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Ankle Closure Methods: An Expert Survey of Orthopedic Trauma Association (OTA) Members and Review of the Literature

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Introduction

Ankle fractures are very common, accounting for 10.2% of all bone injuries, with an incidence in adults of 179 fractures per 100,000 persons per year (1,2) Ankle fractures are mostly caused by falls (61%) followed by sports injuries (22%) and other trauma mechanisms (17%) (1). Depending on the type of injury, ankle fractures can be treated either operatively or nonoperatively. Due to it being associated with superior outcomes though, surgery, particularly open reduction and internal fixation (ORIF), is considered the predominant treatment method for ankle fractures (4).

Wound complication rates after ORIF of ankle fractures vary between 1.4% and 18.8% (5). One of the most prevalent complications, surgical site infections (SSI), have been shown to negatively affect bony union and functional recovery of the ankle (4). Patient factors, such as a history of diabetes, peripheral neuropathy, and medications, are significantly associated with ankle fracture surgery wound complications (5). Although there is substantial evidence indicating skin closure methods are significantly associated with wound complications and surgical outcomes in various types of surgeries, to the best of our knowledge, only one study with a small sample size has investigated this association following ankle fracture surgery, yielding insignificant results (6).

Because of the lack of the subcutaneous support around the ankle, skin closure following ankle surgery is particularly challenging (6). Due to this unique challenge and the scarcity of literature examining skin closure methods following ankle surgery, we sought to evaluate the preferences of orthopedic trauma experts regarding skin closure methods after ORIF of rotational ankle fractures and compare these preferences to the current literature on outcomes of common skin closure methods.

Materials and Methods

A 23 item web-based questionnaire was advertised to active members of the OTA from January to September of 2017. The survey was completed by 167 respondents. 150 (92%) of respondents were male, and the mean age was 45.1 years. The mean number of years in practice was 12.19 and ranged from 0-44 years (Table 1). The questionnaire was designed by the authors. The survey responses were recorded using the LSUHSC Redcap database. Using a cross-sectional survey study design, we evaluated the preferences of suture type and technique for skin closure after fixation of rotational ankle injuries. The majority of respondents are fellowship trained (147, 89.6%), and practice in a Level 1 academic setting (99, 60%). 96 (57.8%) of respondents have an academic practice. 48 (28.9%) reported being in private practice, while the remaining (22, 13.3%) chose “other” as their practice type.

A literature review was also conducted using the main medical databases to evaluate the available literature and to analyze the results of studies examining outcomes following common skin closure methods in a variety of surgeries. A total of 41 studies examining wound closure methods were identified. 17 were excluded due reasons that included very small samples sizes, too specific study populations that results would not be able to be applied to our study, and studies that examined adhesive closure, leaving
24 studies that were included in our review. Five compared suture types and twenty compared sutures verses staples. Nine were randomized controlled trials, five were retrospective cohorts, and ten were systematic reviews/ meta-analyses. Nine studies specifically looked at orthopaedic surgeries.

Results

167 of 1639 OTA members with either “Active,” “Clinical,” “Associate,” or “Candidate” status responded to the survey for a response rate of 10.2%. Nearly all respondents indicated that they close these wounds in a layered fashion (90.4%). The most utilized skin closure method after ORIF of routine ankle injuries was interrupted non-absorbable nylon suture(49.7%) (Figure 1). This preference for interrupted non-absorbable suture increases with treating patients thought to have a higher risk of wound complications (eg diabetics). 68.7% of respondents used interrupted non-absorbable sutures when closing skin for those they considered “high risk” (ie diabetics) (Figure 2). When used, non-absorbable sutures are most commonly removed in the 2 to 3 week post operative period (125, 77.6%) (Figure 3). When asked “Approximately what percentage operative ankle injuries in your practice experience some surgical incision complication?”, 82 (49.7%) responded that these occurred in 1-5% of patients (Figure 4). In regards to how much time, in minutes, was spent closing bimalleolar ankle fractures 80 (48.2%) estimated 5-10 minutes, with 80 (48.2%) estimating >10 minutes (Figure 5). As seen from response to the survey by OTA members, there are multiple common and accepted methods of wound closure after ORIF of rotational ankle fractures.

Of the studies examining sutures vs staples, seven favored sutures and two favored staples when looking at wound complications. Of these studies, three meta-analysis examined orthopeadic surgeries with only one revealing sutures has less complications than staples. While there is conflicting evidence on which method produces less complications, staple closure was significantly associated with greater reported pain and worse cosmetic scores compared to sutures,but had the benefit of quicker closing time. When comparing suture methods, interrupted sutures were associated with a significantly less incidence of wound dehiscence compared to continuous sutures in two separate meta-analyses. Absorbable sutures were associated with significantly better cosmetic outcomes and no significant difference in overall wound complication rates compared to nonabsorbable sutures.

Figure 1: What is your primary method of skin closure for a routine ankle fractures? (N = 165).

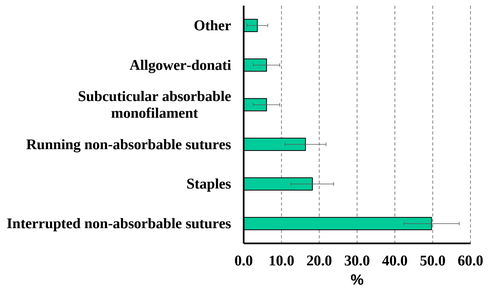


Figure 2: What is your primary method of skin closure for a routine ankle fractures in high-risk patients (e.g. diabetics?) (N = 166).

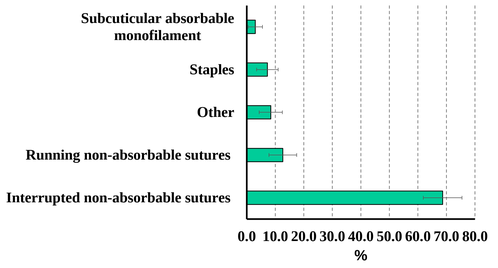


Figure 3: If removable sutures are used, at what time point post operatively do you typically remove sutures if there are no wound complications? (N = 161).

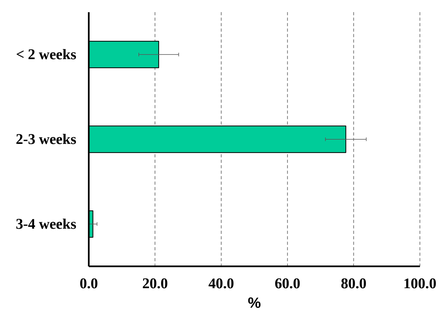


Figure 4: Approximately what percentage operative ankle injuries in your practice experience some surgical incision complication? (N = 165).

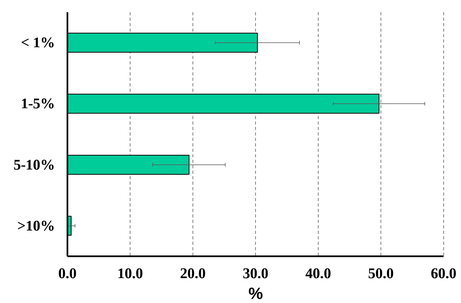


Figure 5: Approximately how long, in minutes, do you spend closing surgical incisions for fixation of bimalleolar ankle fractures? (N = 166).

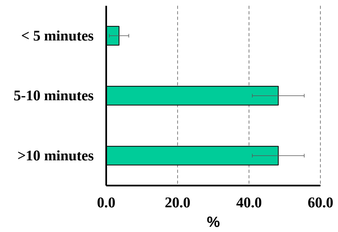
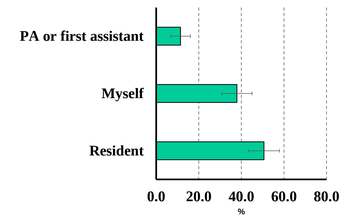


Figure 6: Who performs the majority of your closure? (N = 166).



Conclusions

The best method of skin closure after ORIF of rotational ankle injuries remains unproven. The relative majority of OTA members prefer to close skin with interrupted nylon after a layered closure. The popularity of interrupted non-absorbable suture increased by 20% when comparing “routine ankle fractures” and “routine ankle fractures in high risk patients.” This would suggest that most surgeons rely on this method of closure as the “safest” method. This would imply that most surgeons believe the interrupted non-absorbable closure method is most likely to prevent post operative wound complications. This method has also been shown to be associated with greater cosmetic scores and less pain compared to staples. The decreased rates of dehiscence compared to continuous/ running sutures seen in other surgery types support the higher usage rate following ORIF of ankle fractures.`

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