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Review Article

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Optimizing Infection Prevention in MOHS Procedures: Efficacy of Intraincisional Antibiotic Prophylaxis and Future Research Directions

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Abstract

Recent advancements in Mohs micrographic surgery (MOHS) procedures have demonstrated a significant reduction in the risk of postoperative infections through the implementation of novel practices. Notably, studies indicate that the use of incisional antibiotics has proven effective in decreasing the rate of surgical site infections associated with skin cancer surgery. Recent findings suggest that intraincisional antibiotic prophylaxis may offer a more efficient and localized method of infection prevention in MOHS procedures. While these emerging practices exhibit promise in reducing infection risks, further research is warranted to delve into the optimal strategies and specific agents for intraincisional antibiotic prophylaxis. Additional studies should explore the ideal timing, dosage, and duration of intraincisional antibiotic administration to maximize efficacy while minimizing potential adverse effects. Comparative analyses between intraincisional and systemic antibiotic prophylaxis could provide valuable insights into the most effective approach for different patient populations and surgical scenarios. Moreover, investigating the potential development of antibiotic resistance and the long-term implications of intraincisional prophylaxis is crucial to ensuring the sustainability and safety of these practices. This poster addresses the most recent findings regarding intraincisional antibiotic prophylaxis and explains the need for why further research is essential to address questions related to dosage, timing, and potential resistance development. Such investigations will contribute to refining guidelines for infection prevention in skin cancer surgery, ultimately enhancing patient outcomes and the overall success of MOHS procedures.

Introduction

Mohs micrographic surgery (MMS) has emerged as the standard of care for numerous cutaneous neoplasms, such as basal cell carcinoma, squamous cell carcinoma, and in situ melanoma [1]. MMS enables meticulous control over tumor margin assessment while minimizing the removal of healthy tissue. This is achieved through the systematic removal of thin layers of the tumor, each of which is subsequently fixed in dyes and examined under a microscope to ensure complete excision [2]. In accordance with the appropriate use criteria, MMS is indicated for malignancies characterized by a large area, recurrences, poorly defined borders, aggressive histologic features, contiguous growth pattern, and other criteria [3]. While MMS has the highest cure rates and degree of tissue sparing for skin cancer excision, adverse events remain a concern [4]. Surgical site infections (SSIs) are among the most common postoperative complications in MMS, potentially leading to impaired wound healing and cosmetic outcomes [5]. The CDC defines SSIs as infections occurring within 30 days after surgery, involving the skin or subcutaneous tissue of the incision. These infections exhibit one of the following characteristics: purulent drainage, positive wound culture, signs of inflammation, or a diagnosis of SSI by a healthcare provider [6].

Prophylactic oral antibiotics are commonly recommended for patients at high risk of endocarditis, prosthetic infections, and surgical site infections due to their ability to reduce the risk of postoperative infections. This is especially important for procedures involving anatomical sites known to be at higher risk, such as the lower extremities, groin, ears, lips, nose flaps, and grafts [1]. However, the use of oral antibiotics in MMS has faced criticism, primarily due to the relatively low incidence of postoperative infections associated with this procedure, occurring in roughly 1-3% of cases [7]. This raises concerns about the potential overuse of antibiotics and the development of microbial resistance [7]. In this context, the use of intraincisional antibiotics presents a potential solution, as it can provide a localized effect while still meeting the prophylactic needs of special populations. Despite the potential benefits of intraincisional antibiotics, current guidelines are lacking in this area, particularly in the setting of MMS [7]. Further research is needed to evaluate the effectiveness and safety of this approach, as well as to develop guidelines that can help guide clinicians in making informed decisions regarding antibiotic prophylaxis in MMS.

The objective of this review is to explore the effectiveness of intraincisional antibiotic prophylaxis in reducing postoperative infections in MMS, comparing its efficacy to systemic use. Recent advancements highlight the necessity for further research and guideline refinement in infection prevention for skin cancer surgery.

Discussion

Intraincisional Antibiotic Prophylaxis: Background

Prior to the advent of antibiotics, the field of surgery was characterized by a significant risk of infection, leading to elevated morbidity and mortality rates among patients [8]. The

introduction of antibiotics in the mid-20th century marked a turning point, empowering patients and surgeons alike with effective tools for managing infections [9]. It was discovered that the prophylactic use of antibiotics significantly reduces the incidence of SSIs [10]. However, the enhanced safety of surgical procedures brought forth new challenges, as indiscriminate antibiotic use provided a breeding ground for microbial adaptation, leading to the emergence of antibacterial resistance [11]. Recognizing this growing concern, esteemed organizations such as the American College of Surgeons, the Centers for Disease Control and Prevention, and the World Health Organization have formulated evidence-based guidelines. These guidelines emphasize the importance of tailored prophylactic antibiotic regimens, taking into account the specific surgical procedure, surgical site, and patient characteristics [12]. The primary objective of these guidelines is to minimize the reliance on broad-spectrum antibiotics, advocating for a more targeted approach to reduce the incidence of SSIs, while simultaneously mitigating the development of microbial resistance [13].

Previous studies have examined the efficacy of prophylactic antibiotic administration in MMS. While antibiotics are not routinely prescribed due to careful consideration of risks and benefits, their prophylactic use is deemed effective and essential for specific patient populations, particularly those at higher risk of bacterial dissemination from the surgical site [7]. Conversely, the efficacy of postoperative topical antimicrobial agents, such as neomycin sulfate, bacitracin, mupirocin, and polymyxin B, in preventing infections in closed wounds remains unsubstantiated. Furthermore, their use may increase the risk of sensitization and the development of allergic contact dermatitis [14]. A prior case series highlighted the potential of intraincisional antibiotic prophylaxis in MMS as a viable strategy for reducing SSIs and mitigating microbial resistance. This approach offers a localized tissue concentration of antibiotics that is approximately 40 times higher than achievable with systemic antibiotic use [15].

The use of systemic antibiotics in MMS is a topic of debate, primarily due to the procedure's excellent safety record and concerns about antibiotic resistance [7]. A recent global population-based retrospective cohort study found that perioperative empiric antibiotic therapy (PEAT) did not significantly reduce the risk of SSIs or affect the 5-year overall survival rate in MMS patients [16]. Despite patient selection based on SSI risk factors, the study noted that PEAT was administered to a larger number of patients than anticipated based on the 2008 advisory guidelines [16]. This raises questions about the need for more stringent guidelines or a more judicious use of antibiotics to avoid unnecessary harm to a broader population. Furthermore, the value of a mere 0.5% reduction in SSIs may be scrutinized against the backdrop of increased financial burden and the potential for heightened risks of antibiotic resistance and allergic reactions for patients [4].

Intraincisional Antibiotic Prophylaxis: Mechanism and Rationale

Mohs micrographic surgery (MMS) is a precise surgical technique for removing skin cancer that aims to preserve surrounding tissue, providing excellent cure rates for various types of skin cancers such as basal cell carcinoma (BCC) and squamous cell carcinoma (SCC) [2]. Five-year cure rates for primary BCC and SCC are 99% and 92-99% respectively, whereas cure rates for recurrent BCC and SCC are reported to be 94.4% and 90% [2]. The primary advantage of the procedure lies in its ability to provide precise microscopic control of the entire tumor margin while optimizing the preservation of healthy tissue [2]. MMS is indicated for skin cancers with increased rates of recurrence and in cases where conservation of tissue is integral [2].

Postoperative surgical-site infection (SSI) persists as a significant contributor to patient morbidity and incur notable additional healthcare costs [15]. By introducing innovative techniques, recent progress in MMS procedures has shown a notable decrease in the risk of postoperative infections. The emerging practice of prophylactically administering intra-incisional antibiotics to minimize the risk of SSIs following MMS has shown a decrease in the incidence of such infections, with a documented overall risk of 0.4% [17]. Moreover, with the use of intraincisional antibiotics, systemic antibiotic use can be minimized, decreasing the risk for the development of antibiotic resistance. A meta-analysis evaluating the effect of oral, intravenous, or intraincisional antibiotic prophylaxis on the risk of SSIs in 28 randomized control trials documented a reduction in postoperative SSI risk in MMS in the setting of antibiotic prophylaxis (95% CI, 0.09-0.51) [17]. The implementation of intraincisional antibiotic prophylaxis allows directly targeting potential infection sites, minimizing systemic antibiotic exposure and side effects, while allowing for tailored treatment approaches based on individual patient characteristics.

Mechanism of Action Intraincisonal Antibiotics and Advantages Over Systemic Administration

Intra-incisional antibiotics provide a targeted approach to infection prevention by directly administering antibiotics to the surgical site. This targeted delivery enhances the concentration of antibiotics at the site of potential infection, effectively reducing the risk of microbial colonization and subsequent infection [18]. This localized administration can be particularly beneficial in surgeries where the risk of infection is high or where the consequences of infection are severe.

Research supports intraincisional antibiotic prophylaxis as an effective method in decreasing postoperative SSIs while reducing systemic antibiotic usage [15]. Although prophylactic antibiotics have been demonstrated to decrease postoperative wound infections, debate persists regarding the ideal administration route and treatment duration [19]. Still under discussion is whether the benefits are truly substantial, considering factors such as wound location, existing infection, and the specific characteristics of the lesion on an individual basis [20]. Nevertheless, intraincisional antibiotic prophylaxis has been proven advantageous due to targeted delivery to the affected site, relatively low cost, and ease of use.

When evaluating the advantages and disadvantages of intraincisional antibiotics, a significant advantage includes the reduced risk of systemic exposure to antibiotics, which minimizes common side effects such as gastrointestinal upset, decreases the risk for the development of antibiotic resistance, and reduces potential interactions with other medications [15]. This is especially advantageous for patients who may be more susceptible to adverse reactions or who are already taking medications with the potential for interactions. Additionally, there is a theoretical reduction in overall antibiotic resistance, drug interactions, and other common side effects with exposure to systemic antibiotics [20].

The availability of intraincisional antibiotics prophylaxis can serve as a valuable asset when evaluating postoperative infection risks and determining optimal treatment approaches tailored to the specific needs of each patient. Each patient presents with unique factors that may influence their susceptibility to infection and their response to antibiotics. Factors such as a patient's medical history, coexisting conditions, and the nature of the surgical procedure can all impact the choice and effectiveness of antibiotic prophylaxis. By considering these individualized factors, healthcare providers can tailor the use of intra-incisional antibiotics to optimize outcomes for each patient.

Clinical Evidence Supporting Intraincisional Antibiotic Usage

Research indicates that the utilization of incisional antibiotics has proven to be effective in reducing the occurrence of SSIs related to skin cancer surgery. A trial by Griego et. al studied 790 patients with 908 surgical wounds and found that a single intraincisional dose of local anesthetic preparation containing nafcillin resulted in decreased rates of postoperative wound infections when compared to administration local anesthetic alone [21]. The difference in infection rates between the treatment group (0.2%) and control group (2.5%) was highly significant (p=.003) [21]. Another study assessing the efficacy of intraincisional clindamycin therapy as an alternative to nafcillin treatment in decreasing the risk of postoperative wound infections following MMS documented evidence in support of the use of single-dose preoperative intraincisional antibiotic treatment for dermatology surgery [22]. Of 1172 surgical wounds evaluated in the trial, 6 patients in the study group and 23 patients in the control group had wound scores of 4 or higher indicating infection (p=.001) [22]. Culture-positive wounds were also less frequent in the study group (4 wounds) when compared to the control group (14 wounds), (p=.02) [22].

Intraincisional antibiotic prophylaxis may prevent systemic drug interactions and alteration of the intestinal microbiome since doses are administered locally into the dermis and subcutis [15]. In a study of 11,412 patients undergoing MMSand given intraincisional antibiotic prophylaxis, post-operative surgical site infections were seen in 0.3% of patients [15]. This infection rate is 2.5 to 10 times less than reported for equivalent surgeries at similar surgical sites [15]. Among these patients, there were no reported cases of antibiotic-associated diarrhea or adverse allergic cutaneous drug reactions [15].

Clinical studies have provided compelling evidence for the usage of intraincisional antibiotics suggesting that the application of antibiotics directly into the incision site during surgery can effectively reduce the risk of surgical site infections. Research has demonstrated the benefits of this approach, showing lower infection rates and improved patient outcomes compared to standard antibiotic administration methods. This targeted delivery of antibiotics directly to the incision site assists in creating a higher concentration of the medication where it's needed most, minimizing the chance of bacterial growth and infection [18]. These findings support the use of intraincisional antibiotics as a valuable strategy for infection prevention in surgical procedures.

Comparative Analysis of Efficacy and Safety Profiles of Intraincisional and Systemic Antibiotic Prophylaxis

Evidence of the efficacy of intraincisional antibiotic prophylaxis with respect to systemic antibiotics is inconsistent [5]. Mourad et. al conducted a meta-analysis investigating rates of SSIs following the administration of oral or intraincisional antibiotic prophylaxis in MMS. The study encompassed five randomized controlled trials (RCTs), with three focusing on oral antibiotic prophylaxis and two examining the effects of preoperative intraincisional antibiotic prophylaxis in MMS [5]. While the meta-analysis demonstrated no difference between oral antibiotic prophylaxis and placebo, the data for preoperative intraincisional antibiotic prophylaxis showed statistically significant reductions in SSIs [5]. This evidence is compelling, offering valuable insights into the effectiveness of intra-incisional antibiotic prophylaxis in reducing the incidence of surgical site infections.

Furthermore, there is compelling evidence supporting the efficacy of intraincisional antibiotics over intravenous antibiotics in reducing surgical site infections [18]. In a prospective randomized controlled trial by Dogra et al., the incidence of SSIs was compared among three groups: one receiving IV cefotaxime, another receiving intraincisional cefotaxime, and a third receiving both forms prophylactically. The study demonstrated a lower incidence of SSIs in the intraincisional group compared to the intravenous group, with the group receiving both forms showing the lowest incidence [18]. However, the study did not ascertain the risk-benefit ratio of dual intravenous-intraincisional prophylaxis versus intraincisional prophylaxis alone. Nonetheless, these findings offer valuable insights for determining the necessity of systemic antibiotics versus the appropriateness of intraincisional prophylaxis.

In terms of safety, intraincisional antibiotic prophylaxis has shown promise in minimizing systemic antibiotic exposure and associated adverse effects. Systemic administration of antibiotics can lead to widespread distribution throughout the body, increasing the risk of antibiotic-related complications such as allergic reactions, gastrointestinal disturbances, and the development of antibiotic-resistant bacteria [10]. In contrast, intraincisional prophylaxis limits antibiotic exposure to the surgical site, potentially reducing the likelihood of systemic side effects.

Overall, research studying intraincisional and systemic antibiotic prophylaxis has demonstrated the superior efficacy of intraincisional administration in reducing SSIs while highlighting its potential for minimizing systemic antibiotic exposure and associated risks [15]. However, further study is needed to fully elucidate the comparative safety profiles of these two methods and to determine their ideal use in different surgical settings.

Examination of Different Patient Populations and Surgical Scenarios to Identify the Most Effective Approach

Optimizing surgical prophylaxis involves a careful assessment of various factors to minimize the risk of SSIs while balancing the potential benefits and risks of antibiotic therapy. Factors to consider include the patient's individual risk profile, allergies, the efficacy of different antibiotic strategies, potential adverse effects, cost-effectiveness, and local antimicrobial susceptibility and resistance patterns. In this context, the choice between intraincisional and systemic antibiotics emerges as a critical decision point.

SSIs following surgery can pose significant risks, especially in cutaneous procedures. They not only induce discomfort and impede healing but may also contribute to visible scarring. Consequently, prophylactic antibiotics are frequently employed in dermatologic surgery to mitigate these concerns. Evaluating the patient's risk of developing a SSI based on the location of surgery, patient comorbidities, and the presence of risk factors such as obesity or diabetes is valuable in preventing such adverse events.

There is limited data specifically discussing the most advantageous approach involving intraincisional and systemic antibiotics in the context of Mohs surgery. However, research has shown that a single dose of preoperative intraincisional administration of antibiotics is equally effective as intravenous administration in prevention of SSIs [19]. Moreover, although not statistically significant, a reduced incidence of SSIs was seen in patients who received intraincisional antibiotics [19]. These findings affirm the efficacy of intraincisional antibiotics in preventing SSIs while simultaneously avoiding undesired systemic side effects. Additional research would be beneficial to comprehensively explore the efficacy of intraincisional versus systemic antibiotics across various patient demographics and surgical contexts, identifying the best approach for different scenarios.

Analysis of Potential Cost-Effectiveness and Resource Utilization Implications of Intraincisional Antibiotic Prophylaxis

It is crucial to evaluate the cost-effectiveness of both intraincisional and systemic antibiotic approaches, considering factors such as drug costs, administration costs, and potential savings from preventing SSIs. While SSIs are preventable complications, they have a profound impact on patient prognosis and contribute significantly to the healthcare costs. Minimizing (SSIs) and mitigating their adverse impact on patients will yield beneficial outcomes.

Multiple studies investigating the efficacy of intraincisional antibiotics in decreasing the risk for wound infections following cutaneous surgery found that a single intraincisional dose of antibiotic administered immediately prior to dermatologic surgery was significant in preventing infections. One study found that 0.2% of infections occurred in the patient group that received intraincisional nafcillin and buffered lidocaine solution while 2.5% occurred in the control group [21]. The study's data supports the idea that intraincisional antibiotics are not only efficacious, but inexpensive and safe [21]. These findings were further supported in another study that found that out of 1,172 surgical wounds, 6 occurred in the study group receiving clindamycin for intraincisional antibiotic prophylaxis before MMS, meanwhile 23 infections were seen in the study group [22]. The results of this study not only provided additional support for the use of single-dose preoperative interincisional antibiotic treatment, but also shared an effective and affordable alternative for patients with penicillin allergies [22].

Research studying intraincisional and systemic antibiotic prophylaxis has shown significant efficacy of intraincisional administration in reducing SSIs, alongside its potential for decreasing systemic antibiotic exposure and related risks [15]. Further investigation is warranted to thoroughly evaluate the cost-effectiveness of intraincisional antibiotic prophylaxis and its impact on healthcare resource utilization.

Optimal Strategies for Intraincisional Antibiotic Prophylaxis

With respect to Mohs micrographic surgery, meticulous attention to detail and infection prevention are paramount and exploration of intraincisional antibiotics prophylaxis has emerged as a potentially transformative approach. While a standardized protocol for timing and dosage remains elusive, research endeavors have shed light on the efficacy and nuances of this practice. Griego et al. (1998) conducted seminal work illustrating the benefits of nafcillin administration pre-surgery. Their study documented the utilization of nafcillin at a concentration of 0.5 mg per milliliter within a solution of 1% buffered lidocaine hydrochloride with epinephrine 1:1000000, administered 15 minutes prior to surgery. This regimen demonstrated a noteworthy reduction in infection rates, with only one documented infection out of 461 wounds treated, compared to 12 infections in the control group. Griego's findings underscore the potential of intraincisional antibiotics in mitigating postoperative complications and improving patient outcomes.

Further exploration into intraincisional antibiotic prophylaxis was undertaken by Huether et al. (2002), who conducted a prospective study examining the efficacy of clindamycin. Their investigation revealed intriguing insights into the concentration-dependent effects of clindamycin on bacterial growth inhibition. Concentrations of clindamycin at 408 ug/mL and 544 ug/mL demonstrated robust bacteriostatic properties, effectively preventing bacterial proliferation after 48 hours. However, a lower concentration of 272 ug/mL allowed for bacterial growth, highlighting the critical importance of dosage optimization in achieving therapeutic efficacy. Huether's study emphasizes the nuanced considerations involved in the selection and administration of intraincisional antibiotics, emphasizing the need for tailored approaches to maximize clinical outcomes.

Despite the promising findings regarding the efficacy of intraincisional antibiotics in reducing infection rates, their adoption and utilization among practitioners remain variable. While some Mohs surgeons advocate for the routine implementation of intraincisional antibiotics in the majority of cases, others exercise caution and limit their use to surgeries involving high-risk areas such as the face. Additionally, emerging evidence suggests that the application of intraincisional antibiotics before repairing post-Mohs surgery defects may further enhance outcomes, underscoring the multifaceted potential of this approach.

A comprehensive evaluation of the benefits and drawbacks of intraincisional antibiotics reveals a multitude of considerations. Beyond their direct antimicrobial effects, intraincisional antibiotics offer the advantage of minimizing systemic exposure to antibiotics, thereby reducing the risk of adverse effects such as gastrointestinal disturbances and drug interactions. Moreover, their localized administration may contribute to the preservation of the microbiome and mitigate concerns regarding antibiotic resistance. However, the judicious selection of antibiotics and optimization of dosage regimens are imperative to ensure therapeutic efficacy while minimizing the risk of adverse effects.

The integration of intraincisional antibiotics prophylactically into Mohs micrographic surgery represents a promising avenue for enhancing patient care and optimizing surgical outcomes. By leveraging insights from pioneering research studies and adopting a nuanced approach to implementation, clinicians can

harness the full potential of intraincisional antibiotics to mitigate the risk of postoperative infections and promote the delivery of high-quality, patient-centered care. Continued research efforts and interdisciplinary collaboration are essential to further understand the optimal strategies for integrating intraincisional antibiotics into routine practice, ultimately advancing the field of Mohs micrographic surgery and improving patient outcomes.

Future Directions and Research Needs

While data continues to support the benefits of intraincisional antibiotics, the utilization of this option remains a subject of debate, primarily due to lingering questions regarding the magnitude of its advantages and its applicability in diverse clinical scenarios, taking into account factors such as wound location, pre-existing infection, and lesion morphology on a case-by-case basis [20]. Nonetheless, the collective evidence suggests that intraincisional antibiotic prophylaxis offers tangible benefits, including targeted administration to the affected area, cost-effectiveness, and ease of implementation. Furthermore, theoretical considerations support the notion of decreased resistance, minimized drug interactions, and reduced incidence of common systemic side effects compared to systemic antibiotic administration [20].

Continued research endeavors are warranted to ascertain the true significance of these findings and study the optimal strategies for integrating intraincisional antibiotic prophylaxis into clinical practice. Future research directions could encompass the identification of antimicrobial agents specifically tailored for intraincisional prophylaxis to enhance efficacy and mitigate the risk of antibiotic resistance development. Furthermore, exploration into novel drug delivery systems, such as nanoparticles or hydrogels, holds promise for achieving localized and sustained release of antibiotics at the incision site, thereby optimizing therapeutic outcomes while minimizing systemic side effects. Additionally, a deeper understanding of the microbiome dynamics at the surgical site before and after intraincisional antibiotic prophylaxis is imperative to inform tailored treatment strategies and enhance postoperative outcomes.

As the body of evidence supporting the benefits of intraincisional antibiotics continues to expand, there is a pressing need for the development of predictive models or algorithms that integrate patient-specific factors, such as comorbidities, immune status, and microbiological profile. Such models hold the potential to optimize personalized intraincisional antibiotic prophylaxis regimens and facilitate informed clinical decision-making in Mohs micrographic surgery procedures. Ultimately, the refinement of guidelines and the establishment of evidence-based practices in this domain will not only enhance patient care but also underscore the importance of a multidisciplinary approach in advancing surgical outcomes in dermatology.

Furthermore, to address the variability in practice and outcomes associated with intraincisional antibiotic prophylaxis, large-scale multicenter studies are warranted. These studies can provide robust data on the efficacy, safety, and cost-effectiveness of various prophylactic regimens across diverse patient populations and surgical settings. Additionally, qualitative research methodologies, such as focus groups and interviews with patients and healthcare providers, can offer valuable insights into the perceptions, preferences, and experiences related to intraincisional antibiotic prophylaxis. By incorporating patient perspectives and preferences into clinical decision-making, healthcare providers can enhance patient satisfaction and optimize treatment outcomes.

While the utilization of intraincisional antibiotics in Mohs micrographic surgery presents a debated topic, accumulating evidence supports its efficacy in reducing the risk of postoperative infections. Despite ongoing debates surrounding the magnitude of its benefits and considerations for patient-specific factors, such as wound location and morphology, intraincisional antibiotic prophylaxis offers distinct advantages, including targeted administration, cost-effectiveness, and reduced systemic side effects. Future research endeavors should focus on identifying tailored antimicrobial agents, exploring novel drug delivery systems, and gaining a deeper understanding of microbiome dynamics to optimize prophylactic regimens. Additionally, large-scale multicenter studies and qualitative research methodologies can provide valuable insights into the efficacy, safety, and patient perceptions associated with intraincisional antibiotic prophylaxis, ultimately advancing evidence-based practices and enhancing surgical outcomes in dermatology.

Conclusion

The evolution of intraincisional antibiotic prophylaxis represents a promising frontier in MOHS surgery, offering a targeted and localized approach to infection prevention. However, further research is imperative to optimize its efficacy, minimize adverse effects, and ensure its long-term sustainability in clinical practice. Future areas of research should focus on identifying targeted antimicrobial agents for intraincisional antibiotic prophylaxis, tailoring them to maximize efficacy and minimize the risk of antibiotic resistance. Additionally, novel drug delivery systems, like nanoparticles or hydrogels, for localized and sustained antibiotic release at the incision site should be investigated to improve therapeutic outcomes and reduce systemic side effects. Understanding microbiome dynamics at the surgical site before and after prophylaxis would be invaluable to better understand its impact on the risk of postoperative infections and aid in the development of alternative strategies for infection prevention. Developing predictive models or algorithms considering patient-specific factors, such as comorbidities, immune status, and microbiological profile, can optimize personalized prophylaxis regimens and enhance clinical decision-making in MOHS procedures. Lastly, analyzing the long-term implications of intraincisional antibiotic prophylaxis on microbial ecology, immune function, and the development of antibiotic resistance will aid in establishing sustainable and safe practices for infection prevention in MOHS procedures. By addressing key questions surrounding dosage, timing, antibiotic selection, and resistance development, future investigations in this area will not only refine guidelines for infection prevention but also contribute to the continued advancement of patient-centered care and improved outcomes in skin cancer surgery.

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