Recovery from ICU-acquired weakness; do not forget the respiratory muscles!

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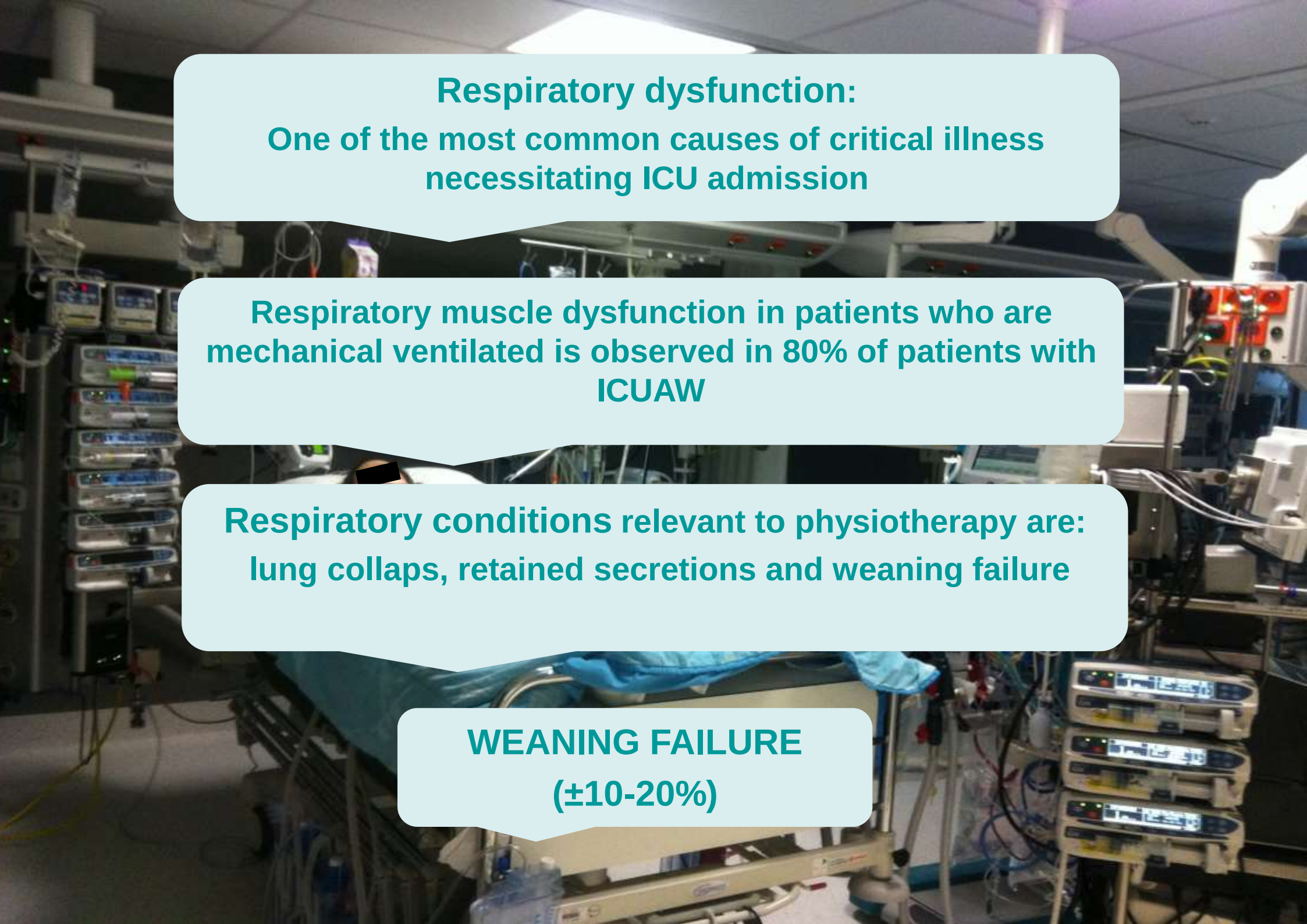


Respiratory dysfunction:

One of the most common causes of critical illness necessitating ICU admission

Respiratory muscle dysfunction in patients who are mechanical ventilated is observed in 80% of patients with ICUAW

Respiratory conditions relevant to physiotherapy are:

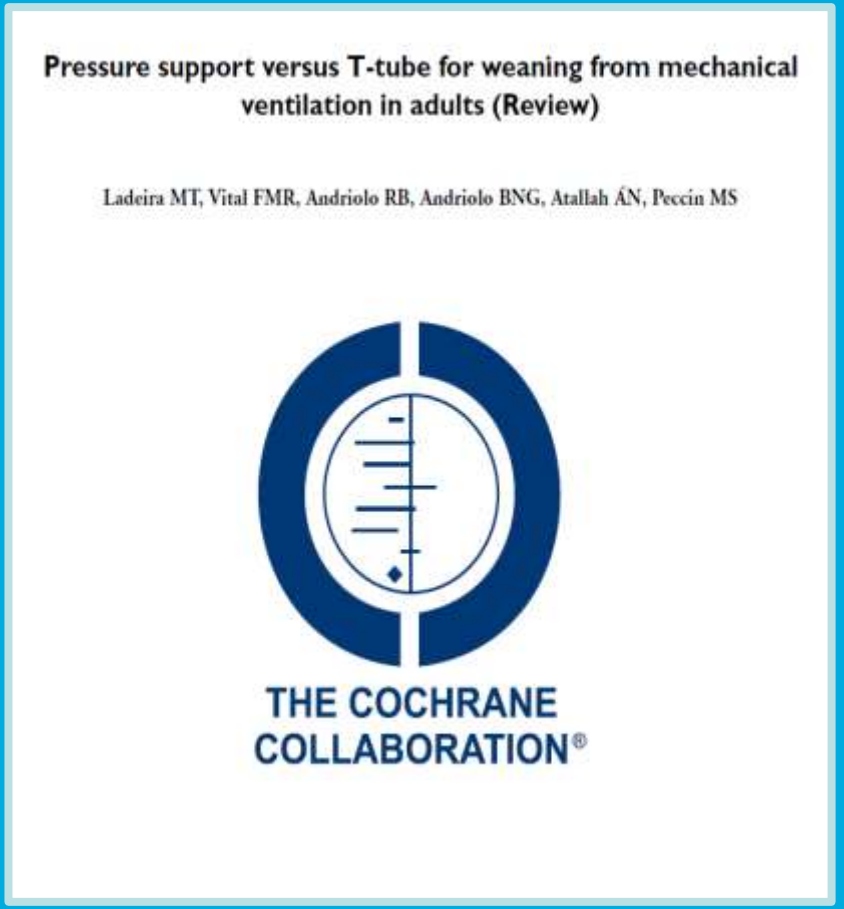
lung collaps, retained secretions and weaning failure

WEANING FAILURE

(±10-20%)

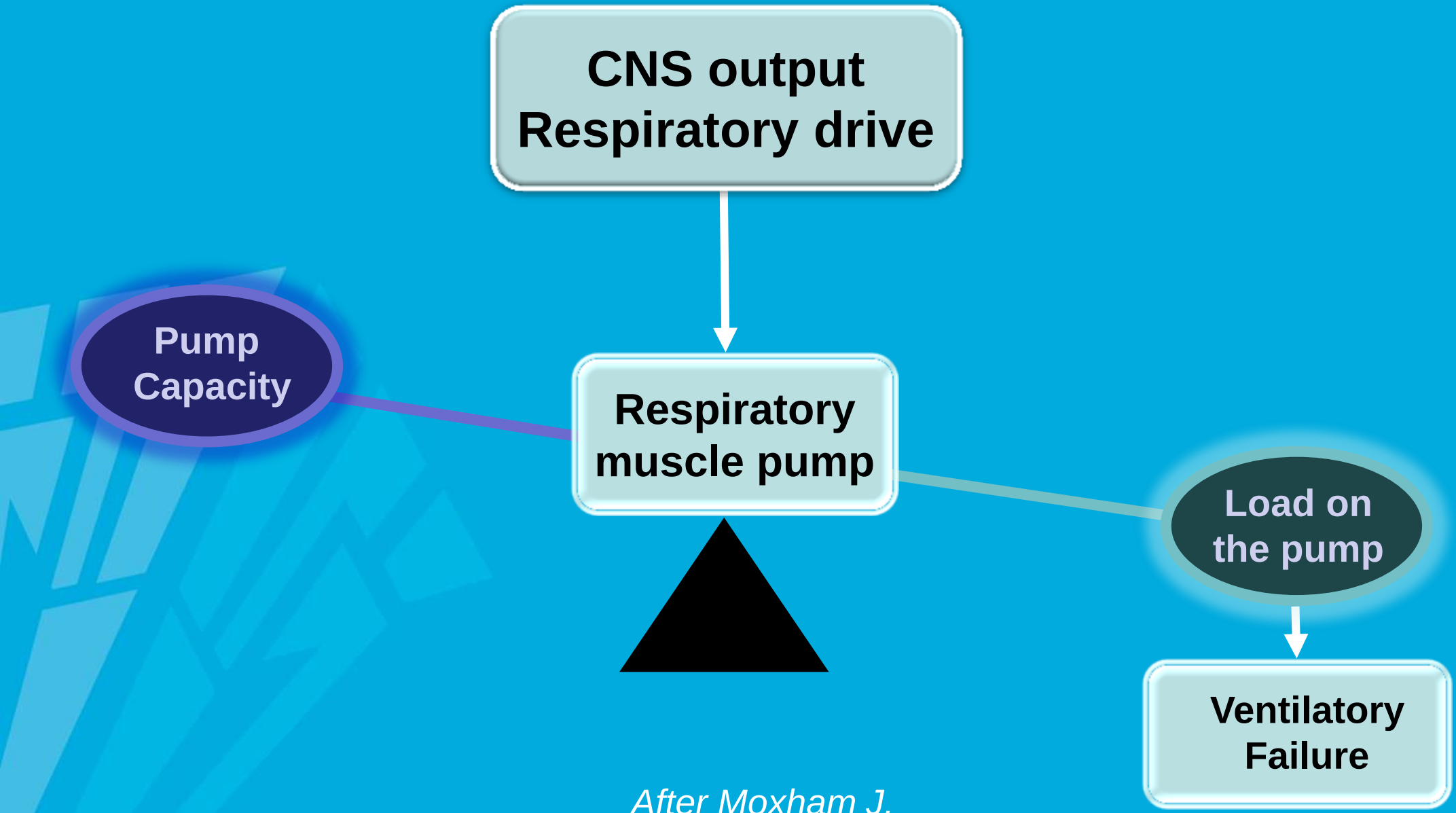
Weaning succes

'The absence of the requirement for ventilatory support within 48 hours after extubation (translaryngeal tube) or withdrawal (tracheostomy tube) of MV.



Ladeira MT et al.Cochrane Database Syst Rev.2014

In the weaning process we must take into account:



After Moxham J.

In analogy with the UZL ‘start to move ASAP’protocol

Start to breathe protocol = start to wean

Gosselink R. et al. Netherlands J Crit Care. 2011; 15(2):1-10

Task: training of inspiratory muscles

- **Respiratory Assessment**
- Training
  - Endurance training
  - Additional strength training (IMT)

Respiratory assessment (prior to treatment)

- Retained secretions – Atelectasis
  - Auscultation
  - Palpation
  - ABG
  - Chest X-Ray
- Respiratory weaning
  - **Inspiratory muscle strength (MIP>-20/-25cmH_2O)**
  - Forced Vital Capacity (>10ml/kg)
  - Clinical signs of muscle fatigue (RSBI<105 breaths/min*L)

Assessment Respiratory Weaning

Inspiratory muscle strength

MIP (max. insp. airway pressure)

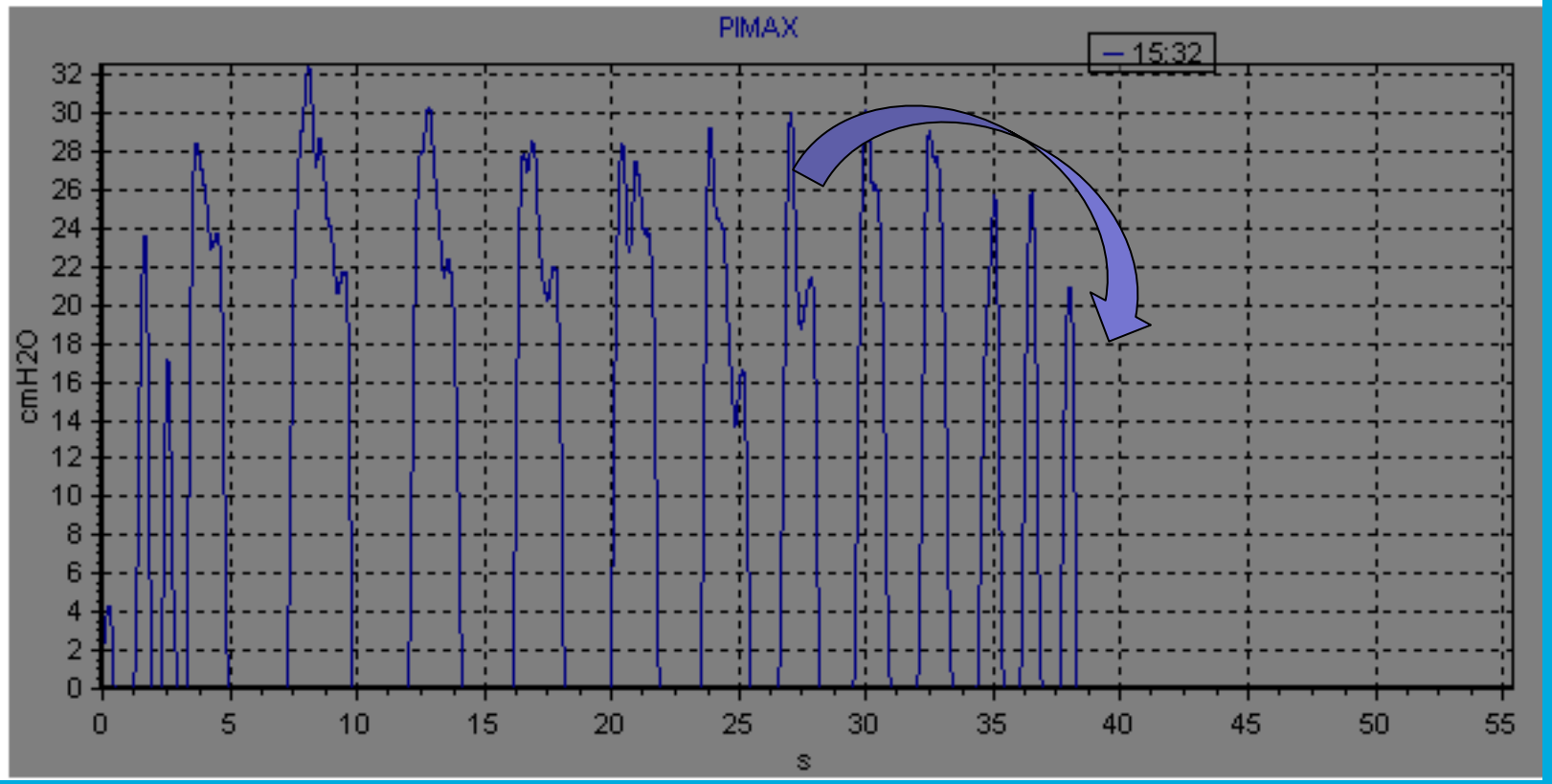
evaluation of respiratory muscle weakness

Assessment Respiratory Weaning

Maximal inspiratory pressure (≤ -20 -25cmH20)

MOUTH PRESSURE

Para	E.	Theo	1	%Theo.	2	%Theo.	3	%Theo.	4	%Theo.	5
PImax Plat.	cmH2O	86.47	30.60	35%							
PImax Peak	cmH2O		33.85								



Task: training of inspiratory muscles

- Assessement
- **Training**
  - **Endurance training**
  - **Additional strength training (= IMT)**

Endurance training: Start to breathe protocol

3 activities:

- Spontaneous breathing
- Cycling with legs, arms (bed-chair)
- Chair (in bed/out of bed)

→ first activities separately
→ 2 activities at the same time
→ 3 activities at the same time

Endurance training: Start to breathe protocol

AIM = increasing spontaneous breathing trial and time

Strength training: IMT

Intermittent loading of the respiratory muscles

AIM = increasing strength of the inspiratory muscles

Inspiratory muscle training

Training regimen:

- Intensity: perceived
- exertion 6-8 on 10 point scale (40-50% MIP)
- 6 à 8 breaths per set
- 3-5 sets per day

Tapered flow resistive loading (POWERbreathe KH1)

Martin et al. Critical Care 2011, 15:R84

Inspiratory muscle training (IMT) as an adjunct to enhance weaning success

What does literature say?

Journal of Physiotherapy 61 (2015) 125–134

Journal of PHYSIOTHERAPY

journal homepage: www.elsevier.com/locate/jphys

Research

Inspiratory muscle training facilitates weaning from mechanical ventilation among patients in the intensive care unit: a systematic review

Mark Elkins [a], Ruth Dentice [b]

Outcome measures

- Inspiratory muscle strength ↑
- Rapid shallow breathing index ↓
- Weaning duration
- Weaning success ↑
- Duration of mechanical ventilation
- Reintubation
- Tracheostomy
- Length of stay ↓
- Non-invasive ventilation ↓ (Shorter time)
- Survival
- Tolerability
- Adverse events

Comparison

- Inspiratory muscle training versus sham/no training

Case

Patient characteristics		*ICU stay*	
Initials	B.J.	Medical ICU	17 days
Sex	M	Surgical ICU	39 days
Age	38 years	Duration MV	10 days
Height	185 cm	Duration weaning (+start IMT)	19 days PSV: 5p,10ass > 48u T-piece
Weight	67 kg		
Diagnose	SSLTX, cystic fibrosis		

Pathophysiology of weaning failure

Pre transplant on venovenous-ECMO

↓

Severe critical illness, ICUAW

↓

Inspiratory muscle weakness

↓

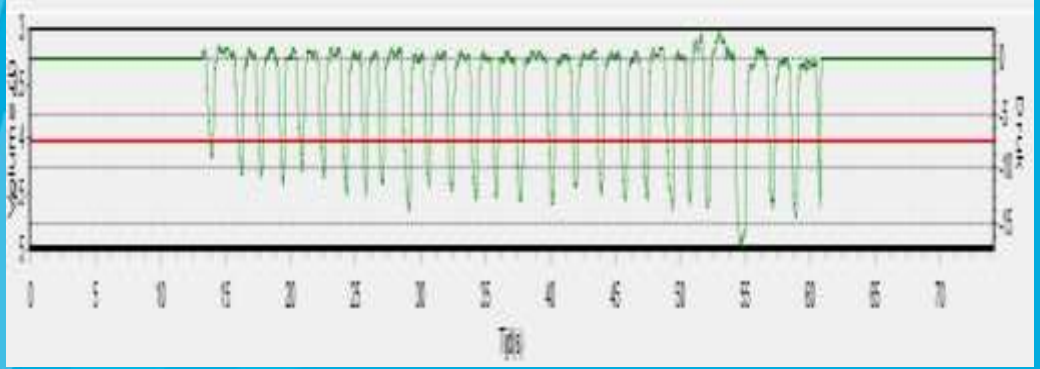
Prolonged weaning

MIP (before and after IMT)

DOB :	1978.02.19	Age :	38	Height (cm) :	185
Sex:	M	Dr:		Weight (kg) :	78
		Smoker:		Medic. :	

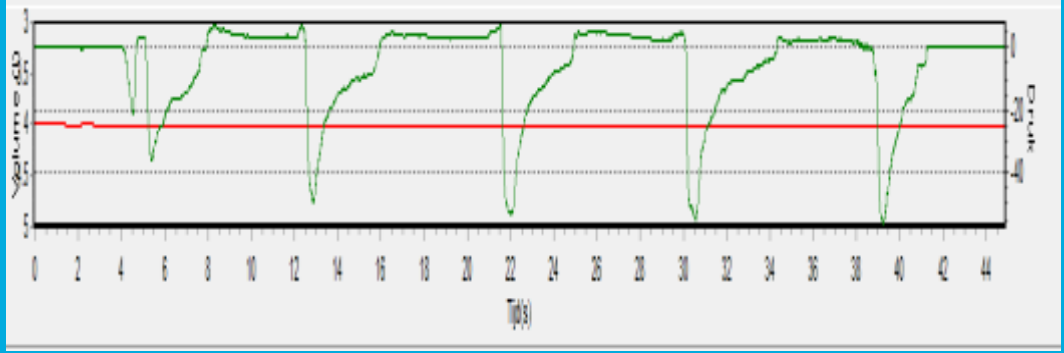
MOUTH PRESSURE Test date 16/06/2016

Para	E.	Pre (1)	%Theo.	Theo	SD
PImax	kPa	1.39	13%	10.29	9.09
PEmax	kPa	0.00	0%	14.36	13.12



MOUTH PRESSURE Test date: 12/07/2016

Para	E.	Pre (1)	%Theo.	Theo	SD
PImax	kPa	4.21	41%	10.29	9.09
PEmax	kPa	0.00	0%	14.36	13.12



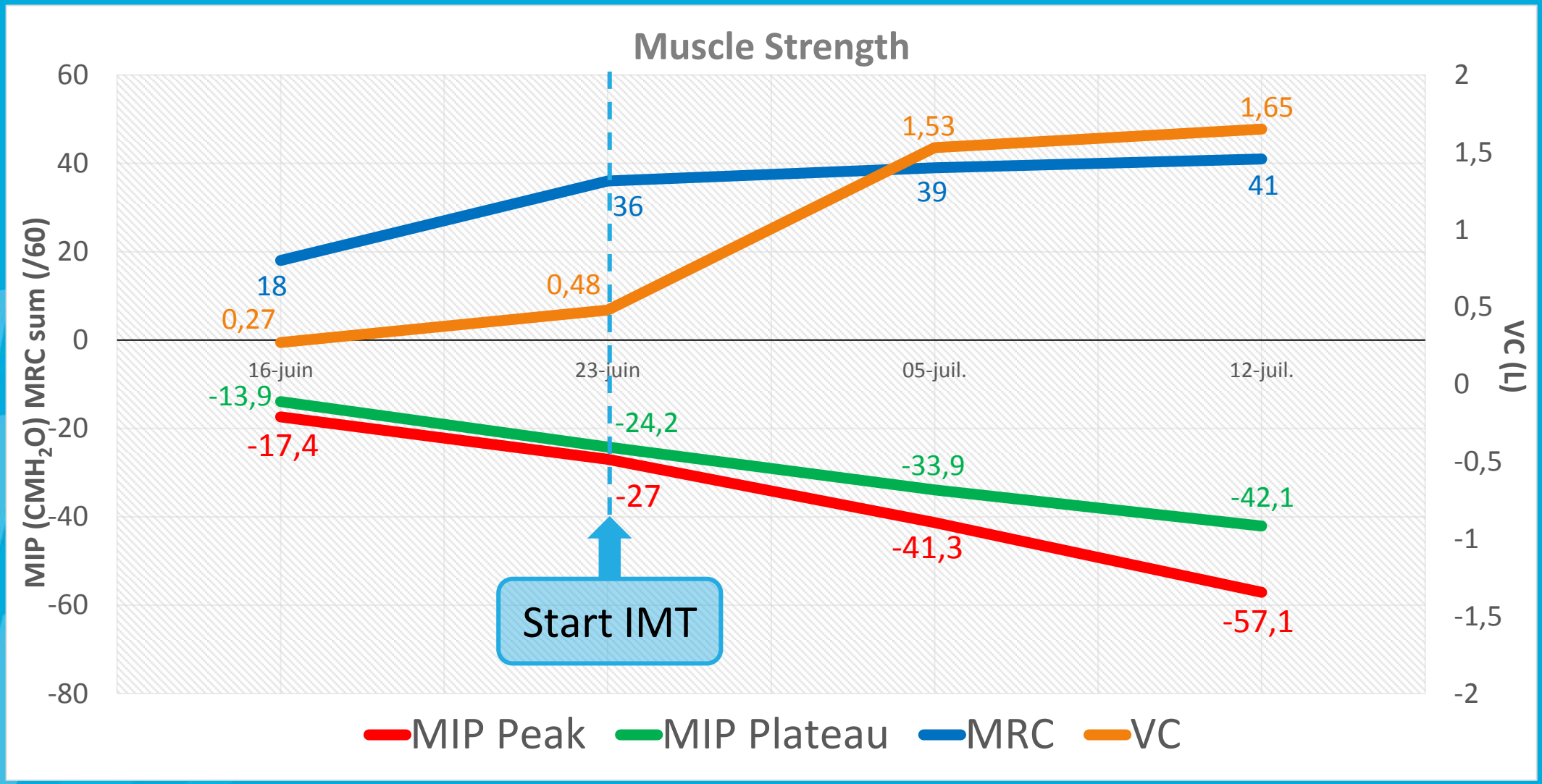
Evolution of the weaning process

Endurance tr.

Strength tr.

DATE	VENT. MODE (SBT)	MIP Plateau (-cmH20)	MIP Peak (-cmH20)	VC (L)	IMT (cmH20)
16/06/16	5p 10ass	14 (13% pred.)	17	0.27 (5% pred.)	Not feasible
		Start to breathe			
23/06/16	5p Oass (3X30')	24 (24% pred.)	27	0.48 (8% pred.)	8 Vt: 0.31L
29/06/16	5p 0ass (12u)			0.56 (10% pred.)	10 Vt: 0.56 L
05/07/16	T-piece (3x2u)	34 (33% pred.)	41	1.53 (26% pred.)	15 Vt: 0.92L
12/07/16	T-piece (24u)	42 (41% pred.)	57	1.65 (28% pred.)	20 Vt: 1.15L

MIP, VC and MRC-sum score



Tapered flow resistive loading (POWERbreathe KH1)

Conclusions

- Additional, inspiratory muscle training (IMT) can provide benefits such as improved resp. muscle strength, weaning success and decreased RSBI.
- Objective measurements such as MIP, VC and RSBI can assist to determine the probability of weaning success
- Our '*Start to Breathe*' protocol consists of 3 major activities: spontaneous breathing, (leg/arm) cycling and body positioning (chair sitting)
- Finally, during the weaning process we must always take into account a good balance between respiratory muscle (pump) workload and muscle (pump) capacity.

ICU Physical Therapy Team

THANK YOU!