Case report

The absence of prophylactic antibiotics administration and the surgical site infection rate in Mohs micrographic surgery

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Abstract

Background: The use of prophylactic antibiotics in dermatologic surgery, particularly in Mohs micrographic surgery (MMS), remains a gray area. Despite the low rate of surgical site infection (SSI), SSI can result in some significant morbidities. Thus, numerous dermatologists keep administering prophylactic antibiotics in MMS.

Method: A search was conducted to identify clinically significant topics followed by literature review through the main available medical literature database. The three selected studies that met the inclusion and exclusion criteria were then critically assessed for their validity, importance, and applicability using the guidance from Centre for Evidence-Based Medicine for Critical Appraisal of Prognostic Studies.

Results: Three articles showed a low SSI rate with a narrow confidence interval (CI): 0.91% (95% CI: 0.38%–1.45%), 0.7% (95% CI: 0.21%–1.19%), and 0.72% (95% CI: 0.5%–0.9%).

Conclusion: Based on the available studies, we conclude that the absence of prophylactic antibiotics is not related to the SSI incidence.

Keywords: Mohs micrographic surgery, antibiotic, infection

Background

Mohs micrographic surgery (MMS) is considered a clean dermatologic procedure.1 Coupled with evidence in the literature, the statistics show a low surgical site infection (SSI) incidence in clean dermatologic surgery; thus, prophylactic antibiotics are occasionally not used.1,2 Despite of this, numerous dermatologic surgeons keep administering prophylactic antibiotics as routine precaution without rational consideration due to the fear of the significant morbidity caused by SSI. The use of prophylactic antibiotics to prevent SSI remains controversial. In the light of this issue, an evidence-based case report was carried out to provide confirmative evidence whether prophylactic antibiotics used prior to MMS would significantly reduce the incidence of SSI or not.

Case illustration

A 75-year-old man with no significant medical history presented with a slow-growing hyperpigmented nodule on his right nasal ala since 1.5 years ago. The tumor size was 190 mm x 140 mm with circumscribed rolled border corresponding to a basal cell carcinoma. Laboratory test results for complete blood count, glucose, and coagulation tests were within normal limit. Two-stage MMS was performed on the patient with dorsal nasal flap reconstruction; the operation lasted for 4.5 hours. The lesion was covered with three layers of sterile cotton gauzes and fixated with paper tape between stages. The procedure resulted in a defect measured 700 mm x 300 mm. The clinician questioned whether the absence of prophylactic antibiotics would increase the SSI incidence in a typical MMS scenario without any risk factor.
Clinical question

In patients undergoing MMS, the prognosis for developing SSI without prior prophylactic antibiotics must be determined.

Using the patient/problem, intervention, comparison, and outcome[s] of interest (PICO), this problem was broken down as follows:

- **P** = Patient undergoing MMS
- **I** = No prophylactic AB
- **C** = No comparison
- **O** = Prognosis for SSI

Methods

Article search

The search for relevant articles was performed on the PubMed, Science Direct, and Clinical Key databases on April 10th, 2017 (Table 1).

Table 1. Literature search strategy

| Database       | Search Strategy                                                                 | Hits  |
|----------------|---------------------------------------------------------------------------------|-------|
| PubMed         | Mohs OR dermatologic surgery AND (prophylactic OR prophylaxis) AND (antibiotic) AND (infection) | 2024  |
| Science Direct | Mohs OR dermatologic surgery AND prophylactic OR prophylaxis OR antibiotic AND infection | 825   |
| Clinical Key   | Mohs OR dermatologic surgery AND prophylactic OR prophylaxis OR antibiotic AND infection | 33    |

Article selection

Article selection was based on the inclusion and exclusion criteria. Manual search of the references section of electronically identified articles was also performed. Our search strategy, inclusion and exclusion criteria, and the results are presented in the flowchart (Figure 1).

Critical appraisal

Critical appraisal was conducted using the guidance from Oxford Centre for Evidence-Based Medicine for Critical Appraisal of Prognostic Studies. In general, the assessment was conducted from three aspects: validity, importance, and applicability.

Results

Based on The Oxford 2011 Levels of Evidence, the best evidence to answer a prognostic clinical question is by systematic reviews of inception cohort studies. Saco et al. performed a systematic review on topical antibiotic prophylaxis on preventing SSI after dermatologic procedures. However, none of the articles used the inception cohort study design. Furthermore, two studies included patients who underwent MMS. These studies were conducted by Maragh et al. and Rogers et al.; we decided to obtain a manual literature search on both articles. Given that the next highest level of evidence for prognosis was individual inception cohort study, we selected another relevant article written by Alam et al. Tables 2, 3, and 4 show the study characteristics, critical appraisal, and study applicability, respectively.
**Inclusion criteria:**
- Patient undergoing MMS
- Without the use of prophylactic antibiotic
- Cohort study

**Exclusion criteria:**
- Reported in a language other than English
- Animal study
- Patient with heart valve or recent prosthetic joint surgery
- Follow-up performed > 30 days postoperatively

**Figure 1.** Flow chart of literature search
### Table 2. Study characteristics

| Article (year)       | Study design          | Domain                      | Number of Patients | Determinant                              | Outcome | Follow-up period                                      |
|----------------------|-----------------------|-----------------------------|--------------------|------------------------------------------|---------|------------------------------------------------------|
| Rogers et al. (2009) | Prospective case series | Patients underwent MMS      | 1000               | No use of prophylactic antibiotics       | SSI     | Between 5 and 14 days postoperatively               |
| Maragh et al. (2005) | Prospective case series | Patients underwent MMS      | 1000               | No use of prophylactic antibiotics       | SSI     | 1st and 4th week postoperatively                    |
| Alam et al. (2012)  | Inception cohort      | Patients underwent MMS      | 8300               | No use of prophylactic antibiotics       | SSI     | 24-h until 1 month postoperatively                  |

### Table 3. Critical appraisal

| Criteria | Validity | Importance | Applicability* | LoE |
|----------|----------|------------|----------------|-----|
| Article (year) | Sample definition, representative, same baseline | Sufficient follow-up time | Blinded Outcome | Prognostic factor adjustment in an independent group of test-set patients | Outcome | Precision of prognosis (95% CI) | Based on population, intervention, and outcome | Based on Oxford CEBM |
| Rogers et al. (2009) | + | + | N/A | - | - | 0.91% (0.38%–1.45%) | + | 4 |
| Maragh et al. (2005) | + | + | N/A | - | - | 0.7% (0.21–1.19%) | + | 4 |
| Alam et al. (2012) | + | + | N/A | + | + | 0.72% (0.5%–0.9%) | + | 2 |

*: appropriate  CI: confidence interval  * Applicability criteria are shown in Table 4  - : not appropriate  N/A: not applicable  LoE: Level of evidence
Table 4. Study applicability

| Article (year) | Population similarity | Intervention similarity | Outcome similarity |
|---------------|-----------------------|-------------------------|--------------------|
| Rogers et al. (2009) | -                     | +                       | +                  |
| Maragh et al. (2005) | +                     | +                       | +                  |
| Alam et al. (2012) | +                     | +                       | +                  |

Discussion

In MMS, several conditions that merit consideration for prophylactic antibiotics are patients with potential increased risk for infective endocarditis or hematogenous total joint infection. However, most dermatologic surgeons are still using prophylactic antibiotics without any of the above indications. This intense vigilance, due to the need to bandage patients while awaiting histopathologic confirmation for clear surgical margins, renders MMS as a clean rather than a strictly sterile procedure. In addition, complex repairs, namely, flap and graft, prolong closure time, thus increasing the wariness of SSI. Other opinions are in favor of the use of prophylactic antibiotics for certain anatomical sites, such as nose, ear, oral mucosa, below the knee, and multistage procedures.

In the protocols used by dermatologic surgeons in Dr. Cipto Mangunkusumo Hospital, prophylactic antibiotics are administered to MMS patients due to the lack of data on SSI incidence in the hospital. Furthermore, World Health Organization reported a higher SSI incidence in low- and middle-income countries, with the number reaching up to 4 times higher than that in high-income countries. The incidence varies between 1.2% and 5.2% among developing countries.

Contrary to popular belief, all the included studies in this evidence-based case report reported low SSI rates among patients who underwent MMS without antibiotic prophylaxis. All the data were supported with a satisfying narrow CI range. Rogers et al. conducted a study at the primary private offices and MMS clinics in New York by fellowship-trained Mohs surgeons. The results showed that 0.91% (95% CI: 0.38%–1.45%) patients developed SSI, confirming that SSI is exceedingly rare and accentuates the safety of performing clean MMS technique in the outpatient setting without the use of prophylaxis antibiotic. The limitation of this study is that it is a single-institution prospective uncontrolled research.

Another study was conducted by Maragh et al. at a tertiary teaching hospital in New York. Similar to the work of Rogers et al., this research was a single-institution prospective uncontrolled study. The overall wound infection rate was 0.7% (95% CI: 0.21%–1.19%). Maragh et al. presented the prognostic factors based on the tumor site, closure type, and stage required despite the lack of adjustment for important prognostic factors. Of the MMSs performed, the infection rates involving the nose, flap closures, and multistage procedures were 1.7%, 2.4%, and 0.8%, respectively; these numbers were exceedingly low and in contrary with the general belief.

The study by Alam et al. was a multicenter prospective inception cohort study involving 21 private and 2 referral centers for MMS from different geographic locations in the United States. Alam et al. evaluated several major adverse events associated with MMS, one of which was SSI. Among the 8300 patients who underwent procedures without prophylactic antibiotics, 83 were reported to develop SSI at a rate of 0.72% (95% CI: 0.5%–0.9%). Although the use of prophylactic antibiotics may reduce SSI, given the absolute risk reduction for each type of procedure at 0.52% (p < 0.001), it only provides small-scale clinical benefits in infection reduction. In the context of cost-benefit analysis, Alam et al. argued that the expense of therapeutic oral antibiotics in event of SSI would cost considerably more than preventing a single infection.
Conclusion

Based on the publications appraised in this evidence-based case report, the absence of prophylactic antibiotics in MMS is a not a significant cause of SSI. The use of prophylactic antibiotics in our MMS protocols requires further evaluation. Further studies should examine the other risk factors for SSI based on patient, tumor characteristics, and surgery techniques, all of which have not been studied in combination.

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