

Does Soaking Fresh Frozen Costal Cartilage in an Antibiotic Solution Reduce Postoperative Infection in Rhinoplasty?

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Background: Fresh frozen costal cartilage (FFCC), from the Musculoskeletal Transplant Foundation (MTF), has recently gained popularity for use in revision rhinoplasty or primary rhinoplasty when there is a paucity of autologous cartilage. However, there are currently no guidelines related to the use of intraoperative antibiotic soaking to reduce postoperative infection rates when using MTF FFCC. This study aimed to evaluate the efficacy of intraoperative antibiotic soaks in reducing surgical site infection rate when using MTF FFCC grafts in rhinoplasty.

Methods: A retrospective chart review of patients who underwent rhinoplasty with the use of MTF FFCC in the senior author's practice was conducted between May 2017 and June 2022. The inclusion criteria were rhinoplasty cases using MTF FFCC with minimum of 12 months of follow-up. Fisher exact test was conducted to determine significance in rates of postoperative infection for patients who underwent rhinoplasty with the use of MTF FFCC with (1) intraoperative antibiotic solution soak versus (2) no antibiotic solution soak.

Results: A total of 310 patients were included and separated into two cohorts, MTF FFCC intraoperative antibiotic solution soak (n = 200) and no antibiotic solution soak (n = 110). There were a total of four (1.3%) cases of infection, all in the antibiotic soak group. There was no statistically significant difference between the rate of infection in the two cohorts ($P = 0.301$).

Conclusion: Our retrospective cohort study demonstrates that soaking MTF FFCC in an antibiotic solution intraoperatively does not reduce postoperative infection rates in rhinoplasty. (*Plast Reconstr Surg Glob Open* 2024; 12:e5997; doi: 10.1097/GOX.0000000000005997; Published online 19 July 2024.)

INTRODUCTION

Rhinoplasty is one of the most common facial plastic surgery procedures performed in North America.¹ Although postoperative infections are uncommon in primary rhinoplasty, with an incidence of ~2%–2.5%, they are more common in revision rhinoplasty or rhinoplasty with use of implants.² The American Association of Plastic Surgeons recommends a single preoperative dose of

antibiotic administered preoperatively and does not recommend antibiotic use intraoperatively or postoperatively; however, the practice of individual practitioners continues to vary greatly.^{3–7} Further, there are no guidelines available for use of perioperative antibiotics in the case of allograft tissue, specifically whether soaking allograft in antibiotic solution is warranted.

When possible, autologous cartilage is preferred, and the gold standard for this is septal cartilage. However, there are many reasons that septal cartilage may not be available for use, including previous rhinoplasty, previous trauma, intranasal medication use, cocaine use, previous septoplasty, or generally insufficient septal cartilage. In these cases, alternate sources of cartilage such as auricular or rib cartilage may be sought, but our preference has been to use allograft to ensure we have sufficient graft

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material and minimal donor-site morbidity. Recently, fresh frozen costal cartilage (FFCC) grafts [Musculoskeletal Transplant Foundation (MTF) Biologics, Edison, N. J.] have gained popularity because they offer an equivalent risk profile to irradiated homologous cartilage, with improved long-term graft outcomes.^{8,9} The sequence of preparation of MTF FFCC starts first with prescreening of the cadaveric donors to thoroughly rule out medical conditions that would be a detriment to allografting (eg, malignancy, infectious diseases, or sepsis). Once cleared, costal cartilage from the seventh to ninth ribs are harvested, and these undergo sterilization and treatment with antibiotic solutions, followed by sterile packaging at -40°C to -80°C . MTF FFCC is ready to use in precut sheets of various sizes.¹⁰

Despite the rigorous sterilization and packaging method of MTF FFCC grafts, with the introduction of foreign material, there is a theoretical increase in the risk of surgical site infection. Though not specifically required by MTF, antibiotic soaking is a surgeon preference step in the preparation of FFCC for use and is commonly done at our center. Although seemingly innocuous, this step introduces a potential allergen and increases the overall cost of surgery. The senior author performs a large volume of revision rhinoplasty and uses MTF FFCC exclusively in these cases for graft material. In all cases performed at the senior author's private office, MTF FFCC is soaked in antibiotic solution, but in all cases performed by the senior author at the academic hospital, antibiotic soaking is avoided due to logistical issues with preparation of the solution.

It is our preference that the use of any medication in patient care be directed by evidence. Thus, the goal of this retrospective cohort study is to evaluate the efficacy of intraoperative antibiotic soaks in reducing surgical site infection rate when using MTF FFCC grafts.

METHODS

A retrospective chart review of patients who underwent rhinoplasty between May 2017 and June 2022 by the senior author was performed. Informed consent was obtained from all patients whose images were included in the present study. The study was approved by the BRANY (Biomedical Research Alliance of New York) institutional review board.

All patients included had undergone open rhinoplasty with the use of MTF FFCC and had at least 12 months of follow-up. All patients provided consent to the use of cadaver material, and our office-based surgery center holds a tissue transplantation license from New York state. Collected patient demographics included age, sex, body mass index, and smoking history. Patients were categorized into two groups: (1) MTF FFCC was immersed in an antibiotic solution (ABx); (2) MTF FFCC was not soaked in antibiotic solution (No-ABx). The intraoperative antibiotic solution is a mixture of 1 g of vancomycin in a 20-mL solution of normal saline into which the entire MTF FFCC graft is soaked. We provide an intraoperative video demonstrating the carving of MTF FFCC for use in rhinoplasty

Takeaways

Question: Does soaking Musculoskeletal Transplant Foundation fresh frozen costal cartilage (FFCC) in an antibiotic solution reduce postoperative infection in rhinoplasty?

Findings: A retrospective cohort study of 310 cases of rhinoplasty with use of Musculoskeletal Transplant Foundation FFCC and a minimum of 12 months of follow-up was conducted. The study revealed no statistically significant difference in rate of infection in the FFCC-antibiotic soak group compared with the no antibiotic soak group.

Meaning: Antibiotic soaking of FFCC does not reduce postoperative infection for rhinoplasty. Additional research is required to further corroborate this claim.

before soaking in antibiotic solution. [See Video (online), which displays carving of MTF FFCC before soaking in antibiotic solution.] All postoperative patients in the senior author's practice receive a course of prophylactic antibiotics, either cefadroxil or clindamycin, with the latter given if there is penicillin allergy. If a patient demonstrates erythema, swelling, or pain of the nose at follow-up appointments, the patient is treated empirically with either amoxicillin-clavulanate or trimethoprim-sulfamethoxazole, again dependent on allergies. The primary outcome of interest was rates of postoperative infection, defined as postoperative erythema requiring antibiotic use after completing the routine course of postoperative prophylactic antibiotics.

Comparative analyses were conducted to determine rate of postoperative infection on patients who underwent rhinoplasty with the use of MTF FFCC with intraoperative immersion in antibiotic solution versus no immersion in antibiotic solution. All analyses were conducted in R (version 4.3.1). Categorical parameters were compared by Fisher exact test, numerical parameters by unpaired *t* tests, and statistical significance was determined as a *P* value below 0.05.

RESULTS

This study reviewed medical records of 1893 rhinoplasty cases, yielding 310 cases of rhinoplasty with the use of MTF FFCC. Overall, 26 patients underwent primary rhinoplasty, and 284 patients underwent revision rhinoplasty. The majority of patients were women (87.4%), with mean age of 36.8 years (range: 18–89 years). The mean follow-up period was 20.4 months, with a minimum of 12 months of follow-up. A summary of demographic data is provided in Table 1.

There were 200 patients who underwent rhinoplasty with the use of MTF FFCC soaked in antibiotic solution (ABx), with the remaining 110 patients in the nonsoaked group (No-ABx). The percentage of primary and revision rhinoplasty cases in each group was comparable (Table 1). There was no statistically significant difference between age or body mass index of the two groups (Table 1). There

Table 1. Patient Demographics of ABx and No-ABx Groups

Demographic	Total	ABx	No-ABx	<i>P</i>
Total	310	200 (64.4%)	110 (36.6%)	
Primary	26 (8.4%)	16 (8.0%)	10 (9.0%)	0.745*
Revision	284 (91.6%)	184 (92.0%)	100 (91%)	
Age (y)	36.8 ± 11.9	37.8 ± 12.5	34.9 ± 10.3	0.586
Sex				
Female	271 (87.4%)	178 (89.0%)	93 (84.5%)	0.282*
Male	39 (12.6%)	22 (11.0%)	17 (15.5%)	
Body mass index (kg/m ²)	22.4 ± 3.2	22.5 ± 3.4	22.0 ± 3.0	0.922
Smoker	7 (2.3%)	2 (28.6%)	5 (71.4%)	

Data are shown as mean ± SD or number (percentage).

**P* value for relative ratio of primary:revision and female:male between ABx and No-ABx groups.

Table 2. Demographics and Outcomes of Infection Cases

Characteristic	No. (%)
Total infection cases	4 (1.3%)
Age range	
30–39 years	2 (0.6%)
40–49 years	0
50–59 years	1 (0.3%)
60–69 years	0
70+ years	1 (0.3%)
Sex	
Female	3 (1.0%)
Male	1 (0.3%)
Body mass index	
<20	1 (0.3%)
20–24.9	2 (0.6%)
>25	1 (0.3%)
Smoker	0
No. patients with infection*	
Abx	4 (1.3%)
No-Abx	0

*Fisher exact test, *P* = 0.301.

was a similar proportion of women to men in each group (Table 1).

There were a total of four cases (1.3%) that demonstrated signs of infection requiring treatment with empiric antibiotics. There was one case that required revision rhinoplasty 2 months after initial surgery due to infection. All of these cases occurred in the ABx soaked group. Despite this, there was no statistically significant difference between the rate of infection in the ABx group versus the No-ABx soaked groups (*P* = 0.301). All cases of infection occurred in revision rhinoplasty cases. An overview of the characteristics of the cases of infection is provided in Table 2.

DISCUSSION

This study evaluates the efficacy of soaking MTF FFCC in an antibiotic solution in reducing postoperative infection rates in rhinoplasty, with a minimum of 12-months of follow-up.

Postoperative infection following rhinoplasty can have a devastating impact on both nasal form and function. In addition to increased pain, delayed wound healing, suboptimal aesthetic outcome, and difficulty breathing,

there is a rare but real risk for systemic life-threatening infection.^{2–5} Oftentimes, revision rhinoplasty is required to manage the sequelae of infection, which can add additional cost and psychological stressors to the patient. All cases of infection in our cohort series occurred in patients undergoing revision rhinoplasty, with each having undergone at least two prior open rhinoplasty procedures. This underscores the challenge associated with these cases and is in agreement with what has previously been published regarding risk factors for infectious complications following revision rhinoplasty.^{4,8,9}

The postoperative infection rate in our study was 1.3%. For the one case in our cohort that required revision rhinoplasty after infection, the supratip was found to be indented in follow-up appointments 4 weeks postoperatively. For most revision rhinoplasty cases in the senior author's practice, the nasal tip complex is the meeting place of an extended spreader and columellar strut graft as well as mastoid fascia for tip refinement. As a result, there is a higher suture burden, which adds further theoretical risk for infection, albeit very minimal.^{11,12} Finally, the nature of revision surgery itself predisposes to increased risk of infection, due to a combination of fibrosis, scar tissue, contamination from previous implants, altered anatomy, possibly compromised blood supply, and overall poorer tissue quality.^{4,8,9} When managing postoperative infection in revision rhinoplasty, we recommend early intervention with appropriate antibiotic therapy with a low threshold for surgical intervention should treatment with antibiotics not be sufficient. Another complication in rhinoplasty surgery is the possibility for delayed presentation of infection. In our study, all cases of postoperative infection occurred within the first month, with no occurrences of late infection within our minimum 12-month follow-up. Interestingly, although smokers have an overall increased risk of postoperative infection, in our study, all patients who were active smokers at the time of their surgery did not have any signs of infection.

All infections occurred in the ABx group, but the difference was not statistically significant (*P* = 0.301), so there is no evidence in our sample that soaking MTF FFCC in antibiotic solution intraoperatively lowers the postoperative risk of infection. A strength of this study is its single-surgeon focus, where the surgical technique is the same in both groups, with the exceptions of the MTF FFCC preparation intraoperatively and the facility. This allows us to

control for the other variables that exist in multi-surgeon studies, such as differences in technique, decision-making, operative time, etc. Additionally, the demographic breakdown for the two groups is extremely similar with no statistically significant differences. The main limitations of this study are its retrospective nature and the small percentage of patients who developed an infection, despite the large number of patients included in the study. Although we do not believe there is a difference in the rate of infection in the two groups, if a very small difference exists, it is possible that our sample may not have enough statistical power to find it. Therefore, additional study is needed to further corroborate our findings. Lastly, though we feel that the sterile technique was comparable between the two sites, our study does not control for any possible differences that may exist in the sterile technique or process at each of the two facilities. Despite the aforementioned limitations, MTF FFCC is overall a safe alternative to other allograft options. Nonetheless, we believe additional studies are needed to further evaluate the ideal intraoperative graft preparation and develop evidence-based guidelines on best methods.⁷

Further studies involving larger sample sizes with longer term follow-up are required to continue informing guidelines on this topic. Additionally, in future works, we hope to study the effects of smoking on postoperative infections in rhinoplasty.

CONCLUSIONS

Revision rhinoplasty is a complicated procedure and is associated with higher rates of infection than primary surgery. Our study finds that using antibiotic soaks intraoperatively does not reduce postoperative infection rates when using MTF FFCC for rhinoplasty.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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