Retrospective validation of a risk stratification tool developed for predicting outcomes of patients with blunt chest wall trauma

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1/5/19

Background

- Blunt chest wall trauma= high complication rates
- No national guidelines or risk stratification tools used in New Zealand
- Scoring system developed in UK

Methods- score generation

Patient factor	**Risk score**
Age	1
Number of fractures	3
Chronic lung disease	5
Anticoagulant use	4
Oxygen saturation level	2
1 additional point per additional 10 years starting at age 10 Each rib fracture has 3 points Oxygen saturations below 94% score 2 for each 5% decrease below starting point of 94%	

Methods- score generation

65 year old= 6 points

2 rib fractures= 6

No lung disease= 0

No anticoag= 0

Sats 95%= 0

TOTAL SCORE= 12

Objectives

Primary:

- validate the scoring system to predict the risk of any complications

Post hoc:

- early and late complications

Complications

Definition of a complication:

1. LRTI, pneumonia, pneumothorax, haemothorax, pleural effusion, ICU admission, ward stay >7 days
2. Early= any complications present on arrival to ED
3. Late= any complication developed after discharge or admission, delayed ICU, prolonged stay, representation

Setting

Auckland City Hospital:

72,000 patients per year

>14 years

Tertiary referral centre for trauma and cardiothoracics

Methods- stats

- Area under the curve for receiver operator characteristics
- Plots sensitivity and specificity
- 0.5= chance
- 0.8= good test characteristic

Methods- sample size

Aim for an outcome with area under ROC of 0.8

- predicted complication rate=33%
- Statistical power= 0.9
- Alpha= 0.05

N=45

Initial analysis- wide CI

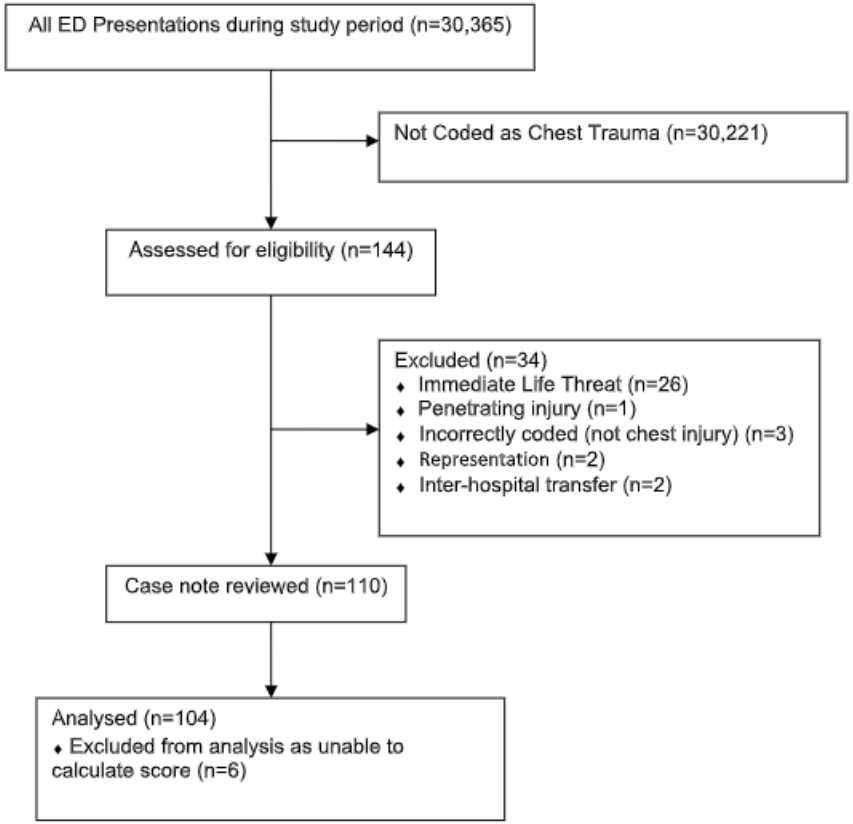
Total sample was then increased to approx. 100

Codes used

Chest wall contusion
Rib fracture
Traumatic pneumothorax
Traumatic haemothorax
Flail chest
Sprain/ strain of ribs

Equivalent to S2 ICD codes

Participant selection



Data extraction

2 data collectors working independently

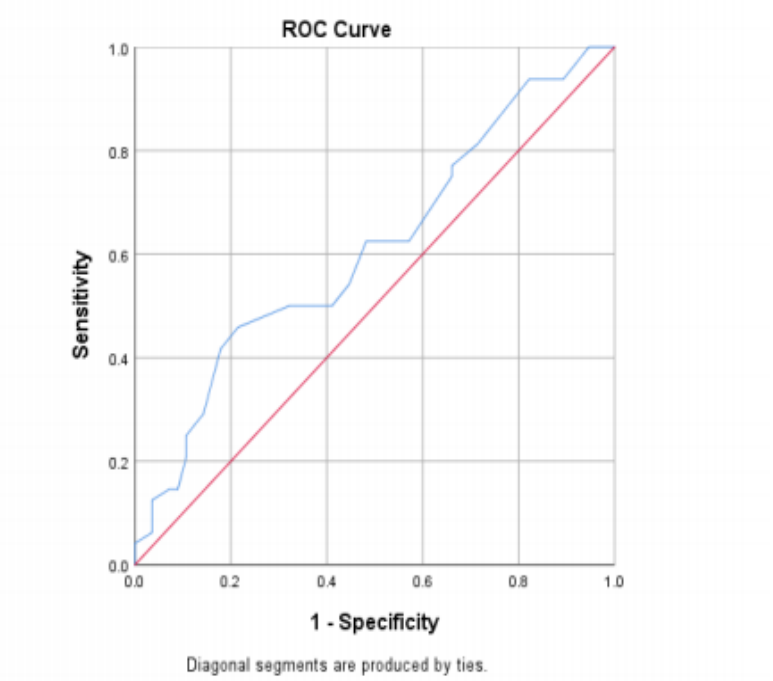
Standardised data collection form

Comparison of each collectors data to check for errors

Any differences on interpretation of participant's data resolved by a third researcher

After first 45 cases agreement for score variables 96.4% and outcome variables 99.3%

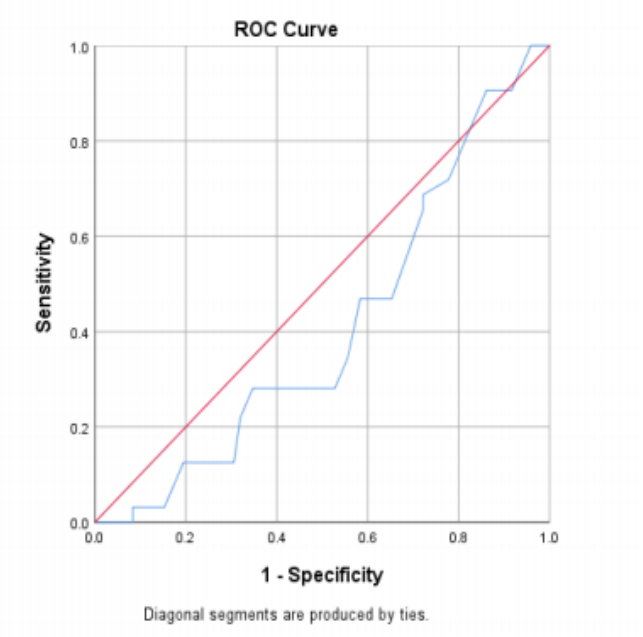
Results- primary outcome



- sensitivity 45.8%
- specificity 78.6%,
- positive likelihood ratio 2.14
- negative likelihood ratio 0.69
- AUROC: 0.612, 95% CI (0.502 to 0.721), p=0.046

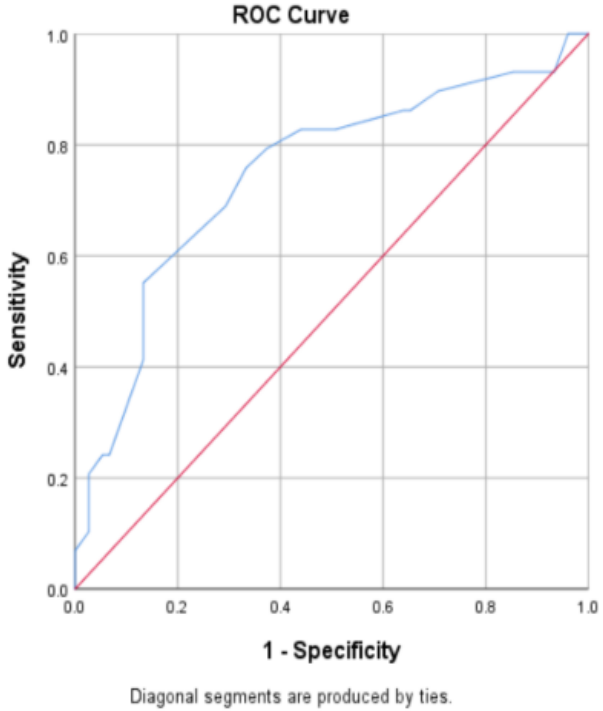
Optimal cut score= 17

Results- secondary outcome- early



- AUROC: 0.410, 95% CI (0.296 to 0.523).

Results- secondary outcome- late



- sensitivity 75.9%,
- specificity 66.7%,
- positive likelihood ratio 2.28
- negative likelihood ratio 0.36.
- AUROC: 0.747, 95% CI (0.634 to 0.860)

Optimal cut score= 15

Discussion- why are our results so different?

- Similar demographics
- Significant difference in CT rate: 63% vs 3%
- Setting: 1 tertiary trauma centre vs 7 different hospitals in UK

Limitations

Potential for coding inaccuracies (4 cases were found to be miscoded)

Patients with a stay <3 hours aren’t coded

Ethnicity was not collected

Length of stay recorded regardless reasons for prolonged stay

Conclusion

1. Score performed little better than chance alone at predicting all complications
2. It may have a role in predicting delayed complications

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Next Steps

Continue our study to include a variety of centres in NZ

Acknowledgements

Associate Professor Peter Jones
William Oldfield- Medical Student

References

1. Battle CE, Hutchings H, Lovett S, Bouamra O, Jones S, Sen A, et al. Predicting outcomes after blunt chest wall trauma: development and external validation of a new prognostic model. Critical Care. 2014, 18 (3)

Text codes

Acquired deformity of chest and rib
Contusion of chest wall
Crushed chest
Flail chest
Late effect of internal injury to chest
Closed fracture of eight or more ribs
Closed fracture of five ribs
Closed fracture of four ribs
Closed fracture of multiple ribs, unspecified
Closed fracture of one rib
Closed fracture of rib(s), unspecified
Closed fracture of seven ribs
Closed fracture of six ribs
Closed fracture of three ribs
Closed fracture of two ribs
Fracture of first rib
Fracture of one rib oth than first rib
Fracture of one rib, other than first rib
Multiple rib fractures inv >= four ribs
Multiple rib fractures inv first rib
Multiple rib fractures inv three ribs
Multiple rib fractures inv two ribs
Multiple rib fractures involving four or more ribs
Multiple rib fractures unspecified
Multiple rib fractures, involving first rib
Multiple rib fractures, involving three ribs
Multiple rib fractures, involving two ribs
Multiple rib fractures, unspecified
Sprain and strain of ribs
Sprain and strain of ribs and sternum
Traumatic haemopneumothorax
Traumatic pneumothorax
haemothorax
Traumatic haemothorax
Traumatic haemothorax without mention of open wound into thorax
Traumatic pneumohaemothorax without open wound into thorax
Traumatic haemopericardium