

Establishment, Functioning, Challenges, and One-Year Report of Uttar Pradesh's First Apex Trauma Center

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Abstract

Trauma is a major public health problem across the world with significant morbidity and mortality. Broadly, it is a disease of middle-aged population and is assuming the status of an epidemic in the 21st century. Road traffic injuries are most common followed by railway injuries, industrial, farming, and domestic injuries, and many others in low- and middle-income countries. Severe traumatic brain injuries are the major proportion with concern for long-term cognitive impairment and high spinal cord injuries due to complete dependence. There is no comprehensive trauma care system covering all geography in India at present. The Government of India (GOI), in 2006, established Jai Prakash Narayan Apex Trauma Center, which is run by All India Institute of Medical Sciences at New Delhi as an apex center to provide quality care, training, research, and registry development. It acts as a role model center for the establishment of new centers and helps in upgradation of existing hospitals to provide quality care trauma services. To curb this epidemic of trauma, GOI envisioned National Trauma Care program during the 11th and 12th Five-Year Plans to strengthen the emergency facilities in government hospitals. Many new centers are coming up with various levels of trauma care across the country. Here we discuss the establishment, resources, initial challenges, trauma burden, and a year of report card of the Uttar Pradesh's first Level I Apex Trauma Center of Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, established with a vision of providing state of the art Level I trauma care to the injured victims.

Keywords

- ▶ Apex Trauma Center
- ▶ trauma
- ▶ trauma epidemic
- ▶ trauma system
- ▶ trauma systems in India

Introduction

Trauma is a major public health problem and it mainly affects middle-aged population. Broadly, it is a disease of middle-aged population with identifiable risk factors, mechanisms, pathology, treatments, and preventive measures. It is assuming the

status of an epidemic in the 21st century. It is associated with high mortality and morbidity in both developed and developing countries. According to the World Health Organization's (WHO) Global Burden of Disease Study estimates, injuries are a health concern in every country around the world, causing

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more than 5 million deaths per year or 14,000 deaths per day.¹⁻³ This accounts to 9% of deaths worldwide and ranks seventh among leading causes of mortality. The deaths caused by injuries have an immeasurable impact on the families and communities affected, whose lives are often changed irrevocably by these tragedies.⁴ According to WHO, India has the highest number of road accidents in the world with 16.8 fatal injuries per 100,000 population and 38.9 nonfatal injuries per 100,000 populations.⁵ According to National Crime Records Bureau India, 413,457 accidental deaths occurred in the year 2015 from both natural and unnatural causes—that is, ~47 accidental deaths taking place every 1 hour. Majority of the deaths were from unnatural causes, constituting 38 deaths per hour. The traffic accidents caused injuries to 486,567 persons and 177,423 deaths during 2015. Uttar Pradesh (UP) is the second leading state with highest deaths of 9.7% following Maharashtra due to unnatural accidents. A survey suggested that in every 5 to 6 minutes, one person dies due to road accidents in India. The reason why road traffic injuries are common in developing countries is the common road space shared by pedestrians, two wheelers, three wheelers, light-weight vehicles, heavy-weight vehicles, and stray animals, among others.⁶ Fall from heights can happen at domestic places, work places, or industrial places. A poor urban infrastructure with no safety measures is a risk factor in developing countries. Assaults arising out of conflicts and rivalries in living spaces due to growing population and increasing robberies are also frequently seen. Migrant workers are the most common floating population in Indian metro cities who are involved in industrial works where suboptimum personnel safety measures are in place. There are no unified trauma systems in India at present with standardized protocols for prehospital management, acute/emergency trauma care, definitive care, and rehabilitation, catering to the whole sub-continent or particular geographic areas.

During the 9th and 10th Five-Year Plans, the Government of India (GOI), in association with the Ministry of Health and Family Welfare (MoHFW) and Ministry of Road Transport and Highways, started a pilot program—Pilot Project for Strengthening Emergency Facilities along the Highways—to address the growing problem and to help in implementing policies in subsequent plans, and as a step toward inclusive trauma system.^{7,8} In 2006, GOI established Jai Prakash Narayan Apex Trauma Center run by All India Institute of Medical Sciences (AIIMS) at New Delhi as an apex center to provide quality care, training, research, and trauma system and registry development, and which helps to formulate policies to implement across the country and acts as a role model center for establishment of new centers and upgradation of existing hospitals to provide quality care services.⁹ During the 11th Plan, GOI instituted “Assistance for Capacity Building for Trauma Care” program for upgradation and strengthening of emergency facilities in government hospitals located on the national highways with 100% central fund to cover Golden Quadrilateral Highway Corridor and North–South and East–West Corridors with a network of 140 trauma care facilities in government hospitals.⁷ Under the 12th Plan, the program was extended and changed to “Capacity Building

for Developing Trauma Care Facilities in Govt. Hospitals on National Highways,” which proposed to establish another 85 new trauma care facilities.¹⁰

Apex Trauma Center Mandate

Under the 11th Plan, GOI designated a total of 15 government hospitals in the State of UP to provide trauma care facilities.¹¹ Of the 15 government hospitals recognized, 8 were Level II and 7 were Level III trauma centers. King George Medical University in the heart of the capital of State of UP was recognized as Level II trauma center. For reasons stated above and also because the State of UP witnesses large-scale social gatherings like the *Kumbha Melas*, there was a need of an apex trauma center to combat the injury epidemic. Hence, to establish state-of-the-art integrated and dedicated trauma care facility in the State of UP at par with country's only Level I trauma center, the Medical Education Department, Government of UP, overtook Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGIMS) and inaugurated the Apex Trauma Center (ATC) with the vision of establishing UP's first Level I trauma center on July 31, 2018, with activation of 60 beds and planned phase-wise expansion to 210 beds.¹²

Trauma Care Facilities

ATC adheres to all the guidelines and recommendations set up by MoHFW for Level I trauma center.¹⁰

Infrastructure: Total capacity of ATC is 210 beds and presently 66 beds are functional with 16 beds under emergency trauma department, 10 beds under intensive care unit (ICU) with step-down unit, and remaining beds distributed in wards with plan for further extension sooner.

Emergency department (ED): It is presently headed by the Department of Trauma Surgery and has a triage area, both adult and pediatric resuscitation bays, monitoring bays for critically and moderately injured victims, and a disaster area. The disaster area is well equipped for resuscitation of critical patients (→ Figs. 1 and 2).

Operation theater (OT) complex: There are six modular OTs that are functional round the clock and are fully equipped with cutting-edge technology instruments including operating microscopes.

Intensive care unit (ICU): ACT has 20-bedded ICU for all polytrauma and isolated head or spinal injury or other organ-specific injury cases. It is operated on semi-closed model with advanced ventilators, intensive hemodynamic monitoring devices, and bedside dialysis facility. The ICU has additional infrastructure for diurnal orientation of recovering ventilator patients to help in day–night orientation to patients (→ Fig. 3).

Equipment: The Center has all the modern state-of-the-art cutting-edge technology instruments and equipment, from resuscitation to definitive care to rehabilitation phase including rapid infusion pumps, basic to advanced surgical instruments, operating microscopes, endo-vision instruments, and angiography suite.

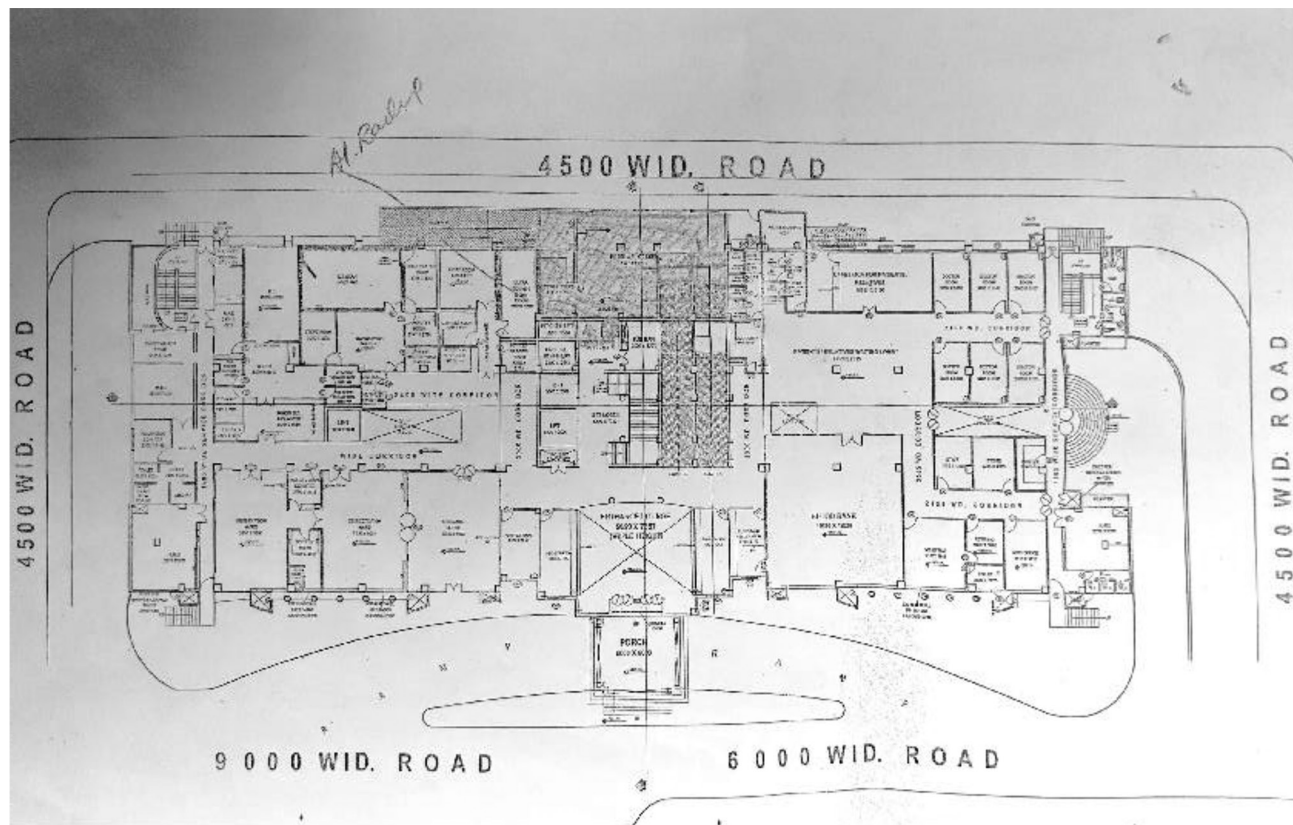


Fig. 1 Emergency department blueprint (for large-scale map details, authors can be contacted through appropriate channel).



Fig. 2 Emergency department resuscitation bay.



Fig. 3 Intensive care unit with neurosurgery cases.

Departments: The clinical specialities functional in the ATC are trauma surgery, neurosurgery, critical care medicine, orthopaedics, gynecology, physical medicine and rehabilitation, and oral and maxillofacial surgery. Besides, diagnostic services are being provided by laboratory medicine and radio-diagnosis departments with clinical support of existing subspecialties of the institute.

Human resources: Trained human personnel are the backbone of any institution. Institute's health care professionals are actively involved in patient care round the clock.

Medical team: There are 18 faculties working round the clock in the various specialities, with 18 senior and 20 junior residents.

Nursing team: There are 82 trained nursing staffs with nurse–patient distribution ratio of 1:2 in ED, 1:1 in ICU, 1:4 in wards with dedicated OT staffs.

Support staff: There are 300 support staffs including administrative officers, medical social workers, public relation officers, physiotherapists, pharmacists, technicians, dieticians, data entry operators, nursing attendants, and hospital attendants.

Outpatient department (OPD) services: There are six OPDs for follow-up patients that run on daily basis for all speciality departments with rehabilitation services.

Rehabilitation unit: There is an integrated dedicated rehabilitation unit under trained physiatrists that provides holistic rehabilitation care: in cases of traumatic brain injuries, spinal cord injuries, peripheral nerve injuries, and orthopaedic injuries; to critically injured polytrauma patients; and for the prevention and management of posttraumatic disabilities. This unit serves to add quality to the lives of trauma patients through comprehensive rehabilitation management and focused team approach.

Hierarchy of the ATC: The ATC is headed by the In-charge of the Trauma Center, also called the Chief of Trauma Center. There is a Trauma Committee to assist in smooth functioning of the activities related to the trauma center headed by Chief of Trauma Center with members from various clinical departments from the SGPGIMS. All the specialities report to the In-charge of the trauma center. Regular meetings are held among all the faculties of different specialities and reports submitted to In-charge for further perusal. All other administrative works are performed in tandem with the registrar office and the director office.

Payment model for initial- and long-term care: Initial care for 24 hours is funded by the institute's hospital revolving fund. This fund is used for investigations to definitive treatment depending on the need of the patients. However, after 24 hours, the patients have to pay a minimum amount fixed by the institute in accordance with the government rules. There are various payment schemes available, namely Prime Minister's Relief Fund, Chief Minister's Relief Fund, and Ayushman Yojana, and also financial assistance to the Below Poverty Line card holders. These various funds are facilitated by the medical social service workers in association with the department of hospital administration.

Protocols and Guidelines

There is a need for well-established protocols to be followed for delivery of effective trauma care services. The injured patients need to be treated in right place, with appropriate facilities and in right time. All the incoming patients are managed as per Advanced Trauma Life Support (ATLS) and Advanced Trauma Care Nursing (ATCN) protocols for acute care in the ED. After stabilization and complete working diagnosis, patients are admitted under respective specialities for definitive management. All the standard protocols are practiced at various levels by different specialities and institute.

Report Card

To commemorate 1 year of successful completion, ATC decided to celebrate the first Foundation Day on July 31, 2019, and organized Continuing Medical Examination cum educational activities on the day. Invited were the father of Indian trauma care, Prof. M. C. Misra, who envisioned the country's first Level I ATC at AIIMS, New Delhi, along with eminent professors from the same institute. Dr. Misra delivered talk on

Injury Epidemic. Prof. Deepak Agarwal delivered a lecture on the role of technology in trauma care and its implementation for effective trauma care, and Prof. Subodh Kumar delivered a lecture on training in trauma care. Apart from this, we had a lecture on road safety by inspector general police of traffic (►Figs. 4, 5).

Patient census: In 1 year, total ATC footfall was 10,210 including ED and OPD (►Fig. 6). Out of the total, 1,240 patients were admitted through ED into various specialities with discharge of 1,111 patients and overall mortality of 118 patients (►Fig. 7). Also, 8,970 patients were seen in OPD, both follow-up and new cases. Besides, 695 patients presented in the ED were admitted under neurosurgery of which 635 patients had head injury and 60 patients had spinal injuries (►Fig. 8).

Total operation cases: Trauma Surgery-71, Orthopaedics-571, Neurosurgery-190, and oral and maxillofacial surgery-58 (►Fig. 9).

Department-wise activities: Activities done over the last 1 year are as follows:

- **Neurosurgery:** So far neurosurgeons have managed 807 patients and operated on 194 patients. Out of these, 124 were head injury patients, 69 spine injury patients, 1 peripheral nerve patient, and more than 200 patients in the OPD.
- **Trauma surgery:** Total of 920 patients were admitted under emergency trauma care and 71 major surgeries



Fig. 4 Plantation drive as part of Foundation Day Celebration with Apex Trauma Center faculty and guest speakers.



Fig. 5 Plantation by guest speaker.

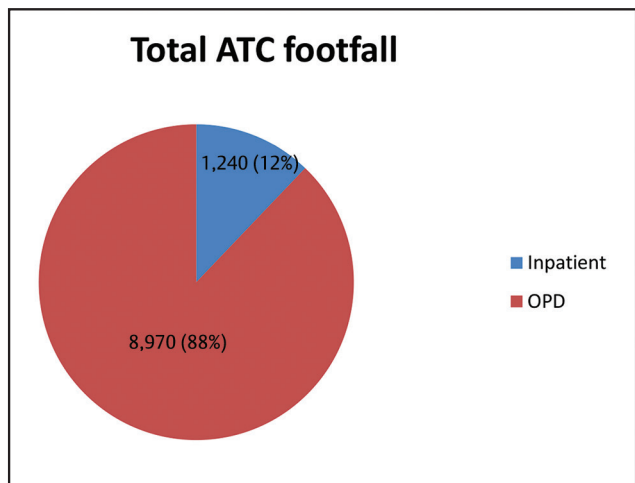


Fig. 6 Total Apex Trauma Center footfall.

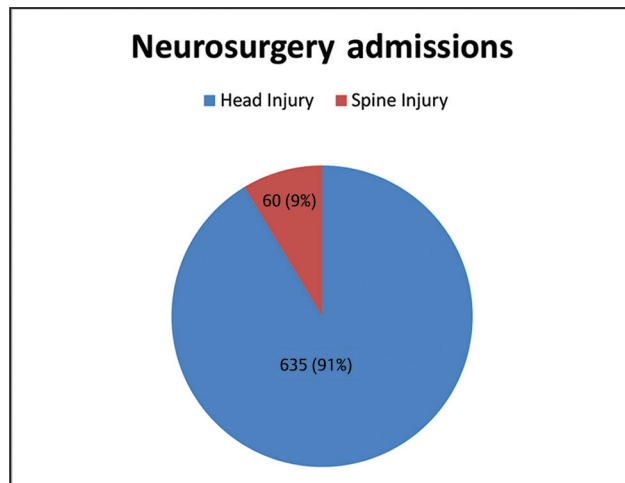


Fig. 8 Neurosurgery admissions.

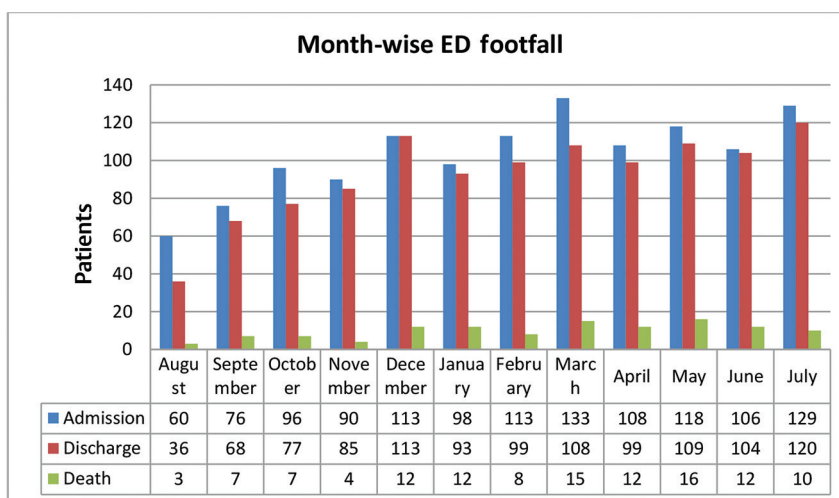


Fig. 7 Month-wise emergency department footfall.

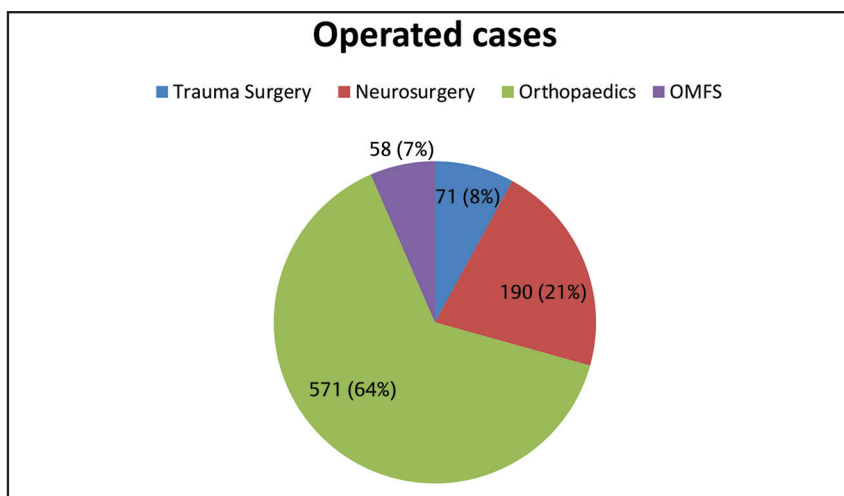


Fig. 9 Total operated cases.

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were performed, including those of tracheal, thoracic, complex pelvic, major intra-abdominal organ, and vascular injuries. Also, 227 minor procedures were performed.

- **Critical care medicine:** They have managed 848 patients out of which 544 patient were for postoperative observation and 304 in the ICU, with 83% patients being successfully discharged from the ICU.
- **Orthopaedic:** Managed a total of 7,370 patients (6,799 outpatients and 571 admitted ones) and successfully performed over 500 major orthopaedic surgeries pertaining to complex trauma (including pelviacetabular surgeries), spinal injuries, joint replacements, sport injuries, arthroscopic surgeries, and deformity corrections. Among the 6,799 outpatients, most of which were referral cases, 1,555 underwent some form of day care procedures like intralesional/intra-articular injections, dressings, and plaster applications.
- **Oromaxillofacial surgery:** Operated on more than 50 cases of maxillofacial trauma under general anesthesia and have managed more than 900 patients in OPD.
- **Anesthesia:** Apart from routine anesthetic care, they are actively involved in multimodal pain management of trauma victims.
- **Physical medicine and rehabilitation:** First trauma center in the country to have integrated a comprehensive rehabilitation facility for trauma patients. So far, they have managed more than 2,200 patients in OPD and indoor.
- **Laboratory medicine:** Speciality of laboratory medicine caters to the laboratory requirement of ATC. It provides 24×7 emergency services and has state of the art fully automated equipments for rapid and reliable report. A special section is also dedicated to the hospital infection control and antibiotic policy.

Challenges

There were many challenges since the inception of ATC.

1. **New center:** SGPGIMS is a super-speciality institute and popular among the population of UP for its specialized care for long time. There is a lack of awareness among general population of existence of emergency trauma services provided for trauma victims. This is our first major challenge for the institute to spread awareness.
2. **Geographical location:** ATC is situated on the outskirts of the main city on highway. Because of this, most injured patients are taken to other more accessible government hospitals.
3. **Training of health care professionals** who had limited or no exposure to management of trauma victims.
4. **Prehospital services:** There are no full-fledged prehospital care services including prehospital information system. Even though the Government operates many ambulances, most of the patients are brought in by relatives in improperly equipped ambulances and after delayed referrals at later stages when we have lost the precious golden hour for their management.

5. **Prehospital information:** There is no prehospital information system in place, which results in unnecessary referral to many centers.
6. **Nontrauma emergencies:** ATC provides not only dedicated trauma care services, but also the basic emergency care for nontrauma patients. However, it poses great difficulty for the relatives of nontrauma cases to convince for the need of other nontrauma care hospitals.

Future Perspective

1. **Expansion:** Expansion of ATC to full capacity of 210 beds with dedicated trauma surgical ICU, neurosurgical ICU, and step-down units. To institute state-of-the-art modular hybrid resuscitation bays and modular hybrid OT complex with digital subtraction angiography facilities for patients requiring both interventional and operative procedures simultaneously.
2. **Prehospital services:** To establish network of both government and private ambulances for effective and safe transfer of the patients to the center with prehospital information.
3. **Human resources training:** Institution of compulsory training of ATLS for medical team and ATLS and ATCN programs for all nursing staffs including orientation classes for all residents.
4. **Coordinators:** To train and establish various coordinators such as trauma nurse coordinators, hospital nurse informatics, wound care nurses, hospital infection control nurse, organ transplant coordinators, including one Trauma Squad. Trauma Squad will consist of advanced life support ambulance with doctor, nurse, and paramedic with advanced onboard facilities for resuscitation during transfer from trauma scene to Level I trauma center.
5. **ATLS and ATCN training program:** To establish ATLS training program endorsed and run by American College of Surgeons Committee on Trauma for medical professional training for emergency care of trauma victims.
6. **Various specialities** are working on implementation of fixed duration training courses for young doctors and nurses with interest in trauma care, like postdoctoral course for geriatric trauma, orthotrauma, neurotrauma, trauma critical care, and trauma rehab courses.
7. **Prevention programs:** Planning to conduct first responder course for different population groups.
8. **Procuring advanced life support ambulances.**
9. **Establishing disaster management team and prehospital trauma education system.**
10. **Adoption of few medical colleges** to implement and advance them to Level II trauma centers as directed by the Government.
11. **To develop Inclusive Trauma System in UP.**

Conclusion

There is no denial to the need of trauma care facilities in the country. However, concerted efforts of the Government and

doctors are bringing a change but the figures are still a far cry from reality. Identification of barriers in delivering trauma care is the cornerstone of improving the system. More awareness and training is required from the prehospital time till patients are completely rehabilitated. Establishment of dedicated trauma centers, giving a comprehensive care, will save many lives and improve the quality of life of innumerable trauma victims.

Conflict of Interest

None.

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Members of the Committee on Trauma of the ATC, SGPGIMS, all faculties of trauma surgery, neurosurgery, orthopaedic surgery, physiatry, oromaxillofacial surgery, anesthesiology and critical care medicines, radiology, laboratory medicine, and all supporting departments of SGPGIMS.

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