

Introduction —

Asthma, originating from the Greek word “Panting”, is one of the most common conditions of the lower respiratory system known to man today. Asthma is an illness that may present in a variety forms of austerly, depending on factors such as our environment, and genetics (family history). According to the Centers for Disease Control and Prevention (CDC), Asthma has caused 3,564 deaths in the U.S. in 2017. Although asthma has been known to be treatable since 326 BC by the Datura Stramonium (Jimsonweed) plant; further research since the 1940’s has made it further treatable to avoid morbidity and mortality. Throughout this article, an explanation of asthma’s etiology, epidemiology, signs and symptoms, differential diagnosis, actual diagnosis, treatments, and prognosis will be included to further explain the research done to develop and understanding of this disease.

Etiology —

Studies suggest that the it is a combination of both environmental and genetic factors that triggers an asthma event (Bonini and Usmani 281). The risk factors for each recognized phenotype of asthma include genetic, environmental and host factors. Although a family history of asthma is common, it is neither sufficient nor necessary for the development of asthma. (Subarrao et al. 09). One cohort study has shown while all factors associated with asthma are not found in all patients with asthma there are one of two factors that certainly predominate (Bnini and Usmani 281). Therefore, asthma cannot only be genetic but certain other factors can trigger this respiratory disease, for example exposure to an irritable environment. Exposure to a variation of environmental irritants that often because allergies are the main triggers of signs and symptoms of asthma (Usmani et al. 20). Such irritants include airborne substances such as dust mites, pollen, fungi spores, pet dander, etc. Other causes linked to signs and symptoms of asthma include but not limited to physical activity, air pollutants such as secondary smoke, obesity, respiratory infections such as colds and flu, and stress and anxiety

(Usmani et al. 21). Genetic factors such as a first degree relative who has asthma has been deemed to be one of the major risk factors for

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developing asthma (Usmani et al. 21).

Epidemiology –

Asthma side effects are accounted for in 11.6% of 6-7-year-old kids around the world. In 2010, in the only us, an expected 18.7 million grown-ups and seven million youngsters were accounted for to have asthma (Olin and Wechsler 1). Asthma is increasingly regular in kids and individuals on a low-income than in the all-inclusive community 7—17% of African American kids and 13.5% of youngsters from low-income families have asthma (Olin and Wechsler 1). Autonomous of high prevalence, increments in the prevalence of asthma is exceeding the impact of improved symptomatic capacities in specific parts of the world (Olin and Wechsler 2).

Signs & Symptoms –

The signs and symptoms of asthma tend to vary from individual to individual, with severity and with type of asthma (King et al. 263). The signs and symptoms usually associated with asthma are shortness of breath (including accessory muscle use), coughing, wheezing, irritation, fatigue, lethargy, poor capillary refill (<2 seconds), cyanosis (late sign), and oxygen saturation below the average saturation level (<95%). Although these are pertinent signs & symptoms, a triad of signs & symptoms are the main cause of all mentioned above. This triad of signs & symptoms are as follows: bronchospasms, airway edema, and increased mucus production. Bronchospasms is the main sign & symptom of asthma, as it is what mainly causes the asthmatic episode

in the patient. Bronchospasms is known as constriction/contraction of the smooth muscle walls in the bronchioles and may be referred as bronchial hyperresponsiveness or bronchoconstriction. Airway edema is caused by triggers in the asthmatic episode through environmental/genetic factors, which leads to smooth wall muscles in the lower airway to swell up, causing only the lumen to narrow/constrict. Edema then leads to mucus and other secretions to get further lodged, exacerbating the symptoms of the patient. Bronchospasms, airway edema, and increased mucus production advance to cause the signs & symptoms mentioned above that aren't part of the triad in the asthmatic patient. The first of these signs & symptoms is shortness of breath (SOB), or difficulty breathing, that leads to the use of accessory muscles. When someone is having difficulty breathing during an asthmatic episode, the use of accessory muscles is a combination of topographical locations used by the body as a reflex to try and acquire oxygen; these locations include the sternum, clavicles, intercostal spaces, and neck. It is common to see a patient in

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respiratory distress in what we call the “Tri-pod” position, and nasal flaring. This goes hand in hand with the use of accessory muscles as the body is using its natural reflexes to try and acquire oxygen. Fatigue, lethargy happen due to inadequate oxygenation happening at the cellular level. Tissues, organs, and cells are not oxygenating properly through perfusion, which leaves the body at a state of anaerobic metabolism; where the brain isn't receiving adequate and proper oxygen and glucose for aerobic metabolism (Krebs Cycle).

Experimentation/Laboratory Test –

There are various medical experimentations and laboratory tests that can be performed for diagnosis and to test out the severity of someone's respiratory distress or asthma. A few examples are: Spirometry, exhaled nitric oxide, challenge tests, and chest x-rays.

Through spirometry the patient is tested and measured how rapid the oxygen is being exhaled. This test is used to evaluate if any airway obstruction or the amount of obstruction there is in the lower respiratory system. Spirometry is used before and after the administration of certain medications to evaluate if there is any change in obstruction. Nitric oxide is another valuable experimentation/lab test that is done on the patient as it evaluates the amount produced, as it is an indicator of inflammation. Alike the spirometer, the nitric oxide test is done by exhaling continuously until a final result is given through special medical machinery.

Differential Diagnosis –

Some of the differential diagnosis for asthma include: chronic obstructive pulmonary disease (COPD) (An umbrella term used to describe progressive lung diseases such as bronchitis (Inflammation of the bronchial tubes), bronchiectasis (Chronic thickening of bronchial walls), pulmonary edema (excess fluid in the lungs), pulmonary embolism (Blockage in one of the pulmonary arteries in your lungs), pneumonia (Infection that inflames air sacs in one or both lungs, which may fill with fluid), hyperventilation Syndrome (Anxiety-related dyspnea and tachypnea), chemical pneumonitis (inflammation of the lung caused by aspirating or inhaling

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irritants), and foreign body obstruction.

Actual Diagnosis –

In an attempt to understand symptoms and their causes, your doctor will have to review your medical history. This review may include your family history, current medications taken, current physical problems, and overall lifestyle. Some of the symptoms looked for to correctly assess asthma include shortness of breath, wheezing, coughing and chest tightness. A history of allergies or eczema will also be helpful in diagnosing asthma. Home and work conditions play a big part as well, for example, pet dander, pollen, dust mites, and tobacco smoke. A physical exam will take a look at your ears, nose, eyes,

throat, skin, chest and lungs. Exams consist of a pulmonary function test, which determines the total volume of air in your lungs (TLC) and the remaining volume when exhaling (RV). Examples of a pulmonary function tests include spirometry, FeNO (exhaled nitric oxide), and challenge tests. In addition to these tests, chest x-rays may be requested.

Treatment –

Asthma has various forms of treatment, when it is diagnosed, or undiagnosed by a medical professional. In extreme cases medical intervention may be required to either the diagnosed or undiagnosed patient; as asthma's austerly could worsen due to different factors mentioned before. Medications include bronchodilators, corticosteroids and antiinflammatories, however self-care such as quitting smoking and supportive care such as oxygen therapy is also very effective in treating asthma (Olin and Wechsler 7). One of the most common types of treatment for an asthmatic patient is metered-dose inhalers (MDI). This type of predetermined amount of mediation is given through aerosol treatment, and the medication in metered-dose inhalers usually contain two chemicals: bronchodilators, or corticosteroids. Although aerosol is one of the most common treatments for asthma, so is fine-powder, or dry-powder inhalers (DPI). This route of administration is similar to aerosol, but instead a dry powder is inhaled; an example of this type of medication is tiotropium (Spiriva). Metered-dose and Dry-powder inhalers are taken at home without the assistance of a medical professional, but when asthmatic events are severe and do not subside with prescribed inhalers, there are other medical treatments that can be done under the supervision of a trained medical professional. These medications consist of oxygen, albuterol (Proventil), levalbuterol (Xopenex), ipratropium bromide (Atrovent), dexamethasone (Decadron), methylprednisolone sodium succinate (Solu-Medrol), and racemic epinephrine (Micronefrin). Oxygen being our first-class medication when it comes to respiratory distress can help alleviate the symptoms of poor oxygenation. One-way oxygen can be given is by it being nebulized with albuterol at 2.5 to 5 mg mixed with 3mL of sterile sodium chloride. Oxygen itself can be given alone depending on the austerly of the situation; for example, someone desaturating below 95% on room air may be given 2-4 L/min via nasal cannula, or 10-15 L/min via a nonrebreather facemask. Other medications mentioned above (Albuterol, Levalbuterol, Combivent, are more complex; as they act on smooth muscle by stimulating beta-2 (β_2) receptors. This stimulation causes smooth muscle throughout

the body that is constricted to become relaxed, causing bronchospasms and bronchoconstriction to subside or become completely relaxed.

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Corticosteroids mentioned above (Decadron, Solu-Medrol) are used to

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reduce inflammation of the lower airway. Corticosteroids may be given as prescription through MDI/DPI, intravenously (IV), or intramuscularly (IM). Special medication may be given for the most severe condition an asthmatic patient may get, also known as status asthmaticus. Status asthmaticus is a condition when an asthma attack is continuous without relief, or an asthma attack happens after an asthma attack was relieved. This medication is known as racemic epinephrine (Micronefrin), which is a bronchodilator/adrenergic agent that stimulates alpha-1, alpha-2, beta-1, and beta-2 receptors; which then causes vasoconstriction, reduced mucus edema, and finally eventually bronchodilation. There may be other medications/treatment given in the medical setting that aren't specifically for asthma but do stimulate and bind to adrenergic receptors that may help smooth muscle that is swelled up to become relaxed.

Prognosis –

Remission is a possibility; however, it is limited to milder cases and rates are low. In general, asthmatic patients are more prone to death from lung diseases, compared to those without. Permanent damage to lung function develops in some patients, most commonly seen in smokers, chronic obstructive pulmonary disease with asthma, and pneumonia with asthma. Patients with unstable (brittle) asthma and those with previous

admissions to an ICU are at a high risk for severe complications with their asthma. Asthmatic patients that contract respiratory infections are more likely to suffer from severe asthma attacks than those without it. Pediatric patients (<18 Years Old) who are diagnosed with asthma at a young age are most likely to have persistent asthma attacks as adults. Premature neonates (newborns) also have an increased risk of asthma but may have remission as they grow older and their organs fully develop.

Conclusion —

In summary, asthma is a very complex and researched disease known to medicine today. Although remission is possible, there is no cure for this illness today. Treatment is available to all with this debilitating disease, through proper education, experimentation/lab, and diagnosis. Whether genetics, or environmental factors are responsible for the treatment is there. The diagnosed patient can live a normal day-to-day life through proper medication prescription whether it be a bronchodilator, corticosteroid, or adrenergic agonist, morbidity and mortality are preventable. Being responsible for your respiratory health and complete well-being is a necessary step for all asthmatic patients, to prevent the further severity of their condition!

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