

# Hyperbaric Oxygen Therapy in Dental Surgery under General Anesthesia Anticipated an Invasive Fungal Infection

Fanny Margaretha Laihad\*

Faculty of Dentistry Hang Tuah University Surabaya.

## \*Correspondence:

Fanny Margaretha Laihad, Faculty of Dentistry Hang Tuah University Surabaya.

Received: 16 Jan 2023; Accepted: 20 Feb 2023; Published: 25 Feb 2023

**Citation:** Fanny Margaretha Laihad. Hyperbaric Oxygen Therapy in Dental Surgery under General Anesthesia Anticipated an Invasive Fungal Infection. *Microbiol Infect Dis.* 2023; 7(1): 1-4.

## ABSTRACT

**Background:** Hyperbaric oxygen therapy (HBOT) is the administration of 100% pure oxygen in a closed room pressurized more than 2 atmospheres and can be used for infections caused by fungi. Fungi are normal flora of the oral cavity but if it becomes a pathogen, this infection is difficult to detect or diagnose and therapy because there are no clinical symptoms. If tooth extraction is carried out in patients with asymptomatic fungal infection, it will result in complications and this has been widely reported in various journals.

**Purpose:** The aims of this article was to evaluate the use of HBOT in dental surgery with general anesthesia anticipated an invasive fungal infections.

**Case:** 17- year- old female who frequently uses antibiotics for headaches to multiple impacted teeth was planned for odontectomy under general anesthesia.

**Case Management:** Before performing general anesthesia, the patient is first given HBOT for 3 consecutive days. After that, a swab was taken on the oral mucosa of the impacted tooth to observe the presence of fungal growth. After surgery, HBOT was given for 3 consecutive days and the swab was taken again. There are difference results in the macroscopic appearance of fungal colonies before and after hyperbaric therapy in the operation with general anesthesia.

**Conclusion:** HBOT can be given to reduce the occurrence of cases of mild to severe fungal infection in oral.

## Keywords

Dental surgery, General anesthesia, Hyperbaric oxygen therapy, Invasive fungal infection.

## Introduction

Fungi are widespread and ubiquitous in the environment and diverse array of fungi can be found on mucous membranes of humans [1]. The human airway is continuously open to the nonsterile environment where fungal spores have the potential to reach lung tissue and produce disease. In the immunocompromised host, many fungi, including species of fungi typically considered

nonpathogenic, have the potential to cause serious morbidity and mortality [2]. Fungi are normal flora of the oral cavity, but if it becomes a pathogen, this infection is difficult to detect or diagnose and therapy because there are no clinical symptoms and are often misdiagnosed [3]. Cases of fungal infections can be detected in oral cavity are candidiasis such as thrush (acute pseudomembranous candidiasis), angular cheilitis, white patches in labial or buccal mucosa, tongue, erythematous mucosa [4]. Many other cases were triggered by tooth extraction in immunocompetent and immunocompromised patient where there were no clinical signs and symptoms before. It is suspected that a fungal infection

already exist in the oral mucosa but there are no clinical signs such as signs of inflammation. After the teeth are extracted, there are wounds that did not heal and even cause swelling and severe inflammatory signs that lead to disability and even death in cases of fungal infections such as mucormycosis and aspergillosis [5-7].

Hyperbaric oxygen therapy (HBOT) may be defined as the therapeutic administration of 100% oxygen at environmental pressures greater than one atmosphere absolute (ATA). Administration involve placing the patient in an airtight vessel, increasing the pressure within the vessel, and giving 100% oxygen for respiration [8]. A potential tool to deal with infections due to microorganisms, both bacteria and fungi, is hyperbaric oxygen [9]. HBOT has also been used to treat mucormycosis. Segal et al. evaluated the use of HBOT in 14 patients with mucormycosis and aspergillosis fungal infections with significant results [10]. Covarrubias et al. (2004) made a chart review of mucormycosis patients referred to the HBO service was performed and 5 mucormycosis patients referred for HBO had complete charts available. All patients were managed with amphotericin B, surgical debridement and HBO. Survival was 60% [11]. Laihad et al. (2015) found a suspected case of fungal infection after tooth extraction 25 without clinical signs and systemic disease, HBOT is given after no effect when given antibiotics and the results look very good even without being given antifungal drugs [5].

The case report aim was to evaluate the use of HBOT in dental surgery with general anesthesia in anticipation of invasive fungal infections.



**Figure 1:** Panoramic photo (Impacted teeth in regions 18,28,38,48).

## Case

A 17-year-old girl came to Oral surgery clinic in Central Naval hospital dr. Ramelan complains of frequent headaches to fainting in March 2017. The patient complains of frequent headaches and pain since 3 months before and it interferes with her activities and education. In history, it was found that patients often consumed analgesics and antibiotics when exposed to pain due to the illness. The patient is immunocompetent or in normal condition, no systemic diseases. Normal condition on extraoral examination. On intraoral examination, there was no visible third molars and 37 and 47 were seen only partially and tilted. At panoramic photograph, there were found impacted teeth at 18, 28, 38 and 48 which were embedded in the lower and upper jaw bones.

## Case Management

The diagnosis of this case was multiple impaction of 18, 28, 37, 38, 47 and 48 and the treatment plan was odontectomy under general anesthesia because it was a high-difficulty case where the left and right maxillary teeth were close to the maxillary sinus. It was also suspected that this operation will provide severe trauma for the patient. The possibility of invasive fungi due to excessive use of antibiotics, anticipate severe trauma which causes the patients to be given hyperbaric oxygen as prophylaxis and after surgery.

Preparations are made for general anesthesia odontectomy surgery by carrying out various examinations in accordance with standard operating procedure of the Central Naval hospital dr. Ramelan. Patient was given hyperbaric oxygen therapy (HBOT) for 3 consecutive days with a pressure of 2.4 ATA, 3x 30 minutes and before surgery, gingival mucosal swabs are performed to monitor for fungal infections in the oral cavity. Surgery was performed in the central surgical room with 47 and 48 teeth taken while only 38 were taken on the left lower jaw, 37 was still retained. For the maxilla: teeth 18 and 28 are taken with a high degree of difficulty. Surgery can be completed well for almost 2 hours. After surgery, the patient's conditions look better and after 2 days, the patient was allowed to go home. Two days later, patient returned to receive again HBOT for 3 consecutive days. Gingival mucosal swabs were again carried out to evaluate the presence of fungal infections in the oral cavity.

In this case observation was made to evaluate the growth of fungal colonies cultured after prophylaxis HBOT before surgery and after surgery and HBOT. The number of fungal colonies was not calculated but only compared their macroscopic appearance. The results before surgery showed 2 colonies of about 0.5 cm and many small colonies in the media and seen still growing.

After surgery and HBOT it looks like there was more fungal growth but in a damaged condition. In addition to visible changes in the growth of the fungus, the patient feels more comfortable after HBO

---

therapy and healing was faster. During the control to open stitches, the patient reported that the head felt lighter and the headaches had disappeared. Six-month after surgery, the patient said that she had never fainted again and this was reported when she was about to start orthodontic treatment.

## Discussion

For surgical procedures, both minor or major surgery, it is necessary to anticipate that the existing invasive fungal infections should not spread systemically by entering the body through open blood vessel (angio-invasive) that will cause undesired effects [5]. In patients with minor surgery, clinical trials have been conducted in anticipation of fungal infections through patient complaints such as pain when anesthetized and tooth extraction. It is done by swabs in the oral cavity, which are then cultured in immunocompromised and immunocompetent patients [12].

It is necessary to watch out for fungal infections in patients with normal gingival mucosa who complain of pain during anesthesia and tooth extraction. Need to be aware of the presence of fungal infection when performing surgery in the oral cavity especially in immunocompromised also in healthy patients and the possibility of spreading the infection to other organs through blood vessel. Further research is needed to ascertain the presence of fungi in the oral cavity that have been considered as a normal flora or even indicate as an invasive fungal infection. Complaints such as aches and pains when anesthetized or dental-extraction will not be found in patients with general anesthesia. For this reason, clinical trials like this need to be done to avoid angio-invasive in patients, especially for patients, which infected with invasive fungi [12].

HBOT administration in the above case based on anamnesis and trauma in operation of difficult case. From the history, it is known that patient often use antibiotics excessively so that they are likely to be infected with invasive systemic fungi. If patient often use antibiotics that would allow the emergence of fungal infections and excessive use of antibiotics will trigger fungal infections [13]. From observing the results of culture from fungal swab, leads to candidiasis which until now is still considered as a normal flora in oral cavity [14]. In this case it was seen that before the operation was carried out, there was indeed a small amount of fungal colonies resembling candida although patient already had prophylaxis HBOT and still growing, it means maybe for candida infection seems to require more than 3 times the administration of HBOT. After the second swab was done, it turned out that the fungal colonies become more numerous but were damaged by HBOT. There is a possibility after the operation it will make the fungal colony increase. With this case, it is hoped that it will provide new insights into the use of HBOT besides being used to accelerate tissue healing after surgery, it can also prevent complications due to fungal infections.

HBOT has a positive effect when used before general anesthesia surgery and after general anesthesia surgery in the oral cavity to anticipate the occurrence of angio-invasive or invasive fungal infections. Should be considered the use of HBOT as prophylaxis before surgery with general anesthesia and after surgery for acceleration of wound-healing, in immunocompetent, especially in immunocompromised patients.

## References

1. Rickerts V, Fredricks DN. Tissue diagnosis of invasive fungal infections: Current limitations and the emerging use of molecular techniques. *Current Fungal Infections Reports*. 2012; 6: 221-228.
2. Puebla, Luis Enrique Jerez. Fungal infections in immunosuppressed Patients. *Immunology and Microbiology, "Immunodeficiency"*, book edited by Krassimir Metodiev. 2012.
3. Cortez J, Gomes BC, Speidel A, et al. Mind the gap: Management of an emergent and threatening invasive fungal infection-a case report of rhino-orbital-cerebral and pulmonary mucormycosis. *Medical Mycology Case Reports*. 2013; 2: 79-84.
4. Akpan A, Morgan R. Oral candidiasis. *Postgraduate medical journal*. 2002; 78: 922.
5. Mohanty N, Misra SR, Sahoo SR, et al. Rhinomaxillary Mucormycosis Masquerading as Chronic Osteomyelitis : A series of Four Rare Cases with Review of Literature. *J Indian Aca Oral Med Radiol*. 2012; 24: 315-323.
6. Alfano C, Chiummariello S, Dessy LA, et al. Combine Mucormycosis and Aspergillosis of Rhinocerebral region. *In vivo*. 2006; 20: 311-316.
7. Laihad Fanny M, Ketut Sudiana I, Guritno Suryokusumo M. Case Report: The Diagnosis, Treatment and Outcome of a Rare Case Suspected Mucormycosis Pinnacle Medicine & Medical Sciences. 2015; 2: 2360-9516.
8. Zhang Q, Gould LJ. Hyperbaric oxygen reduce metalloproteinases in ischemic wounds through a redox-dependent mechanism. *Journal of investigative dermatology*. 2014; 134: 237-246.
9. Khiste JA, Bolde SA, Pandit GA, et al. Mucormycosis of maxillary sinus in immunocompetent patient masquerading as neoplasm: a case report. *International Journal of Oral and Maxillofacial Pathology*. 2013; 4: 4.
10. Segal E, Menhusen MJ, Shawn S. Hyperbaric oxygen in the treatment of invasive fungal infections: a single – center experience. *Isr Med Assoc J*. 2007; 9: 355-357.
11. Covarrubias LG, Barratt DM, Bartlett R, et al. Treatment of mucormycosis with adjunctive hyperbaric oxygen: five cases treated at the same institution and review of the literature. *Rev. Invest Clin*. 2004; 56: 51-55.

- 
12. Laihad FM, Supriyadi H, Hermanto E, et al. Case Report: Fungal Infections in the Normal Gingival Mucosa Affecting Oral Surgery. Pinnacle Medicine & Medical Sciences. 2017.
  13. Osanky E. The relationship between candida and Grave's disease. Ezine articles. 2012.
  14. Gupta S. Mucosal Candidiasis. Medscape. 2017.