



## **Demographic Distribution of Trauma Induced Coagulopathy in Polytrauma Patients: An Institute Based Experience in North East India**

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**Conflicts of Interest:** Nil

### **Introduction**

Trauma is a serious global health problem, accounting for approximately 1 in 10 deaths worldwide<sup>1</sup> Shock, hemorrhage and associated injuries are the usual complications which accompany trauma<sup>2</sup>

In the context of assessment of mortality and morbidity related to trauma, the term “polytrauma” adds a new dimension. Polytrauma or multiple injuries are more than the sum of the individual injuries<sup>3</sup>

Patients with polytrauma tend to develop coagulation disorder, known as trauma induced coagulopathy(TIC). TIC is defined as an endogenous hyper coagulation condition that is seen in the first hour after trauma, or in the immediate post-traumatic period.<sup>4</sup>

In 1969, Simmons RL et al <sup>5</sup>were the first to report a relationship between shock and prolonged prothrombin

time (PT) and partial thromboplastin time (PTT) in combat trauma patients during the Veitnam War

One quarter of trauma patients have laboratory-based evidence of trauma-induced coagulopathy (TIC), which is linked to worse outcomes, including higher mortality, despite a significant upregulation of procoagulant mechanisms.<sup>6</sup>

This study is carried out keeping in mind the dearth of information on poly trauma patients with trauma induced coagulopathy and its relevance in management.

### **Aims and Objectives**

1. To find the prevalence of trauma induced coagulopathy in polytrauma patients in North East India
2. To find out the demographic distribution of trauma induced coagulopathy in polytrauma patients and it’s outcome.

## **Selection of Patients**

### **Inclusion Criteria**

All patients of both sexes above the age of 18 years presenting to the emergency department with history of polytrauma were included in the study.

### **Exclusion Criteria**

1. Age less than 18 years.
2. Patients with burn injuries.
3. Patients on anticoagulant/anti platelet therapy.
4. Pregnancy

### **Materials and Methods**

The study was conducted with the approval of the Ethical Committee, GMCH between 1st June 2021 to 31st May 2022 at Gauhati Medical College and Hospital under the Department of Emergency Medicine. Patients were enrolled for the study after obtaining written and informed consent.

### **Sample Size**

Patients attending the emergency department at Guwahati medical college and hospital, Gauhati during the period of 1st June, 2021 to 31st May, 2022 who satisfied the inclusion and exclusion criteria constituted the sample. It was a hospital based prospective observational study. A total of 103 patients were included for the study.

### **Methodology**

Patients were managed as per the ATLS guidelines starting with the primary survey & initial resuscitations, which were followed by detailed secondary survey including history taking & head to toe clinical examination, complemented with necessary haematological, biochemical & radiological investigations. Relevant notes on demographics, mechanism of injury, time of injury & rescue time, any

prehospital care received or not, details of the organ wise injury were taken meticulously.

In every case, a thorough record was kept regarding infused fluid amount for initial resuscitation in Emergency department, vasopressor dose & duration (if any) & number & type of the each of the blood products transfused.

Final outcome of the patients were carefully noted by follow up survey. In case of mortality, documented cause of death and approximate timing since arrival were noted. Patients who survived, overall hospital stay and final diagnosis and condition during discharge were noted properly and followed up.

### **Results and Observation**

In the present study design, incidence of trauma induced coagulopathy was found in 80(77.70%) patients out of the total 103 polytrauma study population

The mean age of the polytrauma study population is  $38.93 \pm 13.19$  years. The mean age in male is  $42.32 \pm 14$  years while the mean age in female is  $32.34 \pm 8.24$  years. The age range varied from 20-73 years.

The mean age of the polytrauma patients developing TIC is  $39.06 \pm 12.06$  years. The mean age of polytrauma induced TIC in males is  $40.61 \pm 9.2$  years while that of females is  $31.62 \pm 7.78$  years.

In the present study, out of 103 polytrauma patients, 68 patients were male (66%) and 35 patients were female (34%). Out of the 68 males, 54 (67.50%) developed TIC while out of 35 females, 26 (34%) developed TIC. In our study, commonest mode of injury noted was road traffic accident in 81 patients (78.6%) of which 61 patients (76.30%) developed TIC, followed by fall from height in 10 patients (9.7%) of which 9 patients (11.30%) developed TIC. 2.50% developed TIC 8 patients were cases of physical assault (7.8%) of which 7 patients (8.80%)

developed TIC while 4 patients were of heavy landslides (3.9%) of which 3 patients (3.8%) developed TIC in the study population.

In the present study, only 4 patients (3.9%) arrived within 1 hour of injury while majority of the cases i.e.43 cases (41.70%) could reach the hospital within 4-12 hours.

Correspondingly, TIC developed maximum in poly patients presenting within 4-12 hour i.e.42.50%

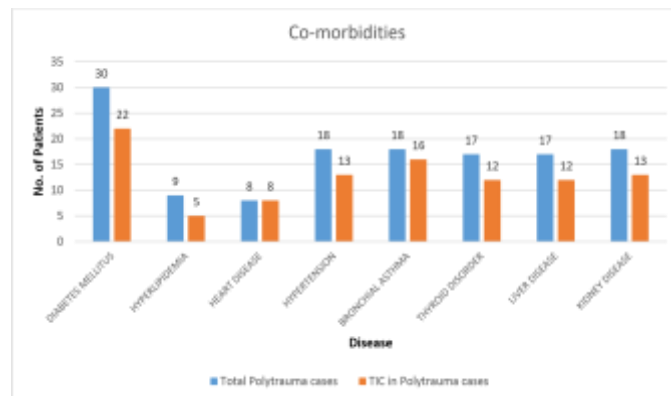
Table 1: Table Showing Duration of Presentation among Study Population

Time Presentation		Total Polytrauma cases	TIC in polytrauma cases
Onset To 1 Hour	N	4	3
	%	3.90%	3.80%
1-3 Hour	N	19	16
	%	18.40%	20.00%
>3 Hour To 4.5 Hour	N	10	8
	%	9.70%	10.00%
>4.5 Hour To 12 Hour	N	43	34
	%	41.70%	42.50%
13- 24 Hour	N	11	7
	%	10.70%	8.80%
>24 Hour	N	16	12
	%	15.50%	15.00%
Total	N	103	80
	%	100.00%	100.00%

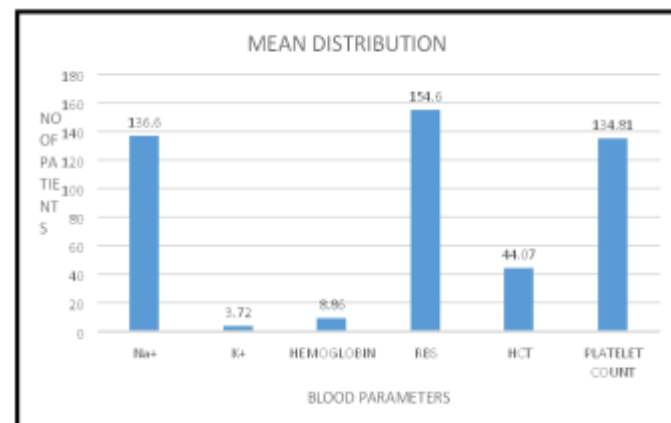
In the present study, most of the patients had more than 2 organ involvement where the maximum organ injured was head injury (47.6%) in 49 patients of which 41 cases (51.30%) developed TIC; followed by neck injury(43.7%) in 45 patients of which 33 patients(41.30%) developed TIC. The incidence of

injury to abdomen, upper extremities, lower extremities, external injury had similar percentage.ie.39.8% in 41 patients of which 31 patients (38.80%) developed TIC. Facial region was least involved in 25 patients (25.3%) of which 23 patients (28.80%) developed TIC.

**Distribution of Co Morbidities**



Graph 1: Bar Diagram Showing Distribution of Co Morbidities



Graph 2: Bar Diagram Showing Mean Distribution of Blood Parameters (On Arrival)

**a) Prothrombin Time**

Prothrombin time was measured on arrival, at 12 hours and 24-hour interval and the mean value is 14.99±10.24,13.59±2.70 and 15.34±3.66 respectively.

Table 2: Table Showing Prothrombin Time at Different Time Interval

Various Time Interval

Prothrombin Time	Mean	Standard Deviation
On Arrival	14.99	10.24
At 12 Hours	13.59	2.70
At 24 Hours	15.34	3.66

**International Normalized Ratio (INR)**

INR was measured on arrival, at 12 hours and 24-hour interval and the mean value is  $0.89 \pm 0.41$ ,  $1.07 \pm 0.40$  and  $1.43 \pm 0.39$  respectively.

Table 3: Table Showing INR at Various Time Interval

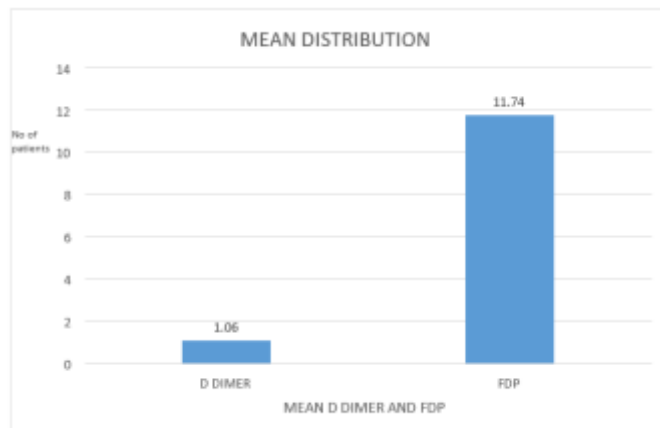
INR	Mean	Standard Deviation
On Arrival	0.89	0.41
At 12 Hours	1.07	0.40
At 24 Hours	1.43	0.39

**Activated Partial Thromboplastin Clotting Time**

aPTT was measured on arrival, at 12 hours and 24-hour interval and the mean value is  $38.54 \pm 9.30$ ,  $42.00 \pm 9.97$  and  $43.54 \pm 11.68$  respectively.

Table 4: Table Showing Aptt at Various Time Interval

Aptt	Mean	Standard Deviation
On Arrival	38.54	9.30
At 12 Hours	42.00	9.97
At 24 Hours	43.54	11.68



Graph 3: Bar Diagram Showing Mean Distribution of D Dimer and FDP

**Complications**

Most common complication seen in the present polytrauma study population was MODS [TIC developed in 38(47.50%) out of 50(48.5%) cases] followed by Haemorrhagic shock [TIC in 31(36.8%) out of 40(38.8%) cases], DIC, PE, SEPSIS [16(20.0%) out of 21(20.40%) cases each] and respiratory failure [8 (8.7%) of 9 (10.0%) cases] of the population

**Outcome**

Of the total overall study population, 72 patients (69.9%) expired while 31 patients survived (30.09%)

Table 5: Table Showing Outcome in The Study Population

Outcome	Number Of Patients	Percentage (%)
Survived	31	30.09
Expired	72	69.9
Total	103	100

**Outcome of Trauma Induced Coagulopathy**

Of the total 103 polytrauma study population, 80 patients developed trauma induced coagulopathy while 23 patients did not develop trauma induced

coagulopathy. Among the 80 TIC patients, 64 expired while 16 patients survived.

**Discussion**

In the present study design, incidence of trauma induced coagulopathy was found in 80(77.70%) patients out of the total 103 polytrauma study population. This study is comparable with Puranik et al<sup>2</sup> and Mujuni et al<sup>7</sup> who reported a greater number of coagulopathic patients in their polytrauma study population

In most of the studies on polytrauma have shown the prevalence of trauma induced coagulopathy more in males compared to females. In the present study, polytrauma comprised of 66% (n=68) males and 34%(n=35) females of the polytrauma study population, TIC developed in 54 males (67.5%) and 26 females (32.5%). This reflects the fact that males are more prone to polytrauma as they are predominantly outdoor workers with the risk of hazards of road traffic accidents, assaults and other injuries more than females.

Similar observation noted in other studies are as follows-  
 Table 6: Comparison of Sex Distribution of Tic of The Study population with Different Studies

Sex	Gioffree et al. <sup>8</sup>	Fawzy et al. <sup>9</sup>	Macleod et al. <sup>10</sup>	Mica et al. <sup>11</sup>	Present Study
Male(%)	38.3%	82%	76.2%	48.7%	54%
Female(%)	61.7%	18%	23.8%	16.4%	26%

**Age Distribution**

In the present study, the peak incidence of trauma induced coagulopathy in polytrauma patients was in fourth decade (41.3%). The mean age was 39.06 years with standard deviation of 12.06. The reason behind such observation could be that the third and fourth decade are more of the working population and are more

active, thus are more vulnerable to accidents and injuries and later develop coagulopathic disorders.

The under mentioned table shows the comparison of our study with different other studies-

Table 7: Age Distribution of Tic In The Study Population Compared To Other Studies

Study	Mean Age
Puranik et al <sup>2</sup>	38.92 ± 17.81 years
Mica et al <sup>11</sup>	41.4 ± 17.9 years
Milton et al <sup>12</sup>	36.5 ± 14.4 years
Present study	39.06 ± 12.06 years

**Mode of Injury**

In our study, most common mode of injury is road traffic accidents (RTA) where TIC comprised of 76.30% of the total cases followed by fall from height 11.30%, physical assault 8.80% and heavy landslides comprising of 3.80% of the cases. Higher number of road traffic accidents can be due to increase in population, poor implementation of traffic rules and regulations, high speed vehicles, harsh driving and alcohol abuse.

Similar studies done by Mujuni et al<sup>7</sup> Milton et al.<sup>12</sup> and Abhilash et al.<sup>13</sup> found that road traffic accidents are relatively more common in causing polytrauma and in return trauma induced coagulopathy.

**Time of Trauma to Ed Presentation**

The duration from trauma to presentation in emergency is crucial. It is crucial to bring patients to a trauma centre within the first 60 minutes after a trauma, a time frame known as the "golden hour." This idea is fundamental to trauma systems, field triage recommendations, emergency medical services, and the treatment of trauma patients in emergency rooms.

In the present study, 4 polytrauma cases could present to the emergency within 1 hour injury of which 3 cases

developed TIC while maximum cases arrived post 12 hours contributing to the propensity of coagulopathy relatively higher with late presentation.

Lustenbeger et al<sup>14</sup> observed in his study the development of coagulopathy within 12 hours in 45% of patients and 24 hours in 65% of patients. Chambers et al observed in his study of 52 patients where 75% became coagulopathic within the 1<sup>st</sup> 2 hour of presentation.<sup>15</sup>

### Organ Involvement in Polytrauma Injuries

In the present study, most of the patients had more than 2 organ involvement where the maximum organ injured was head injury (47.6%) in 49 patients of which 41 cases (51.30%) developed TIC; followed by neck injury (43.7%) in 45 patients of which 33 patients (41.30%) developed TIC. The incidence of injury to abdomen, upper extremities, lower extremities, external injury had similar percentage. ie. 39.8% in 41 patients of which 31 patients (38.80%) developed TIC.

The least organ involvement was the face region (25.3%) in 25 patients of which 23 patients (28.80%) developed TIC.

### Organ Injured in Polytrauma Leading to Tic Compared to Other Studies-

Author	Year	Organ Involvement
Paffrath et al <sup>16</sup>	2014	Head injury-68.7% Chest injury-16.7% Abdominal injury- 5.6%

### Complications

Most common complication seen in the present polytrauma study population was MODS [TIC developed in 38 (47.50%) out of 50 (48.5%) cases] followed by Haemorrhagic shock [TIC in 31 (36.8%) out of 40 (38.8%) Cases], DIC, PE, SEPSIS [16(20.0%) out of 21(20.40%) cases each] and

respiratory failure [8 (8.7%) of 9 (10.0%) cases] of the population.

### Complications Seen in Various Other Literature Are

References	Mods	Haemorr Hagic Shock	DIC	PE	SEPSIS	Respiratory Failure
Hodgson et al <sup>17</sup>	9%	15%	N/A	N/A	17%	6%
Tien et al <sup>18</sup>	5%	15%	N/A	N/A	N/A	N/A

### Outcome

Out of the total 103 patients, 80 patients developed trauma induced coagulopathy. Our findings are comparable with Mujuni et al<sup>7</sup> who also reported more number of coagulopathic patients in their studies. Maegele et al<sup>19</sup> Rugeri et al<sup>20</sup> and Shaz et al<sup>21</sup> reported slightly lower incidences. This may be due to differences in the characteristics of the study population and varying severity of trauma. Out of 80 TIC cases, 64 cases expired while 16 cases survived. Whereas 23 patients who did not develop TIC had good prognosis. Similar study done by brohi et<sup>22</sup> mujuni et al<sup>7</sup> and macleod et al<sup>23</sup> showed mortality was more in the coagulopathic group than in the non coagulopathic group. We found PT, INR and aPTT are predictors of mortality, while platelet count was not. Macleod et al<sup>23</sup> in their study, too, found that PT and aPTT were predictors of mortality.

### Conclusion

Trauma induced coagulopathy was commonly seen in male patients belonging to the young and middle age group where road traffic accident is the major mechanism of injury. Cases of TIC increased with more use of intoxicating substances, particularly in the young adult male group. When the value of coagulation profile increases, there is increase in the length of hospital stay, ICU stay, ventilation use and mortality. Conservative management is the mainstay of treatment. Incidence of

early trauma induced coagulopathy was more in patients with higher level of PT, INR and aPTT.

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