

REBOAは外傷出血患者に
おいて死亡率を改善するか？

UK-REBOA

2024.1.30抄読会

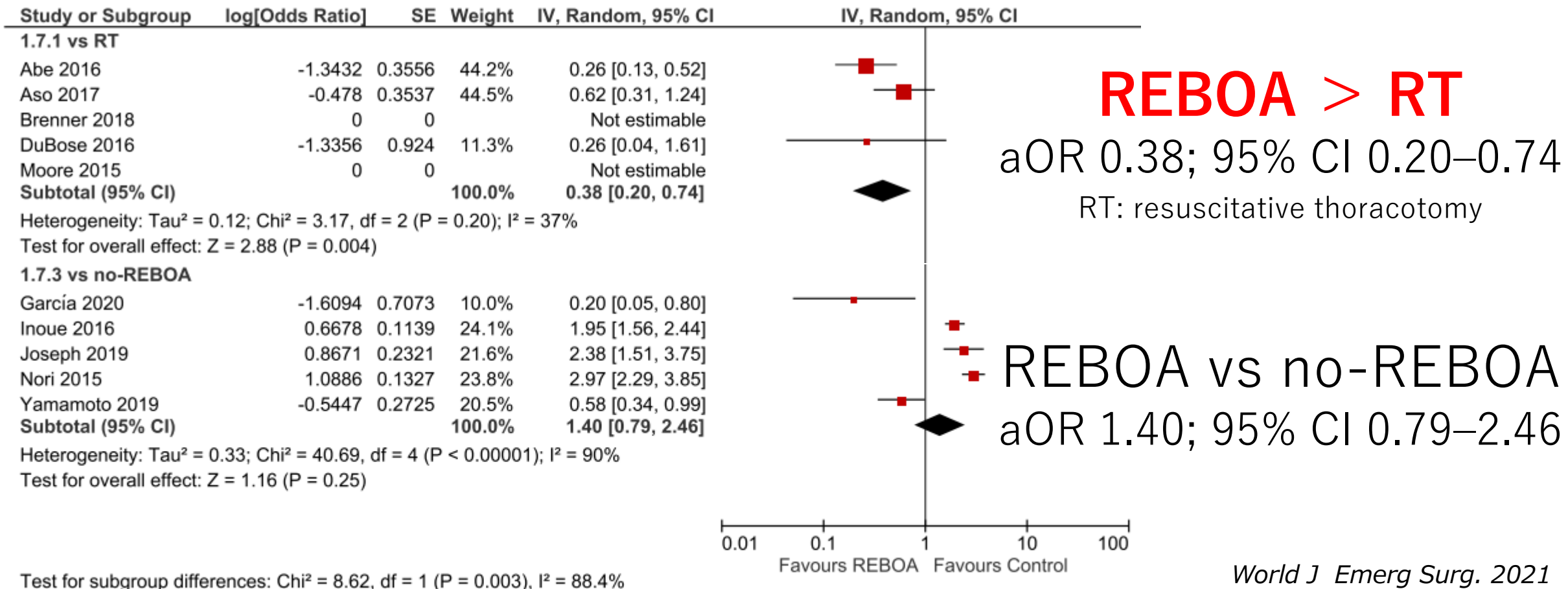
JAMA | **Original Investigation** | **CARING FOR THE CRITICALLY ILL PATIENT**

Emergency Department Resuscitative Endovascular Balloon Occlusion of the Aorta in Trauma Patients With Exsanguinating Hemorrhage The UK-REBOA Randomized Clinical Trial

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JAMA. 2023;330(19):1862-1871. doi:10.1001/jama.2023.20850

背景



背景体幹部外傷に対するREBOAの効果は未だControversial
RCTなし

デザイン

- 英国の16のmajor trauma centerで行われたオープンラベル RCT
- 16歳以上の外傷患者で、体幹部の生命を脅かす出血である/疑われ、REBOAが適していると思われる患者が対象
- 妊婦と明らかに救命困難であるものは除外
- 1：1にランダム割付

介入

- デバイスの指定はなし
- 施行医はトレーニング（2日間）を受講
- 留置部位（Zone I or III）は担当医の判断

vs standard care

（開胸/開腹大動脈遮断を含む）

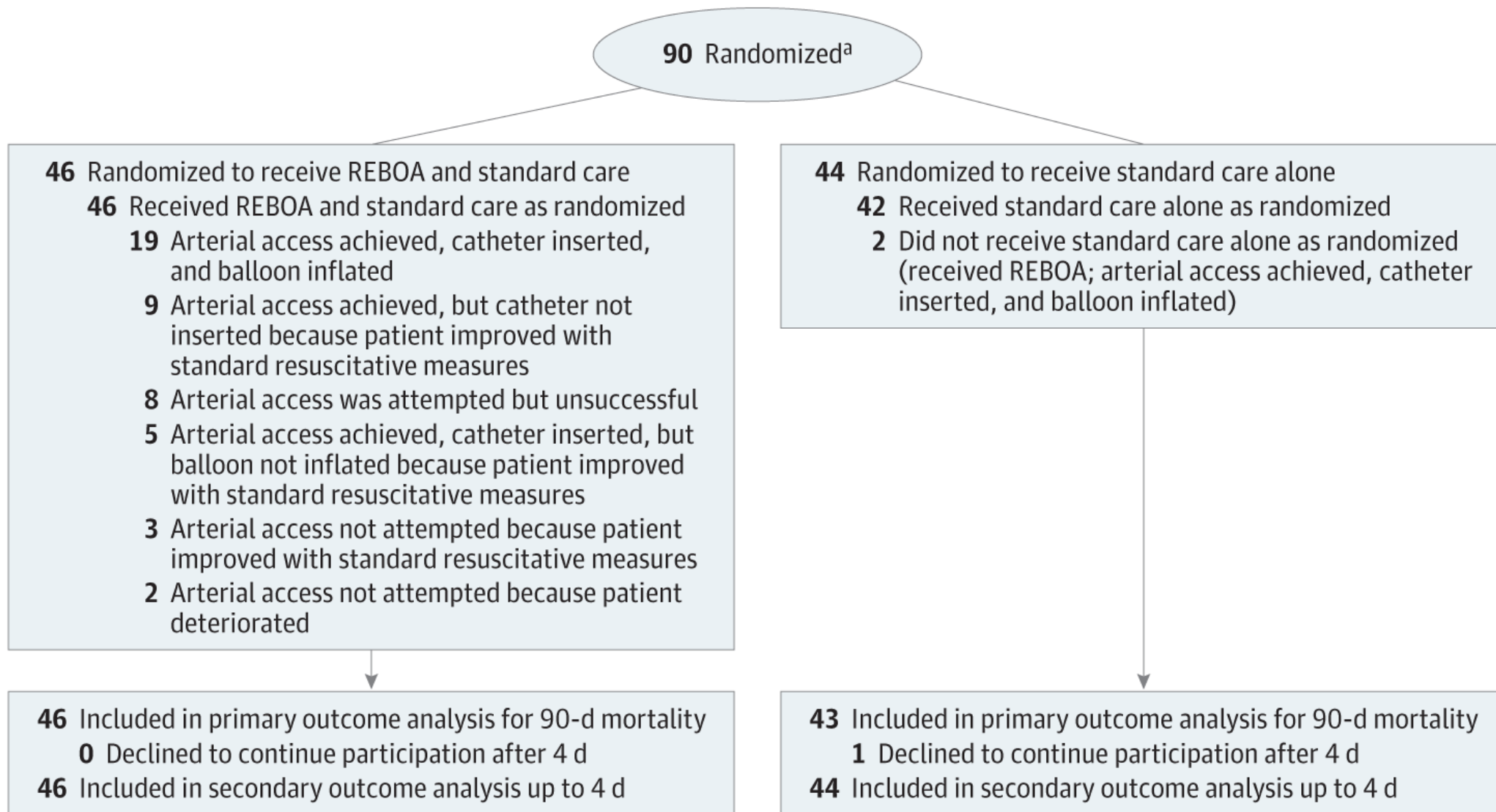
アウトカム

- Primary outcome

90日全死亡

- Secondary outcome

6ヵ月後、入院中、24時間以内、6時間以内、3時間以内の死亡率、確定的出血制御手技の必要性、出血制御の決定的手技開始までの時間、合併症、入院期間、血液製剤使用、死因



結局REBOAをインフレートまでしているのは19/46(41%)
 10例がZone I、9例がZone III

Table 1. Patient Characteristics

	REBOA and standard care (n = 46)	Standard care alone (n = 44)
Demographics		
Age, median (IQR), y	46 (33-62)	39 (30-56)
Sex, No. (%)		
Female	18 (39)	10 (23)
Male	28 (61)	34 (77)
Mechanism of injury, No. (%)		
Blunt	44 (96)	43 (98)
Penetrating	2 (4)	1 (2)
Patient prehospital characteristics		
Systolic blood pressure, mm Hg		
Median (IQR)	85 (66-120) [n = 34]	97 (71-128) [n = 37]
≤70, No./total (%)	11/34 (32)	9/37 (24)
≤90, No./total (%)	18/34 (53)	17/37 (46)
Heart rate, median (IQR), beats/min	113 (94-133) [n = 42]	109 (76-133) [n = 40]
Oxygen saturation, median (IQR), %	88 (80-95) [n = 32]	92 (81-98) [n = 43]
Glasgow Coma Scale score, median (IQR) ^a	10 (3-14) [n = 42]	10 (3-14) [n = 42]
CPR performed, No./total (%)	10/43 (22)	11/44 (25)
Method of transport, No./total (%)		
Ambulance	22/45 (49)	19/43 (43)
Helicopter	17/45 (38)	21/43 (49)
Ambulance and helicopter	6/45 (13)	3/43 (7)

年齢中央値は41歳 ほとんど鈍的外傷
各群2割程度がプレホスでCPRされている
REBOA群で血圧低め

	REBOA and standard care (n = 46)	Standard care alone (n = 44)
Patient characteristics in ED		
Time from injury to ED arrival, median (IQR), min	90 (70-125) [n = 39]	97 (78-119) [n = 41]
Time from ED arrival to randomization, median (IQR), min ^b	13 (4-21) [n = 39]	13 (4-19) [n = 41]
Systolic blood pressure, mm Hg		
Median (IQR)	84 (58-115) [n = 44]	99 (72-115) [n = 42]
≤70, No./total (%)	18/44 (41)	9/42 (21)
≤90, No./total (%)	26/44 (59)	19/42 (45)
Heart rate, median (IQR), beats/min	105 (88-123) [n = 45]	120 (87-135) [n = 43]
Oxygen saturation, median (IQR), %	99 (90-100) [n = 39]	99 (95-100) [n = 40]
Glasgow Coma Scale score, median (IQR)	3 (3-11) [n = 39]	3 (3-15) [n = 39]
CPR performed, No./total (%)	4/40 (9)	4/43 (9)

受傷-到着の時間は中央値90-100分くらい
各群1割くらいがERでCPRされている

	REBOA and standard care (n = 46)	Standard care alone (n = 44)
Injury Severity Score^c		
Median (IQR)	41 (29-50)	41 (29-50)
>25 (very severe), No. (%)	38 (83)	38 (86)
16-25 (severe), No. (%)	7 (15)	4 (9)
9-15 (moderate), No. (%)	1 (2)	1 (2)
1-8 (mild), No. (%)	0	1 (2)
Abbreviated Injury Scale score, median (IQR)^d		
Head	3 (0-4)	0 (0-5)
Thorax	4 (3-4)	4 (1-4)
Abdomen	2 (0-3)	2 (0-4)
Pelvis	2 (0-5)	2 (0-5)
Limbs	2 (2-3)	3 (2-3)

ISS中央値は41とそれなりに25以上が8割以上
 頭部・胸部外傷がそれなりにいて頭部AISはREBOA群で高い

結果

	REBOA and standard care (n = 46)	Standard care alone (n = 44)	Absolute difference (95% CrI), %	Effect estimate (95% CrI)	Posterior probability of OR >1, % ^a
Primary outcome					
All-cause mortality at 90 d, No./total (%)	25/46 (54)	18/43 (42) ^b	11.3 (-8.1 to 30.1)	OR, 1.58 (0.72 to 3.52)	86.9
Secondary outcomes					
Mortality at different time points, No./total (%)					
Death within 6 mo	25/46 (54)	18/43 (42) ^b	11.3 (-8.1 to 30.1)	OR, 1.58 (0.72 to 3.52)	86.9
Death while in the hospital	25/46 (54)	18/43 (42) ^b	11.3 (-8.1 to 30.1)	OR, 1.58 (0.72 to 3.52)	86.9
Death within 24 h	17/46 (37)	10/44 (23)	12.5 (-5.0 to 29.6)	OR, 1.85 (0.79 to 4.46)	91.8
Death within 6 h	13/46 (28)	4/44 (9)	15.8 (1.8 to 30.4)	OR, 3.14 (1.13 to 9.76)	98.6
Death within 3 h	11/46 (24)	2/44 (5)	15.1 (3.3 to 28.4)	OR, 4.25 (1.33 to 15.99)	99.3

120例組み込み予定だったが、80例組み込み時点での2回目の中間解析で有害性が示唆され早期中止

Primary outcomeのデータを収集するために10例追加で組み込んでトータル90例

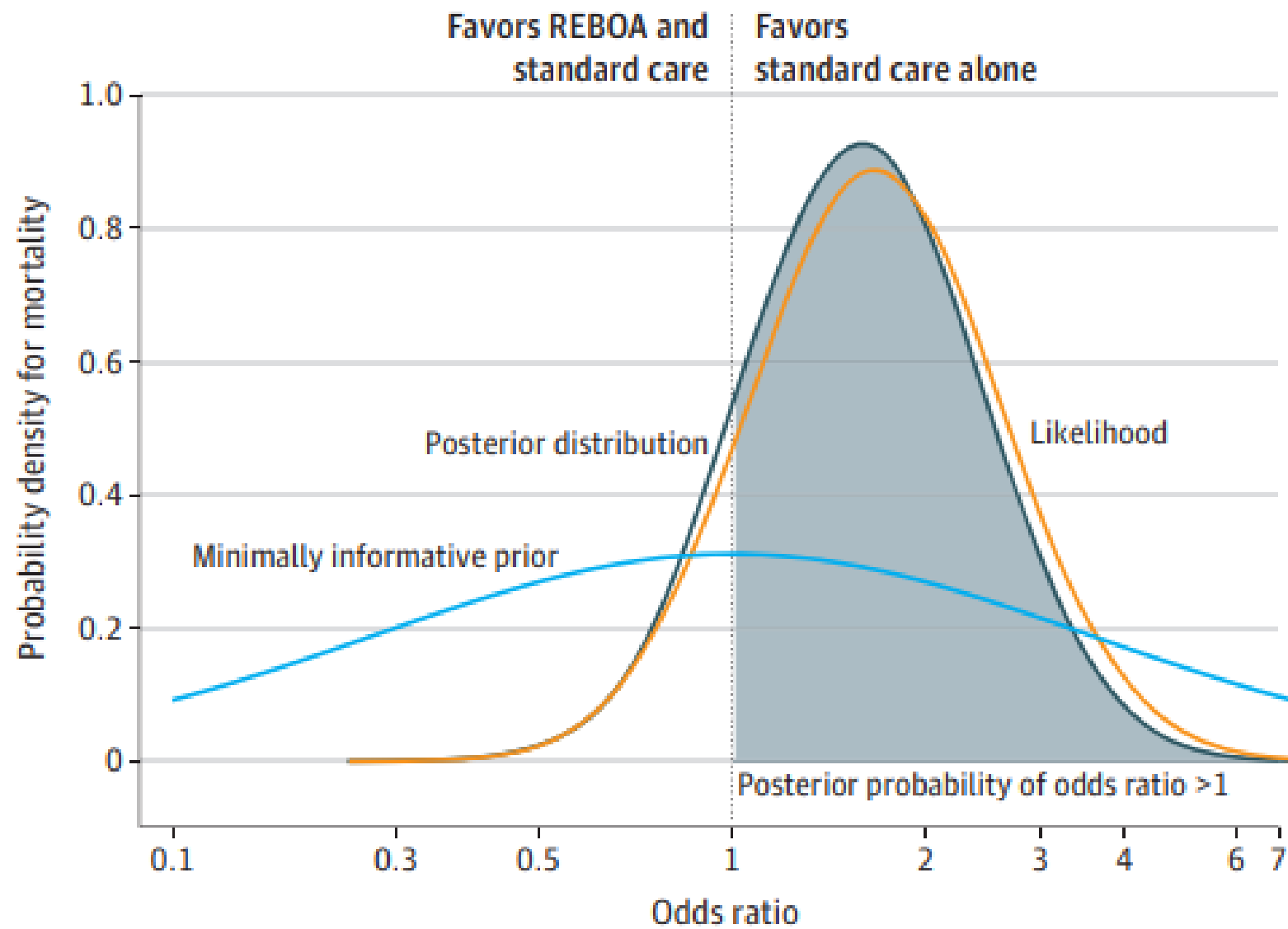
	REBOA and standard care (n = 46)	Standard care alone (n = 44)	Absolute difference (95% CrI), %	Effect estimate (95% CrI)
Underwent a definitive hemorrhage control procedure, No. (%)	14 (30)	19 (43)	-11.5 (-29.6 to 7.1)	OR, 0.60 (0.26 to 1.37)
Time from randomization to definitive hemorrhage control procedure, median (IQR), min	83 (56 to 156) [n = 12]	64 (34 to 83)		
Type of definitive hemorrhage control procedure, No. (%) ^c				
Hemorrhage control laparotomy	7 (50)	12 (63)		
Extremity vascular ligation, shunting, or repair	2 (14)	4 (21)		
Pelvic packing	4 (29)	1 (5)		
Angioembolization	2 (14)	2 (11)		
Hemorrhage control thoracotomy	1 (7)	0		

決定的止血処置を受けたのはREBOA群で3割、標準治療で4割くらい！？
決定的治療までの時間は中央値で83 vs 64minとREBOA群で遅い。

Intensive care unit-free days at 90 d ^d			
Mean (SD)	35 (40)	40 (37)	MD, -4.79 (-20.75 to 11.31)
Median (IQR)	0 (0 to 80)	45 (0 to 78)	
Hospital-free days at 90 d ^d			
Mean (SD)	22 (30)	41 (39)	MD, -18.58 (-32.86 to -3.93)
Median (IQR)	0 (0 to 49)	41 (0 to 82)	
Transfusion requirements			
Red blood cells, units			
Mean (SD)	10 (9)	11 (9)	IRR, 0.92 (0.66 to 1.29)
Median (IQR)	7 (4 to 12)	9 (4 to 17)	
Plasma, units			
Mean (SD)	8 (8)	11 (10)	IRR, 0.73 (0.49 to 1.08)
Median (IQR)	6 (3 to 10)	7 (4 to 18)	
Platelets, pools			
Mean (SD)	1 (3)	2 (2)	IRR, 0.87 (0.50 to 1.52)
Median (IQR)	1 (0 to 2)	1 (0 to 2)	
Cryoprecipitate, units			
Mean (SD)	2 (3)	2 (3)	IRR, 0.79 (0.41 to 1.53)
Median (IQR)	0 (0 to 2)	2 (0 to 3)	
Tranexamic acid, mg			
Mean (SD)	1413 (580)	1568 (695)	IRR, 0.90 (0.70 to 1.16)
Median (IQR)	1000 (1000 to 2000)	2000 (1000 to 2000)	

ICU-/hospital-free days、輸血量に差はなし

A Odds ratio and posterior probability of 90-d mortality



discussion

- K-Mは初期の悪影響が強そう

> 決定的治療が遅れたり、できなかつたりした結果ではないか

limitation

- サイズが小さい。鈍的損傷が多い。
- 決定的治療を受けた患者が少ない。臓器切除、named vesselの結紮・修復・バイパス、腔パッキングを決定的治療とカウントしている。

> 腸間膜損傷に対する腸管切除はカウントされないということも影響？

- 頭部外傷で不均衡があるが、調整後でも影響は少なかった。

コメント

COMMENTARY

Open Access



The end of balloons? Our take on the UK-REBOA trial

Jostein Rødseth Brede^{1,2,3*} and Marius Rehn^{2,4,5}

- AIS41ですべて重症。23%はどこかで心停止している。さらにREBOA群では血圧が低く、蘇生できても生存できたか疑問
 - 頭部AISスコアがREBOA群で高い。頭蓋内出血にREBOAは有害
 - REBOAを結局施行できたのはわずか41%。17%で動脈アクセスに失敗している。
 - 来院までの時間が長い（中央値90分）。
 - REBOAに32分要している。長い。決定的治療までの時間も長い。(83[56-156] vs 64[34-83], min, median[IQR])
- > 結果をREBOAのみに帰するのは間違い。あくまで手段の一つ

私見

- REBOAに30分はかかりすぎ
- 有効なのは横隔膜下の出血のみ、横隔膜上の出血がある時点で controversial、横隔膜上に major bleeding があれば有害
- 当院のように MTP + 迅速な決定的治療が行える状態であれば不要かもしれない??
- IABO/REBOA がより生きるのは二次病院からの転院搬送
bleeding site が単一の内因性出血の refractory shock

QUESTION Does the addition of resuscitative endovascular balloon occlusion of the aorta (REBOA) to standard care reduce mortality in trauma patients with exsanguinating hemorrhage?

CONCLUSION In trauma patients with exsanguinating hemorrhage, a strategy that includes REBOA, when used in the emergency department, does not reduce, and may increase, mortality compared with standard care.

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POPULATION



62 Men 28 Women

Trauma patients aged ≥ 16 years with exsanguinating hemorrhage

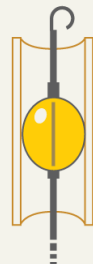
Median age: 41 years

LOCATIONS

16 Major trauma centers in the UK



INTERVENTION



90 Patients randomized
89 Patients analyzed

46

REBOA intervention + standard care

Technique of endovascular aortic occlusion for the purpose of resuscitation as part of overall resuscitation strategy

44

Standard care

Intubation, balanced blood product transfusion, tourniquet application, and interventions for hemorrhage control

PRIMARY OUTCOME

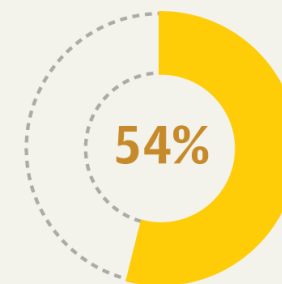
All-cause mortality at 90 days

FINDINGS

All-cause mortality at 90 days

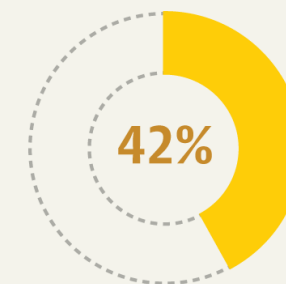
REBOA intervention + standard care

25 of 46 patients



Standard care

18 of 43 patients



Prespecified stopping rule for harm was met and study was terminated:

Odds ratio, **1.58** (95% credible interval, 0.72 to 3.52);
Posterior probability of odds ratio >1 (harm) = 86.9%