuit *et al.* (25) in a meta-analysis, concluded that the application of staples was associated with a higher risk of SSI in knee and hip arthroplasty, of course more in hip arthroplasty.

In contrast, some other studies demonstrated that the incidence of complication was not higher while skin was sutured via metal staples and suturing time was significantly lower in the staple method (26-28). Shantz *et al.* (29) showed that during a six-week follow-up in patients who underwent non-emergent orthopedic surgery, the complication rate was not significantly different between the suture and staple groups. Although the time to close the wound with a staple was shorter, and the pain at the removal time were more remarkable. Both staple and suture surgical site closure provide a favorable healing environment by means of tissue oxygenation, but staple possesses better blood perfusion (30). A meta-analysis conducted by Kim *et al.* demonstrated that in the setting of total knee arthroplasty (TKA), the rate of superficial and deep infection, abscess formation, and wound dehiscence were higher in the suture group. They also concluded that primary surgical site closure with staples had lower wound complications and wound closure time, so staples were superior to sutures in TKA (31).

The results of the present study demonstrated that the age of patients in the nylon thread group was significantly higher than in the other group. Thus, it can be concluded that intertrochanteric femoral fractures are more common in older people (32). Older people, due to their physical condition, need to undergo surgery more urgently, and because of the availability of nylon thread, most emergency surgeries are performed with this method. Therefore, the mean age of patients in the nylon thread group is expected to be higher. Sex differences and underlying diseases did not have a statistically significant impact on the outcomes of our study.

Our results demonstrated that among the two most commonly used techniques of wound closure subsequent to intertrochanteric femoral surgery, the application of nylon thread had better outcomes than staples in elders.

Our study had some limitations; one is that it is a cross-sectional study that have its limitations, including the inability to control all the causes and the underlying variables. In addition, there are certainly many other factors that may affect the incidence of infection and complications after intertrochanteric femoral fracture surgery, but it was certainly not possible to control all of them, especially hospital conditions and the surgeon's skill in one study. Therefore, further studies with the wider statistical community is recommended.

## Conclusion

The results of the present study demonstrated that, in general, the incidence of complications and erythema after surgery of intertrochanteric femoral fractures is lower in the nylon thread group. Therefore, it can be concluded that nylon thread as a technique for surgical site wound closure has a lower complication and infection rate compared to staple.

## Acknowledgements

This study has been adapted from General Practitioner at Semnan University of Medical Sciences. The authors necessitate themselves to thank and appreciate the material and spiritual support of the Vice-Chancellor for Research and Technology of the Semnan University of Medical Sciences.

## Conflict of interest:

None

## Funding support:

The study was funded by Vice-chancellor for Research and Technology, Semnan University of Medical Sciences (IR.SEMUMS.REC.1399.083).

## Authors' contributions:

All authors made substantial contributions to the conception, design, analysis, and interpretation of data.

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