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Neurological Aspects of Long COVID-19: A Review

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ABSTRACT

COVID-19 is a human-to-human infectious disease caused by SARS-CoV-2 virus and defined as a pandemic since early 2020. Because of the high spreadability and severity, it results in high rates of morbidity and mortality associated with the disease. There are several sets of signs, symptoms, or clinical parameters in an infected person, some persist for more than three weeks after the onset called Long COVID. This relates to disease severity, prolong hospital admission especially intensive care, isolation, underlying disease, and other conditions are still unknown. Long COVID is a condition of prolonged symptoms due to infection with the SARS-CoV-2 virus and may present with some neurological symptoms. These symptoms might appear as headache, anosmia, ageusia, sleep disorder, fatigue, and symptoms of neurodegeneration, neuroinflammation, and demyelination. These symptoms can further be detected by checking the nEV levels in COVID-19 patients. The management of patients with Long COVID syndrome should be pragmatic and symptomatic. Collaboration with a patient and multidisciplinary team is needed to support recovery. This review aims to evaluate the incidence and characteristics of long COVID.

Keywords: Long COVID, Neurological Symptoms, COVID-19, SARS-CoV-2.

1. INTRODUCTION

Since it first appeared as pneumonia caused by Coronavirus in December 2019, Severe Acute Respiratory Syndrome-Corona Virus-2 (SARS-CoV-2) has become a pandemic. In January 2020 there are significant clinical evidence that confirm human-to-human transmission. High infectivity, upper respiratory tract (and contact) transmission, relatively long incubation period, and global travel pattern are essential elements in turning this virus into a pandemic. In February 2021, there are at least more than a hundred million people in the world who have been infected by the virus and have been molecularly tested. More than two million deaths have been correlated with this disease [1]. Long COVID or post-acute COVID (persistent symptoms more than three weeks) is a clinical progression which is more complex than previously reported in Wuhan, China. Long COVID causes longer recovery period in COVID symptoms, even in patients with mild severity [2,3]. Previous research found a prevalence of long COVID symptoms ranging from 72% to 89,2% [4,5]. In reference to this high prevalence, this review aims to evaluate the incidence and characteristics of long COVID.

2. DEFINITION

Long COVID or “Post-acute COVID-19”, “Post COVID-19 manifestations”, “Long-term COVID-19 effects”, or “Post COVID-19 syndrome”, is a set of signs, symptoms, or clinical parameter which linger for more than two weeks after the onset of COVID-19 [6]. The diagnosis is purely based on the persistence of symptoms for longer than a specified period after the disease onset. This period of time varies between studies and ranges up to 8 weeks [5], but the minimum period we found on the literature was 2 weeks. The term “Neuro-COVID” is used in reference to the neurological and psychiatric manifestations of COVID-19. These neurological manifestations may also persist after recovery. Some common manifestations are headache and neurophysiological fatigue [7,8].

3. EPIDEMIOLOGY AND ETIOLOGY

Long COVID is frequently reported in recovered COVID patients with history of more severe and critical symptoms. Long COVID is also reported in individuals

with mild infections who did not need hospital admission. Gender, ethnicity, age, viral dose, disease progression, or underlying medical condition has not yet been correlated with increased Long COVID risk. Some research found more cases of Long COVID in women [3]. One research found more cases in 31-40 year old age group, female, overweight patients, patients with mild disease severity, and patients with no other comorbidities [4]. To date, there are currently no research that analyze the correlation between patients' characteristics and the incidence of long COVID.

In Wuhan, China, there are high incidences of neurological symptoms. Around 24.8% has Central Nervous System (CNS) symptoms, 8.9% has Peripheral Nervous System (PNS) symptoms, and 10.7% has musculoskeletal symptoms [7]. The etiology of these neurological symptoms is complex and multifactorial, which further correlates with cerebrovascular disease (including hypercoagulation), infection, physiological compensation, adverse effects of medication, and social aspects of COVID-19 [6].

4. PATHOPHYSIOLOGY

SARS-CoV-2 is transmitted via respiratory droplets from person to person. As it enters the body, it binds to cells' receptors and enters through endocytosis. The functional receptors of this virus is found to be ACE-2, which are expressed in abundance on pulmonary epithelial cells. As the virus binds to the nasal epithelial cells of the upper respiratory tract, it enters the cells and replicates, inducing a limited immune response. In this stage, infected individuals are highly infectious. As the infection progresses to upper respiratory tract, manifestations such as fever, malaise, and dry cough might appear. The immune response is greater and therefore enough to contain the spread of infection. Only around one fifth of all COVID-19 patients progress beyond this stage and into lower respiratory tract infection. The immune response in this stage is even greater, causing what is called a "cytokine storm" which helps fighting off the virus, but also causes inflammation and lung injury. The injury caused by inflammation and viral replication results in loss of type 1 and 2 pneumocytes. This diffuse alveolar damage might eventually leads to acute respiratory distress syndrome [9].

In patients diagnosed with viral encephalitis, gene sequencing was performed and the presence of SARS-CoV-2 in cerebrospinal fluid (CSF) was found. Some hypotheses on how this virus can enter the central nervous system are: hematogenous dissemination, neuronal retrograde transport, and entry of the virus through the nasal cavity and the cribriform plate that supports the olfactory bulb. Viruses can disseminate throughout the body via the bloodstream and damage endothelial cells by interfering with the function of

Angiotensin Converting Enzyme 2 (ACE2) [10]. This virus attacks ACE2 receptors, and these receptors are found in many neural tissues [11].

SARS-CoV-2 targets the CNS through several mechanism:

4.1. Direct infection

Neurotropism or the ability for a virus to infect the neural system of SARS-CoV-2 is related to its affinity for the ACE2 receptor in the endothelial cells. The receptor is found in the brain and is expressed in glial cells and neurons; therefore, the virus has the possibility of infecting these cells. Several studies have contrasting results regarding SARS-CoV-2 invasion in the CNS. One study did not find any presence of the virus in the brain [12], while others found viral particles in the cerebrospinal fluid and in the endothelial cells of the frontal lobe tissue [13,14]. Corona viruses may be able to enter the CNS through several hematogenous mechanisms, such as being carried by infected leukocytes which cross the Blood-Brain Barrier (BBB) and/or by directly infecting the brain vascular endothelial cells. SARS-CoV-2, however, does not implement these types of route since it was not detected in non-neuronal cells of the brain in early stage of infection [14].

Other proposed mechanism of infection is via olfactory nerves or the enteric nervous system. Olfactory nerves, however, does not express ACE2. This suggests an ACE2-independent pathway. Neuropilin-1 (NRP1) is a transmembrane receptor found in abundance on respiratory and olfactory epithelium. It is also found in the olfactory regions of the CNS. This receptor is thought to enhance the entry of SARS-CoV-2 into the brain, therefore suggesting an alternative entry route of the virus via the olfactory nerves [15].

4.2. Blood circulation

Other possible pathway is through the circulatory system. As the Blood Brain Barrier protects the CNS from most of the large circulating molecules, SARS-CoV-2 must enter the CNS using intermediate cells. These cells are the endothelium and leukocytes. ACE2 is highly expressed in the endothelial cells comprising the BBB. Therefore, direct damage of the endothelial cells by the virus might enable them to enter the CNS. Some coronaviruses are able to infect leukocytes. As the leukocytes circulate through the BBB, SARS-CoV-2 use these cells as vectors to spread [12].

4.3. Neuronal pathway

SARS-CoV-2 can enter the CNS through the vagal nerve in the lungs or by enteric nerve in gastrointestinal infection. The transport of neurotropic virus to the CNS

is facilitated by the motor proteins Kinesins and Dynein [17].

4.4. Immune mediated injury

CNS can be damaged by Cytokine Storm Syndrome (CSS) caused by SARS-CoV-2. CSS is composed mainly by Interleukin-6. Neurotropic virus can activate glial cells, leading to the production of IL-6, IL-2, and IL-5. This causes chronic inflammation of the CNS. SARS-CoV-2 can also activate CD4+, therefore causing more production of the IL-6 by macrophages [17].

Lack of ACE2 receptors causes endothelial dysfunction and can lead to neurovascular endothelitis in the brain and other organs. Hyperinflammation and endothelitis can cause disruption of the blood brain barrier, thus allowing the entry of immune cells into the brain and causing continuous inflammation. Continuous inflammation causes hypercoagulation condition [11]. This hypercoagulated state is characterized by an increase in procoagulant factors, including serum fibrinogen, platelet, IL-6, and D-dimer. The inflammatory state also increases the levels of C-Reactive Protein (CRP), IL-7 and other inflammatory markers that make atherosclerotic plaque rupture more easily. Both of these conditions lead to an increased risk of ischemic stroke in COVID-19 patients. In COVID-19, thrombocytopenia, increased levels of D-dimers, and prolonged prothrombin time can also cause bleeding. Downregulation of ACE2 can cause disruption of the renin angiotensin system. This causes vasoconstriction and an increase in blood pressure which can lead to arterial rupture and bleeding [18].

The headache found in COVID-19 cases is thought to be caused by SARS-CoV-2 invasion of the trigeminal nerve endings in the nasal cavity. Another hypothesis is trigemino-vascular activation due to involvement of vascular endothelial cells rich in ACE2 receptors. Another possible mechanism is the release of pro-inflammatory mediators and cytokines during the infection can stimulate the trigeminal nerve endings in the perivascular area, causing headache [18].

The most common neurological symptoms are headache, loss of attention, dementia, depression, anxiety, ageusia, anosmia, memory loss, and hearing loss. In addition, SARS-CoV-2 is also thought to cause myalgic encephalomyelitis / chronic fatigue syndrome (ME / CFS), a multisystem disease that can cause neurological symptoms such as sleep disturbances and decreased cognitive function. Other symptoms that might appear are brain fog and neuropathy [6].

Headache reported in COVID-19 is usually tension-type with moderate to severe severity. The pain is bilateral and gets worse when bending over. Pain is

most felt in the temporoparietal region. Intracranial bleeding is found in 0.5% of COVID-19 patients [10].

About 40% - 88% of severe COVID-19 patients have neurological symptoms, along with symptoms of neurodegeneration, neuroinflammation, and demyelination. However, it cannot be concluded that all neurological symptoms are a consequence of virus entry into the CNS. The sequelae of COVID-19 are still not widely known but basal ganglia dysfunction because of neuroinflammation of the CNS has been widely seen in COVID-19 patients [10].

In Hong Kong, prolonged muscle weakness and other myopathy were found in patients who had recovered from COVID-19. It was also found that the longest lasting symptoms were neurological symptoms. This is similar to the SARS epidemic which found CNS symptoms and chronic fatigue for four years after the first infection [11].

5. CLASSIFICATION OF LONG COVID SYMPTOMS

Based on the classification made by Fernandez-de-Las Penas *et al*, long COVID symptoms are categorized into: (a) potentially infection-related symptoms, ranging from four to five weeks after the onset of infection; (b) acute post-COVID symptoms which happen during the fifth to twelfth week after the onset of infection; (c) long post-COVID symptoms, which happen from week 12 to week 24; (d) persistent post COVID symptoms, which last more than 24 weeks.

The distinction between long and persistent phase are based on the probability of the symptoms to resolve: long post-COVID symptoms are symptoms that are resolving in a delayed manner, while persistent symptoms are those that show no improvement [19].

6. DIAGNOSIS

The diagnosis of long COVID is mainly based on clinical examinations and the persistence of symptoms more than a minimal of two weeks. Neurological symptoms that often appear in long COVID have been elaborated above. Extracellular vesicles (EV) are microvesicles that are secreted by all cells under normal or pathological conditions. EV contains cell proteins, microRNA, and nucleic acids so that it reflects the state of the cell (e.g., excretion of waste products, a signal that indicates cell damage, or as a protection mechanism). EV can diffuse through the blood brain barrier. Neuronal EV (nEV) can show the state of neurons directly. nEV containing the neurotoxic protein amyloid beta, neurofilament light, p-T181-tau, and/or the inflammatory protein HMGB1 has been isolated from patients with HIV and cognitive impairment, Alzheimer's, and traumatic brain injury. nEV can be

assessed in post-COVID patients with neurological symptoms to evaluate the patient's neurological state [20]. Radiological findings that might appear in brain MRI are olfactory bulb injury (shown by hyperintensity) caused by microbleeding and brain hemorrhage [21].

7. CONCLUSION

COVID-19 is a disease caused by the SARS-CoV-2 virus. This virus generally attacks the respiratory system, but through the blood it can spread to other organs. Symptoms of COVID-19 that persist for more than two weeks after infection are known as Long COVID. Neurological symptoms can occur in patients with Long COVID-19. These symptoms can include headaches, anosmia, attention disorders, ageusia, and hearing loss. The neurological symptoms of COVID-19 can be detected by looking at the nEV levels in COVID-19 patients.

AUTHORS' CONTRIBUTIONS

David Giffard Kawi Junior: Conceptualization, Resources, Writing Original draft.

Ilsa Hunaifi: Conceptualization, Resources, Writing Original draft, Reviewing and Editing.

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CONFLICT OF INTEREST

The Author declare no conflict of interest.

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The SARS-CoV-2 virus as the cause of COVID-19 has been declared a pandemic since March 2020. The clinical signs of COVID-19 are heterogeneous, such as 20–51% of patients were accounted have at least one comorbidity, with diabetes melitus (10–20%), hypertension (10–15%) and other cardiovascular and cerebrovascular...

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Nadya Dwi Karsa, Sukri Rahman, Al Hafiz, Hirowati Ali, Hafni Bachtiar

Nasopharyngeal carcinoma (NPC) is a malignant tumor originating from the nasopharyngeal epithelial cells. Cell-mediated immunity has an important role in growth and development of cancer. Many studies have been conducted to predict the existence of an important relationship between immune checkpoints...

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Nasopharyngeal Carcinoma (NPC) is an epithelial carcinoma originating from the nasopharynx mucosa lining. It is the most common head and necks malignant globally, especially in Asia. NPC is mostly located in Fossa of Rosenmüller, an area that is hard to observe. To diagnose NPC, radiologic imaging and...

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Camelia Herdini, Danu Yudistira, Sagung Rai Indrasari

Maxillary giant cell tumor (GCT) is a rare benign bone lesion. It usually appears in the long bones. However, in the head and neck region GCT could also occur although the frequency is only 2% of the all GCT cases. We present a case of a 20-year-old female with GCT of left maxillary sinus who underwent...

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Rimelda Aquinas, Sukri Rahman, Al Hafiz, Hirowati Ali, Hafni Bachtiar

Nasopharyngeal carcinoma (NPC) is a malignant tumour of nasopharyngeal epithelium that has a unique distribution pattern. Nasopharyngeal carcinoma is not only geographically specific but also ethnically. Some ethnic groups tend to suffer NPC. Multifactorial interactions are presumed to be the cause of...

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Danu Yudistira, Sagung Rai Indrasari, Camelia Herdini, Auliya S.B Sumpono, D.A.M. Oktorina

Nasopharyngeal carcinoma (NPC) is a squamous cell malignancy originating from the nasopharyngeal epithelium. This tumor is more commonly found originating from the fossa of Rosenmüller, which is a transitional epithelial area. NPC has a high risk of regional metastases on the neck lymphnodes. However,...

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Yussy Afriani Dewi, Agung Dinasti Permana, Ifiq Budiyan Nazar, Bethy Suryawathy Hernowo

Diffuse large B-cell lymphoma (DLBCL) is a subtype of aggressive non-Hodgkin lymphoma (NHL). Diffuse Large B-cell lymphoma is a subtype of lymphoma most often found in the head and neck region. Overall survival could be used in assessing the effectiveness of therapies that may affect prognosis and survival...

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Hamsu Kadriyan, Yudhi Kurniawan, Sang Ayu Kompiyang Indriyani, Nova L. Audrey Pieter, Masyita Gaffar, Abdul Qadar Punagi

Covid-19 with nasopharyngeal cancer (NPC) comorbidities are rare in children. Post-chemoradiation cancer patients are one of the vulnerable groups to have Covid-19 infection. The Covid-19 infection could occur in an urban and rural area. More challenging issues occur in managing Covid-19 patients, furthermore,...

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Nasal and paranasal sinus (sinonasal) malignancies are rare cases, accounting for only 1% of all malignancies of the body and 3% of malignancies of the head and neck. Patients with sinonasal tumors usually present with an advanced stage and generally have extended to the surrounding tissue. Surgery with...

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Desy Ambriani, Sukri Rahman, Al Hafiz, Hirowati Ali, Hafni Bachtiar

Nasopharyngeal carcinoma (NFC) is a malignancy that come from the nasopharyngeal epithelial cell which is that distribution has been affected by geographic and ethnicity. NFC is caused by multifactorial causes, one of the is Epstein Barr Nuclear Antigen-1 (EBNA-1). EBNA-1 affects some of the signalling...

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Yussy Afriani Dewi, Ifiq Budiyan Nazar, Betty S. Hermono

Immunotherapy acts by a system of immune modulation to destruct cells of cancer. Squamous cell carcinoma of the head and neck (HNSCC), this modality can be administered alone or combined with other therapies. Currently, immunotherapy with chemotherapy has shown better effectiveness as first-line systemic...

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Anton Sony Wibowo, Camelia Herdini, Bambang Udji Djoko Rianto

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Sukri Rahman

Parapharyngeal space (PPS) tumors are rare and constitute less than 1% of all head and neck neoplasms. Benign and malignant tumors can arise from various structures of the parapharyngeal space. The PPS is a space deep in the neck, shaped like an inverted pyramid. The parapharyngeal space is bounded medially...

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Research that Begins with a Patient in Front of You: *Legionella* Bacteria in Puddles on Roads

Ryota Sakamoto

In this article, I would like to describe researches that begin with a patient transferred to an emergency department of a local hospital in a rainy season. A patient transported after a car accident turned out to have Legionnaires' disease (LD). Although the causal relationship is unknown, *Legionella*...

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Hematologic Profile in Patients with Nasopharyngeal Carcinoma

Susilawati Susilawati, Hamsu Kadriyan, Wayan Putu Sutirtayasa

Nasopharyngeal carcinoma (NPC) patients who are undergoing chemoradiotherapy, it is important to have a hematological profile examination to see hemoglobin and erythrocyte levels, the incidence of infection that has an effect on leukocyte levels and the risk of bleeding arising from a decrease in platelet...

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Maxillofacial Fibrous Dysplasia

Christin Rony Nayoan, Dwi Antono, Rully Satriawan

Fibrous dysplasia (FD) is a rare and benign bone disorder, where normal bone and bone marrow are replaced by fibrous connective tissue mixed with irregular bone trabeculae. FD located in the maxillofacial area might lead to bone deformity, facial asymmetry, hearing loss, nasal congestion, pain, paresthesia,...

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Follicular Lymphoma Mimicking a Benign Submandibular Gland Tumor

Izry Naomi Lumbantobing

Follicular lymphoma of the submandibular gland is exceptionally uncommon. Lymphomas within the head and neck region do not have particular clinical behavior and manifestation. Furthermore, frozen section and fine-needle aspiration cytology can only provide a provisional diagnosis. Therefore, surgeons...

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Characteristics of Laryngeal Carcinoma Patients Who Underwent Surgery in Bali, Indonesia

I Gde Ardika Nuaba, Made Gita Ratnasari

Laryngeal carcinoma is a frequent malignancy in the world. However, limited data are found in Indonesia, including in Bali which is one of the famous tourism placed in the world. The purpose of this study was to determine the characteristics of patients with laryngeal carcinoma who underwent surgery...

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Association of Toll-Like Receptor-3 Polymorphism with Nasopharyngeal Carcinoma in The Minangkabau Ethnic Group

Putri Sari Ivanny, Sukri Rahman, Al Hafiz, Hirowati Ali, Hafni Bachtiar

Nasopharyngeal carcinoma (NPC) is an epithelial malignancy in the head and neck region that has a unique geographic distribution and is closely related to Epstein-Barr Virus (EBV) infection. The growth of malignancy due to viruses is largely determined by the host immune response. Toll-Like Receptors...

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Characteristics of Patients with Malignant Laryngeal Tumors in Annually Forest Fire Region in Indonesia

Rusina Hayati, Hamsu Kadriyan

Banjarmasin is one of the regions that annually face the forest fire. The fire led to the low quality of the air. The low quality of the air is one of the risk factors of the malignant laryngeal tumor. The characteristics of patient with malignant laryngeal tumor in Banjarmasin is remain unknown. This...

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Jakarta Head and Neck Oncology Surgery Priority Score (Ja-HOP)

Indra Parmaditya Pamungkas, Marlinda Adham, Bambang Hermani, Ika Dewi Mayangsari, Ferucha Moulanda

COVID-19 Pandemic has made a major change in the health care system including oncologic services. Elective surgery was mostly delayed to preserve resources and decreased COVID-19 transmission. Head and neck oncologic surgery will often be classified as "urgent" surgery and need special management in...

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COVID-19 Prediction Based on DWT and Moment Invariant Features of Radiography Image Using the Artificial Neural Network Classifier

Ditha Nurcahya Avianty, I Gede Pasek Suta Wijaya, Fitri Bimantoro, Rina Lestari, Triana Dyah Cahyawati

COVID-19 is an infectious disease caused by a family of coronaviruses, namely severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The fastest method to identify the presence of this virus is a rapid antibody or antigen test, but to confirm the positive status of a COVID-19 patient, further...

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Auricle Giant Papilloma in a 32 Years Old Indonesian Male: A Case Report

Edo Wira Candra

Head and neck squamous papilloma usually occur in the skin, oral mucosa and upper part of aerodigestive tract. Auricle giant papilloma is uncommon cases worldwide. We report a thirty-two years old Indonesian male seen with auricle giant black mass at our hospital, in Bogor. In this case, mass excision...

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Voice Improvement After Thyroid Surgery

Edo Wira Candra

Patients with enlarged thyroid gland (goiter) that cause paralysis of recurrent laryngeal nerve (RLN) or hoarseness usually have associated with thyroid malignancy. Malignancy can be directly or indirectly related to RLN. Cases of vocal cord paralysis associated with benign thyroid disease or goitre...

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Characteristics of Hearing Impairment in Patients with Nasopharyngeal Carcinoma in AR Bunda Hospital Prabumulih June 2018 - September 2019

Apriyanza Apriyanza, Denny Satria Utama

Nasopharyngeal carcinoma (NPC) is a malignant tumor that grows in the nasopharynx with predilection in the Fossa of Rossenmuller and roof of the nasopharynx. Clinical manifestations of nasopharyngeal carcinoma can be divided in Four categories: nasopharyngeal symptoms, symptoms of tubal dysfunction,...

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Management of Recurrent Regional Nasopharyngeal Carcinoma

Marlinda Adham, Gita Aryanti

Treatment result for nasopharyngeal carcinoma has improved drastically due to introduction of chemotherapy and radiotherapy combination. However, regional failure is still a common finding which occurs to 3-10% patients. Local failure can be divided into 2, residual and recurrent disease. Residual or...

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Quality of Life in a Patient with Total Laryngectomy Without Neck Dissection for Stage III Laryngeal Carcinoma A Case Report with EORTC QLQ-C30

Tengku Reza Alfisyah, Benny Kurnia, Lily Setiani, Marhaban Marhaban

Laryngeal cancer is a malignancy on larynx that may occur in glottis, supraglottic and subglottic. This malignancy is a second most carcinoma in head and neck area Clinical manifestation such as dysphonia, breathing obstruction, dysphagia, odynophagia, and hemoptysis. Reported a laryngeal cancer with...

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Hemiglossectomy with Supraomohyoid Neck Dissection on T3N1M0 Tongue Cancer Patient A Case Report

Karina Witary Ayu Siagian, Benny Kurnia, Fadhlia Fadhlia

Hemiglossectomy, surgical removal of half of the tongue, is one of the procedures for tongue cancer management. Surgery followed with supraomohyoid neck dissection (SOHND) is suggested to treat regional metastasis. SOHND is a selective neck dissection indicated for patients with T2, T3 tongue cancer...

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Management of Pleomorphic Adenoma of Submandibular Gland: A Rare Case

Elvita Nora Susana, Lily Setiani, Baluqia Iskandar

Pleomorphic adenoma is the most common benign tumor in the salivary glands but rarely in the submandibular glands. It is a mass in the submandibular, which is asymptomatic and painless. Excision of the tumor is a treatment that surgeons widely use. The study aimed to describe the management of pleomorphic...

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Management of Stage II Sinonasal Carcinoma (T2N0M0) with Transnasal Endoscopic Resection and Radiotherapy

Riska Handriani, Fadhlia Fadhlia, Benny Kurnia

Nasoethmoidal carcinoma is a malignant tumor found in the nasal cavity and ethmoidal sinuses. The early stage is rarely found due to the similarity of symptoms inflammatory process in sinonasal. The main modality for sinonasal cancer is surgery followed by radiation as adjuvant treatment. The prognosis...

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Management of Stage IVA Sinonasal Carcinoma Infiltrating Skin of Cheek: A Case Report

Luchia Elfira, Fadhlia Fadhlia, Benny Kurnia, Darmayanti Darmayanti

Advanced stage of sinonasal carcinoma that infiltrating skin of cheek is rarely found, surgery is still the main modality since the cancer has not penetrated the intracranial. Based on the distribution, Ohngren is divided into: suprastructure and infrastructure. To report the diagnosis and management...

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The Development of Health Capacity Index for a Semi-Quantitative Earthquake Hazards Risk Analysis with a Special Reference to the Lombok Earthquake Disaster 2018

Wilya Isnaeni, Suryani Asa'ad, Mochammad Hatta, Saidah Syamsuddin, Fahrin R. Andiwijaya, Didi S. Agustawijaya

Earthquakes often caused severe fatalities to human beings, as the case of Aceh earthquake 2004, and Lombok earthquake 2018. For the case of Lombok shallow earthquakes 2018, the earthquakes of a magnitude 7.0 have destroyed almost 800 thousand homes, and caused the death of more than 500 people. The...

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Cystic Adenomatoid Thyroid Nodule

Guntur Bayu Bima Pratama, Denny Satria Utama

Thyroid nodules are a common clinical problem. The prevalence of palpable thyroid nodules approximately 5% in women and 1% in men. In contrast, high-resolution ultrasound (US) can detect thyroid nodules in 19-68%. The clinical importance of thyroid nodules is to exclude thyroid cancer, which occurs in...

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Unilateral Benign Thyroid Lesion Management with Histopathology Results Following Surgery Was a Malignancy

Fadhlia Fadhlia, Elvita Nora Susana

Benign thyroid lesions are cellular differentiation into enormous sizes that can be seen from the outside without interfering with thyroid hormone. The FNAB and USG were used to diagnose thyroid lesions. Unilateral benign lesions may be treated with lobectomy or isthmus lobectomy. Case report: A 40-year-old...

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Extranodal Natural Killer (NK)/T-cell Lymphoma Nasal type A Case Report

Selvianti Selvianti

Extranodal Natural Killer (NK) / T-cell Lymphoma, Nasal type (ENKTCL-NT) is a rare type of Non-Hodgkin Lymphoma (NHL), commonly involves midline areas of the nasal cavity, oral cavity, and/or pharynx. ENKTCL-NT has a very strong relationship with Epstein Barr virus (EBV) infection. Treatment of ENKTCL-NT...

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Surgical Management of Tympanojugulare Paragangliomas: A Rare and Challenging Case of Vascular Neoplasma

Dinna Astrib, Masyita Gaffar, Nova Pieter

Tympanojugulare paragangliomas (TJPs) are benign tumors arising from neural crest cells located along the jugular bulb and the tympanic plexus. TJPs have always presented a challenge to surgeons due to the fact that these tumors are vascularize and locally aggressive and involve important neurovascular...

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Bilateral Non-Invasive Follicular Thyroid Neoplasm with Papillary-Like Nuclear Features (NIFTP) Presenting in a Female Child

Ade Burhanudin

Non-invasive follicular thyroid neoplasm with papillary-like features (NIFTP) is a benign thyroid lesion without recurrence or distant metastasis. The management of NIFTP can be partial or total thyroidectomy, which is sufficient to provide a perfect cure rate. Most cases of NIFTP were found in adults...

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Tornwaldt Cyst: Rare Benign Neoplasm Mimicking Nasopharyngeal Carcinoma

Evans Gunterus, Alamanda Monik

Nasopharyngeal cancer (NPC) is the fifth most common cancer in Indonesia and highest in head and neck area. Its most common manifestations ever reported in Indonesia were unilateral ear problem, followed by persistent nasal obstruction, blood nasal secretion, cephalgia, lymph node enlargement, and tinnitus...

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Acquired Long QT Syndrome (LQTS) Secondary to Electrolyte Imbalance: A Case Report

Yusra Pintaningrum, Ketut Angga Aditya Putra Pramana

The long QT syndrome (LQTS) is a one type of severe cardiac arrhythmia syndrome that leading cause to unexpected cardiac death, characterized with impaired ventricular repolarization caused by hereditary disorder in sodium and potassium channels on cardiac myocyte and acquired caused by drugs or electrolyte...

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Mortality Rate of People Living with HIV/AIDS on Injection Drug Users (IDU) Compared to Non-Injection Drug Users (non-IDU)

Ni Pt Wr Pradnya Nirmala Putri, Jaini Rahma, Nabila Aisyah Putri, Putu Wika Pramesti Iswari, Salsabila Chauna, Wina Arsylia Fakar, Cut Warnaini

Risk factors for transmission of HIV/AIDS are heterosexual (84.7%), Injection Drugs User (IDU) (5.7%), homosexual (4.7%), perinatal transmission (4.6%) and blood transfusion (0.1%). As the second-largest risk factor, IDU is a serious public health concern because of its high potential in transmitting...

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Tramiprosate as a Novel Treatment for Mild-Moderate Alzheimer Disease A Systematic Review

Abiyyu Didar Haq, Visakha Vidyadevi Wiguna, Putu Diah Ananda Putri Atmaja, Cut Warnaini

Alzheimer Disease (AD) is a chronic neurodegenerative disease. Currently, treatment for AD is limited to symptomatic treatment only, which are cholinesterase inhibitor and memantine. Acting as a symptomatic treatment, those drugs don't act on the pathogenesis of AD. Tramiprosate is a small aminosulfate...

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"COMMANDO" Procedures in Cancer of the Head & Neck: Short Communication

Geng Ju Tuang, Chong Sian Ng, Mohd Razif Mohamad Yunus

The "COMMANDO" procedure has been regarded as an intrepid surgical technique in the field of otolaryngology. The procedure involves resecting a portion of the mandible along with neck dissection and removal of the primary intra-oral tumor. Herein, the authors narrated on the indications of composite...

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Education Level as a Predictor for Health Literacy Levels in a Rural Community Health Centre
A Cross-Sectional Study

Fahrin Ramadan Andiwijaya, Hamsu Kadriyan, Arfi Syamsun

Health literacy is an important determinant in individual health and public health. However, evidence suggests that there are still disparities in health literacy levels between different socio-economic and education backgrounds. This study aims to look at level of education as a predictor for achieving...

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Lessons Learned from Online Qualitative Data Collection in an International Collaborative Study During the COVID-19 Pandemic
Teachers' Effort to Cope with Conflict in Implementing Comprehensive Sexuality Education at Secondary Schools in Mataram City, Indonesia

Fumiko Shibuya, Dian Puspita Sari, Cut Warnaini, Arina Windri Rivarti, Rie Takeuchi, Hamsu Kadriyan, Calvin de los Reyes, Jun Kobayashi

An online survey was conducted for an international collaborative study from a remote area during the COVID-19 pandemic because the researchers needed to consider non-face-to-face methods of conducting an international collaborative study in situations in which social distance must be maintained. In...

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The Association Between Prenatal Care (PNC) Coverage and Distribution of Iron Supplements with Cases of Non-infectious Disease in Pregnant Mothers in Narmada Public Health Center (PHC), West Lombok in 2020

Cut Warnaini, Lina Nurbaiti, I Dewa Gede Ngurah Agung, I Wayan Inggita Darmawan, Baiq Maygina Nafsa Sulan, Nikita Andini Putri, Siti Fadhila Musafira, Paul Dugdale

Disturbances at an early stage, provide immediate intervention and prevent death. During PNC visits, mothers will also receive supplements such as folic acid and iron that help in preserving their healthy condition. This study aims to identify the association between PNC coverage and distribution of...

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Acute Dysbaric Disorders: A Case Series in The Hyperbaric Center in Lombok 2016-2020

Eustachius Hagni Wardoyo, Devi RM Tarigan

This study aimed to describe acute dysbaric disorder (ADD) in the hyperbaric center in Lombok during 2016-2020. All types of ADD diagnosis which attend to Diving Health and Hyperbaric center Mataram General Hospital (DHM) 2016-2020 were included in the study. Secondary data of Medical Record then analyzed...

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Zinc Deficiency among Adolescence in Stunting Locus Area, Lombok, Indonesia

Deasy Irawati, Lina Nurbaiti, Ardiana Ekawanti

Adolescence is at risk for zinc deficiency due to their high acceleration of growth, with bone mineral deposition reaching 80-90% by the adolescent phase. In zinc deficiency, adjustments in zinc pools were made, including the release of zinc retention in bones. Severe zinc deficiency could lead to growth...

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A Rare Case of Embolic Stroke in Patient with Uncorrected Pentalogy of Fallot: A Case Report

Yusra Pintaningrum, Ketut Angga Aditya Putra Pramana

Pentalogy of Fallot is cyanotic type congenital heart disease that characterized with anatomical anomalies in Tetralogy of Fallot and atrial septum defect or patent foramen ovale. That condition makes cyanosis because of diminished oxygenated blood flow to the organs. Cerebrovascular accidents like embolic...

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Nasopharyngeal Carcinoma Patient Characteristics at Sayang General Hospital Cianjur West Java

Eman Sulaiman

Nasopharyngeal carcinoma (NPC) is the most common head and neck malignancy in Indonesia, placing it as the fourth most common among all malignancies in Indonesians. NPC has different characteristics from other head and neck epithelial tumors in respect of epidemiology, histopathology findings, diagnosis...

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Different Outcome in Early and Late Abdominal Pregnancy A Case Series on Abdominal Pregnancy at West Nusa Tenggara Hospital

Febie Putra Suwana, I M.W. Mahayasa, Muhammad Rizkinov Jumsa Jumsa, A. Karima

Abdominal pregnancy is a very rare and very dangerous type of ectopic pregnancy, this kind of pregnancy occurs in 1: 10.000 to 30.000 pregnancies (1,4% of all ectopic pregnancies). This kind of pregnancy is a challenge to diagnose and treat, especially in a developing country such as Indonesia. In this...

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Pregnancy and COVID-19 Policy and Strategy

Ario Danianto, Putu Diah Ananda Putri Atmaja, Muhammad Rizkinov Jumsa, Intan Wahyu Lasiaprillianty, Meilisva Audila Anggraini

COVID-19 has led to a global emergency because of its infectivity to the general population, especially the vulnerable population, pregnant women. Changes in the immune system of pregnant women made them more vulnerable to developing adverse complications COVID-19. This study evaluates pregnant women...

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Mucormycosis in Healthy Young Man A Case Report in Indonesia

Metta Octora, Arthur Pohan Kawilarang, Eddy Bagus Wasito

Mucormycosis is one of the most common invasive fungal infections. Unlike other filamentous fungi, Mucorales additionally may be a frequently lethal infection in immunocompetence patient. We describe a 22-year-old male patient that presented wound of right lateral eye and right face, as well as pain...

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Placenta Previa Accreta: A Case Report on Management of Elective Cesarean Delivery at Tertiary Hospital in West Nusa Tenggara

Ainun Karima, G.M Punarbawa, Muhammad Rizkinov Jumsa, F.P. Suwana.

The Incidence and prevalence of placenta accreta and placenta previa has increased due to the increasing numbers of cesarean deliveries. Placenta accreta is one of the most serious complications of pregnancy and is often associated with placenta previa and severe obstetric hemorrhage and one of an important...

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Cell Multiplication in Platelet Rich Fibrin (PRF) and Platelet Rich Plasma (PRP) as Biofuels for Cartilage Tissue Engineering

Ahmad Taufik S, Adnanto Wiweko, Devi Rahmadona, Dyah Purnaning, Mohammad Rizki, Bayu Tirta Dirja

Cartilage injury remains a major orthopedic challenge due to its low repair capacity, with the tendency to cause osteoarthritis. In addition, the treatment method involving platelet rich plasma (PRP) and platelet rich fibrin (PRF) as cartilage engineering components greatly anticipates promising recovery...

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Mass Blood Survey Followed by Active Case Detection Success to Eradicate Malaria in Batunampar Village, Jerowaru Subdistrict, East Lombok, West Nusa Tenggara, Indonesia

Ahmad Taufik S, Adnanto Wiweko, Didit Yudhanto, Deasy Irawati, Heru Farah Subaktianto, Lalu Hamzi Fikri, Mohammad Rizki, Seto Priambodo, Mulyanto Mulyanto

Malaria is an endemic that often occurs in the coastal areas of East Lombok, West Nusa Tenggara. One of the most common ways of spreading this parasite is through asymptomatic malaria. Therefore, mass blood surveys and active case detection are needed to identify parasitemia and eradicate malaria in...

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How Early Detection Error Can Lead to Severe Prognosis in Patient with Post-Partum Urinary Retention: A Case Report of Two Cases

Nada Nafisha Humaera, Muhammad Rizkinov Jumsa

Postpartum urinary retention (PUR) is a condition with a post-void residual volume of more than 150 mL. The incidence of PUR is not clear because of an undiagnosed asymptomatic condition. According to from literature incidence of PUR is about 0.05%-37%. Neglected PUR may result in anuria, hydronephrosis,...

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Assessing Effectiveness of the Dengue Hero Board Game in Improving Children's Knowledge and Attitudes on Dengue Prevention: A Randomized Controlled Experiment

Mochamad Bagus Ferdiawan, Sigit Kusdaryono, Dewi Suryani, Dian Puspita Sari

Educational board games have been used as an alternative method for health promotion and education. This study aimed to assess the effectiveness of the Dengue Hero board game in improving children's knowledge and attitudes regarding Dengue prevention compared to the conventional, lecture-based health...

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Validity and Reliability Test of the Short Form-36 (SF-36) Item Health Survey in Indonesian Version of Post-Heart Attack Patients in Mataram City

I Wayan Manacika Surya Dharma, Dian Puspita Sari, Basuki Rahmat

The Indonesian version of the SF-36 Item Health Survey instrument measured quality of life in patients with chronic diseases. However, the validity and reliability of this instrument have not been tested in the post-heart attack patient population. This study aimed to assess the construct validity and...

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Three Rare Cases of Otolaryngology Tuberculosis: A Report of Extra-Pulmonary Tuberculosis Cases in the Larynx, Tonsil and Parotid

Hamsu Kadriyan, Ima Arum Lestari, Fathul Djannah, Fahrin Ramadan Andiwijaya

Tuberculosis (TB) remains a global health problem, and in the South-East Asia Region, 15% are extra-pulmonary TB (EPTB). The occurrence of EPTB in the upper airway, tonsil and the parotid gland is a rare finding. Moreover, EPTB in these regions would present mimicking symptoms as common ENT cases. The...

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Management of Atypia of Undetermined Significant Thyroid Nodule

Ika Dewi Mayangsari, Ferucha Moulanda

Thyroid nodules are one of frequent clinical problem with prevalence of 5% palpable nodules. Results of atypia of undetermined significance (AUS) can be found with risk of 5-15% malignancy rates. Management of AUS is still challenging and complex including observation until surgical approach. We present...

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Study of SARS-COV 2 Antibody Level Before and After the Third Covid-19 Vaccine Booster on Health Worker in Province of Nusa Tenggara Barat General Hospital

Rina Lestari, Indana Eva Ajmala, Prima Belia Fathana, Yusra Pintaningrum

Vaccination is one of the ways that countries around the world to manage the COVID-19. The effectiveness of a vaccine can be assessed from the degree of protective antibodies produced after the vaccination program. The purpose of this study was to determine the levels of SARS-CoV-2 antibodies in the...

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Community Resilience in the Time of the COVID-19 Pandemic: A Qualitative Study on Local Perspectives in the Island of Lombok

Fahrin Ramadan Andiwijaya, Hamsu Kadriyan, Putu Suwita Sari, Jun Kobayashi, Suryaning Rasyidah, Lalu Hamzi Fikri

The Coronavirus disease (Covid-19), was declared a pandemic as it spread globally. In Indonesia the initiatives on mitigation and slowing the spread of the disease focused on physical distancing efforts. Focusing in Mataram, the main region of the Island of Lombok, West Nusa Tenggara Province. We analysed...

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The Review of *Baccaurea racemosa*: Neglected Plants, but Potential to be Developed

Lina Permatasari, Sugeng Riyanto, Abdul Rohman

The *Baccaurea racemosa* was the plant that spread in the Southeast Asia. *B. racemosa* fruit had a sour taste, so that the economy of this plant was low. *B. racemosa* has almost been forgotten in people. If this plant bears fruit, the fruit is often neglected. If the fruit is sold, the price will be low...

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Laboratory Profiles of Nasopharyngeal Carcinoma Patients

Nur Akbar Aroeman, Ifiq Budiyan Nazar, Yussy Afriani Dewi

Nasopharyngeal Carcinoma (NPC) is one of the most common head and neck malignant neoplasms worldwide. Laboratory profile is rarely evaluated in Indonesia as a prognostic consideration. The aim of this research is to describe the laboratory profile of NPC patients. This is descriptive research using a...

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Correlations Between Laboratory, Clinical and RT-PCR Parameters in Covid-19 Patients Admitted in Nusa Tenggara Barat General Hospital

Prima Belia Fathana, Rina Lestari, Indana Eva Ajmala, Metta Octora

The main problems faced by the COVID-19 pandemic are the high risk of transmission, the lack of fast and valid screening tools, and the length of the disease healing process it will indirectly affect the speed of transmission. This study aimed to assess the clinical correlation and laboratories of COVID-19...

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The Effect of Monosodium Glutamate Administration on Estradiol Levels on Pregnant Wistar Rats

Dian Soekmawaty Riezqy Ariendha, Fitri Apriyanti, Arni Amir, Yanwirasti Yanwirasti

The purpose of this study was to see the influence of the MSG administration to the estrogens levels, progesterone levels, and the quantity of infant on pregnant Wistar rats. The design of this study was experimental research with post test only control group design on 24 samples pregnant albino Wistar...

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Association of Metabolic Syndrome with Cardiovascular Mortality in The Elderly: A Meta-Analysis

Erieka Febriayana Rosiva, Muhammad Miftahul Hadi, Yusra Pintaningrum

Metabolic syndrome should be considered an important issue in elderly individuals, as aging is a major contributor to the prevalence of the constellation of cardiovascular and metabolic risk factors that constitute the syndrome. However, recent studies that have investigated metabolic syndrome as a predictor...

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