



## Assessment and Availability of Trauma Care Services in a District Hospital of South India; A Field Observational Study

Pallavi Sarji Uthkarsh<sup>1\*</sup>, Gopalkrishna Gururaj<sup>2</sup>, Sai Sabharish Reddy<sup>3</sup>, Mandya Siddalingaiah Rajanna<sup>4</sup>

<sup>1</sup>Rajiv Gandhi Institute of Public Health and Centre for Disease Control, Bangalore, Karnataka, India

<sup>2</sup>Department of Epidemiology, WHO Collaborating Centre for Injury Prevention and Safety promotion, Centre for Public Health, National Institute of Mental Health & Neuro Sciences, Bangalore, Karnataka, India

<sup>3</sup>Community Medicine, Sree Siddhartha Medical College, Tumkur, Karnataka, India

<sup>4</sup>Department of Community Medicine, Sree Siddhartha Medical College, Tumkur, Karnataka, India

\*Corresponding author: Pallavi Sarji Uthkarsh

Address: Associate Professor of Department of Community Medicine, Sree Siddhartha Medical College, Tumkur, Karnataka, India.

Tel: +91-9945232944

e-mail: pallavisarji@yahoo.com

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### ► ABSTRACT

**Objective:** To assess the availability of trauma care services in a district referral hospital of Southern India.

**Methods:** This was a cross-sectional study being performed during 2013 in a tertiary healthcare centre in Southern Indian. A detailed assessment of trauma care services was done in a 400 bed speciality hospital which is an apex referral hospital in the public health system using a check list based on WHO guidelines for evaluation of essential trauma care services, along with in-depth interviews of hospital stake holders and key informants.

**Results:** The hospital had physical infrastructure in terms of emergency room, inpatient wards, operation theatres, intensive care unit and blood bank facilities. The recently constructed designated building for trauma care services was not operational and existing facilities were used beyond capacity. A designated trauma team was lacking and speciality services for managing polytrauma were deficient and thus, existing personnel were performing multiple tasks. Neurosurgeons and rehabilitative nursing staff were unavailable, and a radiographer was not available on a 24/7 basis. Existing nursing personnel had not received any formal training in trauma care and standard operating protocols were not available for trauma care. Resources for acute resuscitation were partially adequate. The hospital lacked adequate resources to manage head, abdomen, chest and spine injuries, and most of the polytrauma cases were referred to nearby city hospitals.

**Conclusion:** District hospital, the only referral hospital in public health system for trauma victims of that region, had inadequate resources to manage trauma victims, which was probably responsible for delay in trauma care, improper referrals, high cost of care and poor outcomes.

**Keywords:** Health care facilities; Manpower; Services; Emergency care; Injuries; India.

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### Introduction

Injuries result in death of 5.8 million people each year, which accounts for 10% of the world's deaths,

32% more than the number of fatalities that result from malaria, tuberculosis, and HIV/AIDS combined [1]. World Health Organization (WHO) has predicted that trauma related deaths will move from ninth

position to the third position by 2020 [2]. More than 90% of the injury related deaths occur in low and middle income resource settings where prevention programmes and trauma care services are deficient [3]. In India, injury and violence accounts for nearly 10% of all-cause mortality [4]. Further, for every reported injury death, nearly 30-50 persons seek hospital services, thus placing a huge burden on health care systems [5].

People with life-threatening, but potentially treatable injuries are up to six times more likely to die in a country with no organized trauma systems than in one with an organized and well-resourced trauma system [6]. Well-organized trauma systems have decreased mortality among treated trauma patients by 15%–20% and decreased medically preventable deaths by 50% in High Income countries (HIC) [7]. Trauma care in Low and Middle Income countries (LMICs) like India have not been well established and according to an estimate nearly 2 million lives could be saved each year if these countries were to have the same level of trauma care as the developed world [8].

World Health Organization, in its *Guidelines for Essential Trauma Care* sets forth 14 core essential trauma care services that can reasonably be provided to every injured person in every country at different levels of health care systems from basic to advanced levels [9]. The objectives of the present study were to assess the infrastructure, equipment and supplies to provide essential trauma care in a district hospital and, to delineate the human resources and training needs of health care personnel to deliver essential trauma care.

## Materials and Methods

### Study Area

Tumkur district has a 400 bed district hospital, 4 community centres, 137 primary health centres and number of private hospitals and the study was done in the district hospital during the period from July to September 2013. District hospital is a level 3 trauma centre (according to Excerpt from Questionnaire in the Rajya Sabha. Answered by Shri Ghulam Nabi Azad, Ministry of Health and Family Welfare, Government of India. Question no.167; 2013 December) classified as speciality hospital [10] and is the only referral hospital for the district in a public health system catering to more than 6000 injury cases in a year.

### Study Protocol

The study protocol and medical ethical approval were obtained from Sri Siddharta Medical College ethical committee. Data was collected through a combination of direct facility inventory in the district hospital and in-depth interviews with key administrators and hospital stake holders using validated check lists. Checklist was prepared by referring, tool for evaluation of trauma centers from NIHF (National Institute of Health And

Family Welfare) India and WHO guidelines for essential Trauma care. Check list for human resource comprised the number and availability of different administrative, supportive and specialist professionals for regular and round the clock emergency services and their average response time if on call. It also assessed the composition and availability of trauma team, along with their training and frequency of up gradation of knowledge and skills in trauma care by attending CME (continued Medical education).

The check list for physical inventory was constructed using WHO guidelines for essential trauma care for the speciality hospitals. As India is a middle-income country, both essential and desirable items were included in the checklist. Essential items are those that should be provided to all the injured at the level of health facility concerned in any country. Desirable items are those that add value but are not as cost-effective and are more applicable to middle-income environments/centers with high trauma load [9]. It comprised list of all essential and desirable items applicable for trauma care in a district hospital setting to address airway resuscitation, breathing and circulation, managing specific injuries, operation theatre, blood bank, diagnostic facilities and rehabilitation services. Supplies and services for the safety of health care personnel, at hospital is also collected using a checklist.

### Site Visit Process

Two of the authors (PSU and SSR) were present for site visit to district hospital, each visit lasted between 3-4 hours. The visits were conducted between July to September 2013 to inspect facilities and equipments. Nearly 7-10 visits have been made, which included visits to outpatient department, casualty, operation theatres, ICUs, blood bank, wards, radiography unit, store house and rehabilitation unit.

### One to One Interviews

One to one interviews of hospital administrative heads, chiefs of surgery, orthopaedics, and other relevant specialties, emergency room medical officers, nursing staff, ambulance staff, other clinicians (doctors and nurses) on duty in the casualty, intensive care unit (ICU), and hospital wards were conducted by two of the authors (PSU and SSR) using an open ended questionnaire along with a check list after obtaining informed consent to know the availability of resources for providing resuscitation and treatment of specific injuries (head, chest, abdomen, spine, extremities, burns and paediatric injuries) and difficulties experienced in providing trauma care at district hospital. The district health officer who is in charge administration of district hospital was interviewed to know the composition and availability of trauma care staff, training of such staff in trauma care, percentage of trauma care providers credentialed in continued medical education (CME) related to trauma care, trauma

communication, maintenance of trauma registry, medical audit or any quality improvement programs, staffing and training of staff at rehabilitative section, use of telemedicine and usage of standard treatment protocol to treat trauma patients and referral pattern. The interviews were audio recorded and transcribed.

Availability of trauma care resources was assessed through direct observations and one to one interviews using the validated checklists were grouped as following;

- **Absent: 0**
- **Inadequate: 1** (Less than half of those who need this service or item receive it when needed)
- **Partly adequate: 2** (Most, but not all, of those who need this service or item receive it when needed)
- **Adequate: 3** (Virtually all of those who need this service or item receive it when needed) [7].

## Results

### Human Resources

#### Staffing Pattern

The district hospital has total staff strength of 138 sanctioned posts in which 98 were filled resulting in a deficiency of 29% of human resources. In the existing posts, those of orthopaedicians and general surgeons were less than required, while that of a neurosurgeon was absent. Nevertheless, at least one specialist in orthopaedics and surgery was available on 24/7 call with a response time of 15-20 minutes. Only one anaesthetist and rehabilitation specialist were in place (Table 1). Other staff like senior staff nurses, nursing attendants, occupation therapy (OT) technicians, lab technicians and radiographer were also less than the sanctioned number. Further, radiographers and OT technicians were reported not to be available during evening and late night hours

in the hospital. The emergency room did not have designated casualty doctor(s) or casualty nursing staff. In the emergency room and in the hospital as a whole, there was no dedicated and designated trauma team; however, general surgeons, orthopaedicians, anaesthetists and other doctors of various disciplines and departments worked in co-ordination and on rotation based on the service needs of the injured person at the time of contact.

### Training

All existing Specialists (anaesthetists, orthopaedicians and surgeons) were trained in Advanced Trauma Life Support course. Only one anaesthetist had attended CME programme related to trauma care. Nursing staff had not undergone any official certified training in Basic Trauma Life Support skills but anaesthetists had held an informal training for nursing staff to teach trauma skills. All the nursing staffs were well versed with the knowledge and skills of ventilation but only anaesthetists were confident of intubation in emergency cases.

### Physical Resources

The hospital has 1 emergency room and 6 operation theatres (1 each for Surgery, Orthopaedics, Ophthalmology, Ear Nose and Throat, Obstetrics and Gynaecology and Tubectomy). There are 22 wards with 24 beds in each ward, which includes the Intensive Care Unit (6 beds), Neonatal Intensive care unit (NICU), Ophthalmology ward (5 beds), Special ward (8 beds), Dialysis ward, Nutritional Rehabilitation Centre (10 beds), Tuberculosis ward (5 beds) and Paediatric Intensive Care Unit with 16 warmers and a provision for 5 phototherapy units. The hospital has separate surgical (29 beds for females and 24 / 26 beds for males), orthopaedic (13 beds for

**Table 1.** Manpower availability in district hospital of Southern India for trauma care.

Designation	Sanctioned	In Position	Available in house 24/7	Available on call 24/7	If on call, What's the response time?
General Surgeon	4	2	-	1	15 min
Orthopaedic Surgeon	3	3	-	1	15-20 min
Anaesthetist	3	3	-	1 (with an OPD <sup>a</sup> on the same day)	15 min
Casualty Medical officers	4	0	-	0	On rotation every doctor is posted as CMO <sup>b</sup> every day
Senior Staff Nurses	25	11	4	-	
Nursing Attendant	82	65	11	-	
O.T. Technician	5	4	Available only till 4 PM		
Lab. Technician	7	6	Available only till 4 PM		
Radiographer	2	1	Available only till 4 PM		
Whether Gen. Surgeon trained in Neurosurgery?	0	0	-	-	-
Physical medicine and rehabilitation specialist	3	3	-	-	-
Specialized rehabilitative nursing staff	0	0	-	-	

<sup>a</sup>OPD: Outpatient Department; <sup>b</sup>CMO: Chief Medical Officer; <sup>c</sup>OT: Occupation Therapy

females and 24 beds for males) and a 10 bedded burns ward along with a blood bank and a rehabilitation unit.

District hospital has a separate trauma center constructed exclusively for trauma care that was sanctioned and funded during the 11th five year plan period. Though the physical infrastructure was completely ready by the end of 2011, it is still not functional, and hence lies unused. Consequently, the district hospital common emergency room and other facilities are used for triage and treatment and is common to all emergencies.

### Resources for Acute Resuscitation

Resources to establish airway were partially adequate (Table 2) as endotracheal tubes were not available in the emergency room and had to be brought from the operation theatres. Intubation was always done by an anaesthetist; hence, the entire process was dependant on the availability of an anaesthetist. Oxygen cylinders, suction tubes were also partially adequate, and hospital did not have supply of pulse oximeters. There was adequate availability of crystalloids, intravenous infusion sets and urinary catheters. ECG facilities were partially adequate. Facilities for lactic acid determination and fluid warmer were absent. Blood bank attached to the hospital had adequate availability of all the blood types to manage trauma emergencies.

**Table 2.** Equipment and supplies for acute resuscitation of trauma victims in the district hospital in southern India.

Equipment	Availability <sup>a</sup>
<b>Airway</b>	
Oral and nasal airway devices	2
Suction device	2
Yankauer or other stiff suction tip	2
Laryngoscope and Endotracheal tubes	2
<b>Breathing</b>	
Stethoscope	3
Oxygen supply	3
Chest tubes	3
Pulse oximetry	3
Arterial blood gas determinations	0
Bag-valve-mask	0
Mechanical ventilator	3
<b>Circulation</b>	
Blood pressure cuff	3
Crystalloid	3
Blood transfusion capability	3
Urinary catheter	3
Electronic cardiac monitoring	2
Hemoglobin determination	3
Electrolyte determination	3
Lactic acid determination	0
Fluid warmer	0

<sup>a</sup>The ratings are as follows: 0 (absent), 1 (inadequate; fewer than half of those who need this service or item receive it when needed), 2 (partly adequate; most but not all of those who need this service or item receive it when needed), and 3 (adequate; virtually all of those who need this service or item receive it when needed).

### Resources for Management of Specific Injuries

Towards management of specific injuries like brain and spinal injuries, abdominal and chest injuries that are common among polytrauma patients, the hospital did not have any facilities and resources (Table 3); consequently all these patients were usually referred to the neighbouring city of Bangalore at a distance of 80 kilometres. Adequate equipments were available only to manage uncomplicated extremity injuries. Observations and interview with hospital staff revealed that all poly-trauma patients, complicated injuries due to other injuries like falls, burns, poisoning and others were referred; however, it was gratifying to note that before referral, patients were stabilised with interventions such as airway management including endotracheal intubation, fluid resuscitation and damage control surgery were performed. Staff reported that written protocols to handle general trauma, penetrating trauma or paediatric injuries were unavailable except for brain injuries.

**Table 3.** Resources for management of specific injuries at the district hospital in southern India.

Physical resources to manage specific injuries	Availability <sup>a</sup>
<b>Head</b>	
Computerized axial tomography	0
Operative neurosurgical capabilities	0
Intracranial pressure monitoring	0
Full compliance with AANS guidelines for head injury	0
Operative capabilities for neck injuries	0
<b>Chest</b>	
Auto Infusion from chest tubes	0
Operative capabilities for intermediate thoracotomy	0
Operative capabilities for advanced thoracotomy	0
<b>Abdomen</b>	
Contrast radiography for oesophageal injuries	0
Diagnostic peritoneal lavage	0
Ultrasound	3
Mobile Ultrasound	2
Operative capabilities for laparotomy	3
<b>Extremity</b>	
Skeletal traction	3
External fixation	3
Internal fixation	3
Portable radiography	0
Image intensification limb prosthetics	0
<b>Spine</b>	
Operative capabilities for spine management	0
Computerised axial Tomography scan (CT) and Magnetic Resonance imaging (MRI)	0
<b>Burns and wounds</b>	
Topical antibiotic dressings Skin grafting	3
Tetanus prophylaxis (toxoid and antiserum)	3
Medications	3

<sup>a</sup>The ratings in the table are: 0 (absent), 1 (inadequate; fewer than half of those who need this service or item receive it when needed), 2 (partly adequate; most but not all of those who need this service or item receive it when needed), and 3 (adequate; virtually all of those who need this service or item receive it when needed).

Resources to manage wounds in terms of topical dressings, trauma-related medications, especially antibiotics and analgesics were adequate except suture materials, which patients/relatives were asked to buy from the pharmacy. Antibiotics, analgesics and dressings to manage burns were available. Radiological services were limited up to 4 pm due to non-availability of radiographers even though ultrasound and facilities for emergency laparotomy were adequate and portable radiography facility was available. However, there were inadequate radiography ay films.

#### *Pre-Hospital Services*

Interview with ambulance personnel revealed that the all 108 ambulances were well equipped and did not have difficulty in managing emergencies at the field level or during transport. Most common pre hospital care provided was intravenous fluids and wound care. As per the directives to ambulance personnel, trauma patients would be first taken to the district hospital or to the preferred choice of the attendants. However, it was reported that there was no communication between ambulance personnel/referring hospitals and trauma team of the district hospital. Any type of pre hospital information about the arrival of trauma patient was not received by the hospital team that resulted in unpreparedness of the existing team in managing emergencies.

#### *Rehabilitation Facilities*

The rehabilitation department of district hospital had three physiotherapists and speciality staff like speech therapists and nursing staff were not there. Services provided included physical rehabilitation, mobility exercises (using Parallel Bars), teaching patients various physical exercises, gait training, postural maintenance and strengthening exercises (using dumb bells). As reported by staff, nearly half of the injured patients had dropped out after the first contact and continuity of care was found to be lacking.

#### *Safety of Health Personnel*

All personnel in the district hospital had been trained through several rounds of internal training on universal precautions. Supplies for antiretroviral and post exposure prophylaxis were adequate. However, deficiencies were noticed with regard to availability of gloves and goggles, while improvements were required with regards to waste disposal within the hospital.

#### *Administration and Injury Surveillance*

The District Health Officer is the person in charge of all administrative activities of the hospital and the Head of Orthopaedic department is in charge of the trauma care centre that was yet to become functional. Information system with regard to trauma and injuries was very weak and no systems were in place. The information collected was in tune with clinical and legal requirements and there were no injury surveillance systems or trauma registries. The previous district injury surveillance programme (a collaborative programme of NIMHANS and SSMC) demonstrated the feasibility of such a programme, but had been discontinued due to financial and operational reasons. The hospital had a record showing the number of injury admissions and type of injury without any injury scoring system. Even though large amounts of information was collected as per existing procedures, the information was not analysed and utilised due to lack of skilled and trained personnel. Hospital did not have any separate trauma related quality improvement program (Table 4).

#### **Discussion**

India's Public Health System has developed over the years as a 3-tier system, namely primary, secondary and tertiary level of health care. A District Health System is the fundamental administrative unit for implementing all health care programmes. All 642 districts in India has a district hospital functioning as a tertiary centre linked with the public hospitals/health centres below the district and is a major provider of trauma care services. Several studies including the million-death study [5,11,12] reported that nearly half of deaths occurred in rural India where trauma care is deficient. The district injury surveillance program [13] in Tumkur district, revealed that injuries are a major public health problem with an annual mortality rate of 18.1/100,000/year, much higher than the national and state rate (11.8 and 16/100,000/year, respectively) (NCRB, 2012; Government of India (GoI), 2011) [10,14]. RTIs were the leading problem and accounted for more than a third of all injuries similar to previous reports [15]. Two out of three deaths occurred during transport of the injured to the hospital or in the hospital and nearly one out of four cases reaching the district hospital had poly trauma necessitating the need for appropriate care in district level hospitals [11]. To the best of our knowledge this is the first study undertaken to assess the trauma care service of a district hospital that is a level 3 trauma

**Table 4.** Administrative and organizational functions at the district hospital at southern India.

<b>Administrative and organizational functions at hospital</b>	<b>Yes or No?</b>
Trauma-related quality improvement program	No
Trauma cases integrated into broader improvement programs	No
Trauma registry with severity adjustment	No
Trauma team with pre-assigned roles in acute resuscitations	No

centre using WHO guidelines for essential trauma care in Karnataka, India.

An acute paucity of both general and specialist human resources burdened the existing health care providers, to maintain outpatient, inpatient, emergency service and operating wards duties and responsibilities. Paucity of time and overburdened duty were barriers for the staff to upgrade their knowledge and skills in trauma care through continued education programs. In contrast to study by Mock *et al.*, [16] where the non-availability and high costs of trauma care training as a prohibitive factor contributing for their lack of interest to undergo training. All the specialists were trained in ATLS in contrast to study in Chennai [17] and Lucknow [18] but the nurses' lack certified training in trauma care. Training entire medical staff including paramedical in basic trauma life support skills is essential to improve trauma outcome [19-21].

Lack of trauma team, communication between ambulance and hospital staff and standardised treatment protocol is a area of concern similar to other studies in LMICS [22-25] as pre assigned roles for team members and protocols to assure rapid assembly and efficient team functioning have led to improved care in developed countries and some LMICs [26,27]. Separate trauma care centre constructed beside the district hospital is currently not functional due to lack of manpower. In recent times, the MOHFW has built several trauma care centres along national and state highways throughout the country [28] However, informal reviews and anecdotal reports indicate the suboptimal utilisation of these facilities, thus emphasizing that the establishment of innumerable trauma centers with heavy financial burden should not be the goal, while upgrading existing facilities to treat severely injured patients is an immediate need [21].

The present study also identified the inadequacy in equipments needed for airway resuscitation and wound care similar to studies from LMICS [23,29]. The earlier study and the ambulance data showed that polytrauma was commonly seen in nearly a third of patients [12]. As per the ambulance register nearly 35% were head injury cases, 25% were limb injuries and <5% being injury to chest and abdomen. To manage such cases, there was inadequacy in manpower and equipment availability to make emergency diagnosis and initiate treatment (staff in charge of the X-ray unit was not available after 4pm) similar to the observations from other studies [9,23,30,31]. There was a shortage of films for the portable x-ray and few staff even mentioned inadequacy of plaster of paris supply to fix the fracture. A studies done in Chennai and Kerala (unpublished data 2009) showed tremendous variability in the availability of medical equipment in emergency departments [17,23]. These inadequacies coupled with the fact that the existing trauma care centre was yet to be operationalised resulted in

referral of many injured patients to the nearby city of Bangalore and making them visit more than one hospital before seeking definitive care. Rehabilitation was mainly limited to physiotherapy and providing prosthesis even though it is an integral element of any trauma-care system and there were no facilities for occupational rehabilitation and psychological counselling [28].

The much required trauma related data was not available in the district hospital and paper based formats focussing on legal and procedural details was the common practice. Absence of digital information systems, staff to undertake information collection, lack of human and financial resources and absence of skills [32,33] among existing staff to analyse and interpret data, lack of standardised and uniform hospital data formats, limited availability of electronic data storage and retrieval facilities, inadequate funding and an overall lack of interest were some contributing factors for the lack of information. District hospital did not have any quality improvement program which have been shown to be valuable administrative tools to strengthen the care of severely injured [27,34-37].

Though the study limited to assessment of trauma service of a district hospital, it provides an insight in to the trauma care service of that particular district ,as district has no formal prehospital care system and district hospital is the only first contact definitive care hospital to majority of trauma cases in that district in a public sector. There is a greater need to strengthen pre hospital and in-hospital care in district hospital by augmenting trained and skilled human resources, strengthening physical infrastructure, improving essential supplies, better coordination between ambulance and hospital teams, establishing injury surveillance or trauma registries and implementing trauma care protocols. Improving trauma care in district hospitals is very essential to save lives and prevent disabilities.

In conclusion, current study highlighted inadequacy in human and physical resources, lack of communication and coordination between ambulance and hospital staff, lack of designated trauma team with pre assigned roles, lack of importance towards maintenance of trauma registry and trauma quality improvement program as major lacunae in providing essential trauma care at a district hospital setting in India.

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