Evaluation of the Effect of Two Different Hair Removal Methods Prior to Surgery on Surgical Site Infections

Cerrahi Öncesi Farklı İki Tüy Temizleme Yönteminin Cerrahi Alan Enfeksiyonlarına Etkisinin Değerlendirilmesi

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ABSTRACT

Objective: In this study, it is aimed to assess the effect of two different hair removal methods on surgical site infections (SSI) before surgery.
Methods: The study was conducted between 30.05.2015 and 30.03.2016 as a prospective, randomized controlled study. The sample of the research consisted of 114 male patients (61 intervention, 53 control). Patients were monitored on the 7th-30th-90th days during their stay in the hospital and after their discharge, with forms of descriptive characteristics, surgical site specific information, and SSI patterns. Percentage, median, chi square test was used in the evaluation of the data**.**
Results: It was observed that all the patients in the intervention group (clipping) had no SSI and there was only one patient in the control group (razor) that developed SSI on the 6th postoperative day (1.9%, n=1), and the statistical evaluation revealed an insignificant difference between the two groups (p>0.05; p=0.465).
Conclusion: There is no significant difference between the intervention and control groups in the study.

Key Words: hair removal, nursing, surgery, surgical site infection, nosocomial infections, cardiology

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ÖZET

Amaç: Bu çalışmada ameliyat öncesi iki farklı tüy temizleme yönteminin cerrahi alan enfeksiyonlarına (CAE) etkisinin değerlendirilmesi amaçlanmıştır.
Yöntem: Çalışma 30.05.2015 ile 30.03.2016 tarihleri arasında prospektif, randomize kontrollü olarak gerçekleştirildi. Araştırmanın örneklemini 114 erkek hasta oluşturdu (61 müdahale, 53 kontrol). Hastalar, hastanede kaldıkları süre boyunca ve taburcu olduktan sonra 7.-30.-90. günlerde tanımlayıcı özellikler, ameliyat bölgesine özgü bilgiler ve CAE takip formları ile izlendi. Verilerin değerlendirilmesinde yüzde, ortanca, ki kare testi kullanıldı.
Bulgular: Müdahale grubunda (klipper) bulunan hastaların hiçbirinde CAE gelişmediği, kontrol grubunda (jilet) ise sadece bir hastada (%1.9, n=1) postoperatif 6. Günde CAE geliştiği, istatistiksel değerlendirmeye göre iki grup arasında anlamlı farklılık bulunmadığı gözlendi (p>0.05; p=0.465).
Sonuç: Çalışmada müdahale ve kontrol grupları arasında anlamlı bir fark bulunmadı.

Anahtar Sözcükler: Tüy temizliği, hemşirelik, cerrahi alan enfeksiyonu, nozokomiyal enfeksiyonlar, kardiyoloji

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INTRODUCTION

Hospital infections or health care-associated infections (HAI) are one of the major undesired events that occur during health care and threat to patient safety all over the world from initial recordings of wound infection diagnosis in Ancient Egyptian civilization to now (1–3). Although, the incidence of surgical site infections (SSIs) depends on countries, geographical areas, surgical procedures and surveillance methods, SSI is the most common type of HAI in low- and middle-income countries with an incidence ranging from 1.2% to 23.6%. The overall incidence is 11.8% and the incidence of SSI ranges from 1.2% to 5.2% in developed countries (1,4,5).

According to the 2014 data of the National Health Safety Network, SSI was reported for 20 916 of 2 417 933 surgeries with a general incidence rate of about 1% in the United States (USA) in 2014 (1). According to the meta-analysis of the health spending in USA between 1986 and 2013, it was determined that the total cost of the five major infections was $ 9.8 billion, and that the SSIs took first place with 33.7% of total expenditures (6). According to the 2014 data of National Hospital Infections Surveillance Network (NHISN), 4 257 SSI cases were detected in 509 851 monitored surgeries in Turkey and the SSI rate was determined as approximately 1% according to this data (7). In this study, a group of patients with implanted cardiac electronic devices was included. It was reported that approximately 500 000 new implants are inserted annually and more than 4 million people were implanted with this device around the world (8). The incidence of infected cardiac electronic devices is generally reported to be around 2% (9).

Pre-operative hair removal is traditionally performed in preparation for surgical intervention (10). The hairs in the incision area are removed because it may affect stitching, application of medical dressing materials and adhesion of wound closure strips (11). The hairy skin is also thought as inadequate skin cleansing. The shaving of the hairs is thought to reduce SSI risk (12). However, when it is looked at current recommendations and studies, it is suggested that preoperative hair removal should not be done, or if necessary should be done with clipper or depilatory creams (1,13,14). This study was planned to measure the effectiveness of clipping and razor blade as two hair removal methods which applied before the pacemaker (PM) surgery in reducing SSI risk and to assess the suitability of these materials for evidence-based recommendations of international SSI prevention guidelines.

METHODS

Study Design

This study was conducted in Kocaeli University Cardiology Department's Arrhythmia Service between 30.05.2015 and 30.03.2016 as a prospective, randomized controlled study to analyze the effects of two different pre-operation hair removal methods on the SSIs.

Using random numbers table, with simple random sampling method, double numbered room patients, intervention group, odd numbered room patients were selected as control group. In this study, because patients did not know which group they were in, study was qualified as "single-blind study".

Setting and sample

No sampling calculation was made since it was aimed to reach the whole universe within 10 months. The universe of this study consisted of 227 patients undergoing cardiac pacemaker surgery. In the coronary angiography laboratory while sample of this study consisted of total 114 male patients as 61 patients in intervention group and 53 patient in control group. The male patients who underwent pacemaker surgery due to cardiac causes and battery replacement due to lead replacement and battery depletion were included in the sample. Because of the involvement of male patients with hairs in the incision area, 73 female patients who had no hair in the incision area and 40 male patients (113 patients) who did not meet the criteria or agree to participate in the study (113 patients in total) were excluded (Figure 1).

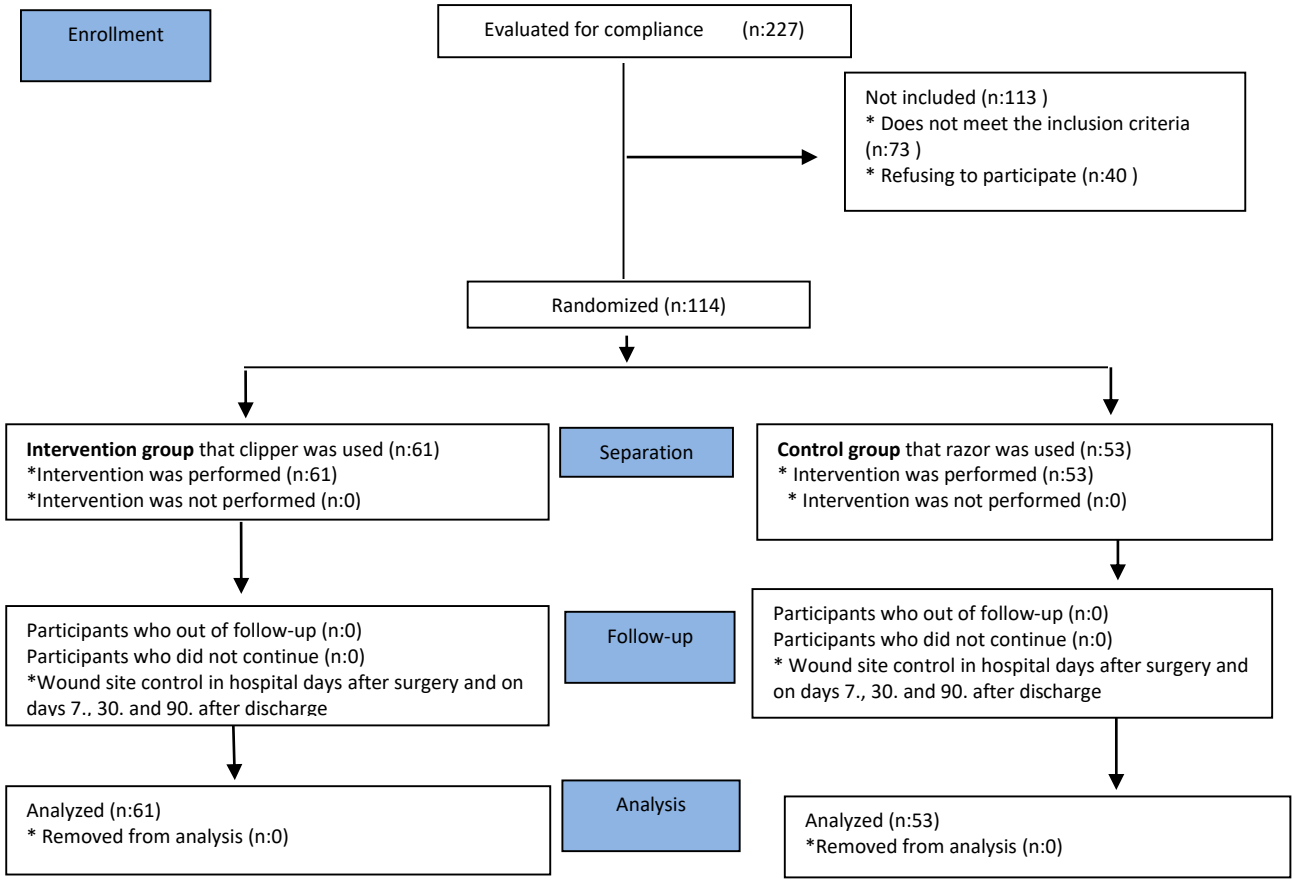

Figure 1. CONSORT Flow Diagram

Ethical consideration

The research project and data collection procedures were approved by Institutional Review Boards and ethics committees of the Kocaeli University (Protocol number: KOU KAEK 2015/88).

Instruments and data collection

In the study, the patients who were shaved with clipping were the intervention group and the patients who were shaved with razor blades were the control group. The informations including patient characteristics, habits, health profile, chronic illness status, past surgical operations, physical and laboratory findings were collected while the patients were in the clinic using the Demographic Information Form. The patients were consecutively randomized and the patients were distributed in the intervention and control groups. In terms of the reliability of the study, the other features of the groups were distributed homogeneously. The physician who carried out the follow-up of SSI did not have any information about the intervention and control groups until the end of the study. None of the patients were showered with antiseptic agents. Prophylactic antibiotics were adminestered to all patients one hour before the surgery. The shaving of the patients with clipping was performed by the nurse in the patient room just before the operation. The patients in the control group were shaved with a razor blade by the patient/ patient's relative at the night of operation at patient's room or home. Just before the operation, all patients were treated with antiseptic skin with povidone-iodine. IV antibiotic treatment was applied during the post-operative hospitalization period. The wound site infection and fever of the patients were followed up by the clinic nurse and the researcher during the hospitalization. The patients who did not develop any complications were discharged after an average of 3 days according to the institutional procedure. Oral antibiotics were continued for 15 days after the discharge.

In the intervention group, 49.2% of the patients had pacemaker implantation, 37.7% of the patients had battery replacement and 13.1% of the patients had lead replacement. In the control group, 52.8% of the patients had pacemaker implantation, 41.5% of the patients had battery replacement and 5.7% of the patients had lead replacement. There was no statistically significant difference between the groups according to surgical intervention ($p>0.05$, $p=0.421$). There were no significant differences between the two groups in terms of hemoglobin, hematocrit, blood sugar, sedimentation, c-reactive protein (CRP) and leukocyte (WBC) median values ($p>0.05$) (Table 2).

When the infection rates of the patients in both groups were analyzed, SSI was not developed in the patients in the intervention group who were shaved with

How to fill in the Post-Discharge Patient Follow-Up Form (how to follow up the fever was taught) was taught to ensure infection control. This form was filled until the day when the day of unstitching and delivered to the researcher. On the 7th day after discharge, the wound site infection was followed up by the physician and the researcher during the taking out stitches. The battery and wound were checked by the physician and the researcher on the 30th day after the surgery. On the 90th day after discharge, the surveillance follow up was performed by the researcher by phone or face-to-face interview with the patient. Infection follow-up form was prepared with the consultancy of the infectious diseases specialist according to the Centers for Disease Control (CDC) criteria.

Data analysis

Statistical evaluation was performed with IBM SPSS 20.0 package program. Percentage, median, Chi-Square Test was used in the analysis of the results. $p<0.05$ was considered as statistically significant.

RESULTS

When the descriptive characteristics of the intervention and control group patients who underwent pacemaker surgery were examined, 52.5% of the patients using the clipper and 50.9% of the control group using the razor blade were over 65 years old and the majority of the patients in both groups were primary/junior high school graduates, there was no significant difference between the groups ($p>0.05$) (Table 1).

The characteristics of the patients in the intervention and control groups were given in Table 1 in terms of the risk factors and the statistical analysis between the two groups showed no significant difference ($p>0.05$) and the groups were also similar in terms of the risk factors (Table 1).

clipper while SSI was developed on the 6th day after surgery in 1.9% (n=1) of the patients in the control group who were shaved with razor blades. The difference between the two methods was not significant ($p=0.465$) (Table 3).

When the findings about surgical incision site infection (Table 4) were analyzed, 85.2% of the patients in the intervention group and 86.8% of the patients in the control group had pain-sensitivity in the incision area and the difference between the groups was not significant ($p>0.05$). Signs and symptoms such as redness, swelling and temperature increase were observed in a patient in the group using razor only and there was no growth in the culture. There was no significant difference between the two groups in terms of signs and symptoms of infection due to heterogeneous distribution ($p>0.05$).

Table 1. Comparison of descriptive characteristics and the risk factors of the patients in the intervention and control groups

Descriptive Characteristics	Type of Shave Intervention Group n=61 (Clipping) n(%[a])	Control Group n=53 (Razor) n(%[b])	Statistical Significance p*
Age			
65 years and under	29(47.5)	26(49.1)	0.872
Over 65 years	32(52.5)	27(50.9)	
Education			
Illiterate	1(1.6)	1(1.9)	
Literate	3(4.9)	3(5.7)	0.977
Primary/junior high school	39(63.9)	32(60.4)	
High School	10(16.4)	11(20.8)	
University	8(13.1)	6(11.3)	
Risk Factors			
Diabetes			
No	43(70.5)	35(66.0)	0.610
Yes	18(29.5)	18(34.0)	
Immun Deficiency			
No	60(98.4)	52(98.1)	1.000
Yes	1(1.6)	1(1.9)	
Smoking			
No	28(45.9)	19(35.8)	0.277
Yes	33(54.1)	34(64.2)	
Malignancy			
No	59(96.7)	48(90.6)	0.248
Yes	2(3.3)	5(9.4)	
Immunosuppressive Drug Use			
No	60(98.4)	53(100.0)	1.000
Yes	1(1.6)	0(0.0)	
Surgical Procedure			
Battery replacement	23(37.7)	22(41.5)	0.421
Pacemaker (PM) implantation	30(49.2)	28(52.8)	
Lead replacement	8(13.1)	3(5.7)	
At least 1 year ago past battery surgery			
No	31(50.8)	28(52.8)	0.830
Yes	30(49.2)	25(47.2)	
Duration of preoperative hospital stay			
3 days and less	42(68.9)	45(84.9)	0.073
4 days or more	19(31.1)	8(15.1)	
Duration of postoperative hospital stay			
3 days and less	59(96.7)	48(90.6)	0.248
4 days or more	2(3.3)	5(9.4)	

a Percentage in the intervention group (n=61)
b Percentage in the control group (n=53)
*p>0.05; there is no statistical significance.

Table 2. Comparison of the preoperative laboratory findings of the patients in the intervention and control groups

Laboratory Findings	Patient Groups	n[a]	Median (25-75 Percentiles)	Statistical Significance p*
Hemoglobin (g/dL)	Intervention	61	13.6 (12.2-14.8)	0.946
	Control	50	13.2 (12.3-14.5)	
Hematocrit (%)	Intervention	61	40.6 (36.8-43.3)	0.457
	Control	50	40.3 (37.8-44.0)	
Blood sugar (g/dL)	Intervention	39	114 (88.0-152.0)	0.381
	Control	47	120.0 (91.0-165.0)	
Sedimentation	Intervention	49	11.0 (6.0-19.5)	0.105
	Control	38	16.5 (8.0-24.2)	
CRP	Intervention	54	0.28 (0.15-0. 57)	0.067
	Control	47	0.42 (0.23-1.35)	
WBC	Intervention	61	7.36 (6.21-9.08)	0.926
	Control	49	7.54 (6.28-8.91)	

n[a]; the numbers vary according to the doctor's request.
*p>0.05; there is no statistical significance.
CRP: C-reactive protein, WBC: Leukocyte

Table 3. Comparison of SSI development in the patients in the intervention and control groups

Infection development status	Intervention Group n=61 (Clipping) n(%[a])	Control Group n=53 (Razor) n(%[b])	Total n	Statistical Significance p*
SSI was developed	0(0.0)	1(1.9)	1	0.465
SSI was not developed	61(100)	52(98.1)	113	

a Percentage in the intervention group (n=61)
b Percentage in the control group (n=53)
*p>0.05; there is no statistical significance.

DISCUSSION

The pre-operative removal of the hairs in the incision site is routinely performed after comparative studies about hair removal from the 1970s to now which showed SSI incidence can be decreased with hair removal (15,16). However, the studies was also published which suggested that "pre-operative hair removal is not beneficial and cause SSI and it should not be done" (17). Therefore, it is important to know how, where, and when the pre-operative hair removal is done, and it is stated that "pre-operative hair removal which is not performed properly increases the incidence of SSI" and the use of razor blades increased the rate of infection (1,18–22). But there is no significant difference between razor blades and clipping in this study.

A similar study with our results was conducted by Varia and Kacheriwala (2016) with 365 patients (Trimming group: 184, Shaving group: 181) and no significant difference was found between the two methods. The infection rate was found to be significantly lower only in patients who had shaved just before to surgery (23).

Another study showing similarities with our findings was conducted by Bala and Obiano (2019) with 98 patients in the general surgery unit, and it was observed that the use of razor blades and depilation cream before surgery did not make a significant difference in terms of surgical site infection, but the statement in the article was stated that those who use razors are prone to surgical site infection (24).

Kattipattanapong et al. (2013) reported that 136 cases with external and middle ear diseases were compared with those with and without preoperative hair removal, and it was stated that the infected cases in both groups were those who had mastoidectomy (25).

Kurien et al.(2018) followed the patients (n=160) who had undergone elective inguinal hernia operation until 30th day after surgery for one year in terms of superficial surgical infection In the study, it was determined that a higher rate of infection was seen in those who had hair removal with the razor compared to the ones with clipper (3). Another study, which does not support our findings, was carried out by Suvera et al. (2013) with 215 patients who underwent elective surgery. In this study, postop wound infection and skin damage were compared in cases where razor blade and depilation cream were used. It was reported that wound infection and skin damage were significantly higher in patients who used razors (26).

When the studies on the incidence of SSI following pacemaker surgery were analyzed, Marschall et al. (2007) found a SSI rate of 16% for all surgical procedures (19 of 116 procedures developed infections) in a randomized controlled study of cardiac pacemakers and implanted cardioverter-defibrillator (ICD) which were performed in cardiothoracic operating rooms related SSI rates (27). In the same study, there was no significant difference between the intervention and control groups in terms of age, race, sex, diabetes, smoking history, timing of antibiotic treatment and hair removal (clipping). In culture from seven patients who developed SSI, coagulase negative Staphylococcus (2 persons), Staphylococcus aureus (2 persons), Serratia marcescens (1 person) were grown and no growth was observed for 2 of them. Similarly, we found that infection was developed in a patient who shaved with razor, but there was no growth in the culture.

Table 4. Comparison of ınfection symptoms in intervention and control group patients with surgical area infection

Infection Findings Categories	Patient Groups: Intervention Group n=61 (Clipping) n(%[a])	Patient Groups: Control Group n=53 (Razor) n(%[b])	Statistical Significance p*
Pain-Sensitivity			
No	9(14.8)	7(13.2)	1.000
Yes	52(85.2)	46(86.8)	
Redness			
No	61(100.0)	52(98.1)	0.465
Yes	0(0.0)	1(1.9)	
Swelling			
No	61(100.0)	52(98.1)	0.465
Yes	0(0.0)	1(1.9)	
Temperature increase			
No	61(100.0)	52(98.1)	0.465
Yes	0(0.0)	1(1.9)	
Culture acquisition			
No	61(100.0)	52(98.1)	0.465
Yes	0(0.0)	1(1.9)	
Presence of infection			
No	61(100.0)	52(98.1)	0.465
Yes	0(0.0)	1(1.9)	

a Percentage in the intervention group (n=61)
b Percentage in the control group (n=53)
*p>0.05; there is no statistical significance

When we look at other studies which analyzed two different methods, a study which analyzed the effect of using a razor blade or clipping for hair removal in terms of infection was the study of Balthazar et al. (1982) (28). In male patients (n=200) who underwent elective inguinal hernia (n= 200), the SSI rate was 2% (n=2) in the patients who were shaved with razor blades immediately before the operation and 1% (n=1) in the patients who shaved with non-sterile clipping. It was emphasized that the use of razor blades increased the rate of infection by causing cuts in the skin. In a prospective study in order to reduce infections after cardiopulmonary bypass surgery (n=1980), Ko et al. (1992) found that the rate of SSI was 1.3% (n=13) in the patients who were shaved with razor blades and 0.4% (n=4) in the patients who were shaved with clipper (29). They concluded that hair removal with clipping had a lower risk of infection than razor and clipping was superior in the prevention of suppurative mediastinitis.

The study on SSI development rates of two different methods before surgery which took into account time factor was performed by Alexander et al. (1983) with 1013 female/male patients who underwent elective surgery (30). In this randomized controlled trial (RCT), the SSI rate was found to be 5.2% in the group in which razor blade was used in the operation night, 6.4% in the group in which razor blade was used in the first morning after surgery, 4% in the group in which used clipping in the operation night and 1.8% in the group which used clipping was used in the first morning after surgery. They stated that the use of clipping in the morning of operation would decrease the infection rate and the patient care and treatment costs. Abouzari et al. (2009) conducted a study (RCT, n=195) on the patients who underwent elective cranial surgery (female/male) and they found that the SSI rate in the the patients which were shaved by razor blades was 4.6% (n=3), the SSI rate in the patients which were shaved by clipping was 1.5% (n=1) and the SSI rate in the patients with no hair removal group was 1.5% (n=1) (31). They indicated that clipping or no hair remowal had a lower risk of infection than razor blade. Court-Brown (1981) conducted a study (RCT, n=404, monocentric) on the patients who underwent abdominal surgery and they reported a SSI rate of 12.4% (n=17) in the patiens which were shaved by razor blades, a SSI rate of 7.9% (n=10) in depilator applied group and 7.8% (n=11) in the group without hair removal (Razor shaving and depilatory cream was used 18-24 hours before elective surgery and 6 hours before emergency surgery) (17). As a result, it was found that there was no statistically significant difference between the use of razor blades and the use of hair depilatory creams.

Another study on the effect of the use of razor blade and the use of depilatory cream in the pre-operative hair removal on SSI rates in the adult patients who underwent elective surgery was carried out by Adisa et al. (2011) (n=165, monocentric, RCT) (32). In the study, it was found that the rate of SSI was 12.8% (n=11) in the group in which razor was used for shaving and 2.5% (n=2) in the group in which depilatory cream was used (razor shaving was made just before the operation, depilatory cream was applied in the operation morning). As a result, they suggested that use of razor blades increased the rate of infection by causing cuts in the skin and reduces the risk of infection because the use of depilatory creams prevented skin damage. Grober et al. (2013) conducted a study (monocentric, RCT) with 215 male patientswho underwent genital surgery (16). They found that the rates of SSI were at the same level (2%, n=2) for razor blade (single use) and clipping (sterile single use). And, they stated that there was no significant difference in the rates of SSI development between the two groups. They also noted that the clipping was more disadvantageous than the razor blade in this region because of the irregular skin folds and delicate structure of the male genital area. Clipping caused more skin damage than the razor blade.

Two study can be given to the comparison of the effect of no hair removal and the effect of the use of razor blades on SSI rates. Seropian et al. (1971) was conducted a study with 406 elective appendectomy operations (single center, RCT) and they reported a SSI rate of 5.6% (n=14) in the group in which razor blade was used for shaving and a SSI rate of 0.6% (n=1) in the group without hair removal (15). They stated that when hair remomal was not very necessary, no hair removal decreased the risk of the development of SSI. The other study (789 women and men, single centered, RCT) was performed on patients who underwent spinal surgery by Çelik et al. (2007) (33). The SSI ratio was found as 1.1% (n=4) in the group in which razor was used for shaving and 0.2% (n = 1) in

the group without hair removal. They stated that razor blades increased the risk of the SSI.

CONCLUSION

Although there was no significant difference between the two methods in terms of infection, an infection developed in razor group and no infection occurred in clipping group. In this study, the number of samples was low and that the factors that may cause infection were not fully excluded, because of that we can not state that the use of razor blades increased the rate of infection. For this reason, it is considered that the the studies with larger number of samples and homogeneous groups should be performed in order to reveal the superiority of the use of clipping. We also believe that the development of the bundle and checklist will be appropriate for the use of common language.

Conflict of interest

No conflict of interest was declared by the authors.

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