



가 * , ** , *** ,

* . ** . *** . ****

Abstract

General Scheme for the Level I Trauma Center in South Korea

Kug Jong Lee, M.D., Jae Yong Kim, M.D.*,
Kang Hyun Lee, M.D.**, Gil Joon Suh, M.D.***, Yeo Kyu Youn, M.D.****

Department of Emergency Medicine, Ajou University School of Medicine, Suwon, Korea
Korean Health Insurance Review Agency, Seoul, Korea*

Department of Emergency Medicine, Yonsei University Wonju College of Medicine, Wonju, Korea**

Department of Emergency Medicine, Seoul National University College of Medicine, Seoul, Korea***

Department of Surgery, Seoul National University College of Medicine, Seoul, Korea****

An ideal trauma care system would include all the components identified with optimal trauma care, such as prevention, access, acute hospital care, rehabilitation, and research activities. Central to an ideal system is a large resource-rich trauma center. The need for resources is primarily based on the concept of being able to provide immediate medical care for unlimited numbers of injured patients at any time. Optimal resources at such a trauma center would include in-house board-certified emergency medicine physicians, general surgeons, anesthesiologists, neurosurgeons, and orthopedic surgeons. Other board-certified specialists would be available, within a short time frame, to all patients who require their expertise. This center would require a certain volume of injured patients to be admitted each year, and these patients would include the most severely injured patients within the system. Additionally, certain injuries that are infrequently seen would be concentrated in this special center to ensure that these patients could be

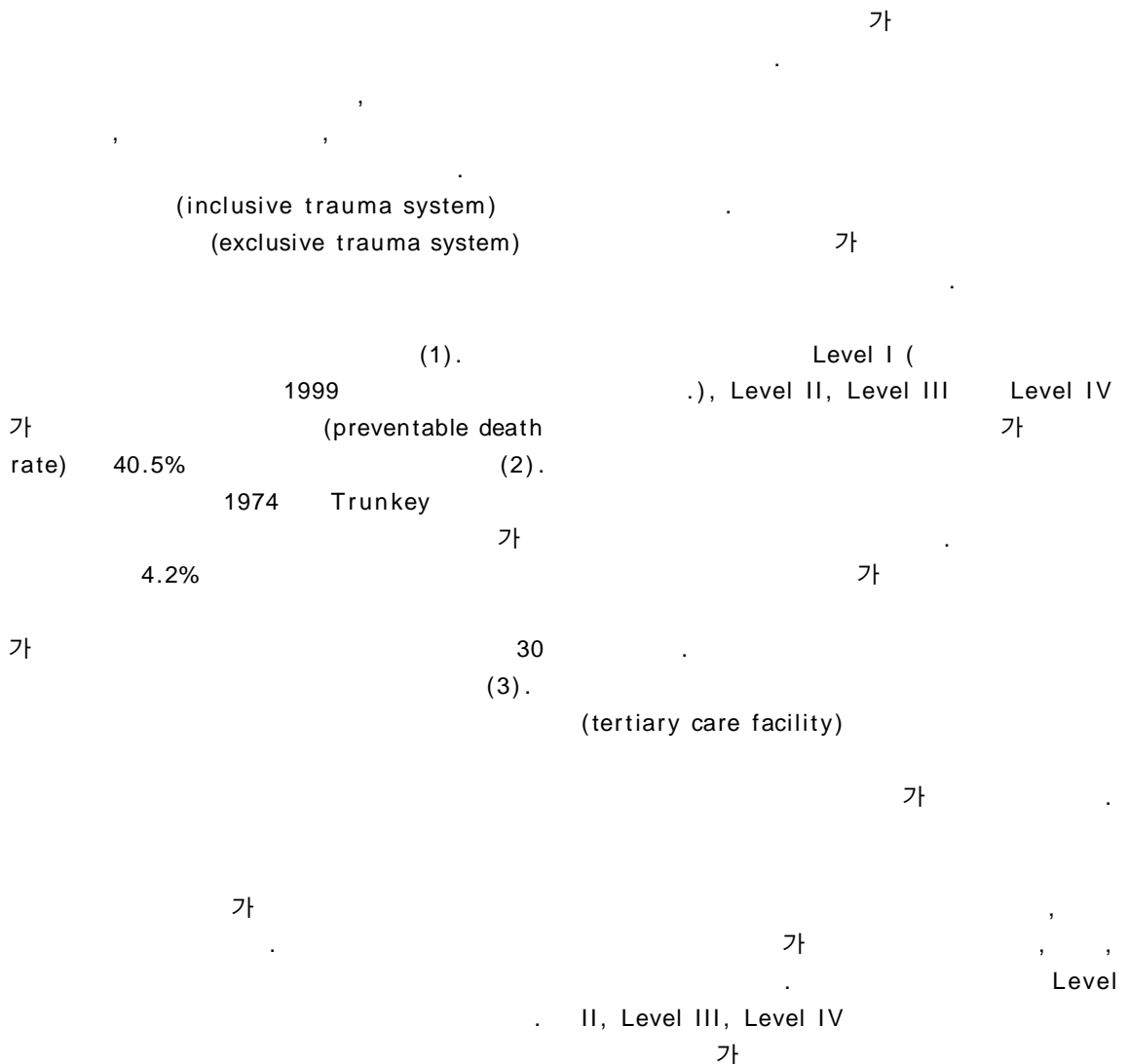
* Address for Correspondence : **Yeo Kyu Youn, M.D.**
Department of Surgery, Seoul National University College of Medicine,
28 Yongon-dong, Chongno-gu, Seoul, 110-744, Korea
Tel : 82-2-760- 3447, Fax : 82-2-766-3975, E-mail : ykyoun@plaza.snu.ac.kr

: 2005 6 1

* 2004

properly treated and studied, providing the opportunity to improve the care of these patients. These research activities are necessary to enhance our knowledge of the care of the injured. Basic science research in areas such as shock, brain edema, organ failure, and rehabilitation would also be present in the ideal center. This trauma center would have an integrated concurrent performance improvement program to ensure optimal care and continuous improvement in care. This center would not only be responsible for assessing care delivered within its trauma program, but for helping to organize the assessment of care within the entire trauma system. This ideal trauma center would serve as a total resource for all organizations dealing with the injured patient in the regional area.

Key Words: Trauma care system, Trauma center, Injury, Organ failure



가

가

가

medical education, CME)
가
(quality control)

(continuing

ICD-10 가 S T

5

(, , ,)

234

가,

가

NISS (new injury severity score) ICD-10 based ICISS (international classification of diseases 10th edition-based injury severity score)

가

NISS

ㄱ. $NISS = (1^{st} AIS\ score)^2 + (2^{nd} AIS\ score)^2 + (3^{rd} AIS\ score)^2$

(surveillance

ㄴ. 가 가

3가

, 1-75

ㄷ. 75

(4).

ICISS

ㄱ. $SRR = \frac{ICD\ coding}{ICD\ coding}$

ㄴ. $ICISS = SRR_{inj(1)} \times SRR_{inj(2)} \times SRR_{inj(3)} \times \dots \times SRR_{inj(10)}$

ㄷ. SRR ICD-10 S, T code

ㄹ. (T33-T356) (T36-T65),

(T66-T78),

(T80-T88)

ICD-10 ICISS

가

가

NISS

— 18 1 —

가 .) 15

(T) 가

ICD-10 . ICISS .

가

NISS

AIS ICD-10 , ,

가 cut-off point .

NISS ICISS

가

ㄱ. ICISS 가 C-statistic 0.667 .

ㄴ. ROC(receiver operating characteristic) 0.562, (=0.712)

(5). ICISS , 0.863

NISS .

ㄴ. NISS , , cut-off point가 ICISS 0.876

1 ~ 8 , 9 ~ 24 , 25 NISS 9

ㄷ. ISS (NISS ICISS cut-off point ISS 15 0.956

Table 1. Patients number according to the region of South Korea

Region	Patients number above ISS 9	Patients number above ISS 15
Seoul city	40,556	16,053
Pusan city	14,743	7,235
Daegu city	11,261	5,407
Incheon city	13,158	3,968
Gwangju city	8,363	3,971
Daejeon city	9,833	4,112
Ulsan city	4,669	2,092
Gyeonggi province	47,241	16,281
Gangwon province	9,694	4,741
Chungcheongbuk province	8,781	4,038
Chungcheongnam province	10,914	4,339
Jeollabuk province	14,856	6,046
Jeollanam province	12,631	6,005
Gyeongsangbuk province	13,906	6,408
Gyeongsangnam province	15,203	7,419
Jeju province	2,097	1,063
Sum	237,906	99,178

ROC 0.898 ISS 15 99178 (Table 1).

가 (injury map) 가 (Table 2), Fig. 1

2003 ISS 9 237906 3.

Table 2. Patients number according to the region of Seoul City

Region	Patients number above ISS 9	Patients number above ISS 15
Jongno-gu	1,348	852
Jung-gu	1,020	533
Yongsan-gu	776	413
Seongdong-gu	1,601	785
Gwangjin-gu	1,598	800
Dongdaemun-gu	2,115	815
Jungnang-gu	1,452	425
Seongbuk-gu	1,672	556
Gangbuk-gu	1,513	431
Dobong-gu	1,064	416
Nowon-gu	2,394	1,247
Eunpyeong-gu	1,554	430
Seodaemun-gu	1,567	672
Mapo-gu	1,219	366
Yangcheon-gu	2,168	790
Gangseo-gu	2,125	412
Guro-gu	1,370	575
Geumcheon-gu	646	168
Yeongdeungpo-gu	3,223	1,562
Dongjak-gu	799	294
Gwanak-gu	1,622	361
Seocho-gu	1,507	843
Gangnam-gu	1,921	806
Songpa-gu	2,198	770
Gangdong-gu	2,084	731
Sum	40,556	16,053



Fig. 3. The all of trauma team members is already gathered at trauma wing before patient 's arrival. They already have core information about trauma victims.



Fig. 4. The special examination and treatment could be started at the same time, immediately after patient 's arrival.

가

가

가

가 가

가

가
가

(Level I trauma center)

(7).

ㄱ.

ㄴ.

1,200

ㄷ.

20%

Injury Severity Score (ISS) 15

ㄹ.

ISS 15

가 35

ㅁ.

가

4

가

1

Table 3 (9,10).

가

(8).

ㄱ.

365 , 24

ㄴ.

가

Table 4

ㄷ.

가

가

ㄹ.

(11).

ㅁ.

5.

(Trauma program)

ㅂ.

1)

ㅅ.

가

가

가

4.

Table 3. Field triage decision scheme.

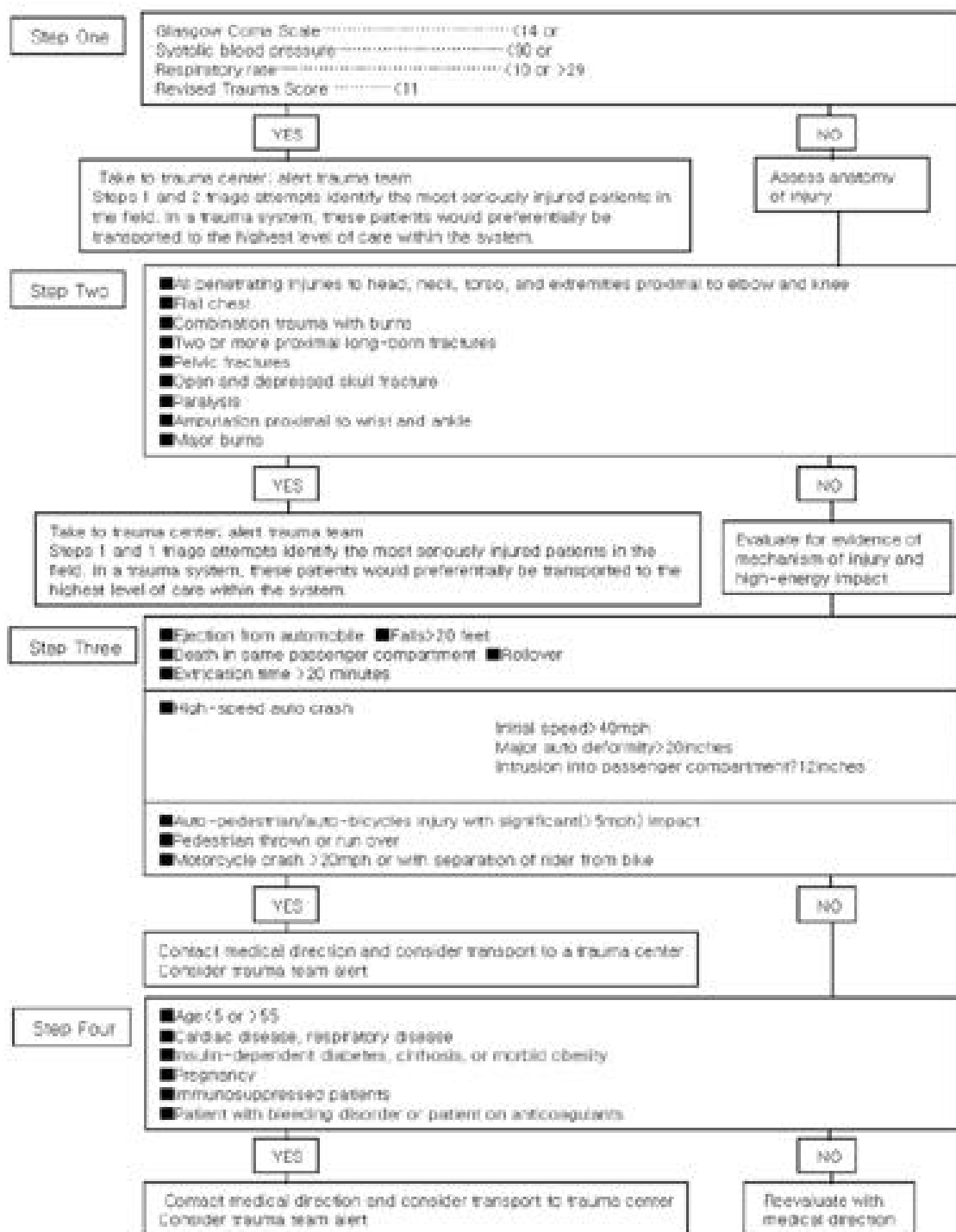


Table 4. This is the criteria for consideration of inter-hospital transfer. These guidelines are not intended to be hospital-specific. It may be appropriate for the injured patient to undergo operative control of ongoing hemorrhage prior to transfer if a qualified surgeon and operating room resources are promptly available at the referring hospital.

CENTRAL NERVOUS SYSTEM

Head injury	-Penetrating injury or open fracture -Depressed skull fracture -Glasgow Coma Scale (GCS) < 14 or GCS deterioration -Lateralizing signs
spinal cord injury	- Spinal cord injury or major vertebral injury

CHEST

Major chest wall injury or pulmonary contusion
Wide mediastinum or other signs suggesting great vessel injury
Cardiac injury
Patients who may require prolonged ventilation

PELVIS/ABDOMEN

Unstable pelvis ring disruption
Pelvic fracture with shock or other evidence of continuing hemorrhage
Open pelvic injury
Solid organ injury

MAJOR EXTREMITY INJURY

Fracture/dislocation with loss of distal pulses
Open long bone fractures
Extremity ischemia

MULTIPLE-SYSTEM INJURY

Head injury combined with face, chest, abdominal, or pelvic injury
Burns with associated injuries
Multiple long-bone fractures
Injury to more than two body regions

COMORBID FACTORS

Age > 55 years
Children < 5 years of age
Cardiac or respiratory disease
Insulin-dependent diabetes, morbid obesity
Pregnancy
Immunosuppression

SECONDARY DETERIORATION (LATE SEQUELAE)

Mechanical ventilation required
Sepsis
Single or multiple organ system failure (deterioration in central nervous, cardiac, pulmonary, hepatic, renal, or coagulation systems)
Major tissue necrosis

(12).

2) (Trauma program)

가

가

(team approach)

가

가 가

(General
(advanced

Surgery)
trauma life support)

가

가

ㄱ.
ㄴ.
ㄷ.
ㄹ.
ㅁ.
ㅂ.
ㅅ.
ㅇ.
ㅈ.
ㅊ.
ㅋ.
ㅌ.
ㅍ.
ㅎ.

가

(14).

(12,13).

ㄱ.

가

가

가

4) (The trauma program
manager)

가

가

ㄴ.

ㄷ.

ㄹ.

ㅁ.

ㅂ.

가

가

ㄱ.

ㄴ.

ㄷ.

ㄹ.

coding
severity score)

(injury

3)

□. 가 EMS , 가,

▣. , , ,

6. (Providing On-Scene Care, GO-TEAM)

(16).

가

7.

가 . 가

1)

119

가

가 가

가 . 가 가 가
가

가 가

ㄱ. 365 , 24

가 24 .
가 가

ㄴ. 가

ㄷ. 가

ㄹ.

(helicopter)

ㅁ. 가

가

2)

가 가

가
가 . 가
가
가

(17).

ㄱ. .

가 . ㄱ. .

ㄴ. . ㄴ. 가

ㄷ. . ㄷ. .

ㄹ. . ㄹ. ,

ㅁ. . 4) 가

가 , , , , ,

3) 가 , 가 ,

가 가 .

가 가 . 가

, , 가 가

(15).

가, 5) 가

, ,

가

ㄱ. 365 , 24

ㄴ.

ㄷ. 가 가

ㄹ.

가

ㅁ.

가

24

6)

가

가

ㄱ.

8)

가

ㄴ.

가

가

ㄷ.

24

가

365 ,

ㄹ.

가

가

가

9)

7)

가

가

가

가

가

ㄱ. 2003

40556 .

ㄴ.

1200 .

ㄷ. 34

가

가

ㄹ.

120

가

ㅁ.

4

2

가

ㅂ.

40

가

ISS 15

16053

20% 240

(18,19).

10)

가

35

1

7

가

가

가

가

가

가

가가

가

가

1

3

(20).

1

가

REFERENCES

- 1) David BH, Coimbra R, Winchell RJ. Management of acute trauma. In: Townsend CM, eds. Sabiston textbook of surgery. 16th ed. St. Louis: W.B. Saunders, 2001:311-344.
- 2) 가 , , . 2001;12:45-56.
- 3) Trunkey DD, Lim RC. Analysis of 425 consecutive trauma fatalities: An autopsy study. *J Am Coll Emerg Phys* 1974;3:368-374.
- 4) Acosta JA, Yang JC, Winchell RJ, Simons RK, Fortlage DA, Hollingsworth-Fridlund P, Hoyt DB. Lethal injuries and time to death in a level I trauma center. *J Am Coll Surg* 1998;186(5):528-533.
- 5) , , , , , . : , 2002.
- 6) Shackford SR, Hollingsworth-Fredlund P, Cooper GF, et al. The effect of regionalization upon the quality of trauma care as assessed by a concurrent audit before and after institution of a trauma system: A preliminary report. *J Trauma* 1986;26:812-820.
- 7) Mullins RJ, Veum-Stone J, Hedges JR, Zimmer-Gembeck MJ, Mann NC, Southard PA, Helfand M, Gaines JA, Trunkey DD. Influence of a statewide trauma system on location of hospitalization and outcome of injured patients. *J Trauma* 1996;40(4):536-546.
- 8) Konvolinka CW, Copes WS, Sacco WJ. Institution and per surgeon volume vs. survivor outcome in Pennsylvania's trauma centers. *Am J Surg* 1995;170:333-340.
- 9) Esposito TJ, Offner PJ, Jurkovich GJ, Griffith J, Maier RV. Do prehospital trauma center triage criteria identify major trauma victims? *Arch Surg* 1995;130:171-176.
- 10) Meredith W, Rutledge R, Hansen AR, Oller DW, Thomason M, Cunningham P, Baker CC. Field triage of trauma patients based upon the ability to follow commands: A study in 29,573 injured patients. *J Trauma* 1995;38(1):129-135.
- 11) Esposito TJ, Sanddal ND, Hansen JD, Reynolds S. Analysis of preventable trauma deaths and inappropriate trauma care in a rural state. *J Trauma* 1995;39:955-962.
- 12) Committee on Trauma, American College of Surgeons. Resources for Optimal Care of the Injured Patient. Chicago: ACS press, 1999.
- 13) Committee on Trauma, The American College of Surgeons. Advanced Trauma Life Support. Chicago: ACS press, 1997.
- 14) Shatney CH, Sensaki K. Trauma team activation for "mechanism of injury" blunt trauma victims: A time for change. *J Trauma* 1994;37(2):275-282
- 15) Hoyt DB, Hollingsworth-Fridlund P, Fortlage D, Davis JW, Mackersie RC. An evaluation of provider-related and disease-related morbidity in a level I university trauma service: Directions for quality improvement. *J Trauma* 1992;33(4):586-601
- 16) Cales RH, Trunkey DD. Preventable trauma death: A review of trauma care systems development. *JAMA* 1985;254(8):1059-1063
- 17) Lucas CE, Dombi GW, Crilly RJ, Ledgerwood AM, Yu P, Vlahos A. Neurosurgical trauma call: Use of a mathematical simulation program to define manpower needs. *J Trauma* 1997;42:818-824
- 18) American Academy of Pediatrics Committee on Pediatric Emergency Medicine: Guidelines for pediatric emergency care facilities. *Pediatrics* 1995;96(3):526-538
- 19) Hulka F, Mullins RJ, Mann NC, Hedges JR, Rowland D, Worrall WH, Sandoval RD, Zechnich A, Trunkey DD. Influence of a statewide trauma system on pediatric hospitalization and outcome. *J Trauma* 1997;42(3):514-519
- 20) Kerby RL. Impairment, disability and handicap. In: DeLisa eds. Rehabilitation Medicine-Principles and Practices. 2nd ed. Philadelphia: J.B. Lippincott, 1993:40-50