Newman et al., Orthop Muscul Syst 2013, 2:3
http://dx.doi.org/10.4172/2161-0533.1000140

Orthopedic & Muscular System

Research Article Open Access

Total Hip Arthroplasty and Surgical Wound Closure: Sutures Versus Staples

Justin T Newman [1,2]; Steven J Morgan [3], Allison E Williams [4], Gustavo V Resende [1], Michael R Dayton [1,2]

[1]*The Department of Orthopaedic Surgery, Denver Health Medical Center, University of Colorado School of Medicine, Denver, Colorado, USA*
[2]*Department of Orthopaedics, University of Colorado Health Sciences Center, Aurora, Colorado, USA*
[3]*Swedish Medical Center, Englewood, Colorado, USA*
[4]*Department of Research and Development, Bay Pines VA Health Care System, Bay Pines, Florida, USA*

Abstract

Discrepancies exist between studies that compare sutures and staples. We retrospectively reviewed 142 consecutive cases of total hip arthroplasty that had surgical wound re-approximation by either staples or absorbable subcuticular sutures. To our knowledge, this is the largest analysis of its kind in the literature. There were equal numbers of cases of sutures and staples (n=71). Two (2.8%) patients in the staple group developed an infection (one superficial and one organ/space) and 1 (1.4%) patient in the suture group developed a superficial infection. The mean total surgical time for the suture group was 119.6 minutes (sd=39.0) and 115.3 minutes (sd=24.2) for the staple group. No significant association was found between closure type and complications or surgical time (p>0.05 for all).

Keywords: Therapeutic study; Level III (retrospective comparative study)

Introduction

It is widely accepted that both sutures and staples can achieve the basic goals of wound closure. Both methods endeavor to re-approximate the skin by creating a watertight, tension-free non-inverted opposition of the edges that promotes rapid healing and a cosmetically acceptable scar [1]. Multiple studies have produced conflicting results regarding the efficacy, economics, rate of complications and cosmetic outcomes achieved when comparing these two closure methods for a variety of applications. However, a review of the literature reveals a dearth of information regarding the closure of wounds after elective orthopaedic procedures.

Discrepancies exist among current reports and no consensus exists to provide evidence based reasoning to guide orthopaedic surgeons to employ a specific type of skin closure technique. The purpose of this retrospective study was to compare staple skin closure to suture skin closure in patients undergoing primary total hip arthroplasty with the intention of comparing surgical time and post-operative complications related to the closure technique.

Materials and Methods

Following approval from the ethics review committee, the medical records of patients who underwent total hip arthroplasty (THA) from January 2003 to January 2007 were reviewed. All patients admitted for a primary THA were eligible for inclusion in the review. Patients were excluded if they were undergoing revision arthroplasty, diagnosed with an underlying malignancy, had suffered previous trauma or had a previous incision that compromised the soft tissues in the operative field. Demographic, surgical and outcomes data were extracted from the charts. Demographic data included age, sex, and ethnicity. Surgical variables recorded were technique employed, surgical time, and surgeon. Outcomes recorded included complications, wound dehiscence, surgical site infection (SSI), repeat operations for debridement and re-closure, and tissue reaction to the closure material. All patients had follow-up through closure of surgical wounds and resolution of surgical complications.

All surgical procedures were performed by two of the authors of the paper (SM and MD). Wound closure for all cases was performed with absorbable and non-absorbable suture at the level of the arthrotomy and absorbable suture in the subcutaneous layer. The skin layer was then re-approximated with either staples or a running subcuticular absorbable suture with steri-strips placed. All post-operative care was standard of care for our facility and was given without knowledge that the patients and their outcomes would be included in a study.

Information regarding wound closure was obtained from the operative record and verified on the immediate post-operative radiograph. The duration of surgery was obtained from the operative record and was defined as the time from initial incision until the time of skin closure completion.

Classification of SSI was per the Center for Disease Control (CDC) criteria. Infections were classified as: superficial/incisional, defined as involving only skin and subcutaneous tissue of the incision; deep incisional defined as involving peri-incisional deep soft tissues (e.g., fascial and muscle layers); and organ/space defined as involving any part of the body, excluding the skin incision, fascia, or muscle layers, that was opened or manipulated during the operative procedure.

Data were analyzed using SPSS 11.5 (SPSS, Chicago, IL). Univariate statistics including frequencies, percentages, and measures of central tendency were calculated for each measurement as well as for the demographic and injury characteristics. Independent samples t-tests and the Mann Whitney test were used to evaluate differences by technique and surgeon according to distributional characteristics of the data. Statistical significance was declared at $p<0.05$.

Results

There were 142 primary THAs eligible for review based on inclusion criteria. Equal numbers were used for each closure technique, 71 patients with staples and 71 with sutures. Surgeon SM performed 73

***Corresponding author:** Justin T Newman, University of Colorado, School of Medicine, Department of Orthopaedics 12631 E. 17th Ave., Mail Stop B202, Aurora, CO 80045, USA, Tel: 303.870.8916; Fax: 303.436.5857; E-mail: Justin.Tyler.Newman@gmail.com

Received October 18, 2013; **Accepted** December 24, 2013; **Published** December 31, 2013

Citation: Newman JT, Morgan SJ, Dayton MR, Resende GV, Williams AE (2013) Total Hip Arthroplasty and Surgical Wound Closure: Sutures Versus Staples. Orthop Muscul Syst 2: 140. doi: 10.4172/2161-0533.1000140

(51.4%) of the cases and used staples in 69 cases and sutures in 4 cases. Surgeon MD performed 69 (48.6%) of the cases and used sutures in 67 cases and staples in 2 of the cases.

Eighty-eight (62.0%) patients were female and 54 (38.0%) were male. The average age of patients in the suture group was 52.4 years (sd=13.5) and in the staples group 55.2 years (sd=10.7). The average age of patients operated on by surgeon SM was 55.2 years (sd=10.5) while patients operated on by MD had a mean age of 52.3 years (sd=13.7). Differences in age between technique utilized and surgeon were not significant (t=1.397, p=0.165 and t=1.407, p=0.162, respectively).

Three cases had complications. Two of these cases occurred in patients with staples (2.8%, one superficial infection and one septic joint) and 1 occurred in a patient with sutures (1.4%, one superficial infection). The association between technique and incidence of a complication was not statistically significant ($\chi 2$=0.341, p=1.000). One superficial infection and the organ/space infection were in patients who were operated on by surgeon SM. The group treated by MD had one superficial infection. A sufficient number of cases were not present to analyze subgroups of infections.

The superficial infection in the staple group was a 48 year old man whose course during the hospitalization for THA was without incident. At 2 week follow-up, there was irritation around the staple sites with mild, small pustules with no evidence of deep infection and the patient was put on a short course of oral antibiotics with subsequent resolution of symptoms. The superficial infection in the suture group was in a 68 year old female who 20 days after the THA procedure returned to the OR because of persistent drainage from the distal one third of her surgical wound. Dissection of the superficial structures revealed a hematoma in the subcutaneous tissues with no evidence of infection extending across the deep fascia, which was intact. The patient underwent a course of intravenous antibiotics while hospitalized and was discharged on oral antibiotics. The joint space in infection in the staple group occurred in an 85 year old male who 19 days after the THA procedure returned to the OR for fever, pain and drainage from his hip and was found to have an infected joint. The patient underwent staged procedures and liner exchange, removal and replacement of the femoral head component, a course of intravenous antibiotics.

Surgical time for the suture group averaged 119.6 minutes (sd=39.0) with 115.3 minutes (sd=24.2) for the staples group. The difference in surgical time was not significant (z=-0.341, p=0.733). Surgical time for MD averaged 117.7 minutes (sd=39.0) and SM averaged 117.2 minutes (sd=25.0). The difference in surgical time between MD and SM was not significant (z=-0.312, p=0.755) and t=-0.083, p=0.162, respectively).

Female patients were more likely to receive sutures and male patients were more likely to receive staples. Fifty-one (58.0%) female patients received sutures and 37 (42.0%) staples. Twenty (37.0%) male patients had their skin re-approximated by the suture technique and 34 (63.0%) by the staple technique. The association between patient sex and technique was statistically significant ($\chi 2$=5.857, p=0.024).

Discussion

The number of patients reviewed for this study of sutures versus staples in surgical wound closure is greater than those that have been reported previously in the orthopaedic literature. This comparative study did not demonstrate any significant differences in complication rates or surgical time when skin closure was undertaken with suture or staple technique in a population of patients undergoing THA.

The strengths of this study include that it consisted of a consecutive series of patients. Furthermore, the patients at our clinic, including those included in this study are relatively uniformly randomized to surgeon and by extension, wound closure method.

The retrospective design of this study introduces a number of potential weaknesses. These include inaccurate or inconsistent documentation of wound complications and surgical times. Additionally, a number of other potentially confounding variables could not be controlled or accounted for; including the influence of body habitus, wound stress and unrecognized or unrecorded medical conditions that may have compromised wound healing abilities. Furthermore, while this was largely a retrospective review of different surgical techniques by two different surgeons, each surgeon used in a few cases a different technique of wound closure for unexplained or analyzed reasons, thereby eliminating surgeon randomization. However, the retrospective design does also lend credibility to the reported results. The results reported here are an accurate representation of the care that was given as the treating surgeons did not anticipate that the outcomes from their operations would be analyzed and reported. This effectively eliminates the observer or participant bias that may occur with prospective trials that incorporate procedures.

There may also be unanalyzed differences in deep layer closure. These weaknesses introduce individual surgeon technique as a variable. However, as all procedures were performed at one facility with common staff, it would be reasonable to assume that this had a proportionally small impact on the outcomes. The common staff caring for each of the patients and the shared standard of care that was given to each of these patients allows their post-operative outcomes to be compared with increased certitude.

Finally, associations between technique utilized and complications may not have been detected due to an insufficient sample size. Given the low rate of complications (2.1%) and small difference in the total surgical times, a larger cohort of subjects would be required to detect statistically significant differences and thus, definitive clinical conclusion must be deferred.

The results of this study further contribute to the body of literature that has compared sutures to staples since automatic skin staplers were introduced in 1972 with the claim of usability and capacity to reduce operating time [2,3]. Follow-up studies focusing on surgical time suggested that staples could save up to 80% of the time required for suturing with equal cosmetic results [4]. Two comparative studies from 1987 and 1992 reported faster wound closure time with staple use but at the cost of wound inflammation, discomfort, and diminished cosmetic results in laparotomy and general wound closure [5,6]. A randomized study of emergency room laceration repair in 1995 found that sutures took more than 7 times longer for wound closure than staples [7]. This was echoed in 1997 when it was reported that with closure of pediatric scalp lacerations, staples were faster and more economical than sutures [8].

While analyzing surgical time for this study, we did not demonstrate statistically significant differences in the total surgical time between the sutures group and the staples group. We could not measure the actual time of wound closure in this retrospective review and are unable to comment on the reduction in closing time alone when isolated from the whole of the surgical procedure. Recognizing the cost constraints of modern medicine, a trend toward decreased surgical time may have a significant impact on decreasing costs when factored over multiple procedures with consideration to the costs of operative time and anesthetic supplies.

The orthopedic literature is mixed in its analysis of sutures versus staples. In a prospective, randomized control trial that compared sutures versus staples for wound closure following Dupuytren's surgery, it was reported that though staples were quicker and equal in cosmesis, they were associated with increased pain upon removal [9]. Shetty et al. in 2004 reported that patients randomized to either sutures or staples after surgery for repair of femoral fractures had a higher complication rate with staples [1]. Singh et al. in 2006 reported less wound discharge and redness with the use of sutures for wound closure after surgery for fracture of the neck of the femur [10]. Khan et al. in 2006 found similar results after hip and knee replacements with both sutures and staples regarding complications and a significantly faster wound closure time when using staples [11]. Much like the results of the present study, in 1991 a prospective, randomized trial of skin closure of 66 hip surgery procedures reported the only difference to be better cosmesis with sutures [12].

Regarding orthopedic procedure related skin closure, it would be prudent to base the use of sutures or staples on the anatomic location and the indication for the operation. It has been reported that staple use provides better blood perfusion to the wound sight than sutures, which was correlated to improved conditions for wound healing [13]. It is possible that in areas with a redundant blood supply and adequate soft tissues, like the hip, that closure method may be irrelevant. In the soft tissues surrounding areas with less soft tissues or increased skin tension there may be a greater degree of vascular compromise based on wound closure technique. Biologically friendly closure techniques may prevent peri-operative wound problems in anatomic regions where there are more restrictions on local resources.

The surgeon's preference and comfort with either method of wound closure should be combined with considerations of cost, operative time, convenience of the removal of wound closure material and patient comfort to determine which method is best suited for individual patients.

References

1. Shetty AA, Kumar VS, Morgan-Hough C, Georgeu GA, James KD (2004) Comparing wound complication rates following closure of hip wounds with metallic skin staples or subcuticular vicryl suture: a prospective randomised trial. J Orthop Surg (Hong Kong) 12: 191-193.
2. Lennihan R, Mackereth M (1975) A comparison of staples and nylon closure in varicose vein surgery. Vasc Surg 9: 200-203.
3. Steichen FM, Ravitch MM (1973) Mechanical sutures in surgery. Br J Surg 60: 191-197.
4. Meiring L, Cilliers K, Barry R, Nel CJ (1982) A comparison of a disposable skin stapler and nylon sutures for wound closure. S Afr Med J 62: 371-372.
5. Ranaboldo CJ, Rowe-Jones DC (1992) Closure of laparotomy wounds: skin staples versus sutures. Br J Surg 79: 1172-1173.
6. Stockley I, Elson RA (1987) Skin closure using staples and nylon sutures: a comparison of results. Ann R Coll Surg Engl 69: 76-78.
7. Orlinsky M, Goldberg RM, Chan L, Puertos A, Slajer HL (1995) Cost analysis of stapling versus suturing for skin closure. Am J Emerg Med 13: 77-81.
8. Kanegaye JT, Vance CW, Chan L, Schonfeld N (1997) Comparison of skin stapling devices and standard sutures for pediatric scalp lacerations: a randomized study of cost and time benefits. J Pediatr 130: 808-813.
9. Bhatia R, Blackshaw G, Barr V, Savage R (2002) Comparative study of "staples versus sutures" in skin closure following Dupuytren's surgery. J Hand Surg Br 27: 53-54.
10. Singh BMMGNSM (2006) Closure of hip wound, clips or subcuticular sutures: does it make a difference? EJOST 16: 124-129.
11. Khan RJ, Fick D, Yao F, Tang K, Hurworth M, et al. (2006) A comparison of three methods of wound closure following arthroplasty: a prospective, randomised, controlled trial. J Bone Joint Surg Br 88: 238-242.
12. Clayer M, Southwood RT (1991) Comparative study of skin closure in hip surgery. Aust N Z J Surg 61: 363-365.
13. Graham DA, Jeffery JA, Bain D, Davies P, Bentley G (2000) Staple vs. subcuticular vicryl skin closure in knee replacement surgery: a spectrophotographic assessment of wound characteristics. Knee 7: 239-243.

Citation: Newman JT, Morgan SJ, Dayton MR, Resende GV, Williams AE (2013) Total Hip Arthroplasty and Surgical Wound Closure: Sutures Versus Staples. Orthop Muscul Syst 2: 140. doi: 10.4172/2161-0533.1000140