Research in prehospital care that should change practice

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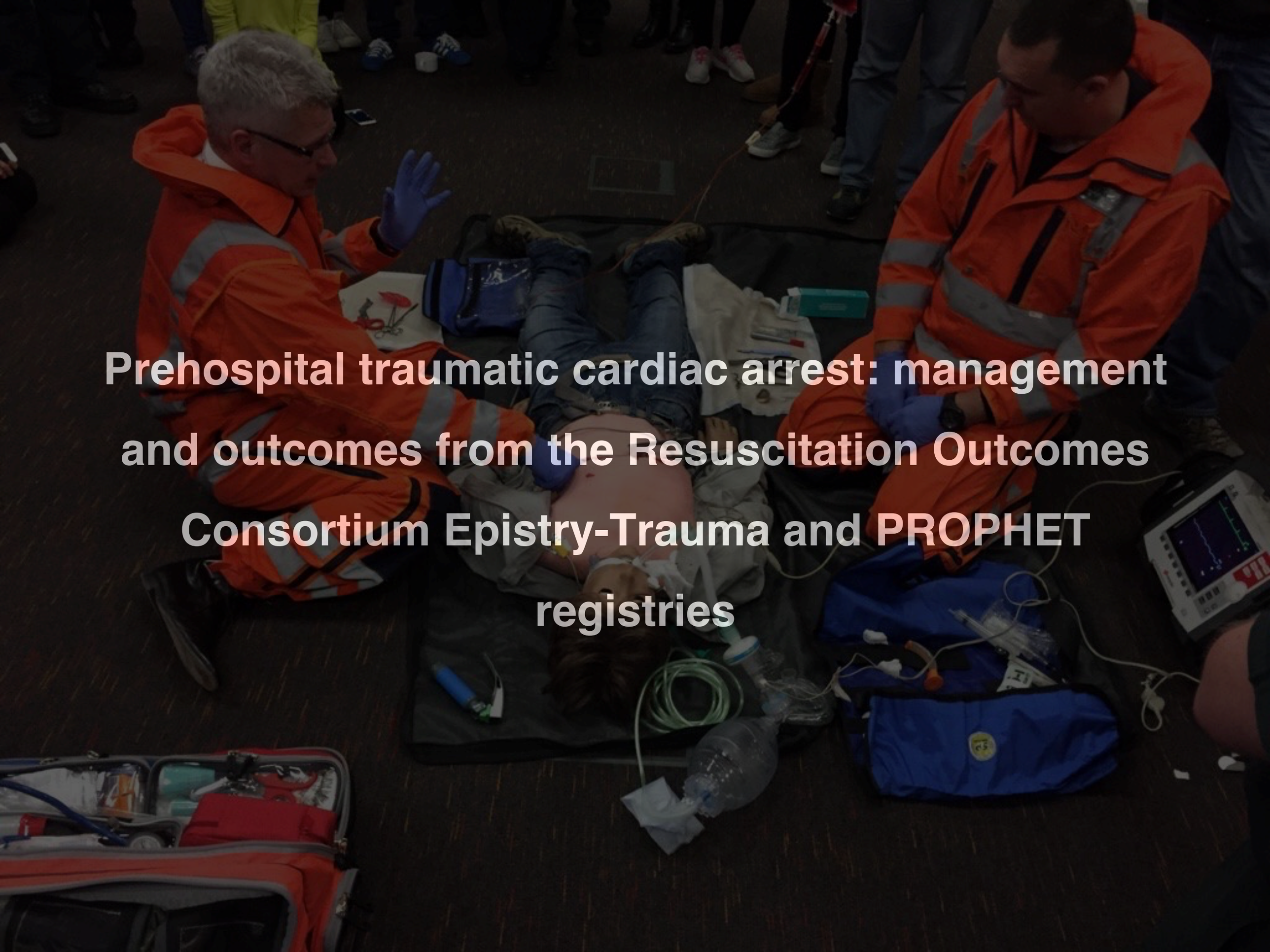
2016

Direct implication for practice change or re-evaluation



Prehospital traumatic cardiac arrest: management and outcomes from the Resuscitation Outcomes Consortium Epistry-Trauma and PROPHET registries

secondary analysis of 2 trauma registries

inclusion: blunt/pen. injury + CPR

logistic regression: association ALS + survival.

Why relevant? 50% all trauma deaths occur prehospital

Wide variation in practice and interventions

Nihilism/Futility argument

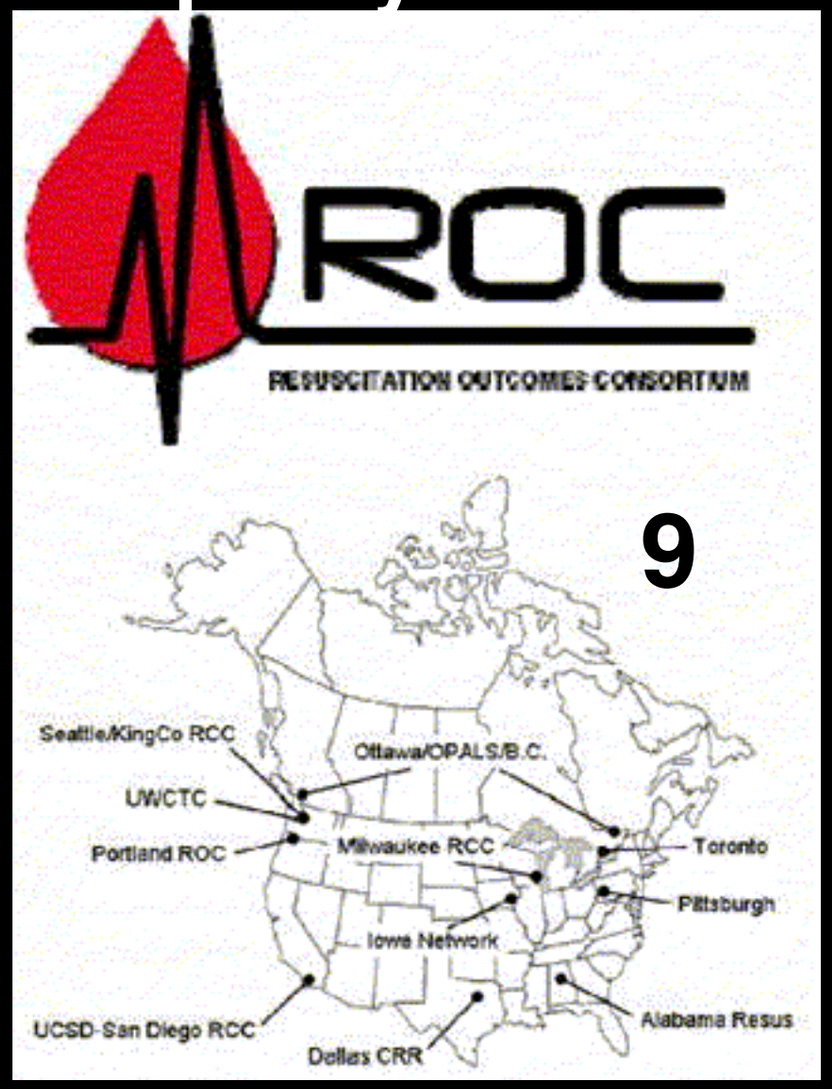
Objectives:

1. describe current mx TCA in N.America

2. determine regional variation in survival

3. association any ALS procedure + survival to discharge

Epistry-Trauma



2005-7

PROPHET
4 EMS
Canada

2010-11

ROC- SBP ≤ 90, RR <10 or >29, GCS ≤ 12, intubated or died in the field

PROPHET-SBP ≤ 90 or GCS ≤ 8 patients had to be transported to a Level I/II trauma center or die in the field or en route with the intention of transporting to a Level I/II trauma center

PROPHET exclusions: declaration non-survivable without Rx, hanging, drowning, burns, trauma with burns>20%TBSA

No direct data capture of TCA. Defined by CPR

Study exclusion: unknown survival status, not trauma

Variables

demographics

injury mechanism

location injury

interventions: ALS v BLS crew, SAD, ETT, needle thoracostomy(PROPHET), IVF, IOF, external haem control.

Outcomes

Primary: survival to DC

Secondary: neuro status at DC (GOS). NOT in ROC

Methods/Stats

data entered into CRFs prehospital, in-hospital

Utstein

descriptive stats

Chi-square and Fisher's exact tests :assess for associations between categorical exposure variables and survival outcomes

multiple regression to estimate associations between interventions and survival

- independent variables: interventions
- dependent variable: primary outcome(survival to DC)

Confounding Variables

a priori

Vitals(HR,BP,RR) on EMS arrival(presence). only in PROPHET (57%)

Type of injury (presenting rhythm,SOL NOT collected)

ROC site (e.g. needle decompression only in PROPHET)

Results

Epistry-Trauma, n=13291 (10% CPR) PROPHET, n=6258 (16% CPR)

2300 patients

Survivors: 145 to DC (6.3%)

TABLE 1. Baseline Characteristics of Traumatic Arrest Cohort by Registry*†

	Epistry			PROPHET		
	Survivors (n = 92)	Nonsurvivors (n = 1,200)	*p* Value	Survivors (n = 53)	Nonsurvivors (n = 955)	*p* Value
Sex: male	73 (80%)	939 (78%)	0.79	42 (79%)	755 (79%)	1
Age, years			0.57			0.20
<5	3 (3.4%)	30 (2.7%)		2 (3.8%)	21 (2.3%)	
5–9	0 (0%)	12 (1.1%)		0 (0%)	5 (0.54%)	
10–19	12 (13%)	109 (9.6%)		7 (13%)	72 (7.8%)	
20–39	40 (45%)	469 (41%)		17 (33%)	388 (42%)	
40–59	21 (24%)	322 (28%)		21 (40%)	276 (30%)	
60–79	12 (13%)	143 (13%)		5 (9.6%)	123 (13%)	
≥80	1 (1.1%)	46 (4.1%)		0 (0%)	37 (4%)	
Mechanism of injury‡						
Fall	21 (23%)	158 (13%)	0.015	15 (28%)	134 (14%)	0.008
MVC—occupant	30 (33%)	326 (27%)	0.32	14 (26%)	226 (24%)	0.77
MVC—motorcyclist	3 (3.3%)	62 (5.2%)	0.62	2 (3.8%)	59 (6.2%)	0.77
MVC—pedestrian	4 (4.3%)	138 (12%)	0.052	2 (3.8%)	118 (12%)	0.097
Gunshot wound	8 (8.7%)	303 (25%)	0.001	4 (7.5%)	259 (27%)	0.003
Stab	11 (12%)	82 (6.8%)	0.11	5 (9.4%)	64 (6.7%)	0.402
Other	14 (15%)	119 (9.9%)	0.15	11 (21%)	126 (13%)	0.175
Injury type: blunt	73 (79%)	802 (67%)	0.018	44 (83%)	628 (66%)	0.014
Location of injury			0.17			0.021
Street/highway	44 (48%)	670 (56%)		28 (53%)	537 (56%)	
Public building	2 (2.2%)	33 (2.8%)		1 (1.9%)	12 (1.3%)	
Place of recreation	1 (1.1%)	24 (2%)		3 (5.7%)	15 (1.6%)	
Industrial place	1 (1.1%)	34 (2.8%)		0 (0%)	23 (2.4%)	
Home residence	28 (30%)	289 (24%)		10 (19%)	269 (28%)	
Other public	11 (12%)	130 (11%)		8 (15%)	85 (8.9%)	
Other private	5 (5.4%)	20 (1.7%)		3 (5.7%)	14 (1.5%)	
Vital signs present on EMS arrival	74 (80%)	245 (20%)	<0.001	43 (81%)	348 (36%)	<0.001

TABLE 2. Outcomes in Traumatic Arrest Patients by Injury Type and Registry*

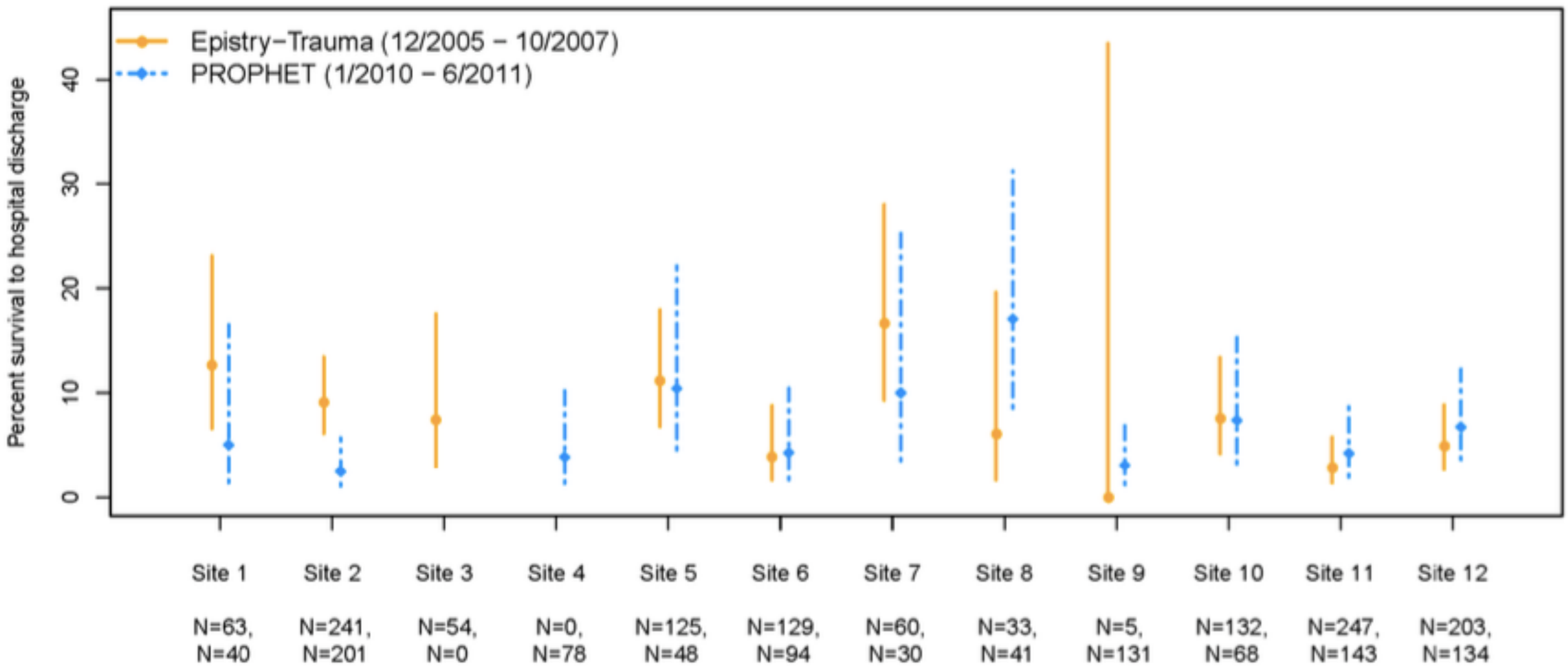
	Epistry			PROPHET		
	Blunt (n = 875)	Penetrating (n = 417)	*p* Value	Blunt (n = 672)	Penetrating (n = 336)	*p* Value
Prehospital status			0.20			<0.001
Prehospital declaration of death without ED admission	237 (27%)	128 (31%)		232 (35%)	79 (24%)	
Transported and admitted to ED	638 (73%)	289 (69%)		440 (65%)	257 (76%)	
Patient status at ED arrival of those admitted			0.054			<0.001
Pulse present†	81 (21%)	25 (14%)		147 (34%)	52 (21%)	
Ongoing resuscitation†	313 (79%)	160 (86%)		285 (66%)	198 (79%)	
Unknown‡	20 (3.1%)	12 (4.2%)		8 (1.8%)	7 (2.7%)	
Not collected‡	224 (35%)	92 (32%)		0 (0%)	0 (0%)	
Survival to hospital discharge	73 (8.3%)	19 (4.6%)	0.018	44 (6.5%)	9 (2.7%)	0.014
Neurologic status of survivors§						0.11
Vegetative state				3 (7.7%)	0 (0%)	
Severely disabled				14 (36%)	1 (11%)	
Moderately disabled				6 (15%)	0 (0%)	
Good recovery				16 (41%)	8 (89%)	

TABLE 3. Prehospital Procedures and Outcomes in Traumatic Arrest Patients by Registry*

	Epistry			PROPHET		
	Patients Receiving	Survival to Hospital Discharge		Patients Receiving	Survival to Hospital Discharge	
Intervention	n (%)†	n (%)	*p* Value	n (%)†	n (%)	*p* Value
EMS training of first rig ALS			0.085			0.95
Yes	546 (43%)	45 (8.2%)		526 (53%)	27 (5.1%)	
No	712 (57%)	40 (5.6%)		461 (47%)	25 (5.4%)	
Airway intervention			0.32			0.071
Bag-mask ventilation only	401 (32%)	24 (6%)		314 (31%)	22 (7%)	
Supraglottic airway‡	92 (7.3%)	2 (2.2%)		181 (18%)	4 (2.2%)	
Endotracheal intubation	769 (61%)	46 (6%)		513 (51%)	27 (5.3%)	
Needle thoracostomy§						0.76
Yes				138 (14%)	6 (4.3%)	
No				870 (86%)	47 (5.4%)	
Hemorrhage control			0.62			0.46
Yes	173 (15%)	12 (6.9%)		163 (16%)	11 (6.7%)	
No	994 (85%)	56 (5.6%)		845 (84%)	42 (5%)	
Intravenous fluid administration			0.004			0.033
Yes	735 (57%)	66 (9%)		471 (48%)	32 (6.8%)	
No	557 (43%)	26 (4.7%)		504 (52%)	18 (3.6%)	
Intraosseous fluid administration			0.19			0.23
Yes	75 (5.8%)	2 (2.7%)		138 (14%)	4 (2.9%)	
No	1217 (94%)	90 (7.4%)		847 (86%)	49 (5.8%)	

TABLE 4. Multivariable Logistic Regression Models of Survival to Hospital Discharge*

	Epistry		PROPHET	
Intervention	**Adjusted OR (95% CI)†**	***p* Value**	**Adjusted OR (95% CI)†**	***p* Value**
EMS training of first rig: ALS	1.09 (0.54–2.22)	0.81	0.99 (0.44–2.21)	0.98
Airway intervention		0.25		0.015
Bag-mask ventilation only	Reference		Reference	
Supraglottic airway‡	0.35 (0.08–1.55)		0.27 (0.08– 0.93)	
Endotracheal intubation	0.70 (0.38–1.31)		0.37 (0.17– 0.78)	
Needle thoracostomy§			0.68 (0.26–1.79)	0.42
Hemorrhage control	0.76 (0.37–1.59)	0.47	1.10 (0.50–2.44)	0.82
Intravenous fluid administration	1.40 (0.78–2.49)	0.25	1.41 (0.66–3.01)	0.37
Intraosseous fluid administration	0.32 (0.07–1.52)	0.11	0.44 (0.14–1.37)	0.13


Epistry−Trauma (12/2005 − 10/2007)
PROPHET (1/2010 − 6/2011)
Percent survival to hospital discharge
0
10
20
30
40
Site 1
N=63,
N=40
Site 2
N=241,
N=201
Site 3
N=54,
N=0
Site 4
N=0,
N=78
Site 5
N=125,
N=48
Site 6
N=129,
N=94
Site 7
N=60,
N=30
Site 8
N=33,
N=41
Site 9
N=5,
N=131
Site 10
N=132,
N=68
Site 11
N=247,
N=143
Site 12
N=203,
N=134

Limitations

High ALS first responders

Interventions not randomised

Selection bias of interventions

Did not answer question of interventions + survival (insufficient power)

Extrapolate to Australasia?

Key messages

Nihilism in TCA not supported

System to target penetrating TCA?

Future advanced haemorrhage control?

PEA arrest v pseudoPEA

Efficacy of Nasal Cannula Oxygen as a Preoxygenation Adjunct in Emergency Airway Management

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O_2

Denitrogenation of the FRC=reservoir during apnoea

The enemy of pre-oxygenation is the SEAL

Supplemental high-flow NC O_2 in presence of leak ?

Goal

assess efficacy of supplemental NC O_2 pre oxygenation with/without face mask leak

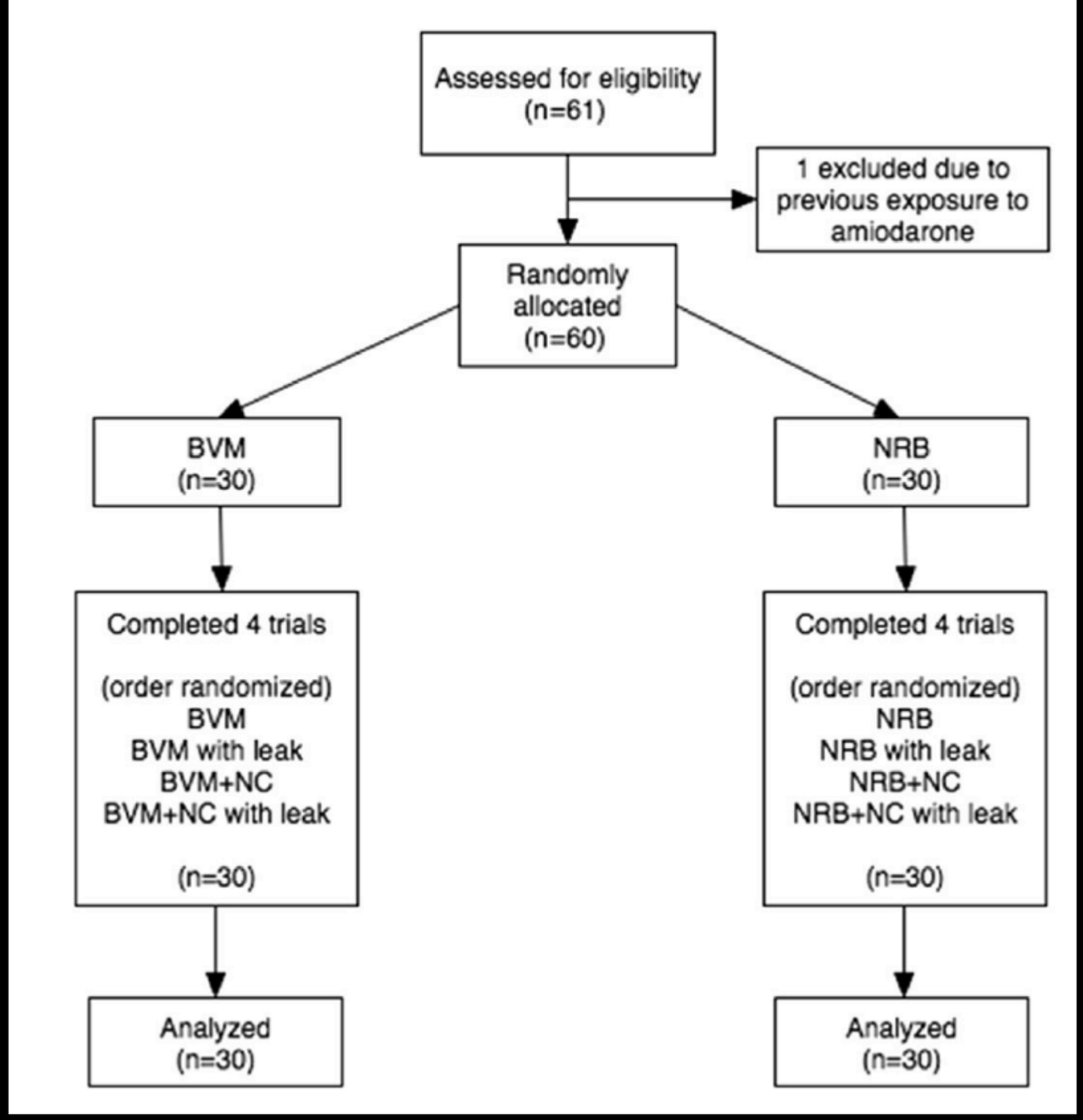
Methods

Healthy volunteers

Exclusion: resp/cardiac disease/meds, pregnancy, bleomycin/amiodarone exposure, facial hair.

Randomised to NRB/BVM. 4 trials.

Primary outcome: ETO2 conc



sequence randomised Latin square

Devices

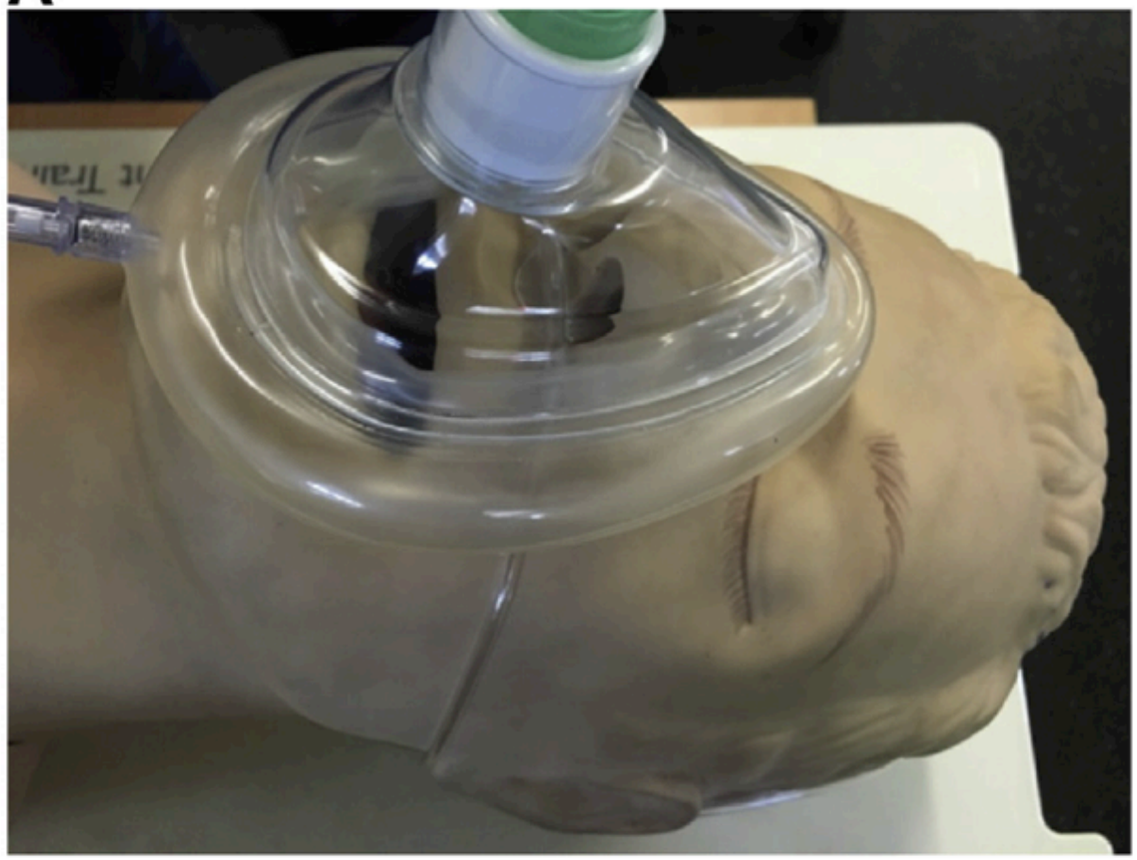
BVM- self-inflating, 2L reservoir. Mayo connected to HME filter + catheter mount

NRB- reservoir and safety vent

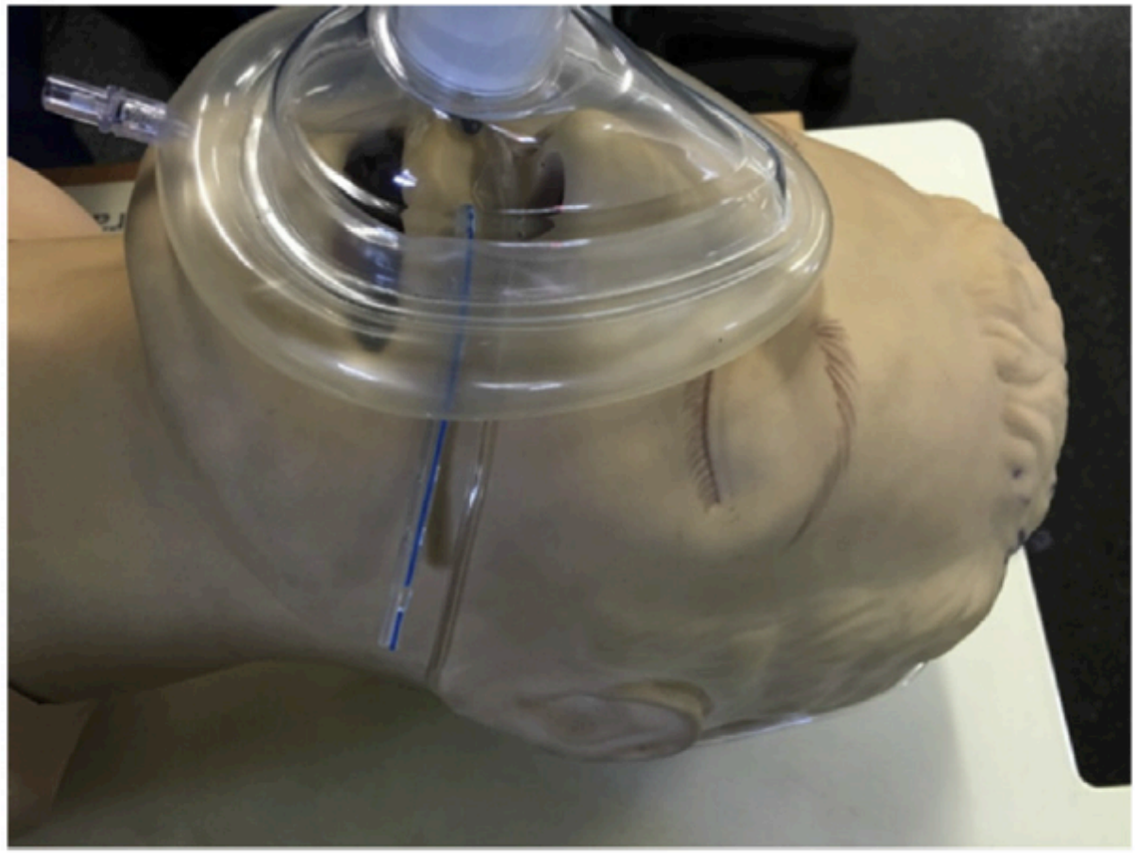
O2 delivery 15L/min. NC- 10L/min

LEAK

A



B



Preoxygenation

supine on pillow

normal TV breaths for 3 min

BVM manually held in place

End 3min: exhaled single breath into ETO2 device

NC 10L/min- superior to 5L/min for ApOx during laryngoscopy

2-3 min washout on RA, it ETO2 2% above baseline rest period extended in 1min increments

ETO2 device calibrated (accuracy SD 2%)

exhalation device: single disposable anaesthesia circuit connector with gas sampling line attached.

ETO2 recorded as max value of alveolar plateau on monitor

Stats ®

®

ETO2 as dependent variable

Pre oxygenation trials as the within-subjects variable

Pre oxygenation method as the between-subjects variable

Sphericity examined, if violated G-G correction to P values

Analysis done on preox trials within BVM and NRb groups + between BVM and NRB for same preox trial only

CIs for diffs in means within BVM and NRB groups

Sample size: 5% diff in ETO2 chosen = extra 30 sec of safe apnoea ((5%x2,400ml)/O2 consumption 250ml/min)

pooled SD previous studies was 0.068

Effect size(mean diff/SD) was 0.74

Cohen's method- power 0.8 and sig. of 0.05= sample size 26 each group.

2nd calc: 2-sample *t*-test =30 each group

MAGIC number=60

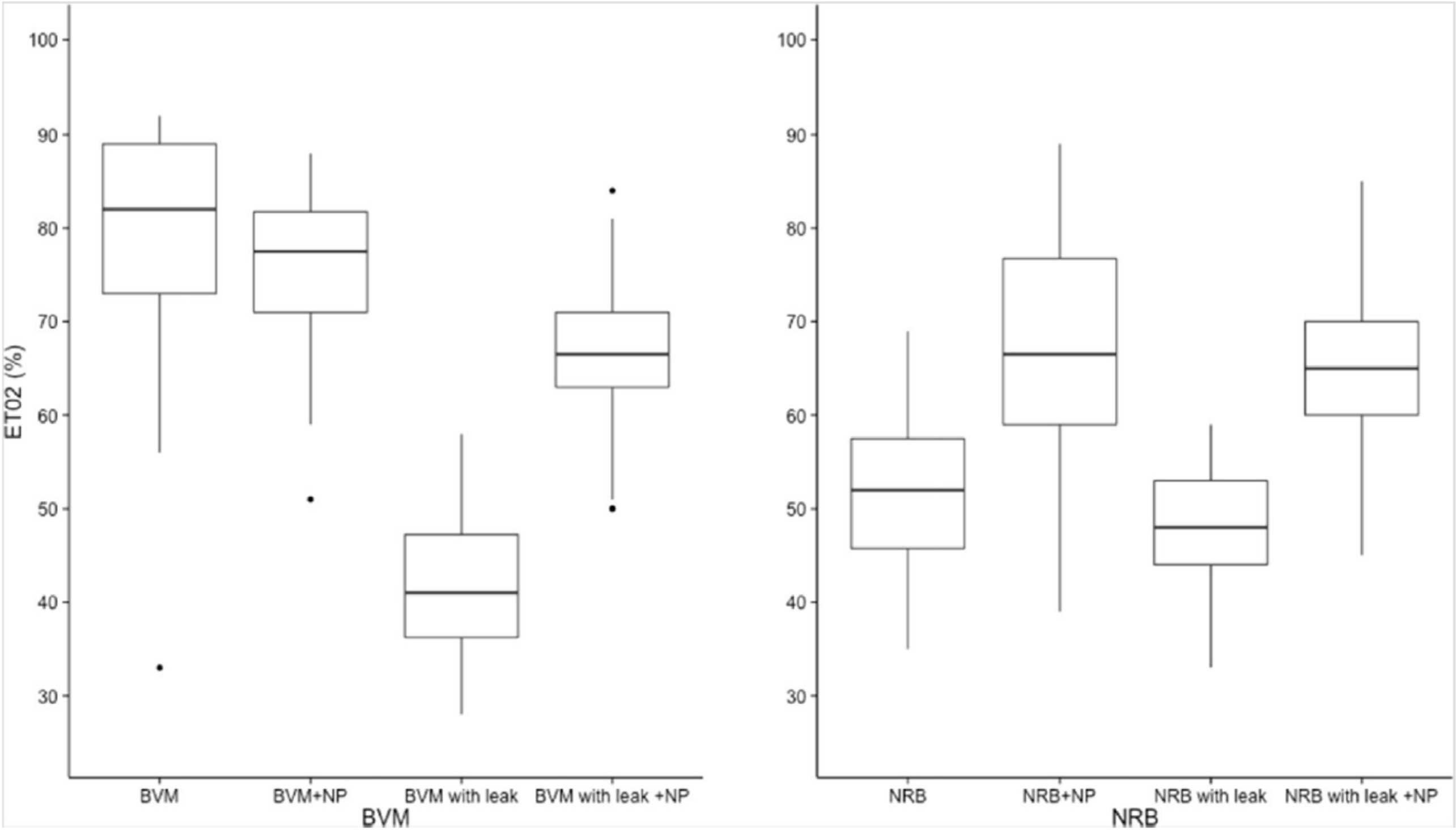
Results

Table 1. Subject demographics.

	Median (IQR)	
Demographics	**BVM**	**NRB**
n	30	30
Age, y	30 (5.5)	37.5 (12.75)
Sex, male	8	10
BMI	22.3 (4.5)	25.5 (6.1)

BMI, Body mass index.

Facemask	ETO_2 %, Mean (SD)		Difference in Means, NC vs No NC (95% CI)
	Mask	Mask+NC	
BVM	79 (14)	75 (8)	−3 (1 to −8)
BVM with leak	41 (7)	66 (8)	25 (21 to 29)
Difference in means (no leak vs leak) (95% CI)	−37 (−33 to −41)	−9 (−5 to −13)	
NRB	52 (8)	67 (12)	15 (12 to 18)
NRB with leak	48 (7)	65 (10)	17 (13 to 20)
Difference in means (no leak vs leak) (95% CI)	−3 (0 to −7)	−2 (2 to −5)	


ET02 (%)
100
90
80
70
60
50
40
30
BVM
BVM+NP
BVM with leak
BVM with leak +NP
BVM
NRB
NRB+NP
NRB with leak
NRB with leak +NP
NRB

Limitations

single-breath method sampling (to avoid contamination free flow O2)

simulated mask leak

co-operative healthy patients

equipment extrapolation?

PEEP not used or higher NC O2 flow rates

Discussion

supplemental NC O2 helpful if mask leak

NC O2 helpful in NRB -leak or no.

NC O2 to BVM with no leak no increase ETO2

- maximal preox by BVM
- NC created small leak

Key messages

Outside setting of ETO2 monitoring face mask leak and air entrainment reduces preox + may be difficult to detect

NC O2 improves preox in BVM leak and NRB.