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Technical Notes

Complication rate of different wound closures after primary hip arthroplasty - A survey of 373 patients

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ABSTRACT

Background: Wound closure is highly associated with wound complications and the best wound closure method was controversial in total hip arthroplasty.

Methods: We performed a retrospective study of primary hip arthroplasty and compared three types of closure method.

Results: 155 cases were closed using continuous subcuticular sutures then with staples, 111 using staples, 141 using interrupted sutures. 28 cases of wound complications occurred. Wound complication rates in subcuticular suture group, staple group and interrupted suture group were 1.9%, 11.7% and 8.5%, respectively ($p < 0.01$).

Conclusion: Wound complication rate was significantly lower when wound was closed with continuous subcuticular suture.

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Introduction

Wound complications, one of the major complications of hip arthroplasty, result in disrupted rehabilitation, prolonged hospital stay, increased costs, reduced satisfaction, and increased morbidity. Wound closure is highly associated with wound complications and may result in deep infection, which highlights the importance of closure technique.^{1,2} During the past decades, many wound closure techniques and materials have been available for orthopaedic surgeons. Among them, metal staples and sutures are the most commonly used skin closure methods in hip arthroplasty.³

Stainless steel has been widely used as a suture material since nineteen-forties.^{4,5} Compared to nylon sutures, metal staples can withstand high loads due to their mechanical strength and biocompatibility, which enables their use in tissues subjected to higher stress.^{6–8} Unlike nylon sutures, the superficial part of the staples seldom contacts the wound edge and do not cross the incision at its depth. Staples cause considerably less damage to wound defenses and reduce immune response. Staples are also believed to be faster than sutures both on closure and removal.^{9–11}

According to Moore et al.,¹² closing with staples could save an average nine point 6 min. Thus, surgeons are more satisfied with staples than sutures due to time saving benefits, especially after a long operation. However, although cost-effectiveness study showed staples may reduce theatre time and ease of removal, they are generally regarded as much more expensive than sutures.^{13,14} Moreover, there're no significant different of patient's satisfaction and wound cosmesis.¹³ Some studies reported the removal of staples can be uncomfortable and more painful for patients than sutures.^{15–18}

Interrupted nylon sutures are the most traditional and commonly used sutures. This method allows selective adjustments of wound edges but may increase immune response due to crossing dermis in depth.¹⁹ Development of absorbable sutures promotes the popularity of subcuticular suturing technique. Absorbable sutures are defined as degradable and absorbable sutures in tissues. Vicryl, for example, a widely used absorbable suture made of polyglactic, is extremely useful as a subcuticular suture to approximate wound edges until the wound has gained enough strength preventing wound dehiscence.²⁰ The inflammatory response decreases due to the absorption of polyglactic acid by hydrolysis.¹⁹ Furthermore, subcuticular suturing technique has many benefits. It provides an excellent way to achieve accurate skin edge apposition without external sutures or cross-hatching, resulting in little tissue reaction, rapid reduction and absence of mark points.²¹ The

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main disadvantage of this method is that wound closure with subcuticular suture requires a longer operative time.²² Subcuticular suture also requires a higher suturing skill of surgeons.

Nevertheless, as to wound complications, current studies showed no clinical evidence on which closure technique is superior to the other.²³ A meta-analysis was performed to compare the use of staples and sutures in orthopaedic surgery.²⁴ It suggested staple closure was three times risky in developing a postoperative infection than suture closure so staple closure should be reconsidered. While another recent published meta-analysis²⁵ reported there was no difference in infection comparing staples with sutures in joint surgery. The reason why results differ may be because the infection rate of primary joint arthroplasty is very low (1.5%–2.5%) while the sample scale of most previous studies is relatively small.²⁶ Thus, we present a retrospective review of 405 patients who underwent hip arthroplasty surgery during 2013–2015 in our department. The purpose was to compare the wound complications followed with three different closure methods in patients undergoing primary hip arthroplasty.

Patients and methods

This study was approved by the ethics committee of Zhujiang Hospital, Southern Medical University (No. 2016-GKZX-002). Patients who underwent joint arthroplasty surgery from January 2013 to December 2015 at our department were searched. Patients admitted for primary hip arthroplasty were included. Exclusion criteria were hip revision, a previous incision in the operative field, underlying malignancy and died within one month after primary surgery.

Surgical procedure

All surgeries were performed by senior surgeons with specialist registry. Surgical procedure, closure technique and wound care were performed without knowledge that the patients and their outcomes would be included in a study. In all cases, fascia was closed with 1–0 vicryl suture (Ethicon) and subsequent layers deep to the dermis were closed with nylon sutures. Skin was closed with continuous subcuticular 4-0 vicryl suture (Ethicon), staples (Mani) or interrupted nylon sutures. Staples were also used in subcuticular suture group due to adhesive skin closure strip was not available at our department. Selection for wound closure was based mainly on treating surgeons' routinely used.

Postoperative management

All wounds were dressed with cotton dressing. Wound dressings were changed every two days postoperatively. Drains were removed after one day postoperatively. Standard protocol of postoperative interventions at our department including postoperative usage of antibiotics for 24 h, deep vein thrombosis prophylaxis and rehabilitation were undertaken for each set of patients. Patients had a routine follow-up at the thirtieth days postoperatively, including wound inspection and radiographic evaluation.

Clinical assessment

All data were collected from the electric records. Preoperative history and basic physical data, including age, gender, body mass index (BMI), diagnosis and previous other joint surgery, were collected. Surgical procedures, type of skin closure technique were evaluated according to the operative reports. Operative and postoperative hospital information including wound characteristics, wound care, removal of staples or sutures and postoperative

hospital stay time were collected.

Statistical analysis

Data was analyzed using SPSS 19.0 (IBM). The Kruskal-Wallis test was used to compare the continuous variables. Pearson's chi-squared test was used to analyze the rates among three groups and the association between two variables. The partition of chi-squared method was used to make pair wise comparisons between groups where an overall significant difference was found. The Fisher's exact test was used otherwise. For partitions of chi-squared method, significance was set at $p \leq 0.0125$. For the rest of the analyses, significance was set at $p \leq 0.05$.

Results

Surgery type and closure method

In the study, 405 patients and 440 consecutive cases of primary hip arthroplasty were reviewed. However, 33 cases were excluded: 14 patients received hip revision, four patients died within one month after primary surgery due to heart failure, 12 patients had previous operation in the operative field, and two patients had malignancy. Thus, 373 patients and 407 cases were included finally. 287 (70.5%) procedures underwent total hip arthroplasty (THA) and 120 (29.5%) procedures underwent hemiarthroplasty (Table 1). 155 (38.1%) procedures were closed using continuous subcuticular sutures then with staples, 111 (27.3%) using staples, and 141 (34.6%) using interrupted sutures.

Patient characteristics

Baseline characteristics of patients were shown in Table 2. Average patient age was 64.1 (range, 18–99) years. Average body mass index was 24.0 (range, 11.9–31.7) kg/m². They were similar among three groups and no significant difference was found. For the surgery procedures, average operation time was 120.9 (range, 30–385) min. Average operative blood loss was 260.7 (range, 50–1200) mL and average blood transfusion during perioperative period was 308.9 (range, 0–1350) mL.

Wound complications

Postoperative wound complications occurred in 28 cases (6.4%) including ten wound discharges, 12 wound redness, one wound dehiscence, two superficial infections and two deep infections (Table 3). Wound complication rates in subcuticular suture group, staple group and interrupted suture group were 1.9%, 11.7% and 8.5%, respectively. There was a statistically difference among three groups ($p = 0.005$). Further pair wise comparisons showed that complication rate was significant lower in subcuticular group. P values of subcuticular suture group versus staple group and subcuticular suture group versus interrupted suture group were 0.001 and 0.010, respectively. There was no significant difference when compared complication rates between staple group and interrupted suture group ($p = 0.45$).

We also analyzed the association of the comorbidity and the wound complication (Table 4). In patients with renal disease, the wound complication rate was higher but without significant difference ($p = 0.17$).

Discussion

Overall, our study had reviewed three different methods of wound closure in 407 consecutive cases of primary hip arthroplasty

Table 1
Surgery type and closure method.

Surgery Type	Subcuticular sutures	Metal staples	Interrupted sutures	Total
Primary THA	133	76	78	287
Hemiarthroplasty	22	35	63	120
Total	155	111	141	407

THA, total hip arthroplasty.

Table 2
Patient characteristics.

	Subcuticular sutures (n = 155)	Metal staples (n = 111)	Interrupted sutures (n = 141)
Male	66	53	56
Female	89	58	85
Age (years)*	60.7 (18–91)	64.1 (25–90)	67.3 (22–99)
BMI (kg/m ²)*	23.9 (11.9–31.7)	24.4 (17.5–31.6)	23.5 (14.9–30.6)
Hypertension	48	29	58
Diabetes mellitus	17	25	22
Inflammation arthritis	7	1	3
Renal disease	3	4	5
Operation time (min)*	135.7 (60–385)	121.8 (45–270)	105.1 (30–270)
Blood loss (mL)*	268.1 (50–1000)	254.1 (50–1200)	259.9 (100–800)
Blood transfusion (mL)*	261.5 (0–1300)	294.0 (0–1300)	371.1 (0–1350)
Hospital stay (days) *	16.5 (7–31)	16.9 (8–30)	17.3 (9–35)
Removal time (days) *	11.0 (7–17)	12.0 (10–18)	12.1 (8–18)

BMI, body mass index; *values are median (range).

Table 3
Closure method and wound complications.

	Subcuticular sutures	Metal staples	Interrupted sutures
Discharge	1	6	3
Wound redness	2	3	7
Stitch abscess	0	0	0
Dehiscence	0	0	1
Superficial infection	0	2	1
Deep infection	0	2	0
Total	3	13	12

Table 4
Comorbidity and wound complications.

Comorbidity	Wound complications	Comorbidity	Wound complications
Hypertension	9	Inflammation arthritis	2
Diabetes mellitus	2	Renal disease	2

and we found a lower complications rate in wound closed with continuous subcuticular suture. Several prospective or randomized control studies had been constructed to compare subcuticular suture and staples in orthopaedic surgery. Eggers et al.²⁷ compared skin adhesives (2-octyl-cyanoacrylate and 2-butyl-cyanoacrylate), staples and subcuticular sutures in total knee arthroplasty (TKA). No significant difference was found in wound complication while closure time was faster with staples. Similar result was reported by Khan et al.¹⁰ and staples were recommended in THA. Graham et al.²⁸ analyzed cutaneous wound characteristics in knee replacement and found wound oxygenation characteristics were similar in 4–0 subcuticular vicryl and staple. There were also studies in favor of subcuticular sutures. Singh et al.¹¹ found that subcuticular vicryl sutures were significantly better than clips in regard to wound healing and cost in hip surgery. Shetty et al.¹⁴ reported a significantly higher incidence of superficial wound infection in hip fracture when wound closing with metal staples. Conversely, a retrospective study by Patel et al.²⁹ found that staples had a lower rate of complications compared with the subcuticular

sutures (3–0 Biosyn and V-Loc suture). Newman et al.³⁰ found a fewer complications with staples than with running subcuticular sutures in another retrospective study of TKA. In addition, most study had not distinguished between interrupted and continuous subcuticular sutures.

Although staples were used after continuous subcuticular skin closures in our study, there was a significant lower wound complication rate in patients with continuous subcuticular skin closure than staple group and interrupted suture group. Continuous subcuticular sutures may provide a better attachment and avoiding inversion of dermal margins. It may reduce the risk of wound complications in joint surgery compared with staples and interrupted sutures. Moreover, Wyles et al.³¹ found running subcuticular closure enabled more blood flow and improve wound healing.

There was no significant difference in wound complication rate between metal staples and interrupted nylon sutures in the present study. This is supported by other studies. Murphy et al.¹³ reported no statistically significant difference in orthopaedic wound healing

and cosmesis between the clips and interrupted sutures. But clips was removed quicker, less painful and with good patient satisfaction. Moore et al.¹² showed wound complications had no difference between nylon sutures or staples in patients with lower limb sarcoma. However, we found the infection rate was higher in staple group. 4 out of 5 cases of infection occurred and deep infections only occurred in staple group.

Wound complications are also highly associated with patient's characteristic and comorbidity.³² Al-Mayahi et al.³³ reviewed cases of orthopaedic infections and found patients with diabetes had a several times higher risk of infection. Miric et al.³⁴ reported patients with chronic renal diseases had more comorbidities and superficial wound infection in a retrospective study of primary TKA. In the present study, there was an increase of wound complication rates in patients with renal diseases ($p = 0.17$). However, there were no differences in the hypertension ($p = 0.84$), diabetes mellitus ($p = 0.29$) and inflammation arthritis ($p = 0.39$).

The major strength of our study was that the sample scale including 373 consecutive patients and 407 cases was larger than most of the previous studies. The other strength was the involvement of continuous suture techniques. Most orthopaedic studies used interrupted subcuticular suture for wound closure and only two studies adopted continuous suture techniques.²⁵ Due to the retrospective study design, there are several limitations in our study. Staple group was made up by fewer patients than subcuticular suture group and interrupted suture group. The use of staples in subcuticular suture group introduced bias into the comparison of complications between subcuticular suture group and staple group. Thus well designed, randomized, prospective trials are needed for future study.

Conclusions

This study suggests that there is significantly lower incidence of wound complications following primary hip arthroplasty when wound closure was performed using continuous subcuticular suture.

Competing interests

The authors declare that they have no competing interests.

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