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RESEARCH ARTICLE

ANAESTHETIC CONSIDERATIONS FOR RHINOCEREBRAL MUCORMYCOSIS CASE USING KETAMINE AS INDUCING AND MAINTENANCE AGENT: A CASE REPORT

¹Dr. Akash Gupta, ²Dr. Sadiya Shakeel and ³Dr. Malti Agrawal

¹Assistant Professor, Department of Anaesthesiology, Rohilkhand Medical College, India

²Junior resident, Anaesthesiology, Rohilkhand Medical College, India

³Professor and HOD, Anaesthesiology, Rohilkhand Medical College, India

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*Corresponding author: Akash Gupta

ABSTRACT

Mucormycosis is a life threatening illness, encountered lately as a sequel of post COVID 19 infection which is commonly found in immunocompromised individuals especially with diabetes mellitus. Due to the aggressive disease progression if not diagnosed early and treated appropriately with antifungals and surgical debridement, the mortality rate rises remarkably. Anaesthetists face challenges in view of poor general condition, hemodynamic instability and difficult airway of the patients. In this case ketamine was used as inducing agent along with propofol and was also used as maintenance agent demonstrating the usefulness and efficacy of the drug.

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INTRODUCTION

Mucormycosis, now a days, encountered as a sequelae of post COVID -19 infection mostly in immunocompromised hosts, particularly in those with diabetes mellitus and renal failure (Chandra, 2021; Singh, 2015) Although mucormycosis invades different body systems – Rhino-Orbital-Cerebral Mucormycosis (ROCM) is the most common presentation (Jiang, 2016; Gupta, 2021). It's not just the massive spread but the emergence of post COVID 19 complications that has led the anaesthesiologists into the battlefield, dealing with the aggressive disease which has increased in the number of reported cases and mortality associated with it (Gupta, 2021). The patients are shown to have raised sugar levels including high value of HbA1C and hypokalaemia as a part of electrolyte imbalance which overall predisposes to poor general condition of the patient. In order to manage the patients, early diagnosis followed by surgical debridement of the necrosed tissue and anti fungal therapy are the mainstay (Singh, 2021; Gupta, 2021; Karaaslan, 2019; Gupta, 2021; Kulkarni, 2015; Oladeji, 2013).

The real challenge lies in the anesthetic consideration in the management of these patients as they are accompanied by hemodynamic instability, acidosis (diabetic ketoacidosis) and difficult airway (Karaaslan, 2019; Gupta, 2021). Here, we present a case of post COVID mucormycosis with known case of type II Diabetes Mellitus with poor general condition and hemodynamic instability in which surgical debridement was done under general anaesthesia. Ketamine was used as inducing as well as maintenance agent.

Case report: A 50 year old male with recently diagnosed diabetes mellitus was brought on account of four weeks history of fever and cough along with sputum. About a week after the onset of these symptoms, the patient developed ulcerative lesion over hard palate and bilateral crusting in nasal cavities. The patient shortly developed bilateral blurring of vision, headache with tenderness over frontal and maxillary sinuses. Clinical examination revealed chronically ill looking, cachexic male with bilateral pedal oedema and presence of diabetic foot of the left foot. The patient was bed ridden since then. Scaly lesions were present all over body since 4-5 days.

Patient was admitted in ENT department, investigated with CT chest and endoscopy and diagnosed with rhinocerebral mucormycosis. Chest X ray findings showed nodular opacity in left lower lobe. Patient was planned and posted for debridement and Functional endoscopic sinus surgery (FESS). Pulse was 120/min, feeble and blood pressure was 90/60 mmHg. On chest auscultation, air entry was bilaterally reduced at the bases and crepitations were present. Patient's haemoglobin was 8.8 mg/dL at the time of admission, hence he was transfused with 1 unit PRBC, which raised the haemoglobin to 10.9. Lab reports further revealed HbA1C of 12.5 and urine ketones as positive. After physician's reference, sugar was optimised using human regular insulin as per sliding scale and long acting insulin and urine ketones later turned to negative. Serum potassium was marginally reduced at 3.2 mmol/L. The kidney function test and coagulopathy were within normal range. Patient was nebulised with ipratropium bromide and levosalbutamol in the night and morning before surgery.

Mode of Anaesthesia: On arrival to operating room, patient was connected to all standard monitors including Non-invasive blood pressure (NIBP), peripheral oxygen saturation (SpO₂), heart rate (HR), electrocardiogram (ECG) and end tidal carbon dioxide (EtCO₂). Patient's BP was 92/66 mmHg and HR was 96 beats/min. Pre-medication was done with Inj. Midazolam 1mg I/V, Inj. Butorphanol 1mg I/V and Inj. Glycopyrrolate 0.2 mg I/V. Following 3 minutes preoxygenation with 100% oxygen, anaesthesia was induced with Inj. Ketamine 50 mg I/V along with Inj. Propofol 50 mg and Inj. Succinylcholine 75 mg I/V. Ketamine was used along with Propofol as patient's blood pressure was low and propofol is a cardiac depressant drug. Using direct laryngoscopy PVC endotracheal tube of size 8 mm was inserted orally under vision and fixed at 21 cm after 5 point auscultation and bilateral equal chest rise. Cuff was inflated, tube was fixed. For maintenance of Anaesthesia, oxygen – 40%, Nitrous – 60%, Inj. Vecuronium 4 mg I/V in bolus dose followed by 1 mg I/V intermittently and Inj. Ketamine 100 mg in 100 ml NS at 20 mcg/kg/min were administered. Isoflurane or any other volatile anaesthetic was avoided due to its cardiac depressant and vasodilating properties. Sugar was optimised in intra operative period with the help of neutralising drip which included– 12 U human regular insulin with Inj. Potassium Chloride 20 mEq in 500 ml DNS. RBS was charted hourly during the procedure and subcutaneous insulin was given accordingly. The choice of fluids were normal saline and Isolyte –P. Inj. Neomol 100 ml I/V was given for analgesia. Mean arterial pressure throughout the surgery was maintained around 73-80 mm Hg with the help of intravenous fluids and ketamine. 30 minutes before the closure Inj. Ondansetron 4 mg I/V was administered. Ketamine infusion was stopped 20 minutes and Nitrous 5 minutes, prior to the closure. After attaining spontaneous respiration, patient was reversed with Inj. Neostigmine 2.5 mg I/V and Inj. Glycopyrrolate 0.5 mg IV at the end of surgery. Patient was extubated after spontaneous respiration, eye opening and following commands. Hemodynamics were maintained during and after the surgery.

DISCUSSION

Mucormycosis is a complex disease causing severe tissue destruction by endothelial invasion. It is an opportunistic fungal infection most commonly seen in diabetics and immunocompromised individuals (Kulkarni, 2015).

Table below shows variety of uses of ketamine and their doses [Anirudda Pai, 2007; Marland, 2013; Abdollahpour, 2020; Kurdi, 2014; Vuyk, 2020]

S.No.	Uses	Dose
1.	Induction of general anaesthesia	0.5 mg/kg IV 4-6 mg/kg IM
2.	Maintenance of general anaesthesia	0.5-1 mg/kg IV with N ₂ O 50% in O ₂ 15-45 mcg/kg/min IV with N ₂ O 50-70% in O ₂ 30-90 mcg/kg/min IV without N ₂ O
3.	Sedation and analgesia	Bolus - 0.2-0.8 mg/kg IV over 2-3 min Infusion – 5-20 mcg/kg/min 2-4 mg/kg IM
4.	Lowers pains score and decrease opiate requirements in post operative patients	Bolus – 0.25-0.5 mg/kg (prior to surgical incision) Infusion – 50-500 mcg/kg/hr (post op)
5.	Preemptive or preventive analgesia	0.15-0.25 mg/kg IV
6.	Treatment of status asthmaticus; maintains spontaneous respiration	Bolus – 0.1-0.2 mg/kg Infusion – 0.15-2.5 mg/kg/hr
7.	Treatment for major depression; decreases suicidal ideas	0.1-0-0.75 mg/kg over 2-100 mins

These patients are chronically debilitated and cachexic and may be hemodynamically unstable or at the lower limit of stability (Singh, 2015; Karaaslan, 2019) Mucormycosis attacks many organ systems and may be accompanied by hemodynamic instability and difficult airway management. Our patient had history of long-standing DM making him immunologically compromised (Gupta, 2021; Karaaslan, 2019). Anaesthesia providers must pay particular attention for the maintenance of an adequate MAP and CO during the whole procedure. There is a high chance of having *hypotension* during induction and also intra-operative with *arrhythmias* therefore heightened awareness for hemodynamic parameters, respiratory parameters and also blood sugar level is needed (Gupta, 2021; Kulkarni, 2015). Our patient posed challenges like– long-standing DM, respiratory system compromised (due to post-covid pulmonary fibrosis) and also difficult airway in view of swelling and oedema in face and limited mouth opening (Oladeji, 2013). Ketamine was used for both induction (1-2 mg/kg) and maintenance of anaesthesia (10-30 mcg/kg/min) in this patient. It is known to preserve respiratory drive and its sympathomimetic properties result in increase in blood pressure and heart rate, making it an appropriate choice in hemodynamically unstable mucormycosis patient. Evidence suggests that ketamine increases MAP by 10%. It is a bronchodilator and improves the pulmonary compliance, beneficial in this patient with reduced air entry (Miller, 2011; Gregers, 2020). Induction of anaesthesia with propofol is associated with significant blood pressure reduction and hemodynamic instability especially in mucormycosis case. Since propofol has dose dependent effect on hemodynamics and is a myocardial depressant, hence can't be used alone as inducing agent here (Hosseinzadeh, 2013; Baradari, 2017; Abdollahpour, 2020). The primary aim of using Ketofol is to attain hemodynamic stability during induction. The hypotensive effects of propofol is related to impairment of the baro-reflex mechanism and systemic inhibition while ketamine stimulates CVS and increase the HR, BP and SVR. Effects of Propofol and Ketamine on CVS are opposing in action thus balance each other when used together (Hosseinzadeh, 2013; Baradari, 2017; Anirudda Pai, 2014; Marland, 2013).

Ketofol is shown to minimise the side effect of each drug and is satisfactory from a clinical point of view. It also has improved sedation consistency rather than propofol alone without any respiratory complications (Hosseinzadeh, 2013; Baradari, 2017; Anirudda Pai, 2014; Marland, 2013). Ketamine has been reported to decrease airway resistance, improve dynamic compliance, and preserve functional residual capacity, minute ventilation and tidal volume while retaining protective pharyngeal and laryngeal reflexes (Abdollahpour, 2020). Inhalational agents like Isoflurane are myocardial depressants and vasodilator, hence can't be used for maintenance of Anaesthesia in a hypotensive patient. Ketamine is henceforth a good choice in such patients for maintenance of Anaesthesia as it also increases peripheral vascular resistance. Ketamine is a useful agent for induction of anesthesia, maintenance of anesthesia procedural sedation and analgesia and reduces post operative opioid use (Anirudda Pai, 2007; Marland, 2013; Park, 2019). Ketamine when combined with Benzodiazepines/opioids, produces minimal hemodynamic perturbations, profound analgesia, amnesia and uneventful recovery (Anirudda Pai, 2007)

CONCLUSION

Anaesthetic considerations in mucormycosis patient is a daunting task. The use of combination of ketamine and propofol for induction and ketamine alone for maintenance of Anaesthesia in ROCM patient, post COVID with diabetes mellitus posted for surgical debridement proved to be efficacious in maintaining hemodynamic stability, intra and post operative analgesia without respiratory and myocardial depression. Ketamine also produced uneventful recovery and reduced opioid use leading to patient comfort and satisfaction.

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