

## Odontogenic Infections in Pregnancy: Case Studies

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### ABSTRACT

**Introduction:** Globally, dental diseases in pregnancy have been reported to affect between 10% and 50% of pregnant women. In Tanzania, periodontal disease burden among pregnant women stands at 14.2%. Despite improvements in antenatal care (ANC) attendance, oral cavity examination is not part of the ANC package in Tanzania. Consequently, oral health evaluation receives little attention from healthcare providers during routine ANC, exacerbating the risk of dental complications during pregnancy.

**Case studies Presentation:** This report presents four distinct cases of dental issues leading to severe complications, including brain abscess, empyema thoracis, Ludwig's angina, and maternal sepsis. A multidisciplinary approach was employed in managing these cases, tailoring interventions based on individual patient needs. While three cases resulted in positive maternal outcomes, one case experienced poor outcomes due to Ludwig's angina. Unfortunately, perinatal deaths occurred in three cases, attributed to preterm delivery and intrauterine foetal demise, with only one case yielding a favourable perinatal outcome.

**Conclusion:** The reported case studies underscore the critical importance of integrating oral cavity evaluation into routine ANC to facilitate timely diagnosis and appropriate management, thereby reducing associated morbidity and mortality risks.

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### INTRODUCTION

Dental diseases encompass a spectrum of conditions, including primary dental caries, gingivitis, periodontitis, and severe systemic manifestations such as dental abscesses, Ludwig's angina, thoracic empyema, and cerebral abscesses.<sup>1</sup> Globally, the prevalence of these conditions during pregnancy is reported to range from 10% to 50%.<sup>1-3</sup> In Tanzania, the burden of periodontal disease among pregnant women is reported to be 14.2%.<sup>4</sup> However, its prevalence in the Lake Victoria zone, North-western Tanzania has not been reported, suggesting a potential underestimation of the problem in this region. Between 2021 and 2022, approximately 45 cases of severe odontogenic infections were admitted at Bugando Medical Centre (BMC) which is the tertiary hospital that serves a catchment population of approximately 10 million population and has only 2 dental surgeons, 2 maxillofacial surgeons and 6 Dental nurses.

During pregnancy, physiological changes such as decreased gastric motility, relaxation of the lower

oesophageal sphincter due to increased progesterone hormone levels, and gastric compression from the gravid uterus collectively predispose pregnant women to heightened intraoral acidity.<sup>5</sup> These conditions create an environment conducive to a bacterial shift towards more acidophilic and cariogenic flora.<sup>5</sup> However, hormonal changes during pregnancy predispose women to gum inflammation and infection, as well as increased cravings for sugary foods and alterations in their dietary habits.<sup>5</sup> Furthermore, cardiovascular changes during pregnancy, such as increased cardiac output and decreased blood pressure due to decreased total peripheral resistance, diminish the body's ability to compensate for sepsis related hypotension.<sup>5</sup> As a consequence, pregnant women are seven times more likely to present with dental diseases compared to the general population. They are at a heightened risk of experiencing severe forms of odontogenic infections.<sup>6</sup> Given the heightened risk of dental diseases during pregnancy, the standard of care mandates raising awareness about proper dental hygiene practices,

scheduling bi-monthly dental check-ups, and fostering a multidisciplinary approach involving collaboration between dentists, nurse midwives, and obstetricians to minimize dental pathologies.<sup>7</sup> Odontogenic infections have the potential to spread through anatomical spaces, extending inferiorly to the mediastinum and pleural cavities, and superiorly to the periorbital or orbital tissues via facial venous drainage to the cavernous sinus. This spread can result in various systemic manifestations.<sup>8</sup> Prevention is paramount, particularly for women planning conception.<sup>9</sup> Women should also undergo regular dental reviews during antenatal care (ANC) visits to ensure optimal oral health, as dental diseases have been associated with adverse maternal-foetal outcomes.<sup>6,9,10</sup>

In this report, we present four cases of odontogenic infections complicated by cerebral abscess, thoracic empyema, Ludwig's angina, preterm birth, and intrauterine foetal death (IUID). While three cases resulted in favourable maternal outcomes, one case experienced poor maternal outcomes due to Ludwig's angina. In terms of perinatal outcomes, only one case had positive outcomes, with three cases resulting in poor outcomes attributed to preterm delivery and IUIDs. These cases underscore the urgent need for routine dental screening for pregnant women during ANC, a measure that can significantly improve both maternal and foetal outcomes in Tanzania and Sub-Saharan Africa at large.

### Case 1. Severe Odontogenic Infection Complicated by Intrauterine Foetal Death (IUID)

**Background:** A 40-year-old pregnant woman, gravida 8, para 7, living 7, was admitted at 39 weeks gestation with a referral from a district hospital. She presented with a four-day history of neck swelling on the chin region accompanied by throbbing pain radiating to the frontal part of the head, fever, and awareness of heartbeats. The patient reported a preceding toothache but hesitated to seek care due to financial constraints. There was no history of difficulty in swallowing, breathing, cough, chest pain, or convulsions. She noticed a lack of foetal movements two days before hospitalization. She had a history of booking for antenatal care (ANC) at 16 weeks and attended four visits, but the underlying problem was that oral cavity history and evaluation were not performed during any visit. Her previous obstetric history was unremarkable.

**Clinical Examination:** On examination, the patient was febrile with a temperature of 39.2°C. A tender, warm, and fluctuating swelling was noted on the right submandibular region. Intraorally, trismus and grossly carious tooth 48 were observed. The patient's blood pressure was measured at 110/74mmHg, and her heart rate was 110 beats per minute. With a body weight of 76kg and a height of 162cm, her Body Mass Index (BMI) was calculated to be 29. Abdominal examination revealed a distended abdomen with a fundal height of 38cm, an absent foetal heart rate, uterine contractions, and 5cm cervical dilation. Other examination findings were generally normal.

**Diagnosis and Management:** The patient was diagnosed with sepsis due to odontogenic infections which contributed to IUID. Laboratory investigations revealed

leukocytosis, normal haemoglobin, and normal platelet levels. Aerobic pus culture and sensitivity test showed no bacterial growth. The patient vaginally delivered a macerated baby girl weighing 3.45kg. She underwent incision and drainage (I&D) and extraction of tooth 48. Treatment included daily wound dressing, intravenous analgesics, broad-spectrum antibiotics (ceftriaxone 2g stat then 1g once daily for 7 days and metronidazole 500mg iv 8hrly for 7days), 3% hydrogen peroxide mouthwash, and dexamethasone. The patient made a remarkable recovery and was discharged on the seventh-day post-hospitalization. However, she did not return for a follow-up visit.

### Case 2. Ludwig's Angina is Complicated by IUID

**Background:** A 32-year-old woman, gravida 6, para 5 living 5, was admitted at 41 weeks gestation with a complaint of neck swelling for seven days associated with throbbing jaw pain radiating to the head and toothache. She had one previous caesarean scar and was admitted as a referral case from a district hospital. The patient reported difficulty in swallowing and breathing but denied awareness of heartbeats. She also noted the absence of foetal kicks for five days before admission. No history of blunt abdominal trauma, vaginal bleeding, or abdominal pain was reported. The patient had booked late for antenatal care (ANC) at 29 weeks, however, despite having 2 ANC visits, she did not undergo oral cavity evaluation, and both HIV and syphilis tests were non-reactive. Her past obstetric history was unremarkable.

**Clinical Examination:** On examination, the patient was fully conscious, afebrile, and mildly pale. She presented with swelling posterior to the left angle of the mandible, which was warm, indurated, and tender on palpation. Intraorally, she exhibited trismus, bulging of the left tonsillar area, and a grossly carious tooth number 36. Vital signs revealed a blood pressure of 110/78mmHg, pulse rate of 87 beats per minute, temperature of 37.2°C, and respiratory rate of 18 cycles per minute. With a body weight of 73.5kg and a height of 169cm, her Body Mass Index (BMI) was calculated to be 25.7. Systemic examination revealed reduced air entry on the lower lobes of both lungs bilaterally, with dull percussion notes on percussion. Abdominally, she had a gravid uterus with a fundal height of 36cm, confirmed foetal demise by ultrasound, and was in early labour at 3cm cervical dilation. Laboratory investigations showed anaemia with a haemoglobin level of 8.3g/dl, while leucocyte and platelet counts were within normal ranges. Other tests on renal, liver, and electrolytes were normal. Aerobic pus culture and sensitivity showed no bacterial growth.

**Diagnosis and Management:** The patient was diagnosed with deep neck space abscess and IUID secondary to odontogenic infections, with Ludwig's angina contributing to respiratory failure. She received intravenous broad-spectrum antibiotics (ceftriaxone-sulbactam 1.5g once daily for 24 hours and metronidazole 500mg eight hourly for 24hours) and underwent incision and drainage (I&D) where pus was drained from the left lateral pharyngeal space. Labour was allowed to progress for a possible vaginal delivery, during which she delivered a macerated baby boy weighing 3.2kg. An emergency tracheostomy

was performed due to respiratory distress, followed by extraction of the offending tooth. Unfortunately, the patient succumbed to respiratory failure within the first 24 hours after admission.

### Case 3. Deep Cervicofacial Space Abscess Complicated by Bilateral Empyema Thoracis

**Background:** A 33-year-old woman, para 7, was admitted as a referral case from a regional hospital after the vaginal delivery of a baby boy, weighing 1.5kg, who unfortunately died on the second day of life due to prematurity. Before delivery, the mother presented with a rapid onset of swelling on the left side of her face, preceded by toothache on the same side of the lower jaw. She experienced pain, pus discharge from the mouth, fever, difficulty swallowing, difficulty breathing, cough, and chest pain. She had booked for antenatal care (ANC) at 12 weeks, and attended twice, the underlying problem in this case was mainly the missed opportunity for oral examination during her ANC visits. Her previous obstetric history was unremarkable.

**Clinical Examination:** On examination, the patient was fully conscious, pale, and hypotensive with a blood pressure of 84/55mmHg. With a body weight of 68kg and a height of 173.5cm, her Body Mass Index (BMI) was calculated to be 22.6. A fluctuant, tender, and warm swelling was palpable on the left submental to the submandibular region, extending to the neck. The intraoral evaluation showed a root remnant number 37. Her pulse rate was 112 beats per minute, and her temperature was 39.2°C. Abdominal and pelvic exams revealed normal findings. Respiratory examination revealed reduced air entry bilaterally in both lung bases with a dull note on percussion.

**Diagnosis and Management:** The patient was diagnosed with a deep cervicofacial space abscess secondary to an odontogenic infection complicated by bilateral empyema thoracis. Laboratory investigations showed a normal random blood glucose (RBG) of 5.8mmol/L, leukocytosis with a leukocyte count of  $11.90 \times 10^9/L$ , low haemoglobin of 7.6g/dL, and normal platelet count. Other blood tests, including electrolytes, liver, and renal functions, were normal. An aerobic pus culture and sensitivity after incision and drainage revealed no bacterial growth. Chest x-ray (CXR) revealed features suggestive of bilateral pleural fluid collections.

**Management:** The patient received intravenous crystalloid fluids, analgesics, broad-spectrum antibiotics (intravenous meropenem 500mg eight hourly for 7 days and metronidazole 500mg eight hourly for 7 days) and dexamethasone 12mg twice daily for three days. She also received two units of whole blood. Treatment included incision and drainage (I&D), culprit tooth extraction, and bilateral underwater seal drainage (UWSD), resulting in drainage of 120mL and 480mL of pus on the right and left sides, respectively, within the first 24 hours. Wound dressing was performed twice daily for nearly 14 days. By the third week of hospitalization, the patient fully recovered, and her bilateral indwelling chest tubes were removed. She was discharged home and reviewed three weeks later at the outpatient clinic, where she resumed

her routine daily activities with no new complaints.

### Case 4. Brain Abscess Secondary to Odontogenic Infection in Pregnancy

**Background:** A 30-year-old woman, gravida 8, para 7 living 6, was admitted at 37 weeks gestation as a referral case from a district hospital. She presented with multiple seizures, which had occurred more than ten times and were initially treated as eclampsia with magnesium sulphate, with no response. Seven days before the onset of convulsions, she experienced a gradual onset of right cheek swelling accompanied by fever, headache, and toothache. She did not seek medical attention out of fear of losing the foetus. She had no difficulty in swallowing, breathing, coughing, or experiencing chest pain, and she reported normal foetal movements. There was no history of head trauma, vaginal bleeding, decreased urine output, blurred vision, or epigastric pain. The patient had no history of chronic diseases such as hypertension, epilepsy, or diabetes. She had booked for antenatal care (ANC) at 16 weeks, and her subsequent four ANC visits were said to be uneventful, although oral cavity examination was not offered during any of her visits.

**Clinical Examination:** Upon admission at Bugando Medical Centre (BMC), the patient was fully conscious with muscle twitching in her upper limbs. Her blood pressure was measured at 102/73mmHg, and her pulse rate was 121 beats per minute. With a body weight of 69kg and a height of 168cm, her Body Mass Index (BMI) was calculated to be 24.4. A swelling was noted over the right parotid gland extending to the temporal region, with an incision discharging pus. Examination of the oral cavity was difficult due to massive swelling and trismus. The patient also experienced labour pains, and she delivered vaginally 7 hours later, giving birth to a 3.0kg baby boy with good appearance, pulse, grimace, activity, and respiration (APGAR) scores. However, she continued to experience muscle twitching in her upper limbs, which were unresponsive to magnesium sulphate.

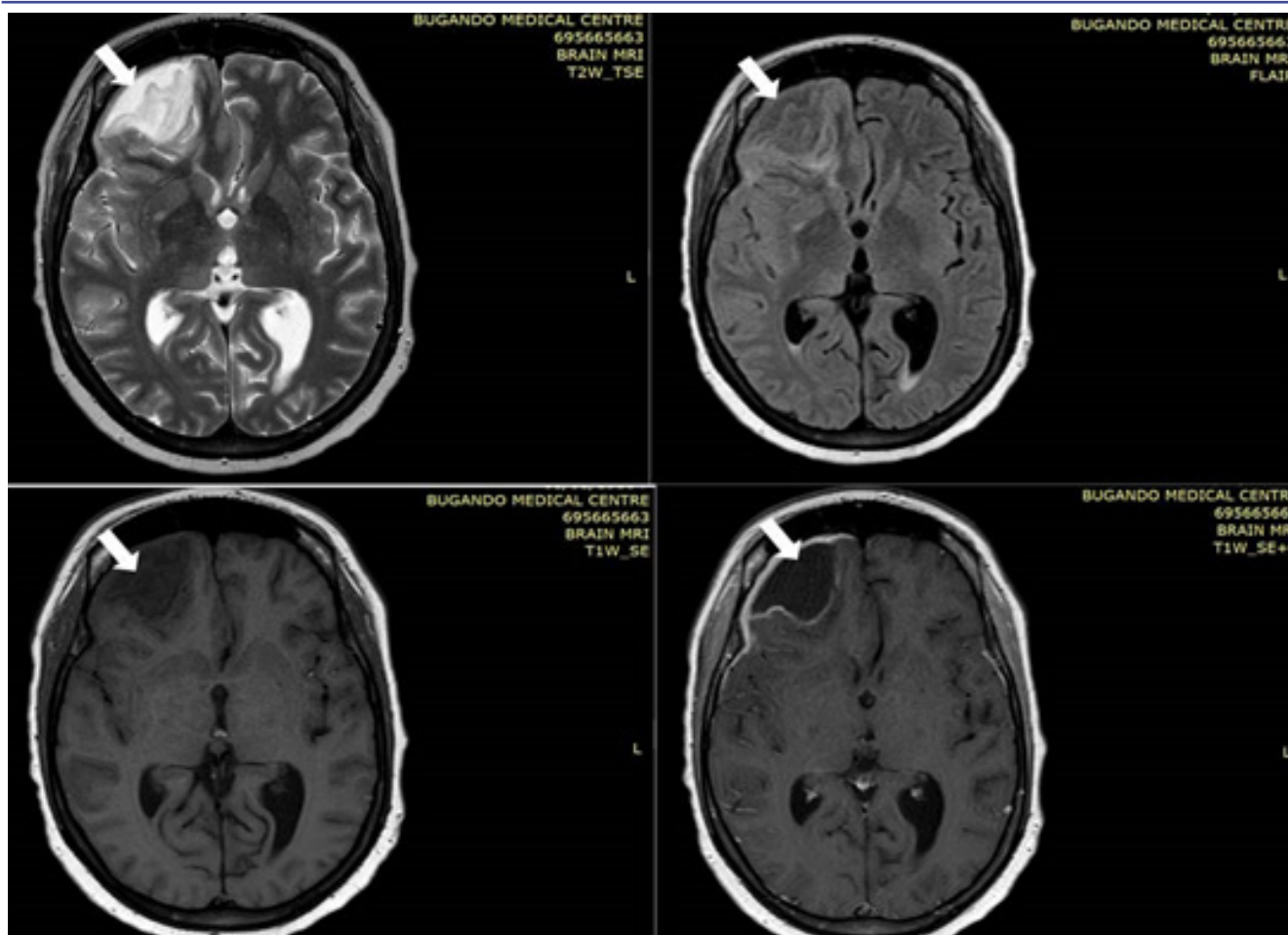
**Diagnosis and Management:** Laboratory tests, including liver, kidney, electrolytes, and a complete blood count, were normal. The patient's haemoglobin level was 11g/dL, and her leukocyte count was normal. An aerobic pus culture from the abscess drained in the neck region did not demonstrate any bacterial growth. She received a full course of intravenous broad-spectrum antibiotics (ceftriaxone-sulbactam 1.5g twice daily for 7 days and metronidazole 500mg eight hourly for 7 days) and daily dressing on the neck region. Brain Magnetic Resonance Imaging (MRI) revealed an abscess on the right frontal lobe.

On the second day postpartum, the patient underwent emergency craniotomy, and over 100mls of foul smelling pus was drained, achieving total abscess capsule removal without intraparenchymal invasion. Surgical lavage into the open sinus over the right parotid gland was performed with hydrogen peroxide and iodine washout. Postoperatively, no discharge from the right parotid region was noted throughout the admission. The patient was kept on oral anti-convulsant, and the seizures completely subsided. She was discharged on the tenth day post admission. Follow-up at one month and three

months was uneventful. The underlying problem in this case was mainly the missed opportunity for oral

examination during her ANC visits.

**FIGURE 1: Right Frontal Lobe Axial MRI**



Right frontal lobe axial MRI showing parenchymal heterogeneous T2 hyper-intensity, FLAIR iso- to hyper-intensity, T1 hypo-intensity, and T1 post-contrast peripherally avid enhancing collection (white block arrows) measuring 4.7cm in maximum axial diameter, with mass effect demonstrated by midline shift towards the left, consistent with a brain abscess.

## DISCUSSION

Odontogenic diseases in pregnancy have significant public health implications, as they have been associated with both foetal and maternal poor outcomes. However, the push towards policy change with a focus on integrated care is yet to be realized in low resource countries.<sup>4</sup> Physiological, hormonal, and anatomical changes have been linked to its increased prevalence<sup>5</sup>. Physiological changes in pregnancy such as increased gastric reflux due to decreased gastric motility and relaxation of the lower oesophageal sphincter due to increased progesterone hormone; and gastric compression from gravid uterus all predispose a pregnant woman to increased intraoral

acidity with the potential of bacterial shift to more acidophilic cariogenic flora.<sup>5</sup> Nevertheless, hormonal influence on gum predisposes the pregnant women to the inflammation and infection of the gum; furthermore, pregnant women experience increased cravings for sugar foods and have changes in their dietary habits which further worsen the condition.<sup>5,12</sup> Cardiovascular changes such as; increased cardiac output and decreased blood pressure as a result of decreased total peripheral resistance result in a decreased ability to compensate for sepsis-related hypotension predispose pregnant women to more severe forms of odontogenic infections.<sup>5</sup>

Therefore, pregnant women are seven times more likely

to present with dental disease compared to the general population.<sup>6</sup> Hence, they are prone to severe forms of odontogenic infections and adverse maternal-foetal outcomes.<sup>6</sup> In our case series, complications observed included intrauterine foetal death (IUFD), preterm delivery, perinatal mortality, Ludwig's angina, and brain abscess. However, other complications such as foetal growth restriction and low birth weight have been reported in several other studies.<sup>5,6,13</sup>

Despite documented adverse maternal-foetal outcomes in several studies,<sup>6,14-16</sup> namely, preterm birth (PTB) none of the cases presented had oral cavity examination during antenatal care (ANC), although all had at least a minimum of two ANC visits. In developed countries, oral cavity evaluation is part of prenatal care, and pregnant women should maintain good oral health throughout pregnancy.<sup>12,17</sup> However, routine dental screening for pregnant women is not common in developing nations like Tanzania, due to limited resources and conflicting healthcare requirements where dental care is often overlooked.<sup>18</sup> Furthermore, the societal myth that tooth extraction during pregnancy results in pregnancy loss and death contributes to delayed health-seeking behaviour. Therefore, this case series aims to stress the need for incorporating dental care evaluation during routine ANC so that early interventions can be provided.

Management of odontogenic infections in pregnancy requires a multidisciplinary team approach and should be individualized for improved outcomes. It involves collaboration among obstetricians, maxillofacial surgeons, dentists, midwives, anaesthesiologists, cardiothoracic surgeons, neurosurgeons, paediatricians, and neonatologists.<sup>5,6</sup> Treatment options range from giving antibiotics with or without surgical interventions. In our cases, treatment received ranged from the provision of broad-spectrum antibiotics covering both aerobic and anaerobic species, incision, and drainage (I&D), tooth extraction, daily wound dressing, underwater seal drainage (UWSD), and craniotomy, which were required in cases 3 and 4 respectively. Several authors have reinstated that the presence of ongoing pregnancy is not a contraindication for surgical treatment of neurosurgical conditions.<sup>19,20</sup> Moreover, airway management and abscess drainage is a *sine qua non*.<sup>13</sup> One of our patients succumbed to death due to respiratory failure as a result of thoracic empyema, as seen in case 2 above. However, three patients had excellent recovery, resulting in a case fatality rate of 25%. Antibiotic therapy initiated soon after diagnosis and before appropriate surgical intervention has been shown to shorten the period of infection and minimize associated risks such as bacteraemia. Nevertheless, antibiotic use should never replace the need for appropriate surgical drainage and/or debridement.<sup>13</sup>

Odontogenic infections are polymicrobial, consisting of aerobic and anaerobic species. The commonest isolate is anaerobic cocci *Prevotella spp* (80%), followed by *Fusobacterium species*, and facultative anaerobes such as the *viridans group streptococci* and the *Streptococcus anginosus* group.<sup>13</sup> Historically, penicillin has been used as a first line agent in combination with an anaerobic agent such as metronidazole in the treatment of odontogenic infections. However, due to increasing rates of penicillin resistance and treatment failures as a result of  $\beta$ -lactamase-

producing species such as *Prevotella* and *viridans group streptococci*, alternative treatment regimens may be necessary.<sup>13</sup> In serious infections, metronidazole should be used in combination with macrolides.<sup>13</sup> The choice of antibiotics should be governed by culture and sensitivity results; however, in all of our cases presented, aerobic culture and sensitivity results revealed no bacterial growth isolate. This can be explained by the inability to perform anaerobic culture in our health facility. Therefore, our patients received empirical treatment with a combination of metronidazole and either ciprofloxacin/ceftriaxone-sulbactam, or amoxiclav intravenously while waiting for culture results. Our patients had excellent clinical improvement. However, another available option for antibiotics could be clindamycin, which has been reported in other studies to have excellent activity against gram-positive organisms, including anaerobes and  $\beta$ -lactamase-producing strains.<sup>5,13</sup> In this era of antimicrobial resistance (AMR), culture and sensitivity patterns are mandated; however, when absent, commonly in resource limited settings, it should not compromise standard or empirical patient care.

The major limitation of these case studies is that only aerobic cultures were performed, and all aerobic cultures were negative due to the inability of the laboratory to isolate all the microorganisms. Largely the hospital laboratory was only able to perform aerobic cultures, which suggests that all the odontogenic infections were likely anaerobic in nature. This further necessitated providing empirical treatment using broad-spectrum antibiotics covering both aerobic and anaerobic organisms due to the polymicrobial nature of odontogenic infections.<sup>13</sup> Again, the case studies lack generalizability; thus, the findings seen cannot be representative of the general population. Additionally, the case studies may be subjective since they represent only a few dental pathology cases referred for clinical management in a tertiary hospital, and most cases would likely be managed at primary healthcare facilities. Furthermore, the likelihood of selection bias is high since the cases were picked from those who were able to obtain consent for publication, potentially resulting in overrepresentation or underrepresentation of these cases in the study sample.

The four cases presented underscore the urgent need for comprehensive dental care during pregnancy, including routine oral cavity evaluation as part of ANC. They highlight the potential consequences of untreated dental diseases during pregnancy and emphasize the importance of timely intervention and multidisciplinary management to prevent adverse maternal and foetal outcomes.

## CONCLUSION

Due to the substantial morbidity and mortality rate related to odontogenic infections in pregnancy, there is an urgent need for policymakers to redesign an ANC package which encompasses oral care. This serves as a timely reminder since the four cases above highlight the gravity with which dental disorders are handled during pregnancy. The ideal practice should prioritize oral health education and basic dental treatment, which includes oral health assessment, screening, and referral.

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