

# Topical Negative Pressure Therapy and Interactive Dressings in Prevention of Wound Infections in High-Risk Orthopaedic Patients

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## Abstract

The likelihood of periprosthetic infection in high-risk patients (obesity and diabetes mellitus) after revisional arthroplasty is extremely high. The authors conducted a pilot prospective comparative study of clinical and economical efficacy of interactive absorbing dressings based on carboxymethyl cellulose impregnated with silver ions and single-use vacuum assisted dressings in prevention of surface surgical site infections in high-risk patients.

**Keywords:** Periprosthetic infection in high-risk patients; Interactive dressings; Topical negative pressure therapy

## Introduction

Periprosthetic infection is the most common complication and basic issue in replacement arthroplasty [1], "infections associated with total hip replacement are a devastating complication with far reaching consequences both for patients and for health care system" [2]. Kuper M. and Rosenstein A. characterized the costs as "mind-boggling" [3], while Rezapoor M. and Parvizi J. predict that in 2015 the U.S. is going to lose 1 billion US dollars to periprosthetic infections. The authors also note that the lethality associated with periprosthetic infections is higher than that of some cancers [4,5].

The incidence of infectious complications occurring after surgical implant placement reaches 3 to 12 per cent [6], while surgical site infections (SSI) following the replacement of big joints is observed in 2.5 per cent of cases [7], in addition, the risk of periprosthetic infection increases 3.3 times in case of revisional prosthetic repair [8]. The number of joint replacement surgeries is on the rise across the world, however the incidence of infectious complications associated with this kind of intervention gains even more momentum [9].

Among the risk factors for periprosthetic infection are immunosuppression, alcohol abuse, systemic use of corticosteroids, inadequate use of antibiotics in disease prevention, obesity, diabetes mellitus, oncological diseases, duration of surgery, intraoperative transfusion of blood components, infectious arthropathies, joint repair and periprosthetic infections in past medical history as well as surface surgical site infections [5,10-18].

Obesity increases the risk of SSI 1.9 times [19], diabetes mellitus raises the same by 2.1, while compounded effect of both obesity and diabetes leads to 5 times bigger risk of SSI [20].

It is a well-known fact that infected wound complications as well as other iatrogenic complications are easier to prevent than to treat. The most effective prevention methods of periprosthetic infection include rational systemic use of antibiotics, topical use of antibiotic-impregnated cement and installation of laminar air supply devices in the operating rooms [12,21,22].

It is also known that the most effective method of prevention and treatment of infected wound complications is topical application of negative pressure - TNP [23-27]. Thus in the study by Condé-Green A [28]. The use of preventative vacuum assisted dressing after hernioplasty

lowered the incidence of wound complications from 63.6 to 22 per cent ( $p=0.020$ ), where the rates of dehiscence dropped from 39 to 9 per cent, skin and adipose tissue necrosis - from 18 to 9 per cent, wound abscess - from 6 to 4 per cent, formation of seromas - from 12 to 0 per cent and relapse of hernia - from 8 to 4 per cent. The study by Soares K.C. showed [29] that the incidence of infected wound complications lowered from 32 to 9 per cent.

Sources offer different takes on the clinical and economical efficacy of single-use preventative vacuum assisted dressings: thus some authors consider them viable [30,31] particularly for obese patients [32], others can not discern the difference in the results as compared with standard dressings [33-35].

Also, some authors recommend using interactive dressings based on carboxymethyl cellulose impregnated with silver ions as preventive measures, noting their high clinical efficacy as compared with standard dressings [36,37].

The goal of our pilot prospective comparative study was to evaluate the efficacy of various wound dressings in prevention of surgical site surface infections in high-risk orthopaedic patients.

## Materials and Methods

The study analyzed the results of treatment of 30 patients who received medical care in City clinical hospital #13 in September 2013-March 2014. Earlier the patients who were considered high-risk underwent hip or knee replacement. The risk factors were: revisional arthroplasty, concomitant obesity (BMI over 28 kg/m<sup>2</sup>) and diabetes mellitus.

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All patients received blood sugar normalization therapy, thromboembolism prevention treatment and perioperative preventive antibiotics for 24 hours; during the surgery all patients had Redon drain placed under the fascia which was later removed on day 3.

All patients were randomly divided into 3 groups of 10, according to their hospital admission sequence.

Patients in group 1 (4 males, 6 females, average age  $57.7 \pm 3.9$  years) had their wounds sutured and covered with cohesive interactive absorbent dressings based on sodium carboxymethyl cellulose impregnated with 1.2 per cent ionic silver solution and reinforced with fiber; the dressings were replaced on day 5 and completely removed on day 12 when the sutures were released (Figure 1).

Patients in group 2 (4 males, 6 females, average age  $56.0 \pm 3.8$  years) had their wounds sutured and covered with single-use vacuum-assisted dressings; the dressings were replaced on day 5 and completely removed on day 12 when the sutures were released (Figure 2).

Patients in group 3 (3 males, 7 females; average age  $54.8 \pm 2.9$  years)

had their wounds sutured and covered with aseptic gauze dressings. Subsequently the incision zones were treated daily with povidone iodine solution and the dressings were replaced every day until the sutures were released (Figure 3).

## Results

In group 1 the average bed stay amounted to  $13.5 \pm 0.2$  days, no infections in the surgical area were observed in the following month after the treatment. In group 2 the average bed stay amounted to  $14.8 \pm 0.8$  days, no infections in the surgical area were observed in the following month after the treatment. In group 3 the average bed stay amounted to  $14.8 \pm 0.8$  days, 3 cases of infection in the surgical area were observed in the form of wound abscesses and suture sinuses within 2-3 weeks after the treatment.

The cost of treatment with respect to dressings used and without notice to the cost of implants, follow-up admissions and treatment of patients with complications amounted to 61,268 rubles in group 1, 69,309 rubles in group 2 and 75,068 rubles in group 3.



**Figure 1a:** Dressing before removal on day.



**Figure 1b:** Surgical site area on day 5.



**Figure 1c:** New dressing.



**Figure 1d:** Surgical site area before suture release.



**Figure 2a:** Dressing before removal on day.



**Figure 2b:** Surgical site area on day.



**Figure 2c:** New dressing.



**Figure 2d:** Surgical site area before suture release.

In the course of the prospective follow-up in 3, 6, 12 and 18 months no cases of infectious complication in all patients of all three groups were observed.

**Discussion:** The use of interactive absorbent dressing based on carboxymethyl cellulose impregnated with silver ions and single-use vacuum-assisted dressings in early postoperative period can reduce the incidence of surgical site infections in high-risk orthopaedic patients as well as cut the costs.

The results are contrary to the opinion of some authors [33-35] with whom we disagree. Moreover, the results were better than that described by other authors [30-32,36,37]. This can be explained only by a small amount of our pilot study - certainly in the larger sample and

in groups using interactive and vacuum-assisted dressings should be a certain percentage of complications.

To make solid conclusions it is required to conduct multi-center randomized study that would include a bigger number of patients.

## Conclusion

Despite the small sample of patients obtained results allow us to recommend the use of interactive absorbent dressings of sodium carboxymethyl cellulose with silver ions and disposable vacuum assisted dressings in the early postoperative period in patients with orthopedic risk groups - revision arthroplasty, the accompanying obesity and diabetes.





a



b



c



d

**Figure 3:a-d:** stages of gauze dressing application after the deep-seated drainage tube was removed.

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