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Correlation of Diabetes Mellitus with HbA1c levels in relation to anticipated difficult airway: Case series of 100 cases of post covid acquired Mucormycosis.

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Abstract
Mucor coupled with Diabetes with deranged HbA1c levels and use of steroids poses unique threat of difficult airway on the operation table, a challenge to anaesthesiologists. Critical airway incidents are arguably the most severe and feared complications to anesthesia practice. This is a retrospective analysis of treatment outcomes and analysis of severity of Diabetes Mellitus in correlation to HbA1c levels and difficulty in securing airway in post covid 19 recovered cases of mucormycosis. Study was conducted on patients admitted to King George Hospital, Visakhapatnam who were admitted during the period of May 2021to July 2021. All of them underwent FESS surgeries lasting 3 hours under general anaesthesia for debridement of mucor tissue. The average age of the patients were 49 ranging from 35 to 75. Most of them belonged to middle or lower social strata. Out of the 100 cases 63 cases had a Mallampati Grading of 3 and 4. When correlation to HbA1c levels were made ,54 of them had their HbA1c levels in range of 7 to 11 percent. Before intubating the patient, all the equipment for difficult airway was kept ready. It was observed that around 57 patients required bougie for endo tracheal intubation, 7 required video laryngoscope and 3 required fibreoptic laryngoscopy for intubation.
Mucormycosis in itself causes disfigurement of the face making bag and mask ventilation difficult. Coupled with usage of steroids cause facial puffiness and airway oedema leading to scenario of anticipated difficult airway. Keen attention must be given to many surgical and anesthetic considerations when planning an effective and safe anesthetic for post covid 19 aquired Mucormycosis co existing with diabetes in the ambulatory surgical setting.

Key Words: *Type 2 diabetes, Prediabetes, Hyperglycemia, Hypoglycemia, Hemoglobin A1c*

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I. Introduction

When there are more active cases of mucormycosis (123) than active COVID-19 cases (110) in the hospital, it is time to sit up and take notice how an infection, which was in the rare disease list, suddenly became an epidemic on its own, and is now surpassing the main challenge of the pandemic itself.

Caused by a fungus that thrives within bodies ravaged by diabetes mellitus, or pumped with corticosteroids, mucormycosis found favourable conditions, riding piggy back on COVID-19. The strong medications, specially steroids which doctors used on severe cases lowered their immunity, letting this fungus thrive. Poorly sterilised medical equipment, especially respiratory tubes, further encourage its growth.

HbA1c represents the percentage of hemoglobin that is glycated, or bound to glucose, and increases as the amount of glucose in the blood rises. Increased amount of HbA1c levels means ,there is inadequate glycemic control in patient. Glycated collagen can also build up in the joints of diabetic patients, causing limited joint mobility. This poses threat to the anaesthesiologist in the form of anticipated difficult airway.

Mucor coupled with Diabetes with deranged HbA1c levels and use of steroids poses unique threat of difficult airway on the operation table, a challenge to anaesthesiologists. Critical airway incidents are arguably the most severe and feared complications to anesthesia practice.

Aim

To assess the HbA1c levels of a patient who has recovered from covid 19 and suffering from Mucormycosis.

Assess the HbA1c levels and do pre anaesthetic evaluation of the patient for assessment of difficult airway. See if there is correlation between HbA1c levels and difficulty in intubation in patients undergoing surgery for debridement of Mucor tissue.

Case series

This is a retrospective analysis of treatment outcomes and analysis of severity of Diabetes Mellitus in correlation to HbA1c levels and difficulty in securing airway in post Covid 19 recovered cases of Mucormycosis. Study was conducted on patients admitted to King George Hospital, Visakhapatnam who were admitted during the period of May 2021to July 2021. All of them underwent FESS surgeries lasting 3 hours under general anaesthesia for debridement of Mucor tissue. The average age of the patients were 49 ranging from 35 to 75. Most of them belonged to middle or lower social strata. Out of the 100 cases 63 cases had a Mallampati Grading of 3 and 4. When correlation to HBA1C levels were made, 54 of them had their HbA1c levels in range of 7 to 11 percent. Before intubating the patient ,all the equipment for difficult airway was kept ready. It was observed that around 57 patients required bougie for endo tracheal intubation, 7 required video laryngoscope and 3 required fibreoptic laryngoscopy for intubation.

Diabetic stiff joint syndrome is of concern to the anesthesiologist because it may severely limit the motion of the Atlanto-occipital joint or, more rarely, the temporomandibular joint, making conventional laryngoscopy almost impossible.

Mucormycosis in itself causes disfigurement for the face making bag and mask ventilation difficult. Coupled with usage of steroids cause facial puffiness and airway oedema leading to scenario of anticipated difficult airway. Keen attention must be given to many surgical and anesthetic considerations when planning an effective and safe anesthetic for post covid 19 aquired Mucormycosis co existing with diabetes in the ambulatory surgical setting.

Besides the overuse of steroids (that are given to control falling oxygen saturation levels), COVID-19 infection is also known to increase glucose levels in blood for the infection causes damage to beta cells that produce insulin.

As insulin levels drop, glucose level goes up. COVID-19 also increases the amount of iron in blood, and iron is a good food for Mucor molds. This is one of the main cause. Some reports also tried to link the fungal disease with the new Delta (B.1.617.2) variant that originated in India and was behind the second wave. There is no study, however, to support what treating clinicians empirically say in this context.

When an unanticipated difficult airway scenario unfolds, it is key to act in a structured and coordinated manner, with no unnecessary delays. Essential equipment for management of the difficult airway must be rapidly accessed, and these tools should be logically organized.

II. Discussion

Mucormycosis is cause for concern because it spreads rapidly, mainly from the sinuses around the nose, working its way towards the brain and eating up flesh and organs in its path. Doctors in several speciality hospitals have performed complicated surgeries to save patients' lives, having removed an eye or part of a jaw. However, patients have still succumbed to the fungus.

There are reports of patients having died of it after having recovered from COVID-19. Researchers feel there could be other reasons too, for the high number of mucormycosis cases in the country, apart from the fact that diabetes mellitus is rampant in India. What this reason is, however, they are still in the dark about.

The treatment for this infection is with the drug Amphotericin B, which is given as an injection. As the fungus is a fast spreading one, it has to be diagnosed early and requires aggressive treatment, with one patient needing over a 100 injections over a four to six week period of treatment. While there are a number of manufacturers of the drug in India, production volumes were always low. Though the disease is more widely spread in India than elsewhere, still had only a small patient base. Production has be augmented with government help now, but the shortage still hasn't been met. The Centre recently lifted import duties on this drug, so the drug is easily available and cost effective .

In addition to pharmacological treatment, surgical debridement of necrotic tissue can also be used to leave living tissue as margins. This then allows for antifungal treatments to be locally delivered to infected areas.

Although Diabetes Mellitis is the most predominant underlying medical comorbidity in patients who are diagnosed with mucormycosis, the incidence of this fungal infection has increased in patients with varying causes of both innate and acquired immunosuppression. This rise in mucormycosis cases is likely to be multifactorial.

The Mucorales fungi are responsible for mucormycosis, with the Rhizopus, Mucor, and Rhizomucor organisms often being responsible for human infections. To cause infection, these fungal spores will typically enter the respiratory tract through inhalation; however, they can also enter host cells through the skin as a result of trauma or through accidental ingestion.

There are several different aspects of Diabetes Mellitis that create an ideal environment for Mucorales fungi. First and foremost, patients with Diabetes often exhibit impaired innate and adaptive immunity, which increases their susceptibility to any type of infection, particularly mucormycosis, as this infection is rarely seen in non-immunocompromised hosts.

Upon exposure to Mucorales spores, a competent immune system will send macrophages to engulf spores and prevent their germination. Comparatively, Diabetes patients often have altered phagocytic pathways, thus rendering macrophages unable to phagocytize these spores. As a result, the free spores swell and form buds throughout the blood vessels of the respiratory tract.

Although polymorphonuclear (PMN) cells are recruited to these areas, these cells often exhibit an impaired function in Diabetic patients, which limits their ability to prevent the proliferation of Mucorales. As a result, the fungal spores are able to extensively invade tissues and large blood vessels.

In addition to the altered immune system in Diabetic patients that allows for the proliferation of Mucorales fungi, both the iron and pH levels of Diabetes patients can also contribute to the development of mucormycosis. When cultured in vitro, the R. oryzae Mucorales species cannot survive in human serum due to the sequestration of iron by iron proteins. Comparatively, when present in iron-limited environments, the high-affinity iron permease allows R. oryzae to acquire iron and thrive in these environments.

When the pH of human serum is reduced, which often occurs in ketoacidosis, R. oryzae can disrupt the iron-binding capacity of transferrin. This disrupted function in transferrin, therefore, allows for free iron to be released into the serum, which can be readily used by the Mucorales spore to thrive in these environments.

There are many effects of diabetes on the human body that complicate the administration of anesthesia. For instance, diabetic patients often have high levels of irreversibly glycated collagen and ineffective collagenase activity that leads to a buildup of collagen and mucin in the tissues.

Glycated collagen can also build up in the joints of diabetic patients, causing limited joint mobility. Often times, "stiff joint syndrome" is manifest by the inability of the patient to properly display the "prayer sign": When the patient puts their palms together, they are unable to approximate the palmar surfaces of their fingers.[31] Diabetic stiff joint syndrome is of concern to the anesthesiologist because it may severely limit the motion of the Atlanto-occipital joint or, more rarely, the temporomandibular joint, making conventional laryngoscopy almost impossible.

A hemoglobin A1c (HbA1c) test measures the amount of blood sugar (glucose) attached to hemoglobin. Hemoglobin is the part of your red blood cells that carries oxygen from your lungs to the rest of your body. An HbA1c test shows what the average amount of glucose attached to hemoglobin has been over the past three months. It's a three-month average because that's typically how long a red blood cell lives.

If your HbA1c levels are high, it may be a sign of diabetes, a chronic condition that can cause serious health problems, including heart disease, kidney disease, and nerve damage.

HbA1c results are given in percentages. Typical results are below.

- **Normal**: HbA1c below 5.7%
- **Prediabetes**: HbA1c between 5.7% and 6.4%
- **Diabetes**: HbA1c of 6.5% or higher

If you have diabetes, the American Diabetes Association recommends keeping your HbA1c levels below 7%.

Hence aggressive control of diabetes, stabilization of the patient prior to surgery, early debridement of mucor tissue, precautions taken to prevent airway mishaps can be life saving in a patient of post covid infected Mucormycosis.

III. Conclusion

Post Covid -19 acquired Mucormycosis has become a disease of epidemic proportions particularly in India. The prevalence of type 2 diabetes is increasing rapidly among all age groups and all races. The risks associated with placing diabetic patients under sedation or general anesthesia are significant; HbA1c levels help us to know the long term glycemic control in a patient. Deranged HbA1c levels can cause gylcosylation of tissues leading to difficult airway scenarios. Coupled with disfigurement due to Mucormycosis along with use of steroids increase the chances of airway mishaps. Therefore, the Anaesthesiologist has an obligation to understand the pathophysiology of the disease and its common comorbid conditions. Keen attention must be

given to many surgical and anesthetic considerations when planning an effective and safe anesthetic for Post Covid 19 aquired cases of Mucormycosis patients in the surgical setting.

References:

[1]. Steinbrink, J. M., & Micheli, M. H. (2021). Mucormycosis. Infectious Disease Clinics of North America 35(2); 435-452. doi:10.1016/j.idc.2021.03.009.

[2]. Al Hassan, F., Aljahli, M., Molani, F., & Almomen, A. (2020). Rhino-orbito-cerebral mucormycosis in patients with uncontrolled diabetes: A case series. International Journal of Surgery Case Reports 73; 324-327. doi:10.1016/j.ijscr.2020.07.011.

[3]. Diabetes statistics 2021 [Online]. Available from: https://www.singlecare.com/blog/news/diabetes-statistics/.

[4]. Rammaert, B., Lanternier, f., Poiree, S., et al., (2012). Diabetes and mucormycosis: A complex interplay. Diabetes & Metabolism 38(3); 193-204. doi:10.1016/j.diabet.2012.01.002.

[5]. Centers for Disease Control and Prevention. Diabetes public health resource. Atlanta, GA: Centers for Disease Control and Prevention; 2016. Available at: www.cdc.gov/diabetes/statistics/prev/national/figpersons.html. Accessed June 2016. [Google Scholar]

[6]. National Center for Chronic Disease Prevention and Health Promotion, Division of Diabetes Translation. National diabetes statistics report, 2014. Estimates of diabetes and its burden in the United States. Atlanta, Ga: Centers for Disease Control and Prevention; 2014. Available at: www.cdc.gov/diabetes/pubs/statsreport14/national-diabetes-report-web.pdf Accessed June 1, 2016. [Google Scholar]

[7]. Population estimates. Washington, DC: US Department of Commerce, United States Census Bureau; 2016. Available at: www.census.gov. Accessed June 2016. [Google Scholar]

[8]. Statistics about diabetes. Alexandria, VA: American Diabetes Association; April 2016. Available at: www.diabetes.org/diabetes-basics/statistics/?loc=db-slabnav. Accessed June 2016.[Google Scholar]

[9]. Sheehy AM, Gabbay RA. An overview of preoperative glucose evaluation, management, and perioperative impact. J Diabetes Sci Technol. 2009; 6: 1261– 1269. [PMC free article] [PubMed] [Google Scholar]

[10]. Diagnosing diabetes and learning about prediabetes. Alexandria, VA: American Diabetes Association; 2014. Available at: http://www.diabetes.org/are-you-at-risk/prediabetes/. Accessed June 2016 [Google Scholar]

[11]. So . . . do i have prediabetes? New York, NY: Ad Council; 2016. Available at: https://doihaveprediabetes.org/index.html. Accessed June 2016. [Google Scholar]

[12]. Vann MA. Perioperative management of ambulatory surgical patients with diabetes mellitus. Curr Opin Anaesthesiol. 2009; 22: 718– 724. [PubMed] [Google Scholar]

[13]. Global report ON DIABETES. Washington, DC: World Health Organization; January 2016. Available at: http://www.who.int/diabetes/global-report/en/. Accessed June 2016. [Google Scholar]

[14]. Roberstshaw HJ, Hall GM. Diabetes mellitus: anaesthetic management. Anaesthesia. 2006; 61: 1187– 1190. [PubMed] [Google Scholar]

[15]. Diabetes pathophysiology. 3D Medical Animation; June 2014. Available at: https://youtu.be/C9XYnZdEIPE. Accessed June 2016.[Google Scholar]

[16]. Hall JE. Guyton and Hall Textbook of Medical Physiology. 12th ed. Philadelphia, PA: Saunders Elsevier; 2011. [Google Scholar]

[17]. Cornelius BW. Diabetes in the ambulatory surgery setting. Presented at the University of Pittsburgh School of Dental Medicine, Department of Dental Anesthesiology; 2015.[Google Scholar]

[18]. Longnecker DE, Brown DL, Newman MF, Zapol WM.Anesthesiology. 2nd ed. New York, NY: McGraw Hill Medical; 2012. [Google Scholar]

[19]. Cryer PE. Hypoglycemia, functional brain failure, and brain death. J Clin Invest. 2007; 117: 868– 870. [PMC free article][PubMed] [Google Scholar]

[20]. Hemphill RR. Hyperosmolar hyperglycemic state. New York, NY: Medscape; April 2014. Available at: http://emedicine.medscape.com/article/1914705-overview. Accessed June 2016. [Google Scholar]

[21]. Management of common comorbidities of diabetes. Jacksonville, FL: American Association of Clinical Endocrinologists, AACE Diabetes Resource Center; 2016. Available at: http://outpatient.aace.com/type-2-diabetes/management-of-common-comorbidities-of-diabetes. Accessed June 2016. [Google Scholar]

[22]. Saha DC, Choia IS, Plauschinat C, Kwon J, Baron M. Impact of comorbid conditions and race/ethnicity on glycemic control among the US population with type 2 diabetes, 1988-1994 to 1999-2004. J Diabetes Complicat. 2010; 24 6: 382– 391. [PubMed] [Google Scholar]

[23]. The NICE-SUGAR Study Investigators. Intensive versus conventional

[24]. Scleredema. Alphen aan den Rijn, the Netherlands: UpToDate; 2015. Available at: http://www.uptodate.com/contents/scleredema. Accessed August 2016. [Google Scholar]

[25]. Erden V, Basaranoglu G, Delatioglu H, Hamzaoglu NS.Relationship of difficult laryngoscopy to long-term non-insulin-dependent diabetes and hand abnormality detected using the 'prayer sign'. Br J Anaesth. 2003; 91 1: 159– 160. [PubMed] [Google Scholar]

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