

The Practices and Attitudes of Saudi Plastic Surgeons in Managing Contaminated Autologous Grafts

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Background: The use of autologous grafts is a standard reconstructive option in plastic surgery. The absence of a well-established protocol for decontamination after accidental contamination increases the risk of postoperative infection. We aimed to explore the current practice and decontamination methods among Saudi plastic surgeons. This would help develop a well-established, unified method of decontamination intraoperatively.

Methods: A validated self-administered questionnaire cross-sectional study was conducted in February 2022. The questionnaire was distributed through social media to all board-certified plastic surgeons in Saudi Arabia. The questionnaire was designed to obtain data on incidents, treatment preferences, and management of autograft contamination.

Results: A total sample size of 61 participants was included, with an overall response rate of 64.58%. Out of the 61 respondents, 73.8% (n = 45) had previously experienced graft contamination. Regarding the methods of graft contamination, the most common way was accidentally dropping the graft on the floor (39.7%, n = 25). The majority of the surgeons answered that they decontaminated the graft using povidone-iodine (44.6%, n = 29) and then used it (45.9%, n = 28). The lower extremity area was the most common anatomical location having surgery at the time of the graft contamination, accounting for 32.5% of the cases (n = 25).

Conclusions: Our study indicates that graft contamination is a common occurrence among our population, but we lack national guidelines on dealing with these situations. Although most responders used adequate decontamination methods, the lack of standardization could pose a risk to patients. (*Plast Reconstr Surg Glob Open* 2022;10:e4475; doi: 10.1097/GOX.0000000000004475; Published online 24 August 2022.)

INTRODUCTION

The use of autologous grafts is a standard reconstructive option in plastic surgery. The autologous graft can

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range from skin, fat, tendon, nerve, bone, and cartilage. Intraoperatively, accidental contamination could be encountered. A challenging situation arises when a graft is dropped on the operation theater floor. Graft contamination is quite common.¹ The absence of a well-established protocol for decontamination increases the risk of postoperative infection.^{2,3} Different decontamination methods are mentioned in the literature, including the use of neomycin and polymyxin, chlorhexidine 0.4%, and povidone-iodine 10% (PVP-I).⁴ The preferred method among plastic surgeons seems to be disinfection and completion of grafting without reharvesting, with povidone-iodine being the preferred disinfectant.¹ However, the literature reports that PVP-I could be damaging to fibroblasts. As little as a 15-minute exposure to 10% PVP-I was found to kill 100% of human fibroblasts, and a low concentration of 1% PVP-I was toxic as well.⁵ Luciano et al⁶ evaluated different decontaminants for tendon grafts. They found that intraoperative graft decontamination is possible using 0.5% chlorhexidine with a rate of 100% decontamination. An experimental study by Mat-Salleh et

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al⁷ on 225 bone specimens prepared from discarded bone fragments during a series of 45 knee and hip arthroplasty procedures found that the incidence of a positive culture from a dropped bone fragment was 86.5%. Chlorhexidine yielded a 5.4% incidence of positive culture, 67.6% using povidone-iodine, and 81.1% using alcohol. In this article, we aim to explore the current practice and methods of decontamination as this would help us develop a well-established and unified method of graft decontamination intraoperatively. This will ultimately decrease the incidence of graft reharvest, which is unpractical and carries a high morbidity rate for patients and postoperative infection.

METHODOLOGY

A survey-based cross-sectional study was conducted to evaluate the current practice of plastic surgeons in Saudi Arabia regarding the accidental contamination of autologous grafts intraoperatively in February 2022. After receiving ethical approval from the ethical committee at King Abdullah Medical City, Makkah, Saudi Arabia (22-881), a validated self-administered questionnaire was developed based on a previous publication with the authors' permission.¹ The questionnaire was distributed through social media to all board-certified plastic surgeons in Saudi Arabia.¹ The single inclusion criteria was being a board-certified plastic surgeon currently in practice. All residents, registrars, and non-board-certified surgeons were excluded. The questionnaire was designed to obtain data on incidents, treatment preferences, and management of autograft contamination. Statistical Packages for Social Sciences version 24 was used to analyze the data, New York, IBM Corp. The whole group of respondents was described using descriptive statistics, counts, proportions (percentages), mean, and standard deviation. Participants' responses to the following items were analyzed using a multiple response analysis: ways of graft contamination, methods of graft decontamination used, anatomical area of the primary surgical site, type of autologous tissue involved, and way of disclosure of the incident to the patient/family. Descriptive statistics were used to assess the frequencies and percentages of participants' responses. A Fisher exact test was used to assess the relationship between participants' years of practice and their experience with the number of graft contamination events, experience, and the way the graft was decontaminated. A 0.05 *P* value with a 95% confidence interval was used to determine the statistical significance.

RESULTS

Ninety-six plastic surgeons were asked to participate in this anonymous online questionnaire. Only sixty-one board-certified plastic surgeons' responses were included in the analysis, with an overall response rate of 64.58%. The questionnaire started by inquiring about the length of time the participant had been in practice; 27.9% (*n* = 17) of the 62 plastic surgeons have been practicing for 6–10 years, while 26.2% (*n* = 16) have been practicing

Takeaways

Question: What are Saudi plastic surgeons' current practices and decontamination methods after accidental graft contamination?

Findings: This cross-sectional study shows that more than half of our participants had previously experienced graft contamination and the majority decontaminated the graft using povidone-iodine.

Meaning: Povidone-iodine was the most commonly used antiseptic in disinfecting dropped grafts.

for more than 20 years. Of the 61 respondents, 73.8% (*n* = 45) had previously experienced graft contamination. In general, the mean \pm SD of years in practice was 2.07 ± 1.40 . Physicians without previous experience with graft contamination (*n* = 16, 26.2%) were not included in the statistical analysis. Most individuals who had witnessed graft contamination experienced at least one graft contamination (19.7%, *n* = 12). Regarding the methods of graft contamination, the most common way was by accidentally dropping it on the floor (39.7%, *n* = 25), followed by exposure of the graft to the non-sterile part of the field/drape (30.2%, *n* = 19) [Table 1](#). Many questions in the survey allowed for multiple replies to gather a wider variety of experiences for each surgeon. In addition, participants were asked about managing the contaminated graft if no substitute was available in the same operative field. The majority of the surgeons answered that they irrigated the contaminated graft and then used it (45.9%, *n* = 28), and 19.7% (*n* = 12) said they reharvested another graft from an alternative site other than the operative field. If the graft was decontaminated and used, the majority mentioned that they had decontaminated the graft using povidone-iodine (44.6%, *n* = 29). Saline irrigation was practiced by 27.7% (*n* = 18), followed by antibiotic solution (15.4%, *n* = 10). If an antibiotic was chosen, the most common antibiotic was gentamicin (*n* = 7/10). Only 14.8% of surgeons (*n* = 9) witnessed graft or surgical site infection among those who had witnessed graft contamination. The lower extremity area was the most common anatomical location having surgery at the time of the graft contamination, accounting for 32.5% of the cases (*n* = 25), followed by the upper extremity (20.8%, *n* = 16) ([Fig. 1](#)). The varieties of contaminated grafts are listed in [Table 1](#). The most common graft involved was the skin (46.4%, *n* = 32), followed by the cartilage graft (15.9%, *n* = 11) ([Fig. 2](#)). Thirty-two percent of the surgeons (*n* = 20) did not disclose the contamination incident to the patient. Other actions taken are shown in [Table 2](#). Interestingly, only 16.4% (*n* = 10) have discussed it as part of the informed consent process. The relationship between participants' years of practice and witnessing or experiencing contamination of an autologous graft during a plastic surgery procedure was not statistically significant; the *P* value was 0.127. Furthermore, the relationship between years of practice and the number of graft contamination events was not statistically significant, with a *P* value of 0.808 ([Tables 2 and 3](#)).

Table 1. Participants’ Responses Regarding Their Practices in Case of Graft Contamination (n = 61)

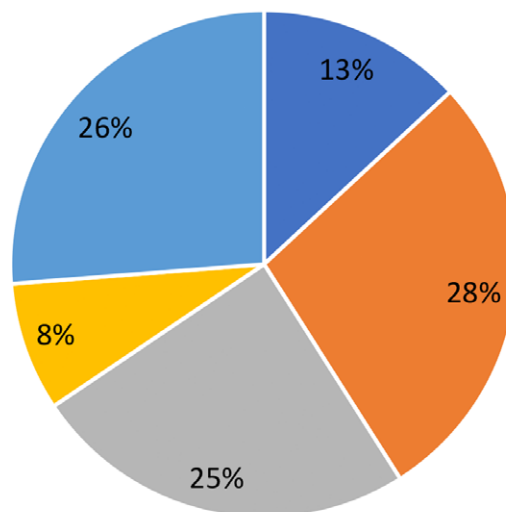
Variable	Answers	Frequency	Percentage
If this graft was critical to the procedure and no substitute was readily available in the same operative field, how did you manage the problem?	Graft discarded and operation ended	2	3.3
	Graft harvested from an alternative site other than operative field	12	19.7
	Other reconstructive techniques used	3	4.9
If the graft was decontaminated and used, what did you use?	Graft irrigated or decontaminated and then used	28	45.9
	Bulb saline irrigation	18	27.7
	Pulse/lavage saline irrigation	4	6.2
	Povidone-iodine	29	44.6
	Antibiotics solutions	10	15.4
To the best of your knowledge, did the use of decontaminated graft in any of these incidents lead to an infection of the graft or surgical site?	None	4	6.2
	Yes	9	14.8
	No	36	59.0
How was disclosure to the incident to the patient/family handled?	Incident not disclosed	20	32.8
	Chart notation/incident report made	22	36.1
	Patient/family informed postoperatively	9	14.8
	Risk discussed as part of informed consent process	10	16.4
	Exposure to nonsterile part of field/drape	19	30.2
In what way was the graft contaminated?	Exposure to nonsterile specimen container/suction catheter-canister/instrument	8	12.7
	Exposure to contaminated part of operating field (ear, nasopharynx, anorectal, and genitourinary)	6	9.5
	Graft/flap fell on floor	25	39.7
	Graft/flap discarded in trash	3	4.8
	Other	2	3.2

DISCUSSION

Grafts are used in many scopes of a surgeon’s practice nowadays. Not only plastic surgeons, but orthopedic, maxillofacial, and head and neck surgeons all deal with grafts in their practice. Although looking up the literature, we found very few publications on intraoperative graft contamination in surgery. Even similar published surveys like ours showed a low response rate. This intrigued our research group to learn about current plastic surgeons’ practices to shape national guidelines that can be adapted.

In most cases, graft contamination is managed according to a surgeon’s individual opinion or the policies of a specific institution. The review also shows that a dropped graft can be used safely if sterilized before placement. Harvesting another graft is often impractical and/or can lead to an additional disease burden. Substitute alloplastic material may not be available, and obtaining an allograft can take days. Additionally, both approaches would necessitate patient consent. In addition, aborting an operation or postponing it is definitely inconvenient.¹

Years in practice



■ 0-5 years ■ 6-10 years ■ 11-15 years ■ 16-20 years ■ >20 years

Fig. 1. Number of years the participants have been in practice.

Frequency of events

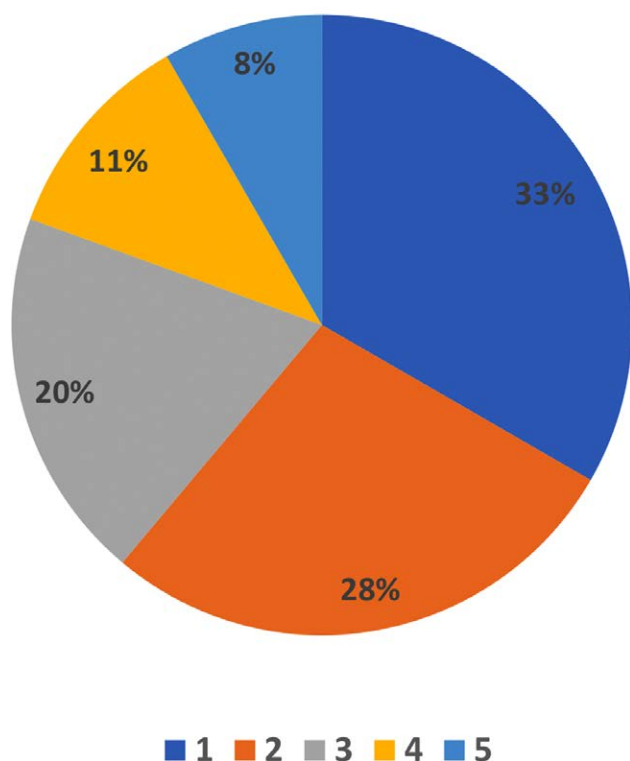


Fig. 2. Number of graft contamination events.

In our survey, 61 respondents agreed that autografts, except fat, are difficult to reharvest due to donor site morbidity and a lack of consent to utilize another donor site. On the other hand, fat grafts (nine contaminated incidents) can be readily reharvested in the majority

Table 2. Relationship between the Number of Years in Practice and Encountering Graft Contamination

		Have You Ever Witnessed Graft Contamination?		Total	P
		Yes	No		
How many years have you been in practice?	0 to 10 years	16	9	25	0.127
	11 to 20 years	18	2	20	
	> 20 years	11	5	16	
Total		45	16	61	

Table 3. Demonstrates the Relationship between the Number of Years in Practice and Number of Times Encountering Graft Contamination

		How Many Graft Contamination Events Witnessed or Experienced?					Total	P
		1	2	3	4	5		
How many years have you been in practice?	0–10 y	4	4	4	2	0	14	0.808
	11–20 y	6	4	2	2	3	17	
	>20 y	2	2	1	0	0	5	
Total		12	10	7	4	3	36	

of patients from the same donor site. A large number of respondents (94%) decontaminated the graft and proceeded with their surgical plan. Only 7% harvested another graft, 4% used another reconstructive technique, and only 2% alternatively used an alloplastic material.

According to our study, regarding the methods of graft contamination, the most common way was accidentally dropping the graft on the floor (39.7%), followed by graft exposure to the nonsterile part of the field/drape (30.2%). In a similar survey, 70% (157/223) of responding plastic surgeons reported graft contamination, and 70% of those were multiple occurrences. Similarly, the most common source of contamination was accidentally dropping the graft on the floor.¹ In another survey of orthopedic surgery literature, 25% (49/196) reported contaminating an anterior cruciate ligament graft.⁸ Based on these previously published reports, contamination prevention should include minimizing and mitigating human error. Recommendations to obtain this include notifying ancillary staff of the graft used, avoiding graft manipulation outside of the sterile field, storing the graft in a sealed container away from trafficked areas, and minimizing the number of tissue hand-offs.⁹ Several studies have cultured grafts deliberately dropped and left on the operating room floor for as little as 15 seconds. Although one study found no positive cultures on contaminated samples,¹⁰ others reported that between 58% and 96% of dropped grafts became contaminated.¹¹

Many contradictory findings exist in the literature regarding which antimicrobial solution is most effective, which concentration or volume of a solution is preferable, and how long grafts should be exposed to a solution. One thing is certain: an autograft can be contaminated in the average operating room in seconds. Knowledge of the graft’s pharmacokinetic properties and the potential influence of the incorporated antibiotics on the physical properties of the graft is required before clinical use of antibiotic-loaded grafts.¹² The main focus of research into locally applied antibiotics has been on efficacy against bacteria and suitability for the surrounding tissue. In our study, the management of contaminated grafts by antibiotic solution was reported by 15.4% of surgeons. The most common antibiotic was gentamicin (n = 7/10). Previous research has suggested that vancomycin is the most appropriate antibiotic because it has bactericidal activity against the most relevant germs and has the least cytotoxic effect on growing osteoblasts.¹³ Aminoglycosides are another excellent option for local application, have been in clinical use for several years, and have demonstrated efficacy and good compatibility with vital tissue.¹⁴

The majority of our study participants chose to decontaminate the graft using povidone-iodine (44.6%). The effectiveness of graft decontamination with 10% povidone-iodine has been questioned, as it has previously been reported to be the most common method of sterilizing contaminated grafts among 223 members of the American Society of Aesthetic Plastic Surgery.¹ Stanford et al¹⁵ questioned the effectiveness of PVP-antimicrobial solutions, discovering that even after 30 minutes of soaking or washing with irrigation, 10% PVP-I did not decontaminate cadaver patellar bone-tendon autografts. One

study¹⁶ found that using a triple antibiotic solution or chlorhexidine failed to sterilize all contaminated anterior cruciate ligament graft specimens.¹⁶ Interestingly, 4% and 2% chlorhexidine gluconate solutions have been reported to be the most consistently effective disinfection methods researched. Still, they are not the most widely used.¹⁷

The World Health Organization published guidelines in 2008 that identified a number of recommended practices (including a “Surgical Safety Checklist”) to ensure the safety of surgical patients worldwide.¹⁹ The Surgical Safety Checklist consists of 19 items divided into three sections that must be completed in a total of 3 minutes at key points in surgical procedures. Haynes et al²⁰ discovered that incorporating the World Health Organization Surgical Safety Checklist into operating rooms in eight different hospitals was associated with significant surgical outcomes. On average, postoperative complication rates were reduced by 36%, and a comparable percentage of reduced death rates.

Study Limitations and Future Recommendations

There are several limitations in this article that must be addressed. First, since the survey was self-reported, the results might be biased and subject to respondent recall and interpretation biases. Second, our findings might be affected by nonresponse bias. However, we think that our findings reflect the current practice of plastic surgeons in Saudi Arabia, given the high response rate (64.58%). In order to determine how graft contamination impacts the likelihood of successful graft taking after surgery, further studies are needed.

CONCLUSIONS

The current study concluded that promoting tissue graft decontamination in plastic surgery intraoperatively is conceivable. The technique used follows the directed protocol and uses an actual sterilizing agent. Although the current study demonstrated that povidone-iodine was the most commonly used antiseptic in disinfecting dropped grafts, many conflicting results were reported in the literature. Further studies to assess alternative decontamination methods during the operation are required.

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ETHICAL APPROVAL STATEMENT

This study has gained institutional review board approval. The authors declare that it conforms to the Declaration of Helsinki.

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