



Malaysian Society of Paediatric
Anaesthesiologists (MSPA)



Asian Society of Paediatric
Anaesthesiologists



Safe Extubation in NORA

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**Asian Society of Paediatric
Anaesthesiologists**

Disclosures





Safe Extubation in NORA

Anticipation of difficult extubation

Preparation for difficult extubation

Management of difficult extubation

Post-extubation care

General Anesthesia in NORA

Dental procedures

Angiography Lab; cath, ablation

Invasive radiological procedures

Endoscopy

Differences from OR

**Challenging and unfamiliar, remote
locations**

Equipment

Lack of Experienced personnel

**Difficult cases, challenging medical or
behavioral issues**

Inadequate monitoring

Recovery

SOAP-ME

- **S- Suction, proper apparatus**
- **O- Oxygen; reliable oxygen source, a spare cylinder**
- **A-Airway; age-appropriate airway, equipment and intubation table**
- **P- Pharmaceuticals; basic emergent and anesthetic drugs**
- **M- Monitors; Pulse oxymetry, ECG, Blood pressure, portable ETCO₂, temperature**
- **E- Equipment; special equipment like defibrillator**

Removal of ETT is challenging

Laryngospasms?

SpO₂ ↓ ?

Airway obstruction?

Cough or Vomit?!



Too early?

or

Too late?



Respiratory complications

tracheal extubation = 3 x intubation and induction

Extubation

Was there any previous difficulty in controlling the airway?

What is the risk of pulmonary aspiration?



Anesthetics, not reversed, reflexes depressed

Contraindicated in pt.s with OSA, at risk of gastric contents aspiration, difficult airways
Reduce potential for bronchospasm, coughing, Valsalva-like straining, hyperdynamic response during emergence

Anesthetics stopped, NMB reversed

As a general rule, pt.s should be extubated awake

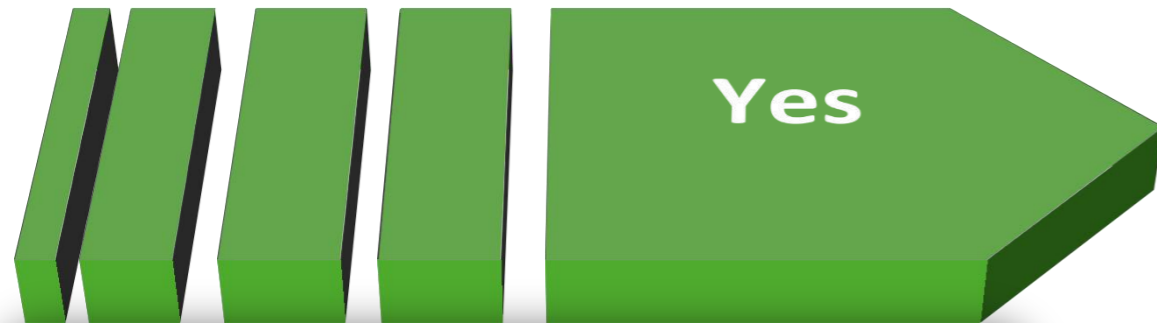
Swallowing

Eyes open

Spontaneous ventilation

Emergence and Extubation

Can this pt be extubated while deeply anesthetized?



Deep

- No residual NMB
 - Easy mask ventilation
 - Easily intubated
 - Not at risk for regurgitation/aspiration
 - Normothermic
- UAI, cough, straining unwanted, reactive airway*



Awake

- Difficult mask ventilation
 - Difficult intubation
 - Residual NMB present
 - Full stomach (increased intraabdominal pressure, obese, recent ingestion of food, ascites)
- Neonates, Prematures, infants*

Article

Deep vs. Awake Extubation and LMA Removal in Terms of Airway Complications in Pediatric Patients Undergoing Anesthesia: A Systemic Review and Meta-Analysis

Chang-Hoon Koo ^{1,2}, Sun Young Lee ², Seung Hyun Chung ³ and Jung-Hee Ryu ^{1,3,*}

- Data sources: 17 RCTs (conducted from 1999 to 2015)
- Criteria: Airway complications during deep and awake extubation in pediatric patients

Deep vs Awake	n	Result	Odd ratio (95%CI)
Overall complications	1395	favours Deep	0.56 (0.33–0.96) p=0.04
Airway obstruction	866	favours Awake	3.38 (1.69–7.73) p=0.0005
Cough	1115	favours Deep	0.30 (0.12–0.72) p=0.007
Desaturation (<96%)	1791	favours Deep	0.49 (0.25–0.95) p=0.04
Laryngospasm	1672	ns	1.05 (0.59–1.86) p=0.63
Breath holding	744	ns	0.58 (0.22–1.49) p=0.26

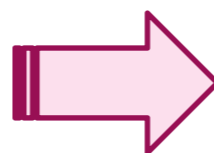


Complications associated with removal of airway devices under deep anesthesia in children: an analysis of the Wake Up Safe database

Lisa Vitale^{1,2*}, Briana Rodriguez^{1,3}, Anne Baetzel^{1,4}, Robert Christensen^{1,5} and Bishr Haydar^{1,6}

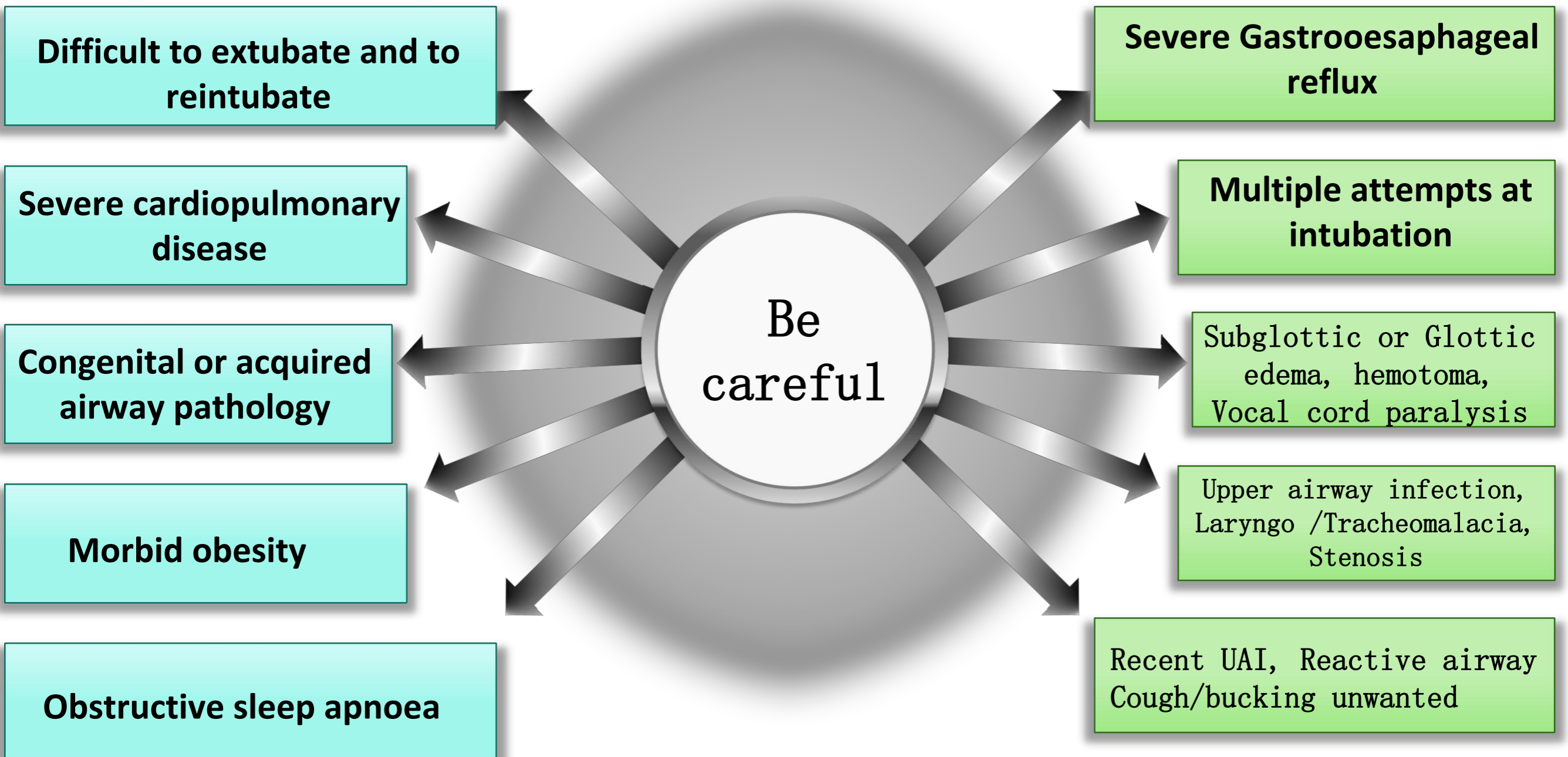
- Data source: 2019 Wake Up Safe database
- Criteria: Events during emergence/recovery from general anesthesia in patients who were removed ETT/SGA deep
 - 66 events out of 3652 events met the criteria and **64 events** were **related to anesthesia and respiration**
 - 46 events in OR 18 events in or in transport to PACU

Respiratory event	n (%)
Laryngospasm	35 (54.7)
Airway obstruction	7 (10.9)
Emesis	5 (7.8)
Apnea	4 (6.3)
Bronchospasm	4 (6.3)
Others	13 (20.3)
Multiple events	7 (10.9)



Outcomes	n
Cardiac arrest	19
Re-intubation	5
PICU admission	24

High Risk Pt.s for Difficult Extubation



Emergence and Extubation

Can this pt be extubated immediately following surgery and emergence from anesthesia?

Yes

- Awake
- Following commands
- Breathing spontaneously (*well oxygenated, not excessively hypercarbic*
– $PaCO_2 \leq 50$ mmHg)
- Fully recovered from NMB (*sustained head/hip lift, strong hand grip, strong tongue protrusion*)

No

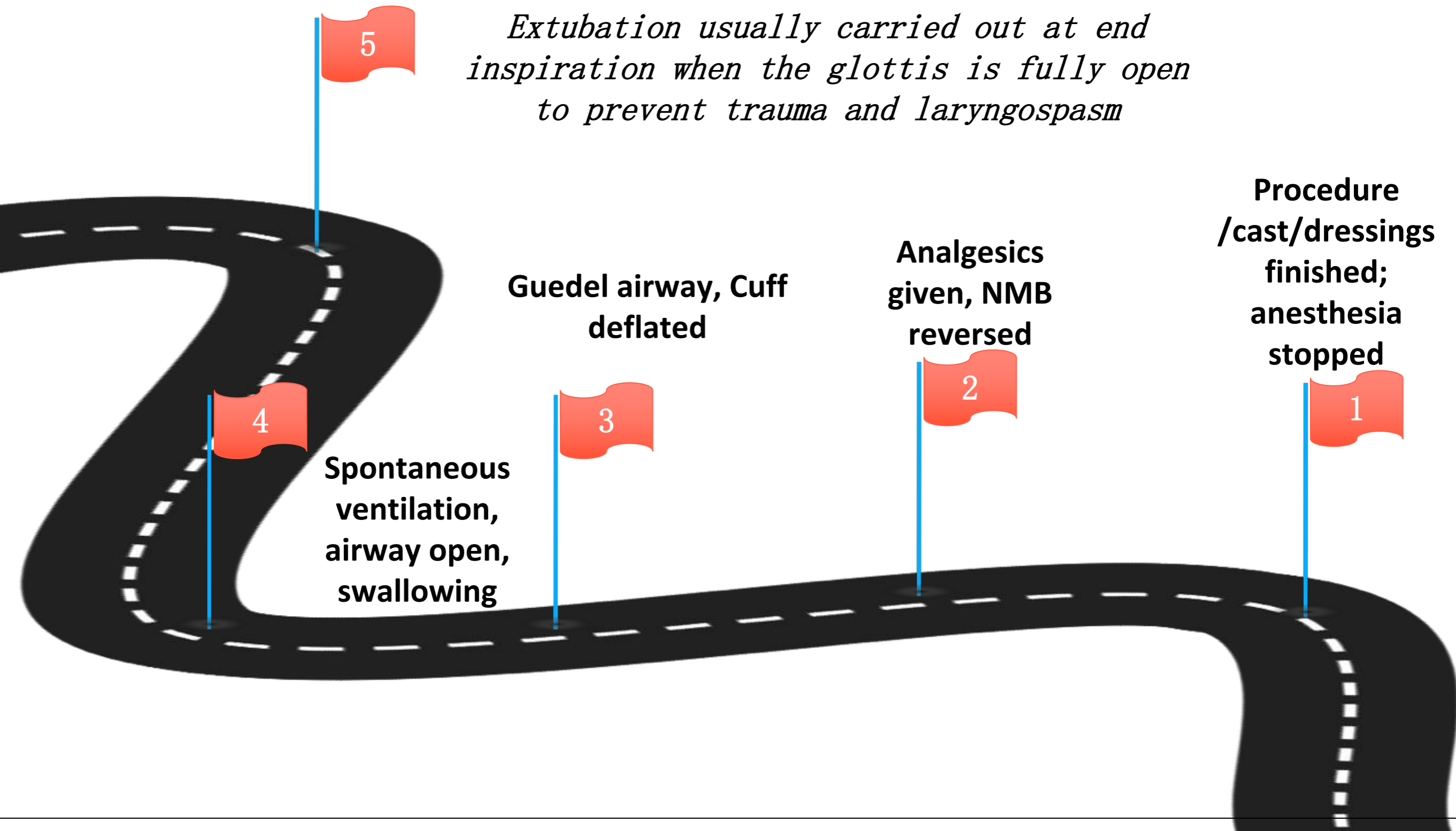
- Hypoxic ($SpO_2 < 90$ mmHg)
- Excessively hypercarbic ($PaCO_2 > 50$ mmHg)
 - Hypothermic ($< 34^\circ C$)
 - Residual NMB present
- Pt unable to protect airway
- Excessively long procedure
- Airway difficult to reestablish
- Unexplained hemodynamic instability

Tidal volume > 5 ml/kg

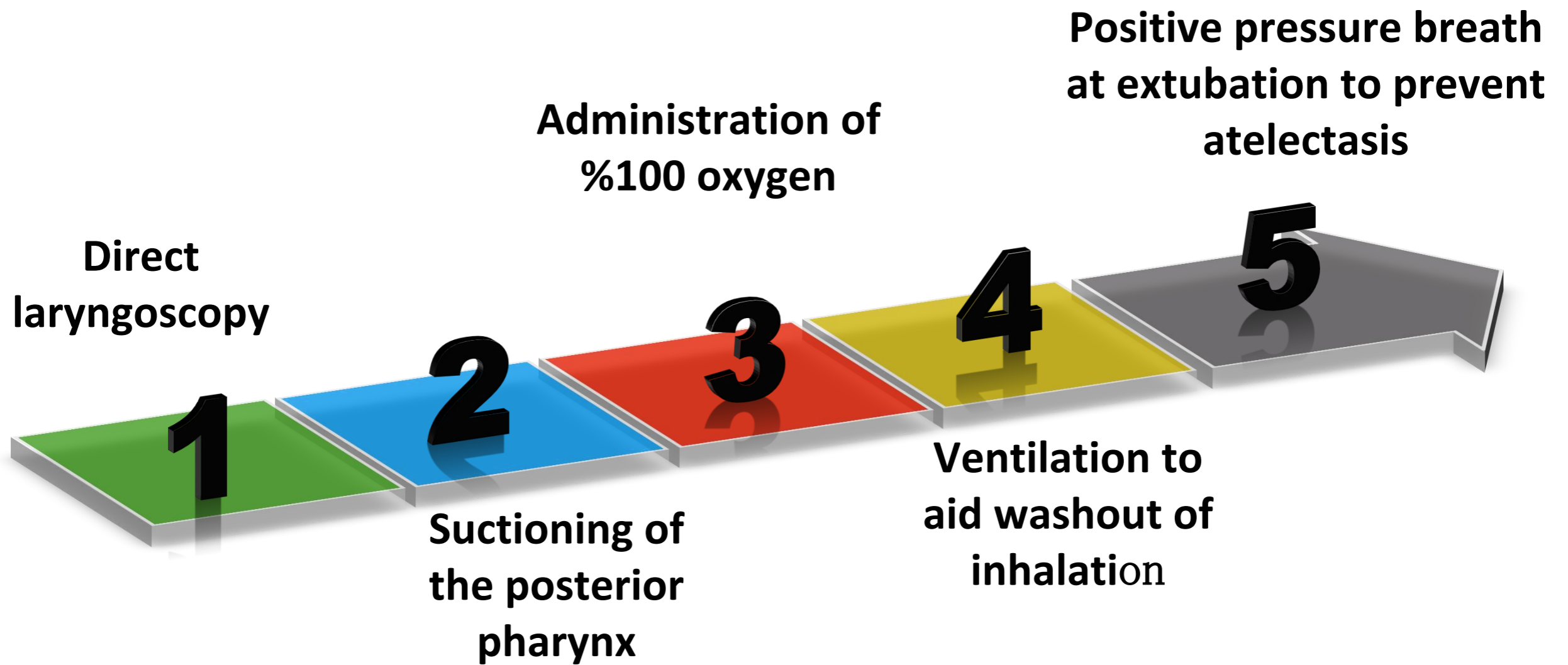
$SpO_2 > 95\%$

Age-appropriate respiratory rate

Timing of extubation



Tracheal Extubation



Extubation

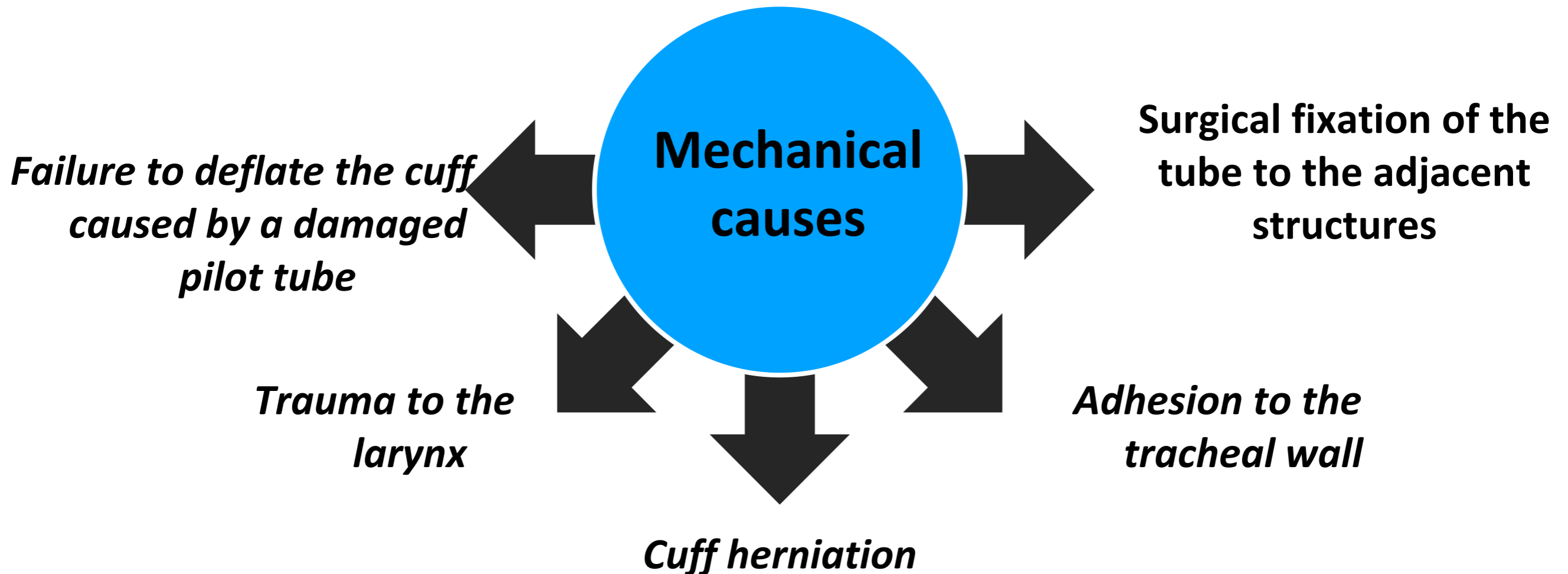
Airway reactivity

Hyperdynamic state; Tachycardia, hypertension (*severe arterial bleeding in fresh surgical field*)

Valsalva-like straining raises the central venous pressure; *bleeding at the highly vascularized procedure site*

Increases in ICP detrimental to recently resected AV-malformation bed or CSF leak

Problems Associated with Extubation



*Do not apply undue force
Be gentle to the airway*

**Problems
Associated
with
Extubation**
Cardiovascular
Response

Attenuated
by

**Esmolol 1.5 mg/ kg i.v. 2-5 min
before extubation**

Magnesium

Propofol infusion

Remifentanil infusion

Lidocaine (1 mg/kg i.v. over 2 min)

Topical lidocaine

Problems Associated with Extubation

Respiratory Complications

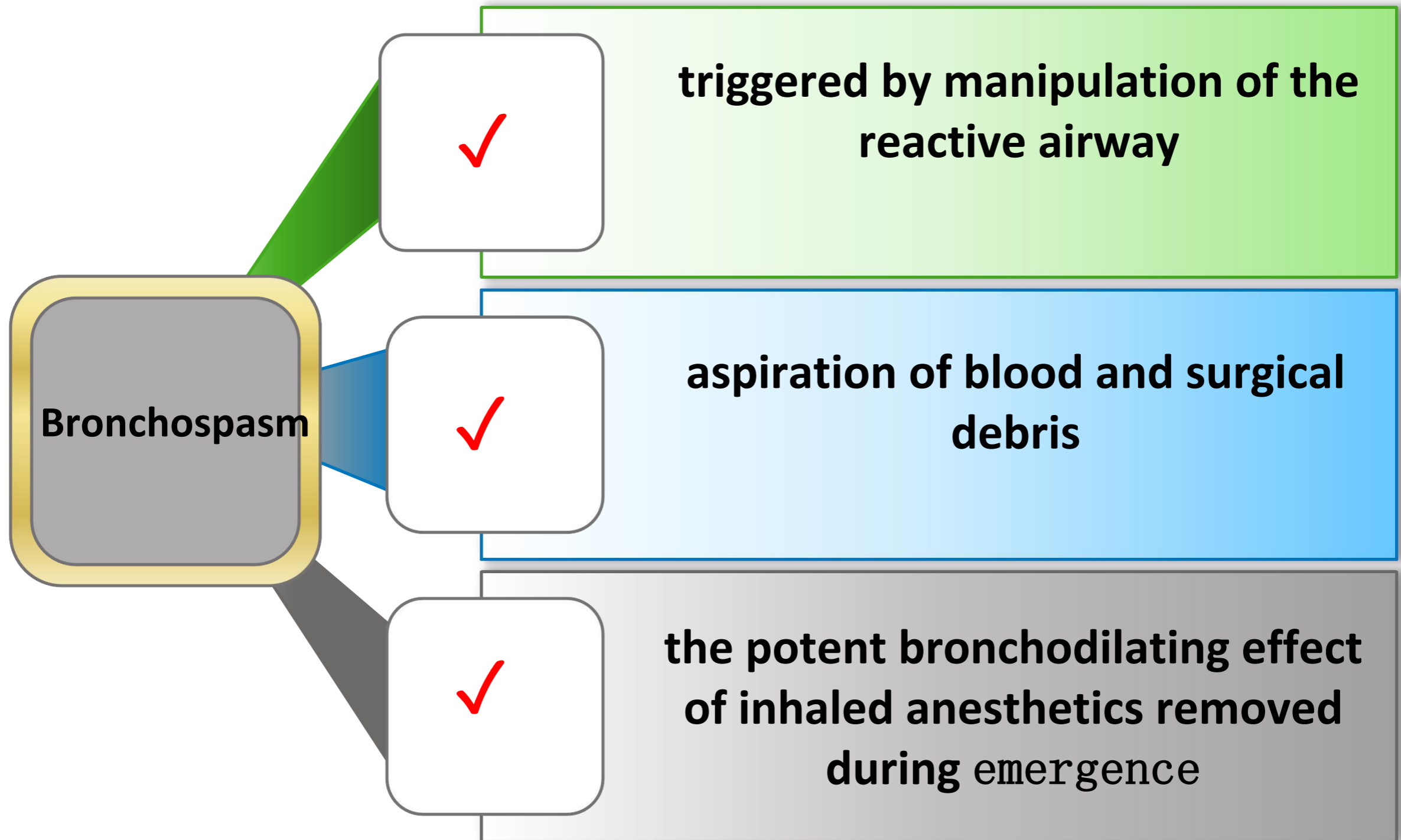
**Coughing and
sore throat**

**Early
postoperative
hypoxemia**

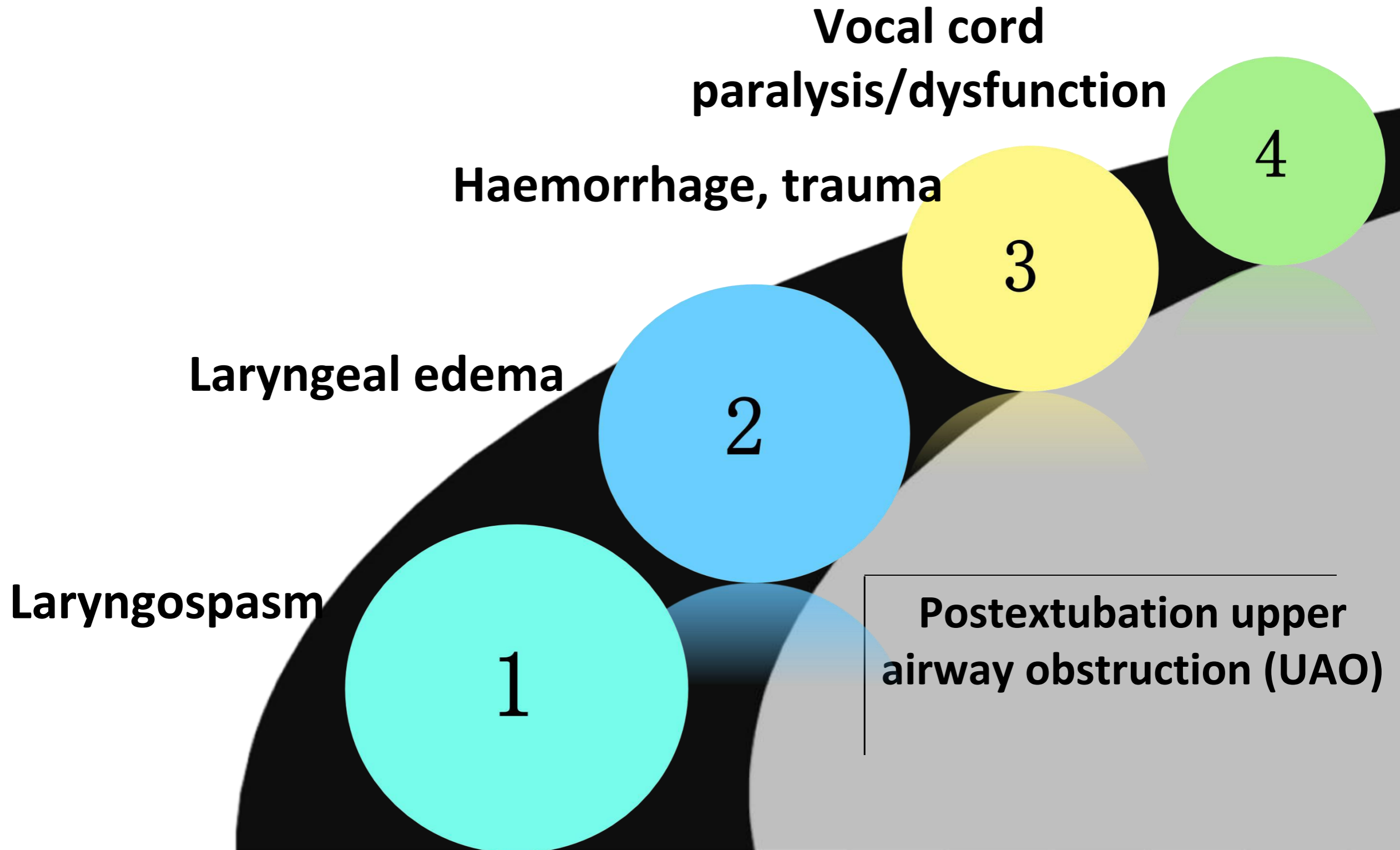
Residual NMB

Problems Associated with Extubation

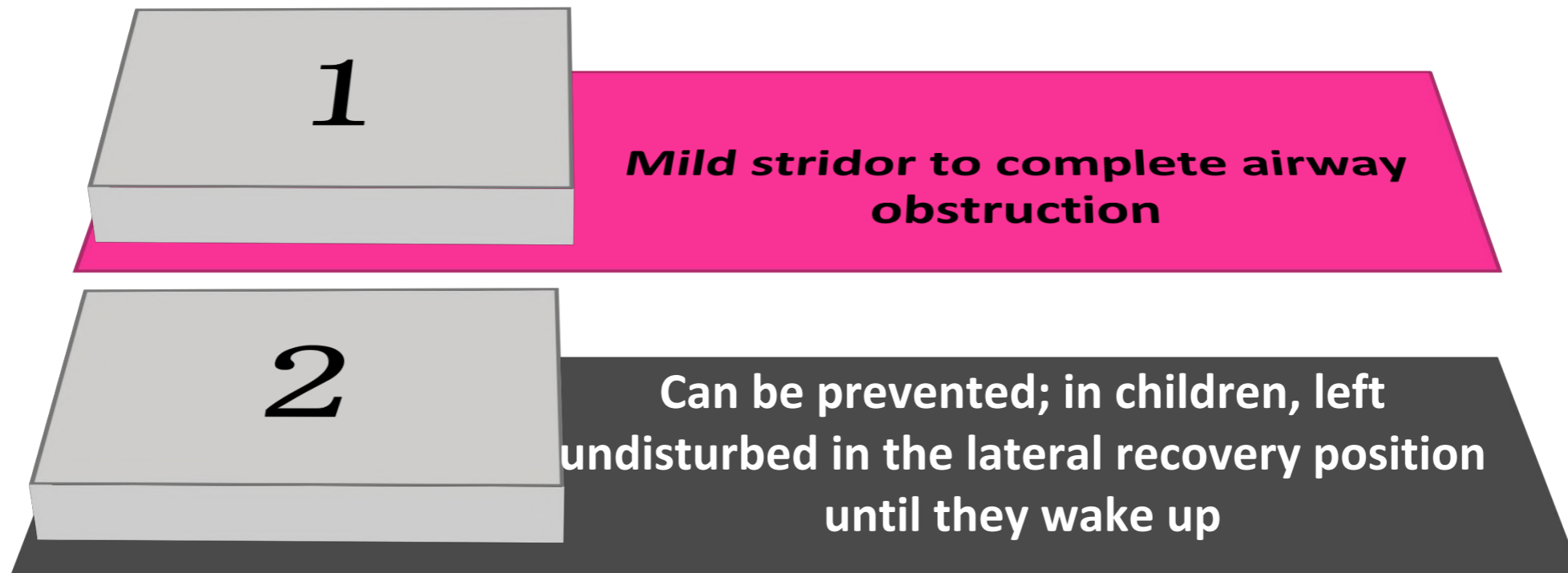
Bronchospasm



Problems Associated with Extubation

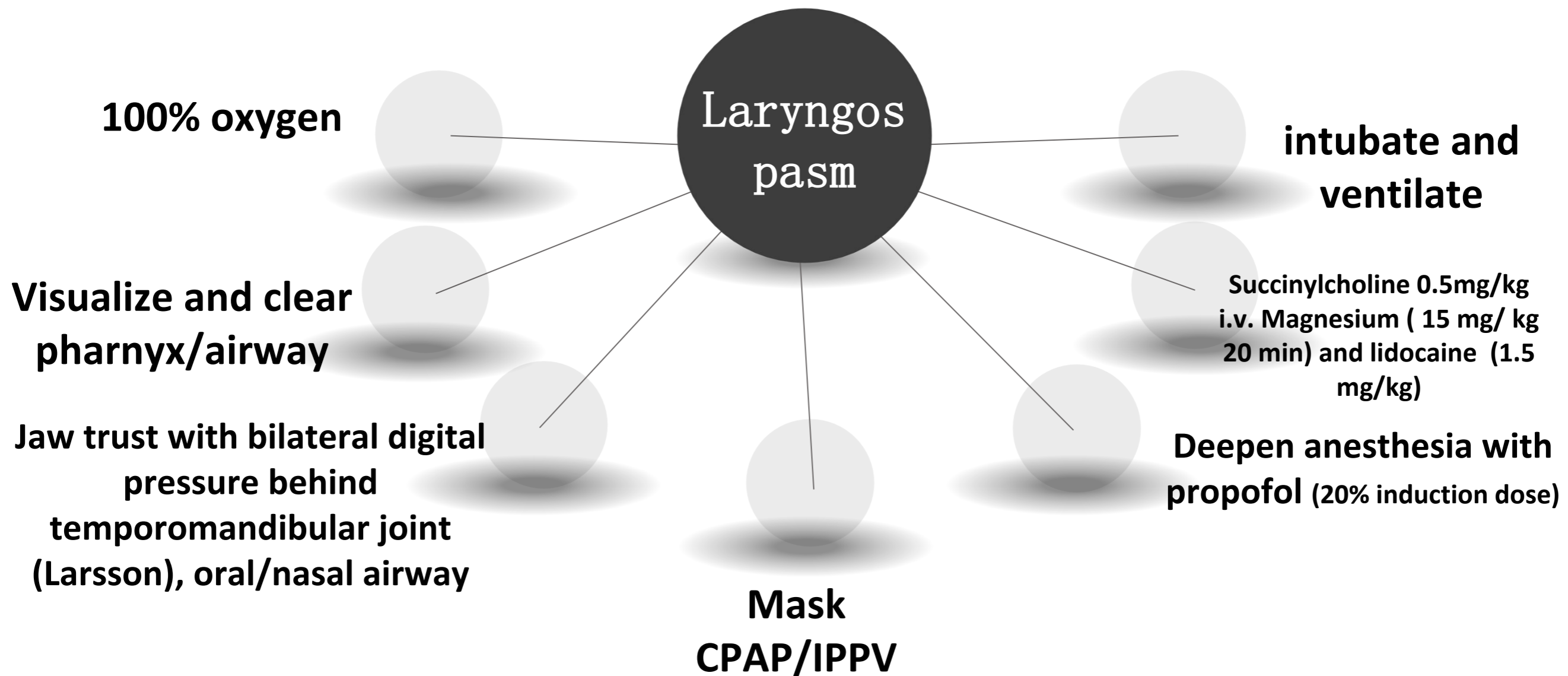


Laryngospasm



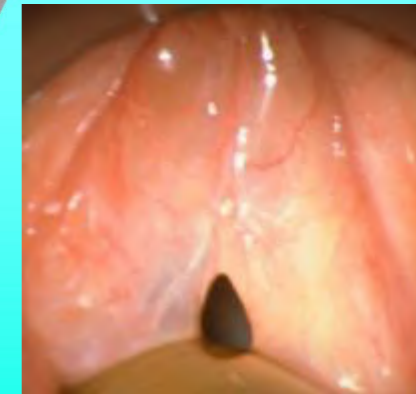


Laryngospasm Management



Laryngeal oedema

Infants, neonates, presents with inspiratory stridor within 6 h of extubation

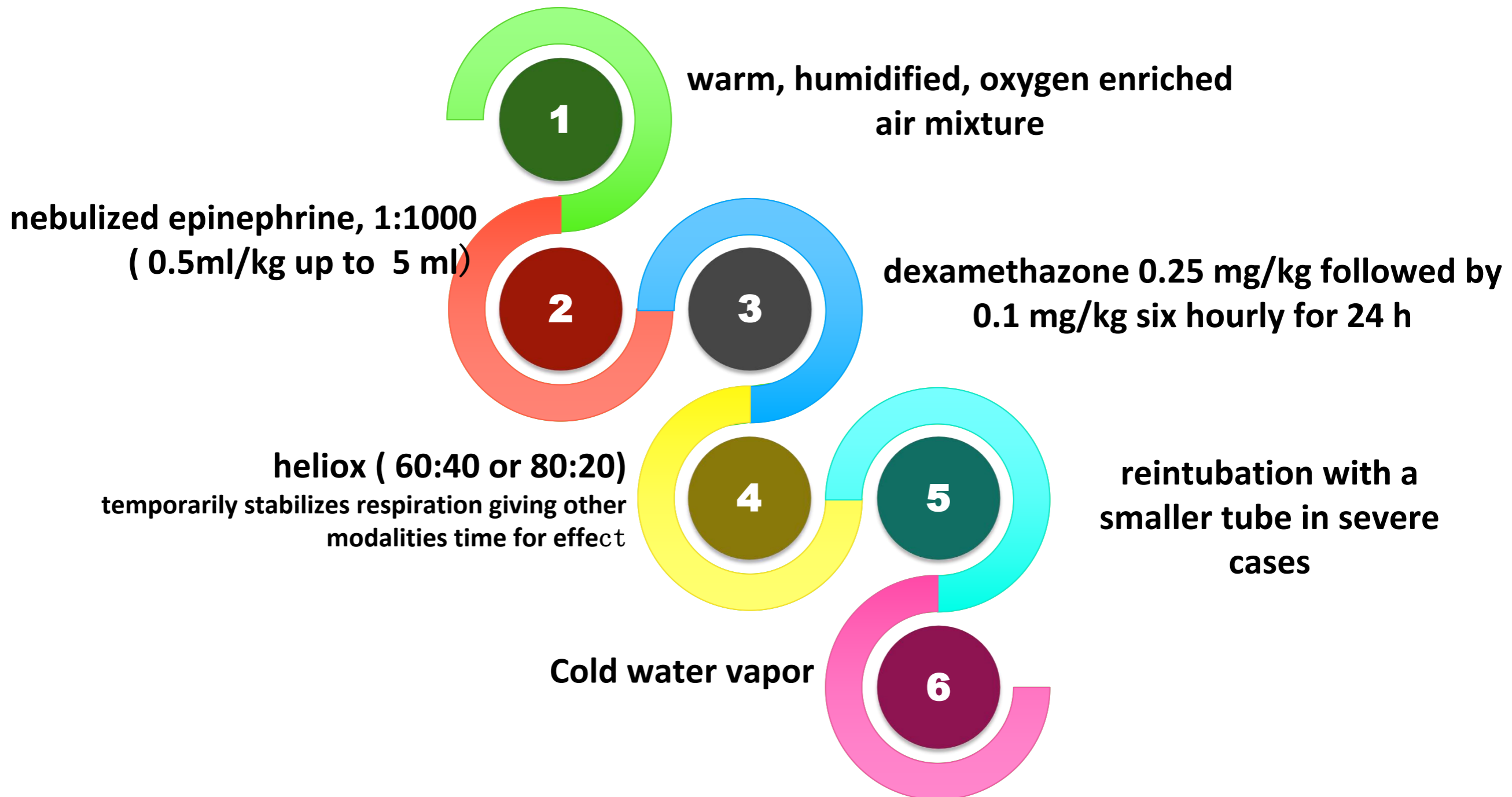


Supraglottic oedema
Retroarytenoidal oedema
Subglottic oedema

Tight fitting TT, change of head and neck position during surgery, trauma at intubation, duration of intubation >1 h, coughing on the tube, 'cuffed, microcuff ETT'



Laryngeal oedema Management

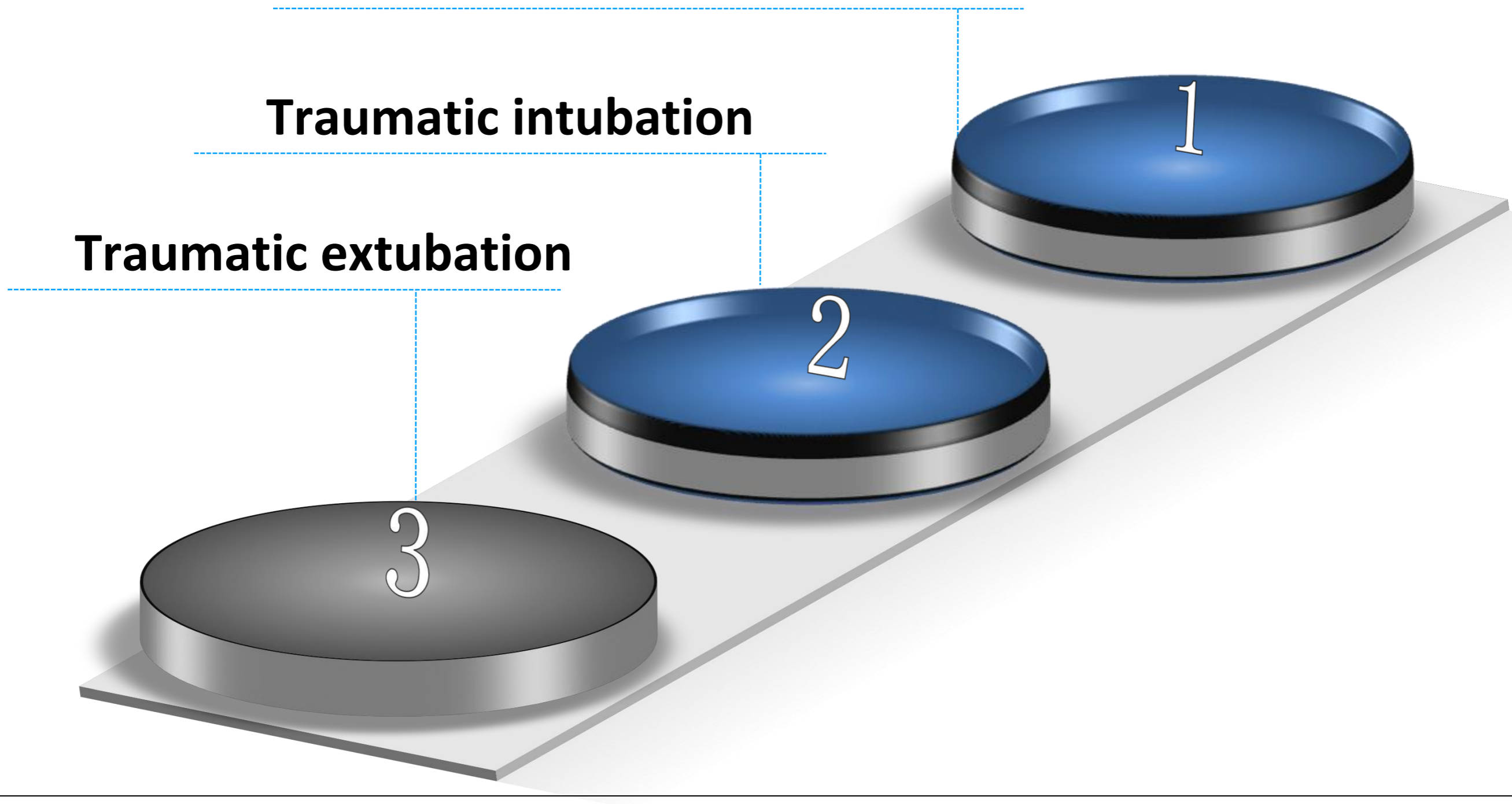


Trauma to the airway

Excessive suctioning

Traumatic intubation

Traumatic extubation



Vocal Cord Paralysis

Trauma to the vagus nerve after surgery or direct trauma or pressure from intubation itself

Unilateral

- hoarseness early postoperative period
 - managed conservatively
- recover several weeks

Bilateral

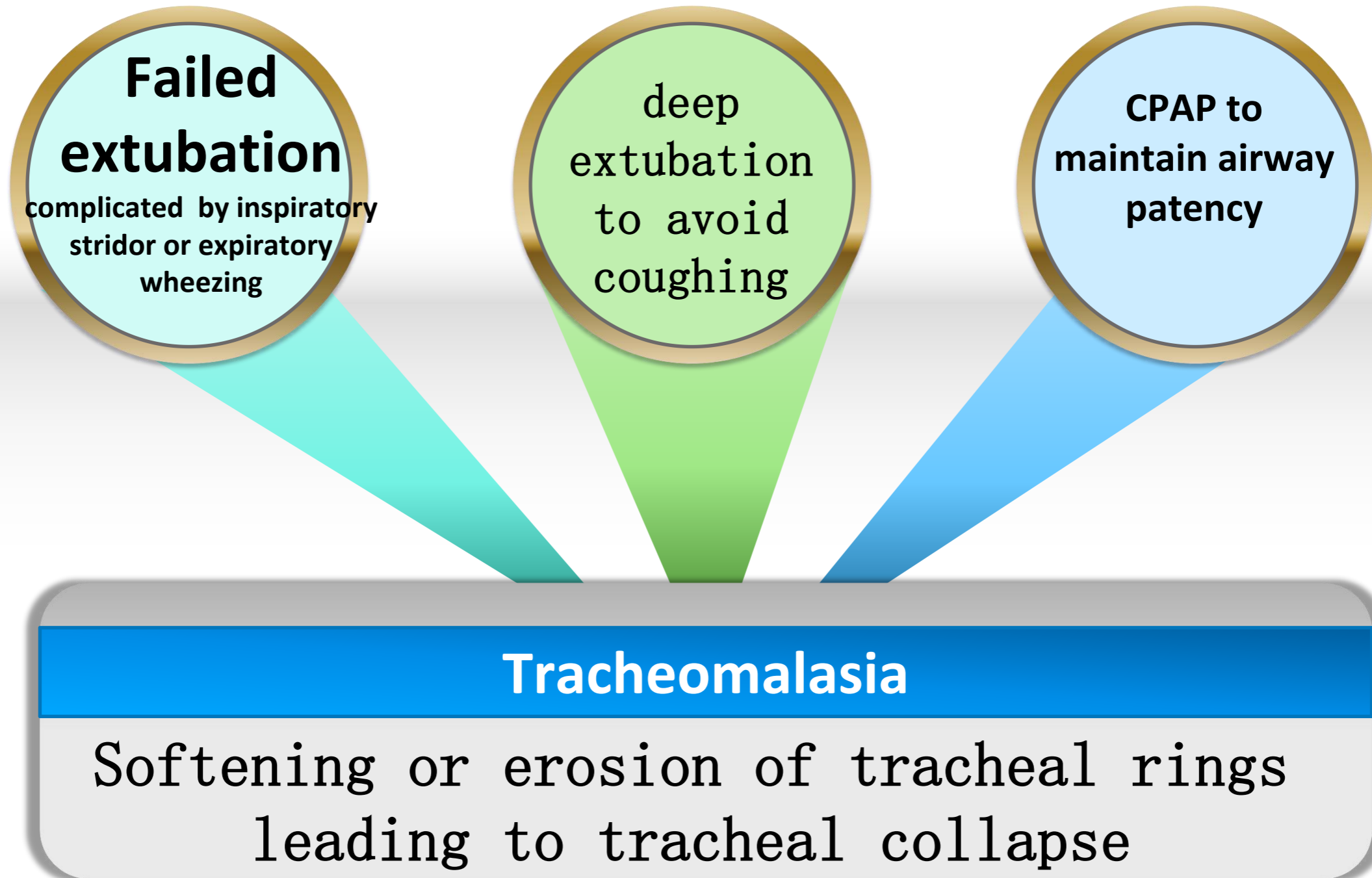
- acute postextubation UAO
 - immediate reintubation

Postobstructive Pulmonary Oedema

Postoperative desaturation

Resolve within 24h with non sequelae

Tracheomalasia



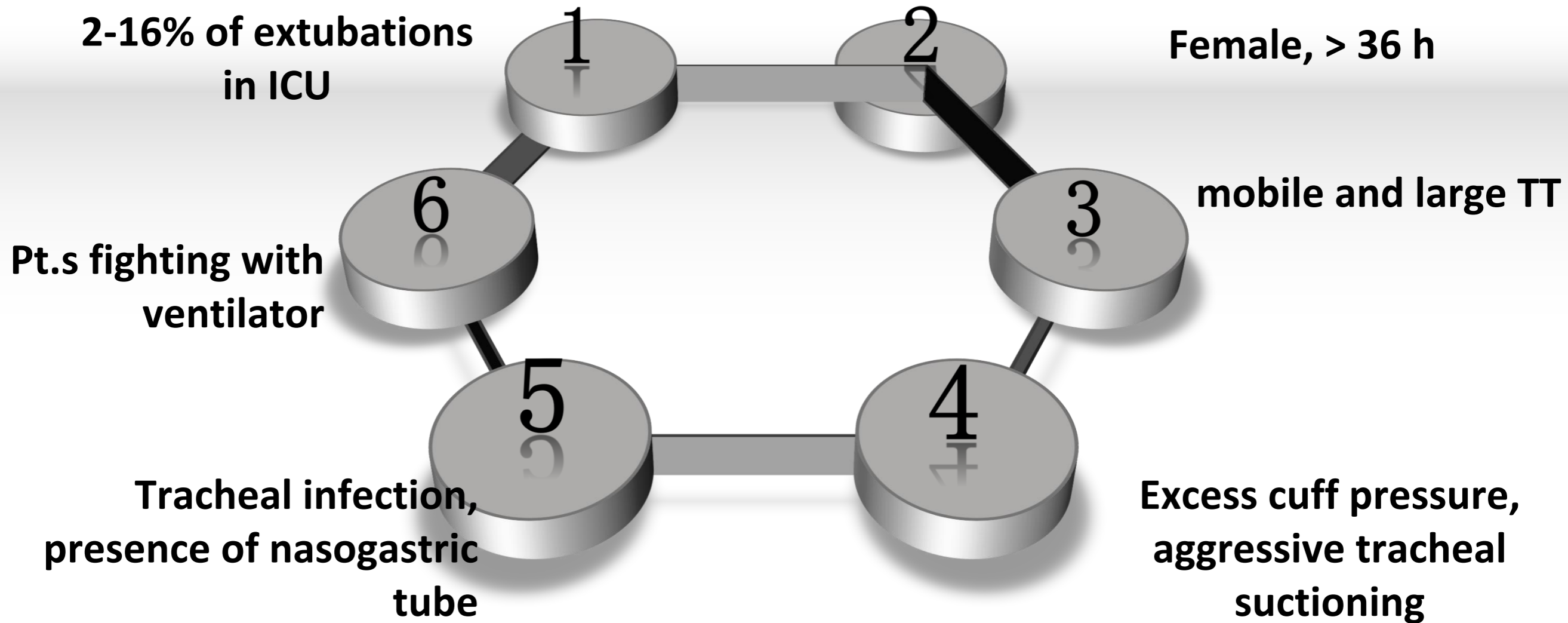
Pulmonary Aspiration

Swallowing reflex is obtunded by anesthetic agents

Laryngeal function disturbed with an inability to sense foreign substance

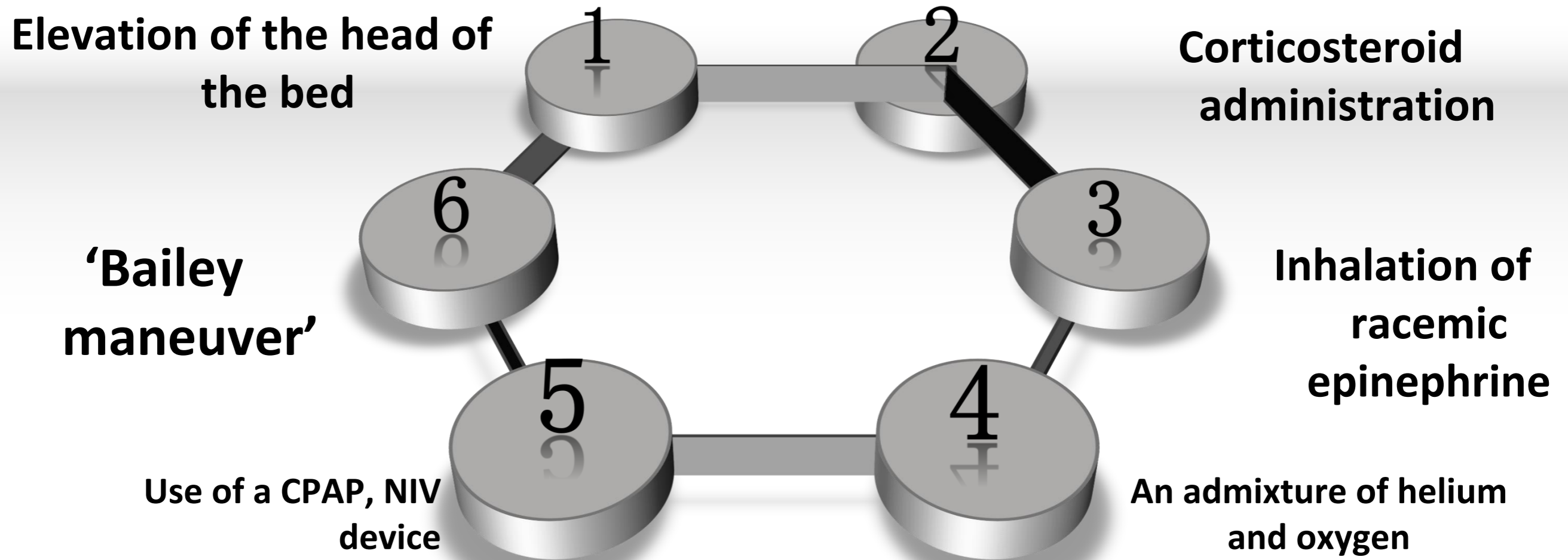
At least 4 h

Postextubation stridor



Less severe airway compromise

Conservative strategies



Strategies for Difficult Extubation

Substituting a LMA for TT while the pt is still anesthetized and paralysed

Use of TT exchange catheter (reversible tracheal extubation)

Predicting unsuccessful extubation

Extubation over a flexible bronchoscope (laryngeal paralysis, tracheomalacia, or tube entrapment)

Extubation in the intensive care unit

Take home

**E m e r g e n t
reintubation is
almost always
more difficult
than elective
intubation**

1

**Extubation of
difficult airway in
NORA involves
p l a n n i n g ,
preparation, and
backup plans,
experienced team**

2

**The careful use
of an AEC can
r e d u c e
morbidity during
reintubation
attempts**

3

**Decision to extubate
deep/awake needs
to be taken with
regards to the
experience and 6th
sense of anesthetist**

4



Thank You
Terima Kasih

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