Post-Operative Infections Following Dentoalveolar Surgery Admitted to an Oral and Maxillofacial Surgery Tertiary Centre

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Introduction

Post-operative infections (POI) represent a critical complication in oral and maxillofacial surgery (OMS), with implications for patient morbidity, hospital resource utilisation and long-term clinical outcomes. In South Australia, there is a single OMS Unit that operates within a tertiary hospital. Any severe odontogenic infection will generally be referred for management through this Unit, either as an inpatient or outpatient. This Unit has an Acute Head and Neck Infection protocol which aims to streamline patients to identify high risk patients with a risk of airway compromise.

The clinical management of POI varies based on the clinical context and associated patient factors, with variables such as fascial space involved, comorbidities of the patient, admission length, intensive care unit admission, type of anaesthetic provided and choice of antimicrobials.

Antibiotics play a key role in the management of severe odontogenic infections, with current Australian guidelines advising the use of systemic antibiotics as an adjunct to surgical intervention, and only in the presence of severe deep space involvement or failure to respond to primary surgical therapy. From a POI perspective, the disease journey can be split into treatment completed within Phase 1 (the initial dental surgery), and Phase 2 (the subsequent management of the severe odontogenic infection in the hospital). Antibiotic resistance can also complicate POI, as demonstrated by a previous study from South Australia that the antibiotic resistance rate within a group of patients with severe odontogenic infections was 17.8%.

This retrospective cross-sectional audit aimed to identify treatment variables from Phase 1 and Phase 2 in the POI disease journey, patient factors associated with admission and changes over a five-year period.

Materials and Methods

A retrospective audit was performed at the chosen tertiary hospital between January 2019 and December 2023, for patients admitted to the Oral and Maxillofacial Surgery Unit with a spreading odontogenic infection. Inclusion criteria included a severe odontogenic infection subsequent to a surgical procedure completed previously, patient ages of 18 and above and patients admitted to the tertiary hospital OMS Unit in South Australia. Exclusion criteria included patients who required the causative tooth to

be removed during their inpatient stay, patients admitted for normal post-operative swelling of a procedure, non-odontogenic orofacial infections and non-infectious diseases (such as trauma, cancer or elective surgeries).

Results

3.1 Patient Presentation Data

Over 5 years, 107 patients were admitted associated with a POI. There were 33 admissions (30.8%) in 2023, as compared with 15 (14.1%) in 2020, with the remaining years between this range. The month of July had the greatest number of admissions over the study period with 17 (15.9%), whilst 4 (3.8%) patients presented during May. The mean and median age of admission was 43.5 years and 38 years respectively (range: 19–88 years). Most patients were in the 31–40 years of age category (28.0%; n = 30), followed by 21–30 years of age (25.2%; n = 27), 51–60 years of age (16.8%; n = 18), 41–50 years of age (11.2%; n = 12) and 71–80 years of age (8.4%; n = 9). Females showed a slightly higher presentation, with 57.9% (n = 62), compared with males at 42.1% (n = 45).

Based on the Australian Bureau of Statistics (ABS) Socio-Economic Indexes for Areas, 53.1% (n = 53) of the postcodes of the admitted patients are in the high socio-economic advantage range (deciles 8, 9 and 10), with 22 (20.6%) coming from decile 1, 2 or 3.

3.2 Patient Health Data

Of the admitted patients, 13 (12.1%) had a diagnosis of type 1 or 2 diabetes Hypertension was a medical diagnosis for 14 (13.1%) patients; nine (8.4%) patients had hyperlipidemia; five (4.7%) patients had hypothyroidism; and 3 (2.8%) patients took denosumab for osteoporosis. A total of four (3.7%) patients were on immunosuppressants. Most patients were non-smokers (63.6%; n = 68), and 29 (27.1%; n = 29) patients were current smokers, with the remaining 10 (9.3%) being ex-smokers.

3.3 Phase 1 Data

Mandibular teeth were most commonly involved in the original procedure, with 95 (88.8%) patients having had a mandibular tooth removed. There were 11 (10.3%) cases of maxillary teeth removed during the initial surgery, and one (0.9%) patient had floor of mouth surgery initially. In 75 (70.1%) of patients, there was one tooth initially removed, and 24 (22.4%) had two teeth initially removed.

Initial treatment providers were dental students for eight (7.5%) patients; qualified dentist for 56 (52.3%) patients; house dentist at the Oral and Maxillofacial Surgery unit for nine (8.4%) patients; periodontist for two (1.9%) patients; Oral & Maxillofacial Surgery registrar for nine (8.4%) patients; and Oral and Maxillofacial Surgeon for 23 (21.5%) patients. Two (1.9%) patients were initially treated overseas, where the operator and clinic details were not found.

The initial surgery was found to be routine in 58 (54.2%) cases, with a surgical approach required for the remaining 49 (45.8%) cases. Procedures were mostly completed under local anaesthesia (73.8%; n = 79), with the remaining completed under general anaesthesia (22.4%; n = 24) or intravenous sedation (3.7%; n = 4).

Antibiotics were given during the initial procedure to 36 (33.6%) patients; 18 (16.8%) received amoxicillin; six (5.6%) received amoxicillin and metronidazole; five (4.7%) received amoxicillin with clavulanic acid; five (4.7%) received cefalexin and metronidazole; one (0.9%) received clindamycin and another received phenoxymethylpenicillin.

3.4 Phase 2 Data

The infection onset in days had an average of 17.4 days following the initial surgery, with a median of 5 days. There were two admissions (one being 240 days following the initial procedure and another 547 days following the initial procedure) which were significantly higher than the remaining admissions, with one case being a coronectomy and the other case a wisdom tooth removal with a retained root tip. The spaces involved in the infection (as per the diagnosis) included buccal space infections (15.0%; n = 16), canine space (0.9%; n = 1), Ludwig's angina (2.8%; n = 3), multispace infections (0.9%; n = 1), parapharyngeal space (6.5%; n = 7), parotid space (0.9%; n = 1), pterygomandibular space (5.6%; n = 6), sublingual space (6.5%; n = 7), submandibular space (42.1%; n = 45), submasseteric space (9.3%; n = 10), submental space (5.6%; n = 6), and temporal space (3.7%; n = 4). Of the patients, 77 (72.0%) were admitted to ICU during their stay, primarily due to infection severity rather than medical comorbidities, especially given the airway risk associated with severe odontogenic infections. The average length of admission for patients was 5.4 days, with a median of five.

The most common antibiotic given during the inpatient admission was metronidazole, and this was given to 99 (92.5%) patients, followed by cefazolin, which was given to 84 (78.5%) patients. Seven (6.5%) patients were given amoxicillin/clavulanic acid or benzylpenicillin. For penicillin-sensitive patients, clindamycin was used in four (3.7%) patients. Piperacillin/tazobactam was given to five (4.7%) patients. Three (2.8%) patients received vancomycin and one (0.9%) patient required meropenem.

3.5 Antimicrobial Data

Clinical microbiological data was available for 68 (63.6%) patients with sensitivity panels performed on a smaller subset (n = 40; 37.4%). Bacterial cultures demonstrated the majority of infections to be polymicrobial in nature. The total rate of resistance to any antibiotic was 35% (n = 14). Infections with identified antibiotic-resistant organisms demonstrated a poorer clinical response to treatment. Compared with the total sample

population, the presence of antibiotic resistance resulted in statistically significant differences in length of hospital admission.

Discussion

This study reviews the prevalence, features, and management of POI after dentoalveolar surgery at a tertiary oral and maxillofacial centre in South Australia. Admissions rose from 15 in 2020 to 33 in 2023, possibly due to delayed dental care during COVID-19, leading to more severe cases. Earlier research showed fewer dental abscess presentations initially, followed by a spike in serious odontogenic infections. For POI, delays in treatment may allow infection to progress beyond primary care, requiring referral to a tertiary facility.

The mean age of patients with POI (43.5 years) is similar to previously reported studies regarding POI following dental surgery, a cohort of patients actively involved in the workforce. Previous studies have reported the increase in male presentations with severe odontogenic infections to a hospital; however, this study found a slight predominance of females with POI at 57.9%.

There is an overrepresentation of patients from high socio-economic advantaged areas, with 53.1% of patients coming from postcodes within deciles 8, 9 and 10 and 20.6% of patients came from deciles listed as either 1, 2 or 3. Previous studies have discussed the increased severity of dental issues in lower socioeconomic patients. It is postulated that patients with higher socioeconomic status access dental care earlier in the disease process. Commonly, patients of lower socioeconomic status will present to a hospital with a severe odontogenic infection and have the causative tooth present.

Mandibular molars were the most common source of POI with 88.8%, similar to previous studies. The reason mandibular molars are common with POI is likely due to the requirement for such cases to be managed via a general anaesthesia due to spread of infection to the submandibular space. Post-operative infections from maxillary teeth can be managed under local anaesthesia with incision and drainage.

The study revealed that 45.8% of initial procedures required a surgical approach, which has been shown to be associated with a higher risk of POI due to increased tissue trauma and longer operative times.

Odontogenic infections are generally polymicrobial and the majority are caused by mixed aerobic and anaerobic bacteria. Of the specimens taken for sensitivity testing, 35% showed resistance to an antibiotic, significantly higher than previously reported in South Australia at 17.8,%; however, the sample size in this study is considerably lower. Penicillin resistance rates appear stable, and the absence of resistance to amoxicillin/clavulanic acid is encouraging, as this combination remains a cornerstone of empirical therapy for severe odontogenic infections.

This study showed patients with identified antibiotic resistance demonstrated a statistically significant poorer response to surgical therapy with longer admissions and a greater requirement for repeated surgical drainage. Multi-disciplinary management of such cases involving infectious disease physicians is critical for guiding the correct use of broad-spectrum antimicrobials.

The average inpatient stay of 5.4 days was in line with similar studies. Of note was the amount of general anaesthetic facilities required, with 81.3% of patients requiring an anaesthetic and subsequent admission to the intensive care unit for post-operative observations and management. Using the figures from a study previously completed in South Australia estimating that each admission is above $12,000 for odontogenic infections, we can estimate the costs incurred from the POI to be $1.3 million over the study period.

This study has several limitations that should be acknowledged. Firstly, it is not possible to retrieve records from the original procedure for all patients, as the majority have come from private practice. Therefore, there is a reliance on the clinical notes from admission to discharge, which can be inaccurate or not report the history of the original procedure in detail. A further limitation is given by the retrospective study design, the variables identified simply show association rather than causation. Finally, the sample size is not large for describing antimicrobial resistance and would benefit from an expanded cohort set.

Future research should ideally focus on prospective studies within the single centre to better understand risk factors for POI, incorporate private practices, and have a deeper analysis of medical comorbidities which contribute to POI.