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Preoperative Octenidine Application in Breast Reconstruction Surgery

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Abstract. *Background/Aim: Postoperative infection in implant-based reconstructive breast surgery is a common problem. The preoperative application of a disinfecting washing agent may reduce postoperative infection rates. This retrospective analysis aimed to evaluate whether preoperative Octenisan® application yields a reduction in postoperative complications or infection rates in breast reconstructive surgery. Patients and Methods: Between 2016 and 2019, 127 women received implant-based breast reconstruction at the municipal hospital of Cologne, Holweide, Germany. A total of 197 treatments were performed. After giving consent, patients were asked to use Octenisan® wash lotion for five days before breast reconstructive surgery. All patients were asked by a simple questionnaire whether they performed showering and washing according to the proposed protocol. In 96 cases patients did adhere to the protocol. In 101 cases they did not. Patient cohorts were then divided into patients who had applied Octenisan® wash lotion and patients who had not. Endpoints were defined as minor complications with no implant loss and major complications with consecutive implant loss. Results: Patient adherence to the application regimen was 48.7%. Overall minor complications occurred in 34.4% with preoperative Octenidine usage and 36.6% without preoperative Octenidine usage. Major complications happened in 7% with preoperative Octenidine and 5% without Octenidine. Overall, there was no significant difference concerning minor or major complication rates. Conclusion: Preoperative washing protocols involving the Octenisan® wash lotion is relatively cheap and easy to follow. There is evidence that washing protocols result in a reduction of S. aureus infections leading to a better perioperative outcome. Octenisan® is safe to use in implant-based breast reconstructive surgery and is not associated with higher risks for patients. Our study did not yield any significant reduction in perioperative and postoperative complication and infection rates. This is attributed to a relatively low study population. Wash lotion compliance was only 48.7%. Proper patient education is crucial. With those preliminary data, it is now possible to design a larger analysis since patient adherence to washing protocol with Octenisan® wash lotion has been established.*

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Postoperative wound infections, pneumonia, and urinary tract infections account for the most common nosocomial infections in hospitals. Wound infections represent the largest part (24.3%) of nosocomial infections followed by urinary tract infections (23.2%) and pneumonia (21.7%). Whereas for breast surgery perioperative and postoperative mortality is very low postoperative wound infection is the most frequent morbid complication occurring in 4.3-8.3% (1, 2). The reason for the loss of a breast implant in breast reconstructive surgery is in approximately 83% of cases a perioperative or postoperative infection. About half of all implant losses occur within 90 days after surgery. *S. aureus* and S. epidermidis are some of the most common of all detected germs in nosocomial infections and mainly responsible for implant losses (3-5). Decreasing perioperative and postoperative infections, therefore, is of utter importance.

Bode *et al*. performed a randomized, double-blinded, placebo-controlled multicenter trial between 2005 and 2007. By screening 6,771 presurgical patients they identified a total of 1,251 patients who were nasal carriers of *S. aureus*. A total of 917 of those patients were enrolled in an intention-to-treat study. They were able to significantly decrease the number of postoperative wound infections by treating nasal *S. aureus* carriers with mupirocin ointment in combination with chlorhexidine gluconate soap (6). Ammerlaan *et al*. conducted a trial to eradicate *S. aureus* carriers. They were able to eradicate 60% of *S. aureus* carriers after one trial and could increase that number to 80% success rate after 5 trials (7). Notably, the resistance to the topic of antibiotic mupirocin is increasing worldwide (8). Preoperative bathing with antiseptic agents has been proven to be effective in reducing skin microflora and eradicating *S. aureus* (9). The World health organization (WHO) and the Centre for disease control and prevention (CDC) guidelines consider preoperative bathing with soap (antimicrobial or plain) at least the night before the operative day as "good clinical practice" (10, 11).

Octenidine (Octenisan® Wash lotion, Schülke& Mayr GmbH, Norderstedt, Germany) is a modern antiseptic with a broad antimicrobial spectrum against Grampositive and Gram-negative bacteria including MRSA plaque-forming bacteria, Chlamydia, Mycoplasma, and fungi (12). Octenidine is not percutaneously absorbed and partly remains on the location of the application. It, therefore, exerts a sustained antimicrobial effect. Octenidine is very effective in the eradication of MRSA-carriers (13). In contrast to antibiotic treatment, bacteria do not undergo a selection of resistance against Octenidine due to its unspecific antimicrobial mechanism (14). Octenidine, therefore, seems to be a promising therapeutic approach in reducing the number of perioperative and postoperative infections.

This retrospective analysis evaluates the following objectives:

- Is Octenisan® safe to use in breast reconstructive surgery?
- Does Octenisan® application yield a reduction in perioperative and postoperative complications and infection rates in breast reconstructive surgery?
- Is the usage of Octenisan® wash lotion applicable for all patients?
- Is the usage of Octenisan® wash lotion cost-effective?

Patients and Methods

Between 2016 and 2019, 127 women received implant-based breast reconstruction at the municipal hospital of Cologne, Holweide, Germany. A total of 197 treatments were performed. The protocol was constructed analogously to the protocol of Bode *et al*. and Stambough *et al*. as a universal approach (6, 15). The intention was to treat all patients. There was no admission screening for MSSA/MRSA. After giving consent patients were asked to use Octenisan® Wash lotion for five days before breast reconstructive surgery and thoroughly wash and clean especially at and around the incision site. In 96 cases patients performed showering according to protocol. In 101 cases the protocol was not followed due to incompliance. For analysis, patient cohorts were divided into patients who applied Octenisan® wash lotion and patients who did not. An overview of all patient characteristics is found in Table I. Endpoints were defined as minor complications with no implant loss and major complications with consecutive implant loss. All complications and complication rates for both study groups are illustrated in Table II. Infection was defined according to the U.S. Centers for Disease Control and Prevention (CDC)/ National Healthcare Safety Network definition. Infections occurring after breast implant surgery were characterized by three or more of the following findings: local swelling, Pain, seroma, erythema, fever, pus, wound dehiscence, or perforation of the skin. All Events occurred within 90 days after surgery.

Statistics. Statistical analysis was performed using the VassarStats1 (Vassar College, Poughkeepsie, NY, USA) statistics program. ANOVA analysis and *t*-tests were used to evaluate significances when appropriate.

Results

Patient adherence to the application regimen was 48.7%. In 96 cases patients used Octenisan® wash lotion preoperatively whereas in 101 cases patients did not. Both two groups did not differ significantly in age and BMI (Table I). There was a significantly lower part of nicotine abuse in the group of Octenisan® wash lotion users (p=0.017). The indications for implant insertion were prophylactic (27.7% *vs*. 25%), oncological (61.4% *vs*. 55.2%) or cosmetic reasons (10.9% *vs*. 19.9%). The side of surgery was 46.9% left and 53.1% right for Octenisan® wash lotion users. Non-Octenisan® wash lotion users' side of surgery was 57.4% left and 42.6% right. Minor complications comprised seroma in 13.5% *vs*. 10.9%, capsular fibrosis in 4.2% *vs*. 6.9%, Infection (without no operative revision) in 10.4% *vs*. 7.9%, Immediate implant rotation or dislocation in 1% *vs*. 1%, Red-Breast-Syndrome in 0% *vs*. 2%, Impaired wound healing or necrosis (without operative revision) in 4.2% *vs*. 4% and Haematoma (with operative revision without implant loss) in 1% *vs*. 4%. Overall minor complications occurred in 34.4% with preoperative Octenidine usage and 36.6% without preoperative Octenidine usage. Major complication comprised infection of the expander or breast implant with implant loss in 3.1% *vs*. 2%, Implant loss because of allergic reaction in 0% *vs*. 1%, Wound healing or necrosis in 1% *vs*. 2%, and massive rebleeding or implant malfunction with implant loss in 1% *vs*. 2%. Capsular fibrosis which leads to implant change or DIEP was classified as late complications and occurred in 3.1% *vs*. 3%. Overall, there was no significant difference concerning minor or major complication rates (Table II).

Table I. *Characteristics of patients who used Octinisan (Preoperative Octinisan) preoperatively and those who did not (Non-preoperative Octinisan).*

	Preoperative octinisan		Non-preoperative octinisan		
	Number of cases	%	Number of cases	%	*p*-Value
	101	100	96	100	
Number of patients	65		62		
Gender (female)	101	100	96	100	
Median age (Range)	49 (18-82)		51 (16-73)		0.727
Median BMI (Range)	22.7 (16.9-37.7)		23.2 (17.8-40.5)		0.976
Nicotine abuse	39	38.6	22	22.9	0.017
Side/Breast					
Left	58	57.4	45	46.9	
Right	43	42.6	51	53.1	
Implant insertion					
Prophylactic	28	27.7	24	25	0.663
Oncological	62	61.4	53	55.2	0.380
Cosmetic	11	10.9	19	19.8	0.082

BMI: Body mass index.

Table II. *Minor and major complications of patients who used Octinisan (Preoperative Octinisan) preoperatively and those who did not (Non-preoperative Octinisan).*

	Non-preoperative octinisan		Preoperative octinisan		
	Number of cases	%	Number of cases	%	*p*-Value
	101	100	96	100	
Number of patients		65		62	
Minor complications (no implant loss)					
Overall	37	36.6	33	34.4	0.740
Seroma	11	10.9	13	13.5	0.572
Capsular Fibrosis	7	6.9	4	4.2	0.399
Infection (no operative revision)	8	7.9	10	10.4	0.543
Immediate Implant rotation/ dislocation	1	1	1	1	Not applicable
Red-Breast-Syndrome	2	2	0	0	0.166
Impaired wound healing or necrosis (no operative revision)	4	4	4	4.2	Not applicable
Haematoma (operative revision, no implant loss)	4	4	1	1	0.192
Major complications (with implant loss)					
Overall	7	7	5	5	0.610
Infection of expander/ breast implant with implant loss	2	2	3	3.1	0.584
Implant loss because of allergic reaction	1	1	0	0	0.327
Wound healing or necrosis with implant loss	2	2	1	1	0.590
Massive rebleeding or implant malfunction with implant loss	2	2	1	1	0.590
Late complications					
Capsular fibrosis which led to implant change or DIEP	3	3	3	3.1	Not applicable

Seroma: Symptomatic, detectable by ultrasound and requires at least one needle aspiration; DIEP: deep inferior epigastric perforator.

Discussion

Health-care associated infections (HCAI) mainly comprise postoperative wound infections, pneumonia, and urinary tract infections and affect 1.7 million hospitalized patients in the U.S. alone per year. One in 17 dies due to HCAI (16). In 2016 the German prevalence of nosocomial infection was 4.6% of all patients. HCAI is a worldwide problem and is not restricted to one country (17). Apart from obvious medical complications caused by nosocomial infection, there is also a financial dimension resulting in an increased financial burden per patient, a prolonged length of stay as

well as a higher 30-day readmission rate (18). It is, therefore, crucial to reducing the incidence of HCAI.

For patient-driven regimens, our study highlights the importance of proper patient education. All participants were asked to use the Octenisan® wash lotion. The patient's adherence to the application regimen was only 48.7%. This result indicates a great deficiency in current patient-driven regimens. Interestingly adherence rate of drug intake in chronic disease is reportedly around 50% as well (19). Other studies showed compliance levels to preoperative washing protocols as low as 22% (20). Modern methods for increasing patient compliance include educational interventions, behavioral interventions, self-management interventions, or risk communication interventions. For preoperative bathing regimens, it could be shown that one hour of preoperative patient education significantly increased patients' adherence rates (21). In finding a potent treatment for the reduction of nosocomial wound infections self-administered regimens require an effective and easy-to-follow patient education to ensure proper medication adherence rates.

Up to date, chlorhexidine (2% or 4%) is the most commonly used applicant worldwide. It significantly reduces epidermal bioburden. Chlorhexidine is superior to regular soap as it binds to skin proteins and therefore continues to exert its antiseptic effects (22). Current studies show that Octenidine is equally efficient as Chlorhexidine (23). The ABATE Infection Cluster Randomized Trial showed that decolonization with universal Chlorhexidine bathing and targeted mupirocin for MRSA carriers did not reduce multidrug-resistant organisms or all-pathogen bloodstream infection in all non-critical care patients (24). Nonetheless, Kapadia *et al*. were able to demonstrate that the preoperative usage of Chlorhexidine reduced the incidence of surgical wound infections in total hip arthroplasty (25). A carefully selected population, therefore, seems to benefit from preoperative antimicrobial soap bathing.

In our trial, we were not able to show a significant benefit of preoperative body washing with Octenisan® wash lotion. Considering all minor and major complication rates Octenisan® wash lotion did not prove to be inferior. We observed a numerical tendency leaning towards the usage of Octenidine for minor (8 *vs*. 10) and major complications (2 *vs*. 3). The overall infection rate was 11.7% whereas loss of implant due to infection was 2.5%. Comparing infection rates to other studies there was no significant difference. Franchelli *et al*. observed infection rates in 240 breast reconstruction operations in patients with breast cancer. Though the overall infection rate (6.7%) was slightly lower compared to our population the rate of implant loss due to infection was considerably higher (4.6%) (26).

Larger numbers are certainly needed and are currently being adhered to as Octenisan® is continuously given to patients. At a real-life application of only 50% of patients, we would require approximately n=4,000 real-life patients to estimate the above-mentioned n=1,941 (with a 100% application rate). A multicenter analysis will be available in approximately 5 years.

An advantage of this study is its unique study population. To our best knowledge thus far there is no study investigating the possible advantages and disadvantages of the preoperative application of Octenisan® wash lotion. This is a single-center study with relatively low numbers. Additionally, a possible bias in this study could be the significantly higher number of smokers in patients who performed the body washing with Octenisan® wash lotion. Smoking is known to be a major risk factor concerning wound infections and prolonged wound healing (27, 28). The showering technique of patients was not recorded and is likely to be another bias. This study there is considered preliminary.

Importantly, we were able to show that Octenisan® wash lotion is not associated with any certain risks and seems safe to use for patients.

Octenisan® wash lotion is an easy-to-handle medium with no known major side-effects. It is relatively inexpensive. The costs for one treatment are 3€ (500 ml Octenisan® Wash lotion). This does not include the relative costs for prescription, dispensing, information material, or time for counseling. An English study showed that general ward costs per bed day are about £586.59 (around 638€). Notably, this did not include additional costs for isolation or ICU which have to be considered in the case of HCAI. Annual costs for HCAI were calculated to amount to up to £11.9 million (12.9€) (29). In Germany, Arefian *et al*. measured the additional costs attributable to nosocomial infections to €5.823-€11.840 ($7.453-$15.155) per infected patient (30). Though we were not able to demonstrate a significant benefit by preoperative bathing for Octenisan® wash lotion this study shows that Octenisan® wash lotion can be considered to be generally safe to use for breast reconstruction surgery. As other studies were able to show a clear benefit of preoperative bathing especially in the case of usage of alloplastic material it is necessary to evaluate the benefit of Octenisan® wash lotion in a larger population.

Conclusion

Preoperative washing protocols involving the Octenisan® wash lotion are relatively cheap and easy to follow. There is evidence that washing protocols result in a reduction of *S. aureus* infections leading to a better perioperative outcome. Octenisan® is safe to use in implant-based breast reconstructive surgery and is not associated with higher risks for patients. Our study did not yet yield a significant reduction in perioperative and postoperative complication and infection rates. This is attributed to low numbers. Wash lotion compliance was only 48.7%. Proper patient education is crucial. With those preliminary data, it is now possible to

design a larger analysis since patient adherence to washing protocol with Octenisan® wash lotion has been established.

Conflicts of Interest

All Authors declare that there are no conflicts of interest regarding this study.

Authors' Contributions

CE and JH designed the study. All Authors contributed to data collection and analysis. JH and CE wrote the article. All Authors revised and approved the final form. CE was the supervisor.

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