Appendix 1

Singapore Triage Score

The Singapore Paediatric Triage Scale (SPTS)[1], currently used in our local tertiary paediatric hospital, is a four-level triage system. Patients are triaged by trained nurses based on three fundamental aspects: quick initial impression of illness severity using the Paediatric Assessment Triangle (PAT); history-taking and evaluation of the presenting complaint; and assessment of behaviour and age-related physiological measurements. The Severity Index Score (SIS)[2] is incorporated into this assessment to determine the urgency of care.

References:

1. Ganapathy S, Yeo JG, Thia XHM et al, Singapore Med J 2018 Apr;59(4): 205-209
2. Nelson KG. An index of severity for acute paediatric illness. Am J Public Health 1980;70: 804-7

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Appendix 2

Department triage guidelines

Patients with moderate to severe respiratory distress were brought into resuscitation bay if they had the following:

1) Respiratory or cardiac arrest

2) Grossly Unstable **Vital Signs:**

a) Pulse rate:

>=180 if less than 5 years old

>=160 if more than 5 years old

<= 60 for all age group if haemodynamically unstable

b) Respiratory rate:

>60 or < 16 in newborn to 1 month

>=50 or <=8 over 1 month

c) Pulse oximetry (good signal):

<=92%

d) Severity Index Score:

< 7

3) Evidence of moderate to severe respiratory distress

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a) Moderate to severe supraclavicular, sternal or intercostal retractions

b) Moderate accessory muscle use

c) Nasal flaring <2 yrs old

d) Grunting respiration

e) Tripod position

f) Upper airway obstruction (drooling, dysphagia, muffled voice, laboured respiration and

stridor), including foreign body obstruction.

g) Cyanosis (or history of cyanotic event, especially in infants)

h) lethargy or confusion or inability to recognised caregiver

i) single words or no speech

j) marked tachypnoea or hypoventilation

k) absent or decreased breath sounds

l) tachycardia or bradycardia

m) unprotected airway (weak to absent cough or gag reflex)

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Appendix 3

Department guidelines on management of moderate to severe asthma

Initial resuscitation would include oxygen supplementation as needed and a set of 2-3 cycles of intensive bronchodilator therapy. If the SPO_2 is less than 90% on room air on arrival, children less than 1 year old or those who have less than 10 kg body weight are given nebulized salbutamol 0.5ml: ipratropium bromide 0.5ml : saline 2 ml via 8-10 litres/min of oxygen. The children more than 1 year of age and with a body weight more than 10 kg and with SPO_2 less than 90% on room air are given nebulized salbutamol 1ml: ipratropium bromide 1ml: saline 2ml via 8-10 litres/min of oxygen.

If the SPO_2 is more than 90% in room air on arrival, children less than 1 year of age and less than 10kg body weight are given a bronchodilator cycle which includes salbutamol 5 puffs: ipratropium bromide 2 puffs delivered via a spacer device with or without low flow oxygen 1 -2 litres/min. Children more than 1 year of age and with body weight more than 10 kg receive bronchodilator cycles which include salbutamol 10 puffs: ipratropium bromide 4 puffs delivered via a spacer device with or without low flow oxygen 1 -2 litres/min.

Depending on the initial response, the child may then be given another 1-2 cycles of the above bronchodilators every 5 to 15 minutes. The nurses were informed to take their observations after a total of 2-3 cycles of bronchodilator therapy.

IV bronchodilator therapy and IV Magnesium Sulphate or IV Aminophylline are not considered as part of the initial resuscitative measures. Please refer to the following flowchart for the department management guidelines for moderate to severe wheezing.

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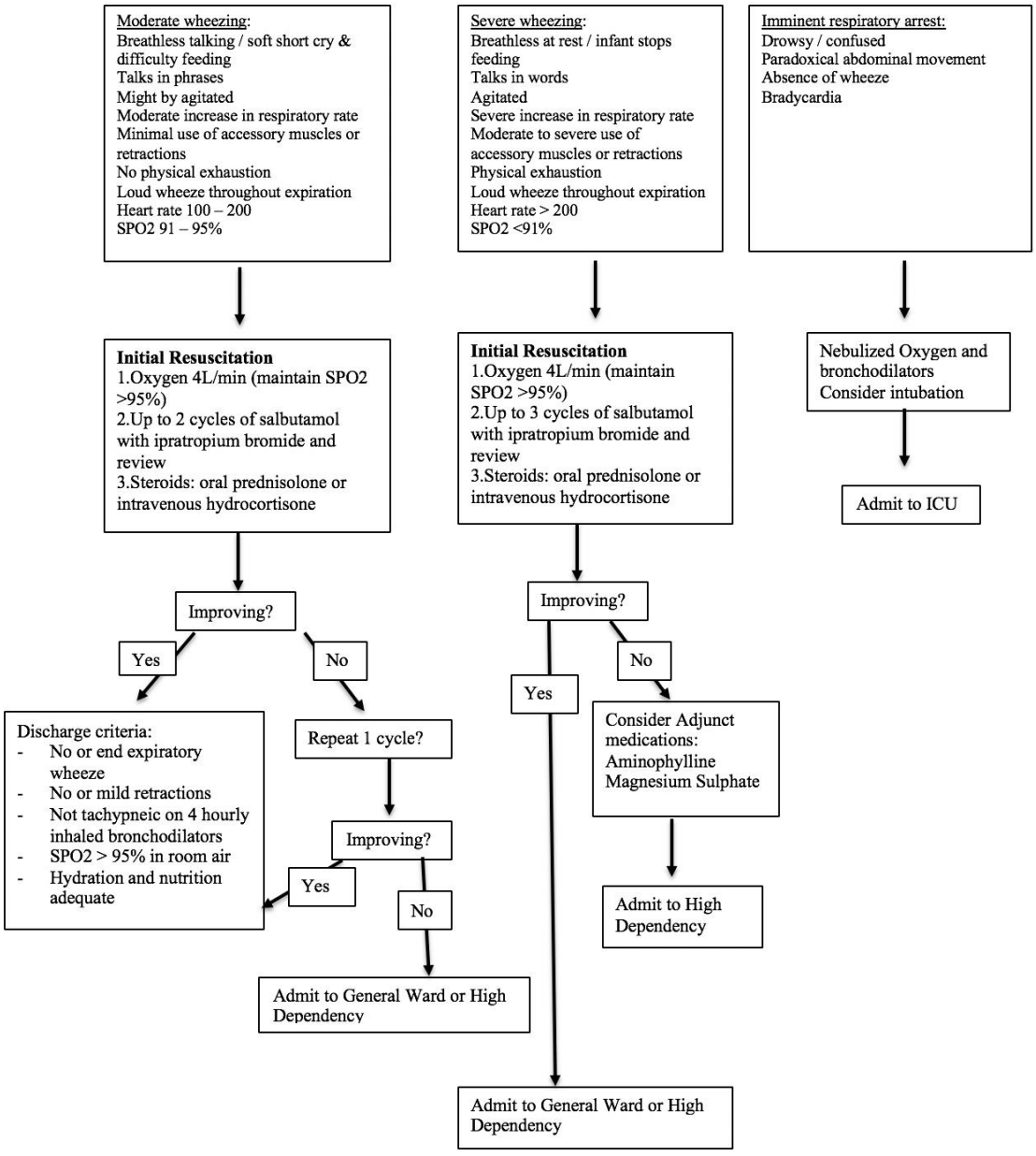
Moderate wheezing:
Breathless talking / soft short cry & difficulty feeding
Talks in phrases
Might by agitated
Moderate increase in respiratory rate
Minimal use of accessory muscles or retractions
No physical exhaustion
Loud wheeze throughout expiration
Heart rate 100 – 200
SPO2 91 – 95%
Severe wheezing:
Breathless at rest / infant stops feeding
Talks in words
Agitated
Severe increase in respiratory rate
Moderate to severe use of accessory muscles or retractions
Physical exhaustion
Loud wheeze throughout expiration
Heart rate > 200
SPO2 <91%
Imminent respiratory arrest:
Drowsy / confused
Paradoxical abdominal movement
Absence of wheeze
Bradycardia
Initial Resuscitation
1.Oxygen 4L/min (maintain SPO2 >95%)
2.Up to 2 cycles of salbutamol with ipratropium bromide and review
3.Steroids: oral prednisolone or intravenous hydrocortisone
Initial Resuscitation
1.Oxygen 4L/min (maintain SPO2 >95%)
2.Up to 3 cycles of salbutamol with ipratropium bromide and review
3.Steroids: oral prednisolone or intravenous hydrocortisone
Nebulized Oxygen and bronchodilators
Consider intubation
Admit to ICU
Improving?
Yes
No
Discharge criteria:
- No or end expiratory wheeze
- No or mild retractions
- Not tachypneic on 4 hourly inhaled bronchodilators
- SPO2 > 95% in room air
- Hydration and nutrition adequate
Repeat 1 cycle?
Improving?
Yes
No
Admit to General Ward or High Dependency
Improving?
Yes
No
Consider Adjunct medications:
Aminophylline
Magnesium Sulphate
Admit to High Dependency
Admit to General Ward or High Dependency

Appendix 4

Training package undergone by triage nurses:

Triage nurses were trained rigorously over 1 week to detect PP on the waveform. All the triage nurses attended 30-minute training sessions every day for 1 week at the beginning of each shift. The sessions were conducted by the study team members.

Training included lectures with slides on the principles of pulsus paradoxus and example images of pulse wave variability on the pulse oximetry tracings which are considered to reflect pulsus paradoxus. They were also showed images of normal pulse wave forms to show the difference. After 1 week of training, the triage nurses were tested independently by getting them to look through a series of images of pulse oximetry tracings and identify the presence or absence of pulsus paradoxus. Those who had difficulty in passing the test were re-trained and re-tested till they were confident in identifying the pulse wave variability accurately.

Subsequently, a 2-week pilot study was conducted where onsite assistance was provided by the study team members. Difficulties faced by the nurses when analysing the plethysmograph were identified and troubleshot. By the time the study commenced in December 2014, the triage nurses were confident and consistent in their assessments of the pulse oximeter plethysmograph.

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