DISASTER & TRAUMA UPDATED

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Emergency Management of Trauma

11. **Hemorrhage Control Advances: TXA, Tourniquets, and Hemostatic Agents**
12. **Whole Blood Resuscitation in Trauma Management**
13. **Advancements in Trauma-Induced Coagulopathy Management**
14. **Prehospital Airway Management: Video Laryngoscopy and Supraglottic Devices**
15. **Trauma Resuscitation Using Point-of-Care Ultrasound (eFAST, RUSH Exam)**
16. **Updated Spinal Immobilization and Clearance Guidelines in Trauma**
17. **Damage Control Surgery and Resuscitation in Trauma Patients**
18. **Advancements in Traumatic Brain Injury (TBI) Management**
19. **Revised Burn Injury Management and Fluid Resuscitation Protocols**
20. **Trauma Simulation Training and Virtual Reality in Emergency Education**

Er„ency Medicine in Disaster Management

1. **Advancements in Mass Casualty Triage Systems** (SALT, JumpSTART, ESI for disaster settings)
2. **Use of Artificial Intelligence and Machine Learning in Disaster Response**
3. **Drone-Assisted Emergency Response and Medical Supply Delivery**
4. **Telemedicine in Disaster Medicine: Remote Triage and Consultation**
5. **CBRN (Chemical, Biological, Radiological, Nuclear) Disaster Preparedness and Response**
6. **Psychological First Aid and Mental Health Support in Disasters**
7. **Climate Change and Emerging Disaster Risks** (Wildfires, Heatwaves, Floods)
8. **PPE Innovations for Infectious Disease Outbreaks in Disasters**
9. **Hospital Surge Capacity and Crisis Standards of Care in Disasters**
10. **Role of EMS in Large-Scale Disaster Response and Coordination**

The pre-hospital phase

Primary Survey

X : Control arterial bleeding

A : Airway and Cervical Spine Protection

B : Breathing and Ventilation

C : Circulation and Hemorrhagic control

D : Disability

E : Exposure and Environmental control

Adjunct to Primary Survey

Secondary survey

SAMPLE

S: Sign and symptom

A: Allergy

M: Medication

P: Past history / Pregnancy

L: Last meal / last menstrual period

E: Event

Adjunct to Secondary survey

Head to Toe evaluation

Pre-hospital Associated Factors of Survival in Traumatic Out-of-hospital Cardiac Arrests: An 11-Year Retrospective Cohort Study

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Abstract: **Introduction:** Traumatic out-of-hospital cardiac arrest (TOHCA) presents significant public health challenges. The high accident rates and variability in prehospital management in Thailand further complicate TOHCA treatment. This study aimed to analyze prehospital prognostic factors of survival in TOHCA cases. **Methods:** This study is a retrospective cohort study utilizing data from the Information Technology of Emergency Medicine System (ITEMS) from January 2012 to December 2022. It included TOHCA patients who received prehospital care and were transported to the emergency department (ED). We used an exploratory approach, incorporating all prognostic variables into a multivariable logistic regression model. Results are presented as odds ratios (OR) with 95% confidence intervals (CIs) and p-values. **Results:** Over an 11-year period, 35,724 patients with the mean age of 39.69±20.53 (range: 1-99) years were included in the final analysis (78.69% male). Of these, 6,590 (18.45%) survived to hospital admission, while 29,134 (81.55%) died in the ED. Prehospital management factors significantly increasing the likelihood of survival to hospital admission included stopping bleeding (OR=1.38, 95% CI=1.24-1.54, P<0.001), endotracheal intubation (ETT) (OR=2.09, 95% CI=1.74-2.50, P<0.001), intravenous fluid administration (OR=1.66, 95% CI=1.35-2.05, P<0.001), defibrillation (OR = 2.35, 95% CI=1.96-2.81, P<0.001), age (aOR = 0.99, 95% CI = 0.98-0.99, P < 0.001), closed fracture (aOR = 0.59, 95% CI = 0.53-0.66, P < 0.001), open fracture (aOR = 0.54, 95% CI = 0.48-0.61, P < 0.001), dislocation (aOR = 0.60, 95% CI = 0.45-0.81, P = 0.001), and on scene time <10 min (aOR = 0.63, 95% CI = 0.54-0.75, P < 0.001). **Conclusion:** To improve survival to hospital admission in TOHCA, several factors should be prioritized. These include administering intravenous fluid boluses, controlling external bleeding, delivering defibrillation when indicated, and performing ETT.

Keywords: Wounds and Injuries; Out-of-hospital cardiac arrest; Emergency Medical Services; Emergency Service, Hospital; Advanced Trauma Life Support Care; Prognosis

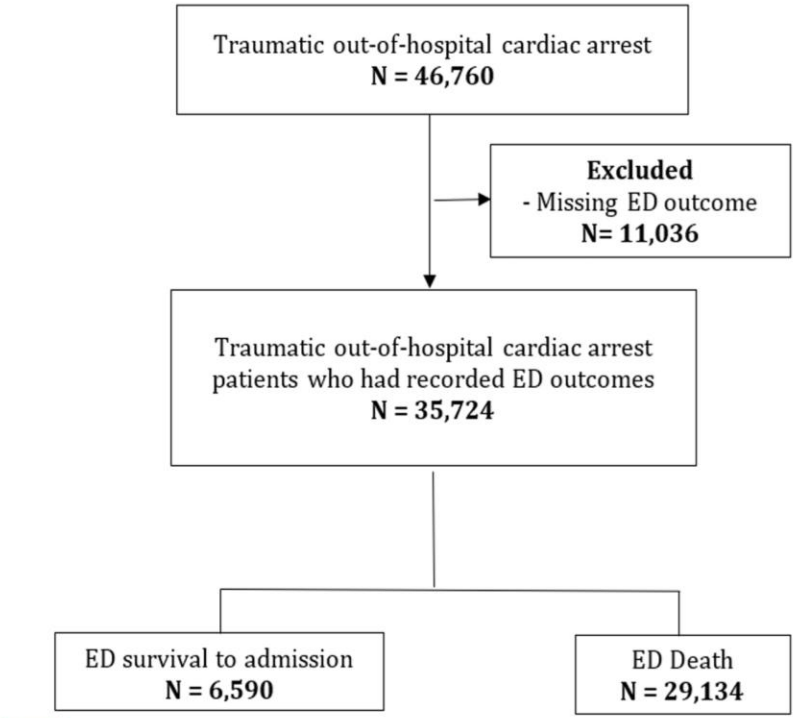
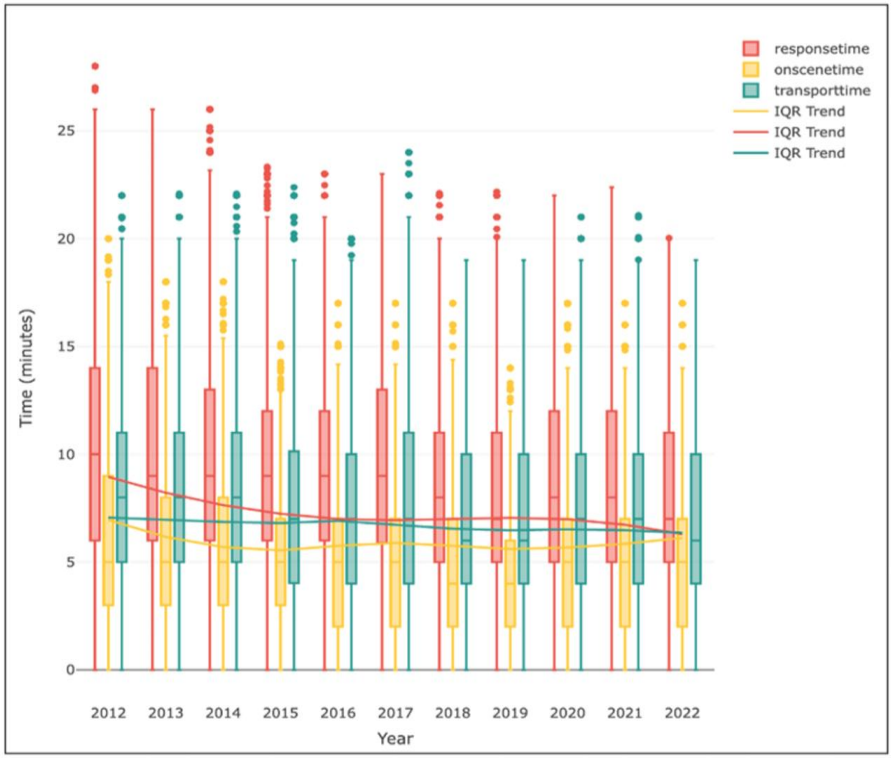


Figure 1: Study flowchart of patients' inclusion. ED: emergeny department.



Prehospital procedure				
Stop bleeding	1.02 (0.99-1.06)	0.209	1.38 (1.24-1.54)	<0.001
ETT intubation	1.81 (1.59-2.05)	<0.001	2.09 (1.74-2.50)	<0.001
IV fluid administration	1.41 (1.25-1.60)	<0.001	1.66 (1.35-2.05)	<0.001
Prehospital AED/Defibrillation	1.94 (1.70-2.21)	<0.001	2.35 (1.96-2.81)	<0.001
Adrenaline use	0.78 (0.73-0.83)	<0.001	0.96 (0.88-1.06)	0.418
Level of operation				
ALS	0.58 (0.55-0.62)	<0.001	0.89 (0.08-1.88)	0.862

Data are presented as frequency (%) or medina (IQR). IQR: interquartile range, km: kilometer, ETT: Endotracheal tube, IV: intravenous, AED: Automated External Defibrillator, ALS: advanced life support; cOR: crude Odds ratio; aOR: addjusted Odds ratio; CI: confidence interval.

Prehospital Trauma care

แบบรายงานปฏิบัติการดูแลผู้บาดเจ็บนอกโรงพยาบาล (Trauma Record Form)

หน่วยอำนวยการและปฏิบัติการแพทย์ฉุกเฉิน ภาควิชาเวชศาสตร์ฉุกเฉิน

คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล

ส่วนที่ 1 : ข้อมูลรับแจ้งเหตุ

ปฏิบัติการที่ ..... **เลขปฏิบัติการ** .....

วันที่ ..... **รับแจ้งจาก** ☐ ศูนย์เอราวัณ ☐ ศูนย์กู้ชีพนเรนทร ☐ อื่นๆ ..... **ทาง** ☐ วิทยุสื่อสาร ☐ โทรศัพท์

ลักษณะการออกปฏิบัติการ ☐ ปฏิบัติการ ณ จุดเกิดเหตุ ☐ สนับสนุนชุดปฏิบัติการ ณ จุดเกิดเหตุ ☐ รับต่อระหว่างทางกับชุดปฏิบัติการ

สถานที่เกิดเหตุ ..... **พิกัด**[1] Lat. _ _. _ _ _ _ _ Long. _ _ _. _ _ _ _ _ _

พื้นที่เกิดเหตุ ☐ ในพื้นที่ ☐ นอกพื้นที่ โซน ..... **ระยะห่างจากศูนย์** ..... กม. **Estimate time to scene** ..... นาที

ผู้แจ้งเหตุ ..... **โทรศัพท์ติดต่อ** .....

ข้อมูลผู้ป่วย ☐ ผู้ชาย ☐ ผู้หญิง อายุ ..... ปี **อาการสำคัญ** .....

กลไกการบาดเจ็บ ☐ MVC ☐ Falling ☐ Assault ☐ Shooting ☐ Stab ☐ Other .....

Incident dispatch code (IDC)[2] .....

กลุ่มอาการหลัก	☐ **วิกฤต**[3]
☐ 20 เด็ก/ทารก (กุมารเวชกรรม)	☐ 1. Arrest ☐ 2. Airway ☐ 3. Breathing ☐ 4. Circulation ☐ 5. Disability
☐ 21 ถูกทำร้าย/บาดเจ็บ	☐ 6. High risk[4] .....
☐ 22 ความร้อน/กระแสไฟฟ้า/สารเคมี	☐ 7. Severe pain: pain scale ..... ☐ 8. Danger vital sign[5] .....
☐ 23 จมน้ำ/บาดเจ็บทางน้ำ	☐ **เร่งด่วน**
☐ 24 พลัดตกหกล้ม/อุบัติเหตุ	
☐ 25 อุบัติเหตุยานยนต์	

ให้คำแนะนำ .....

ที่มาของคำแนะนำ ☐ Prearrival instruction ☐ Medical director advise ☐ EMD advise **โดย** ☐ วิทยุสื่อสาร ☐ Phone ☐ VDO call

ส่วนที่ 2 : ข้อมูลปฏิบัติการ

ทีมปฏิบัติการฉุกเฉิน รถ ALS คันที่ ..... แพทย์ ..... Paramedic 1 ..... Paramedic 2 .....

EMT / ผู้ช่วยพยาบาล ..... พนักงานขับรถ ..... อื่นๆ .....

อุปกรณ์ป้องกันตนเอง ☐ EID 1 ☐ EID 2 ☐ PPE Level C

ข้อมูลเวลา[6]

รับแจ้ง	สั่งการ	ออกจากฐาน	ถึงที่เกิดเหตุ	พบเหตุ	เคลื่อนย้ายจากที่เกิดเหตุ	ออกจากที่เกิดเหตุ	ถึง รพ.	ถึงฐาน
_ _ : _ _ : _ _	_ _ : _ _ : _ _	_ _ : _ _ : _ _	_ _ : _ _	_ _ : _ _	_ _ : _ _	_ _ : _ _	_ _ : _ _	_ _ : _ _
เลข กม.								

Dispatch time ..... นาที ..... วินาที Activation time ..... นาที ..... วินาที Response time ..... นาที ..... วินาที

Scene time ..... นาที ..... วินาที ระยะทางถึงเหตุ ..... กม. ระยะทางถึง รพ. ..... กม.

Scene Time for Platinum 10 Minutes

☐ Inadequate / threatening airway

☐ Impair ventilation

☐ Significant external hemorrhage or suspect internal hemorrhage

☐ GCS ≤13 or motor <6 / seizure / sensory or motor deficit

☐ Penetrating trauma : ศีรษะ, ลำคอ, ลำตัว, ต้นแขน, ต้นขา

☐ Amputation or near-amputation

☐ Significant trauma in:

☐ U/D: ACS, COPD, bleeding disorder

☐ Age >55 years or children

☐ Pregnancy >20 weeks

☐ Hypothermia or burn

Lifting and Moving ☐ Traditional spinal immobilization (TSI) ☐ Spinal motion restriction (SMR) ☐ KED

ส่วนที่ 3 : ข้อมูลการดูแลรักษา ณ จุดเกิดเหตุ

Scene size up

Scene safety ☐ ปลอดภัย ☐ ไม่ปลอดภัย ระบุ.....

Number of patients ..... ราย

Additional resource ☐ None ☐ ALS ☐ BLS ☐ Police ☐ Rescue ☐ Fireman ☐ HazMat team

☐ Other (ระบุ) .....

Initial evaluation

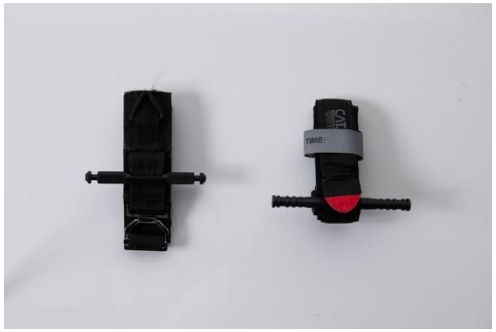
Consciousness ☐ Alert (A) ☐ Verbal response (V) ☐ Painful response (P) ☐ Unconscious (U)

Breathing ☐ Yes ☐ No

Circulation ☐ Yes ☐ No (ใช้ **แบบรายงานปฏิบัติการช่วยฟื้นคืนชีพ** แนบ)

Primary Survey	Primary Survey		Resuscitation
X Exsanguination Bleeding	☐ No exsanguination bleeding		
	☐ Arterial bleeding Site..... ☐ Venous bleeding Site.....		☐ Direct pressure time..... by..... ☐ Pressure dressing time..... by..... ☐ Tourniquet time..... by..... ☐ Other..... time..... by..... ☐ CoTCCC / CRoC / JETT / SJT time..... by.....
	☐ Patency		
	☐ Compromise	☐ Stridor ☐ Apnea / Unconsciousness ☐ Severe TBI ☐ Risk for aspiration (bleeding / vomiting)	☐ Jaw thrust time..... by..... ☐ Suction time..... by..... ☐ NPA. ☐ OPA time..... by..... ☐ Adjunct airway: time..... by

Primary Survey		Primary Survey		Resuscitation
X Exsanguination Bleeding		☐ No exsanguination bleeding		
		☐ Arterial bleeding Site.....		☐ Direct pressure time..... by..... ☐ Pressure dressing time..... by..... ☐ Tourniquet time..... by..... ☐ Other..... time..... by..... ☐ CoTCCC / CRoC / JETT / SJT time..... by.....
		☐ Venous bleeding Site.....		
A	Airway	☐ Patency		
		☐ Compromise	☐ Stridor ☐ Apnea / Unconsciousness ☐ Severe TBI ☐ Risk for aspiration (bleeding / vomiting) ☐ Risk for obstruction (neck hematoma, laryngeal / tracheal injury) ☐ Severe maxillofacial injury	☐ Jaw thrust time..... by..... ☐ Suction time..... by..... ☐ NPA. ☐ OPA time..... by..... ☐ Adjunct airway: time..... by..... ☐ LMA ☐ I-gel ☐ ETT intubation time..... by..... ☐ DAI ☐ RSI ☐ Crash airway (ใช้ **แบบรายงานการใส่ท่อช่วยหายใจ** แนบ) ☐ Cricothyroidotomy time..... by.....
	C-spine	☐ No evidence of C-spine injury		
		☐ Evidence **Blunt trauma + High risk mechanism**	☐ GCS < 15 ☐ Spinal pain / tenderness ☐ Neurologic deficit / complaint ☐ Anatomic deformity of spine ☐ Evidence of alcohol / drug ☐ Painful distracting injury[7] ☐ Inability to communication	☐ Cervical collar time..... by.....
B	Breathing and	Inspection ☐ Normal ☐ Tachypnea ☐ Bradypnea ☐ Accessory muscle use Palpation Lung expansion: ☐ Equally ☐ Decrease Rt. / Lt		O_2 therapy ☐ Mask with bag ≥10 LPM ☐ Bag-valve-mask device



	Ventilation	**Trachea:** ☐ Midline ☐ Deviation Rt. / Lt. **Subcutaneous emphysema:** ☐ Yes ☐ No **Percussion** ☐ Normal ☐ Hyporesonance Rt. / Lt. ☐ Hyperresonance Rt. / Lt. **Auscultation** ☐ Poor air entry ☐ Decrease Rt. / Lt. ☐ Murmur	☐ Needle thoracostomy ☐ ICS : 2nd MCL ☐ ICS : 5th Ant-Mid AL time..... by..... ☐ Finger thoracostomy : 5th Ant-Mid AL time..... by..... ☐ Three side dressing time..... by.....
		SpO_2 ..... % ☐ Room air ☐ Supplemental O_2	
		☐ Adequate ☐ Tension pneumothorax : Rt. / Lt. ☐ Open pneumothorax : Rt. / Lt. ☐ Massive hemothorax : Rt. / Lt. ☐ Flail chest : Rt. / Lt. ☐ Cardiac tamponade	
C	**Circulation**	**Skin color** ☐ Normal ☐ Pale **Skin** ☐ Warm ☐ Cool **Cap refilling time** ☐ ≤ 2 sec ☐ > 2 sec. **Radial pulse** ☐ Strong ☐ Weak ☐ Regular ☐ Irregular	**IV access : En route (ยกเว้น entrapment)** ☐ 1st NSS / RLS ☐ Peripheral ☐ IO rate..... time..... by..... ☐ 2nd NSS / RLS ☐ Peripheral ☐ IO rate..... time..... by..... * ในเด็ก ให้ 20 ml/kg x 2 ครั้ง * ☐ Transamine 1 g IV time..... by..... ☐ Blood component .....
		☐ Adequate	☐ Shock **Classification of shock** ☐ Class I ☐ Class II ☐ Class III ☐ Class IV ☐ Control hemorrhage ☐ Uncontrol hemorrhage
	Hemorrhagic control	☐ No bleeding site	
		☐ Bleeding	☐ Chest ☐ Pelvis ☐ Discrepancy of legs ☐ Perineal ecchymosis ☐ Gap of pubic symphysis ☐ Femur ☐ Close ☐ Open **Site:** Rt. / Lt. ☐ External: estimate loss ..... ml
			☐ Abdomen **Inspection** ☐ Normal ☐ Distension ☐ Contusion / ecchymosis **Palpation** ☐ Tender ☐ Guarding ☐ Rebound tenderness
			On scene procedure ☐ Pelvic binder time..... by..... **En route procedure** ☐ Traction splint time..... by..... ☐ Rigid splint ☐ Vacuum splint fracture site ..... time..... by.....

D	Disability	Glasgow Coma Scale (GCS) Score = _____ / 15			
			>4 Years - Adult	<4 Years	Infant
		Eye 4	Spontaneous		
		3	To speech		
		2	To pain		
		1	No response		
		Verbal 5	Alert & oriented	Appropriate words / social smile / fixes and follow	Coos, babbles
		4	Disoriented	Crying but consolable	Irritable cry
		3	Speak nonsensical	Persistently irritable	Cries to pain
		2	Moans	Restless, agitated	Moans to pain
		1	No response	No response	No Response
		Motor 6	Follows commands		
		5	Localizing		
		4	Normal flexion		
		3	Abnormal flexion		
		2	Extension		
		1	No response		

Pupils	Right	Left
Size	.....mm	.....mm
React TL	R / S / N	R / S / N

- ☐ Normal
- ☐ Increase intracranial pressure (Cushing's phenomenon)
- ☐ Uncal herniation Rt. / Lt. (Pupil dilate same site, weakness opposite site)
- ☐ Tonsillar herniation
- ☐ Mild hyperventilation: Adult 20, Ped 25, Infant 30 (keep $EtCO_2$ 30-35 mmHg)
- ☐ Keep SBP ≥100 mmHg (50-69 yr.) OR ≥110 mmHg (15-49 / >70 yr.)
- ☐ Mannitol 0.25-1 g/kg (per protocol)
- ☐ ปลด collar ให้หลวม
- ☐ Transamine 1 g IV (mild-mod. TBI)

time..... by.....

E	Exposure	☐ Cut dress ☐ Log roll	☐ Life threatening wound (ระบุ) ..... ☐ Keep ambulance compartment temperature 29 °C

Adjuncts to Primary Survey (q 5 min)

Time	PR	BP	RR	SpO_2	$EtCO_2$	E	V	M	Rt.	RTL	Lt.	RTL	EKG
นาทีที่ 0										Y / N		Y / N	
นาทีที่ 5										Y / N		Y / N	
นาทีที่ 10										Y / N		Y / N	
นาทีที่										Y / N		Y / N	
นาทีที่										Y / N		Y / N	

Secondary Survey

SAMPLEs

Symptoms .....

Allergies .....

Medications .....

Past medical / surgical history .....

Last meal / LMP .....

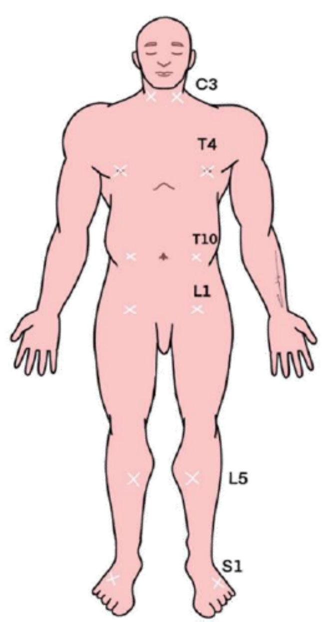
Events .....

Head to Toe Evaluation

Head & Scalp	☐ Intact	☐ Basilar skull ☐ Skull fracture ☐ Depressed skull fracture ☐ Penetrating skull injury
Eyes	☐ Intact	☐ Subconjunctival hemorrhage ☐ Hyphema ☐ Rupture globe ☐ Chemical burn **Site:** Rt. / Lt.
Face	☐ Intact	☐ Orbital blow-out fracture ☐ Nasal bone fracture ☐ Midface fracture ☐ Zygoma fracture ☐ Mandibular fracture ☐ Temporomandibular joint dislocation
Neck	☐ Intact	☐ Laryngeal injuries ☐ Traumatic carotid artery dissection: TCAD
Chest	☐ Intact	Inspection ☐ Normal ☐ Tachypnea ☐ Bradypnea ☐ Accessory muscle use Palpation Lung expansion: ☐ Equally ☐ Decrease Rt. / Lt

		Trachea: ☐ Midline ☐ Deviation Rt. / Lt. Subcutaneous emphysema: ☐ Yes ☐ No Percussion ☐ Normal ☐ Hyporesonance Rt. / Lt. ☐ Hyperresonance Rt. / Lt. Auscultation ☐ Poor air entry ☐ Decrease Rt. / Lt. ☐ Murmur
Abdomen	☐ Intact	☐ Distension ☐ Tender ☐ Guarding ☐ Rebound tenderness

Neurological examination ☐ Intact

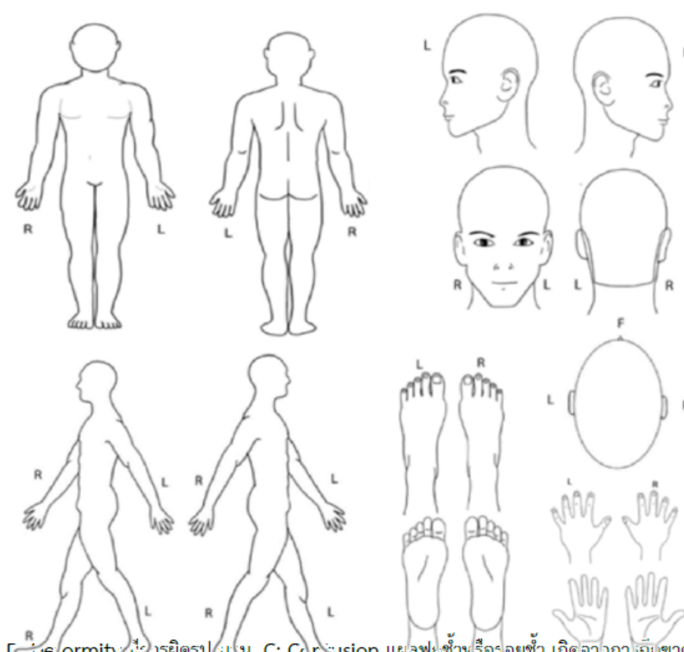


☐ Motor

☐ Sensory

	Rt.	Lt.
C3		
T4		
T10		
L1		
L5		
S1		

External wounds



D: Deformity มีการผิดรูปร่าง C: Contusion แผลฟกช้ำหรือรอยช้ำ เกิดจากการฉีกขาดของหลอดเลือดฝอยใต้ผิวหนัง A: Abrasion แผลถลอก มีการฉีกขาดไม่เกินชั้นหนังกำพร้า

P: Penetration แผลถูกแทง ผิวหนังฉีกขาดเป็นรูที่มีความลึกมากกว่าเส้นผ่าศูนย์กลางของบาดแผล

B: Burn แผลไฟไหม้น้ำร้อนลวก T: Tenderness กดแล้วมีอาการเจ็บ L: Lacerations บาดแผล

1. Extended FAST

Pericardia	☐ Normal	☐ Abnormal.....				
Hepatorenal	☐ Normal	☐ Abnormal.....				
Splenorenal	☐ Normal	☐ Abnormal.....				
Cul de sac	☐ Normal	☐ Abnormal.....				
Rt. lung	**Sliding sign**	☐ Yes	☐ No	**M-mode**	☐ Seashore sign	☐ Barcode sign
Lt. lung	**Sliding sign**	☐ Yes	☐ No	**M-mode**	☐ Seashore sign	☐ Barcode sign


Patient 2293 :
Printer Out of Paper
2.0 cm/mV
Lead Fault
SpO2
1x
94
113
71
(85)
@13:59 Man.
99
SpMet
0.3
Program
IN1-HDMI
IN2-HDMI2
14:03:09
STATUS
CH1 IN1
CH2 IN2
CH1_VOL 100
CH2_VOL 95
Audio Mode Follow
PGM Out 1080P60
14:04:15
2025-02-21
F1 : Reso
F2 : SRC
F3 : StreamVol
STILL : OFF
StreamVol : 80%

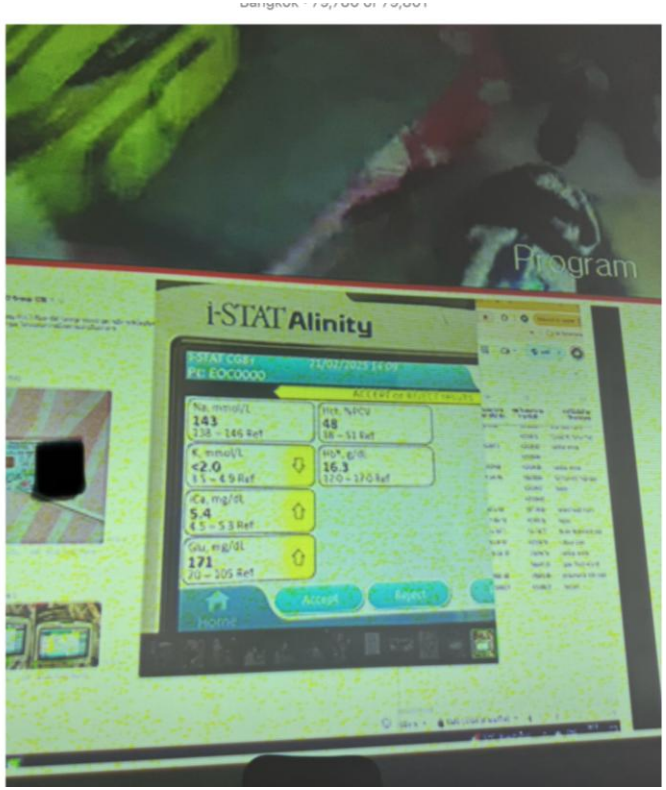
2. POCT

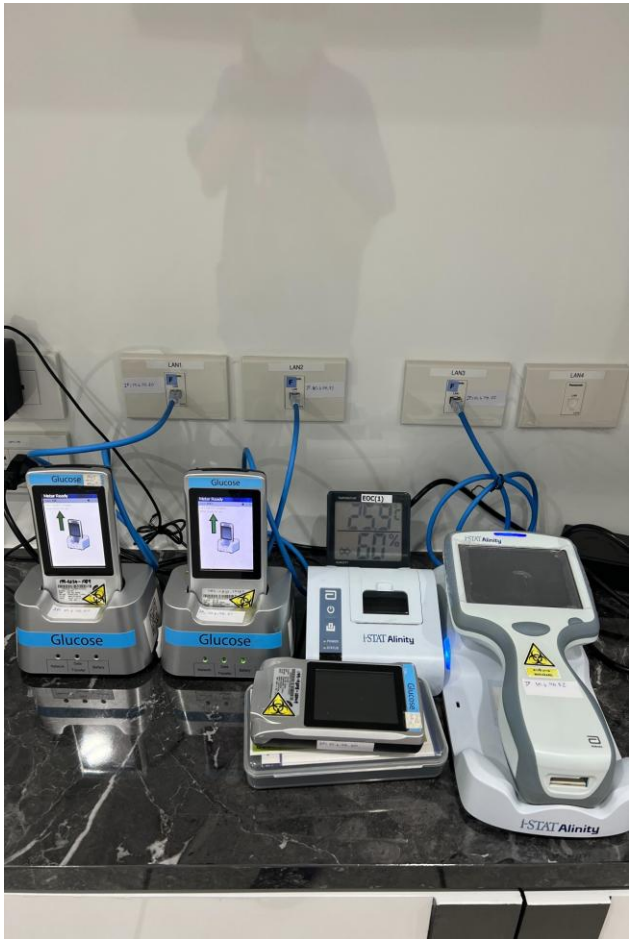
☐ CBG time..... by..... result .....

☐ ABG time..... by..... result .....

☐ K+ time..... by..... result .....

☐ Other time..... by..... result .....





อายุ 4 ปีขึ้นไป

การให้ยาระงับปวด ☐ คะแนนประเมิน ≥ 7 ☐ Fentanyl IV 1 มคก./กก. ☐ Methoxyflurane

	ก่อนให้	5 นาที	10 นาที	15 นาที	20 นาที	25 นาที	30 นาที	45 นาที	60 นาที
คะแนนปวด									

Scene Triage

กลุ่มอาการหลัก ☐ 20 เด็ก/ทารก (กุมารเวชกรรม) ☐ 21 ถูกทำร้าย/บาดเจ็บ ☐ 22 ความร้อน/กระแสไฟฟ้า/สารเคมี ☐ 23 จมน้ำ/บาดเจ็บทางน้ำ ☐ 24 พลัดตกหกล้ม/อุบัติเหตุ ☐ 25 อุบัติเหตุยานยนต์	☐ **วิกฤต**[3] ☐ 1. Arrest ☐ 2. Airway ☐ 3. Breathing ☐ 4. Circulation ☐ 5. Disability ☐ 6. High risk[4] ..... ☐ 7. Severe pain: pain scale ..... ☐ 8. Danger vital sign[5] ..... ☐ **เร่งด่วน**			
Shock index (En route)	**นาทีที่ 0 =**	**นาทีที่ 5 =**	**นาทีที่ 10 =**	ER =
Revised trauma score	**นาทีที่ 0 =**	**นาทีที่ 5 =**	**นาทีที่ 10 =**	ER =
Triage accuracy (auditor)[8]	☐ Accurate	☐ Under triage	☐ Over triage	

การใส่ท่อช่วยหายใจ ณ จุดเกิดเหตุ (Prehospital Intubation Record Form)

ส่วนที่ 1 : ข้อมูลผู้ป่วย

วันที่ ..... เวลา ..... น. ชื่อ-สกุลผู้ป่วย ..... อายุ ..... ปี

HN ..... ☐ คนไทย ID Card _ - _ _ _ _ - _ _ _ _ _ - _ _ - _ ☐ ชาวต่างชาติ ประเทศ ..... Passport No. .....

ส่วนที่ 2 : Prehospital Intubation Checklist

ประเมินความยากของการใส่ท่อช่วยหายใจ		ประเมินความยากของการช่วยหายใจด้วย Bag-valve-mask device	
☐ **L:** Look externally	.....	☐ **M:** Mask seal	.....
☐ **E:** Evaluate 3-3-2	.....	☐ **O:** Obstruction / Obesity	.....
☐ **M:** Mallampati score	.....	☐ **A:** Age ≥ 55 years	.....
☐ **O:** Obstruction / Obesity	.....	☐ **N:** No teeth	.....
☐ **N:** Neck mobility	.....	☐ **S:** Stiffness of lungs	.....
ประเมินความยากของการใส่ Supraglottic airway device		**ประเมินความยากของการผ่าตัดทางเดินหายใจ (Cricothyrotomy)**	
☐ **R:** Restriction	.....	☐ **S:** Surgery	.....
☐ **O:** Obstruction / Obesity	.....	☐ **M:** Mass	.....
☐ **D:** Distorted airway	.....	☐ **A:** Access / Anatomy	.....
☐ **S:** Short thyromental distance	.....	☐ **R:** Radiation	.....
		☐ **T:** Tumor	.....

อุปกรณ์ Airway	อุปกรณ์ Ventilation
☐ Direct and Video laryngoscopy with Blade No.	☐ Power on transport ventilator
☐ Endotracheal tube No. ..... with stylet	☐ In-line suction
☐ Bag-valve-mask device with HEPA filter	☐ End-tidal CO_2
☐ Facemask (Check for proper size)	☐ HEPA filter of expiratory limb
***** In case of difficult airway *****	☐ **Ventilator setting:**
☐ Gum elastic bougie	☐ Mode: PCV / VCV ☐ V_T 6-8 mL/Kg = ... mL
☐ Laryngeal mask airway / I-Gel No.	☐ FiO_2 1.0 ☐ RR 16-24 /min = ... /min
☐ Surgical airway device set	☐ PEEP 8 mmHg ☐ T_{insp} 0.8-1 sec = ... sec

สารน้ำและยาที่ต้องเตรียม		
☐ 0.9% NaCl 1,000 mL		
☐ Fentanyl	..... mcg	Dose: 1 mcg/Kg
☐ Midazolam	..... mg	Dose: 0.2 mg/Kg
☐ Atropine	..... mg	Dose: 0.02 mg/Kg
☐ Propofol	..... mg	Dose: 1.5 mg/Kg
☐ Ketamine	..... mg	Dose: 1.5 mg/Kg
☐ Succinylcholine	..... mg	Dose: 1.5 mg/Kg
☐ Rocuronium	..... mg	Dose: 1 mg/Kg

<u>Vasopressor</u>

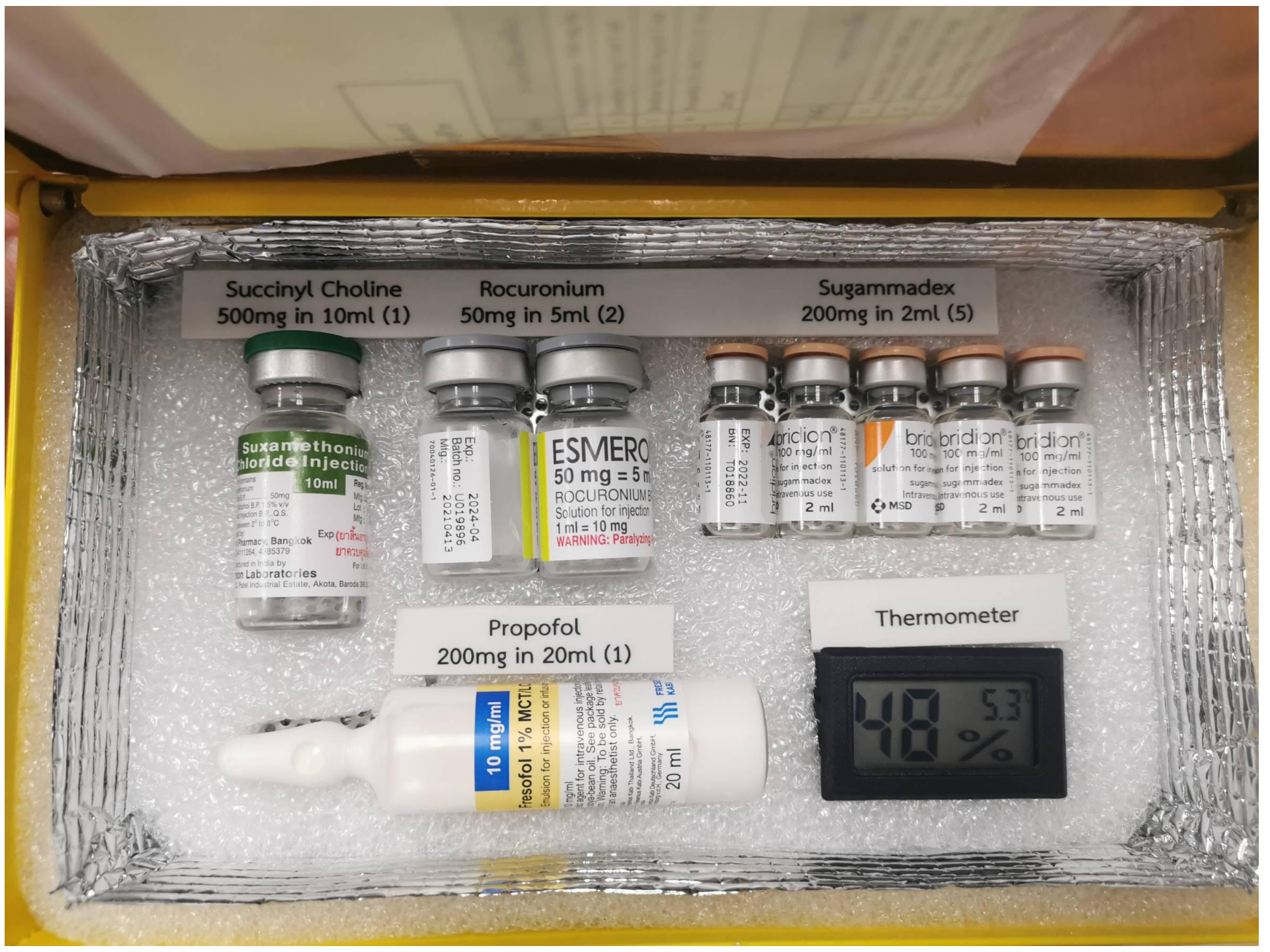
☐ Norepinephrine 4 mg + 5%D/W up to 100 mL

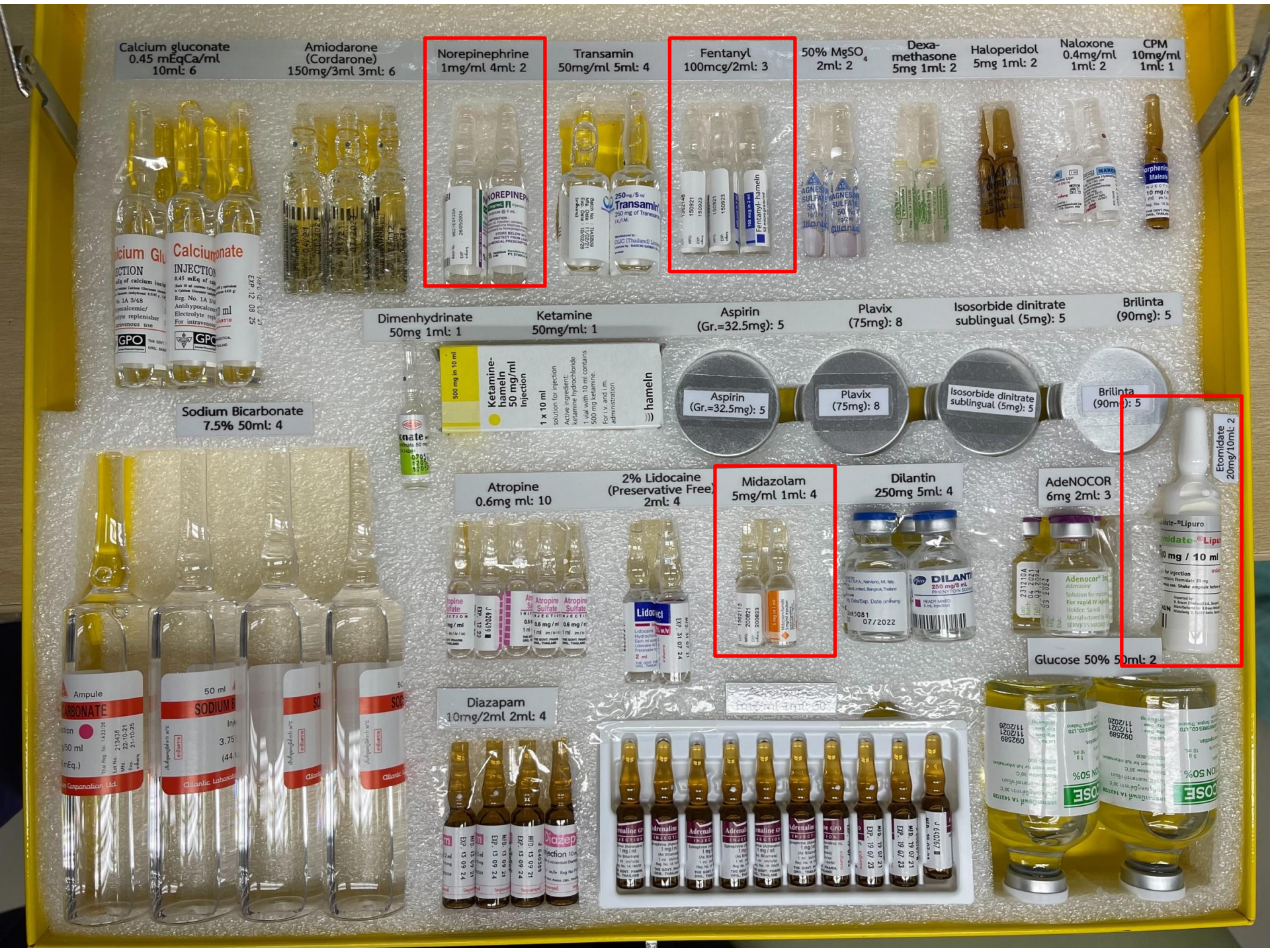
<u>Reversal of Rocuronium</u>

☐ Sugammadex (Bridion®) 16 mg/Kg

<u>Post-intubation sedation</u> (Optional)

☐ Fentanyl 1 mcg/Kg/dose


Succinyl Choline
500mg in 10ml (1)
Rocuronium
50mg in 5ml (2)
Sugammadex
200mg in 2ml (5)
Suxamethonium
Chloride Injection
10ml
ESMERO
50 mg = 5 m
ROCURONIUM
Solution for injection
1 ml = 10 mg
WARNING: Paralyzing
bridion®
100 mg/ml
solution for injection
sugammadex
Intravenous use
2 ml
MSD
Propofol
200mg in 20ml (1)
10 mg/ml
20 ml
Thermometer
48 %
53


Calcium gluconate 0.45 mEqCa/ml 10ml: 6
Amiodarone (Cordarone) 150mg/3ml 3ml: 6
Norepinephrine 1mg/ml 4ml: 2
Transamin 50mg/ml 5ml: 4
Fentanyl 100mcg/2ml: 3
50% $MgSO_4$ 2ml: 2
Dexa-methasone 5mg 1ml: 2
Haloperidol 5mg 1ml: 2
Naloxone 0.4mg/ml 1ml: 2
CPM 10mg/ml 1ml: 1
Dimenhydrinate 50mg 1ml: 1
Ketamine 50mg/ml: 1
Aspirin (Gr.=32.5mg): 5
Plavix (75mg): 8
Isosorbide dinitrate sublingual (5mg): 5
Brilinta (90mg): 5
Sodium Bicarbonate 7.5% 50ml: 4
Atropine 0.6mg ml: 10
2% Lidocaine (Preservative Free) 2ml: 4
Midazolam 5mg/ml 1ml: 4
Dilantin 250mg 5ml: 4
AdeNOCOR 6mg 2ml: 3
Etomidate 20mg/10ml: 2
Glucose 50% 50ml: 2
Diazepam 10mg/2ml 2ml: 4

Pre-intubation assessment: Time ..... น.

☐ HR ..... /min ☐ BP ..... mmHg

☐ SpO_2 ..... % ☐ ECG monitoring

Peri-intubation assessment: Time ..... น.

☐ HR ..... /min ☐ BP ..... mmHg

☐ SpO_2 ..... % ☐ ECG monitoring

☐ HR ..... /min ☐ BP ..... mmHg

☐ SpO_2 ..... % ☐ ECG monitoring

Pre-intubation optimization:

☐ 0.9% NaCl 1,000 mL IV bolus ..... mL IV

Time ..... น. By .....

☐ Norepinephrine 4 mg + 5%D/W up to 100 mL IV

Rate ..... mL/Hr.

Time ..... น. By .....

☐ Fentanyl ..... mcg IV

Time ..... น. By .....

☐ Midazolam ..... mg IV

Time ..... น. By .....

☐ Atropine ..... mg IV

Time ..... น. By .....

Intubation :

1st attempt with DL / VL By .....

Start time ..... น. Stop time ..... น.

2nd attempt with DL / VL By .....

Start time ..... น. Stop time ..... น.

3rd attempt with DL / VL By .....

Start time ..... น. Stop time ..... น.

Peri-intubation hypoxemia ☐ Yes ☐ No

Lowest SpO_2 ..... %

Peri-intubation hypotension ☐ Yes ☐ No

Peri-intubation cardiac arrest ☐ Yes ☐ No

Aspiration ☐ Yes ☐ No

Airway trauma ☐ Yes ☐ No

Paralysis with induction: **(Body weight ..... Kg)**

Induction:

☐ ..... Dose: ..... mg IV

Time ..... น. By .....

Paralysis:

☐ Succinylcholine Dose: ..... mg IV

Time ..... น. By .....

☐ Rocuronium Dose: ..... mg IV

Time ..... น. By .....

Other medication:

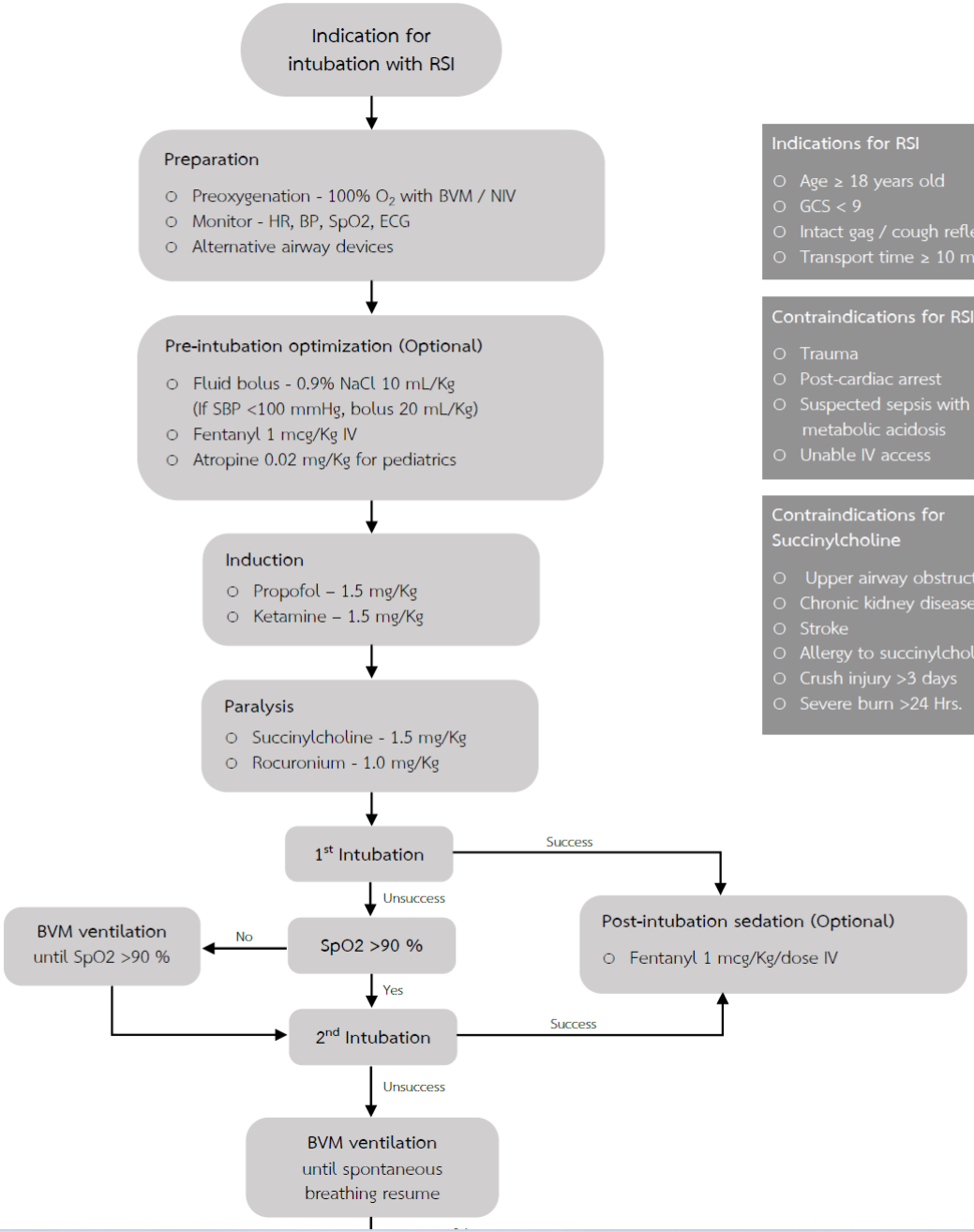
☐ ..... Dose: ..... mg IV

Time ..... น. By .....

☐ ..... Dose: ..... mg IV

Time ..... น. By .....

Ramathibodi Prehospital Rapid Sequence Intubation Protocol



Drugs	Recommended dosage (per body weight: Kg)				
	50 Kg	60 Kg	70 Kg	80 Kg	100 Kg
Pretreatment agents					
Fentanyl (1 mcg/Kg)	50	60	70	80	100
Concentration 50 mcg:ml	1.0	1.2	1.4	1.6	2.0
Midazolam (0.2 mg/Kg)	10	12	14	16	20
Concentration 5 mg:ml	2.0	2.4	2.8	3.2	4.0
Atropine (0.02 mg/Kg)	1.0	1.2	1.4	1.6	2.0
Concentration 0.6 mg:ml	1.6	2.0	2.4	2.6	3.2
Induction agents					
Propofol (1.5 mg/Kg)	80	90	110	120	150
Concentration 10 mg:ml	8.0	9.0	11.0	12.0	15.0
Ketamine (1.5 mg/Kg)	80	90	110	120	150
Concentration 50 mg:ml	1.6	1.8	2.2	2.4	3.0
Paralytic and reversal agents					
Succinylcholine (1.5 mg/Kg)	75	100	125	150	150
Concentration 50 mg:ml	1.5	2.0	2.5	3.0	3.0
Rocuronium (1 mg/Kg)	50	60	70	80	100
Concentration 10 mg:ml	5.0	6.0	7.0	8.0	10.0
Sugammadex (16 mg/Kg)	800	950	1,000	1,000	1,000
Concentration 100 mg:ml	8.0	9.5	10.0	10.0	10.0

Emergency Ramathibodi

รศ.ดร.นพ.ไชยพร ยุกเซ็น
ภาควิชาเวชศาสตร์ฉุกเฉิน
คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี
มหาวิทยาลัยมหิดล

Trauma Patient Care in ED

Primary Survey

A: Airway maintenance with
restriction of cervical spine motion

B: Breathing and Ventilation

C: Circulation and Hemorrhagic control

D: Disability

E: Exposure / Environmental Control

Adjunct to the Primary Survey

Secondary survey

AMPLE

A: Allergy

M: Medications currently used

P: Past illness / Pregnancy

L: Last meal

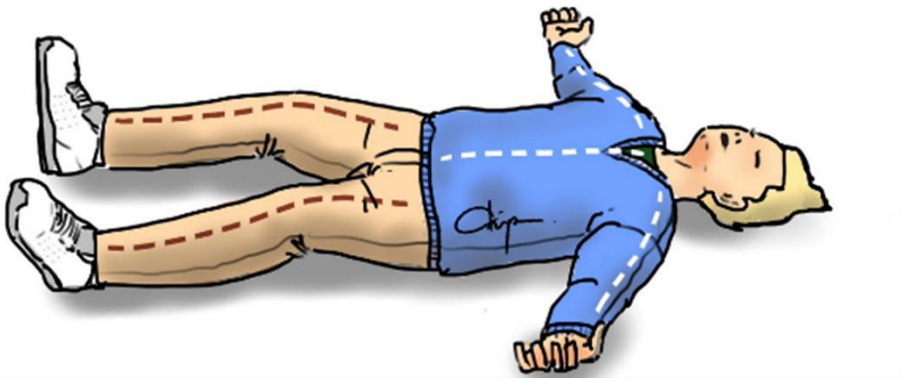
E: Event / Environment related to
the injury

Emergency room phase

Adjunct to the Secondary Survey

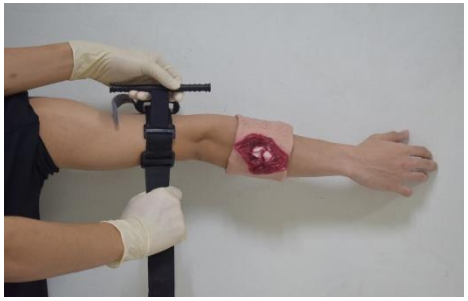
Head to Toe evaluation

X=Exsanguinating hemorrhage



X=Exsanguinating hemorrhage

Direct pressure → Pressure dressing → Tourniquet



Junctional hemorrhage

Combat Ready Clamp (CRoC)

Junctional Emergency Treatment Tool (JEET)

SAM Junctional Tourniquet

Airway maintenance with restriction of cervical spine motion

Emergency room phase

ORIGINAL RESEARCH

Traditional Spinal Immobilization versus Spinal Motion Restriction in Cervical Spine Movement; a Randomized Crossover Trial

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Abstract: **Introduction:** Proper cervical spine immobilization is essential to prevent further injury following trauma. This study aimed to compare the cervical range of motion (ROM) and the immobilization time between traditional spinal immobilization (TSI) and spinal motion restriction (SMR). **Methods:** This study was a randomized 2x2 crossover design in healthy volunteers. Participants were randomly assigned by Sequential numbered, opaque, sealed envelopes (SNOSE) with permuted block-of-four randomization to TSI or SMR. We used an inertial measurement unit (IMU) sensor to measure the cervical ROM in three dimensions focusing on flexion-extension, rotation, and lateral bending. The immobilization time was recorded by the investigator. **Results:** A total of 35 healthy volunteers were enrolled in the study. The SMR method had cervical spine movement lower than the TSI method about 3.18 degrees on ROM in flexion-extension ($p < 0.001$). The SMR method had cervical spine movement lower than the TSI method about 2.01 degrees on ROM in lateral bending ($p = 0.022$). The immobilization time for the SMR method was 11.88 seconds longer than for the TSI method ($p < 0.001$) but not clinically significant. **Conclusion:** SMR that used scoop stretcher resulted in significantly less cervical spine movement than immobilization with a TSI that used long spinal board. We recommend implementing the SMR protocol for transporting trauma patients, as minimizing cervical motion may enhance patient outcomes.

Keywords: spinal immobilization, prehospital care, traditional spinal immobilization, spinal motion restriction

Cite this article as: Nuanprom P, Yuksen C, Tienpratarn W, et al. Traditional Spinal Immobilization versus Spinal Motion Restriction in Cervical Spine Movement; a Randomized Crossover Trial. Arch Acad Emerg Med. 2024; 12(1): e36. https://doi.org/10.22037/aaem.v12i1.2263.

Figure 1: Position for installing inertial measurement unit (IMU) on the forehead and the chest.

Figure 2: **A:** Traditional spinal immobilization (TSI) that used long spinal board (left) **B:** Spinal motion restriction (SMR) that used scoo stretcher (right).

Table 1: Comparing three-dimensional range of motion (ROM) in the flexion-extension, rotation, and lateral bending of the cervical motio as well as immobilization time between traditional spinal immobilization (TSI) and spinal motion restriction (SMR)

Variables	**TSI**		**SMR**		**P-value**
	Mean ± SD	**95% CI**	**Mean ± SD**	**95% CI**	
Range of motion (degree)					
Flexion-extension	13.92 ± 4.97	12.22 - 15.63	10.74 ± 3.33	9.60 - 11.88	0.001
Rotation	13.86 ± 3.87	12.50 -15.16	14.05 ± 3.74	12.77 - 15.34	0.769
Lateral bending	16.09 ± 4.69	14.47 -17.70	14.07 ± 5.17	12.30 -15.85	0.022
Immobilization time (second)					
Mean ± SD	150.93 ± 33.58	-	162.81 ± 37.07	-	< 0.001

CI: confidence interval; SD: standard deviation.

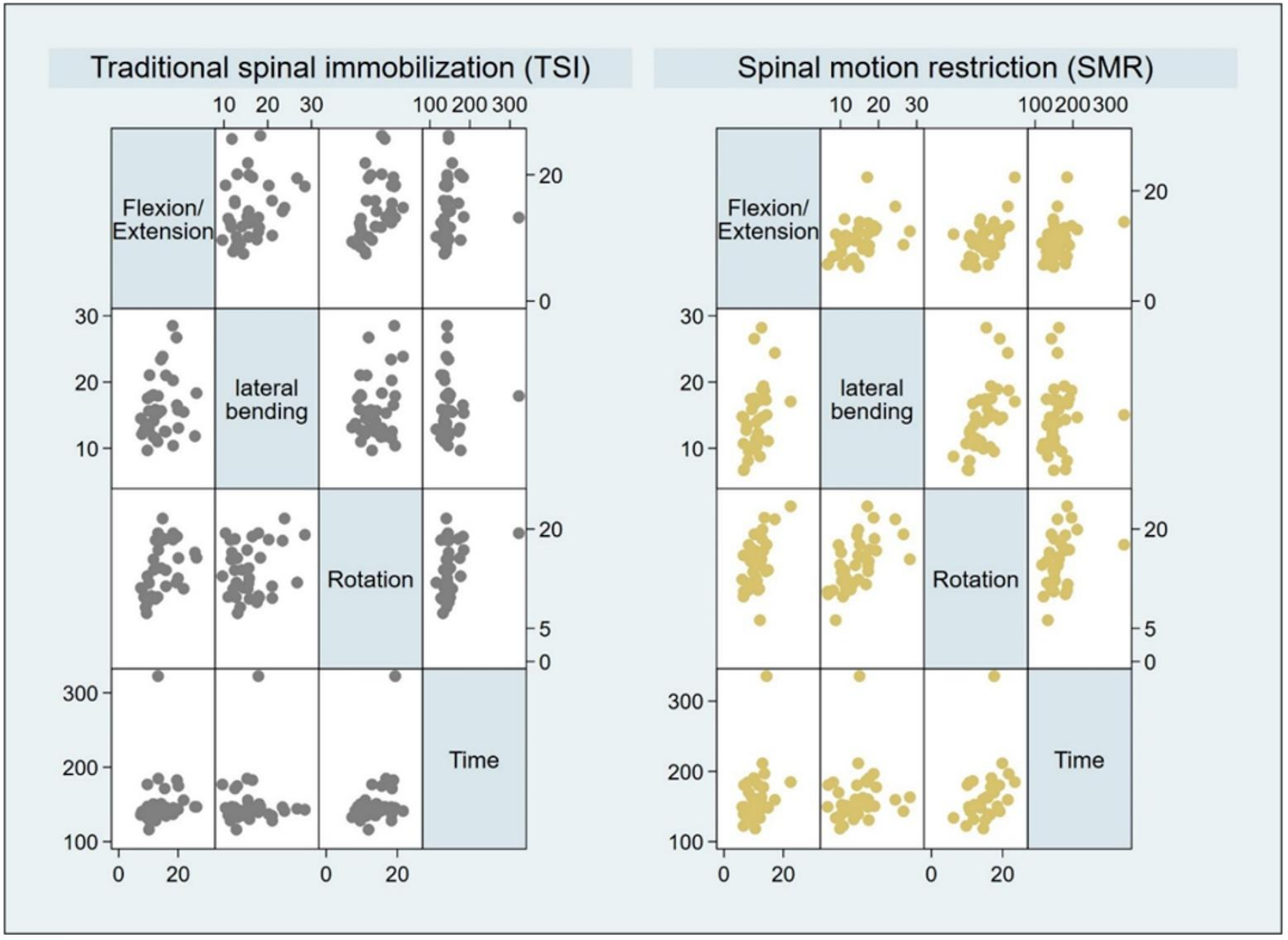


Figure 2: Scatter plot of Three-dimensional Range of motion (ROM) in the flexion, extension, rotation, lateral bending of the cervical motio

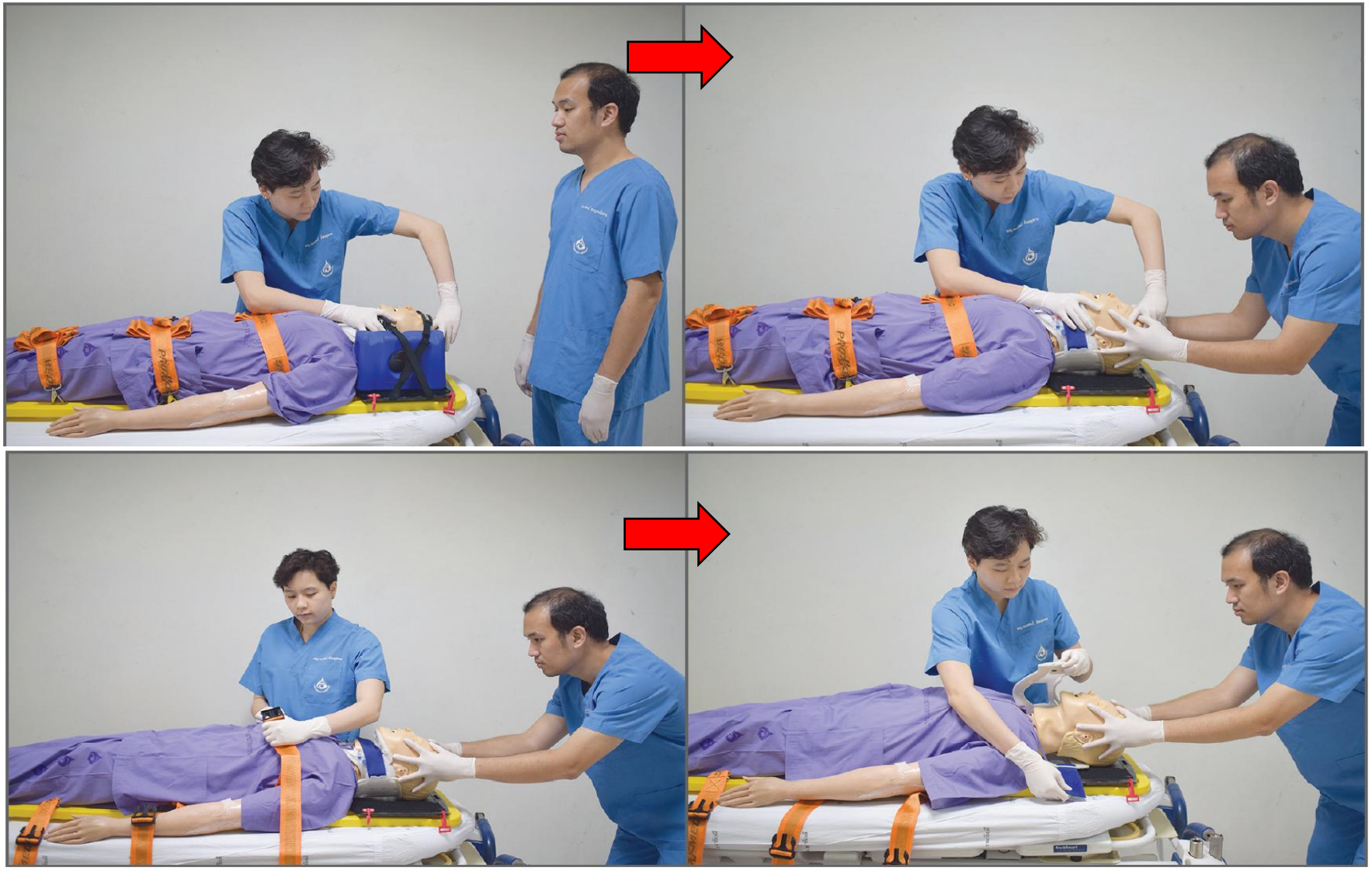
รูปที่ 34-1 การยึดตรึงกระดูกสันหลังแบบดั้งเดิม

TSI

รูปที่ 34-2 การจำกัดการเคลื่อนไหวของกระดูกสันหลัง

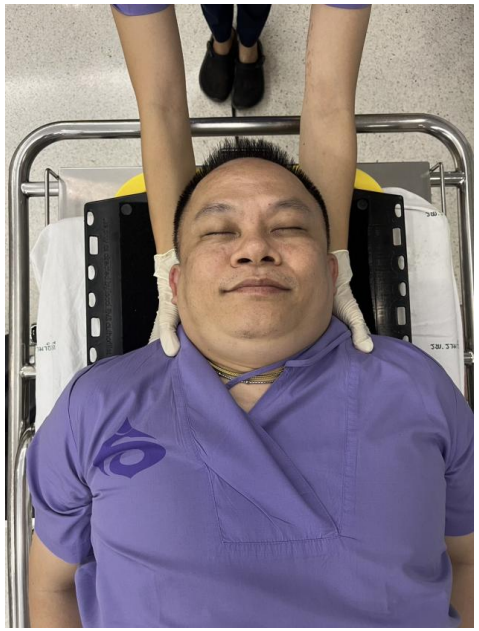
SMR

- C spine protection → **“Restriction of spinal motion”**
- Clearing cervical spine injury == **Canadian C Spine Rule (CCR) and NEXUS Criteria**
- New myotome diagram



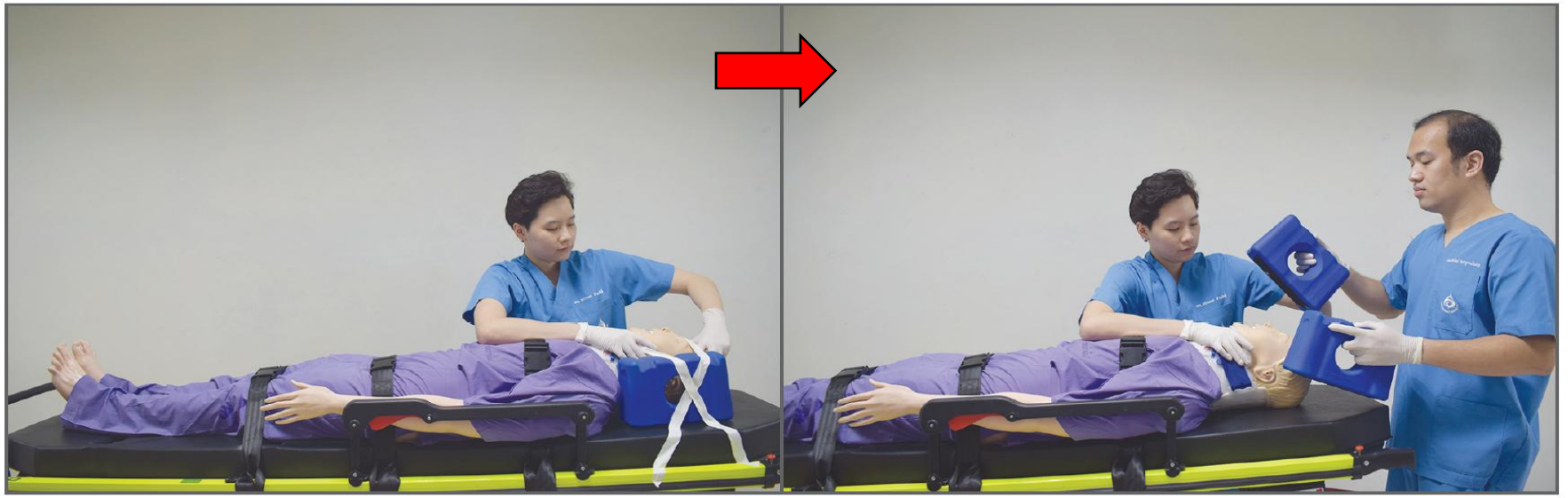
Traditional Spinal Immobilization: TSI

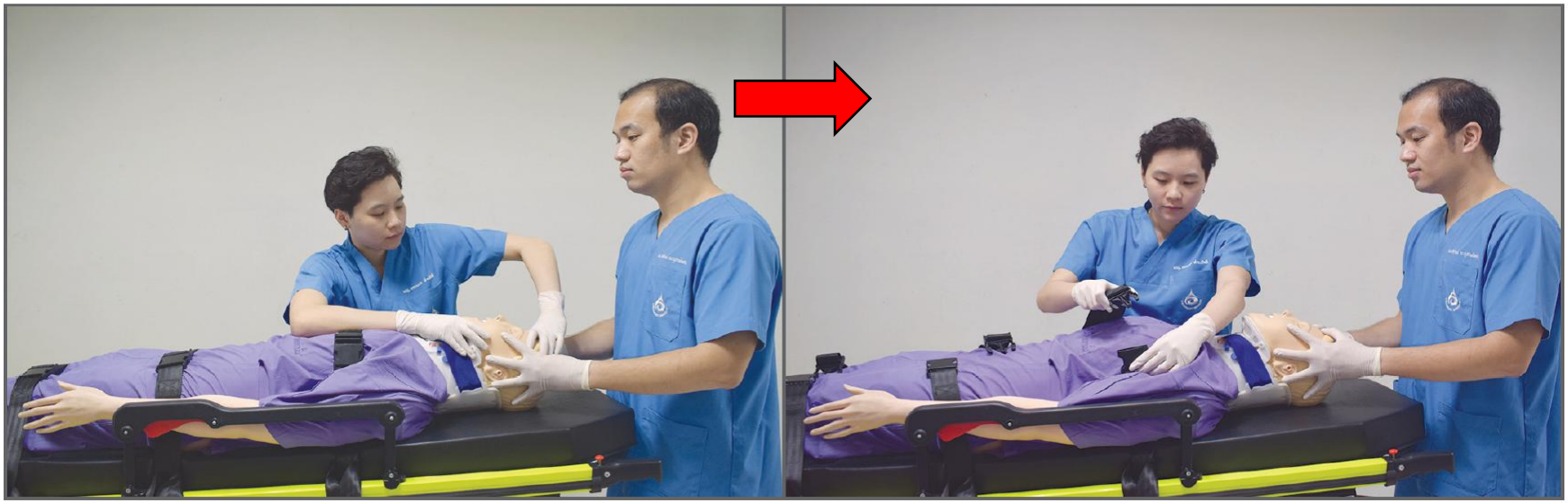
- Prolonged backboard usage (>2 hours) should be avoided



- Cervical spinal motion restriction technique

Trapezius Grip

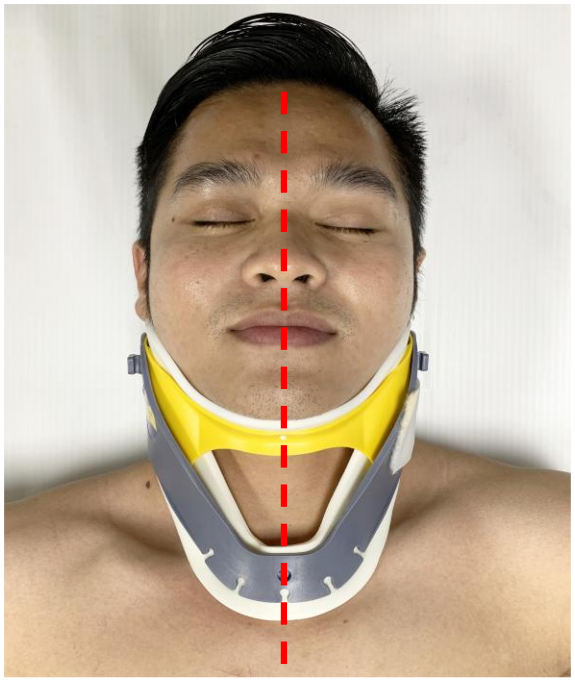




Spinal Motion Restriction: SMR


FERNO

Emergency room phase



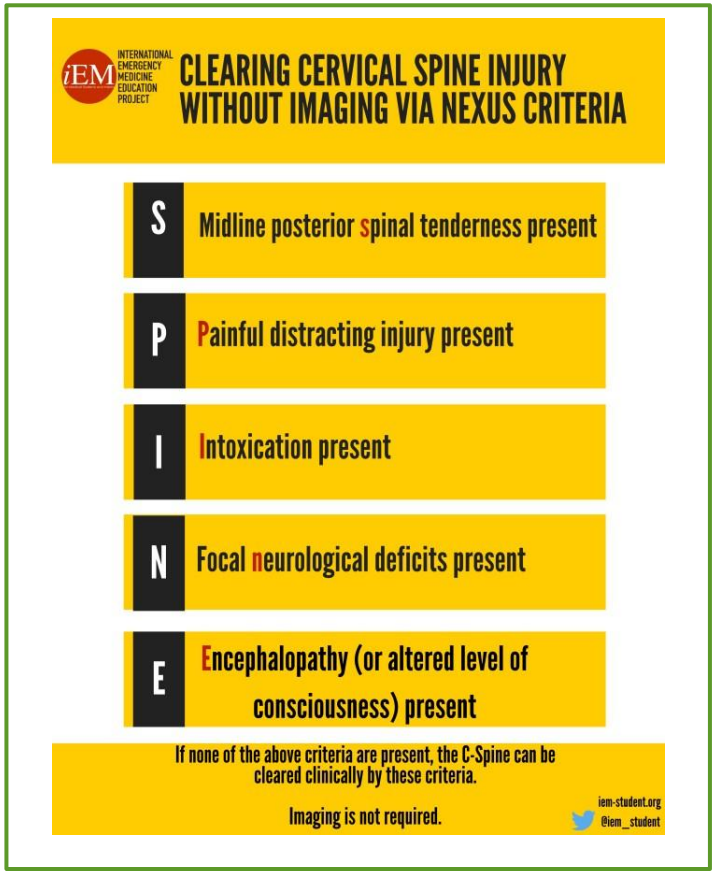
Cervical spinal motion restriction technique

Trapezius Grip

Pitfall

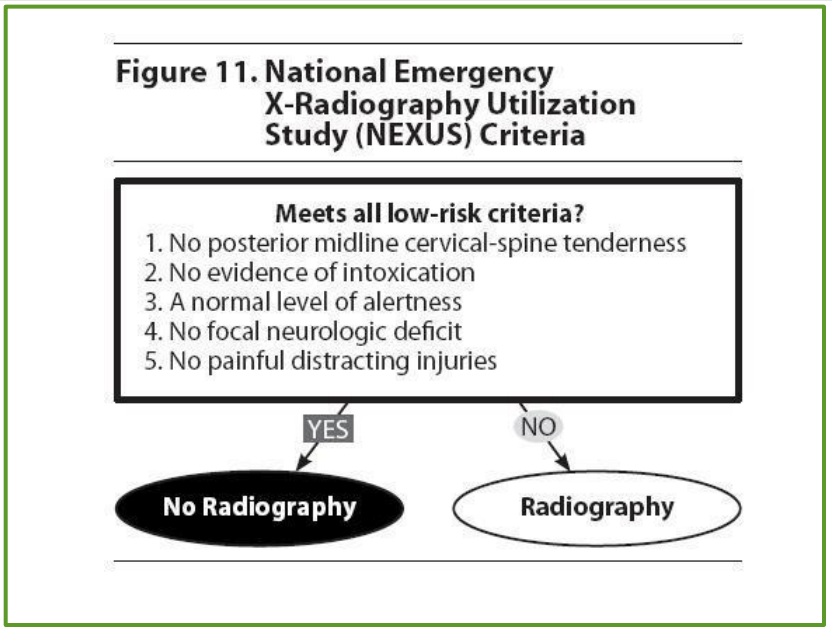
Clearing cervical spine injury without imaging via the NEXUS Criteria

Emergency room phase



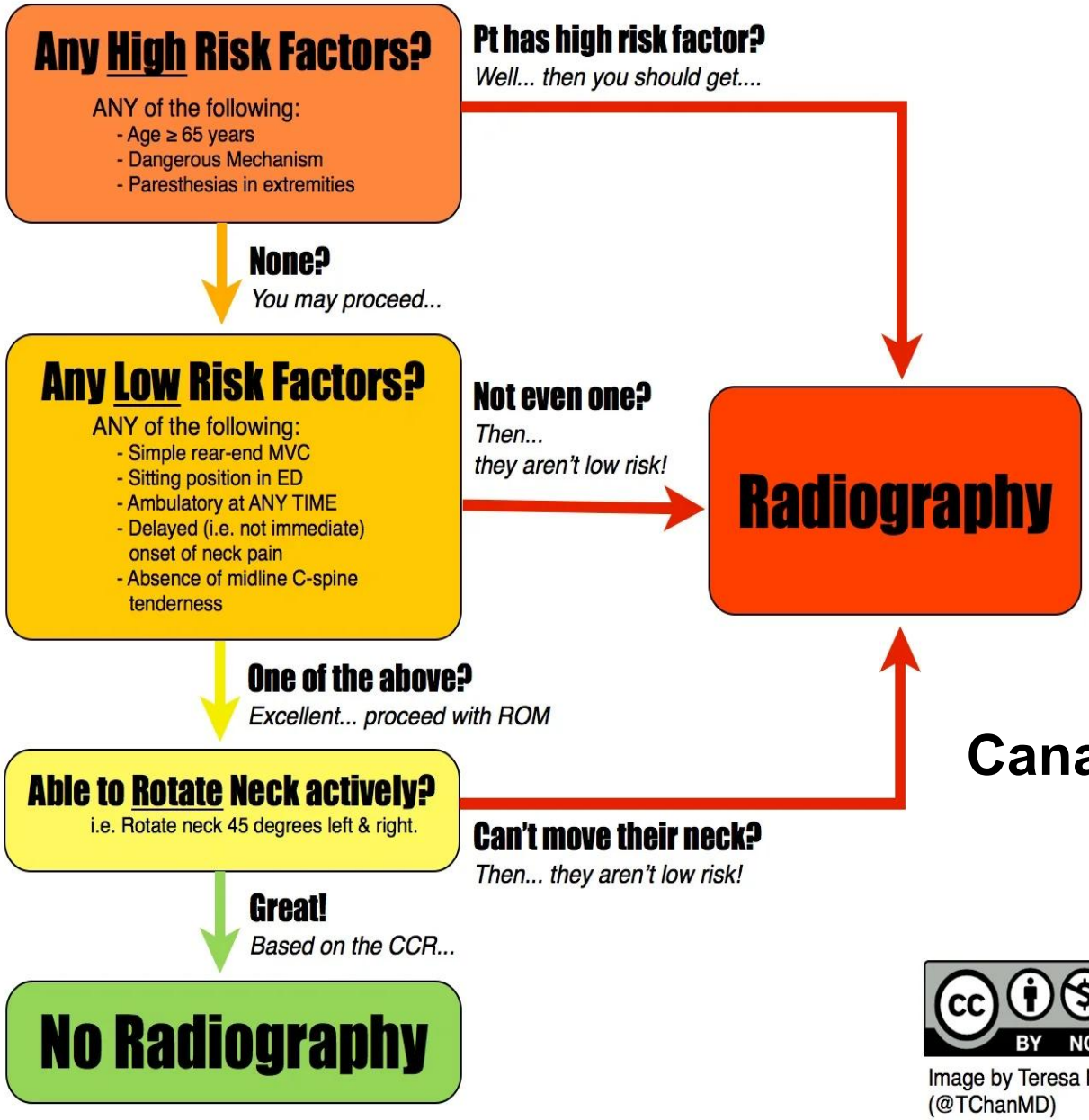
NEXUS Mnemonic

N– Neuro deficit
E– EtOH (alcohol)/intoxication
X– eXtreme distracting injury(ies)
U– Unable to provide history (altered level of consciousness)
S– Spinal tenderness (midline)



Hoffman JR, Wolfson AB, Todd K, Mower WR. Selective cervical spine radiography in blunt trauma: methodology of the National Emergency X-Radiography Utilization Study (NEXUS). Ann Emerg Med. 1998;32(4):461-469. doi:10.1016/s0196-0644(98)70176-3

Emergency room phase



Dangerous mechanisms:

- Fall from ≥ Im/5 stairs
- An axial load to the head
- A motor vechicle collision
  - At high speed (> 100 km/hr)
  - Rollover
  - Ejection
- Motorized recreational vehicle collision
- A bicycle collision

Canadian C-spine rule

https://canadiem.org/tiny-tip-canadian-c-spine-rule/

Airway Management

- RSI → Drug Assisted Intubation (DAI)
- Video laryngoscopy

Manual maneuvers (Trauma Jaw thrust)

Prehospital

Mahidol University
Wisdom of the Land

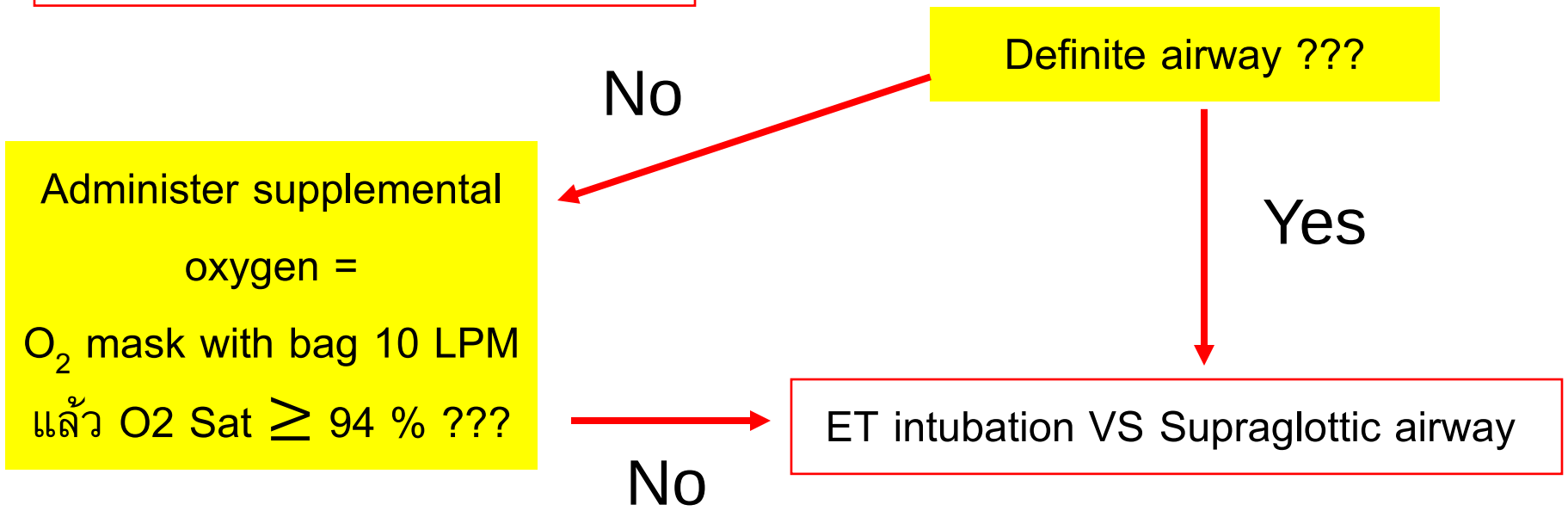
Management

1. Cervical spinal motion restriction technique
2. Manual clearing
3. Manual maneuvers (Trauma Jaw thrust)
4. Suction
5. Simple adjuncts (OPA / NPA)

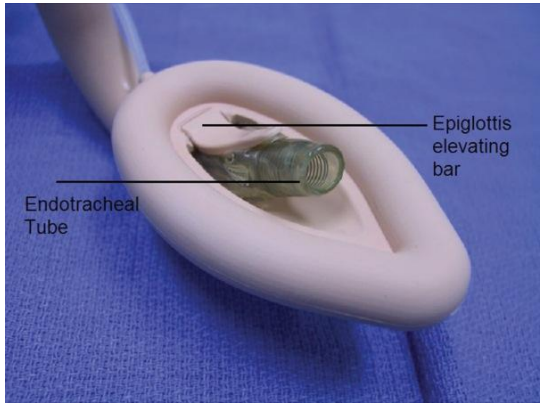
Smoke inhalation injuries

Laryngeal Trauma

Maxillofacial Trauma

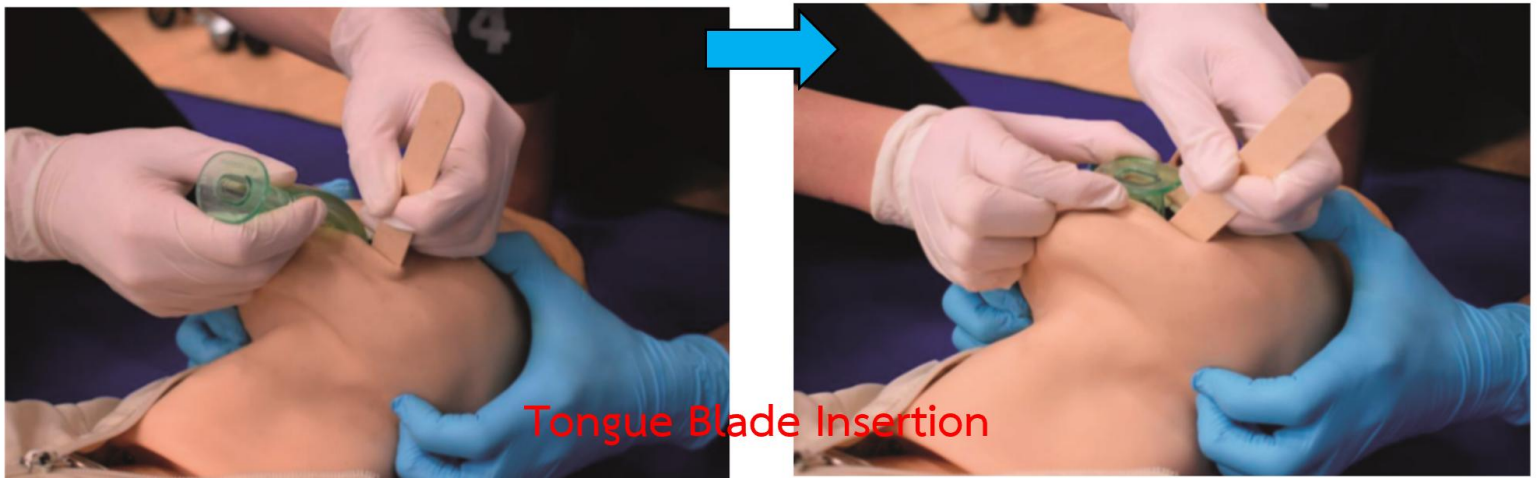


A	Airway	☐ Patency		
		☐ Compromise	☐ Stridor ☐ Apnea / Unconsciousness ☐ Severe TBI ☐ Risk for aspiration (bleeding / vomiting) ☐ Risk for obstruction (neck hematoma, laryngeal / tracheal injury) ☐ Severe maxillofacial injury	☐ Jaw thrust time..... by..... ☐ Suction time..... by..... ☐ NPA. ☐ OPA time..... by..... ☐ Adjunct airway: time..... by..... ☐ LMA ☐ I-gel ☐ ETT intubation time..... by..... ☐ DAI ☐ RSI ☐ Crash airway (ใช้ **แบบรายงานการใส่ท่อช่วยหายใจ** แนบ) ☐ Cricothyroidotomy time..... by.....



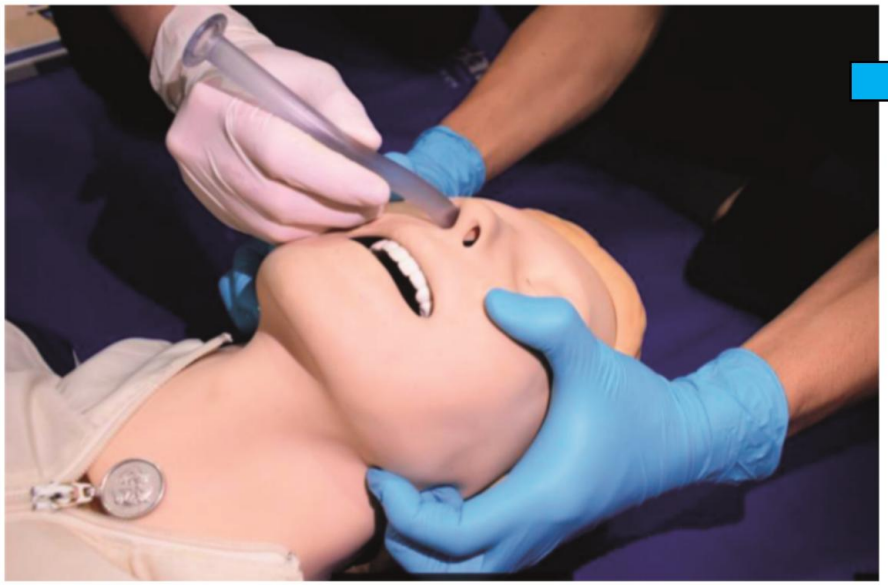
Simple adjuncts (Oropharyngeal Airway)

Tongue Jaw Lift Insertion



Tongue Blade Insertion

Simple adjuncts (Nasopharyngeal Airway)



Fracture base of the skull?

DAI (Drug assisted intubation)

RAPID SEQUENCE INTUBATION

ROSEN'S EMERGENCY MEDICINE EDITION 9

BY A SIMPLIFIED SOLO TRAVELLER

INITIAL ASSESSMENT

NEED INTUBATION ?

DIFFICULT AIRWAY ?

ADJUNCT ?

- Videolaryngoscopy
- Fiberoptic Bronchoscopy
- Laryngeal Mask Airway
- Blind Nasotracheal Intubation
- Cricothyrodotomy

SEDATION

SEDATION + PARALYTIC AGENTS

INDUCTION AGENTS

Etomidate	0.3 mg/kg
Ketamine	1-2 mg/kg
Propofol	1.5 mg/kg
Midazolam	0.3 mg/kg
Thiopental	3 mg/kg

PARALYTIC AGENTS

Succinylcholine	1.5 mg/kg
Rocuronium	1 mg/kg

7P RSI STEPS

1. PREPARATION - 10 MIN

- SOAP-ME (Suction, O2, Airway equipment, Pharmacology, Monitor Equipment)

2. PRE-OXYGENATION - 5 MIN

- 100% O2 for 3 min
- 8 vital capacity breaths

3. PRE-TREATMENT - 3 MIN

- Atropine, Fentanyl, Lidocaine

4. PARALYSIS WITH INDUCTION 0 MIN

5. POSITIONING + 30 SEC

- Sniff Position

6. PLACEMENT OF TUBE + 45 SEC

7. POST-INTUBATION MANAGEMENT + 2 MIN

- ETCO2, CXR
- Sedation, Analgesia, Mechanical Ventilation

Open Access Full Text Article

ORIGINAL RESEARCH

Video Laryngoscopy for Endotracheal Intubation: A Consideration for Manual In-Line Stabilization Without Cervical Collar Versus Full Immobilization

Kasamon Aramvanitch[1], Sittichok Leela-Amornsin[2], Welawat Tienpratarn[1], Promphet Nuanprom[1], Supassorn Aussavanodom[1], Chaiyaporn Yuksen[1], Sirinapa Boonsri[1], Natcha Boonjarus[1], Somchoak Sanepim[1]

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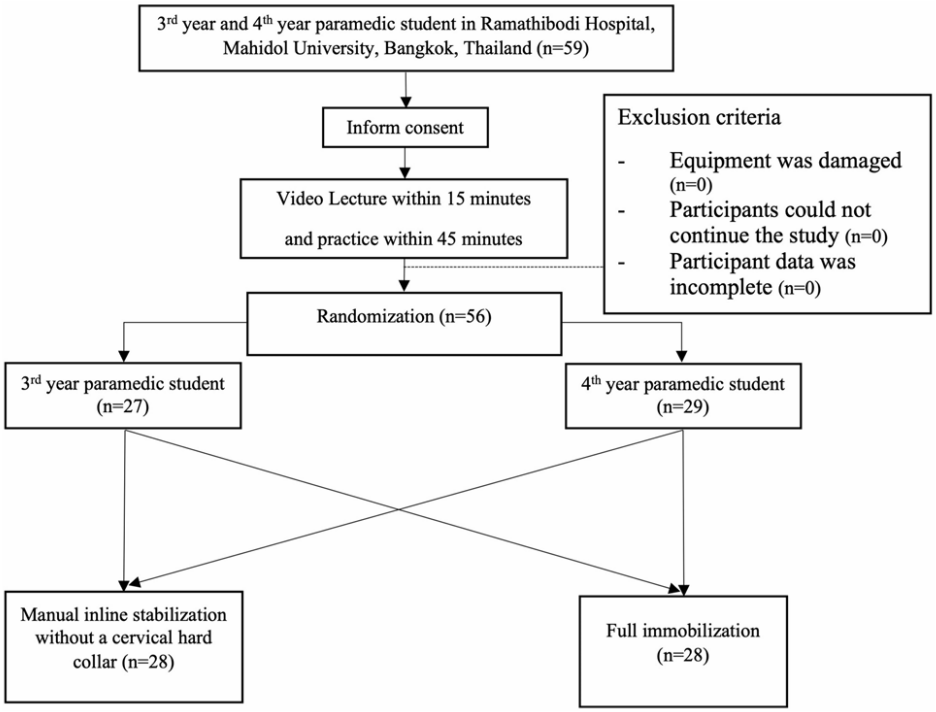
Introduction: Traumatic patients with cervical spine motion restriction have difficulty with endotracheal intubation (ETI) due to the limitations of neck movement and mouth opening. Nevertheless, the removal of the cervical collar for ETI in a prehospital setting may lead to a deterioration in neurological outcomes. This study compares the success rate of ETI utilizing a video laryngoscope (VL) on a manikin, contrasting manual in-line stabilization (MILS) without a cervical hard collar against full immobilization.

Methods: A randomized, non-crossover study was conducted involving 56 paramedic students assigned by SNOSE to utilize various box sizes for VL intubation with MILS without a cervical hard collar or full immobilization technique on a manikin. The primary outcome was the intubation success rate. Secondary outcomes included attempts, time for successful intubation, and Cormack-Lehane classification.

Results: Fifty-six participants were evaluated; 28 were in the full immobilization group, and another 28 were in the MILS without cervical hard collar group. Baseline characteristics showed no difference between both groups. The success rate of VL intubation showed no difference between the full immobilization group and the MILS without a cervical hard collar group (28 [100%] vs 28 [100%]; 24 [85.71%] vs 27 [96.43%] on first attempt; 4 [14.29%] vs 1 [3.57%] on second attempt; p-value 0.352). Time required to perform successful intubation (median [IQR] 17.20 [12.53, 24.40] vs 17.53 [14.06, 23.73], p-value 0.694) and Cormack-Lehane classification (11 [39.29%] vs 10 [35.71%] in grade I; 16 [57.14%] vs 17 [60.71%] in grade II; 1 [3.57%] vs 1 [3.57%] in grade III, p-value 1.000) showed no statistical difference between the two groups.

Conclusion: It is unnecessary to remove the cervical hard collar when performing endotracheal intubation while using a video laryngoscope.

Keywords: video laryngoscope, full immobilization, success rate, endotracheal intubation



udy flowchart

Conclusion: It is unnecessary to remove the cervical hard collar when performing endotracheal intubation while using a video laryngoscope.

Keywords: video laryngoscope, full immobilization, success rate, endotracheal intubation

Breathing (Ventilation)

การประเมิน Breathing

1. **Look (observe)**
2. **Listen (auscultate)**
3. **Feel (palpate)**
4. **Percussion**

หายใจ ปกติ 10-20 /min → Observe / O_2 mask with bag 10 LPM

หายใจเร็ว 20-30 /min → O_2 mask with bag 10 LPM

หายใจเร็วมาก >30 /min → Assisted ventilation

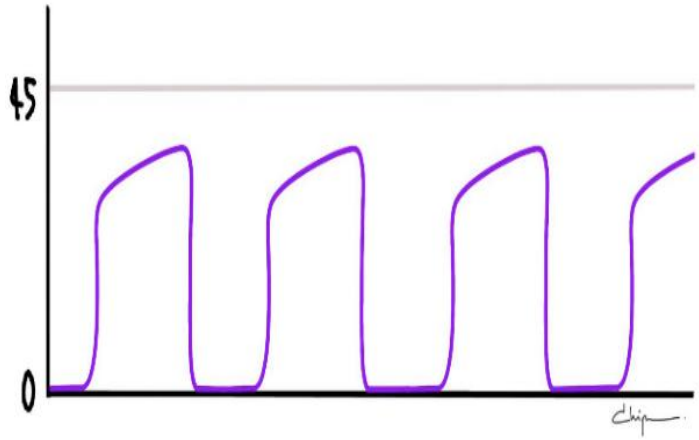
ช้า < 10 ครั้ง → Assisted / total ventilation

ไม่หายใจ → Total ventilation

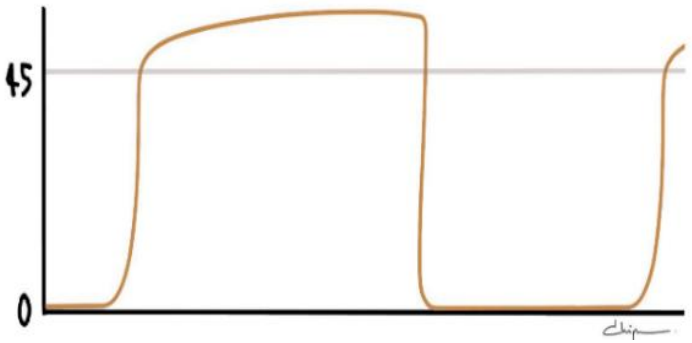
**** Target SpO_2 greater than ≥ 94 % ****

	Adult	Child	Infant
Assist ventilation (Rate)	10	20	25
Assist ventilation (tidal volume)	500 - 800 ml	100 - 500 ml or until good chest rise	6 - 8 ml/kg
Hyperventilation	20	25	30

Routine hyperventilation = poor outcomes (Not Routine)



Hyperventilation



Hypoventilation

life-threatening thoracic injuries

1. Airway obstruction
2. Tracheobronchial tree injury
3. Tension pneumothorax
4. Open pneumothorax
5. Massive haemothorax
6. Cardiac tamponade

1. Tension pneumothorax

1. Worsening respiratory distress or difficulty ventilating with a bag-mask device

2. Unilateral decreased or absent breath sounds

3. Decompensated shock (systolic blood pressure less than 90 mm Hg with a narrowed pulse pressure)

Clinical diagnosis → Treatment not delay by waiting CXR confirmation.

National Association of Emergency Medicine Technicians. Thoracic Trauma. In: McSwain N, Pons PT, Chapleau W, editors. Prehospital trauma life support. 8th ed. United States of America: World Headquarters; 2016. p.334-461.

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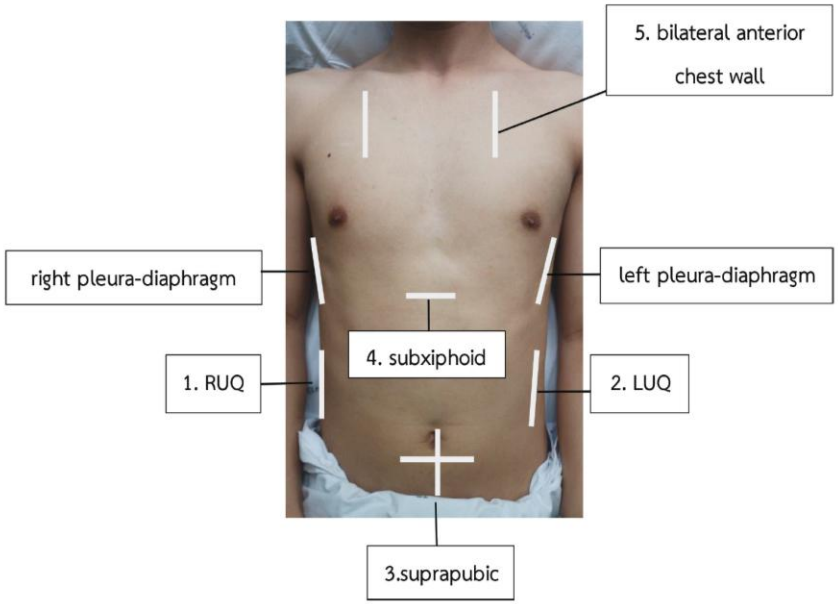

The focused abdominal sonography for trauma (FAST) = rapid diagnosis of pneumothorax.

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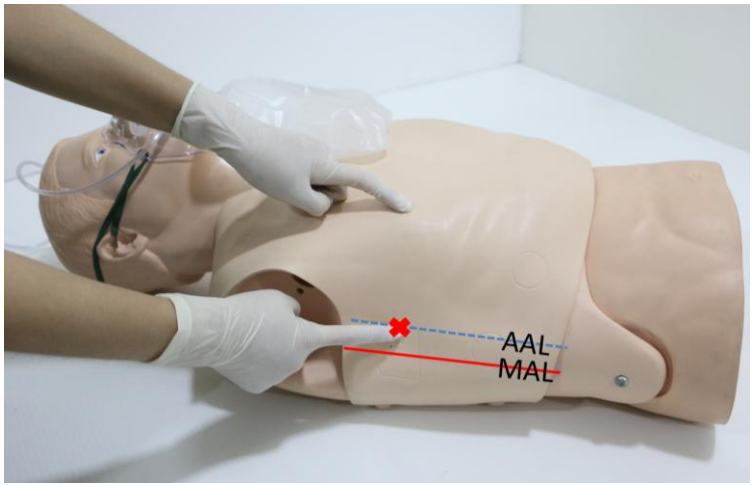
Needle decompression / Needle thoracostomy



*** Needle No **14** (8 cm)

- 4th or 5th intercostal space in the mid-axillary line. (Adult)
- 2nd intercostal space in the mid-clavicular line (children)
- Needle thoracocentesis = temporizing measure only
- Definitive treatment = chest drain

Finger thoracostomy

- ☐ Stridor
- ☐ Apnea / Unconsciousness
- ☐ Severe TBI
- ☐ Risk for aspiration (bleeding / vomiting)
- ☐ Risk for obstruction (neck hematoma, laryngeal / tracheal injury)
- ☐ Severe maxillofacial injury

Breathing (Ventilation)

Circulation

D - Tube Displacement

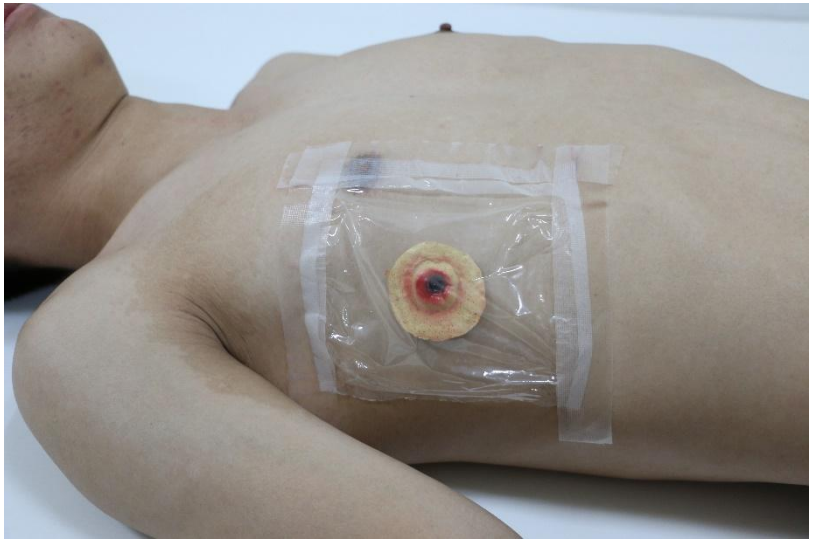
O - Tube Obstruction

P - Pneumothorax

E - Equipment Failure

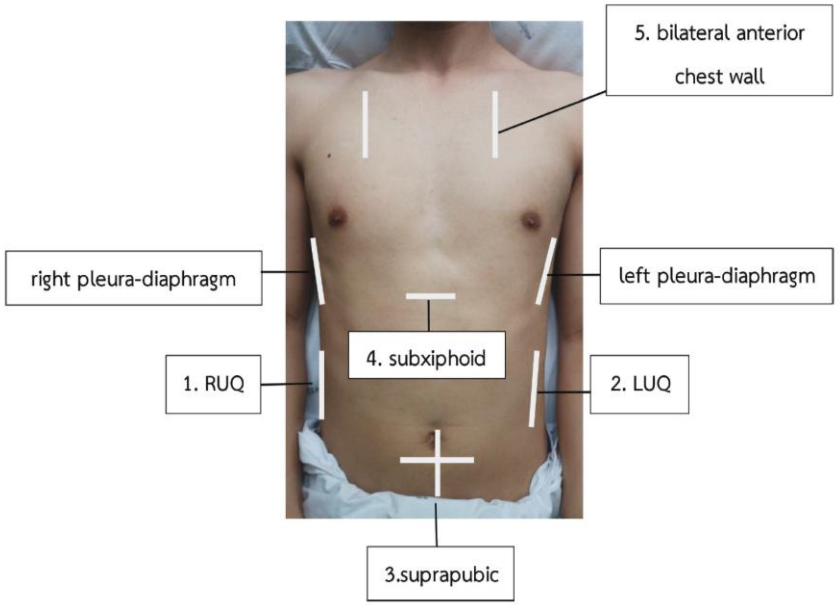
2. Open pneumothorax

- Sucking chest wound
- Equilibration : Intrathoracic P = Atmospheric P
- Opening wound 2/3 of diameter trachea



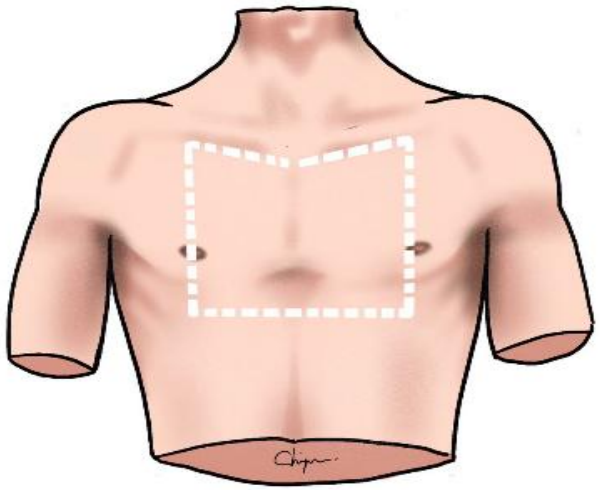
3. Massive hemothorax

- Rapid blood accumulation > 1,500 cc OR > 1/3 of patient blood volume
- Most common cause = Penetrating chest wound
- Hypotensive resuscitation



28-32 Fr chest drain for hemothorax (not 36-40 Fr)

4. Cardiac tamponade



Most common = Penetrating injury

Beck's triage

1. Venous pressure elevation
2. Hypotension
3. Muffled heart tone

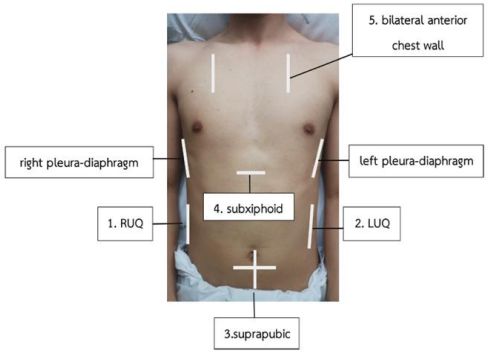
- Initial IV fluid 2,000 cc in 15 min

- The right ventricle = most anterior chamber in penetrating trauma.

- Pulseless electrical activity

- NSS load

- Pericardiocentesis



Circulation and Bleeding control

- only 1 L of crystalloid fluid is provided during the initial assessment.
- > 1.5 L of crystalloid == increased mortality in trauma.
- Massive transfusion == transfusion > 10 units of blood in 24 hours, or > 4 units of blood in 1 hour.
- Early resuscitation with blood (Class III and IV haemorrhage.)

	ระดับที่ 1	ระดับที่ 2	ระดับที่ 3	ระดับที่ 4
ปริมาณการเสียเลือด (มล.)	< 630	630-1,260	1,260-1,680	> 1,680
ร้อยละการเสียเลือด	< 15	15-30	30-40	> 40
การเต้นของหัวใจ (ครั้ง/นาที)	< 100	100-120	120-140	> 140
ความดันเลือด	ปกติ	ปกติ	ลดลง	ลดลง
Pulse pressure	ปกติ/เพิ่มขึ้น	ลดลง	ลดลง	ลดลง
การหายใจ (ครั้ง/นาที)	14-20	20-30	30-40	> 35
ปริมาณปัสสาวะ (มล./ชม.)	> 30	20-30	5-15	เล็กน้อย
Base deficit (mEq/L)	0 – (-2)	(-2)–(-6)	(-6)–(-10)	> (-10)
ระดับการรู้สึกตัว	ปกติ	กระวนกระวาย	ลดลง/สับสน	สับสนมาก/ซึม
การให้สารน้ำ/เลือด	crystalloid	crystalloid และพิจารณาให้เลือด	crystalloid และพิจารณาให้เลือด	ให้เลือดหรือสารประกอบของเลือดปริมาณมาก

แสดงระดับความรุนแรงของการเสียเลือดและการตรวจร่างกายที่พบได้ (สำหรับน้ำหนัก 60 กก.)

ที่มา : ดัดแปลงจาก Committee on Trauma, American college of Surgeons (2017). ATLS: Advanced Trauma Lift Support Program for Doctors (10thed.) Chicago: American College of Surgeons.

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Fluid resuscitation: 1L warm crystalloid, 18G peripheral access x 2.

1. Uncontrolled hemorrhage

- Class 1, 2: keep vein open: KVO) / 30 ml/hr.

- Class 3, 4 NSS/RLS 1 L keep SBP 80-90 mmHg / MAP 60-65 mmHg

**** Permissive/hypotension resuscitation ****

TBI: Prevent secondary brain injury

≥ 100 mmHg: patients 50-69 Years

≥ 110 mmHg: patients 15-49 Year or >70 Years

2 large Caliber (Minimum 16 G)

2 Caliber (Minimum 18 G)

Warming Intravenous Fluids

The ideal temperature for fluids is 102°F (39°C).

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Fluid resuscitation: 1L warm crystalloid, 18G peripheral access x 2.

2. Controlled hemorrhage

- **Class 1:** keep vein open: KVO / 30 ml/hr.

- **Class 2, 3, 4** NSS/RLS 1 L + FAST/X ray & reevaluate

Rapid response

Transient / No response: keep SBP 80-90 mmHg

/ MAP 60-65 mmHg

**** Permissive/hypotension resuscitation ****

2 large Caliber (Minimum 16 G)

2 Caliber (Minimum 18 G)

Warming Intravenous Fluids

The ideal temperature for fluids is 102°F (39°C).

ORIGINAL RESEARCH

Clinical Associated Factors of Tile B/C Type of Pelvic Ring Fractures; a Retrospective Cross-sectional study

Welawat Tienpratarn[1], Nucha Nakpipat[1], Chaiyaporn Yuksen[1]*, Sirote Wongwaisayawan[2], Yuranun Phootothum[1], Sutap Jaiboon[1]

1. Department of Emergency Medicine, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Thailand.

2. Emergency Radiology Unit, Department of Diagnostic and Therapeutic Radiology, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand.

Received: February 2024; Accepted: March 2024; Published online: 12 May 2024

Abstract: **Introduction:** Pelvic ring fractures categorized under Tile Categories B and C denote partially and fully unstable fractures, respectively. This study aimed to identify the clinically associated factors of Tile B/C pelvic ring fractures. **Methods:** This retrospective cross-sectional study reviewed medical records from the Emergency Medicine department at Ramathibodi Hospital in Bangkok, Thailand. The study included individuals aged ≥ 15 who experienced accidents from 2012 to 2021. To investigate the associations between the clinical variables and three critical outcomes, including Tile B/C pelvic ring fractures, major vascular injuries, and the necessity for surgical or radiological interventions, multivariable logistic regression analysis was employed. **Results:** A total of 198 patients were included in the study, among whom 34.8% were diagnosed with Tile B/C pelvic ring fractures. The analysis revealed several significant predictors of Tile B/C fractures, including the presence of pelvic tenderness (adjusted odds ratio [aOR] = 15.25, 95% confidence interval [CI] = 5.86-39.66, $p < 0.001$), and a shock index (SI) ≥1 (aOR = 4.2, 95% CI = 1.24-14.22, $p = 0.021$). Moreover, Tile B/C pelvic ring fractures were associated with an increased incidence of major vascular events and the imperative requirement for surgical or radiological interventions. **Conclusions:** Clinical findings of pelvic tenderness and an SI ≥1 are strong predictive clinical factors associated with Tile B/C pelvic fractures. Early diagnosis, application of an pelvic binder, provision of initial resuscitation, and prompt transportation to a definitive care facility are crucial components of management.

Keywords: Pelvic, fracture; trauma; emergency; injury

Cite this article as: Tienpratarn W, Nakpipat N, Yuksen C, et al. Clinical Associated Factors of Tile B/C Type of Pelvic Ring Fractures; a Retrospective Cross-sectional study. Arch Acad Emerg Med. 2024; 12(1): e49. https://doi.org/10.22037/aaem.v12i1.2243.

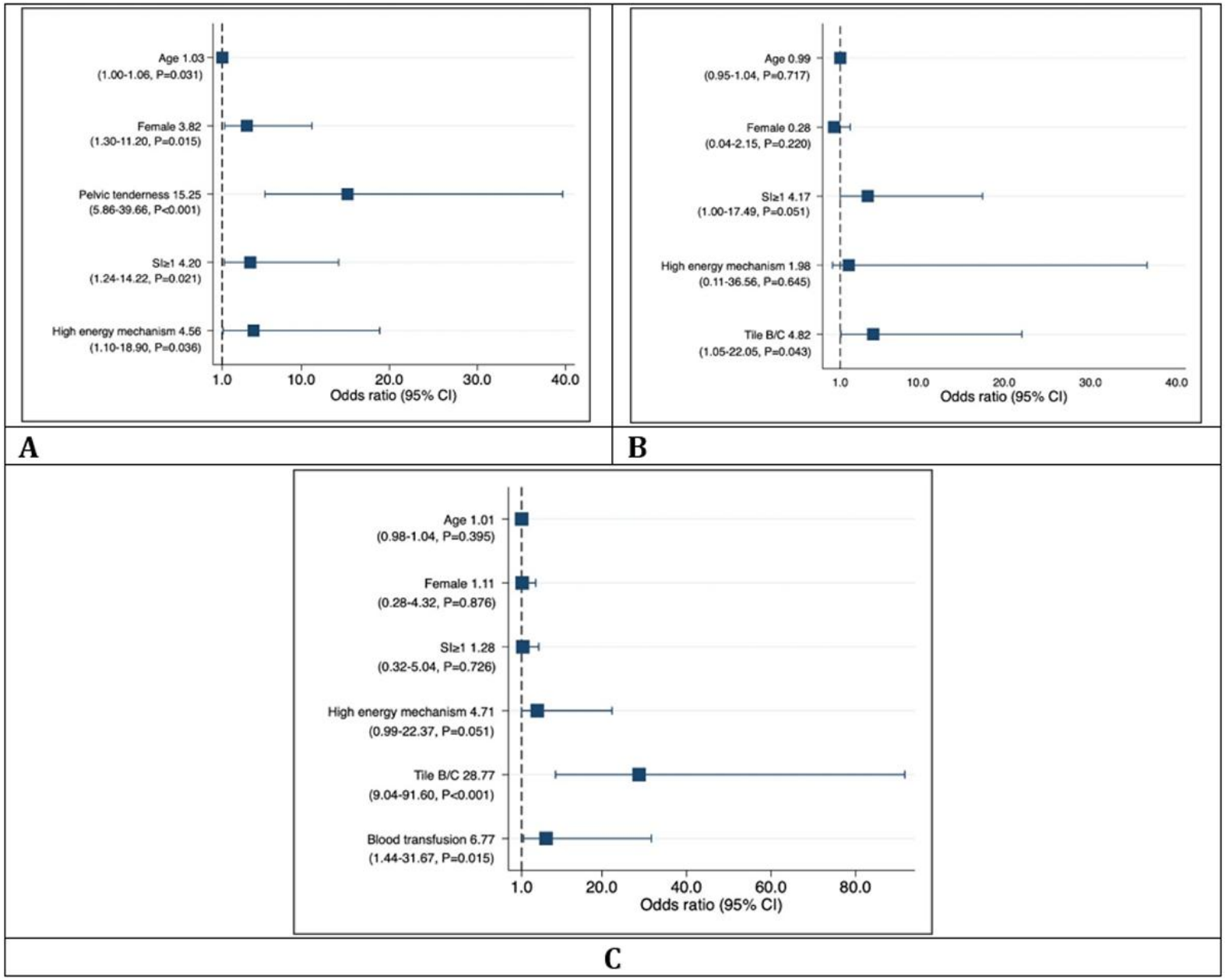
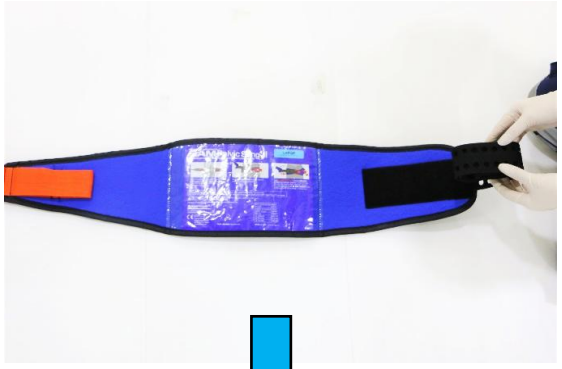


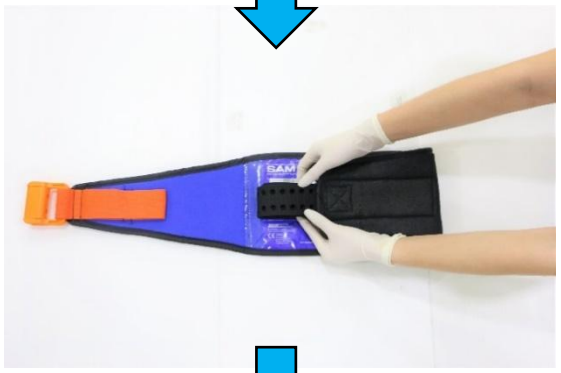
Figure 1: Odds ratio plot of the associated factors of Tile B/C pelvic ring fractures (A); major vascular injuries (B); and need for surgical or radiological interventions (C).

ity

Pelvic binder

Indication ??





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CRASH-2, 40 countries, evaluated TXA in adult trauma patients (significant hemorrhage)

- Statistically significant decrease mortality in the group receiving **TXA within 3 hours of the time of the injury.**
- > 3 hours post injury, Increase mortality.
- IV: Loading dose: **1,000 mg over 10 minutes (within 3 hrs of injury), followed by 1,000 mg over the next 8 hours.**

Clinical trial included patients with significant hemorrhage (SBP <90 mm Hg, heart rate >110 bpm, or both)

CRASH-3, in mild and mod TBI.

The CRASH-2Collaborators. Effects of tranexarnic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial. Lancet. 2010;376:23-32.

Morrison JJ, Dubose JJ, Rasmussen TE, Midwinter MJ. Military Application ofTranexarnic Acid in Trauma Emergency Resuscitation (MATTERs)Study. Arch Surg. 2012;147:113-119.

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Traction splint

Indication = midshaft femur fracture

Contraindication : Pelvic fracture,

below knee fracture

Disability

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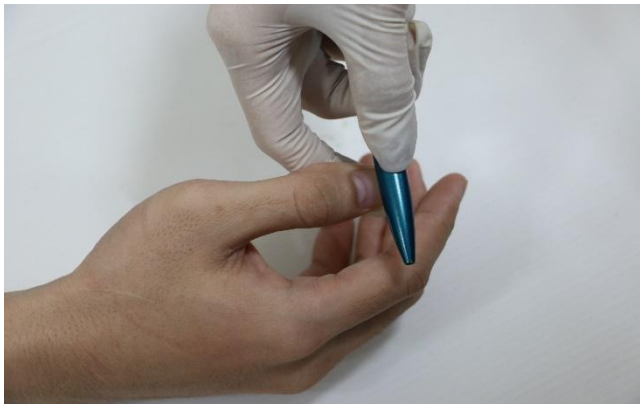

nail bed pressure

10 sec

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GCS: "to speech" --> "to sound".

GCS: "to pain" --> "to pressure".

GCS: can document as "NT (non-testable)".

RESPONSE	SCORE
Eye opening	
No eye opening	1
To pain	2
To speech	3
Spontaneously	4
Best verbal response	
None	1
Incomprehensible sounds	2
Inappropriate words	3
Patient confused	4
Patient oriented	5
Best motor response	
None	1
Extensor response to painful stimulus	2
Flexion to painful stimulus	3
Withdraws from pain	4
Localizes to pain stimulus	5
Obeys commands	6

4 = Spontaneous
3 = To sound
2 = To pressure
1 = None

5 = Orientated
4 = Confused
3 = Words
2 = Sounds
1 = None

6 = Obey commands
5 = Localizing
4 = Normal flexion
3 = Abnormal flexion
2 = Extension
1 = None

Pupils	Right	Left
Size	.....mm	.....mm
React TL	R / S / N	R / S / N

☐ Normal

☐ Increase intracranial pressure (Cushing's phenomenon)

☐ Uncal herniation Rt. / Lt. (Pupil dilate same site, weakness opposite site)

☐ Tonsillar herniation

☐ Mild hyperventilation: Adult 20, Ped 25, Infant 30 (keep $EtCO_2$ 30-35 mmHg)

☐ Keep SBP ≥100 mmHg (50-69 yr.) OR ≥110 mmHg (15-49 / >70 yr.)

☐ Mannitol 0.25-1 g/kg (per protocol)

☐ ปลด collar ให้หลวม

☐ Transamine 1 g IV (mild-mod. TBI)

- Prolonged hyperventilation with PCO2 <25mmHg not recommended.
- Mannitol 0.25-1 g/Kg to control ICP, avoid arterial hypotension.
- High-dose barbiturate to control refractory IICP, avoid arterial hypotension.
- **Phenytoin** can reduce the incidence of early post-traumatic seizure (within 7 days).

Clinical Parameters

- Systolic BP ≥ 100 mmHg
- Temperature 36–38°C

Monitoring Parameters

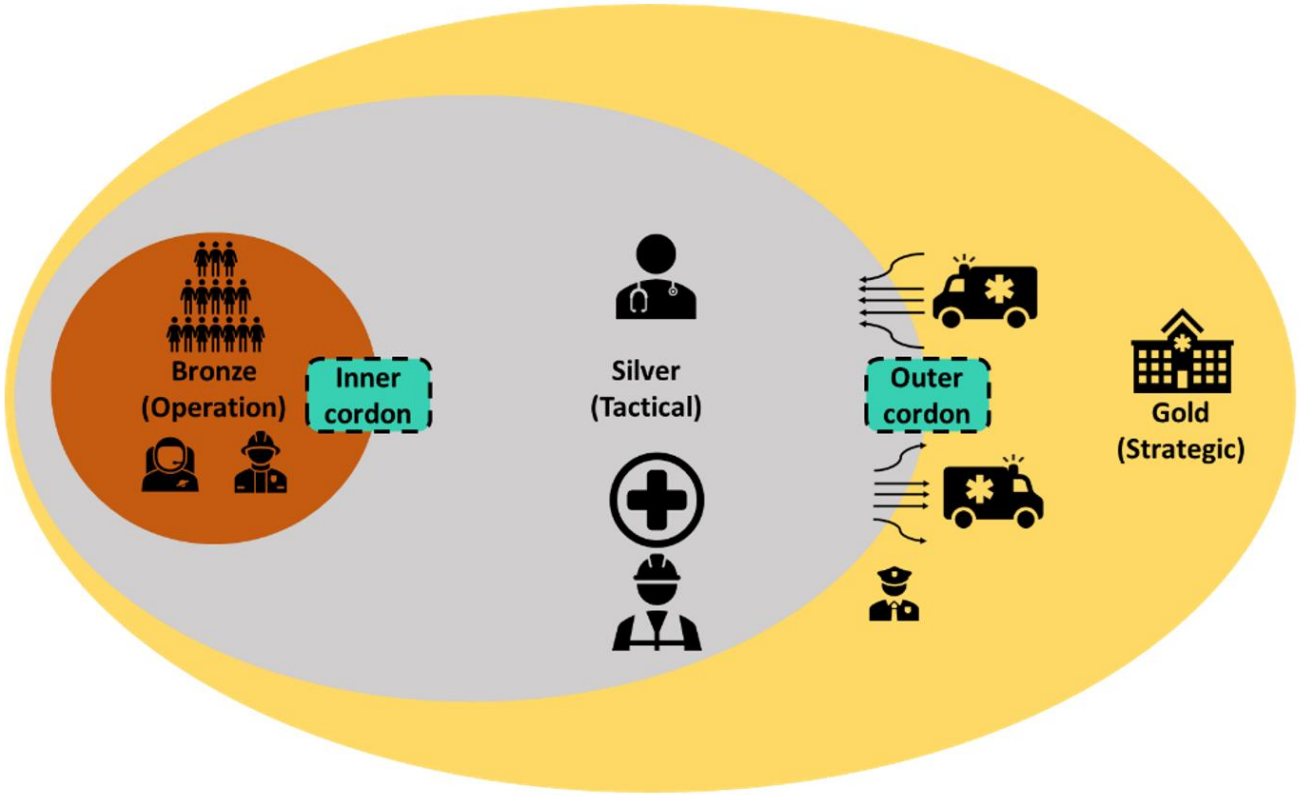
- CPP ≥ 60 mm Hg*
- ICP 5–15 mm Hg*
- $PbtO_2$ ≥ 15 mm Hg*
- Pulse oximetry ≥ 95%

Laboratory Parameters

- Glucose 80–180 mg/dL
- Hemoglobin ≥ 7 g/dl
- INR ≤ 1.4
- Na 135–145 meq/dL
- PaO_2 ≥ 100 mmHg
- $PaCO_2$ 35–45 mmHg
- pH 7.35–7.45
- Platelets ≥ 75 $X10^3/mm^3$

Er„ency Medicine in Disaster Management

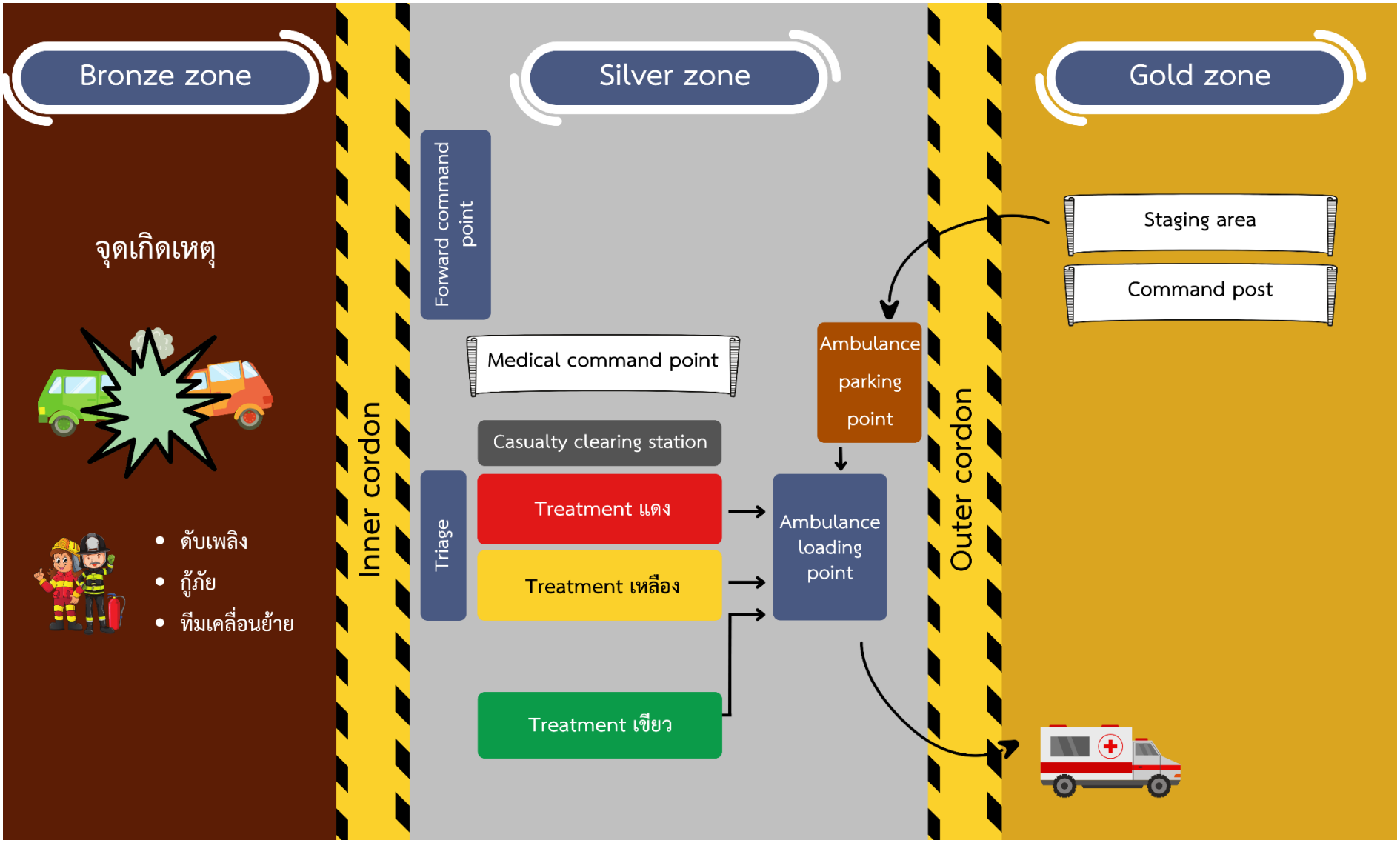
1. **Advancements in Mass Casualty Triage Systems** (SALT, JumpSTART, ESI for disaster settings)
2. **Use of Artificial Intelligence and Machine Learning in Disaster Response**
3. **Drone-Assisted Emergency Response and Medical Supply Delivery**
4. **Telemedicine in Disaster Medicine: Remote Triage and Consultation**
5. **CBRN (Chemical, Biological, Radiological, Nuclear) Disaster Preparedness and Response**
6. **Psychological First Aid and Mental Health Support in Disasters**
7. **Climate Change and Emerging Disaster Risks** (Wildfires, Heatwaves, Floods)
8. **PPE Innovations for Infectious Disease Outbreaks in Disasters**
9. **Hospital Surge Capacity and Crisis Standards of Care in Disasters**
10. **Role of EMS in Large-Scale Disaster Response and Coordination**

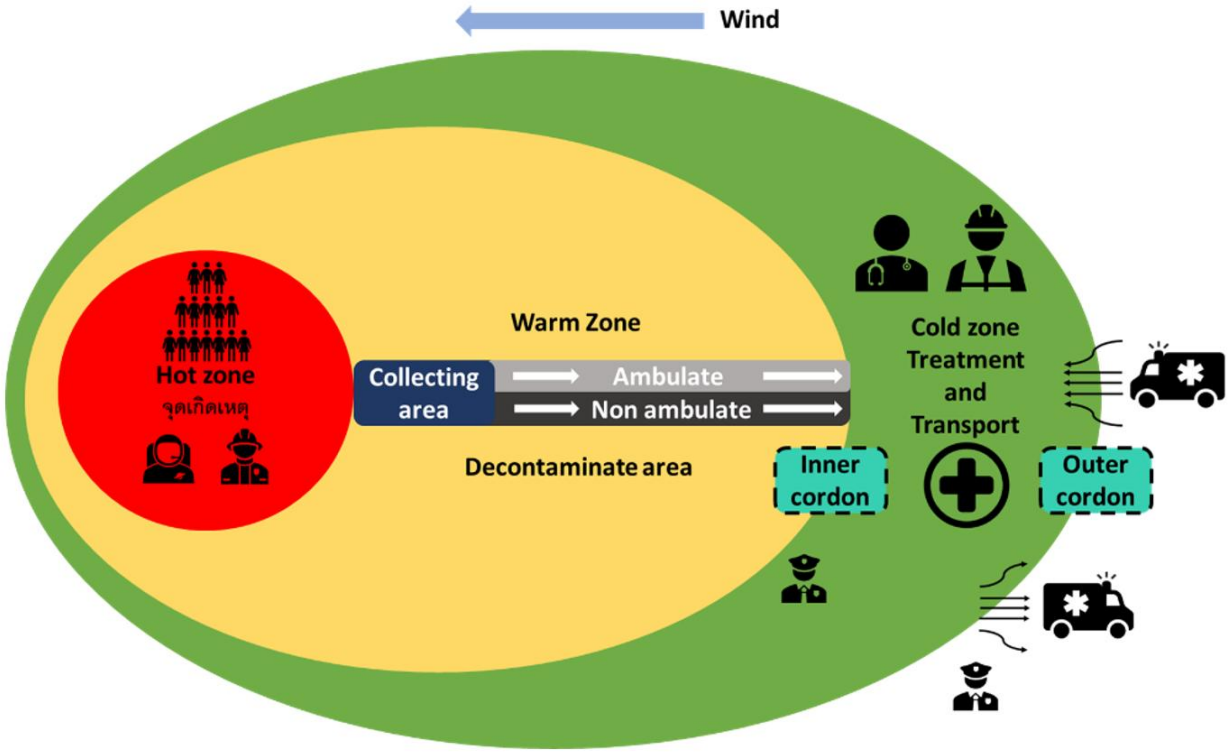


ภาพที่ 11-6 การจัดขอบเขตการปฏิบัติงานแบบ Bronze, Silver and Gold Zone

(เขียนภาพโดย : กานต์ สุทธาพานิช)

(ดัดแปลงจาก Greaves I, Hunt P. Responding to terrorism. Edinburgh: Elsevier; 2011.)


Bronze zone
Silver zone
Gold zone
จุดเกิดเหตุ
Inner cordon
Outer cordon
Forward command point
Medical command point
Triage
Casualty clearing station
Treatment แดง
Treatment เหลือง
Treatment เขียว
Ambulance parking point
Ambulance loading point
Staging area
Command post
ดับเพลิง
กู้ภัย
ทีมเคลื่อนย้าย



ภาพที่ 11-6 การจัดขอบเขตการปฏิบัติงานแบบ Hot, Warm and Cold Zone

(เขียนภาพโดย : กานต์ สุทธาพานิช)

Hot zone

จุดเกิดเหตุ

- ดับเพลิง
- กู้ภัย
- ทีมเคลื่อนย้าย

Warm zone

จุดล้างตัว

จุดรวมตัวผู้บาดเจ็บ Collecting area

- ผู้บาดเจ็บเดินได้ ♂
- ผู้บาดเจ็บเดินไม่ได้
- ผู้บาดเจ็บเดินได้ ♀

Cold zone

Medical command post

Ambulance parking point

Triage

Casualty clearing station

Treatment แดง

Treatment เหลือง

Treatment เขียว

Ambulance loading point


EMT
FIRE
EMT


ลำดับที่
2
Glasgow Coma Scale รวม :
Total Glasgow Coma Scale
Respiratory Rate
Systolic BP
12 = ลำดับที่ 1
11 = ลำดับที่ 2
0-10 = ลำดับที่ 3
รวม :
เวลา :
C-Closed Fracture
O-Open Fracture
B-Burn
L-Laceration
A-Abrasion


ลำดับที่
3
ลำดับที่
1


MEDTAG


Conscious/Unconscious Pupils: equal /unequal

Pulse ..... B.P ..... Resp. Rate .....

DIAGNOSIS ..... الإصابة

MANAGEMENT ..... الإجراء / العلاج

.....

.....

.....

.....

Tourniquet No. Yes / Time : رباط ضاغط

IV ..... IM .....


طب الميدان

بطاقة الاخلاء

Name ..... الاسم

Military No. ..... الرقم

Rank ..... الرتبه

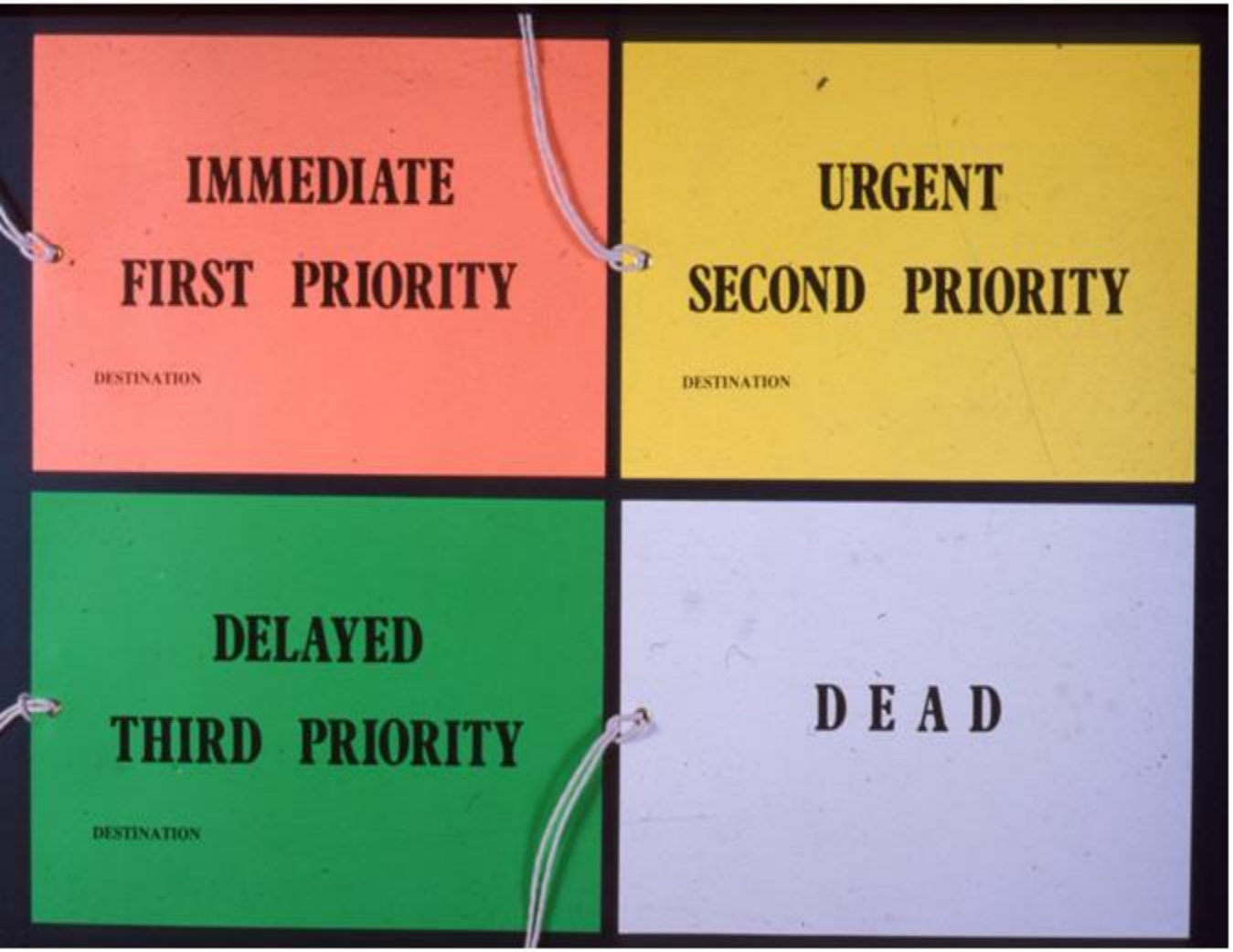
Unit/SQ ..... الوحده

Transport from ..... منقول من

Destination ..... منقول إلى

Date ..... التاريخ

Doctor's Name & Signature ..... اسم وتوقيع الطبيب


IMMEDIATE
FIRST PRIORITY
DESTINATION
URGENT
SECOND PRIORITY
DESTINATION
DELAYED
THIRD PRIORITY
DESTINATION
D E A D

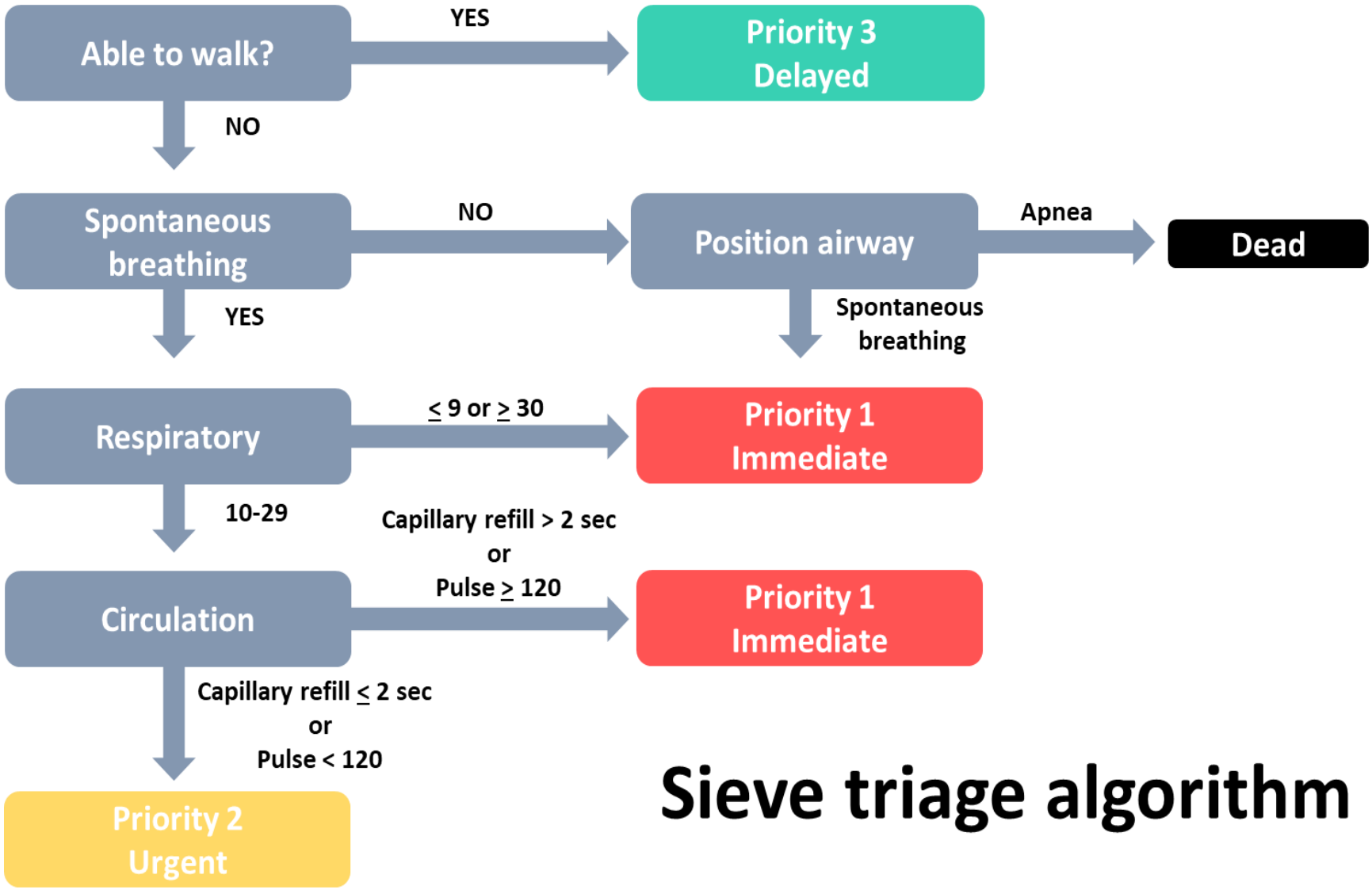
1. การคัดแยกระดับผู้บาดเจ็บขั้นที่ 1 (Primary triage)

ระดับการบาดเจ็บ	ลำดับการรักษาพยาบาล	คำอธิบาย
P1	Intermediate	ผู้บาดเจ็บวิกฤต ต้องได้รับการรักษาอย่างเร่งด่วนที่สุด
P2	Urgent/Delayed	ผู้บาดเจ็บเร่งด่วน
P3	Delayed/Minor/Minimal	ผู้ที่ได้รับบาดเจ็บเล็กน้อย
Dead	Dead	เสียชีวิต
P1(Hold)	Expectant	มีโอกาสเสียชีวิตสูง/เสียชีวิต

ดัดแปลงจาก : Bazyar J, Farrokhi M, Khankeh H. Triage systems in mass casualty incidents and disasters: A review study with a worldwide approach. Open Access Maced J Med Sci 2019;7:482-94.

วาดภาพโดย : กานต์ สุทธาพานิช

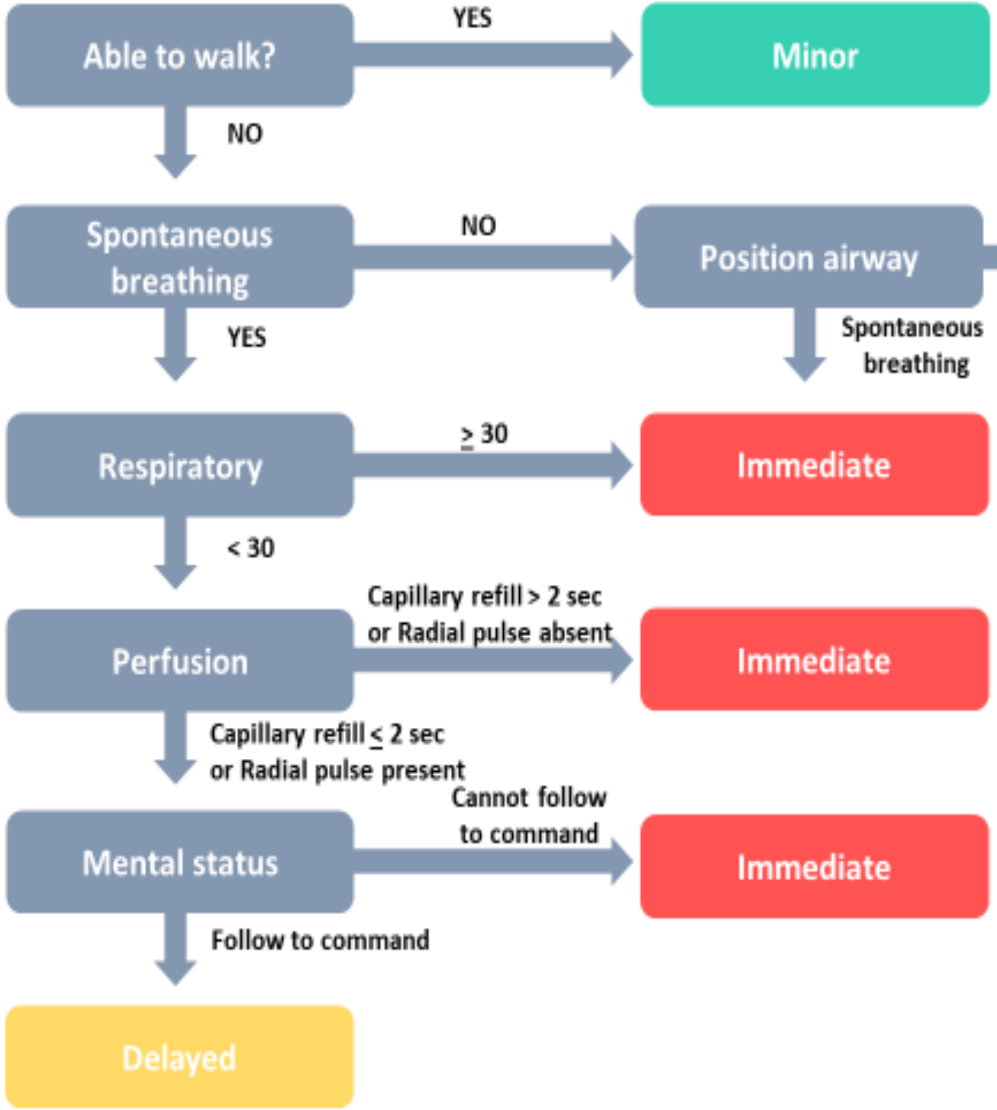
Sieve triage ใช้หลักการ 30-2



Sieve triage algorithm

ดัดแปลงจาก : Smith W. Triage in mass casualty situations. Cont Med Ed 2012;30:413-5.

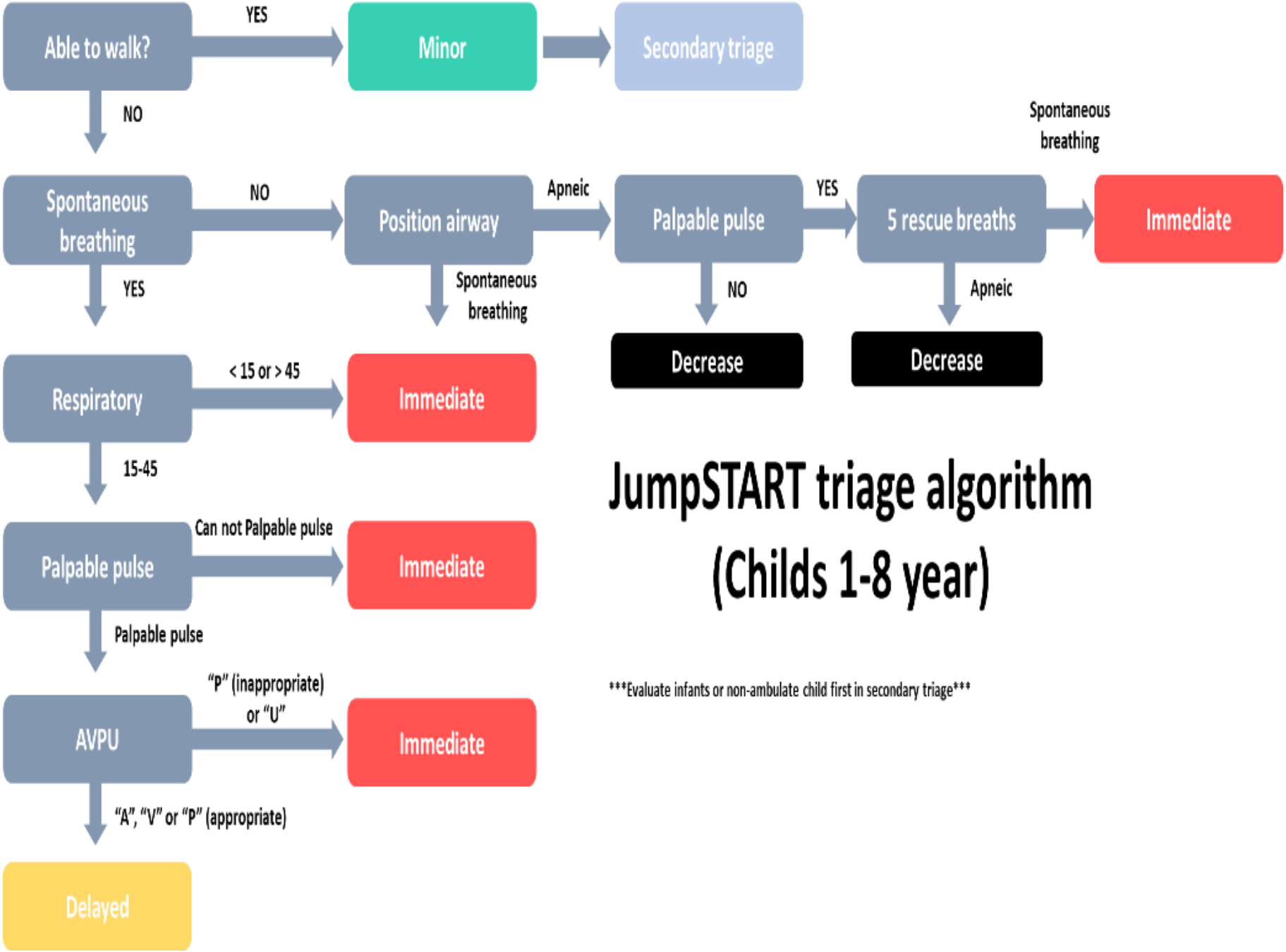
วาดภาพโดย : กานต์ สุทธาพานิช



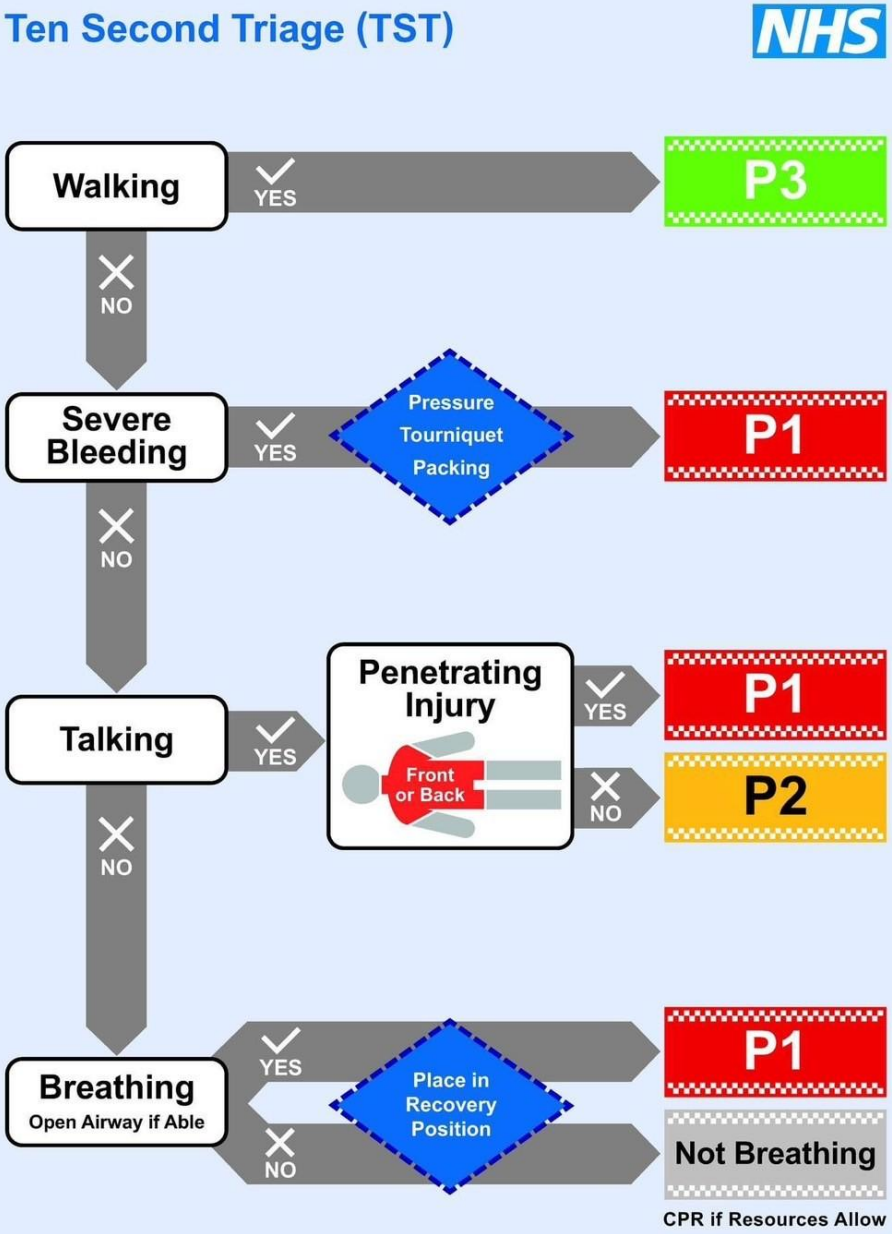
START triage algorithm RPM 30-2-Can do

ดัดแปลงจาก : Bhalla MC, Frey J, Rider C, Nord M, Hegerhorst M. Simple Triage Algorithm and Rapid Treatment and Sort, Assess, Lifesaving, Interventions, Treatment, and Transportation mass casualty triage methods for sensitivity, specificity, and predictive values. Am J Emerg Med 2015;33:1687-91.

วาดเขียนภาพโดย : กานต์ สุทธาพานิช

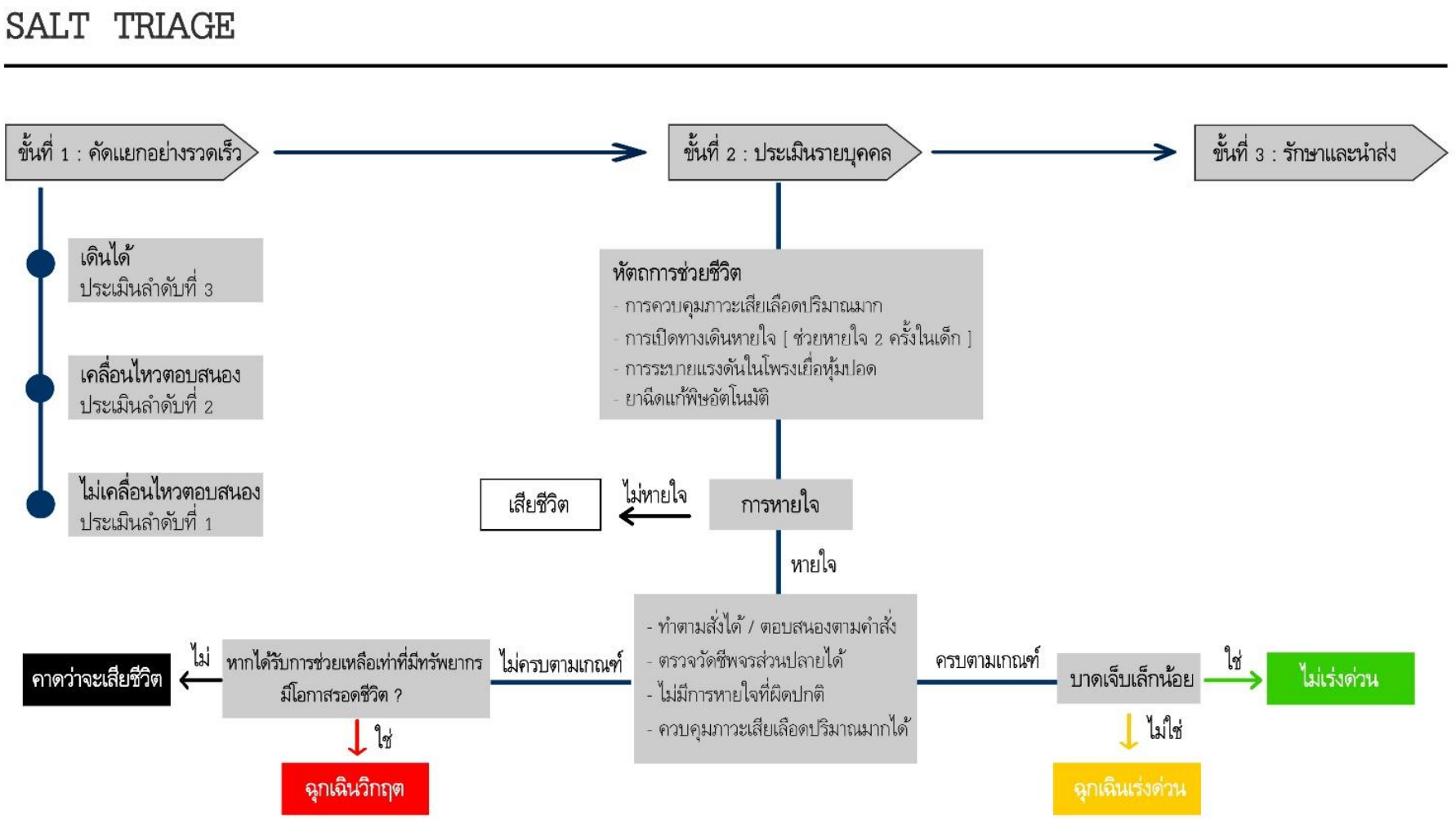

Able to walk?
YES
Minor
Secondary triage
NO
Spontaneous breathing
NO
Position airway
Apneic
Palpable pulse
YES
5 rescue breaths
Spontaneous breathing
Immediate
YES
Spontaneous breathing
NO
Apneic
Decrease
Decrease
Respiratory
< 15 or > 45
Immediate
15-45
Palpable pulse
Can not Palpable pulse
Immediate
Palpable pulse
AVPU
"P" (inappropriate) or "U"
Immediate
"A", "V" or "P" (appropriate)
Delayed
JumpSTART triage algorithm
(Childs 1-8 year)
Evaluate infants or non-ambulate child first in secondary triage

Ten Second Triage (TST)



- **Initial treatment**
- Stop bleeding ถ้ามีภาวะเสียเลือดมาก (exsanguinating hemorrhage)
  - การห้ามเลือดด้วยสายรัดห้ามเลือด (tourniquet)
  - ทำแผลโดยใช้แรงกด (pressure dressing)

3. SALT triage (Sort, Assess, Lifesaving interventions, and Treatment/Transport)



อ้างอิงรูปภาพจาก : Lerner EB, Schwartz RB, Coule PL, Weinstein ES, Cone DC, Hunt RC, et al. Mass casualty triage: An evaluation of the data and development of a proposed national guideline. Disaster Med Public Health Prep 2008;2(S1):S25-S34.

เขียนภาพโดย : กานต์ สุทธาพานิช

PLEASE HEAD HERE

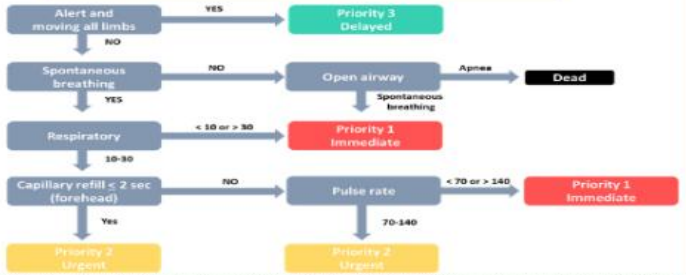
50-80 cm or 3-10 kg

80 cm

80-100 cm or 11-18 kg

100 cm

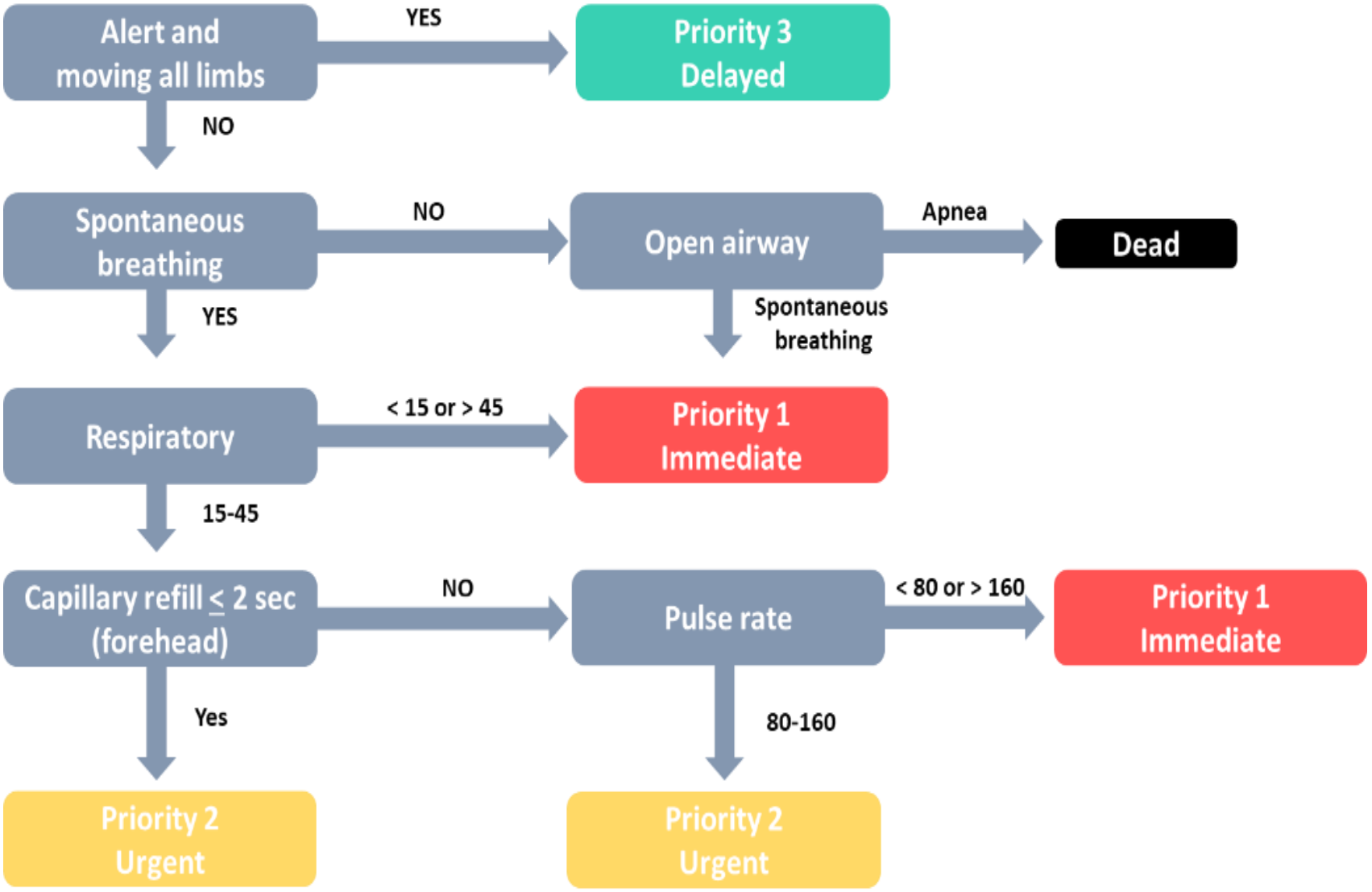
100-140 cm or 19-32 kg



140 cm

Use Adult Triage

50-80 cm or 3-10 kg



2. การคัดแยกระดับผู้บาดเจ็บขั้นที่ 2 (Secondary triage)

Triage Revised Trauma Score (TRTS)

คะแนน	อัตราการหายใจ	ความดันเลือด	ความรู้สึกตัวกลาสโกว์
4	10 - 29	> 90	13 - 15
3	> 29	76 - 89	9 - 12
2	6 - 9	50 - 75	6 - 8
1	1 - 5	1 - 49	4 - 5
0	0	0	3

คะแนนรวม = อัตราการหายใจ + ความดันเลือด + ความรู้สึกตัวกลาสโกว์

คะแนนรวม	ลำดับความสำคัญ
12	ไม่เร่งด่วน
11	ฉุกเฉินเร่งด่วน
< 10	ฉุกเฉินวิกฤต

SORT triage algorithm

	Response	Score
E: Eye opening	Spontaneously	4
	To speech	3
	To pain	2
	No response	1
V: Verbal	Good orientated	5
	Confuse conversation	4
	Inappropriate responses, words discernable	3
	Incomprehensible sounds or speech	2
	No verbal response	1
M: Motor	Obeys commands to movement	6
	Localizes pain	5
	Normal flexion Withdraws from pain	4
	Abnormal flexion	3
	Abnormal extension	2
	No response	1
	Glasgow Coma Score	3-15

Glasgow Coma Score	Score
13-15	4
9-12	3
6-8	2
4-5	1
3	0
Respiratory rate	**Score**
10-29	4
>29	3
6-9	2
1-5	1
0	0
Systolic blood pressure	**Score**
>89	4
76-89	3
50-75	2
1-49	1
0	0
Total Score	**0-12**

Priority	TRTS Score
Immediate	1-10
Urgent	11
Delayed	12
Dead	0
Expectant	1-3


คิดถึง ER
คิดถึง รามาธิบดี