

DECADE-LONG EVALUATION OF TRAUMA CARE AT A LEVEL 1 TRAUMA CENTER IN SOUTHERN MALAYSIA



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INTRODUCTION

The first **Level 1 Trauma Center in Malaysia** was established in 2011, serving a population of 3.7 million in the Southern Region. With the introduction of these new trauma services, this study aims to evaluate our experience and the impact of the trauma care system at our center. **We hypothesized that the implementation of this trauma care system would reduce overall mortality rates, major trauma mortality rates, and bleeding-related fatalities, achieving effectiveness comparable to that in high-income countries.**

CONCLUSION

This is one of the **largest single-center experiences in the trauma care in South-East Asia**. With a well-structured **trauma care system** and adequate resources, our center has significantly **reduced mortality rates** and **bleeding-related fatalities**, serving as a model for other low- and middle-income countries. This underscores the pivotal role of dedicated trauma surgeons and organized trauma teams in enhancing patient outcomes.

METHODS

This retrospective study covers two distinct periods: January 2011 to December 2013 (Early Period) and January 2018 to December 2020 (Late Period). Data were collected from an electronic trauma database and case notes. We analyzed patient demographics, injury mechanisms, major trauma severity, clinical management, and outcomes. Mortality rates were assessed for all patients and those with severe injuries (NISS > 15), and compared between the two periods, as well as with those reported from high-income countries with established trauma systems.

RESULTS

Table 1: Patient and trauma characteristics

	Total n (%)	2011-2013 n (%)	2018-2020 n (%)	P-value
Total Patients	5031	2208 (43.9%)	2823 (56.1%)	
Gender (missing=0)				
Male	4337 (86.2%)	1957 (88.6%)	2380 (84.3%)	<0.001
Female	694 (13.8%)	251 (11.4%)	443 (15.7%)	
Age (missing=0)				
0 - 14 (Young age)	54 (1.1%)	54 (2.4%)	0	<0.001
15 - 64 (Working age)	4570 (90.8%)	2015 (91.3%)	2555 (90.5%)	
≥65 (Old age)	407 (8.1%)	139 (6.3%)	407 (8.1%)	
Mean (SD)	37.5 (16.7)	35.7 (16.2)	38.9 (17.0)	<0.001
Median (IQR)	34.0 (11-91)	32.0 (11-88)	35.0 (15-91)	
Trauma mechanism (missing=0)				
Blunt	4692 (93.3%)	2009 (91.0%)	2683 (95.0%)	<0.001
Penetrating	334 (6.6%)	198 (8.9%)	136 (4.8%)	
Blast	5 (0.1%)	1 (0.1%)	4 (0.1%)	
Causes of blunt trauma (missing=3)				
RTC	4014 (85.6%)	1765 (87.9%)	2249 (83.9%)	<0.001
Fall	514 (11.0%)	206 (10.3%)	308 (11.5%)	
Industrial injury	54 (1.2%)	3 (0.1%)	51 (1.9%)	
Assault	95 (2.0%)	35 (1.7%)	60 (2.2%)	
Others	12 (0.3%)	0	12 (0.4%)	
Breakdown of RTC				
Motorcycle	2965 (74.2%)	1255 (71.2%)	1710 (76.5%)	0.003
Car	787 (19.7%)	379 (21.5%)	408 (18.3%)	
Heavy vehicle	67 (1.7%)	34 (1.9%)	33 (1.5%)	
Bicycle	32 (0.8%)	18 (1.0%)	14 (0.6%)	
Pedestrian	146 (3.7%)	76 (4.3%)	70 (3.1%)	
Causes of penetrating trauma (missing=2)				
Knife (stabbing)	229 (69.0%)	133 (67.2%)	96 (71.6%)	<0.001
Industrial tool	34 (10.2%)	22 (11.1%)	12 (9.0%)	
Agricultural tool	30 (9.0%)	28 (14.1%)	2 (1.5%)	
Gun shot	14 (4.2%)	11 (5.6%)	3 (2.2%)	
Others	25 (7.5%)	4 (2.0%)	21 (15.7%)	
GCS on admission (missing=20)				
GCS ≤8	735 (14.7%)	290 (13.1%)	445 (15.9%)	0.006
GCS ≥9	4276 (85.3%)	1918 (86.9%)	2358 (84.1%)	
Mean (SD)	13.2 (3.6)	13.4 (3.3)	13.1 (3.8)	0.002
Systolic Blood Pressure				
Mean (SD)	128.6 (26.1)	124.9 (25.6)	131.5 (26.1)	<0.001
Heart Rate				
Mean (SD)	93.2 (25.8)	93.2 (30.6)	93.1 (21.0)	0.456
Source of admission (missing=39)				
ED admission	3366 (67.4%)	1458 (66.0%)	1908 (68.5%)	0.064
Interhospital referrals / transfers	1627 (32.6%)	750 (34.0%)	877 (31.5%)	
New Injury Severity Score (NISS) (missing=7)				
≤15	2456 (48.9%)	1030 (46.6%)	1426 (50.6%)	0.005
>15 (Major Trauma)	2568 (51.1%)	1178 (53.4%)	1390 (49.4%)	
AIS Anatomical region injury score (AIS≥1) (missing=0)				
Head or neck	1422 (28.3%)	481 (21.8%)	941 (34.8%)	<0.001
Face	665 (13.2%)	281 (12.7%)	384 (13.6%)	0.363
Chest	3251 (64.6%)	1404 (63.6%)	1847 (65.4%)	0.176
Abdomen	1331 (26.5%)	543 (24.6%)	788 (27.9%)	0.008
Extremities or pelvic	2236 (44.4%)	835 (37.8%)	1401 (49.6%)	<0.001
External (skin and soft tissue)	2242 (44.6%)	1121 (50.8%)	1121 (39.7%)	<0.001

SD standard deviation, IQR interquartile range, RTC road traffic crash, GCS Glasgow Coma Scale, AIS Abbreviated Injury Score

Table 2: Management and outcomes

	Total n (%)	2011-2013 n (%)	2018-2020 n (%)	P-value
Trauma team activation (TTA) (missing=0)				
Yes	305 (6.1%)	82 (3.7%)	223 (7.9%)	<0.001
No	4726 (93.9%)	2126 (96.3%)	2600 (92.1%)	
ICU / NHDU admission (missing=14)				
Yes	1427 (28.4%)	732 (33.4%)	695 (24.6%)	<0.001
No	3590 (71.6%)	1462 (66.6%)	2128 (75.4%)	
Length of ICU stay (days)				
Mean (SD)	7.8 (7.0)	8.2 (7.6)	7.1 (5.9)	0.004
Median (range)	6 (1-61)	6 (1-56)	5 (1-61)	
Duration of hospital stay (days)				
Mean (SD)	8.3 (10.1)	9.6 (11.7)	7.3 (8.5)	<0.001
Median (range)	5 (1-160)	6 (1-160)	4 (1-102)	
Mortality rate (missing=0)				
All patients	443 (8.8%)	239 (10.8%)	204 (7.2%)	<0.001
Major trauma patients	425 (16.5%)	234 (19.9%)	191 (13.7%)	<0.001
Minor trauma patients	12 (0.5%)	5 (0.5%)	7 (0.5%)	1
Cause of death (% of all deaths) (missing=0)				
Severe head injury	206 (46.5%)	78 (32.6%)	128 (62.7%)	<0.001
Sepsis	110 (24.8%)	73 (30.5%)	37 (18.1%)	
Bleeding	53 (12.0%)	48 (20.1%)	5 (2.5%)	
Chest related injury	47 (10.6%)	26 (10.9%)	21 (10.3%)	
Multi-organ failure	21 (4.7%)	14 (5.9%)	7 (3.4%)	
Medical	6 (1.4%)	0	6 (2.9%)	

SD standard deviation, IQR interquartile range, ICU intensive care unit, NHDU neurosurgery high dependency unit

Table 3: Mortality rate by years

	2011 n (%)	2012 n (%)	2013 n (%)	2018 n (%)	2019 n (%)	2020 n (%)
Mortality rate (missing=0)						
All patients	77 (10.9%)	89 (11.8%)	73 (9.8%)	55 (5.7%)	97 (9.0%)	52 (6.7%)
Major trauma patients	77 (21.9%)	85 (19.5%)	72 (18.4%)	52 (11.4%)	95 (17.5%)	44 (11.3%)

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