

Predictors of missed injuries in hospitalized trauma patients in the ER

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Introduction

- 65% ER p't had major and minor trauma
- 34% of them missed injuries in ER
- Resulted in distrust, prolonged hospitalization, adverse outcomes
- Object: to determine
 - the extent of missed injuries with major trauma
 - primary contributing factors
 - subsequent adverse short-term outcomes

Methods: Characteristics of the hospital

- Unique trauma referral center in Eastern Turkey.
- Cover 3 million population.
- 1150 beds
- Consultation from any department are possible
- Echo, CT in ER are available

Methods: Status of trauma management in Turkey

- state H: GP
 - university H: EMR (emergent medicine resident) do the primary survey and decide who to call to form the trauma team.
- No trauma teams
No fellowship program

Methods: Study design and setting

- Retrospective analysis of **prospectively** collected data on a cohort of trauma patient in level I trauma center in Turkey
- Primary and second survey were performed by EMR and consulted physician
- **Before transferred from ER**, EMR completed the record, including interpret all imaging studies.
- GCS, AIS, ISS, NISS were used.
- **Only hospitalized** pt were enrolled.
- The author (**didn't know the physician**) compared ER record with ward documents and ensure the pain, additional surg, longer hospital stay, and death caused by miss injuries.

Methods: Definitions

- Missed injury = clinically significant injury that wasn't suspected on admission and identified at ward before discharged.

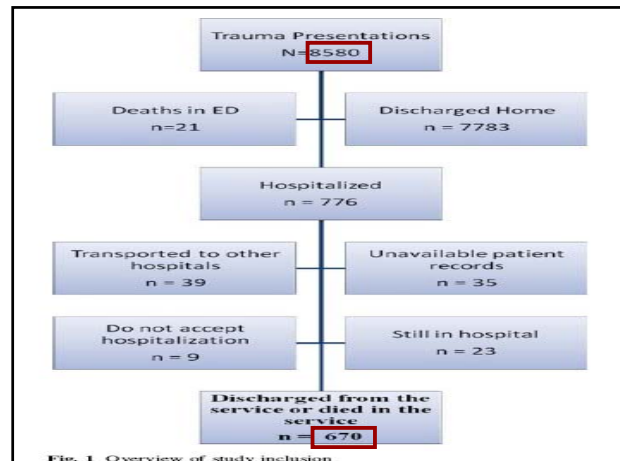


Fig. 1. Overview of study inclusion

Result: patient characteristics

Characteristic	MI (n = 89)	No MI (n = 581)	p value
Median age (years)	36 (3-93)	28 (0.2-93)	0.0009
Male (%)	73.0 (63.8-82.3)	76.9 (73.6-80.4)	NS
MVA (%)	50.6 (50.5-70.8)	36.5 (32.6-40.4)	0.011
Fall from height (%)	15.7 (8.2-23.4)	19.4 (16.2-22.7)	NS
Median injuries per patient	3 (1-9)	1 (1-9)	<0.0001
GCS median	15 (3-15)	15 (3-15)	NS
Comatose patient (%) ^a	7.9 (2.3-13.5)	7.6 (5.5-9.8)	NS
ISS median	17 (4-61)	10 (2-43)	<0.0001
NISS median	17 (4-75)	11 (2-61)	<0.0001
Median seniority of ED physician (years)	3 (1-6)	5 (1-6)	<0.0001
Median number of consultant	3 (1-7)	2 (1-7)	<0.0001
Night shift (%)	55.1 (44.7-65.3)	53.4 (49.3-57.4)	NS
Median length of stay in ED (minutes)	160 (8-435)	100 (2-660)	<0.0001
Median hospitalization day	8 (1-36)	7 (1-121)	NS
Operation (%)	50.6 (40.2-61.0)	46.1 (42.0-50.0)	NS
Mortality (%)	13.5 (6.4-20.6)	6.5 (4.5-8.5)	0.020

Values in parenthesis are minimum and maximum values for median numbers and 95% CI values for proportions

Result:

- NISS and ISS was higher for MVA than other mechanisms ($p < 0.0001$)
- MVA (38%): the most
- Missed injuries per p't was 1.64
- Missed diagnoses in all injuries: 11%
- Most frequently missed diagnoses were musculoskeletal system (38%), following thorax (24%), Abd(19%)...

Table 2 Multivariate logistic regression: predictors of missed injuries in hospitalized trauma patients

Characteristic	B	Adjusted OR	95% CI	p
Age	0.014	1.01	1.00-1.03	0.024
MVA	-0.053	0.95	0.56-1.62	0.846
Length of stay in ED	0.005	1.01	1.00-1.01	<0.0001
Seniority of ED physician	-0.301	0.74	0.63-0.87	<0.0001
Number of consultant	-0.183	0.83	0.64-1.08	0.172
Total number of injuries	0.556	1.74	1.38-2.20	<0.0001
ISS	0.094	1.10	1.03-1.18	0.008
NISS	-0.041	0.96	0.91-1.01	0.139
Death	-0.487	0.61	0.25-1.53	0.296

Injury	MI % (n/N)	Anatomic location MI % (n/N)
Skull fracture	5 (6/119)	Head and neck 4 (1/287)
Brain contusion	1 (1/80)	
ICH (subarachnoid, subdural, epidural)	4 (3/67)	
Cervical fracture and/or dislocation	5 (1/21)	
Mandibular fracture	21 (1/487)	Face 18 (1/691)
Eye injury	8 (2/24)	
Rib fracture	17 (1/75)	Thorax 15 (5/256)
Hemothorax and/or pneumothorax	20 (1/70)	
Pulmonary contusion	8 (4/51)	
Clavicle contusion and/or laceration	22 (2/9)	
Diaphragm laceration	33 (1/5)	
Thoracic fracture and/or dislocation	4 (1/28)	
Gastric and/or pancreatic contusion and/or laceration	0 (0/7)	Abdomen/pelvic contents 13 (28/190)
Splenic contusion and/or laceration	7 (2/28)	
Bowel perforation and/or laceration	13 (3/23)	
Liver contusion and/or laceration	5 (2/41)	
Kidney contusion and/or laceration	7 (1/14)	
Retroperitoneal hematoma	20 (5/25)	
Lumbar fracture and/or dislocation	29 (1/52)	
Humerus fracture and/or dislocation	2 (1/54)	Extremities/pelvic girdle 12 (3/6/88)
Radius and/or ulna fracture and/or dislocation	17 (8/46)	
Scapula fracture	26 (5/19)	
Clavicle fracture and/or dislocation	35 (6/26)	
Sternum fracture	0 (0/3)	
Pelvic fracture and/or dislocation	18 (1/67)	
Patungul and/or tarsal fracture-dislocation	13 (6/21)	
Tibia and/or fibula fracture and/or dislocation	8 (3/61)	
Femur fracture and/or dislocation	3 (3/97)	
Vascular injury	3 (1/29)	
Peripheral nerve injury	15 (6/39)	
Total injury (n)	11 (1/49)	11 (3/61/296)

Table 4 Contributing factors to diagnosing tool and outcome of the missed injuries

Patient related (%)	Nil	60.3
	Head injury or unconsciousness	28.2
	Intubation	10.7
	Language	0.8
Radiological error (%)	Nil	11.5
	Inadequate view	4.6
	Failure to X-ray	19.1
	Misinterpretation by clinician	29.8
90%	Delay in reporting	35.1
	X-ray	43.5
	CT	38.9
	USG	0.8
How was missed injury realized? (%)	Laparotomy	4.6
	MRI	5.3
	Other	6.9
	Nil	6.1
	Pain	48.9
	Restricted range of motion in extremity	8.4
	Complication	6.1
	Prolongation of hospitalization	30.5
	Death	2.2
	Outcome of injury (%)	

Result:

- Radiology errors: 90%
- P't related factor: HI, unconsciousness
- Missed exam: CT, X-ray (available at ER)
- Caused: pain, hospital stay, additional surg, death...

Discussion

- Rate of missed diagnosis = 13.3%
- P't characteristic: higher age, MVA accidents, more injuries, higher ISS, NISS scores, more consultants, lower number of exam, longer stay in ER (table 1)

Discussion

- Major predictor of miss injuries:
 - numbers of injuries !
 - (re-exam is the solving key)
 - seniority of ER physician
 - ISS

Discussion: consultation

- 30% of p't didn't consult at relevant specialist → trauma team survey
- The remaining 70% (probably inexperienced, prejudice)

Discussion

- Higher numbers over musculoskeletal system
- Higher ratio over face, thorax, abd system

Discussion

- 90% had radiological errors:
 - delay in reporting
 - misinterpretation
 - low quality image

Limitation

- Lack of pt discharged from ER (those treated and released)

Conclusion

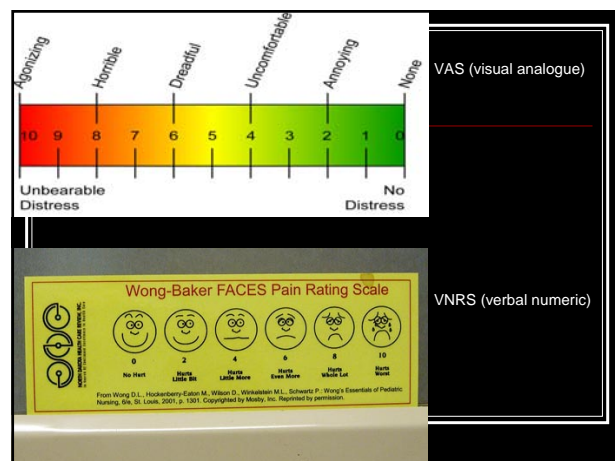
- Major predictor: seniority of Dr, total number of injuries, and ISS
- Radiological insufficiency → online reporting
- Missing trauma team → multi-disciplinarity

The end of the line? The Visual Analogue Scale (VAS) and Verbal Numerical Rating Scale (VNRS) as pain assessment tools in the ER

*Emerg Med J, 2010 May
Helen Mohan, John Ryan, Bredan Whelan, Abel Wakai*

Object and settings

- Compare VAS and VNRS in ER.
- Determine the influences of demographics
- Setting: Dublin, 479 bed teaching H, annual ED 36,000 p't.



Materials and Methods

- Prospective observation on ED p't with acute pain (2006/July – August)
- Eng-speaking adult (>18y/o)
- P't scored their pain on both VAS and VNRS in 1 hr of arrival, and 1.5, 2, 2.5, 3hr

Results

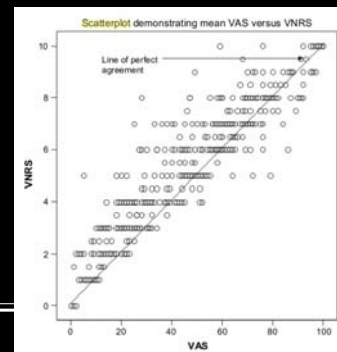
- 123 p't were included
- 531 paired measurement
- Source of pain: Trauma (44.7%)

Characteristics of study participants

Table 1 Demographics of study participants

Characteristic	No (%)
Sex	
Male	54 (43.9)
Female	69 (56.1)
Educational level	
Primary school equivalent	30 (9.8)
Junior certificate/GCSE equivalent	24 (19.5)
Leaving certificate/ A levels equivalent	21 (17.1)
University level	66 (53.7)
Marital status	
Married	37 (31.7)
Unmarried	84 (68.3)
Social class	
Professional	16 (13)
Managerial and technical	30 (24.4)
Non-manual	22 (17.9)
Skilled manual	14 (11.4)
Semi-skilled manual	16 (14.6)
Unskilled	7 (5.7)
Unemployed and unclassifiable	16 (13)

Correlation



- VNRS > VAS (398)
- VNRS < VAS (88)
- VNRS = VAS (45)
- P=0.298

Demographics difference

- Lack of university level **education** (largest difference)
- **Female sex** ($p < 0.005$)
- Increased **age** ($p < 0.005$)
- Trauma vs non-trauma (no significant)
- Location of pain (no significant)

Time effect

Table 2 Spearman rank correlation coefficient for VAS and VNRS scores corresponding to time of measurement

Time of measurement	Correlation coefficient	CI (n)
First measurement	0.89	0.85 to 0.92 (123)
30 minutes	0.94	0.92 to 0.96 (123)
60 minutes	0.93	0.90 to 0.95 (108)
90 minutes	0.95	0.93 to 0.97 (93)
120 minutes	0.95	0.92 to 0.97 (84)

No statistically significant relationship was found between initial VAS and VNRS individual scores and patient characteristics.
VAS, visual analogue scale; VNRS, verbal numerical rating scale.

Practical limits

- VAS easier: 17.89%
- **VNRS** easier: 34.96%
- No difference: 47.15%

Discussion

- Strong correlation between VAS and VNRS (but not perfect agreement)
- Older age, female sex, 3rd level education had significant influence on agreements of VAS and VNRS
- Preference for VNRS in ER p't
- P't tends to score higher on VNRS (previous study, too)

Conclusion

- VAS and VNRS are not interchangeable in individual p't
- VNRS practically better than VAS in this setting

Thank You !