



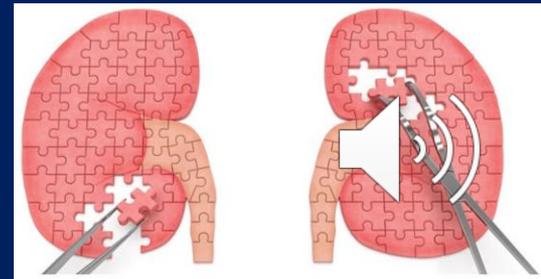
# Nontransplant Surgery in Kidney Transplant Recipients

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30<sup>th</sup> ABAN 1399



## Minor surgical procedures

Defined as a set of procedures in which short surgical techniques are applied on superficial tissues, usually with local anesthesia, and minimal complications, that usually do not require postoperative resuscitation and need minimal equipment, many of which are used on a daily basis, and can be easily and safely performed in a short amount of time during clinic visit.





## What is aesthetic plastic surgery?

Aesthetic plastic surgery (also called cosmetic surgery) refers to procedures that improve the appearance of the face and body. They include [tummy tuck \(abdominoplasty\)](#), breast augmentation, breast reduction, [eyelid surgery](#), nose reshaping (rhinoplasty), face lift and removal of fat (liposuction).



Many of the **principles** of peri- and intraoperative management **are the same** in transplant and non-transplant patients.

However, there are a few important differences. It is strongly recommended that **the transplant center be consulted** prior to any planned surgical intervention in kidney transplant recipients.



**Br. J. Surg. Vol. 65 (1978) 228–230**

# **Morbidity and mortality in renal transplant patients after incidental surgery**

**M. BAKKALOGLU, D. N. H. HAMILTON, S. G. MACPHERSON AND J. D. BRIGGS\***



## Table I: SURGICAL PROCEDURES IN SUCCESSFULLY TRANSPLANTED PATIENTS

### Investigation of transplanted kidney (n = 17)

Drainage of perirenal lymphocele	7
Drainage of perirenal haematoma	4
Drainage of perirenal abscess	3
Exploration of renal artery stenosis	2
Exploration of renal artery aneurysm	1

### Gastrointestinal operations (n = 16)

Peptic ulcer	
Repair of perforation	1
Vagotomy and pyloroplasty for haemorrhage	3
Partial gastrectomy for haemorrhage	1
Drainage of intra-abdominal abscess	2
Splenectomy	2
Laparotomy for pancreatitis, laparotomy for intra-abdominal bleeding, repair of incisional hernia, repair of inguinal hernia, hemicolectomy for carcinoma of caecum, colostomy for perforated diverticulum, haemorrhoidectomy	1 each

### Orthopaedic procedures (n = 10)

Hip arthroplasty	4
Exploration and bone graft to talus	2
Excision of head of radius and lower humerus	2
Replacement of knee joint	1
Orthodesis of ankle	1

### Urological procedures (n = 14)

Excision of hydrocoele	5
Reimplantation of transplanted ureter	3
Removal of calculus from kidney or urethra	2
Repair of urinary fistula from ureter or bladder	2
Drainage of scrotal abscess	1
Excision of renal cyst	1

### Miscellaneous procedures (n = 8)

Termination of pregnancy and sterilization	2
Parathyroidectomy, unilateral nephrectomy, drainage of pilonidal sinus, iridectomy, corneal graft, hysterectomy (for fibroids)	1 each

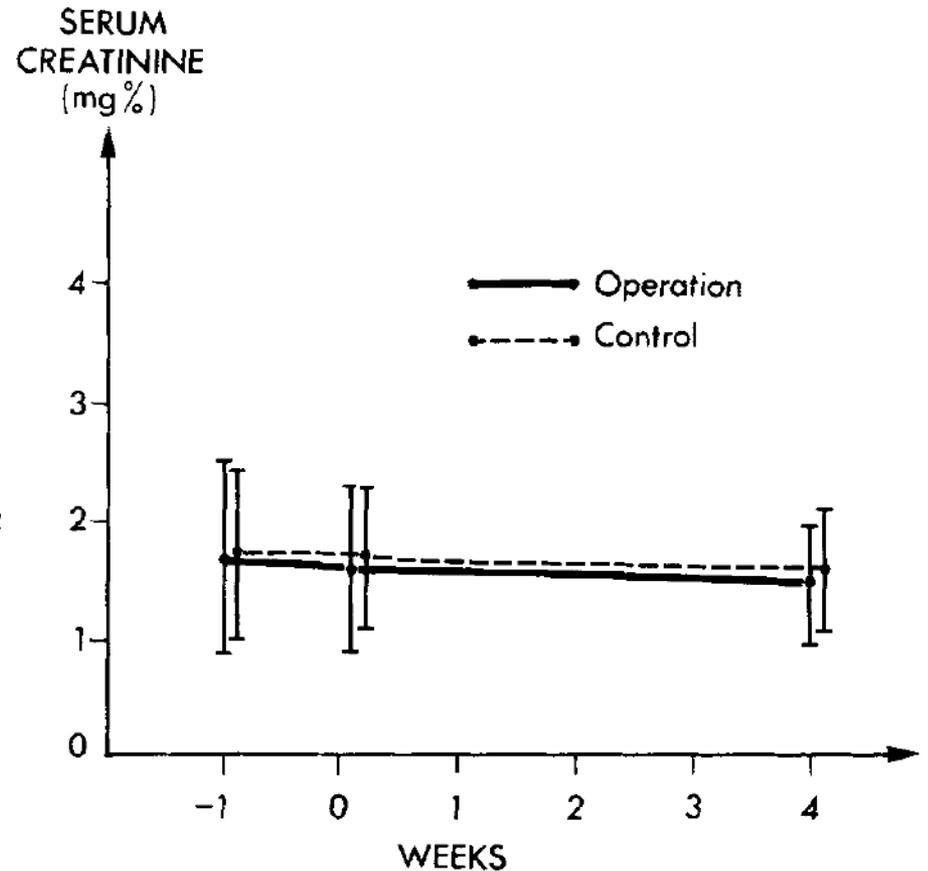


Fig. 1. Mean serum creatinine values before and after surgery in successfully transplanted patients (solid line) and a control, non-operated group transplanted at the same time (dotted line). Only surgical procedures carried out more than 3 months after transplantation have been included. Operations on the transplanted kidney have also been excluded.



Successfully transplanted patients need not be regarded as a high risk group, nor does surgery cause deterioration of renal function.



**Research**

# Is Aesthetic Surgery Safe in the Solid Organ Transplant Patient? An International Survey and Review

Meredith T. Vandegrift, MD; and Foad Nahai, MD, FACS

Aesthetic Surgery Journal  
2016, Vol 36(8) 954–958  
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[journals.permissions@oup.com](mailto:journals.permissions@oup.com)  
DOI: 10.1093/asj/sjw044  
[www.aestheticsurgeryjournal.com](http://www.aestheticsurgeryjournal.com)

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## Abstract

**Background:** Improved immunosuppression and lifespans have afforded solid organ transplant (SOT) recipients the opportunity to seek aesthetic surgery.

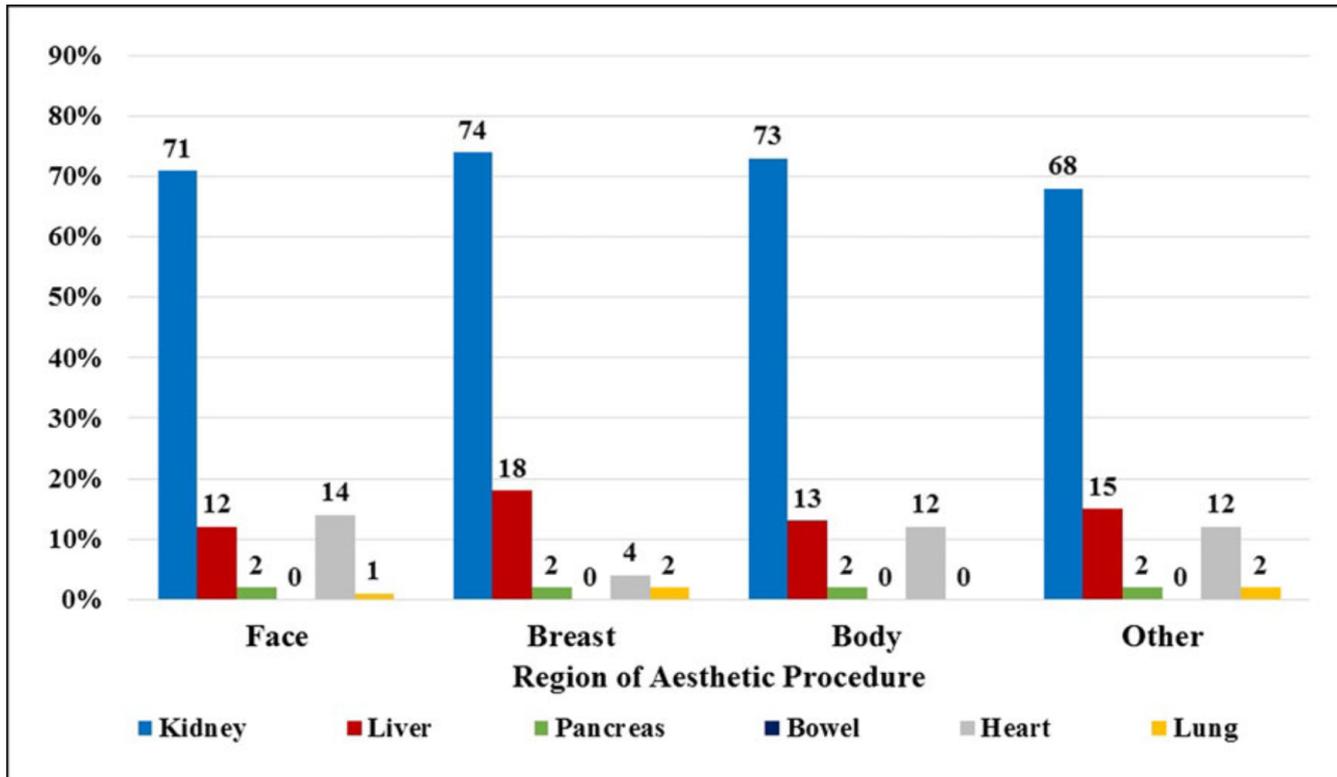
**Objectives:** To determine current trends in the provision of aesthetic in the SOT patient population, we polled the international plastic surgery community. We specifically sought to evaluate their experiences with this patient population, as well as to perform a review of the literature to provide updated guidelines for practitioners who may consider performing surgery in the SOT patient population.

**Methods:** A web-based survey was sent to national and international colleagues to query the experiences and complication rates of performing aesthetic surgery in this patient population.

**Results:** Thirty percent of the 1308 respondents performed surgery in SOT patients. Three hundred and forty practitioners performed 552 procedures with a 4.3% complication rate. Over 68% of all procedures were performed on kidney transplant recipients.

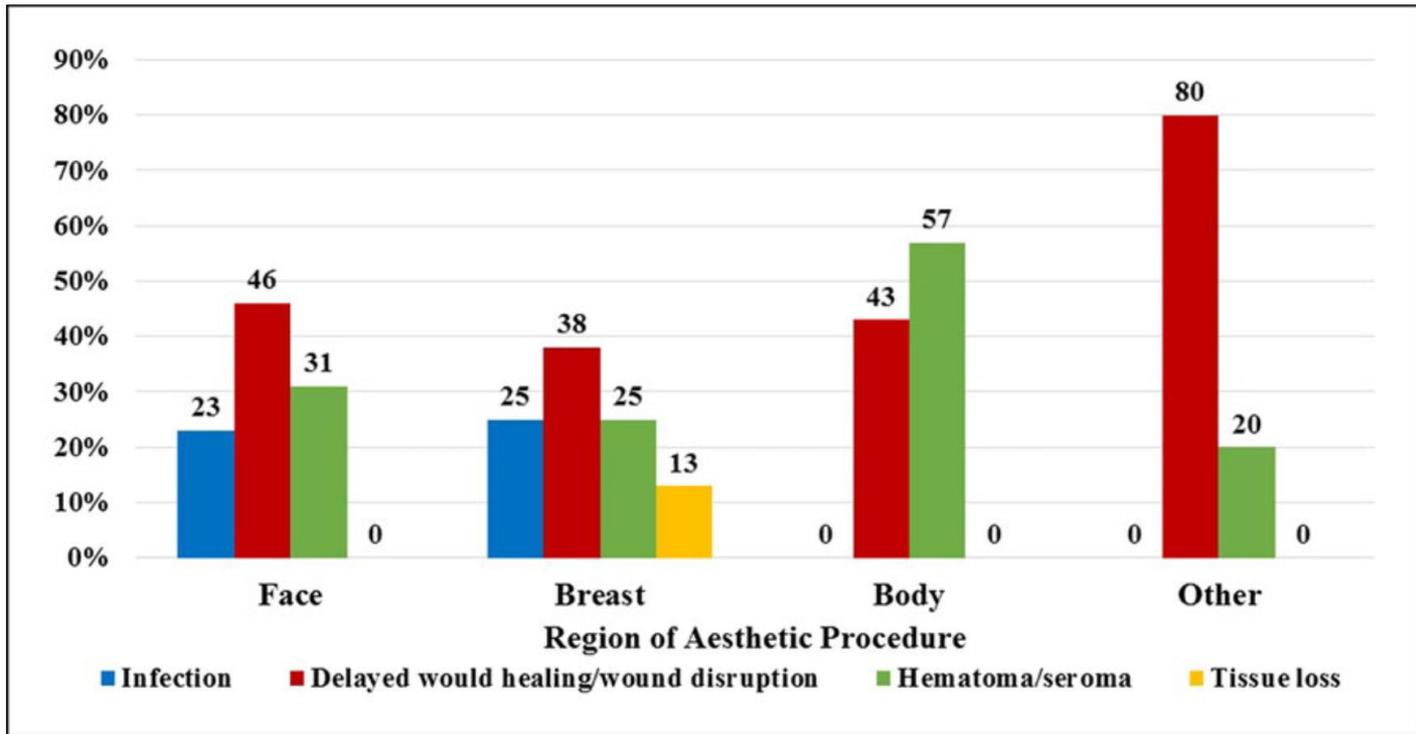
**Conclusions:** SOT patients can safely undergo elective aesthetic procedures. We recommend working closely with the medical team to assure the best outcomes.





**Figure 1.** Responses to the following survey question: “For those respondents who have performed aesthetic surgery in a SOTP, indicate the region of the body you operated on and the type of organ transplanted.”





**Figure 2.** Complications reported by body region.



## The New Face of Transplant Surgery: A Survey on Cosmetic Surgery in Transplant Recipients

Iliana Sweis · Ivo Tzvetanov · Enrico Benedetti

A survey was sent to ASPS members asking about their experience with transplant patients undergoing aesthetic procedures.

Results Of the 789 plastic surgeons who responded, 25% have performed aesthetic surgery on transplant recipients. A total of 278 patients underwent 292 surgical aesthetic procedures and 64 patients underwent 94 nonsurgical aesthetic procedures.

The incidence of **reported perioperative complications was 3.4%**.

There were very few additional precautions taken with the patients relative to the general population.



**Table 2** Allograft type and number of the cosmetic procedures performed

Allograft	No. cosmetic surgery procedures	No. cosmetic nonsurgical procedures
Kidney	196	51
Liver	36	7
Heart	21	3
Kidney-pancreas	9	0
Pancreas	6	1
Lung	4	2
Lung-kidney	2	0
Heart-lung	1	0
Liver-kidney	1	0
Liver-pancreas	1	0
Bone marrow	1	0
Heart-kidney	0	1
Unspecified	14	29
Total	292	94



**Table 3** Aesthetic surgery procedures performed

Surgical cosmetic procedure	No. procedures performed
Rhytidectomy	75
Blepharoplasty (2 lids)	59
Liposuction	31
Augmentation mammoplasty	30
Reduction mammoplasty	27
Abdominoplasty	23
Scar revision	9
Mastopexy	9
Panniculectomy	5
Brow lift	4
Breast reconstruction	4
Fat transfer	2
Gynecomastia treatment	2
Removal of breast implants	2
Capsulectomy with implant exchange	2
Rhinoplasty	2
Otoplasty	1
Chin implant	1
Neck lift	1
Breast augmentation revision	1
Bracheoplasty	1
Earlobe repair	1
Total	292



The nonsurgical aesthetic procedures included Botox Cosmetic injections, soft tissue filler injections, chemical peels, laser skin resurfacing, and Intense Pulse Light treatment.

**Table 4** Nonsurgical aesthetic procedures performed

Nonsurgical cosmetic procedure	No. transplant patients treated
Soft tissue fillers (Juvederm, Radiesse, Restylane, Sculptra)	40
Botox Cosmetic	38
Ablative and nonablative skin resurfacing lasers	10
Chemical peels	2
Laser hair removal	1
Thermage	1
Alloderm	1
Intense pulse light	1
Total	94



The majority of the patients (73%) were kidney transplant recipients. The most common aesthetic surgery was a Rhytidectomy ( face lift), and the most common nonsurgical aesthetic procedures were facial injectable including Botox Cosmetic and soft tissue fillers. There were 10 postoperative complications reported for an incidence of 3.4% . The most common complications encountered in the postoperative period included delayed wound healing and seroma formation.

**Table 5** Type and total number of all reported postoperative complications ( $n = 10$ )

Allograft	Plastic surgery procedure	Complication
Kidney	Abdominoplasty	Seroma
Kidney	Capsulectomy/implant exchange	Seroma
Kidney	Bilateral subcutaneous mastectomy/immediate gel implant reconstruction	Anemia requiring transfusion and urinary tract infection
Kidney-pancreas	Mastopexy	Delayed healing <sup>a</sup>
Pancreas	Facelift	Delayed healing <sup>a</sup>
Liver	Reduction mammoplasty	Delayed healing <sup>a</sup>
Liver	Reduction mammoplasty	Prolonged nausea and decreased GI motility
Liver	Liposuction/scar revision	Marginal necrosis of scar edge
Liver	Abdominoplasty	Soft tissue loss
Heart	Reduction mammoplasty	Delayed healing <sup>a</sup> of periareolar incision

<sup>a</sup> The survey reports of delayed healing did not specify the time frame for complete wound healing



Some of the plastic surgeons added coverage with antibiotics or antiviral medications.

A few gave a stress dose of steroids. Others left sutures in wounds for a slightly extended period of time.

However, there were no consistent guidelines or protocols for managing these patients.

Women accounted for 91% and men accounted for 9% of the total number.

Furthermore, aesthetic procedures are no longer limited to the older segment of the population.

Breaking down procedures by age group, the 2007 data from ASAPS demonstrated that 46% of cosmetic procedures were on individuals between 35 and 50 years of age and 21% were on individuals between 19 and 34 years of age.





A series of 41 transplant recipients undergoing plastic surgery procedures. In their series, only patients undergoing plastic surgery procedures early after transplantation experienced increased morbidity.

## Reconstructive Surgery for Kidney Transplant Recipients

O. Papadopoulos, P. Konofaos, C. Chrisostomidis, S. Lionaki, P. Georgiou, K. Vlaslis, and A. Kostakis

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### ABSTRACT

Many decades have passed since the first kidney transplantation, which is now the most common organ transplant performed worldwide. Despite the impressive advances, some patients may develop posttransplant complications that require proper management and treatment. The plastic and reconstructive surgeon, among others, may be called on to help resolve a number of reconstructive problems present in the immunosuppressed kidney recipients. This study presents our experience with 41 kidney recipients who needed plastic surgical treatment. Patients were placed into one of three study groups according to the type of posttransplant surgical condition. Group 1 included 17 patients with posttraumatic wound healing problems; group 2, 17 patients with skin tumors; and group 3, 7 patients with other posttransplant surgical complications. Only two of these patients had early posttransplant wound dehiscence; the remaining patients suffered late complications. In conclusion, the kidney recipient can successfully undergo minor or major reconstructive procedures. The possibility of surgical problems arising during the early posttransplant period presents increased complication rates, possibly due to high immunosuppressive drug levels.

Virtually all transplant recipients have impaired wound healing and increased risks of infection secondary to immunosuppression and their primary disease. However, these risks are not uniformly distributed in the post transplant period. Awareness of the individual stage and level of immunosuppression could prevent complications and undesirable surgical outcomes





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Surg Clin N Am 86 (2006) 1147–1166

# The Preoperative Evaluation of the Transplanted Patient for Nontransplant Surgery

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## Level of immunosuppression and risk of postsurgical infection:

The pattern of susceptibility tends to follow the “net state of immunosuppression,” which is influenced greatly not only by the dose, but also by the duration, nature, and temporal sequence of immunosuppressive therapy.

For instance, because the risk of acute rejection is highest **in the first weeks to months following transplantation**, immunosuppression is maintained at high levels in this period and tapered to maintenance dosages thereafter. Similarly, **acute rejection** is usually managed with high-dose steroids or antilymphocyte antibody therapy (for steroid-resistant rejection), followed by an intensification of maintenance immunosuppressive therapy to levels often equal to or even greater than the initial 6-month perioperative period.

Both of these clinical scenarios represent periods of heightened risk for infection, and hence, **a suboptimal time to proceed with an elective or nonemergent surgery.**



The maintenance immunosuppressive agents that the patient is receiving are continued in the perioperative period; dose modification is usually unnecessary.



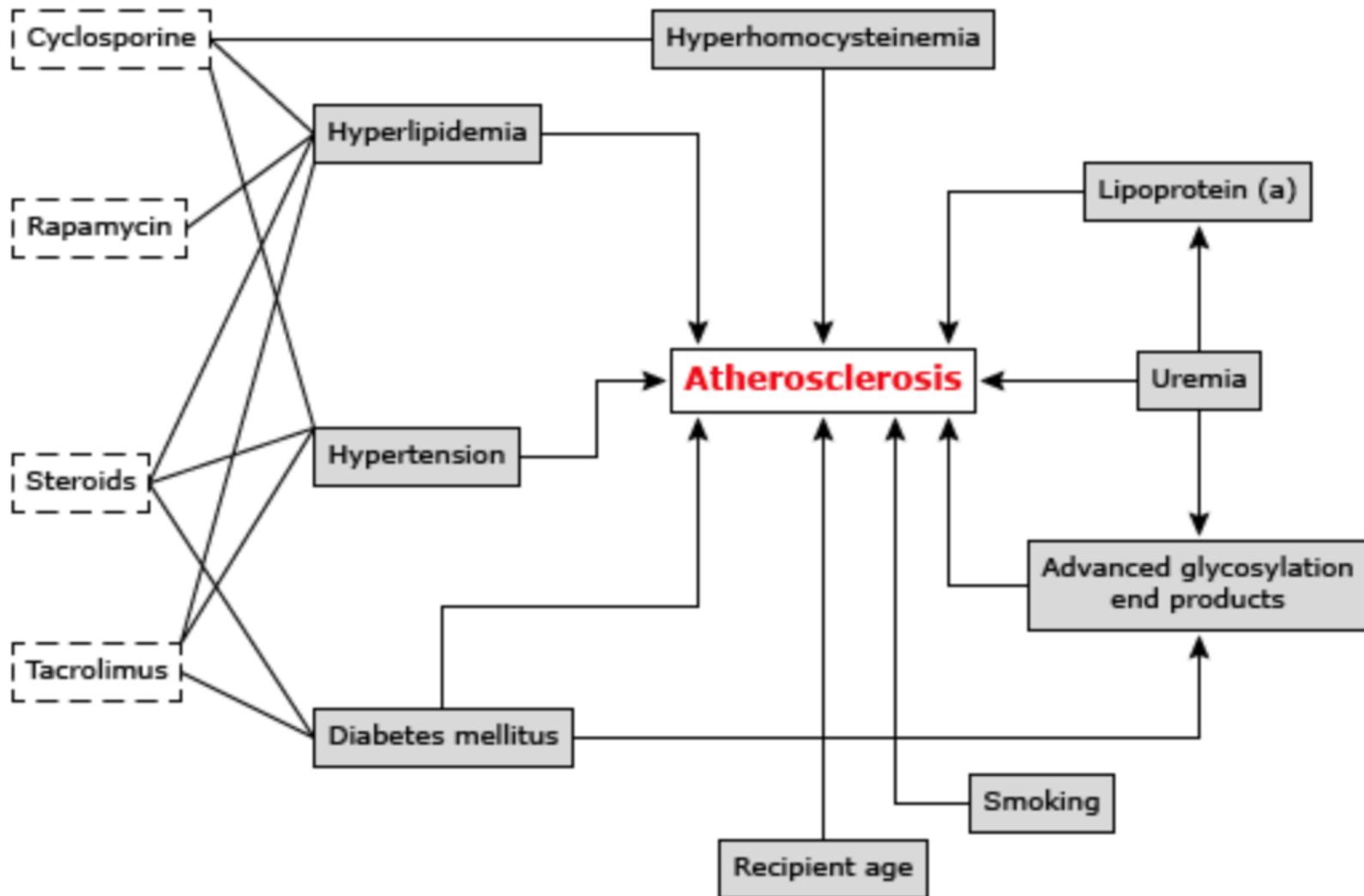
The cardiovascular risk among transplant recipients who do not have ESRD related to diabetes is still higher than in the general population . The increased cardiovascular risk is due to the following:

- An exacerbation of traditional risk factors present in the general population by immunosuppressive drugs
- Nontraditional risk factors related to immunosuppressive agents or to chronic kidney disease

Following risk factors are independently associated with post transplant atherosclerotic cardiovascular disease:

- Increasing patient age
- Diabetes mellitus
- Male sex
- Cigarette smoking
- Hypertension
- Elevated serum cholesterol





## Corticosteroids

Currently, with the advent of more potent maintenance immunosuppressive agents (such as cyclosporine, tacrolimus, mycophenolate mofetil, and sirolimus), maintenance glucocorticoids are either avoided entirely or the doses are markedly reduced. Thus, adrenal suppression has become much less of a problem.

In general, the administration of high doses of glucocorticoids is usually unnecessary and may be relatively contraindicated. Giving such doses is not entirely benign and can occasionally be associated with gastritis, bleeding, induction of diabetes, and worsening of glycemic control.



# Adrenal insufficiency

In patients on low maintenance dose (5-10 mg/day) there is sufficient evidence to suggest the administration of high doses is usually unnecessary.

In a prospective study of 40 renal transplant patients admitted with various sources of stress (including sepsis, metabolic abnormalities, and surgery), no clinical evidence of adrenal insufficiency was noted despite being maintained only on their baseline dose of prednisone (5–10 mg/d).

Additionally, the study demonstrated that the cosyntropin stimulation test significantly overestimated the presence of clinically significant adrenal deficiency, and hence, was not a reliable marker for the need of additional glucocorticoids. For this reason, several authors have recommended that patients on chronic low-dose glucocorticoids undergoing surgery receive only their usual dose of glucocorticoid perioperative.



The following two regimens may be utilized in patients considered to have suppression of the hypothalamic-pituitary-adrenal axis:

- One approach is to provide high doses of glucocorticoid to those with proven or suspected adrenal insufficiency, starting at the time of induction of anesthesia. A continuous infusion of 10 mg of hydrocortisone per hour or the equivalent amount of dexamethasone or prednisolone eliminates the possibility of glucocorticoid deficiency as the cause of an adverse event (such as hypotension).

The glucocorticoid dose can be halved the day after surgery, and the maintenance dose usually can be resumed the second postoperative day. This amount of glucocorticoid for this amount of time carries a negligible risk of adverse effects; however, prolonged postoperative pharmacologic glucocorticoid therapy can mask symptoms and signs of infection and produce undesirable side effects.

- The other regimen utilizes parenteral hydrocortisone "boosts." Generally, 100 mg of hydrocortisone is given intravenously every eight hours perioperative, and the dose is slowly reduced (but not the frequency) until the patient can be switched to his or her regular doses of oral medications.



- In contrast, patients who have received more than 20 mg/d of prednisone or its equivalent for more than 3 weeks should be assumed to have functional suppression of the hypothalamic–pituitary–adrenal axis, but nevertheless, rarely require additional steroids to accommodate acute stress .
- However, if the patient exhibits signs or symptoms of adrenal insufficiency postoperatively, the use of perioperative “stress coverage” would be warranted. Although traditionally the dosage used for stress coverage has been 100 mg of hydrocortisone every 8 hours, this dose in actuality is far higher than the physiologic cortisol response, which peaks at 150 mg/d after major surgery and returns quickly to baseline. A consensus paper recommends giving much lower peak doses (**maximum 50 mg of hydrocortisone every 8 hours with dose adjustment based on the degree of surgical stress**), and then **quickly returning the dosage to baseline** .
- There is no evidence to suggest that steroid supplementation needs to be tapered over a prolonged period. **A taper over 1 to 3 days** is adequate in uncomplicated situations. 

## Vitamin A and Steroids

- Glucocorticoids lower the levels of TGF- $\beta$  and IGF-I in wounds. Both of these growth factors are necessary in the inflammatory cascade that leads to collagen synthesis.
- Vitamin A has been shown to reverse the retarding effects of glucocorticoids on wound healing . The mechanism by which this occurs is not fully understood. It is believed that vitamin A works by restoring TGF- $\beta$  and IGF-I levels so that the normal inflammatory cascade can occur, thereby allowing collagen production.



# Increased Susceptibility to Infection

- Patients are at the greatest risk of infection during periods of greatest immunosuppression. This is usually during the first few months after transplantation and during acute rejection episodes. Furthermore, certain viral infections such as cytomegalovirus (CMV) are themselves immunosuppressive and may increase the risk of secondary Infection .
- As such, it is critical to ensure that the patient is far enough in the postoperative course and is on a stable immunosuppressive schedule to determine the appropriate timing for elective surgery.



**Antibiotic prophylaxis** — In general, chronically immunosuppressed transplant patients may be considered at higher risk to develop infectious complications after surgical, endoscopic, or dental procedures. Routine antibiotic prophylaxis, either with **a first-generation cephalosporin or, in the case of dental procedures, oral amoxicillin, is ordinarily sufficient in most cases** . Patients who receive prophylactic **antibiotics within a two-hour "window" period before the initial incision** have lower rates of surgical-site infection than patients who receive them either too early or postoperatively.

Two macrolides, **erythromycin and clarithromycin**, should be avoided in patients being administered cyclosporine or tacrolimus as these antibiotics antagonize the CYP 3A4 enzyme system, **leading to elevated levels of cyclosporine and tacrolimus**. Although azithromycin is also a macrolide, it does not significantly affect this enzyme system, and its use usually does not alter cyclosporine or tacrolimus levels. Other safe alternatives are ciprofloxacin and clindamycin, which also do not significantly affect cyclosporine or tacrolimus levels.



- As with any patient undergoing an invasive procedure, antibiotic prophylaxis is an important component of the perioperative management of the transplant recipient. Although these patients may be considered at higher risk of developing infectious complications after surgical, endoscopic, or dental procedures, there is **no evidence to suggest that prolonged or heightened antibiotic prophylaxis has any added benefit in preventing infectious complications in these individuals.**
- However, given the frequent unusual clinical presentations of these patients, we do advocate **the liberal use of cultures** if there is any possibility of an infectious etiology. Oral amoxicillin or clindamycin are appropriate for dental procedures.
- It is recommended **that infusion of the first antimicrobial dose be given within 1 to 2 hours before the surgical incision**, because these patients have lower rates of surgical site infection compared with patients who receive them either too early or postoperatively.



## Tissue integrity and wound healing

Chronically immunosuppressed patients, even those on low doses of glucocorticoids, may frequently be noted intra operatively to have "weak" tissues. Although gentle handling of tissues is an old and well-accepted surgical principle, it is particularly important in the technical performance of surgical procedures in transplant patients.

Wound healing is generally slower in immunosuppressed patients . As an example, when **skin staples are utilized, they may need to be kept in up to three times longer than in non-transplant patients .**

- whether specific immunosuppressive agents may enhance wound-healing complications, even during the period immediately post transplantation?

- Some evidence suggests that **sirolimus may lead to a higher incidence of adverse outcomes in this setting**. In a study of 59 and 64 kidney transplant recipients receiving a tacrolimus- or sirolimus-based immunosuppressive regimen, respectively (plus mycophenolate mofetil and glucocorticoids in both groups), the incidence of allograft wound complications was significantly higher in the sirolimus group (47 versus 8 percent, respectively) . Perigraft fluid collections, superficial wound infections, and incisional hernias were reported.



Since cosmetic procedures are elective by nature, the use of sirolimus may be a relative contraindication to aesthetic surgery



- Many transplant surgeons advocate the use of nonabsorbable sutures whenever possible. When an absorbable suture is warranted, monofilament, synthetic, absorbable sutures have been recommended because of their ability to maintain adequate tensile strength over a long period.
- Due to concerns of delayed wound healing, it also has been recommended that skin staples be kept in place two to three times longer in the transplant recipient.



# Perioperative fluid management

- Must ensure restoration and maintenance of intravascular volume, in order to obtain good graft function.
- Diuretics should not be given without careful evaluation of the patient's volume status.
- In anesthetic management, it is prudent to choose drugs that do not rely on the kidney for excretion.
- Nephrotoxic drugs should be avoided .



## Liposuction

Pose special consideration in these patients. Since fluid shifts can be substantial in patients undergoing liposuction, it is important to stage these procedures and limit the number of areas undergoing liposuction per procedure.



# Kidney transplant recipients

- It seems wise to choose drugs that do not rely on renal excretion such as propofol and atracurium. A similar strategy should be used when choosing postoperative analgesics and sedatives.
- In particular, meperidine and propoxyphene should be avoided in patients with significant graft dysfunction .
- If an opiate is required for pain relief in these patients, fentanyl is likely best tolerated because of its short distribution phase, the lack of active metabolites, and unchanged free fraction .



Nonsteroidal anti-inflammatory drugs should not be used .  
Conversely, neither diuretics nor intravenous fluids should be given without an initial thorough evaluation of the patient's volume status. Accordingly, proper management may require right heart monitoring to provide objective parameters for intravascular volume management.



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# **Anesthetic Considerations in Transplant Recipients for Nontransplant Surgery**

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Katarina Tomulić Brusich and Ivana Acan



Anesthetic agent	Effect with immunosuppressive drugs
Isoflurane	↓ Clearance of oral CyA
Thiopental	Nil
Benzodiazepines	↑ Blood level of benzodiazepines
Propofol	Nil
Etomidate	Nil
Opioids	CyA ↑ analgesic effect produced by fentanyl
Muscle relaxants	Prolonged neuromuscular blockade
Neostigmine	Caution in heart transplant patients
Local anesthetics	Bupivacaine and ropivacaine can be safely used

**Table 4.** Effect of specific anesthetic agent on immunosuppressive drugs.



Drug class	Drug	Effect on blood level Adverse effect
Benzodiazepines	Diazepam, midazolam, alprazolam, flurazepam, clonazepam	↑ Benzodiazepines
Antibiotics	Erythromycin, metronidazole, norfloxacin, levofloxacin	↑ CyA and Tac level
Antimicrobial	Rifampicin	↓ CyA and Tac level
Antimalarial	Chloroquine, mefloquine	↑ CyA and Tac level
Antifungal	Ketoconazole, fluconazole, itraconazole, voriconazole, amphotericin B	↑ CyA and Tac level Renal dysfunction
Anti-retroviral	Ritonavir, atazanavir, darunavir, cobicistat, delaviridine	↑ CyA and Tac level
Cardiovascular drugs (antiarrhythmics and calcium channel blocker)	Amiodarone, lidocaine, quinidine, verapamil, diltiazem, amlodipine, felodipine	↑ CyA and Tac level QT prolongation by amiodarone and quinidine
Statins	Simvastatin, atorvastatin, lovastatin, pravastatin	↑ Statin concentration
Anticoagulants	Apixaban, dabigatran, rivaroxaban	↑ Anticoagulant concentration
Oral hypoglycemics	Sulfonylurea, biguanides	↑ CyA level
Gastrointestinal	Metoclopramide, omeprazole, lansoprazole, octreotide, cimetidine, ranitidine	↑ CyA and Tac level Renal dysfunction QT prolongation by octreotide with Tac
Analgesics	Nonsteroidal anti-inflammatory drugs	↑ CyA and Tac level Renal dysfunction
Antipsychotics	Haloperidol, desipramine, fluoxetine, trazodone, pimozide	↑ CyA and Tac level ↑ Pimozide level
Hormones	Estrogen and testosterone preparation	↑ CyA and Tac level
Others	Bosentan, carbamazepine	↓ CyA and Tac level

CyA = cyclosporine A; Tac = tacrolimus.

**Table 3.** Drugs that interact with cyclosporine A and tacrolimus.



CyA	Tac	Aza	Ster	MMF	ATG	OKT3	
Anemia	-	-	+	-	+	-	-
Leucopenia	-	-	++	-	+	+	+
Thrombocytopenia	-	-	-	-	+	-	-
Hypertension	++	+	-	+	-	-	-
Diabetes	+	++	-	++	-	-	-
Neurotoxicity	+	+	-	+	-	-	-
Renal insufficiency	+	++	-	-	-	-	-
Anaphylaxis	-	-	-	-	-	+	+
Fever	-	-	-	-	-	+	+

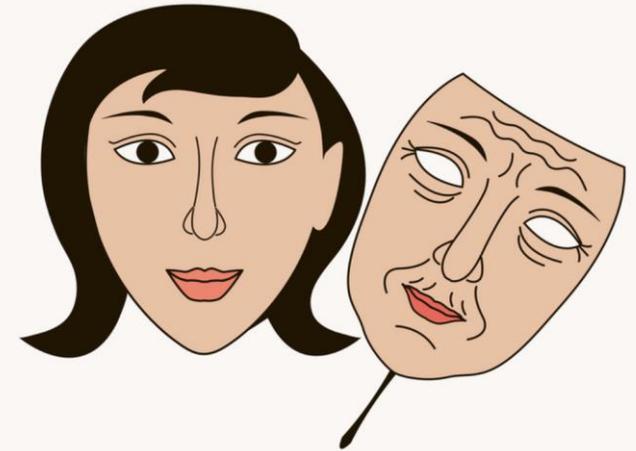
ATG = anti-thymocyte globulin; Aza = azathioprine; CyA = cyclosporine A; MMF = mycophenolate mofetil; OKT3 = monoclonal antibodies directed against CD-3 antigen on the surface of human T-lymphocytes; Ster = steroids; and Tac = tacrolimus.

**Table 2.** Side effects of immunosuppressive that have direct impact on anesthetic and perioperative management [1].



## Take Home Messages...

- Aesthetic surgery and nonsurgical aesthetic procedures are being performed safely in organ transplant recipients.
- The timing of these procedures relative to the transplant procedure itself is critical.
- All elective surgical procedures should be postponed during any interval requiring reintroduction or increased administration of steroids.
- It is strongly recommended that **the transplant center be consulted** prior to any planned surgical intervention in kidney transplant recipients.
- Basic perioperative precautions should be undertaken in transplant recipients , then a comparable degree of success following cosmetic surgery may be expected.
- The maintenance **immunosuppressive agents that the patient is receiving are continued in the perioperative period.**
- **Patients on chronic low-dose glucocorticoids undergoing surgery receive only their usual dose of glucocorticoid perioperative**



Thanks for Your Attention

