

Antibiotic Prophylaxis in Plastic Surgery Correlation Between Practice and Evidence

La Prophylaxie Antibiotique en Plasturgie : Une Corrélation Entre la Pratique et les Données Probantes

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Abstract

Background: The use of appropriate preoperative antibiotic prophylaxis decreases the risk of surgical site infections (SSI); however, the breadth of plastic surgery procedures makes it challenging to ensure appropriate use for each unique procedure type. Currently, plastic surgeons lack a cohesive and comprehensive set of evidence-based guidelines (EBG) for surgical prophylaxis. We sought to profile the perioperative antibiotic prescribing patterns for plastic surgeons in British Columbia to investigate if they are congruent with published recommendations. In doing so, we aim to determine risk factors for antibiotic overprescribing in the context of surgical prophylaxis. **Methods:** A literature review identifying EBG for antibiotic prophylaxis use during common plastic surgery procedures was performed. Concurrently, a provincial survey of plastic surgery residents, fellows, academic and community plastic surgeons was used to identify their antibiotic prophylaxis prescribing practices. These findings were then compared to recommendations identified from our review. The compliance of the provincial plastic surgery community with current EBG was determined for 38 surgical scenarios to identify which clinical factors and procedure types were associated with unsupported antibiotic use. **Results:** Within the literature, 31 of the 38 categories of surveyed plastic surgery operations have EBG for use of prophylactic antibiotics. When surgical procedures have EBG, 19.5% of plastic surgery trainees and 21.9% of practicing plastic surgeons followed recommended prophylaxis use. Average adherence to EBG was 59.1% for hand procedures, 24.1% for breast procedures, and 23.9% for craniofacial procedures. Breast reconstruction procedures and contaminated craniofacial procedures were associated with a significant reduction in adherence to EBG resulting in excessive antibiotic use. **Conclusion:** Even when evidence-based recommendations for antibiotic prophylaxis exist, plastic surgeons demonstrate variable compliance based on their reported prescribing practices. Surgical procedures with low EBG compliance may reflect risk avoidant behaviors in practicing surgeons and highlight the importance of improving education on the benefits of antibiotic prophylaxis in these clinical situations.

Résumé

Historique : Une prophylaxie antibiotique préopératoire appropriée réduit le risque d'infections au foyer de l'opération (IFO), mais en raison de l'éventail des interventions de plasturgie, il est difficile d'en garantir la bonne utilisation pour chaque type d'intervention. À l'heure actuelle, les plasticiens ne possèdent pas d'ensemble de directives fondées sur des données probantes (DDP) cohésives et complètes à l'égard de la prophylaxie chirurgicale. Les chercheurs ont cherché à saisir les habitudes de prescription d'antibiotiques périopératoires des plasticiens de la Colombie-Britannique pour vérifier si elles concordent avec les recommandations publiées. Ce faisant, ils ont voulu déterminer les facteurs de risque de surprescription d'antibiotiques dans le cadre de la prophylaxie chirurgicale. **Méthodologie :** Les chercheurs ont effectué une analyse bibliographique faisant état des

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DDP relatives au recours à une prophylaxie antibiotique pendant des interventions de plasturgie courantes. Parallèlement, un sondage auprès des résidents, des associés, des scientifiques et des généralistes de la plasturgie a permis de déterminer les pratiques de prescription de prophylaxie antibiotique. Les chercheurs ont comparé ces observations aux recommandations relevées dans leur analyse. Ils ont établi l'adhésion du milieu provincial de la plasturgie aux DDP à jour dans 38 scénarios chirurgicaux pour déterminer les facteurs cliniques et les types d'intervention associés à l'utilisation d'antibiotiques non préconisés. **Résultats :** Dans les publications scientifiques, 31 des 38 catégories d'opérations de plasturgie sondées étaient assorties de DDP sur la prophylaxie antibiotique. Lorsque les interventions chirurgicales étaient ainsi associées à des DDP, 19,5% des stagiaires en plasturgie et 21,9% des plasticiens en exercice respectaient les recommandations relatives à l'utilisation de la prophylaxie. L'adhésion moyenne aux DDP s'élevait à 59,1 % dans le cas des interventions de la main, à 24,1 % dans celui des interventions mammaires et à 23,9 % dans celui des interventions craniofaciales. Les interventions de reconstruction mammaire et la contamination des interventions craniofaciales étaient liées à une diminution importante de l'adhésion aux DDP entraînant une utilisation excessive d'antibiotiques. **Conclusion :** Même en présence de recommandations fondées sur des données probantes relatives à la prophylaxie antibiotique, les pratiques de prescription déclarées par les plasticiens démontrent une adhésion variable aux DDP. Les interventions chirurgicales assorties d'une faible adhésion aux DDP pourraient refléter des comportements d'évitement risqués de la part des chirurgiens en exercice et font ressortir l'importance d'améliorer l'enseignement sur les avantages de la prophylaxie antibiotique dans ces situations cliniques.

Keywords

antibiotic prophylaxis, cosmetic surgery, practice guidelines, reconstructive surgery

Introduction

Surgical site infections (SSIs) are a major complication for postoperative patients, with an estimated 300 000 SSI occurring annually in the United States. Surgical site infections are the second most common cause of infection among surgical patients and are estimated to produce an annual incremental cost of 1 billion USD.¹ Most SSIs are a result of introducing the patient's endogenous skin flora into the incised tissue. Appropriate antimicrobial therapy can decrease the risk of SSI and associated complications postoperatively.² Preoperative antibiotics were initially used to prevent bacteremia-induced joint prosthesis infection or infective endocarditis in high-risk patients; however, widespread inappropriate use of antibiotics during clean surgery and faulty timing of administration have become increasingly common.^{3,4} Excess antibiotic use has not been linked to a marked reduction in SSIs, and antibiotic misuse has the potential to induce patient morbidity secondary to antibiotic adverse effects or promotion of microorganism resistance. In current surgical practice, the most common error associated with antibiotic prophylaxis is the prolonged use of antibiotics beyond the time of maximal benefit.³ With inappropriate antibiotic prophylaxis, the associated risks likely exceed any potential benefits.⁴

In plastic surgery, maintaining an appropriate understanding of antibiotic prophylaxis use is especially challenging, given the breadth and variety of procedures within the specialty. Even though there is supporting literature for antibiotic prophylaxis use for hand, craniofacial, breast, and aesthetic surgery, plastic surgeons lack cohesive and comprehensive evidence-based guidelines (EBG) to assist their decision-making. Several surgical specialties including orthopedics and otolaryngology have created EBGs in an attempt to reduce confusion around appropriate antibiotic decision-making.^{5,6} The current absence of similar guidelines within plastic surgery may contribute to

the variability and existing inappropriate use of antibiotic prophylaxis.

The aim of this project is to identify clinical conditions that lead to antibiotic use without supporting evidence. We sought to investigate current perioperative antibiotic prescribing patterns for plastic surgeons in British Columbia and identify which clinical scenarios and factors result in reduced compliance with currently published literature. By amalgamating antibiotic prophylaxis evidence, we additionally present a resource to aid plastic surgeons' appropriate antibiotic prophylaxis use and to promote future investigation for procedures that still require consensus.

Methods

Identification of SSI Guidelines in Plastic Surgery

The American Society of Plastic Surgeons website was initially reviewed for the most commonly performed plastic surgeries in the areas of hand, craniofacial/head & neck (CFHN), breast, and aesthetic surgery. A short-list of 38 representative procedures was then selected from within the four broader categories.

A literature review was then conducted to specifically identify studies documenting clinical practice guidelines for antibiotic prophylaxis for the 38 selected procedures. Using a single search engine (PubMed), a keyword-based search for relevant studies was performed. Individual searches consisted of using the term "antibiotic prophylaxis" OR "prophylactic antibiotic" with the procedure name such as "breast augmentation." The search results were screened by titles and abstracts for relevant studies using the following inclusion criteria: (1) They evaluated antibiotic prophylaxis at a timepoint in surgical care. (2) They evaluated a surgical procedure that is considered within the domain of plastic surgery. This process

was repeated for each relevant procedure. A complete review of the identified studies was then performed to compose a list of evidence-based recommendations for antibiotic prophylaxis that also included the level of evidence for each recommendation. Guidelines were considered evidence-based if they were supported by level I or level II evidence, produced by randomized control trials or systematic reviews. Guidelines that did not have adequate supportive literature to provide both antibiotic use and duration were not considered evidence-based.

Survey Composition

To complement the literature review, an anonymized web-based survey was designed to specifically investigate antibiotic prophylaxis use for the same 38 plastic surgery procedures in the province of British Columbia, Canada. The survey was constructed de novo, consisting of multiple-choice questions evaluating the circumstances and clinical variables that influence surgeons' antibiotic prophylaxis prescribing patterns. Questions were structured using a stem to describe a clinical scenario with respondents being able to choose a prophylaxis prescribing pattern from a list of options that fit their current practice patterns. Respondent demographic information was also collected. After an iterative review process, the survey was distributed by email to the British Columbia Section of Plastic Surgeons, University of British Columbia (UBC) Division of Plastic Surgery members and all affiliated residents and fellows. A description of the study was included within the survey cover letter. Participant consent was outlined with the attached survey link and obtained through agreement to proceed with survey completion. The participants were instructed to answer the survey questions to the best of their ability and instructed not to utilize external resources while answering each question.

A 3-month survey completion window was used with potential respondents emailed reminders to increase response rates. After 3 months, survey results were collected and segregated into the 4 areas of surgical focus (hand, CFHN, breast, and aesthetic). Each participant's response for antibiotic use and duration was reviewed, comparing this to the EBG determined through the literature review. For all completed surveys, each evaluated response was labeled as being either "adherent" or "non-adherent" based on its alignment with current EBG. An adherent response was one that completely followed current EBG from the review with respect to the initiation time point of prophylaxis and the total duration of the treatment course. For each surgical procedure evaluated, the percent of respondents (% adherence) that followed current EBG was calculated. Statistical analyses using Student *t* tests were performed to determine whether there were significant differences between adherence with EBG for the evaluated surgical procedures ($\alpha = .05$).

Results

The literature review of antibiotic prophylaxis guidelines identified a total of 85 studies documenting appropriate prescribing

use in 31 of the 38 selected plastic surgery procedures. A summary of the EBG extracted from these studies for antibiotic prophylaxis and their level of evidence is presented in Table 1, categorized by surgical area. Of the identified studies, 66% of procedures had level I evidence, 15.8% had level II, and 18.4% had level III evidence or less (Table 1). The majority of studies (52%) recommended antibiotic prophylaxis for up to 24 hours with no prolonged use. No EBG for emergent open hand injury with hardware, elective extra-oral CFHN with bony implants, and clean aesthetic body contouring procedures were identified through our literature review.

For the antibiotic prophylaxis survey, a total of 107 eligible participants were contacted of which 43 responded (40% response rate). The largest category of responders (51.1%) was academic plastic surgeons with a general practice focus who had been in practice for more than 20 years. Participant characteristics are highlighted in Table 2. From the survey results, practicing plastic surgeons on average followed the recommended antibiotic prophylaxis prescribing pattern for 21.9% of EBG-supported procedures. Similarly, trainee on average followed recommended prophylaxis use for 19.5% of EBG-supported procedures. No statistical difference in EBG adherence was found between these 2 levels training (*P* value = .87).

The percentage of respondents that adhered to EBG recommendations was then calculated for each subspecialty within plastic surgery. For hand procedures, 59.1% of respondents followed EBG which was found to be the highest rate of adherence of all subspecialties. For breast surgery, only 24% of respondents followed recommended EBG. Similarly, for CFHN procedures, only 23.9% of respondents followed EBG. Participant adherence to EBG for each surgery is outlined in Table 3 by plastic surgical subspecialty.

Hand surgeries represented 5 of the 38 surgeries evaluated within the distributed survey. Of these procedures, 4 of the 5 surgeries were found to have more than 50% of respondents compliant with antibiotic prophylaxis EBG (Table 1). The procedures with the highest adherence rates were elective closed hand procedures with an implant and emergent closed hand procedures with an implant where 72.1% and 79.1% of respondents followed EBG recommendations. Lowest compliance was seen for elective bony procedures without an implant (39.5% adherence to EBG). There was no significant difference in the mean percentage of respondent compliance with EBG with prophylaxis use between emergent and elective procedures (34% vs 54%, *P* = .4, Table 3).

Of the 38 evaluated procedures, 11 were classified within the domain of CFHN. These surgeries were found to have a large variation in overall respondent compliance with EBG and only 1 procedure had more than 50% of respondents complying with EBG recommendations (Table 1). The highest percentage of respondents were adherent to EBG for emergent closed bony injuries, extra-oral, with an implant (72.1%) while the lowest guideline compliance was found for contaminated soft tissue injuries, extra-oral (0%). Of the 11 procedures, 4 were classified as contaminated and had a mean guideline adherence of 3.5% of respondents. The presence of a drain markedly lowered

Table 1. Literature Review of Evidence Supporting Antibiotic Prophylaxis Use for Plastic Surgery Procedures.^a

Surveyed procedure	Evidence-based guideline	Level of evidence	% EBG compliance	References
Hand elective				
Soft tissue only	No prophylaxis	Level I	51.2	4,10,12-17
Bony, no implant/hardware	No prophylaxis	Level I	39.5	4,10,12-17
Bony, with implant/hardware	≤24 hours	Level II	72.1	16,18-23
Hand emergent				
Bony, closed injury, with percutaneous (PC) hardware	≤24 hours	Level II	53.5	16,18-23
Bony, closed, implanted hardware	≤24 hours	Level II	79.1	16,18-23
Contaminated open bony procedure	No prophylaxis	Level II	NA	24-26
Contaminated open bony procedure, PC hardware	≤24 hours	Level III	NA	4,23,27
Contaminated open, bony procedure, implanted hardware	≤24 hours	Level III	NA	4,23,27
Craniofacial head and neck, elective				
Soft tissue only, extra-oral	No prophylaxis	Level I	44.2	10
Soft tissue only, intra-oral	≤24 hours	Level I	39.5	28-30
Bony, extra-oral, with implant/hardware	Single preop	Level III	NA	28,31
Bony, intra-oral, with implant/hardware	≤24 hours	Level I	27.9	28-30
Craniofacial head and neck, emergent				
Soft tissue only, extra-oral	≤24 hours	Level II	0.0	4,10
Soft tissue only, intra-oral	≤24 hours	Level II	2.3	4,10
Bony, closed injury, extra-oral with implant/hardware	Single preop	Level III	NA	28,31
Bony, closed, intra-oral, with implant/hardware	≤24 hours	Level I	51.2	28-30
Bony, open with implant/hardware	≤48 hours	Level I	7.0	4,28,31
Craniofacial head and neck, aesthetic				
Soft tissue only, extra-oral, no drains	No prophylaxis	Level I	30.2	4,10,32,33
Soft tissue only, extra-oral, with drains	No prophylaxis	Level I	14.0	4,10,32,33
Soft tissue only, mucosal ± external incisions, no drains and no packing	No prophylaxis	Level I	10.5	6
Soft tissue only, mucosal ± external incisions, no drains and with <48 hours packing	No prophylaxis	Level I	8.3	6
Breast, reconstructive				
Alloplastic recon, no dermal matrix, no drain	≤24 hours	Level I	3.1	4,18,34-36
Alloplastic recon, with dermal matrix, no drain	≤24 hours	Level I	3.1	4,18,34-36
Autogenous recon, no alloplastic component, no drain	≤24 hours	Level I	2.3	4,18,34-36
Autogenous recon, with alloplastic component, no drain	≤24 hours	Level I	2.3	4,18,34-36
Alloplastic recon, no dermal matrix, with drain	≤24 hours	Level I	0.0	4,18,34-36
Alloplastic recon, with dermal matrix, with drain	≤24 hours	Level I	3.3	4,18,34-36
Autogenous recon, no alloplastic component, with drain	≤24 hours	Level I	4.7	4,18,34-36
Autogenous recon, with alloplastic component, with drain	≤24 hours	Level I	2.3	4,18,34-36
Breast, aesthetic				
Bilateral subpectoral breast augmentation, IMF incision	Single preop	Level I	53.7	4,35,37,38
Bilateral subglandular breast augmentation, IMF incision	Single preop	Level I	50.0	4,35,37,38
Bilateral subpectoral breast augmentation, peri-areolar incision	Single preop	Level I	51.4	4,35,37,38
Bilateral subglandular breast augmentation, peri-areolar incision	Single preop	Level I	47.1	4,35,37,38
Bilateral mastopexy, no augmentation	Single preop	Level I	67.4	4,35,38
Bilateral mastopexy with augmentation	Single preop	Level I	46.5	4,35,37,38
Aesthetic body				
Without risk factors, no drains	No prophylaxis	Level III	NA	39-41
Without risk factors, drains	No prophylaxis	Level III	NA	39-41
With risk factors (obesity, diabetes, steroid therapy, prior radiation)	Single preop	Level IV	NA	39,41,42

Abbreviation: EBG, evidence-based guidelines.

^aProcedures in literature review with EBG and level of evidence. With EBG ≤24 hours, this is prophylaxis given preoperative and extending to a total of 24 hours postoperatively. This is similar for ≤48 hours. Single preoperative dose is given prior to the surgical incision with no postoperative antibiotic use. NA denotes procedures not specifically addressed in the disseminated survey but are supported by EBG identified by the literature review.

guideline adherence with only 14% of respondents following recommended antibiotic use for aesthetic soft tissue extra-oral procedures when a drain was present compared to 30.2% of respondents when a drain was absent. When comparing all

elective CFHN procedures to emergent CFHN procedures, there was no significant difference in respondent prophylaxis use (29% vs 62%, $P = .11$). However, there was a statistically significant difference in compliance with EBG between

Table 2. Survey Respondent Demographic Characteristics.

Category	Response	Percentage (%)
Years in practice	<10 years	30.2
	10-20 years	11.6
	>20 years	34.8
	In training	23.3
Practice type	Academic	34.9
	Community	32.6
	Mixed practice	9.3
	In training	23.3
Primary practice focus	General practice	51.1
	Hand/upper limb	14.0
	Breast reconstruction	9.3
	Craniofacial/head & neck	2.3
	Pediatrics	7.0
	Aesthetics	16.3

Table 3. Surgical Categories and Adherence to EBG.

Category	% of respondents follow EBG		P value ($\alpha < 0.05$)
Hand	Elective: 54.3	Emergent: 34.3	.4
CFHN	Elective: 28.8	Emergent: 61.6	.11
CFHN	Contaminated: 9.1	Non-contaminated: 42.4	.002 ^a
Breast	Alloplastic: 2.5	Autologous: 2.9	.62
Breast	Augmentation: 52.7	Reconstruction: 2.6	<.001 ^a

Abbreviations: CFHN, craniofacial/head & neck; EBG, evidence-based guidelines.

^aTable outlining the various statistically analyzed categories, their means for each variable and the associated *P* value. Statistically significant comparisons (*P* value < .05).

contaminated CFHN and non-contaminated procedures (4% vs 33%, $P = .002$) with the majority of respondents prescribing prophylaxis beyond recommended EBG for contaminated CFHN procedures.

Breast procedures represented 14 of the 38 evaluated surgeries. Across all breast procedures, there was a tendency to prolong antibiotics beyond EBG. Only 4 breast procedures were found to have more than 50% of respondents compliant with EBG on antibiotic prophylaxis. For breast reconstructive procedures, only 2.6% of respondents adhered to EBG compared to 49.7% of respondents for augmentation procedures. The highest percentage of respondents were noted to follow EBG for bilateral mastopexy without augmentation (67.4%), while 0% of respondents followed guidelines for immediate alloplastic breast reconstruction with a drain and no acellular dermal matrix (ADM). No statistically significant difference in respondent compliance was found between autologous and alloplastic reconstruction (3% vs 2%, $P = .62$). A higher proportion of respondents were found to follow EBG recommendation for breast augmentation procedures (52.7%) compared to reconstructive procedures (2.6%, $P \leq .001$).

As there was insufficient evidence to create antibiotic prophylaxis EBG for aesthetic body contouring procedures, these 3 procedures were not evaluated for respondents' compliance with EBG.

Discussion

There are no cohesive clinical practice guidelines for antibiotic prophylaxis in plastic surgery. After a review of the literature, a total of 31 procedures were identified across hand, CFHN, breast, and body contouring aesthetic surgery for which there is high-quality evidence for appropriate prophylaxis use. These have been consolidated for ease of integration into clinical practice (Table 1). A number of the selected procedures still lack high-quality evidence: emergent open hand injury with hardware, elective extra-oral CFHN with bony implants, and aesthetic body contouring surgery. These procedures require future investigation to determine EBG.

Across all categories, the highest proportion of respondents adherent to EBG was for hand procedures. EBG recommend no prophylaxis for any hand procedure not involving an implant or hardware, whereas for those with implants or hardware, up to 24 hours of prophylaxis is recommended. Respondents generally followed these recommendations with compliance ranging from 39.5% for elective bony operations without an implant to 79.1% for emergent closed bony operations with an implant. The hand procedure with the highest compliance was emergent hand with implanted hardware (79.1%). Even in contaminated wounds, many respondents abstained from extended courses of antibiotics beyond 24 hours, in accordance with EBG. There are a number of reasons postulated for high adherence to an appropriate short duration of prophylaxis: Hand injuries are very common, rates of SSI are low, and management of SSI under local anesthetic in the emergency department is often feasible, making plastic surgeons more comfortable accepting SSI risk in contaminated hand surgery.⁷⁻¹⁰

Of the 3 surveyed categories, CFHN procedures had the weakest EBG adherence, with a tendency toward extending prophylaxis beyond recommendations. This was most evident for procedures that included contaminated soft tissue wounds and drains. Of the assessed CFHN procedures, the procedure type with the lowest adherence (0%) was emergent soft tissue with extra-oral approach. Respondents chose longer durations for antibiotics, despite EBG recommending ≤ 24 hours of prophylaxis. Surgeons may prefer to extend antibiotic duration longer than EBG to reduce the perceived risk of severe complications. An infection of the head and neck can cause life-threatening complications such as orbital cellulitis or necrotizing fasciitis. Furthermore, it can be difficult to achieve adequate debridement of infected tissues in the head and neck without damaging vital structures and causing significant aesthetic defects. In the case of severe facial infections, patients often have a prolonged course in hospital, requiring intravenous therapy with the potential for significant surgical interventions.¹¹ The gravity of SSI sequelae may be responsible for increased prophylaxis durations. When we compared concordance between contaminated and non-contaminated CFHN procedures, there was a statistically significant difference in concordance with EBG ($P = .002$). This highlights the fact that contaminated CFHN injuries influenced prophylaxis patterns of participants in our study, with a tendency to prolong antibiotics beyond EBG.

When breast procedures were specifically evaluated for their concordance with EBG, it was found that an increase in antibiotic duration beyond what was recommended was correlated with breast reconstructive procedures. Adherence to EBG significantly decreased across all reconstructive procedures evaluated, with a mean concordance of 2.6%. When we compared all augmentation to reconstructive procedures, we found a statistically significant difference in concordance to EBG, suggesting participants were consistently over-prescribing antibiotics for breast reconstructive procedures. This implies that across all breast procedures, the clinical factor of being a reconstructive patient carries more weight in surgical decision-making to extend antibiotic duration beyond EBG. Reasons for this low concordance are likely related to increased risk of the reconstructive population for postoperative complications.⁷ The frequent requirement for chemo and radiotherapy perioperatively in breast reconstruction may influence surgeons to extend prophylaxis.⁷ Using a dermal matrix may prompt more aggressive prophylaxis after studies such as Lee et al. found an increased risk of infection associated with the use of ADMs.⁸ The potentially severe consequences of postoperative infections for breast reconstruction may be a driving factor for this poor concordance. Bacterial infection or overgrowth within the capsule has been shown to have an increased correlation with capsular contracture.⁹ An infection of the implant or a peri-implant abscess often requires surgical intervention. Reconstructive surgeons may also be concerned with post-mastectomy skin flap viability, reducing their willingness to tolerate a potential surgical intervention that may arise from an infected implant. Finally, infection may compromise the ability to achieve an aesthetically pleasing reconstructive outcome and may cause loss of the reconstruction altogether. Knowing the potential complications of infection in breast reconstruction, surgeons may opt to extend prophylaxis in spite of EBM to the contrary.

This study is limited by its small sample size and the fact that only British Columbian plastic surgeons and trainees were surveyed. The results may be a product of local training and hospital practices. The authors recognize that all antibiotic use must be assessed on a case-by-case basis. High-quality studies in areas currently lacking Level I/II evidence are required, as are studies to assess the risk of SSI versus the complications of antibiotic overprescription.

Conclusion

Antibiotic prophylaxis is a tool to mitigate risk in surgical procedures. The lack of uniform recommendations across plastic surgery can act as barrier to physician adherence to EBG for antibiotic prophylaxis. This article aggregates EBG for antibiotic prophylaxis in plastic surgery procedures and highlighting areas where further research is needed. The majority of recommendations for antibiotic prophylaxis we have included are based on high-quality evidence (level I or II). Staff and trainee adherence to EBG were found to be similar and were low, particularly in the domain of craniofacial and reconstructive breast procedures. Promoting appropriate prescribing patterns

with current best evidence will help minimize overall patient morbidity and improve both patient care and postoperative outcomes.

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