

Original Article

Dressing change frequency following anterior cruciate ligament reconstruction: a pilot study

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Abstract

Background: Data in the literature are limited concerning the impact of different time scheduling, in regards to dressing change frequency, on infectious complications at the surgical site attributable to the dressing procedure itself. **Methods:** A pilot, randomized trial was conducted to assess the safety of two different dressing removal protocols performed after anterior cruciate ligament reconstruction for deficiency. Patients assigned to “standard” protocol underwent a dressing change on postoperative day 2, 4 and 6. Those assigned to the “revised” protocol underwent a change just on day 6. All patients’ surgical site skin was cultured at baseline and on postoperative day 6 immediately after dressing removal. **Results:** Forty patients were assigned to the “standard” protocol and forty to the “revised” one. The percentage of culture positive subjects was 2.5% (1/40) in the “standard” protocol group compared to 0% in the “revised” one. No significant differences were found in the number of positive culture subjects between methods. **Conclusion:** Changing dressing frequently doesn’t seem to provide any additional benefit to the patients, while retaining it doesn’t lead to any increased risk of infection. Moreover, the patient’s inconvenience and increased related cost caused by frequent dressing change suggest that the dressing should be retained for at least 6 days postoperatively. **Level of evidence:** 2b

Keywords: ACL, Bandage, Infection, Removal, Surgical wound

Introduction

Dressings that are applied to surgical wounds at the time of surgery can either be removed early, changed regularly, or retained until the removal of sutures¹. Frequent dressing changes may lead to damage of the skin barrier which protects the body against infection². Additionally, this may cause an increased risk of complications due to the increased frequency of wound exposure². Dressing change has been reported as the most painful procedure associated with wounds. Pain contributes to stress and anxiety, consequently leading to potentially delayed healing. Moreover, dressing change, which may sometimes be traumatic and time consuming, seems to have great impact on patients’ quality of life³. Moreover, the economic burden that arises from frequent dressing changes is not to be overlooked. Cost-effective care practices and reduced expenditure on wound dressings are mandatory⁴.

Despite the importance of this issue regarding the frequency of the dressing change in surgical wounds, data in literature are limited. It has been reported that

there were no significant differences between the early and delayed dressing removal group in the proportion of people who developed superficial surgical site infection¹. Additionally, a 7-day interval between changes of the negative pressure wound therapy (NPWT) is acceptable as compared to a 3-day one⁵. However, there is no clear indication in literature about what the optimal time interval for dressing changes following anterior cruciate ligament reconstruction (ACLR) is. To address this issue, a pilot, clinical trial was designed to compare two different

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| Characteristics | “Standard” protocol group (n=40) | “Revised” protocol group (n=40) | P value |
|-------------------------------|----------------------------------|---------------------------------|---------|
| Age (years) | | | |
| Mean SD | 27.08±6.50 | 27.10±7.31 | 0.828 |
| Median (Min-Max) | 26.0 (17.0-41.0) | 25.5 (17.0-44.0) | |
| Gender | | | |
| Male n (%) | 21 (52.5) | 24 (60.0) | 0.652 |
| Female n (%) | 19 (47.5) | 16 (40.0) | |
| Weight (kg) | | | |
| Mean SD | 73.45±14.26 | 76.25±15.51 | 0.403 |
| Median (Min-Max) | 73.5 (48.0-110.0) | 73.5 (50.0-120.0) | |
| Height (m) | | | |
| Mean SD | 1.80±0.12 | 1.81±0.12 | 0.585 |
| Median (Min-Max) | 1.8 (1.5-2.1) | 1.8 (1.5-2.0) | |
| BMI (kg/m²) | | | |
| Mean SD | 22.52±2.07 | 22.98±2.49 | 0.462 |
| Median (Min-Max) | 22.1 (19.4-29.9) | 22.5 (19.4-29.7) | |
| Sport | | | |
| Volleyball n (%) | 3 (7.5) | 8 (20.0) | |
| Basketball n (%) | 9 (22.5) | 6 (15.0) | |
| Ski n (%) | 6 (15.0) | 6 (15.0) | |
| Soccer n (%) | 11 (27.5) | 8 (20.0) | |
| Tennis n (%) | 3 (7.5) | 5 (12.5) | |
| Other n (%) | 8 (20.0) | 7 (17.5) | |

Table 1. Patients' demographic and clinical characteristic.

schedules for dressing changes in such patients.

The aim of the study was to assess the impact of the different time scheduling, in regards to dressing change frequency, on infectious complications at the surgical site attributable to the dressing procedure itself.

Materials and methods

A pilot, randomized, single-blinded trial was conducted to assess the safety of two different dressing removal protocols performed after ACLR. Patients were eligible to participate in the study if they were between 19 and 35 years of age and underwent a primary ACLR for deficiency. Exclusion criteria were smoking, diabetes mellitus, venous insufficiency, hematologic disease, cancer, obesity, immunosuppression or other severe chronic disease. Permission from institutional review board and written informed consent from all patients were provided. The study meets the ethical standards of the journal⁶.

All surgical procedures were executed by a single, ACLR surgeon (NG). Prophylactic antibiotic medication was administered to all patients at time of induction. All surgical

wounds resulting from ACLR were closed with sutures by layers. Subcutaneous tissue was closed with no. 2-0 absorbable sutures, and skin incisions with surgical staples. Afterwards, the surgical site was covered with adhesive bandages followed by gauzes, cotton and elastic bandage without the use of brace⁷. All patients received postoperative thrombo-prophylaxis with bemiparin sodium.

Immediately after the operation, patients were randomly assigned to (1:1 intervention allocation) either the “standard” dressing removal protocol or the “revised” one. Randomization was performed using an internet interface (Sealed Envelope Ltd., www.sealedenvelope.com) by one of the researchers (NG, AK) on the day of surgery. The block randomization method was used and the block size was determined to be 4. Patients who were assigned to “standard” protocol underwent a dressing change on postoperative day 2, 4 and 6. On the other hand, patients assigned to the “revised” protocol underwent a change just on day 6. It was not practically possible to blind either the operating surgeon or patients.

The change dressing was performed by the surgeon

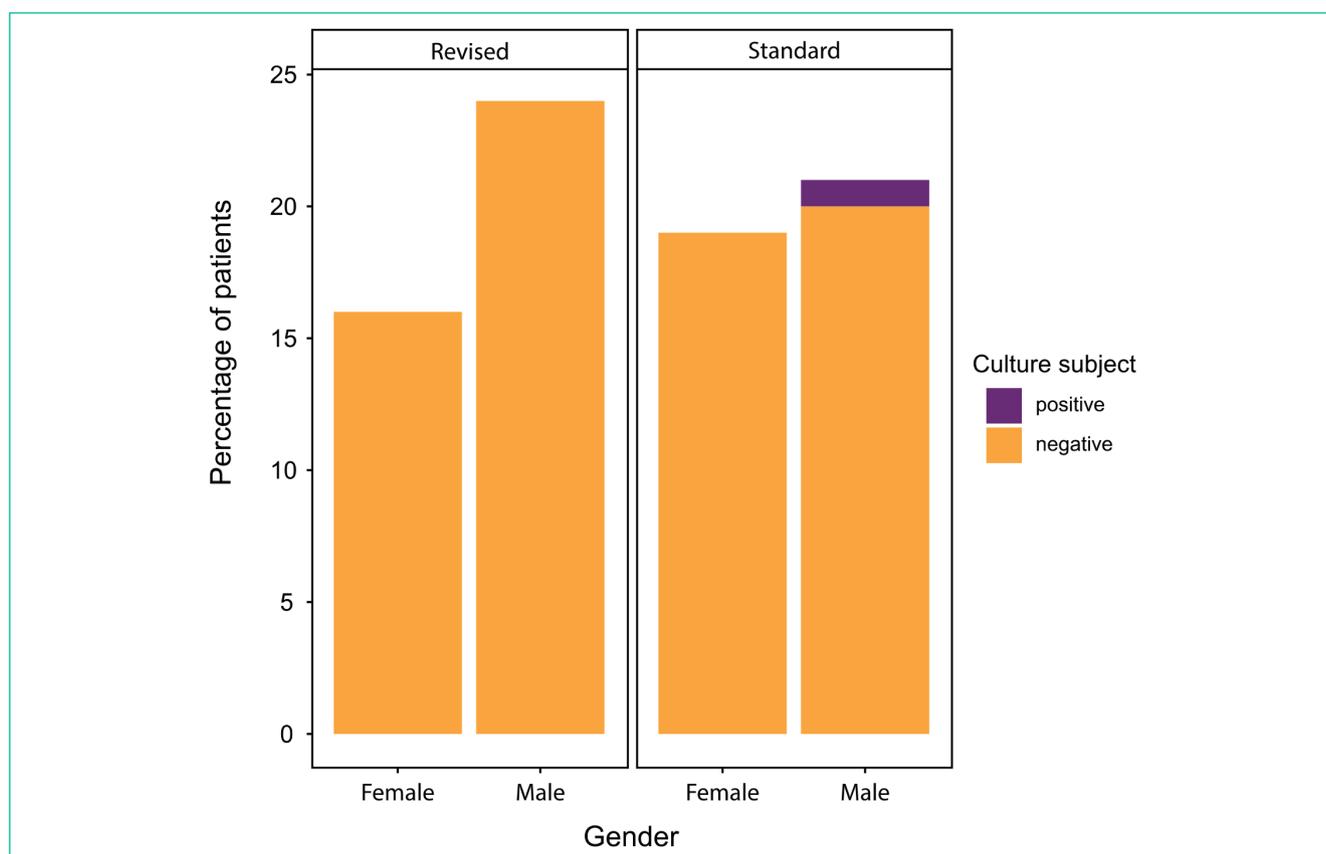


Figure 1. The percentage of culture positive subjects in the “standard” and “revised” protocol group.

(NG). Wound cleansing was carried out using sterile gauze and 10% povidone-iodine solution. The site was then covered with adhesive bandage followed by elastic one. From postoperative day 1 to day 6, erythema, swelling, tenderness, induration, pain, pruritus and purulence were carefully checked and reported at all dressing changes.

All patients’ surgical site skin was cultured using flocked swabs with a longitudinal stroke 1-2 cm medial and lateral to the incision at baseline (immediately after closure with suture) and on postoperative day 6 immediately after dressing removal. Additionally, cultures of the non-operative knee were obtained on postoperative day 6 to use as controls. A single, blinded microbiologist prepared and read the cultures according to established methodologies used in the microbiology department of the hospital; the species of bacteria or fungi developed were recorded.

The primary endpoints were: 1) the percentage of culture-positive subjects by postoperative day 6 in each group, 2) the identification of pathogenic species of organisms cultured by postoperative day 6 in each group and 3) the detection of possible statistically significant difference in the percentage of culture-positive subjects between the two groups.

Statistical analysis

A statistical analysis of the data was performed using the software Statistical Package for Social Sciences (SPSS), version 22.0 (SPSS, Inc., Chicago, IL, USA). Descriptive statistics were used to describe the study population’s demographic and clinical characteristics. All continuous variables were expressed as the mean \pm standard deviation, median and range, whereas categorical variables were presented as frequencies and percentages. Fisher’s exact test was used to compare dichotomous variables between the two groups. T-test or Mann-Whitney test was used to compare continuous variables. To check if there are statistical differences in the number of infected patients between the two protocols, a chi-square test was performed. Moreover, to investigate if gender, sports and the BMI had an effect in the number of infected patients we used a Cochran-Mantel-Haenszel chi-squared test for count data was used. All tests were two sided and the significance level was chosen to be $\alpha=0.05$.

Results

Eighty patients were enrolled in this pilot study; forty patients were assigned to the “standard” protocol and 40

to the “revised” one. Patients’ demographic and clinical characteristic are presented in Table I. The percentage of culture positive subjects was 2.5% (1/40) in the “standard” protocol group compared to 0% (0/40) in the “revised” one (Figure 1). The culture was obtained on postoperative day 6 and it was positive for *Acinetobacter baumannii*; the patient was treated with tazobactam. None of the cultures obtained from the non-operative knee on postoperative day 6 was positive. Most importantly, no significant differences were found in the number of positive culture subjects between methods ($\chi^2=1.01$, $p=1$). In addition, gender, sports and BMI did not have a significant effect in the number of positive culture subjects.

Discussion

The general practice, in all fields of surgery, is to cover the surgical wounds post-operatively with dressings in order to control bleeding and give protection to the surgical wound⁶. The ideal interval between dressing changes is generally determined by the surgeon, the patient’s general status, the wound status, the presence or not of any signs of infection and by surgeon’s preference^{5,9}.

In practice though, different dressing methods are used. Some professionals prefer to leave wounds uncovered, others keep them covered until suture removal and others uncover them after 24-48 h⁹. The ideal interval between dressing changes with regards to minimize wound complications and possible infection is an unresolved issue in the literature. Our pilot study suggests that the dressing should be retained for at least 6 days postoperatively.

Mangram et al have reported that all surgical incisions are usually covered with a sterile dressing for 24-48 h, but beyond 48 h it is unclear whether an incision must be covered or not¹⁰. Berg et al, in their review have stated that uncovered or early exposed wound may be associated with an increased risk of surgical site infection but also claimed that studies with longer dressing periods showed no benefits⁸. They concluded that the timing of dressing removal for wounds, should be put into perspective⁸. Walter et al, have also found also no significant differences in pain, scarring or surgical site infection with any dressings or no dressing at all (leaving the wound exposed)¹¹.

Another topic of interest, regarding the frequency of changing dressings is the nursing time and hospital costs. One common strategy, that has passed through generations, is to change the dressings every 2 or 3 days until suture removal¹². Lindholm et al have reported that over 60% of community nurses’ time is consumed with dressing changes. They conclude that most of the human resource in the health system is used in wound management and recommend that reducing the dressing change frequency in conjunction with a reduction in the number of dressings could lead to a reduction in dressing expenditure¹². The same opinion has been also expressed by other authors, as they support the view that less frequent changes can have benefits for the

patients, as the wound bed is not exposed, the wound healing outcomes are optimized and there is a reduction on dressing expenditure^{4,13}.

It should be also mentioned that frequent dressing changes can lead to pain and stress experienced by patients. Upton et al have concluded that heart rate measurements were significantly increased during dressing change and this could have an impact on delay healing, increased morbidity, reduced quality of life and increased costs of care³. The pain that patients experience during dressings change is an issue also discussed by Benbow M¹⁴. He has reported that pain during wound management can be intense, a new tissue can be ripped away and the surrounding skin of the wound can be damaged through frequent removals of dressings. One of the recommendation in his study is changing the frequency of dressing changes.

Rasero et al have examined the interval for central venous catheter dressing changes and found that patients with longer intervals did not show a significant increase in the rate of local infection, while those who received dressing changes every 2 days had a significant increase in local skin toxicity¹⁵. They also found that longer interval were associated with reduced costs¹⁵. Benhamou et al, are of the same opinion as they found a 70% relative reduction in the incidence of local skin toxicity in children with high-dose chemotherapy in the group with less frequent catheter dressing changes without increasing local infection and catheter-related bacteremia. In their unit dressings are changed every 8 days¹⁶.

Schade et al, in their study, concluded that treatment of chronic foot and ankle wounds is resource and time expensive for the patient and the physician and state that a reduction in the frequency of dressing changes and office visits is an important factor to lower costs¹⁷. Kim et al, examined the ideal interval between dressing changes during negative pressure wound therapy for open traumatic fractures and found also that elongating dressing change intervals to 7 days is acceptable taking into account patient comfort, costs related to negative pressure wound therapy and final outcomes⁵.

The main limitation of a study like this is the fact that the sample size is relatively small. However, for a preliminary pilot study the sample size is significant¹⁸. Interpretations of the study results should be done with caution and replication of the findings is necessary. However, in anticipation of a randomized, controlled trial, a pilot study can provide useful information for clinical practice, since dressing change frequency is often a challenging issue and evidence is limited.

Conclusion

Changing dressing frequently doesn’t seem to provide any additional benefit to the patients, while retaining it doesn’t lead to any increased risk of infection. Moreover, the patient’s inconvenience and increased related cost caused by frequent dressing change suggest that the dressing should be retained for at least 6 days postoperatively.

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