Title

Efficacy of Care and Antibiotic Use for Chalazia and Hordeola

Journal

Eye & Contact Lens Science & Clinical Practice, 48(4)

ISSN

1542-2321

Authors

Alsoudi, Amer F
Ton, Lauren
Ashraf, Davin C
et al.

Publication Date

2022-04-01

DOI

10.1097/icl.0000000000000859

Peer reviewed

HHS Public Access

Author manuscript

Eye Contact Lens. Author manuscript; available in PMC 2023 April 01.

Published in final edited form as:

Eye Contact Lens. 2022 April 01; 48(4): 162–168. doi:10.1097/ICL.0000000000000859.

Efficacy of Care and Antibiotic Use for Chalazia and Hordeola

Amer F. Alsoudi, BS[1], **Lauren Ton, BS**[1], **Davin C. Ashraf, MD**[2], **Oluwatobi O. Idowu, MD**[2,*], **Alan W. Kong, BS**[1], **Linyan Wang, MD**[2,†], **Robert C. Kersten, MD**[2], **Bryan J. Winn, MD**[2], **Seanna R. Grob, MD**[2], **M. Reza Vagefi, MD**[2]

[1]School of Medicine, University of California San Francisco, San Francisco, CA.

[2]Department of Ophthalmology, University of California San Francisco, San Francisco, CA.

Abstract

Objectives: To evaluate whether use of an antibiotic improves the efficacy of care for a chalazion or hordeolum.

Methods: A cross-sectional retrospective review was performed. All patients treated for a newly diagnosed chalazion or hordeolum at the University of California, San Francisco from 2012 to 2018 were identified. Patients were excluded when clinical notes were inaccessible or there was inadequate documentation of treatment modality or outcome. Patient demographics, setting of initial presentation, treatment modalities, antibiotic use, and outcomes were analyzed.

Results: A total of 2,712 patients met inclusion criteria. Management with an antibiotic was observed in 36.5% of patients. An antibiotic was 1.53 times (95% CI, 1.06–2.22, p = 0.025) more likely to be prescribed in emergency or acute care setting for a chalazion. Older age was associated with a higher risk of receiving an antibiotic for a hordeolum (adjusted RR 1.07 per decade, 95% CI, 1.05–1.11, p <0.001). The addition of an antibiotic to conservative measures for a chalazion (adjusted RR, 0.97, 95% CI, 0.89–1.04, p = 0.393) or hordeolum (adjusted RR, 0.99, 95% CI, 0.96–1.02, p = 0.489) was not associated with an increased likelihood of treatment success.

Conclusion: Though frequently prescribed, an antibiotic is unlikely to improve the resolution of a chalazion or hordeolum.

Keywords

antibiotic; antibiotic resistance; antibiotic stewardship; chalazion; hordeolum

A chalazion is a benign eyelid lesion associated with blepharitis that typically presents as a subacute tender nodule arising from an obstructed meibomian gland characterized by lipogranulomatous inflammation.[1,2] In contrast, a hordeolum is an acute bacterial

Corresponding author: M. Reza Vagefi, MD Wayne and Gladys Valley Center for Vision Department of Ophthalmology University of California, San Francisco 490 Illinois Street San Francisco, CA 94143 reza.vagefi@ucsf.edu.

*Dr. Idowu is now employed by AbbVie Inc. North Chicago, Illinois, U.S.A.

†Dr. Wang is now with the Department of Ophthalmology, The Second Affiliated Hospital, College of Medicine, Zhejiang University, Hangzhou, China.

Disclosures and Conflicts of Interest

Dr. Oluwatobi Idowu is now employed by AbbVie Inc. as a Medical Science Liaison. The other authors have no conflict of interests to disclose.

infection of the eyelid typically caused by the *Staphylococcus* genus and is divided between those originating from an eyelash follicle and adjacent glands of Zeis or Moll (external) versus those arising from a meibomian gland (internal).[3] This nomenclature is often used interchangeably despite differing etiologies. They represent the second leading cause of nonemergent, eye-related emergency department visits in the U.S. accounting for more than 100,000 visits a year.[4] Both entities are typically self-limiting and resolve with conservative measures, including warm compresses and eyelid hygiene.[5,6] If initial therapy fails, the use of intralesional steroid (ILS) injection for a chalazion and/or incision and drainage (I&D) for either is effective.[7,8]

Antibiotics are not indicated for the treatment of a chalazion, yet they are often prescribed with the endorsement for their use when there is associated severe blepharitis, blepharitis associated rosacea, or chronic chalazia.[9,10] In contrast, antibiotics are thought to shorten the duration and severity of a hordeolum, though there is a paucity of evidence to support this.[11] Judicious use of antibiotics is especially germane when considering that nearly one-third of outpatient antibiotic prescriptions for common conditions are unnecessary or inappropriate.[12] Moreover, in the United States alone, antibiotic-resistant infections affect 2.8 million people and cause over 35,000 deaths per year.[13] Specifically in ophthalmology, antibiotic misuse is well substantiated in the setting of acute conjunctivitis and peri-procedural prophylaxis, with high rates of antibiotic resistance identified among bacterial conjunctival pathogens with repeated use of topical antibiotics.[14,15] Antimicrobial stewardship thus remains imperative across disciplines.[16–18]

When considering the utility of an antibiotic for the treatment of chalazia and hordeola, little exists in the literature. In this study, the authors assess the management of chalazia and hordeola at a single academic institution, identify factors associated with antibiotic use, and report the treatment success of the variously employed interventions.

Methods

A retrospective chart review was performed of all cases of a chalazion or hordeolum managed at the University of California, San Francisco between April 2012 and December 2018. The study was approved by the Institutional Review Board of the University of California, San Francisco (Study Number: 18–25060). The review was performed in compliance with the provisions of the United States of America Health Insurance Portability and Accountability Act of 1996 and adhered to the World Medical Association's ethical principles for medical research involving human subjects outlined in the Declaration of Helsinki as amended in 2013.

Cases were identified using the International Classification of Diseases codes (ICD-9 and ICD-10) corresponding with chalazion (373.2 and H00.1X) and hordeolum (373.11, 373.12, H00.0XX, H00.02X and H00.03X). Exclusion criteria included inaccessible clinical notes or inadequate documentation of treatment modality or outcome.

Patient demographics, treatment modalities, antibiotic use, antibiotic type, reason for antibiotic prescription, treatment outcome, and setting of initial presentation were extracted

from the electronic medical record (Epic Systems Corporation; Verona, WI). Treatment modalities included medical management defined as conservative measures (warm compress with or without eyelid hygiene), conservative measures and antibiotics, or antibiotics only. Procedural management was defined as any combination of ILS, I&D, and/or full thickness eyelid resection. The reason for prescribing an antibiotic was collected if explicitly stated. Treatment success was defined by patient report and/or provider examination of resolution of symptoms and clinical findings related to the initial diagnosis. Recurrence was defined as a subsequent diagnosis of chalazion or hordeolum in the eyelid of initial presentation after reported treatment success.

Descriptive statistical analysis was performed to observe the distribution of variables among subjects. The chi-squared test was used to compare proportions, and the two-tailed t-test to compare means. Relative risk (RR) and adjusted relative risk (ARR) were calculated using a modified Poisson regression utilizing robust standard errors. Univariate regression was initially performed, followed by multiple regression to adjust for potential confounders. Domain expertise was used to select variables suspected as potential confounders. Non-binary categorical variables were included in models as single categorical variables with multiple levels. A multiple regression model was constructed for each diagnosis (chalazion and hordeolum) to assess the relationship between antibiotic prescribing and initial clinical setting; age, gender, and duration of the symptoms were included as potential confounders. Two multiple regression models were constructed for each diagnosis to evaluate the efficacy of medical and procedural management; age, gender, duration of symptoms, and initial clinical setting were included as potential confounders. Subgroup analysis of the cohort receiving conservative measures in addition to antibiotics was carried out to evaluate the relative efficacy of different antibiotic administration routes using a separate multiple regression model for each diagnosis; age, gender, duration of symptoms, and initial clinical setting were included as potential confounders. All analyses were conducted in R version 4.0.2 (R for Statistical Computing, 2020; Vienna, Austria).

Results

A total of 2,712 patients with a newly diagnosed chalazion or hordeolum met inclusion criteria (Table 1). The cohort was comprised of 58% females and had a mean age of 37 ± 24 years. Mean age was similar between patients with hordeola and chalazia, but those with chalazia were typically symptomatic for longer prior to presentation. Among the study population, 49% were diagnosed with a chalazion and 51% with a hordeolum. An associated diagnosis of blepharitis/meibomian gland dysfunction or rosacea was noted 24% and 1.4% of the time, respectively. Most of the patients were initially evaluated by a health care provider outside of ophthalmology or optometry, with 65% seen in a primary care clinic and 11% in the emergency department or acute care clinic. Hordeola were relatively more commonly diagnosed in primary care, emergency, and acute care settings, whereas chalazia were relatively more often seen in ophthalmology and optometry clinics.

Medical management was the preferred initial treatment option across clinical settings (98.5%). Among medically managed patients, 1,684 (63.0%) were treated with conservative measures; 963 (36.0%) with conservative measures and a topical and/or oral antibiotic;

and 26 (1.0%) with an antibiotic alone (Table 1). Hordeola were more often prescribed an antibiotic as part of a medical regimen, whereas chalazia were more often prescribed a topical steroid/antibiotic combination. Three hundred ninety-seven (14.6%) patients failed medical management and had a subsequent procedure. Procedural management was more common for chalazia.

Patients initially evaluated at the emergency department or acute care clinic were more likely to be prescribed an oral or topical antibiotic for a chalazion (ARR, 1.53, 95% CI, 1.06–2.22, p = 0.025) compared to those who initially presented to an ophthalmology clinic (Table 2). There were no other statistically significant differences in antibiotic prescribing patterns for either diagnosis between the different clinical settings (Table 2). Age, gender, and duration of symptoms were not significantly associated with antibiotic prescribing for chalazion; however, older age was associated with a higher risk of receiving an antibiotic prescription for hordeolum (ARR 1.07 per decade, 95% CI, 1.05–1.11, p <0.001).

An indication of suspected infection was documented 16.5% of the time when prescribing an antibiotic (Table 1). Meibomian gland dysfunction or rosacea was recorded as the reason for an antibiotic 1.3% of the time. An antibiotic was prescribed 3.5% of the time with specific documentation of the absence of an infection.

Oral doxycycline and topical erythromycin were the most commonly prescribed antibiotics (Supplemental Table 1). The most commonly prescribed topical steroid/antibiotic combination was neomycin/polymyxin B sulfates/dexamethasone ophthalmic ointment. Subgroup analysis was performed for those prescribed an oral macrolide or tetracycline class of antibiotic. Neither class of oral antibiotics was associated with a higher rate of treatment success or lower rate of recurrence relative to other oral antibiotics (Supplemental Table 2). Further analysis was performed to evaluate antibiotic dosing indicative of an anti-inflammatory regimen for azithromycin (>1 week duration) and doxycycline (>2 weeks duration and/or <100 mg twice daily dose). These represented 26/34 (76.5%) of azithromycin and 46/154 (29.9%) of doxycycline prescriptions. An anti-inflammatory antibiotic regimen was associated with a lower risk of recurrence among chalazia (ARR, 0.16, 95% CI, 0.05–0.58, p=0.005) and a higher risk of recurrence among hordeola (ARR, 6.55, 95% CI, 1.82, 23.56, p = 0.004), but was not associated with treatment success. Subgroup analysis was also performed to examine antibiotic coverage for methicillin-resistant *Staphylococcus aureus* (MRSA) with sulfamethoxazole-trimethoprim, doxycycline, tetracycline, and/or clindamycin. Diagnosis of a hordeolum was not associated with increased risk of MRSA coverage, after adjustment for age, gender, and duration of symptoms (ARR 1.08, 95% CI, 0.88–1.31, p = 0.444). Similarly, the initial clinical setting was not associated with antibiotic coverage for MRSA. Older age was, however, associated with higher risk of receiving MRSA coverage for both hordeola (ARR 1.07 per decade, 95% CI, 1.01–1.13, p=0.014 and chalazia (ARR 1.09 per decade, 95% CI, 1.01–1.17, p=0.022) (Supplemental Table 3).

Medical management was associated with a 75.9% success rate among patients diagnosed with chalazia and 93.5% with hordeola (Table 4). After adjustment for age, gender, duration of symptoms, and initial clinical setting, the addition of an antibiotic, regardless

of formulation, to conservative measures was not associated with a significant difference in treatment success for either condition (Table 3). Subgroup analysis stratified by type of antibiotic used with medical management revealed that an oral antibiotic or the combination of a topical and oral antibiotic for the treatment of a chalazion or hordeolum was associated with a trend towards lower treatment success, though this was not statistically significant (Table 3).

Procedural management was highly effective for both diagnoses (94.8% for chalazia and 97.1% for hordeola) (Table 4), and no significant differences were found between the different minimally invasive modalities (Table 3). Lipogranulomatous inflammation consistent with chalazion was the most common histopathological finding among patients who underwent biopsy via a full thickness eyelid resection (Table 5). There was one case of basal cell carcinoma identified and no instance of sebaceous cell carcinoma.

Discussion

In this retrospective review of patients with newly diagnosed chalazion or hordeolum, the authors found that nearly 37% of individuals were initially managed with an antibiotic. In addition, antibiotic use differed among clinical sites, with patients seen in emergency and acute care settings significantly more likely to be prescribed an antibiotic for a chalazion. Older age was associated with a higher risk of receiving an antibiotic for a hordeolum. Overall, success with medical management was highly favorable, and an antibiotic did not statistically improve the rate of resolution for either chalazia or hordeola, regardless of whether prescribed as a topical and/or oral formulation. When medical management failed, a procedural intervention yielded excellent outcomes.

The decision to prescribe an antibiotic in the setting of a chalazion is likely multifactorial. Despite being a common inflammatory eyelid lesion, diagnostic confusion is possible as a chalazion may simulate other conditions, including a hordeolum.[19,20] This confusion can also be found in the medical literature where the two entities are sometimes used interchangeably.[21,22] While a chalazion shares some of the clinical characteristics of a hordeolum, its subacute onset and lack of significant pain or suppuration provides distinction from the other. The principle that periocular infections are to be classified as either pre-septal or post-septal in origin further adds to the muddle. Clinicians are understandably concerned about failing to treat a periocular infection and causing permanent morbidity; however, while infectious in nature, a hordeolum is a pre-septal process with little risk for orbital sequelae or significant visual consequences. In fact, there is only one documented case in the literature of a hordeolum progressing to an orbital cellulitis that occurred in the pre-penicillin era.[23] Encouragingly, it has been demonstrated that healthcare professionals without formal ophthalmology training can achieve comparable accuracy in the recognition of eyelid lesions.[24] Moreover, the non-ophthalmic literature by and large correctly describes the fundamental difference between a hordeolum and chalazion and designates both entities as pre-septal in origin.[25–27]

Cognitive bias may also play a role in the determination to prescribe an antibiotic. Research has demonstrated that physician overconfidence, the anchoring effect and information or

availability bias may all be associated with diagnostic inaccuracies.[28] Reliance on initial presentation and thus anchoring on an inaccurate diagnosis whether that of a hordeolum or a post-septal infection allows the subsequent decision to prescribe an antibiotic to be more probable. These biases are likely compounded by the fast-paced environment of an emergency department or acute care clinic characterized by multitasking and task switching that may contribute to error.[29] Indeed, research has demonstrated that prescribing an antibiotic avoids more complex decision-making and allows a physician to more easily manage patient expectations.[30] In addition, this high acuity setting could impact risk perception and result in overly cautious decision making, thus explaining the 1.5-fold higher risk of receiving an antibiotic for a chalazion observed in the present study when initially presenting to an emergency room or acute care clinic. [31]

Given the inflammatory etiology of a chalazion, antibiotics are generally not considered to be an aspect of their management, and the use of conservative measures is typically the mainstay of therapy.[5,6] This study observed similar efficacy for medical management compared to what has previously been reported in the literature with a resolution rate of 76.7%.[5,6] In support of this, a recent randomized control trial (RCT) looking at conservative therapy found no difference between the sole application of warm compresses compared to the addition of a topical antibiotic or antibiotic/steroid combination ointment to the treatment regimen.[5] In a related context, oral antibiotics are frequently endorsed for the treatment of blepharitis even though a lack of level I evidence exists to support their use.[32,33] Likewise, despite the observed association of blepharitis with chalazia, antibiotics were not found to improve their resolution regardless of type or formulation.[2] Furthermore, when examining the tetracycline and macrolide classes, specifically endorsed for their anti-inflammatory and lipid regulating properties in blepharitis, a difference in treatment success for chalazia was not detected compared to other oral agents. However, when evaluating antibiotic regimens employed for their proposed anti-inflammatory properties (long duration and/or low dose) as opposed to anti-microbial, a reduced risk of recurrent chalazia was observed. Interestingly, a higher risk of recurrent hordeola was noted for these regimens. The difference in effect is supported by the pathogenesis of these two entities and the proposed mechanism of anti-inflammatory antibiotic dosing. Improvement in chronic eyelid inflammation would be expected to reduce the risk of recurrent chalazia, whereas under treatment (from a low antibiotic dose) or over-treatment (from a long duration) of eyelid bacteria could have deleterious effects for infectious hordeola, such as the development of antibiotic resistance or eradication/disruption of commensal bacteria.[34]

Minimally invasive procedural management of refractory chalazia was highly efficacious without significant difference between modalities. It should be noted that a RCT comparing medical to procedural management found a higher success rate for procedural intervention as first line therapy for chalazia that was statistically significant with no difference between ILS and I&D; a second RCT also confirmed equal efficacy of the two procedural interventions.[7,8]

While the benefit of a topical antibiotic has been demonstrated for post-surgical care of the periocular area, there are no formal trials establishing the role of topical or oral antibiotics in the management of hordeolum.[11,35] Instead, treatment recommendations are based largely

on those found in the older, nonophthalmic literature with a paucity of cited evidence; these recommendations are in turn recapitulated in newer publications.[25,36–39] Nevertheless, the present study observed that for hordeola neither antibiotics alone nor antibiotics in combination with conservative measures were associated with improved treatment success relative to conservative measures alone. Moreover, despite the increased prevalence of MRSA soft tissue infections in the United States, neither the diagnosis of hordeolum nor the acuity of the clinical setting was associated with a higher risk of antibiotic coverage for MRSA.[40] Interestingly, however, older patients with hordeola were more likely to receive antibiotics as well as coverage for MRSA. Granted, evaluation of MRSA coverage may be confounded by the preferential use of doxycycline observed in the present study. Lastly, while hordeola less frequently required procedural management, an intervention proved to be efficacious in their resolution without significant difference between modalities.

When considering the larger context of antibiotic misuse, the selection and spread of resistant microorganisms is a legitimate threat to the health and well-being of patients.[13–17] In 2013, the American Academy of Ophthalmology recognized this concern in the Choosing Wisely campaign in which two of the five initiatives raised awareness of antibiotic misuse in ophthalmology pertaining to acute conjunctivitis and intravitreal injections.[41] In fact, the Federal Task Force on Combating Antibiotic-Resistant Bacteria (CARB) recently updated the National Action Plan (2020–2025) presenting the strategic actions that the US government will take in the next five years to change the course of antibiotic resistance.[42] Nevertheless, research has demonstrated that antibiotic stewardship best begins at the local, institutional level and thus highlights the imperative that such programs play in combating antimicrobial resistance.[18]

There are several limitations to the present study. Because of its retrospective, non-randomized nature, the analysis was limited to reporting associations. All diagnoses and outcomes were based on the clinical documentation available in the electronic medical record by the treating provider and thus subject to accuracy and recall bias; of note, medical treatment success was similar between clinic settings, suggesting that misdiagnosis by non-ophthalmic providers was of limited importance. Abstraction bias may have been introduced because the chart reviewers were not masked to diagnoses or outcomes.

Given the retrospective nature of the investigation, a defined protocol for clinic evaluations including systematic collection of treatment and disease data could not be performed for the study. Therefore, an assessment of whether the intensity by which conservative measures were employed contributed to treatment success or time to resolution was not possible given the limited nature of the electronic medical record documentation. Similarly, reliable reporting of time to resolution was not available, and therefore it was not possible to determine if antibiotics led to faster recovery, if not a higher chance of recovery. Sampling bias should also be acknowledged since the review was performed at a single academic institution and may not be representative of the overall population.

In the study cohort, treatment selection was based on provider judgment, and thus confounding factors such as patient demographics, disease severity, provider preference, and clinical setting may have influenced the selection of an intervention. Most notably,

it is possible that patients with more severe presentations were preferentially prescribed an antibiotic. Research has demonstrated that with increasing disease severity, physicians are more likely to prescribe an antibiotic, select broader-spectrum antimicrobial therapy as well as adopt a new to market antibiotic option.[43–45] In addition, treatment success was determined by patient reportage and/or the provider's documentation of clinical resolution. Whether the aggressiveness of the intervention or satisfaction with the treatment influenced the patient's or provider's interpretation of treatment success cannot be determined. Therefore, a possible benefit to antibiotic treatment, while not detected, cannot be ruled out.

To the authors' knowledge, a RCT has not been performed to determine the efficacy of non-surgical treatments for hordeolum.[11] Similarly, there are only two RCTs that consider medical management for chalazion, neither of which evaluate oral antibiotics.[5,7] A prospective RCT examining the efficacy of oral antibiotics in the treatment of each entity with standardized definitions of clinical resolution would therefore provide the strongest level of evidence to guide definitive care.

In conclusion, over a third of patients diagnosed with a chalazion or hordeolum were prescribed an antibiotic despite a lack of evidence demonstrating efficacy. Variation in prescribing patterns was significant with patients presenting to an emergency or acute care setting more likely to receive an antibiotic for the diagnosis of a chalazion and older patients more likely to receive an antibiotic for a hordeolum. After adjustment for age, gender, duration of symptoms and initial clinical setting, the use of antibiotics alone or in conjunction with conservative measures was not associated with a significant difference in the rate of resolution of chalazia or hordeola, relative to conservative measures alone. Further prospective research is warranted to evaluate the potential role for anti-inflammatory antibiotic dosing regimens in preventing recurrent chalazia.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

The authors would like to acknowledge Catherine E. Oldenburg, ScD of the Francis I. Proctor Foundation for Research in Ophthalmology at the University of California, San Francisco for her review of the statistical methods and analyses employed in the study.

Funding: This work was supported in part by NIH-NEI EY002162-Core Grant for Vision Research and by an unrestricted grant from Research to Prevent Blindness.

References

1. Shields JA, Shields CL. Eyelid, Conjunctival, and Orbital Tumors: An Atlas and Textbook Lippincott Williams & Wilkins; 2008.
2. Nemet AY, Vinker S, Kaiserman I. Associated morbidity of blepharitis. Ophthalmology 2011;118(6):1062–1068. [PubMed: 21276617]
3. Wald ER. 85 - Preseptal and Orbital Infections. In: Long SS, Prober CG, Fischer M, eds. Principles and Practice of Pediatric Infectious Diseases (Fifth Edition). Elsevier; 2018:517–522.e1.

4. Channa R, Zafar SN, Canner JK, et al. Epidemiology of Eye-Related Emergency Department Visits. JAMA Ophthalmol 2016;134(3):312–319. [PubMed: 26821577]
5. Wu AY, Gervasio KA, Gergoudis KN, et al. Conservative therapy for chalazia: is it really effective? Acta Ophthalmol 2018;96(4):e503–e509. [PubMed: 29338124]
6. Perry HD, Serniuk RA. Conservative Treatment of Chalazia. Ophthalmology 1980;87(3):218–221. [PubMed: 7422261]
7. Goawalla A, Lee V. A prospective randomized treatment study comparing three treatment options for chalazia: triamcinolone acetonide injections, incision and curettage and treatment with hot compresses. Clin Experiment Ophthalmol 2007;35(8):706–712. [PubMed: 17997772]
8. Ben Simon GJ, Rosen N, Rosner M, Spierer A. Intralesional triamcinolone acetonide injection versus incision and curettage for primary chalazia: a prospective, randomized study. Am J Ophthalmol 2011;151(4):714–718.e1. [PubMed: 21257145]
9. Chalazion Management: Evidence and Questions. American Academy of Ophthalmology Published September 1, 2015. Accessed April 29, 2020. https://www.aao.org/eyenet/article/chalazion-management-evidence-questions
10. Bagheri N, Wajda B, Calvo C, Durrani A, eds. The Wills Eye Manual: Office and Emergency Room Diagnosis and Treatment of Eye Disease Seventh edition. Wolters Kluwer; 2017.
11. Lindsley K, Nichols JJ, Dickersin K. Non-surgical interventions for acute internal hordeolum. Cochrane Database Syst Rev 2017;1:CD007742. [PubMed: 28068454]
12. Fleming-Dutra KE, Hersh AL, Shapiro DJ, et al. Prevalence of Inappropriate Antibiotic Prescriptions Among US Ambulatory Care Visits, 2010–2011. JAMA 2016;315(17):1864–1873. [PubMed: 27139059]
13. CDC. Antibiotic-resistant Germs: New Threats. Centers for Disease Control and Prevention Published March 13, 2020. Accessed May 20, 2020. https://www.cdc.gov/drugresistance/biggest-threats.html
14. Yin VT, Weisbrod DJ, Eng KT, et al. Antibiotic resistance of ocular surface flora with repeated use of a topical antibiotic after intravitreal injection. JAMA Ophthalmol 2013;131(4):456–461. [PubMed: 23430175]
15. Shekhawat NS, Shtein RM, Blachley TS, Stein JD. Antibiotic Prescription Fills for Acute Conjunctivitis among Enrollees in a Large United States Managed Care Network. Ophthalmology 2017;124(8):1099–1107. [PubMed: 28624168]
16. Schwartz SG, Flynn HW, Grzybowski A, et al. Intracameral Antibiotics and Cataract Surgery: Endophthalmitis Rates, Costs, and Stewardship. Ophthalmology 2016;123(7):1411–1413. [PubMed: 27342325]
17. Relhan N, Pathengay A, Schwartz SG, Flynn HW. Emerging Worldwide Antimicrobial Resistance, Antibiotic Stewardship and Alternative Intravitreal Agents for the Treatment of Endophthalmitis. Retina 2017;37(5):811–818. [PubMed: 28338559]
18. Peragine C, Walker SAN, Simor A, et al. Impact of a Comprehensive Antimicrobial Stewardship Program on Institutional Burden of Antimicrobial Resistance: A 14-Year Controlled Interrupted Time-series Study. Clin Infect Dis Off Publ Infect Dis Soc Am 2020;71(11):2897–2904.
19. Kersten RC, Ewing-Chow D, Kulwin DR, Gallon M. Accuracy of clinical diagnosis of cutaneous eyelid lesions. Ophthalmology 1997;104(3):479–484. [PubMed: 9082276]
20. Özdal PÇ, Codère F, Callejo S, et al. Accuracy of the clinical diagnosis of chalazion. Eye 2004;18(2):135–138. [PubMed: 14762403]
21. Wald ER. Periorbital and Orbital Infections. Pediatr Rev 2004;25(9):312–320. [PubMed: 15342822]
22. Amato M, Pershing S, Walvick M, Tanaka S. Trends in ophthalmic manifestations of methicillin-resistant Staphylococcus aureus (MRSA) in a northern California pediatric population. J AAPOS 2013;17(3):243–247. [PubMed: 23623773]
23. Green J. Orbital Cellulitis Following Hordeolum. Trans Am Ophthalmol Soc 1925;23:233–239. [PubMed: 16692709]
24. Mohite AA, Johnson A, Rathore DS, et al. Accuracy of clinical diagnosis of benign eyelid lesions: Is a dedicated nurse-led service safe and effective? Orbit 2016;35(4):193–198. [PubMed: 27322204]

25. Deibel JP, Cowling K. Ocular inflammation and infection. Emerg Med Clin North Am 2013;31(2):387–397. [PubMed: 23601478]
26. Carlisle RT, Digiovanni J. Differential Diagnosis of the Swollen Red Eyelid. Am Fam Physician 2015;92(2):106–112. [PubMed: 26176369]
27. Gordon AA, Danek DJ, Phelps PO. Common inflammatory and infectious conditions of the eyelid. Dis Mon 2020;66(10):101042. [PubMed: 32622681]
28. Saposnik G, Redelmeier D, Ruff CC, Tobler PN. Cognitive biases associated with medical decisions: a systematic review. BMC Med Inform Decis Mak 2016;16(1):138. [PubMed: 27809908]
29. Skaugset LM, Farrell S, Carney M, et al. Can You Multitask? Evidence and Limitations of Task Switching and Multitasking in Emergency Medicine. Ann Emerg Med 2016;68(2):189–195. [PubMed: 26585046]
30. Krockow EM, Colman AM, Chattoe-Brown E, et al. Balancing the risks to individual and society: a systematic review and synthesis of qualitative research on antibiotic prescribing behaviour in hospitals. J Hosp Infect 2019;101(4):428–439. [PubMed: 30099092]
31. Klein EY, Martinez EM, May L, et al. Categorical Risk Perception Drives Variability in Antibiotic Prescribing in the Emergency Department: A Mixed Methods Observational Study. J Gen Intern Med 2017;32(10):1083–1089. [PubMed: 28634909]
32. Geerling G, Tauber J, Baudouin C, et al. The International Workshop on Meibomian Gland Dysfunction: Report of the Subcommittee on Management and Treatment of Meibomian Gland Dysfunction. Invest Ophthalmol Vis Sci 2011;52(4):2050–2064. [PubMed: 21450919]
33. Wladis EJ, Bradley EA, Bilyk JR, et al. Oral Antibiotics for Meibomian Gland-Related Ocular Surface Disease: A Report by the American Academy of Ophthalmology. Ophthalmology 2016;123(3):492–496. [PubMed: 26707417]
34. Langdon A, Crook N, Dantas G. The effects of antibiotics on the microbiome throughout development and alternative approaches for therapeutic modulation. Genome Med 2016;8(1):39. [PubMed: 27074706]
35. Ashraf DC, Idowu OO, Wang Q, et al. The Role of Topical Antibiotic Prophylaxis in Oculofacial Plastic Surgery: A Randomized Controlled Study. Ophthalmology 2020;127(12):1747–1754. [PubMed: 32698033]
36. Diegel JT. Eyelid problems. Blepharitis, hordeola, and chalazia. Postgrad Med 1986;80(2):271–272. [PubMed: 3737498]
37. Olson MD. The common stye. J Sch Health 1991;61(2):95–97. [PubMed: 2016867]
38. Bragg KJ, Le PH, Le JK. Hordeolum. In: StatPearls StatPearls Publishing; 2020. Accessed July 26, 2020. http://www.ncbi.nlm.nih.gov/books/NBK441985/
39. Willmann D, Guier CP, Patel BC, Melanson SW. Stye. In: StatPearls StatPearls Publishing; 2020. Accessed May 9, 2020. http://www.ncbi.nlm.nih.gov/books/NBK459349/
40. Storandt MH, Walden CD, Sahmoun AE, Beal JR. Trends and risk factors in the antibiotic management of skin and soft tissue infections in the United States. J Dermatol Treat 2020;0(0):1–5.
41. American Academy of Ophthalmology | Choosing Wisely Published February 24, 2015. Accessed March 31, 2021. https://www.choosingwisely.org/societies/american-academy-of-ophthalmology/
42. Federal Task Force on Combating Antibiotic-Resistant Bacteria: National Action Plan for Combating Antibiotic-Resistant Bacteria Published October 9, 2020. Accessed March 31, 2021. https://aspe.hhs.gov/system/files/pdf/264126/CARB-National-Action-Plan-2020-2025.pdf
43. McKay R, Mah A, Law MR, McGrail K, Patrick DM. Systematic Review of Factors Associated with Antibiotic Prescribing for Respiratory Tract Infections. Antimicrob Agents Chemother 2016;60(7):4106–18. [PubMed: 27139474]
44. Cressman AM, MacFadden DR, Verma AA, Razak F, Daneman N. Empiric Antibiotic Treatment Thresholds for Serious Bacterial Infections: A Scenario-based Survey Study. Clin Infect Dis 2019;69(6):930–937. [PubMed: 30535310]
45. Metlay JP, Shea JA, Asch DA. Antibiotic prescribing decisions of generalists and infectious disease specialists: thresholds for adopting new drug therapies. Med Decis Making 2002;22(6):498–505. [PubMed: 12458980]

Table 1.

Baseline Characteristics and Treatment Modalities for Patients Presenting with Chalazion or Hordeolum

Characteristic	Total N=2712 (%)	Chalazion N=1324 (%)	Hordeolum N=1388 (%)	p-value
Mean Age (years)	36.8 ± 24.3	37.5 ± 24.9	36.2 ± 23.7	0.164
Mean Duration of Symptoms (weeks)	6.8 ± 18.6	10.8 ± 25.1	2.9 ± 7.1	<0.001
Female Gender	1571 (57.9)	762 (57.6)	809 (58.3)	0.712
Eyelid				
Upper	1464 (54.0)	705 (53.2)	759 (54.7)	0.434
Lower	1211 (44.7)	599 (45.2)	612 (44.1)	0.565
Unknown/Not stated	37 (1.4)	20 (1.5)	17 (1.2)	0.498
Laterality				
Bilateral	140 (5.2)	105 (7.9)	35 (2.5)	<0.001
Co-existing Condition				
Blepharitis/MGD	652 (24.0)	455 (34.4)	197 (14.2)	<0.001
Rosacea	39 (1.4)	26 (2.0)	13 (0.9)	0.016
Unknown/Not stated	2021 (74.5)	852 (64.4)	1169 (84.2)	<0.001
Medical Management at Presentation	2673 (98.5)	1293 (97.7)	1380 (99.4)	<0.001
Conservative measures	1684 (63.0)	959 (74.2)	725 (52.5)	<0.001
Conservative measures and antibiotic	963 (36.0)	322 (24.9)	641 (46.4)	<0.001
Antibiotic only	26 (1.0)	12 (1.0)	14 (1.0)	1.000
Antibiotic Prescribed	989 (36.5)	334 (25.2)	655 (47.2)	<0.001
Topical antibiotic	553 (55.9)	132 (39.5)	421 (64.2)	<0.001
Topical antibiotic/steroid	116 (11.7)	68 (20.4)	48 (7.3)	<0.001
Oral antibiotic	227 (23.0)	85 (25.4)	142 (21.7)	0.023
Topical and oral antibiotics	93 (9.4)	49 (14.7)	44 (6.7)	<0.001
Reason Provided for Antibiotic Prescription				
Infection suspected	163 (16.5)	48 (14.4)	115 (17.6)	0.023
MGD/Rosacea	13 (1.3)	12 (3.6)	1 (0.2)	<0.001
Not stated	779 (78.8)	260 (77.8)	519 (79.2)	0.375

Eye Contact Lens. Author manuscript; available in PMC 2023 April 01.

Characteristic	Total N=2712 (%)	Chalazion N=1324 (%)	Hordeolum N=1388 (%)	p-value
Prescribed with documentation that infection was not suspected	34 (3.5)	14 (4.2)	20 (3.1)	0.126
Procedural Management*	397 (14.6)	329 (24.8)	68 (4.9)	<0.001
ILS	82 (21.2)	68 (20.7)	14 (20.6)	0.949
I&D	151 (38.0)	118 (35.9)	33 (48.5)	<0.001
I&D and ILS	142 (35.8)	124 (37.7)	18 (26.5)	<0.001
Full thickness eyelid resection	22 (5.5)	19 (5.8)	3 (4.4)	0.010
Biopsy Performed	58 (2.1)	48 (3.6)	10 (0.7)	<0.001
Initial Clinical Setting				
Primary care clinic	1762 (65.0)	799 (60.3)	963 (69.4)	<0.001
Emergency department/Acute care clinic	310 (11.4)	76 (5.7)	234 (16.9)	<0.001
Optometry clinic	247 (9.1)	169 (12.8)	78 (5.6)	<0.001
Ophthalmology clinic	302 (11.1)	221 (16.7)	81 (5.8)	<0.001
Other	91 (3.3)	59 (4.5)	32 (2.3)	0.002

The chi-squared test was used to compare proportions. The two-tailed t-test was used to compare means.

*Some individuals received more than one procedural intervention.

Abbreviations: ILS: Intralesional steroid; I&D: Incision and drainage; MGD: Meibomian gland dysfunction

Table 2.

Relative Risk of Antibiotic Prescribing at Presentation for Chalazion or Hordeolum by Clinical Setting

	Chalazion			Hordeolum		
Initial Clinical Setting	**ARR [95% CI]**	**P value**	**P value, adjusted***	**ARR [95% CI]**	**P value**	**P value, adjusted***
Ophthalmology clinic	1.00			1.00		
Optometry clinic	0.99 [0.69,1.42]	0.732	0.959	0.88 [0.65, 1.18]	0.191	0.383
Primary care clinic	0.83 [0.62, 1.10]	0.247	0.193	0.83 [0.68, 1.02]	<0.001	0.078
Emergency department/Acute care clinic	1.53 [1.06, 2.22]	0.005	0.025	1.04 [0.83, 1.31]	0.103	0.717
Other clinic	1.52 [0.94, 2.45]	0.009	0.088	0.82 [0.38, 1.77]	0.047	0.611
Covariates						
Age (per decade)	0.98 [0.94, 1.02]	0.055	0.295	1.07 [1.05, 1.11]	<0.001	<0.001
Gender (female)	0.98 [0.87, 1.11]	0.820	0.783	1.00 [0.95, 1.06]	0.706	0.885
Duration (per month)	1.00 [0.99, 1.01]	0.769	0.949	0.96 [0.92, 1.01]	0.056	0.104

Modified Poisson regression using robust standard errors. One multiple regression model was constructed for each diagnosis.

*Adjusted for age, gender, and duration of symptoms.

Abbreviations: ARR: Adjusted relative risk; CI: Confidence interval

Table 3.

Relative Risk of Treatment Success for Chalazion or Hordeolum by Intervention

	Chalazion			Hordeolum		
Medical Management	**ARR [95% CI]**	**P value**	**P value, adjusted***	**ARR [95% CI]**	**P value**	**P value, adjusted***
Conservative measures only	1.00			1.00		
Conservative measures and antibiotic	0.95 [0.87, 1.02]	0.459	0.152	0.99 [0.96, 1.02]	0.389	0.469
Antibiotic only	1.05 [0.78, 1.41]	0.809	0.762	0.94 [0.75, 1.17]	0.540	0.555
Subgroup Analysis: Antibiotic Route						
Conservative measures only	1.00			1.00		
Conservative measures and topical antibiotic	1.02 [0.93, 1.11]	0.372	0.673	1.00 [0.97. 1.02]	0.961	0.826
Conservative measures and topical steroid/antibiotic	0.86 [0.69, 1.08]	0.265	0.207	1.03 [0.94, 1.12]	0.776	0.571
Conservative measures and oral antibiotic	0.88 [0.75, 1.03]	0.257	0.123	0.97 [0.92, 1.02]	0.249	0.194
Conservative measures and oral and topical antibiotics	0.90 [0.72, 1.11]	0.188	0.318	0.94 [0.86, 1.04]	0.312	0.225
Covariates						
Age (per decade)	0.99 [0.98, 1.00]	0.268	0.045	1.00 [0.99, 1.00]	0.013	0.192
Gender (female)	1.07 [1.00, 1.14]	0.153	0.061	0.98 [0.96, 1.01]	0.817	0.216
Duration (per month)	0.98 [0.97, 1.00]	0.008	0.009	0.97 [0.95, 0.99]	0.003	0.006
Initial Clinical Setting						
Ophthalmology clinic	1.00			1.00		
Optometry clinic	1.05 [0.95, 1.17]	0.115	0.344	1.09 [1.00, 1.19]	0.020	0.062
Primary care clinic	0.96 [0.87, 1.05]	0.211	0.354	1.04 [0.95, 1.14]	0.185	0.401
Emergency department/Acute care clinic	1.09 [0.97, 1.23]	0.034	0.144	1.07 [0.98, 1.17]	0.012	0.143
Other clinic	0.91 [0.68, 1.22]	0.652	0.528	0.82 [0.50, 1.34]	0.423	0.429
Procedural Management	**ARR [95% CI]**	**P value**	**P value, adjusted†**	**ARR [95% CI]**	**P value**	**P value, adjusted†**
Intralesional steroid injection	1.00			1.00		
Incision and drainage	1.09 [0.98, 1.21]	0.053	0.128	0.93 [0.84, 1.03]	0.164	0.174
Incision and drainage with intralesional steroid injection	1.10 [0.99, 1.22]	0.031	0.077	0.99 [0.95, 1.03]	0.217	0.572
Covariates						

	Chalazion			Hordeolum		
Medical Management	**ARR [95% CI]**	**P value**	**P value, adjusted***	**ARR [95% CI]**	**P value**	**P value, adjusted***
Age (per decade)	1.00 [0.98, 1.01]	0.409	0.609	0.98 [0.94, 1.01]	0.229	0.236
Gender (female)	1.03 [0.97, 1.10]	0.420	0.274	0.96 [0.90, 1.02]	0.163	0.189
Duration (per month)	1.00 [1.00, 1.00]	0.562	0.522	1.00 [1.00, 1.00]	0.174	0.253

Modified Poisson regression using robust standard errors. Multiple regression models were constructed for each diagnosis and for each of three multi-level categorical variables: type of medical management, type of procedural management, and antibiotic route (subgroup analysis).

*Adjusted for age, gender, duration of symptoms, and initial clinical setting.

†Adjusted for age, gender, and duration of symptoms.

Abbreviations: ARR: Adjusted relative risk; CI: Confidence interval

Eye Contact Lens. Author manuscript; available in PMC 2023 April 01.

Table 4.

Treatment Success and Recurrence Rates for Patients Presenting with Chalazion or Hordeolum

	Chalazion		Hordeolum	
Medical management	**Number**	**Resolution (%)**	**Number**	**Resolution (%)**
Total	1293	981 (75.9)	1380	1290 (93.5)
Conservative measures	959	736 (76.7)	725	681 (93.9)
Conservative measures and antibiotic	322	236 (73.2)	641	596 (93.0)
Antibiotic only	12	9 (75.0)	14	13 (92.9)
Recurrence	55		32	
Mean interval to recurrence (months)	5.8 ± 6.0		6.6 ± 9.1	
Procedural management	**Number**	**Resolution (%)**	**Number**	**Resolution (%)**
Total	329	312 (94.8)	68	66 (97.1)
ILS	68	60 (88.2)	14	14 (100)
I&D	118	115 (92.0)	33	31 (93.9)
I&D and ILS	124	118 (97.5)	18	18 (100)
Full thickness eyelid resection	19	19 (100)	3	3 (100)
Recurrence	48		7	
Mean interval to recurrence (months)	0.9 ± 0.5		1.0 ± 0.5	

Abbreviations: ILS: intralesional steroid, I&D: incision and drainage

Table 5.

Histopathological Diagnosis of Eyelid Biopsy in Patients with Chalazion or Hordeolum

Pathology	**N=58 (%)**
Chalazion	39 (67.2)
Pyogenic granuloma	10 (17.2)
Chalazion and pyogenic granuloma	3 (5.2)
Non-specific inflammation	2 (3.4)
Basal cell carcinoma	1 (1.7)
Epidermal inclusion cyst	1 (1.7)
Juvenile xanthogranuloma	1 (1.7)
Indeterminate	1 (1.7)