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

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Objectives

- Investigate the efficacy of intraincisional antibiotic prophylaxis in reducing the risk of postoperative infections in Mohs micrographic surgery (MOHS) procedures, highlighting recent advancements and emerging practices.
- Evaluate the optimal strategies, including timing, dosage, and duration, for intraincisional antibiotic administration to maximize efficacy while minimizing potential adverse effects, addressing the need for further research in this area.
- Compare the effectiveness of intraincisional antibiotic prophylaxis with systemic antibiotic prophylaxis in different patient populations and surgical scenarios, emphasizing the importance of refining guidelines for infection prevention in skin cancer surgery.

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] 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.[2]
- While MMS has proven to be one of the most effective and conservative treatment options for cutaneous malignancies, adverse events remain a concern. Surgical site infections (SSIs) are among the most common postoperative complications, potentially leading to impaired wound healing and cosmetic outcomes.[3]
- Prophylactic oral antibiotics are recommended for patients at high risk of endocarditis, prosthetic infections, and surgical site infections. Special consideration for prophylactic antibiotics should be given to procedures involving the lower extremities, groin, ears, lips, nose flaps, and grafts.[1]
- Criticism of oral antibiotic use may arise due to the low incidence of post-Mohs surgical site infections, particularly when considering the growing concern regarding microbial resistance. The use of intraincisional antibiotics could mitigate this concern by providing a localized effect while still meeting the prophylactic needs of special populations. However, current guidelines are still lacking in this area.[4]
- 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.

Image 1

Discussions

MOHS Procedures and Intraincisional Antibiotics Prophylaxis in MOHS

Surgery

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).[5] 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%.[5] 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.[5] MMS is indicated for skin cancers with increased rates of recurrence and in cases where conservation of tissue is integral.[5]

Postoperative surgical-site infections persist as a significant contributor to patient morbidity and incur notable additional healthcare costs.[6] 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 surgical site infections (SSIs) following MMS has shown a decrease in the incidence of such infections, with a documented overall risk of 0.4%.[7] 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).[7]

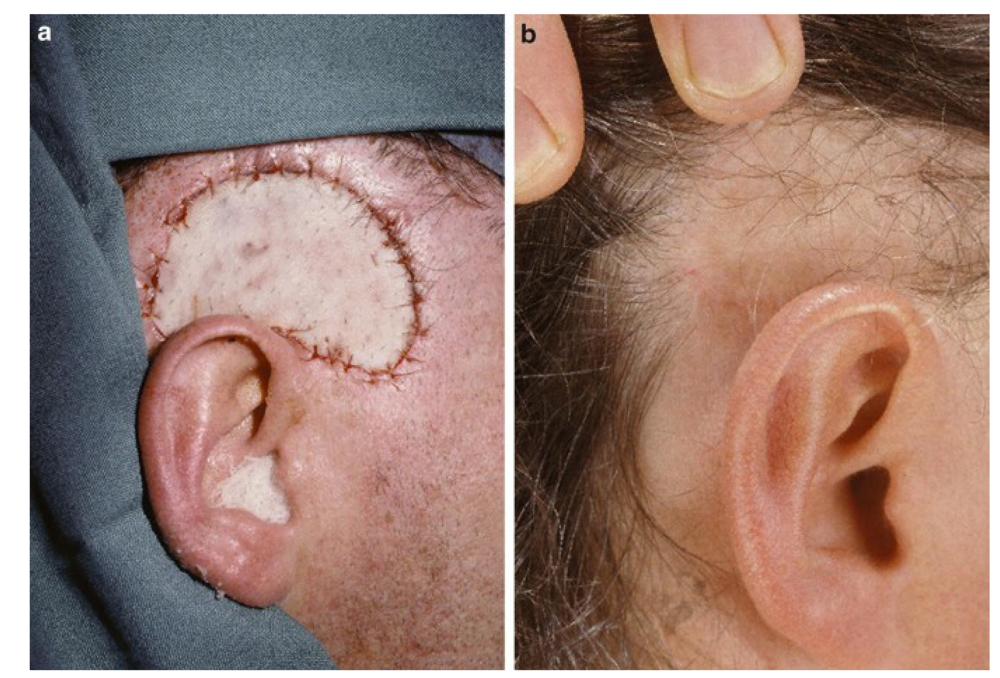

Image 2

Optimal Strategies for Intraincisional Antibiotic Administration

While no standardization for timing and dosage of intraincisional antibiotics prophylactically in Mohs surgery currently exists, the use of nafcillin for this purpose was documented in a study by Griego et al. Patients were treated 15 minutes before surgery with local anesthesia with a solution of 0.5 mg nafcillin sodium per milliliter of 1% buffered lidocaine hydrochloride with epinephrine 1:1000000.[8] This dosage and timing resulted in 1 documented infection out of 461 wounds treated and the infection being attributed bacterial colonization due to wound-edge necrosis from sutures when compared to the control in which 12 infections were documented out of 447 wounds treated.[8]

The use of intraincisional clindamycin was documented in a prospective study conducted by Huether et al. with concentrations of the antibiotic at 408 ug/mL and 544 ug/mL showing no growth of bacterial after 48 hours while a lower concentration of 272 ug/mL did allow for bacterial growth after 48 hours when it was tested 7 days after initial mixing of the solution at a 1:8 dilution.[9]

Clinical Evidence and Case Studies

Research indicates that the utilization of incisional antibiotics has proven effective in reducing the occurrence of surgical site infections 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.[8] The difference in infection rates between the treatment group (0.2%) and control group (2.5%) was highly significant (p=.003).[8] 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.[9] 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).[9] Culture-positive wounds were also less frequent in the study group (4 wounds) when compared to the control group (14 wounds), (p=.02).[9]

Comparative Analysis

Evidence of the efficacy of intraincisional antibiotic prophylaxis with respect to systemic antibiotics is inconsistent.[3] Mourad et. al conducted a meta-analysis investigating rates of SSIs following the administration of oral or intraincisional antibiotic prophylaxis in MMS.[3] 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.[3] 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.[3] 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.[10] 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.[10] 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.[10] 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.

Image 3

Implications for Patient Care

With data being clear that intraincisional antibiotic prophylaxis does display a significant decrease in infection rates compared to control groups, the risk assessment for whether to utilize this approach continues to be a point of discussion and differs among providers. Some Mohs surgeons have reported using intraincisional antibiotic prophylaxis in the majority of their patients. Others have reported always using the approach in surgeries of the face. Use of intraincisional antibiotics before repairing a defect that occurred due to Mohs surgery has also been shown to be effective.[8]

When considering the pros and cons of intraincisional antibiotics, one benefit is the decreased risk of systemic exposure to antibiotics, minimizing risk of common side effects such as gastrointestinal upset, interactions with other current medications, and theoretically overall antibiotic resistance.[9] Having the option of intraincisional antibiotics prophylactically may serve as a good tool when considering postoperative risk for infection as well as what treatment options may work for that unique patient.

While data continues to support the benefits of intraincisional antibiotics, the use of this option is still debated due to questions surrounding whether the advantages are in fact significant as well as taking into consideration the location of the wound, pre-existing infection, and morphology of the lesion on a case by case basis.[11] Overall however, intraincisional antibiotic prophylaxis has been shown to be beneficial for reasons including direct administration to the affected area, relatively low cost, and ease of use. Additionally, there is theoretical decrease in resistance, drug interactions, and other common side effects with exposure to systemic antibiotics.[11]

Image 4

Areas for Future Research

Identify targeted antimicrobial agents specifically tailored for intraincisional antibiotic prophylaxis to maximize efficacy and minimize the risk of antibiotic resistance development.

Investigate the potential use of novel drug delivery systems, such as nanoparticles or hydrogels, for localized and sustained release of antibiotics at the incision site, aiming to improve the therapeutic outcomes and reduce systemic side effects.

Examine the microbiome dynamics at the surgical site before and after intraincisional antibiotic prophylaxis to understand its impact on the risk of postoperative infections and the development of alternative strategies for infection prevention.

Develop predictive models or algorithms integrating patient-specific factors, such as comorbidities, immune status, and microbiological profile, to optimize personalized intraincisional antibiotic prophylaxis regimens and enhance clinical decision-making in MOHS procedures.

Analyze the long-term implications of intraincisional antibiotic prophylaxis on microbial ecology, immune function, and the development of antibiotic resistance, aiming to establish sustainable and safe practices for infection prevention in skin cancer surgery.

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.

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.