Hypotension during and after field intubation for trauma

Asher brand, md

CBF = MAP - ICP

Hemodynamic collapse in Shocked patients

> To improve is to change; to be perfect is to change often.
>
> **Winston Churchill**

The frequency and significance of postintubation hypotension during emergency airway management☆

Alan C. Heffner MD [a, b], Douglas Swords BA, MS III [b], Jeffrey A. Kline MD [b], Alan E. Jones MD [b, c,*]

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[c]Department of Emergency Medicine, University of Mississippi Medical Center, Jackson, MS, USA

N=336

25% incidence of hypotension in RSI

Normotensive to start

ETI assoc w/ higher mort = CI 1.9 (1.1-3.5)

The association between admission systolic blood pressure and mortality in significant traumatic brain injury: A multi-centre cohort study

2014

Gordon Fuller[a,1,*], Rebecca M. Hasler[b,1], Nicole Mealing[c], Thomas Lawrence[a], Maralyn Woodford[a], Peter Juni[c], Fiona Lecky[d]

Known Harm:

- Hypotension is associated with mortality in Trauma and especially TBI
- Fuller (Injury, 2014) demonstrated relationship with mortality to mortality:

BTF says keep SBP>90

1.5X if SBP >120
2.0X if SBP < 100
3.0X if SBP < 90

This Matters!

Difficulty with Terms

- "Fentanyl Dropped his pressure"
- What is hypotension
  - Depends on clinical situation, physiology, injuries, etc
  - Limits not really established (BTF wants SBP > 90)
- Clinically significant Hypotension

Redefining hypotension in traumatic brain injury

Cherisse Berry, Eric J. Ley, Marko Bukur, Darren Malinoski, Daniel R. Margulies, James Mirocha, Ali Salim *

Department of Surgery, Division of Trauma and Critical Care, Cedars-Sinai Medical Center, Los Angeles, CA, United States

Injury, 2012

TBI pts > 15 yrs, Isolated Brain injury

Head AIS > 3

Admitted to Level I or II

N=15,733

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15-49 YRS: SBP < 110 OR: 1.98 (1.65-2.3)

50-69 YRS: SBP < 100 OR: 2.20 (1.46-3.31)

> 70 YEARS: SBP < 110 OR: 1.92 (1.35-2.74)

Prehospital risk factors of mortality and impaired consciousness after severe traumatic brain injury: an epidemiological study

SCANDINAVIAN JOURNAL OF trauma, resuscitation & emergency medicine

Sophia Tohme[1], Cecile Delhumeau[1], Mathias Zuercher[2], Guy Haller[1,3] and Bernhard Walder[1*] 2014

- 589 pts - Endpoints: Death or GCS <13 at 2 wks
- Inclusion:
  - Median GCS = 4 (but some GCS 14).
  - or, Head AIS > 3
- Increased Risk Associated with:

  hypoxia, hypotension, hypothermia, total Prehospital time and direct triage

Hypoxia 12.6%

Hypotension 4.1%

Hypothermia 24.8%

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n=589

Statistical Analysis (multivariate analysis)

Hypotension and hypoxia associated with death

Hypoxia associated with poor outcome

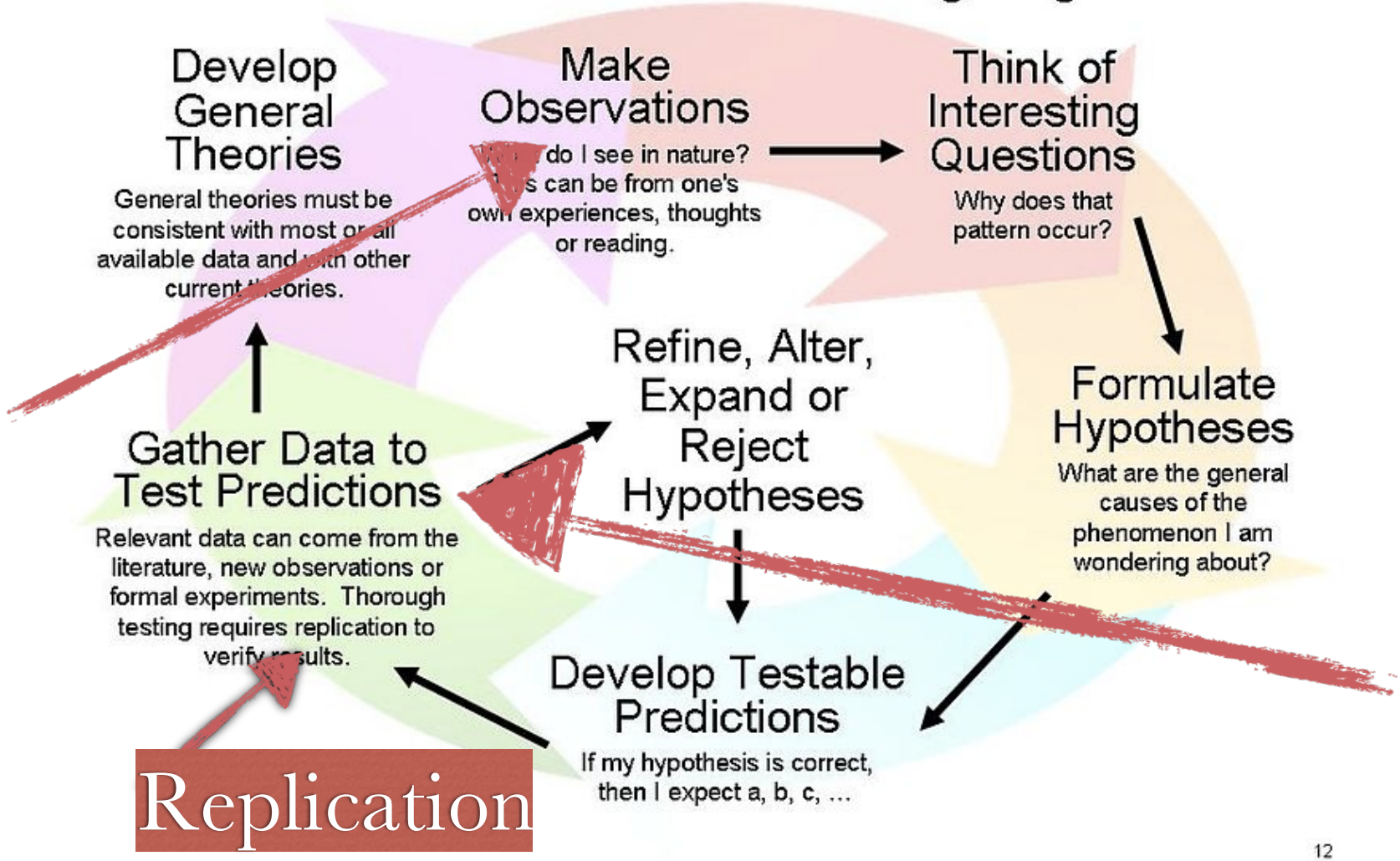
OK so far – Right

"Indirect admission was protective"


-20 -15 -10 -7 -5 -3 -2 -1 0 1 2 3
ACS:LAW
BULLSHIT DETECTOR


SOAP

The Scientific Method as an Ongoing Process



Science

- **Association does NOT imply Causation**
  - Associations are observations
  - Very EASY to drink the cool-aid
- **Human Nature**

Prehospi

Kim

Af

Science

- **Same study**
  - Helicopter transport to level I same as level II.

    CI: (1.74 - 2.03) and (1.64-2.00)

Answer: WE DO NOT KNOW!!!

Prehospital airways

- Larger studies
- **Very** little scientific support

Pre-Hospital ETI/RSI

- Vast majority of studies are associations
- Lots of Emotion

Prehospital non-drug assisted intubation for adult trauma patients with a Glasgow Coma Score less than 9

Christopher Charles Douglas Evans,[1] Robert J Brison,[1] Daniel Howes,[1] Ian G Stiell,[2] William Pickett[1]

2012

INCREASED MORTALITY = 2.8 (1.1-7.6)

GROUND PROVIDERS

Is Prehospital Endotracheal Intubation Associated with Improved Outcomes in Isolated Severe Head Injury? A Matched Cohort Analysis

Efstathios Karamanos, MD; Peep Talving, MD, PhD; Dimitra Skiada, MD; Melanie Osby, MD; Kenji Inaba, MD; Lydia Lam, MD; Ozgur Albuz, MD; Demetrios Demetriades, MD, PhD

Case matched cohort

n=55 (165 matched controls)

Ph-Eti=69% mortality

Basic airway =55% mortality

P=.011

Why, oh why???

- Lots of studies showing good success rates
- RSI improves first pass
- Don't believe it?
- Makes no sense

Is Prehospital Endotracheal Intubation Associated with Improved Outcomes in Isolated Severe Head Injury? A Matched Cohort Analysis

2015

Efstathios Karamanos, MD; Peep Talving, MD, PhD; Dimitra Skiada, MD; Melanie Osby, MD; Kenji Inaba, MD; Lydia Lam, MD; Ozgur Albuz, MD; Demetrios Demetriades, MD, PhD

11% Desat during RSI

9.5% sbp < 90

71% hyperventilation

PREHOSPITAL ANESTHESIOLOGISTS!

Predictors of the complication of postintubation hypotension during emergency airway management☆

Alan C. Heffner MD[a,b,*], Douglas S. Swords BA, MS IV[b], Marcy L. Nussbaum MS[c], Jeffrey A. Kline MD[b], Alan E. Jones MD[b,d]

[a]Division of Critical Care Medicine, Department of Internal Medicine, Charlotte, NC
[b]Department of Emergency Medicine, Carolinas Medical Center, Charlotte, NC
[c]Dickson Institute for Health Studies, Carolinas HealthCare System, Charlotte, NC
[d]Department of Emergency Medicine, University of Mississippi Medical Center, Jackson, MS

2012

N=300

STABLE FOR 30 MIN PRIOR TO RSI

IF HYPOTENSIVE (SBP<90)

THEN MORT INCREASED CI 2.1 (1.2-3.9)

Predictors of the complication of postintubation hypotension during emergency airway management☆

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Table 2 Results of logistic regression analysis for the end point of PIH

Variable	OR	95% CI
Preintubation SI	55.1	13-232
End-stage renal disease	3.7	1.1-13.1
Chronic renal insufficiency	3.4	1.2-9.6
Intubation for respiratory failure	2.1	1.0-4.5
Age	1.03	1.01-1.04
ACE inhibitor use	0.3	0.1-0.7
Intubation paralysis	0.04	0.003-0.4

Model fit: *C* statistic, 0.81; Hosmer-Lemeshow test, $P = .35$.

Shock index

- SI = HR/SBP
- 0.3-0.7 are "normal"

Heart Rate	SBP	Shock Index
110	140	0.8
120	120	1.0
120	100	1.2

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Pre-RSI SI group Shock Index	Total n = 300	PIH positive n = 66	PIH negative n = 234	OR	95% CI
<0.5	62	4 (6.5%)	58 (93.6%)	1.0	
0.5-0.69	101	13 (12.9%)	88 (87.1%)	2.1	0.7-6.9
0.7-0.89	84	21 (25.0%)	63 (75.0%)	4.8	1.6-14.9
0.9-1.09	30	16 (53.3%)	14 (46.7%)	16.6	4.8-57.3
>1.1	23	12 (52.2%)	11 (47.8%)	15.8	4.3-58.2

Cochrane-Armitage test for trend, $P < .001$.

LOWEST RATE IS 6.5%


HOLY
COW!

Why does hypotension matter?

- **Known Harm:**
  - Hypotension is associated with increased mortality in TBI
  - **Fuller** (Injury, 2014) demonstrated relationship with mortality to mortality:

1.5X	if SBP >120
2.0X	if SBP < 100
3.0X	if SBP < 90

This Matters!

BTF says keep SBP>90

Prehospital Rapid Sequence Intubation Improves Functional Outcome for Patients With Severe Traumatic Brain Injury: A Randomized Controlled Trial

Barnard 2010

Double blind RCT

N = 299

Improved "good" Functional Outcome

No mortality difference

Prehospital Rapid Sequence Intubation Improves Functional Outcome for Patients With Severe Traumatic Brain Injury: A Randomized Controlled Trial

360 Critical Care Ground Paramedics

Serving 4 Million People

97% Success Rate

All pts between 10 and 30 min from trauma center

Prehospital Rapid Sequence Intubation Improves Functional Outcome for Patients With Severe Traumatic Brain Injury: A Randomized Controlled Trial

TABLE 3. Outcomes at 6 Months After Injury

	Rapid Sequence Intubation Group (n = 157)	Hospital Intubation Group (n = 142)	P*
Primary outcome measure			
GOSe 1 (dead)	53	55	
GOSe 2 (vegetative state)	1	3	
GOSe 3 (severe disability-lower end)	19	20	
GOSe 4 (severe disability-upper end)	4	8	
GOSe 5 (moderate disability-lower end)	32	18	
GOSe 6 (moderate disability-upper end)	21	14	
GOSe 7 (good)	20	12	
GOSe 8 (normal)	7	12	
Median GOSe (IQR)	5 (1–6)	3 (1–6)	0.28
Secondary outcome measures			
Good neurologic outcome (GOSe 5–8)	80/157 (51%)	56/142 (39%)	0.046
Age ≤60 yr and GOSe 5–8	75/121 (62%)	54/105 (51%)	0.094
Age >60 yr and GOSe 5–8	5/35 (14%)	2/35 (6%)	0.23
Transport time ≥20 min and GOSe 5–8	48/97 (50%)	33/87 (38%)	0.12
Initial GCS 5–9 and GOSe 5–8	45/81 (57%)	34/73 (47%)	0.27
Survival at hospital discharge number	107 (67%)	97 (64%)	0.57

*P values are calculated by either a χ^2 test or a Mann-Whitney U test.
GOSe indicates Glasgow Outcome Scale-extended; IQR interquartile range; GCS, Glasgow Coma Scale.

TABLE 3. Outcomes at 6 Months After Injury

NO DIFFERENCE IN THE PRIMARY OUTCOMES "MASSAGE THE DATA"

Good neuro outcome
PH RSI 51%
Hospital 39%
p=0.046

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There were 10 arrests after RSI in the prehospital group and none in the hosptial Group

TABLE 3. Outcomes at 6 Months After Injury

There was no difference in outcome between the groups based on initial GCS 3 to 4 compared with initial GCS 5

PreHospital Death

- There were 10 deaths after P
  - 2 had SBP = 70 prior to RSI
  - 5 had confirmed tube ... died en route
    - 2 initial SBP = 1
    - 3 initial nor... blood pressure
  - 3 had fa... and hypoxia and death

What if the these 10 lived?

What if the 10 lived?

Assume that PH and ER rates are the same, and the 10 that died at PH-RSI were saved

Then PH had a 30% death rate and
ED had a 38% death rate.
p=.0327

Row #	Category	Observed	Expected #	Expected
1	PH Dead	47	60	38.217%
2	PH Alive	110	97	61.783%

If we can prevent hypotension and hypoxia during RSI....

Points to Consider

- **Patients at Risk for Hypotension**
  - shock index
  - Trauma (shock or not)
  - TBI population is vulnerable
  - any person undergoing RSI

HYPOTENSION

What causes Hypotension

- Drugs?
- Reduction in Adrenergic Tone?
- Changes in Cardiac output?
  - Drugs? Doses?
  - Preload?
  - Contractility

Drugs

- Benzodiazepines
- opiates
- Etomidate
- Ketamine
- dexmetetomidine

Drugs

- Choose the right agent
- Choose the right dose

Adrenergic tone

- Lower drug doses
- Titrated Drug doses ?
- Preventative pressors ?

Vagal slowing of the heart during haemorrhage: observations from 20 consecutive hypotensive patients

K SANDER-JENSEN, N H SECHER, P BIE, J WARBERG, T W SCHWARTZ

ALL 20 HAD HIGH VAGAL TONE

BIOCHEMICAL MARKER

Cardiac Output

- Pretreat with volume ?
- Pressors to increase preload ?
- Preload physical maneuvers?
- Address vagal tone ?

$$CO = HR\ x\ \ SV$$

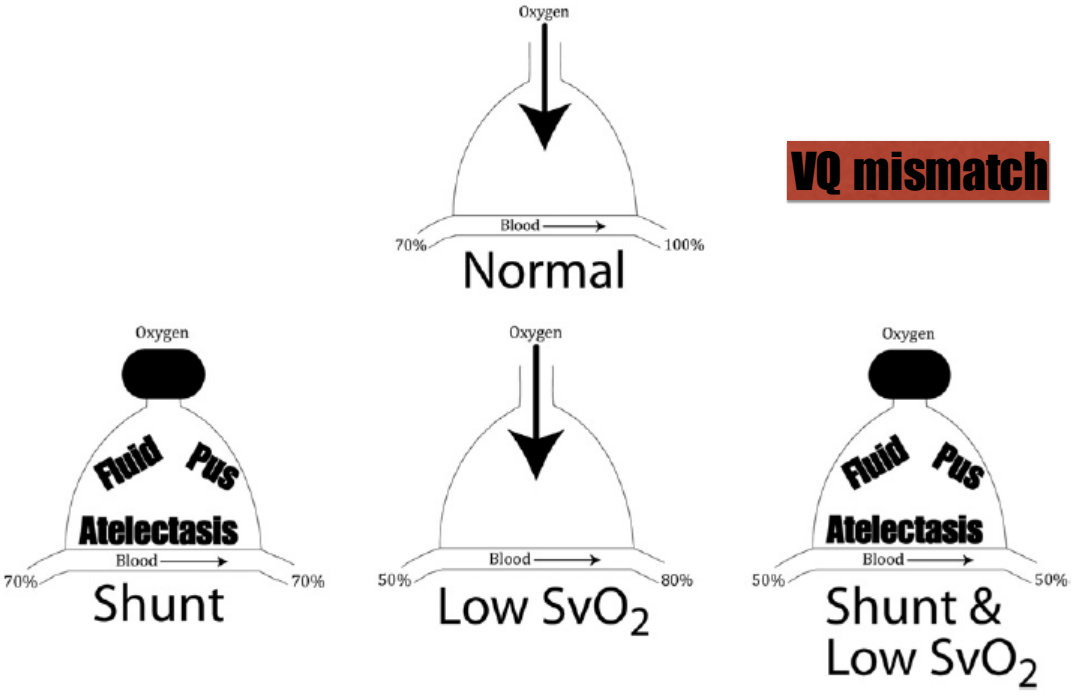
OXYGENATION

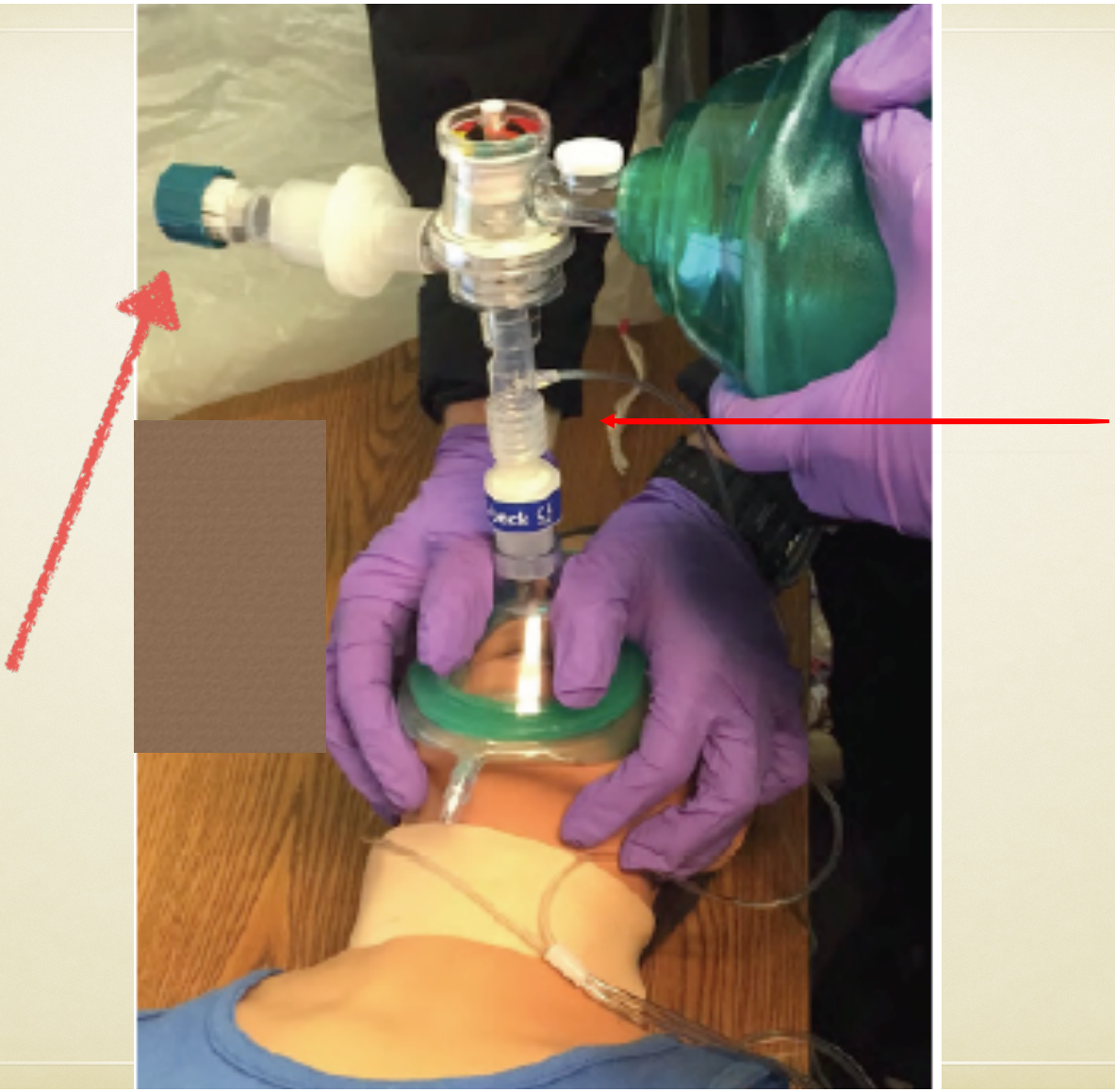
Causes of Hypoxemia

- Low FiO_2 and Toxins
- Extra-pulmonary Shunt
- Intrapulmonary Shunt
- Physiologic Shunt at Alveoli (apex)
- Low SvO_2
- Dead Space
- Apnea

Oxygen Carrying Capacity?
Acidosis
Anemia

Hypoxia - RSI


Oxygen
Blood
70%
100%
Normal
VQ mismatch
Oxygen
Fluid
Pus
Atelectasis
Blood
70%
70%
Shunt
Oxygen
Blood
50%
80%
Low SvO2
Oxygen
Fluid
Pus
Atelectasis
Blood
50%
50%
Shunt &
Low SvO2



TREATMENT BUNDLES

- DELAYED SEQUENCE INTUBATION
- NO INTUBATION
- PREOXYGENATION
- ADDRESSING PRELOAD
- PRESSORS
- MODIFY VENTILATION TECHNIQUES

.....Other Stuff

Aspiration and VAD

- Elevate the head of the bed
- Et tubest with supraglottic suction