Examining the spectrum of antimicrobial resistance among inpatient ocular cultures

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Introduction

- Antimicrobial resistance in ocular infections is a growing concern.
- Bacterial eye infections are common and those that do not self-resolve are typically treated empirically with broad spectrum antibiotics.
- Resistant microorganisms increase the risk of prolonged infection and subsequent complications.
- We sought to better understand the distribution of microorganisms isolated from inpatient ocular cultures and their patterns of antibiotic resistance.

Methods

We used the Medical Information Mart for Intensive Care IV (MIMIC-IV) database to examine inpatient eye culture results derived from the hospital-wide electronic health record at Beth Israel Deaconess Medical Centre (BIDMC). MIMIC-IV is a large, freely available database containing inpatient data for patients admitted to the BIDMC emergency department between 2008-2019. Microbiology specimens were filtered to include only inpatient eye cultures. We examined the different eye culture results, including the type of test conducted, micro-organism(s) identified and antibiotic sensitivities. Within the MIMIC-IV Microbiology table, each specimen may have multiple bacteria cultured and/or multiple sensitivities tested for those bacteria.

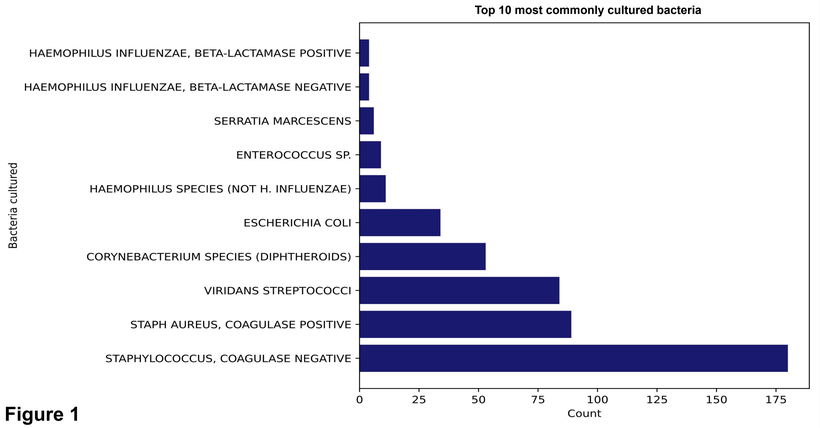


Figure 1

Results

- 774,421 individual inpatient microbiology samples are available in MIMIC-IV (across all types - including blood, urine, wound samples etc) for 197,933 inpatient admissions
- We identified 356 ocular microbiology samples from 285 hospital admissions
  - **278 of 356** sample cultures were positive; of these, 141 were further tested for antibiotic sensitivities
- The most commonly cultured bacteria were: Coagulase negative *Staphylococcus* (n = 180), Coagulase-positive *Staph. aureus* (n = 89), *Viridans streptococci* (n = 84), *Corynebacterium* species (Diphtheroids) (n = 53) and *Escherichia coli* (n = 34) (Fig. 1).
- 262 (**19.4%**) of the 1352 antibiotic sensitivity tests performed identified antibiotic resistance; there were 23 intermediate results and 1067 antibiotic sensitivities
- Erythromycin, clindamycin, ampicillin and trimethoprim/sulfa were the antibiotics to which bacteria were most commonly resistant (Fig. 2).
- The most commonly resistant bacteria were Coagulase-positive *Staph. aureus*, *Escherichia coli*, Coagulase-negative *Staphylococcus* and *Pseudomonas aeruginosa* (Fig. 3) .

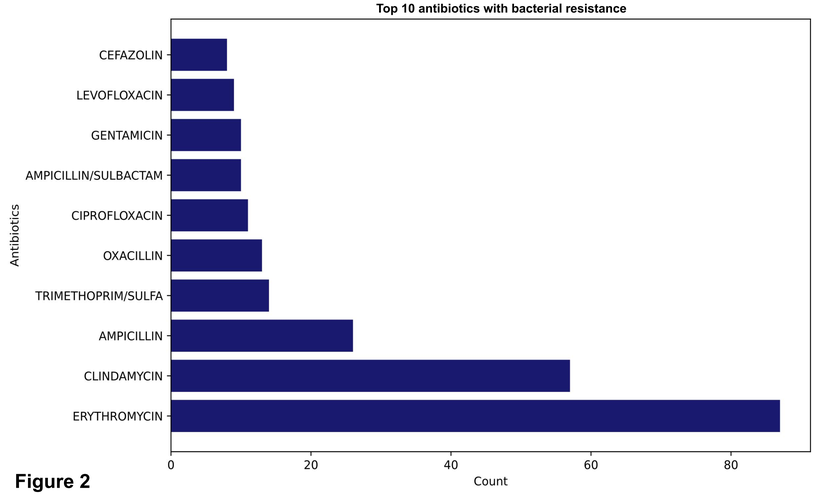


Figure 2

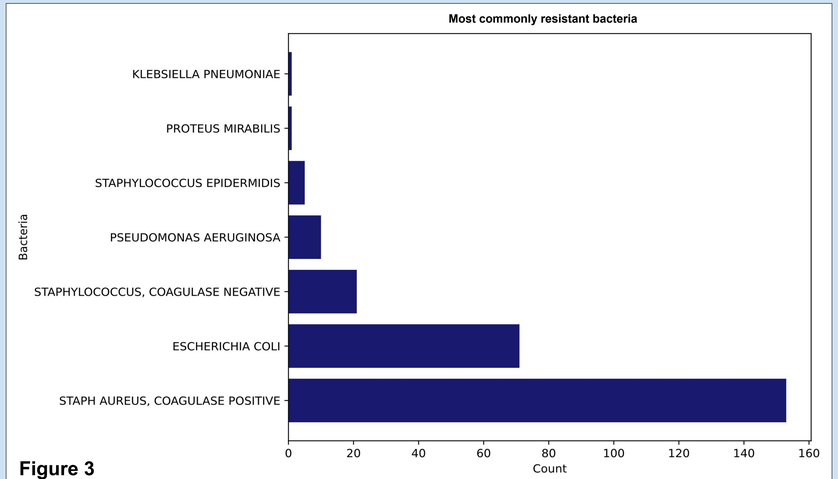


Figure 3

Discussion

- Our findings demonstrate the spectrum of ocular microbial isolates and their patterns of antibiotic resistance.
  - Previous studies have similarly demonstrated bacteria in the *Staphylococcus* genus are the most commonly isolated from ocular cultures.[1]
  - Antibiotic sensitivity results in keeping with previous research highlighting fluoroquinolones as among the most effective antimicrobials in vitro against bacterial ocular infections.[2]
- Further research is needed to identify targetable hospital and community-based risk factors for ocular antimicrobial resistance.

Limitations:

1. Single centre analysis of a tertiary academic medical centre in the USA.
   a. Results may not be fully comparable to UK/worldwide patterns of antimicrobial resistance
2. Deidentification of patient admission dates in MIMIC-IV prevents analysis of temporal trends in antimicrobrial resistance.
3. Decision to send ocular samples for culture depends on hospital policy and/or individual clinician practice.
   a. This may influence the distribution of bacteria cultured and corresponding spectrum of antibiotic resistance identified.

[1]Tewldemedhin et al. BMC Ophthalmology. doi:10.1186/s12886-017-0612-2
[2]Grandi et al. Eur J Ophthalmology. doi:10.1177/1120672119896419