DEPARTMENT OF PAEDIATRICS
RIPAS HOSPITAL
Policy and Procedures

SOP No: SOP-PAEDS-004	Effective Date: May 2016

SOP Title:
GUIDELINE FOR THE MANAGEMENT OF CHILDREN WITH ASTHMA

1.0 Objective

1.1 This guideline provides an evidence-based framework for the assessment, investigation and management (acute and follow-up) of children aged 12 years and below presenting to RIPAS Hospital with asthma

1.2 To standardize the management of acute paediatric asthma in RIPAS Hospital

2.0 Scope

2.1 This policy is applicable for healthcare personnel who are clinically taking care of paediatric patients aged 12 years and below with asthma in RIPAS Hospital

3.0 Background

3.1 Asthma is a disease of the respiratory tract characterized by recurrent and/or chronic episodes of airway inflammation and obstruction (manifested by wheeze or cough, or demonstrated upon pulmonary function testing) and evidence of reversibility of obstruction. Despite advances in the understanding of asthma and development of effective medical interventions to prevent morbidity and improve quality of life, asthma remains a burden in prevalence, health care use and mortality.

4.0 Related documents

4.1 Management of bronchial asthma in children- Emergency Department

5.0 Initial assessment of a child with asthma

5.1 Diagnosis of asthma is mainly clinical and should be based on the following features:

- More than one of the following symptoms - wheeze, cough, difficulty breathing, chest tightness **-** particularly if these are frequent and recurrent; are worse at night and in the early morning; occur in response to, or are worse after, exercise or other triggers, such as exposure to pets; cold or damp air, or with emotions or laughter; or occur apart from colds
- Personal history of atopic disorder
- Family history of atopic disorder and/or asthma
- Widespread wheeze heard on auscultation
- History of improvement in symptoms or lung function in response to adequate therapy

5.2 Assessment of asthma should include:

5.2.1 History

- Presenting complaints
    - Duration of illness
    - Precipitants/triggers
    - Any disturbances of sleep or daytime activity?
    - Any episodes of choking/vomiting/reflux?
    - Frequency of treatment at home e.g use of relievers
- Past history
    - Age of onset
    - Number of exacerbations in the last 6 months
    - Previous severe episodes – hospital admissions, emergency visits, PICU admissions, IV treatment
    - Interim symptoms e.g nocturnal cough/wheezing or with exercise
    - Review the severity of symptoms e.g exercise limitation, sleep disturbance, school absence
    - Personal history of atopy
- Current medications
    - Dosage of inhalers
    - Method of delivery
    - Compliance with medications
    - Asthma action plan
- Family and social history
    - Atopy / Asthma
    - Pets at home
    - Exposure to secondhand smoke

5.2.2 Physical examination

Assess for:

- Respiratory rate
- Heart rate
- Blood pressure
- Ability to speak
- Level of consciousness
- Central cyanosis
- Sternal/Chest recessions
- Accessory muscle use
- Wheeze and air entry on auscultation
- Oxygen saturation (%): pre- and post- bronchodilator administration (nebulization or inhaler)

5.2.3 Severity assessment of asthma

- In children with exacerbation, no single assessment tool appears to be best for assessing severity, treatment monitoring, or predicting admission; however using a uniform Asthma clinical score may facilitate handover between clinicians regarding the severity of a child's condition.
- It is also useful to re-assess after each intervention and re-score to evaluate the response to treatment, i.e pre-treatment vs post-treatment Asthma clinical score.
- Assessment by the Asthma clinical score also can be helpful in deciding which management pathway to follow.

ASTHMA CLINICAL SCORE (PRAM) Calut D, Ducharme F, Davis G Journal of Pediatrics 2000;137:762-768 Ducharme, F. M., Chalut, D., Plotnick, L., et al Journal of Pediatrics 2008;152:476–480				
Signs	0	1	2	3
Suprasternal Indrawing (Tracheal tug)	Absent		Present	
Scalene retractions (use of accessory muscles)	Absent		Present	
Wheezing	Absent	Expiratory only	Inspiratory and expiratoty	Audible without stethoscope/ silent chest with minimal air entry
Air entry	Normal	Decreased at bases	Widespread decrease	Absent/ minimal
Spo2 in room air	≥94%	90 – 93%	≤89%	

Severity	Asthma Clinical Score
Mild	0 - 4
Moderate	5 – 8
Severe	9 - 12
Impending respiratory failure	Regardless of score, presence of lethargy, cyanosis, decreasing respiratory effort, and/or rising pCO2

5.3 Investigations:

5.3.1 A **chest x-ray** rarely provides additional information and is not routinely indicated. It should be performed if the following is suspected:

- Subcutaneous emphysema,
- Persisting unilateral signs suggesting pneumothorax, lobar collapse or consolidation
- Life-threatening asthma not responding to treatment

5.3.2 **Blood tests** may be considered in moderate-severe cases where IV access is already obtained. It may be helpful to do Full blood count, blood culture (if febrile), urea & electrolytes (especially serum potassium), blood glucose and CRP.

5.3.3 **Blood gas** measurements should be considered if there are life-threatening features not responding to treatment.

5.4 Criteria for admission to hospital

- Those with moderate symptoms should be admitted to APU/HDU and carefully monitored
- Severe or life-threatening episodes should be treated in PICU

6.0 Management of asthma. *(Please refer to algorithm for management of acute exacerbation of asthma in children)*

Initiate treatment according to severity as determined by Asthma Clinical Score.

6.1 First line treatment of asthma

6.1.1 β2-agonist (Salbutamol)

a) via Spacer and pressurized Metered Dose inhaler (pMDI)

- Salbutamol administration via pMDI-spacer is preferred except in severe or critical asthma as there is good evidence that pMDI + spacer is as effective as, if not better than, nebulizers for treating mild to moderate asthma in children.
- The ongoing quantity of puffs administered is based on age (Salbutamol 100mcg per puff)
    - Less than 6 years – 2 to 6 puffs
    - 6 years and above – 6 to 12 puffs

b) Via Nebulizer

- In severe or critical asthma, nebulizer use is more practical.
- If increasing fatigue, then continuous nebulized salbutamol can be given.
- If there is no spacer with MDI available, nebulized salbutamol can be given even with mild cases.
- The dosage of nebulized salbutamol administered is based on age.
    - Less than 6 years – 2.5mg
    - 6 years and above – 5mg

6.1.2 Ipratropium Bromide

- There is good evidence for the safety and efficacy of frequent doses of anticholinergic ipratropium bromide (every 20–30 minutes) used in addition to salbutamol for the first hours of a severe asthma attack. It also avoids hospital admission in 1 out of 12 school-aged children with severe exacerbation.
- For moderate to severe asthma or if symptoms are refractory to initial β2 agonist treatment, add ipratropium bromide.
- *Please add Ipratropium bromide 250 micrograms to the nebulized salbutamol solution (2.5mg or 5mg, according to age) with adequate amounts of normal saline to make up to a total solution of 4mLs and give 3 doses of the mixed solution 20 minutes apart in the first hour.*
- The ipratropium dose should be weaned to four to six- hourly or discontinued, as it has not been shown to provide significant benefit after

the child is hospitalized; therefore, it is not a standard therapy to be considered in the inpatient management of acute exacerbations.

6.1.3 Oxygen

- Children with life-threatening asthma or SpO2 <94% should receive high flow oxygen via a tight fitting face mask or nasal cannula.
- Please ensure that when oxygen is given via a tight fitting face mask, the minimum flow is 4LPM.
- Administer the lowest flow of oxygen required to maintain oxygen saturation ≥ 94%.
- If oxygen therapy is commenced it should be reviewed at least every 30 minutes as requirement for oxygen may decrease rapidly

6.1.4 Steroid Therapy

- The early use of steroids in emergency departments and assessment units can reduce the need for hospital admission and prevent a relapse in symptoms after initial presentation.
- Steroid therapy may not be necessary in mild cases.
- A short (3 - 5 days) course of corticosteroids (Prednisolone 1mg/kg up to 40 mg daily) is the current standard treatment for moderate to severe exacerbations.
- Those already receiving maintenance steroid tablets should receive 2mg/kg prednisolone up to a maximum dose of 60 mg.
- Repeat the dose of prednisolone in children who vomit within 30 minutes of ingestion and consider intravenous steroids in those who are unable to retain orally ingested medication or refuse oral medication
- Consider IV Hydrocortisone 4mg/kg in severe asthma, maximum 100mg.
- Treatment for up to three days is usually sufficient, but the length of course should be tailored to the number of days necessary to bring about recovery.
- Tapering is unnecessary unless the course of steroids exceeds 14 days.
- Where a diagnosis of asthma is questionable (due to lack of interval symptoms) a working diagnosis of viral wheeze is sometimes given to preschool aged children. There is currently insufficient evidence to advocate for the use of systemic corticosteroids steroids in this group.
- It is good practice for children already receiving inhaled corticosteroids to continue with their usual maintenance dose during an asthma attack whilst receiving additional treatment.

6.2 Second line treatment of asthma

- Children with continuing severe asthma despite frequent nebulized salbutamol and ipratropium bromide plus oral steroids, and those with life-threatening features, need urgent review by a specialist with a view to transfer to a high dependency unit or paediatric intensive care unit (PICU) to receive second line intravenous therapies.

- *IV magnesium sulphate should be the first choice in the second line treatment of asthma, followed by IV salbutamol.*
- Nebulized bronchodilators should be continued while the patient is receiving intravenous bronchodilators.

6.2.1 IV Magnesium Sulphate

- Intravenous magnesium sulphate should be given to all children presenting to hospital with acute severe asthma, all children who either fail to respond to initial therapy or whose asthma is felt severe enough to warrant intravenous therapy.
- It is readily available, relatively inexpensive, easy to administer and minimal side effects.
- Give bolus IV magnesium sulphate of 40mg/kg, diluted in 100mLs of normal saline over 30mins. This can be initiated in the Emergency Department, if the child is not already admitted to PICU.
- Please ensure that during administration of magnesium sulphate, the child is put on continuous cardiac monitoring.
- Please document the start of the infusion and the patient's baseline level of consciousness using the Glasgow Coma Scale.
- Consider a fluid bolus if patient appeared dehydrated as magnesium infusion may induce hypotension. Repeat blood pressure every 15 minutes during magnesium infusion.
- Note that magnesium sulphate infusion is incompatible with IV salbutamol. A second IV access needs to be established if IV Salbutamol is to be given.
- There is insufficient evidence regarding the benefit from continuous infusion of magnesium sulphate or nebulized magnesium sulphate in acute exacerbations.

6.2.2 IV Salbutamol

- Consider addition of a single bolus dose of intravenous salbutamol (15 micrograms/kg over 10 minutes) in a severe asthma attack where the patient has not responded to initial inhaled therapy and 20 minutes after completion of IV magnesium sulphate.
- A continuous intravenous infusion of salbutamol should be considered when there is uncertainty about reliable inhalation or for severe refractory asthma.
- Mix 25mLs of salbutamol 0.5mg/mL in 25mLs of normal saline, to produce 250mcg/mL dilution.
- Start the infusion of IV Salbutamol at *1mcg/kg/min*, titrating upwards in increments of 1mcg/kg/min to a maximum of 5mcg/kg/min as clinically indicated.

- IV Salbutamol infusion should be given in a PICU setting (up to 5 micrograms/kg/ min) with continuous electrocardiogram (ECG) monitoring and twice daily electrolyte monitoring.
- Once the patient is improving the intravenous infusion should be reduced before reducing the frequency of nebulized bronchodilators.

6.3 Discharge planning

- Children can be discharged when stable on 4 hourly inhaled bronchodilators that can be continued at home and SpO2 >94%.
- Acute asthma attacks should be considered a failure of preventive therapy and thought should be given about how to help families avoid further severe episodes.

6.3.1 Discharge plans should address the following:

- Review of inhaler technique
- Consider the need for preventer treatment
- A written **asthma action plan** for subsequent asthma attacks with clear instructions about the use of bronchodilators and the need to seek urgent medical attention in the event of worsening symptoms not controlled by up to 10 puffs of salbutamol four hourly
- Arrange a follow up appointment in a paediatric asthma clinic within one to two months
- A supply of bronchodilators and where applicable, the remainder of the course of medications received in the hospital

7.0 Assessing levels of asthma control

7.1 Asthma Control

The aim of asthma management is to achieve good control of the disease.

Levels of asthma control *(modified from GINA 2014)*

Characteristics	*Controlled (All of the following)*	*Partly Controlled (Any measure present in any week)*	*Uncontrolled*
Daytime symptoms	None	≥2 per week	≥3 features of partly controlled asthma present in any week
Limitations of activities	None	Any	
Nocturnal symptoms/awakening	None	Any	
Need for reliever	None	≥2per week	
Lung function (PEF/FEV1)	Normal	<80% predicted or personal best (if known)	
Exacerbations	None	≥1 per year	One in any week

8.0 A quick guide to preventers

Preventer medication should be considered for patients with any of the following:

- Severe exacerbations of asthma or in children aged 5-12 years who have had asthma attack requiring oral corticosteroids in the last two years
- Use of reliever ≥ three times per week
- Asthma symptoms ≥ three times per week
- Waking at least one night per week due to asthma symptoms

The following information is confined to inhaled corticosteroids, leukotriene receptor antagonists and long acting beta agonists.

8.1.1 a) Inhaled Corticosteroids (ICS)

- Preventers that are combined with long-acting beta-agonists (e.g. Seretide™ or Symbicort™) **should not be first line** but may be considered as step-up treatment in children 5 years and older.
- Commence ICS such as Beclomethasone dipropionate (BDP) -or equivalent- at a dose of 200 to 400mcg/day.

- A guide to equivalent levels of dosing are as follows:

Dose Level	*Beclomethasone dipropionate (Becotide)*	*Fluticasone Propionate (Flixotide)*	*Budesonide (Pulmicort)*
Low	100-200mcg	100 – 200mcg	200 – 400mcg
Medium	200 – 400mcg	200 – 400mcg	400 – 800mcg
High	>400mcg	>400 mcg	>800mcg

8.1.2 b) Leukotriene receptor antagonist (Montelukast - Singulair™)

- In children under five years who are unable to take ICS, leukotriene receptor antagonists may be used as an alternative preventer.
- The first choice as add-on therapy to inhaled corticosteroids in children under five years old is a leukotriene receptor antagonist.
- Dosing is based on age:
  - Children 2–5 years: 4 mg chewable tablet nocte
  - Children 6–14 years: 5 mg chewable tablet nocte

8.1.3 c) Inhaled long-acting β2 agonist (LABA)

- The first choice as add-on therapy to inhaled corticosteroids (ICS) in children aged 5-12 years is an inhaled long-acting β2 agonist, which should be considered before going above a dose of 400 micrograms BDP or equivalent per day.
- LABAs can be prescribed in children in combination with ICS.
- There are two most popular **combination medications** in Brunei are:
  - Fluticasone and salmeterol (Seretide™) for children 4 years and over
  - Budesonide and eformeterol (Symbicort™) for children 12 years and over
- If asthma control remains suboptimal after the addition of an inhaled long acting β2 agonist then the dose of inhaled corticosteroids should be increased to 400 micrograms/day in children (5–12 years), if not already on these doses. The next step would be to add in a leukotriene receptor antagonists if control remains poor.

8.2 Adjusting medications:

- If asthma is **not controlled** on the current treatment regimen, **step up** treatment. Generally, improvement should be seen within 1 month.
- Before initiating a new drug therapy, check patient's adherence with existing therapies, inhaler technique and eliminate trigger factors.
- If asthma is **partly controlled**, consider **stepping up** treatment, depending on whether more effective options are available, safety and cost of treatment and patient's satisfaction with the level of control

achieved.

- If **control is maintained** for at least 3 months, **step down** gradually with the medication dosage. The goal is to decrease treatment to the least medication necessary to maintain adequate control.
- For children <5 years, start low dose ICS for partly-controlled cases. For children with uncontrolled or partly controlled with low-dose inhaled steroids, either double the ICS dose or add on Leukotriene antagonists.

9.0 References:

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