CODEN [USA]: IAJPBB ISSN : 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES
SJIF Impact Factor: 7.187

Available online at: http://www.iajps.com *Review Article*

OVERALL REVIEW AND EVALUATION OF PAEDIATRIC ASTHMA

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Article Received: October 2022 **Accepted:** October 2022 **Published: October** 2022

Abstract:
Asthma is defined as a habitual seditious complaint of the airways. The habitual inflammation is associated with airway hyperresposiveness (an inflated airway- narrowing response to specific triggers similar as contagions, allergens and exercise) that leads to intermittent occurrences of gasping, breathlessness, casket miserliness and/ or coughing that can vary over time and in intensity. Viral respiratory tract infections, Exercise, Weather changes in temperature and humidity, Domestic pollutants (eg, pests, mould and dust mites), Environmental pollutants (eg, air pollution), Secondhand smoke exposure, Pets and animals, etc.. are the common factors that triggers asthma in children. Personal or family history of atopy: eczema, allergic rhinitis or nasal polyposis, Family history of asthma, Exposure to secondhand smoke, Preterm birth, Low birth weight, Obesity, Poor housing quality/mould and dampness, Air pollution are the risk factors associated with asthma. The pathophysiology involved in asthma is the infiltration of inflammatory cells (neutrophils, eosinophils, and lymphocytes) into the airway, activation of mast cells, and damage to epithelial cells. These responses leads to airway swelling, increased mucus secretion, and bronchial dysfunction which produce airway flow limitation and asthma symptoms. Paroxysms of dypnoea, intermittent occurrences of gasping, Coughing (particularly at night or in the early morning), casket miserliness and Sleep dislocation are the signs associated with asthma in children. The treatment involved in asthma includes Oxygen for hypoxia, inhaled and oral corticosteroids, leukotriene receptor antagonist, long-acting beta2-agonist, immunoglobulin E.

Key words: *Asthma, Inflammation, Airway, IgE, Corticosteroids, Pulmonary function.*

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Please cite this article in K. Senthilpandi et al, ***Overall Review And Evaluation Of Paediatric Asthma****., Indo Am. J. P. Sci, 2022; 09(10).*

INTRODUCTION:

Asthma is defined as a habitual seditious complaint of the airways. The habitual inflammation is associated with airway hyperresponsiveness (an inflated airway- narrowing response to specific triggers similar as contagions, allergens and exercise) that leads to intermittent occurrences of gasping, breathlessness, casket miserliness and/ or coughing that can vary over time and in intensity. Symptom occurrences are generally associated with wide, but variable, tailwind inhibition within the lungs that's generallyreversible either spontaneously or with applicable asthma treatment similar as a fast- acting bronchodilator [1]. Exacerbations of asthma are occurrences of progressive increase in briefness of breath, cough, gasping or casket miserliness [2]. Asthma is anseditious complaint of the respiratory tract characterized by intermittent and/ or habitual occurrences of airway inflammation and inhibition (manifested by wheeze or cough, or demonstrated upon pulmonary function testing) and substantiation of reversibility ofinhibition[3]. Asthma is a complaint of airways that's characterised by increased responsiveness of the tracheobronchial tree to avariety of stimulants performing in wide gyms modic narrowing of the air passages which may be relieved spontaneously or byremedy. Asthma is an episodic complaint manifested clinically by paroxysms of dyspnoea, cough and gasping. still, a severe andrunning form of the complaint nominated status asthma ticus may prove fatal.[4]

ETIOLOGY

Although inheritable predilection is easily apparent, gene- by- terrain commerce presumably explains much of the transnationalvariation in frequence rates for mislike and asthma. Environmental factors similar as infections and exposure to endotoxins may be defensive or may act as threat factors, depending in part on the timing of exposure in immaturity and nonage. Some antenatal threatfactors, including motherly smoking, have been forcefully established, but diet and nutrition, stress, use of antibiotics and mode ofdelivery may also affect the early development of mislike and asthma. latterly in nonage, apparent threat factors include exposure toallergens, breastfeeding (which may originally cover and also increase the threat of sensitization), family size and structure, and coitusand gender. In majority, rush of nonage asthma may be just as common as new- onset asthma, which may have an occupational base [5].

RISK FACTORS

TABLE:1 COMMON ASTHMA TRIGGERS [6]

- Viral respiratory tract infections
- Exercise
- Weather changes in temperature and humidity
- Domestic pollutants (eg, pests, mould and dust mites)
- Environmental pollutants (eg, air pollution)
- Secondhand smoke exposure
- Pets and animals
- Strong odours
- Anxiety or strong emotions

TABLE:2 ASTHMA RISK FACTORS [6]

- Personal or family history of atopy: eczema, allergic rhinitis or nasal polyposis
- Family history of asthma
- Exposure to secondhand smoke
- Preterm birth
- Low birth weight
- Obesity
- Poor housing quality/mould and dampness
- Air pollution

MORBITITY: Asthma is one of the most common majornon-communicable conditions and for numerous, has a substantial impact on quality of life. Encyclopedically, asthma is ranked 16th among the leading causes of times lived with disability and 28th among the leading causes of burden of complaint, as measured by disability- acclimated life times. Around 300 million people have asthma worldwide, and it's likely that by 2025 a farther 100 million may be affected [7]. There's a large geographical variation in asthma frequency, inflexibility, and mortality.

While asthma frequency is advanced in high income countries, utmost asthma- related mortality occurs in low-middle income countries [8]. Asthma mortality dropped from0.09 per, 1000 children in 2003 to 0.02 per, 1000 children in 2014, with an average mortality of 0.06 per, 1000 children. Mortality due to respiratory conditions was four times more common in cases with asthma than in the general population of children progressed> 5 times, despite diminishments in asthma- related mortality. [9]

TYPES OF ASTHMA ([10]

In children with asthma, three wheeze phenotypes have been identified 1. flash beforehand gasping; 2. nonatopic gasping; and 3. IgE intermediated (atopic) gasping. Te flash gasping phenotype is associated with symptoms that are limited to the frst 3 – 5 times of life; it isn't associated with a family history of asthma or antipathetic sensitization. Threat factors for this phenotype include dropped lung function that's diagnosed before any respiratory illness has passed, motherly smoking during gestation, and exposure to other siblings or children at daycare centres. Tenon-atopic gasping phenotype represents a group of children who witness occurrences of gasping up to nonage that aren't associated with atopy or antipathetic sensitization. Rather, the gasping is associated with a viral respiratory infection (particularly with the respiratory syncytial contagion (RSV)) endured in the frst 3 times of life. Children with this phenotype tend to have milder asthma than the atopic phenotype. IgE-intermediated (atopic) gasping (also appertained to as the "classic asthma phenotype") is characterized by patient gasping that's associated with atopy, early antipathetic sensitization, signifcant loss of lung function in the frst times of life, and airway hyperresponsiveness

TABLE:3 CONTRASTING FEATURES OF THE TWO MAJOR TYPES OF ASTHMA.[10]

FEATURE	EXTRINSIC ASTHMA	INTRINSIC ASTHMA
1. Age at onset	In childhood	In adult
2. Personal/family history	Commonly present	Absent
3. Preceding allergic illness (atopy)	Present (e.g. rhinitis, urticaria, eczema)	Absent
4. Allergens	Present (dust, pollens, danders etc)	None
5. Drug hypersensitivity	None	Present (usually to aspirin)
6. Serum IgE level	Elevated	Normal
7.Associated chronic bronchitis, nasal polyps	Absent	Present
8. Emphysema	Unusual	Common

CLINICAL FEATURES

➢ Paroxysms of dypnoea
➢ intermittent occurrences of gasping
➢ Coughing(particulary at night or in the early morning)
➢ casket miserliness [18]
➢ Sleep dislocation

Three different patterns of intermittent wheeze in pediatric cases have been proposed [11], and a fourth was lately described [12]. still, it should be noted that patterns 1 and 2 (listed below) can only be discerned retrospectively and aren't suitable for use when treating the child.

1. flash gasping Children who blow during the first 2 – 3 times of life, but don't blow after the age of 3 times
2. Nonatopic gasping substantially touched off by viral infection and tends to remit latterly in nonage
3. patient asthma gasping associated with the following
   - Clinical instantiations of atopy (eczema, antipathetic rhinitis and conjunctivitis, food mislike), blood eosinophilia, and/ or elevated total immunoglobulin E(IgE)
   - Specific IgE- intermediated sensitization to foods in immaturity and early nonage, and latterly to common gobbled allergens [13 – 17]
   - Inhalant allergen sensitization previous to 3 times of age, especially with sensitization and high situations of exposure to specific imperishable allergens in the home
   - A maternal history of asthma [14]
4. Severe intermittent gasping [12] occasional acute gasping occurrences associated with the following
   - minimum morbidity outside of time of respiratory tract illness
   - Atopic characteristics, including eczema, antipathetic sensitization and supplemental blood eosinophilia [14]

TABLE: 4 CLASSIFICATIONS OF SEVERITY BASED ON SYMPTOMS

MILD	MODERATE	SEVERE
➢ Attacks no more often than once a week	➢ Exacerbation of cough and wheezing once a week	➢ Daily wheezing
➢ Respond to bronchodialators in 24 to 48 hours	➢ Cough and low grade of wheezing between acute episodes	➢ Exacerbations frequent, often severe
➢ No clinical signs of asthma between episodes	➢ Exercise tolerance diminished	➢ Tendency to become "tight" suddenly with cyanosis
➢ Good exercise tolerance	➢ May be up at night because of cough and wheezing	➢ May have unconscious or hypoxic seizures
➢ No sleep interruption owing to asthma	➢ Hyperinflation may be clinicaly evident	➢ Poor exercise tolerance
➢ No hyperinflation		➢ Much sleep interruption
➢ Normal chest X ray films	➢ Signs of airway obstruction on PFT	➢ Chronic hyperinflation leads to chest deformity
➢ Minimal or no evidence of airway obstruction on PFT	➢ Lung volumes increased	➢ Substantial degree of airway obstruction on PFT ➢ Substantial increase in lung volumes
➢ No to minimal degree of increased lung volume.		

TABLE :5 NORMAL RESPIRATORY RATE FOR AGE [2]

PATHOPYSIOLOGY

AGE	Respiratory rate (breaths per minute)
Infant	30–60
Doddler	24–40
Preschooler	22–34
School aged child	18–30
Adolescent	12–16

Extrinsic (atopic, allergic) asthma [10]

This is the most common type of asthma. It generally begins in nonage or in early adult life. utmost cases of this type of asthma have particular and/ or family history of antedating antipathetic conditions similar as rhinitis, urticaria or immature eczema. Acuity to colorful foreign antigenic substances or 'allergens' is generally present in these cases. utmost of these allergens begets ill goods by inhalation e.g. house dust, pollens, beast danders, moulds etc. Occupational asthma stimulated by smothers, feasts and organic and chemical dusts is a variant of foreign asthma. There's increased position of IgE in the serum and positive skin test with the specific off ending gobbled antigen representing an IgE-intermediated type I acuity response which includes an ' acute immediate response ' and a ' late phase response ' Acute immediate response is initiated by IgE- sensitised(mast cells(towel counterparts of circulating basophils) on the mucosal face. Mast cells on degranulation release intercessors like histamine, leukotrienes, prostaglandins, platelet cranking factor and chemotactic factors for eosinophils and neutrophils. The net goods of these intercessors are bronchoconstriction, oedema, mucus hypersecretion and accumulation of eosinophils and neutrophils. Late phase response follows the acute immediate response(and is responsible for the prolonged manifestations of asthma. It's caused by inordinate mobilisation of blood leucocytes that include basophils besides eosinophils and neutrophils. These affect in farther release of intercessors which accentuate the below- mentioned goods. In addition, seditious injury is caused by neutrophils and by major introductory protein(MBP) of eosinophils

Intrinsic (idiosyncratic, on-atopic) asthma [10]:

This type of asthma develops latterly in adult life with negative particular or family history of mislike, negative skin test and normal serum situations of IgE. utmost of these cases develops typical symptom complex after an upper respiratory tract infection by contagions. Associated nasal polypi and habitual bronchitis are generally present. There are no recognisable allergens but about 10 of cases come hypersensitive to medicines, most specially to small boluses of aspirin (aspirin-sensitive asthma).

Mixed type:[10]

Numerous cases don't easily fit into either of the below two orders and have mixed features of both. Those cases who develop asthma in early life have strong antipathetic element, while those who develop the complaint late tend to be non-allergic. Either type of asthma can be rained by cold, exercise and emotional stress.

Figure:1 [10]

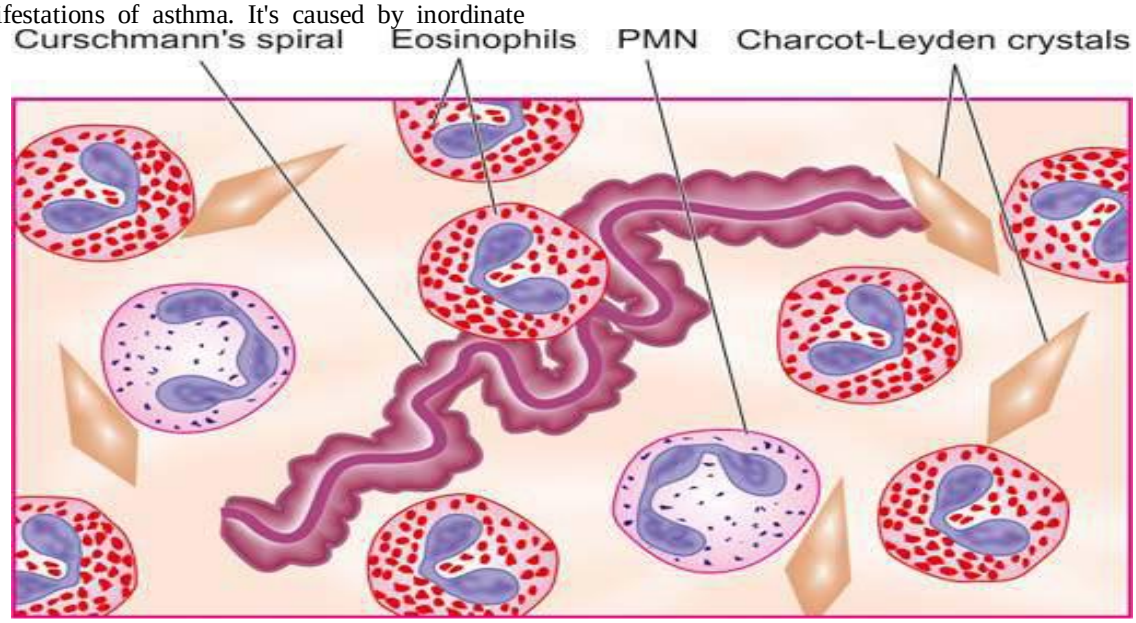
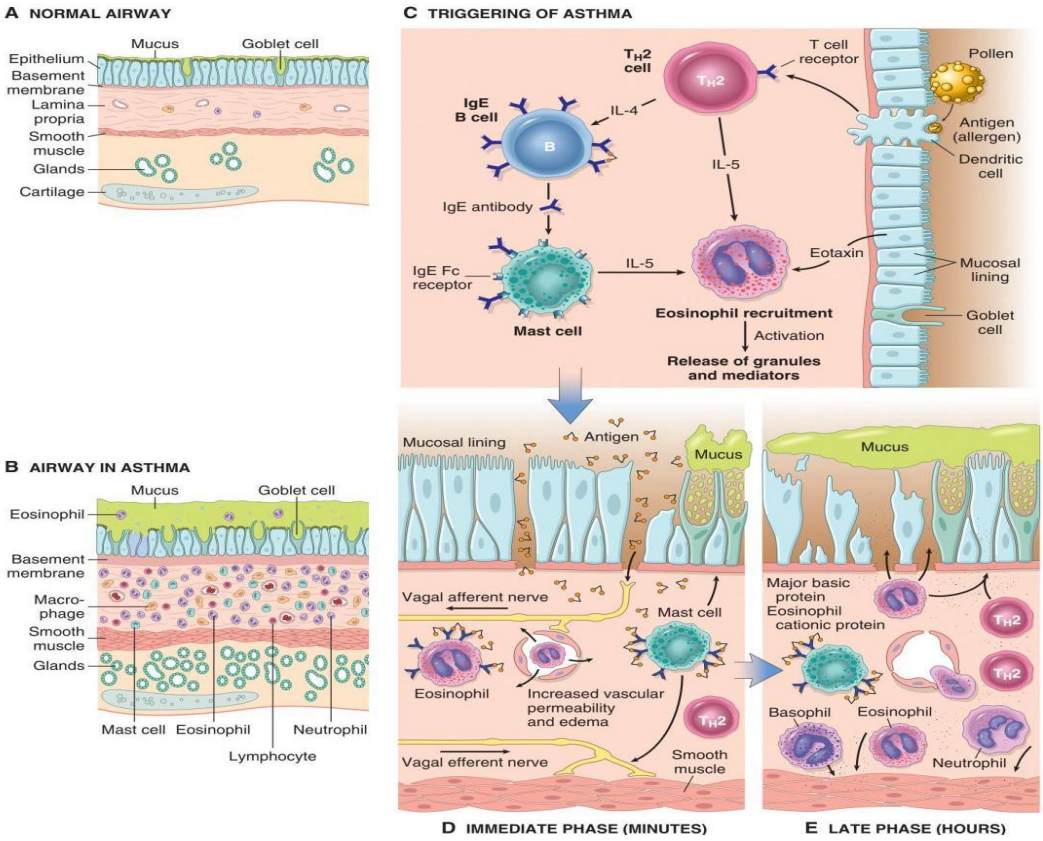


Figure:2 [11]



DIAGNOSIS:

➢ opinion is made primarily by history of intermittent occurrences of coughing, gasping, casket miserliness or short of breath and confirmational spirometry [21].

➢ History of exercise or cold air pouring dyspnea during specific seasons suggests asthma

➢ Pulmonary function test or lung function tests are useful in assessing the functional status of the respiratory system in both physiological and pathological conditions. It's grounded on the dimension of volume of air breathed in and out in quiet breathing and forced breathing [22]

➢ likewise, children with asthma and food disinclinations were estimated to have further eosinophills in foam than children with asthma without food disinclinations.

➢ Analysis of exhaled breath condensate is another invasive system to reflect airway inflammation.

Medical tests for asthma include

Spirometry: Spirometry is a common test that measures how important air you gobble, how important air you exhale, and how snappily you exhale to determine how well your lungs serve.

Spirometry is used to diagnose asthma, COPD, and other respiratory diseases. A spiromery test allows you to breathe into a tube connected to a spirometer unit. A nanny , a technician, or your croaker will give you clear instructions before you perform the test.

Spirometry way followed by

• You'll probably be seated during the test

• To keep your nostrils closed, a clip will be put on your nose.

• You'll be take a deep breath and breath out as hard as you can for several seconds in to the tube. It's important that your lips form a tight seal around the tube to help air from escaping.

• You'll need to do the test atleast 3 times to make sure your resuls are fairly consistant if there's variations repeat the test again

• The entire process requires lower than 15 twinkles.

Peak expiratory flow: Peak inflow measures may be used to assess lung function in children over 5 times with asthma, but symptom monitoring is the most dependable assessment of asthma control. They're stylish used for short ages to assess these varity of asthma and to cover response to treatment; nonstop use of peak inflow measures may abstract from compliance with inhalers [23].

The peak expiratory inflow, also called peak expiratory inflow rate (PEFR), is a person's maximum speed of expiration, as measured with a device called peak inflow cadence, you strongly exhale into the tube to measure the force of air you can expend out of your lungs.

Peak expiratory inflow rate (PEFR) is the outside inflow rate generated during a forceful exhalation, starting from full lung affectation. PEFR primarily reflects large airway inflow and depends on the voluntary trouble and muscular strength of the case.

Pulmonary function test

Pulmonary function testing is an important tool in the operation of asthma used to determine asthma inflexibility, along with clinical symptoms.

Short acting bronchodilator remedy was withheld for at 8 hours and longacting bronchodilator remedy for atleast 24 hours. palpitation oximetry was recorded in the children with asthma. PFTs are noninvasive tests that show how well lungs are working. The tests measure lung volume, capacity, rates of inflow, and gas exchange.

Chest x-ray

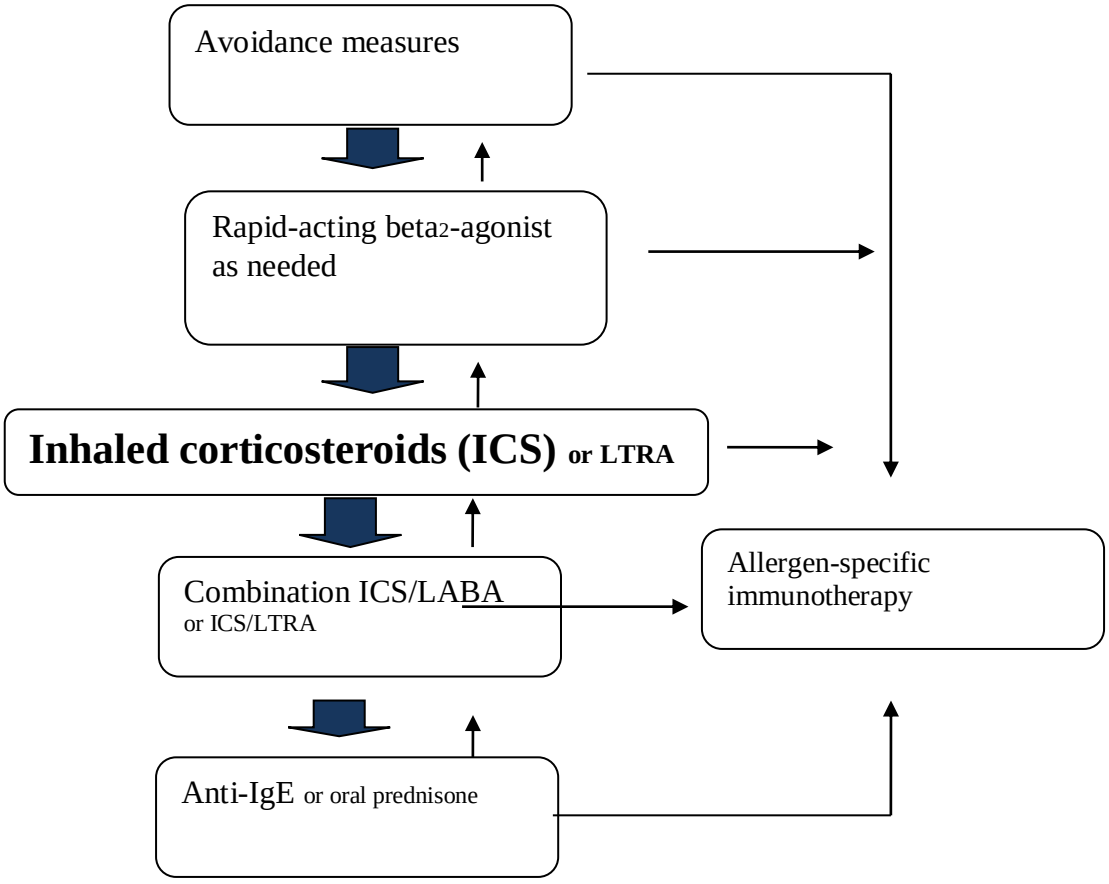
Chest radiographic imaging is an important tool in the examination of cases with an exacerbation of asthma, casket radiography is the original imaging evaluation in utmost individualities with symptoms of asthma. It generally is more useful in the original opinion of bronchial asthma than in the discovery of exacerbations [24]

TREATMENT

Oxygen:

Oxygen must be considered as a drug in a situation of acute asthma, reducing hypoxic pulmonary vasoconstriction and interfering with the ventilation-perfusion mismatch characteristic for severe bronchoconstriction [26]. No controlled studies have evaluated which level of oxygen saturation that is adequate during an acute asthma attack, but recent guidelines recommend that oxygen saturation in children should be kept above 95% [27].

A stepwise algorithm for the treatment of asthma:



A simplified, stepwise algorithm for the treatment of asthma. ICS: inhaled corticosteroid; LTRA: leukotriene receptor antagonist; LABA: long-acting beta2-agonist; IgE: immunoglobulin E Note: Treatments can be used individually or in any combination

Oral corticosteroids:
Although systemic corticosteroid therapy is listed as a treatment option for severe asthma management, there is no protocol to guide this therapy in children.[28] Oral steroid therapy has been shown to be an effective treatment of acute asthma [29,30]and equal in efficacy when compared with intravenous therapy in pediatric patients [31]. A short-term course of systemic corticosteroids can be used to achieve asthma control.[32] The lowest effective dose should be used, and the dose should be gradually decreased to the lowest dose that can maintain asthma control.[30] The few trials in pediatric patients that have evaluated use of inhaled corticosteroids as an alternative to systemic corticosteroids for acute asthma have yielded mixed results [33,34]. Meanwhile, other non-steroid medications such as biological therapies or long-acting anticholinergic drugs need to be considered for severe asthma management. Frequent use of systemic steroids increases the risks for adverse events including adrenal suppression, obesity, high blood pressures, bone fractures and osteoporosis [28]

Short acting bronchodilator:
Inhaled short-acting beta-agonists (eg, salbutamol) should always be readily available for asthma patients for when they experience asthma symptoms. Inhaled beta-agonists are the first-line treatment for relieving symptoms of acute asthma [35]. Aerosolized β2- adrenergic agonist therapy is part of the home regimen for daily management of asthma symptoms and also as initial treatment of acute exacerbations; these commonly are firstline agents in the ED.[36] β2 receptors are found in the airways, heart, blood vessels, skeletal muscle, uterus, liver, pancreas, and kidney.[37,38] In the airways, β2-adrenergic agonists cause smooth muscle relaxation, decrease the amount of hyperreactivity, improve mucociliary clearance, and reduce airway edema.School-aged children should always carry a short-acting beta-agonist in their school bags and an additional short-acting betaagonist should be kept on the school premises. As pressurized metered dose inhalers (pMDIs) should be used in conjunction with valved holding chambers, older children and adolescents often prefer taking smaller, unobtrusive dry powder beta-agonist inhalers to school. In such situations, it is important that a pMDI should also be available at the school in case of a severe asthma episode when the child may have difficulty using a dry powder inhaler. Anticholinergics such as ipratropium bromide offer little benefit as an add-on bronchodilator treatment during acute asthma exacerbations and hence have a limited role in treating bronchoconstriction in children.[39] chronic, short-acting anticholinergic bronchodilator therapy is not recommended for use in children [40].

Combination ics/laba inhalers
The combination of a LABA and ICS has been shown to be highly effective in reducing asthma symptoms and exacerbations, and is the preferred treatment option in adolescents or adults whose asthma is inadequately controlled on low-dose ICS therapy, or in children over 6 years of age who are uncontrolled on moderate ICS doses. combination ICS/LABA inhalers are preferred because they preclude use of the LABA without anICS, are more convenient and may enhance patient adherence. Combination budesonide/formoterol has been approved for use as a single inhaler for both daily maintenance (controller) and reliever therapy in individuals 12 years of age and older.[40]

Theophylline:
Theophylline is an oral bronchodilator with modest anti-inflammatory effects. Given its narrow therapeutic window and frequent adverse events (e.g., gastrointestinal symptoms, loose stools, seizures, cardiac arrhythmias, nausea and vomiting), its use is generally reserved for patients over 12 years of age who are intolerant to or continue to be symptomatic despite other add-on therapies [40].

Long-acting muscarinic receptor antagonists
The LAMA, tiotropium, administered by mist inhaler can be used as add-on therapy for patients with a history of exacerbations despite treatment with ICS/LABA combination therapy. It is only indicated for patients 12 years of age and older.[41]

CONCLUSION:

During last decades, asthma prevalence has been increasing worldwide. As a chronic condition that usually starts in early childhood, it imposes a high lifetime burden on individuals, their caregivers and the community. Heterogenicity, Social and Environmental factor are the most important reason for the cause of asthma in children. In order to improve outcomes accurate diagnosis and management are essential. Due to heterogenecity of asthma characteristics, treatment decisions should be critically made. Symptoms control of asthmatic patients should be closely monitored, as well as risk

factors and frequency of exacerbations, and the response to treatment should be regulary monitored and reviewed by specialists. Inhaled Corticosteroids are the most effective treatment for the control of asthma attacks. Ongoing monitoring of adherence to the treatment and asthma control by spirometry must be encouraged. Paediatric asthma are currently poor and many deaths are preventable.

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