



Original Article

Chest Trauma Evaluation and Outcome of Management in a Tertiary Hospital - One Year Experience

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ABSTRACT

Background: Chest trauma is responsible for 50% of deaths due to trauma. This kind of death usually occurs immediately after the trauma has occurred. Various therapeutic options have been reported for management of chest injuries like clinical observation, thoracocentesis, tube thoracostomy and open thoracotomy.

Objective: To observe the pattern and outcome of management in chest trauma

Methods: This is an observational study carried out in Casualty department of Chittagong Medical College Hospital (CMCH), Chittagong, between April 2015 to March 2016. Our study was included all patients, both sexes, following chest injury at Casualty units of Chittagong Medical College Hospital. All the data were recorded through the preformed data collection sheet and analyzed.

Result: The mean age was found 37.7 ± 18.1 years with range from 12 to 80 years. Male female ratio was 11.8:1. The mean time elapsed after trauma was found 6.1 ± 3.1 hours with range from 1 to 72 hours. Almost one third (35.7%) patients was affecting road traffic accident followed by 42(27.3%) assault, 35(22.7%) stab injury, 15(9.7%) fall and 7(4.5%) gun shot. More than three fourth (80.5%) patients were managed by tube thoracostomy followed by 28(18.2%) observation and 2(1.3%) ventilatory support. No thoracotomy was done in emergency department. 42(27.2%) patients was found open pneumothorax followed by 41(26.6%) rib fracture, 31(20.1%) haemopneumothorax, 14(9%) simple pneumothorax, 12(7.8%) haemothorax, 6(3.9%) chest wall injury, 5(3.2%) tension pneumothorax, and 3(1.9%) flail chest. About the side of tube 60(39.0%) patients were given tube on left side followed by 57(37.0%) patients on right side, 9(5.8%) patients on both (left & right) side and 28(18.2%) patients needed no tube. Regarding the complications, 13(30%) patients had persistent haemothorax followed by 12(29%) tubes were placed outside triangle of safety, 6(13.9%) tubes were kinked, 6(13.9%) patients developed port site infection, 2(4.5%) tube was placed too shallow, 2(4.5%) patients developed empyema thoracis and 2(4.5%) patients developed broncho-pleural fistula. The mean ICT removal information was found 8.8 ± 3.6 days with range from 4 to 18 days. Re-insertion of ICT was done in 6(4.7%) patients. More than two third (68.2%) patients were recovered well, 43(27.9%) patients developed complication and 6(3.9%) patients died. More than two third (66.9%) patients had length of hospital stay 11-20 days.

Conclusion: Most of the patients were in 3rd decade and male predominant. Road traffic accident and tube thoracostomy were more common. Open pneumothorax, rib fracture and haemopneumothorax were commonest injuries. Nearly one third of the patients had developed complications. Re-insertion of ICT needed almost five percent and death almost four percent.

Key words: Chest trauma, Tube thoracostomy

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Introduction

Chest injuries are often life threatening. Chest injuries account for 25% of all trauma death¹. Despite of its severity, less than 10% of blunt chest injuries and 15%-30% of penetrating thoracic trauma require thoracotomy². Most patients are cared for with simple interventions such as tube thoracostomy³⁻⁶. Hippocrates was the first to report from chest

decompression in case of pleural empyema⁷. In 1978 Hewitt was the first to use a completely closed intercostal drainage system⁸. Many patients with chest injury can be managed non-operatively and the key is early physiological resuscitation followed by diagnosis. A reproducible and safe approach to diagnosis and management of chest injury is taught by the Advanced Trauma Life Support course. The life threatening injuries in case of chest injury are airway obstruction, tension pneumothorax, pericardial tamponade, open pneumothorax, massive haemothorax, flail chest etc. Efficient initial assessment should focus on identifying and correcting the immediate threats of life by using ATLS protocol. The management range from observation to tube thoracostomy, thoracotomy and ventilatory support. Patients have minor chest wall injuries, rib fractures without haemo/pneumothorax and mild lung contusion can be treated conservatively. Patients having blood or air in the pleura can be treated with tube thoracostomy. Initial management of life threatening thoracic injuries carried out according to type and nature of injury. In particular ATLS recommends that all traumatic pneumothoraces be treated by tube thoracostomy on the basis that any simple pneumothorax left untreated could convert into a life threatening tension pneumothorax. ATLS also recommends that acute haemothorax, sufficiently large to appear on chest radiograph, best treated with a chest drain. The drain evacuates blood, reduces the risk of clotted haemothorax and provides a means of continuously monitoring blood loss. In case of sucking chest wound (open pneumothorax) no attempt should be made to close the wound until tube thoracostomy is done⁹.

The purpose of the study is to observe the outcome of chest trauma and identify the factors related to mortality and morbidity regarding chest trauma in a tertiary hospital.

This is an observational study carried out at Casualty units in the Chittagong Medical College Hospital (CMCH) in Chittagong, Bangladesh from April 2015 to March 2016. All the data were recorded through the preformed data collection sheet. All patients, both sexes, following chest injury admitted at Casualty and Surgery Units of Chittagong Medical College Hospital were included. Sample size was 154 following chest injury at Casualty and Surgery units of Chittagong Medical College Hospital during study period.

The entire patients admitted with chest trauma were managed according to Advanced Trauma Life Support. Haemodynamically unstable patients, features of tension pneumothorax or open pneumothorax immediate tube thoracostomy was done on affected side. Haemodynamically stable patients were investigated on an emergency basis. Chest X-ray both A/P and Lateral view were mostly diagnostic. As soon as diagnosis has been made, decision was taken about type of management whether conservative or surgical procedure should be adopted.

Materials and Methods:

Study design: Observational study.

Place of study: The study was performed in Casualty units in the Chittagong Medical College Hospital (CMCH) in Chittagong, Bangladesh. The hospital is a 1313 bed tertiary referral hospital for Chittagong City and the surrounding districts covering around 10 million populations.

Study period: April 2015 to March 2016.

Study population: All patients, both sex, following chest injury at Casualty and Surgery units of Chittagong Medical College Hospital were included.

Sample size: Sample size was 154 following chest injury at Casualty and Surgery Units of Chittagong Medical College Hospital during study period.

Sampling technique: Purposive sampling

Selection criteria:

- i) **Inclusion criteria:** All patients admitted following chest injury at Casualty and Surgery units of Chittagong Medical College Hospital during study period.
- ii) **Exclusion criteria:** Poly-trauma e.g. Head injury, abdominal injury, limb fracture etc.

Chest trauma:

Chest trauma implies trauma to any or combination of different thoracic structures, which can arbitrarily be divided into 4 distinct anatomical regions i.e. the chest wall, the pleural space, the lung parenchyma and the mediastinum. It may be classified into blunt and open chest trauma.

Tube Thoracostomy:

Insertion of water seal drain tube into chest cavity through triangle of safety to drain out air, blood or any collection.

Statistical analysis

All the relevant data will be summarized in form of proportion and frequency table for categorical variables. Mean, median, mode, standard deviation were used to summarize continuous variables compile on a master chart first. Statistical analyses were carried out by using the Statistical Package for Social Sciences version 16.0 for Windows (SPSS Inc., Chicago, Illinois, USA). The quantitative observations were indicated by frequencies and percentages.

Results:

Table 1. *Distribution of the study patients by age (n=154)*

Age (years)	Number of patients	Percentage
d"20	29	18.8
21-30	46	29.9
31-40	23	14.9
41-50	19	12.3
51-60	19	12.3
61-70	13	8.4
>70	5	3.2
Mean±SD	32.7	±18.1
Range (min, max)	12	, 80

Table 1 shows age of the study patients, it was observed that almost one third (29.9%) patients belonged to age 21-30 years. The mean age was found 32.7±18.1 years with range from 12 to 80 years.

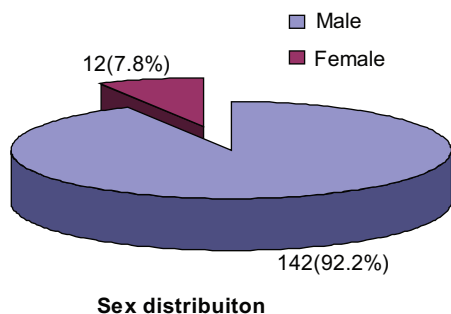


Figure 1. *Pie chart showing sex distribution of the patients.*

Figure 1 shows sex of the study patients, it was observed that majority (92.2%) patients were male and 12(7.8%) patients were female. Male female ratio was 11.8:1.

Table 2. *Distribution of the study patients by time elapsed after trauma (n=154)*

Time elapsed after trauma (hours)	Number of patients	Percentage
<6	33	21.4
6-12	112	72.7
13-24	3	1.9
>24	6	3.9
Mean±SD	6.1	±3.1
Range (min, max)	1	72

Table 2 shows time elapsed after trauma of the study patients, it was observed that majority (72.7%) patients were found elapsed after trauma 6-12 hours. The mean time elapsed after trauma was found 6.1±3.1 hours with range from 1 to 72 hours.

Table 3. *Distribution of the study patients by mechanism of injury (n=154)*

Mechanism of injury	Number of patients	Percentage
Blunt		
Road traffic accident	55	35.7
Assault	42	27.3
Fall	15	9.7
Penetrating		
Stab injury	35	22.7
Gun shoot	7	4.5

Table 3 shows mechanism of injury of the study patients, it was observed that more than one third 55(35.7%) patients was injured by road traffic accident followed by 42(27.3%) assault, 35(22.7%) stab injury, 15(9.7%) fall and 7(4.5%) gun shot injury.

Table 4. Distribution of the study patients by management (n=154)

Management	No. of patients	Percentage
Tube thoracostomy	124	80.5
Observation	28	18.2
Ventilator support with ICT	2	1.3
Thoracotomy	0	0.0

Table 4 shows management of the study patients, it was observed that more than three fourth (80.5%) patients was found tube thoracostomy followed by 28(18.2%) observation and 2(1.3%) ventilator support with ICT. No thoracotomy was done on emergency basis.

Table5 Distribution of the study patients by pattern of injury (n=154)

Pattern of injury	No. of patients	Percentage
Rib fracture	41	26.6
Haemopneumothorax	31	20.1
Open pneumothorax	42	27.2
Simple pneumothorax	14	9.0
Haemothorax	12	7.8
Chest wall injury	6	3.9
Tension pneumothorax	5	3.2
Flail chest	3	1.9

Table 5 shows pattern of injury of the study patients, it was observed that 42 (27.2%) patients were found open pneumothorax followed by 41(26.6%) rib fracture, 31(20.1%) haemopneumothorax, 14(9%) simple pneumothorax 12(7.8%) haemothorax, 6(3.9%) chest wall injury, 5(3.2%) tension pneumothorax, and 3(1.9%) flail chest.

Table 6 Distribution of the study patients by medical information (n=154)

Medical information	No. of patients	Percentage
Hypertension	25	16.2
Diabetes	16	10.4
Ischemic Heart Disease	4	2.6
Chronic obstructive pulmonary disease	0	0
Bronchial asthma	0	0
No concomitant disease	115	74.7

Table 6 shows medical information of the study patients, it was observed that 25(16.2%) patients had Hypertension, 16(10.4%) had Diabetes and 4(2.6%) had Ischemic Heart Disease.

Table 7 Distribution of the study patients by side of tube (n=154)

Side of tube	Number of patients	Percentage
Left side	60	39.0
Right side	57	37.0
Both side	9	5.8
Not given	28	18.2

Table7 shows side of tube the study patient, it was observed that 60(39.0%) patients given tube left side followed by 57(37.0%) right side, 9(5.8%) both (left & right) side and 28(18.2%) tube not given.

Table 8 Distribution of the study patients by complication (n=43)

Complication	No. of patients	Percentage
Persistent haemothorax	13	30.0
Improper position	12	29.0
Kinked /blocked tube	6	13.9
Port side infection	6	13.9
Too shallow	2	4.5
Empyema thoracic	2	4.5
Broncho-pleural fistula	2	4.5

Table 8 shows complication (total=43) of the study patients, it was observed that 13(30.0%) patients had persistent haemothorax followed by 12(29.0%) outside triangle, 6(13.9%) kinked/blocked, 6(13.9%) port side infection, 2(4.5%) too shallow, 2(4.5%) empyema thoracic and 2(4.5%) broncho-pleural fistula.

Table 9. Distribution of the study patients by ICT removal information (n=103)

ICT removal information (day)	No. of patients	Percentage
≤5	16	15.5
6-10	65	63.1
11-15	20	19.4
>15	2	1.9
Mean±SD		8.8±3.6
Range (min, max)		4, 18

Table 9 shows ICT removal information of the study patients, it was observed that almost in two third (63.1%) patient ICT removal was done in 6-10 days. The mean ICT removal was done in 8.8 ± 3.6 days with range from 4 to 18 days.

Table 10. Distribution of the study patients by re-insertion of ICT (n=126)

Re-insertion of ICT	No. of patients	Percentage
Needed	6	4.7
Not needed	120	95.3

Table 10 shows re-insertion of ICT of the study patients, it was observed that majority (95.3%) patients not needed re-insertion of ICT and 6(4.7%) needed re-insertion of ICT.

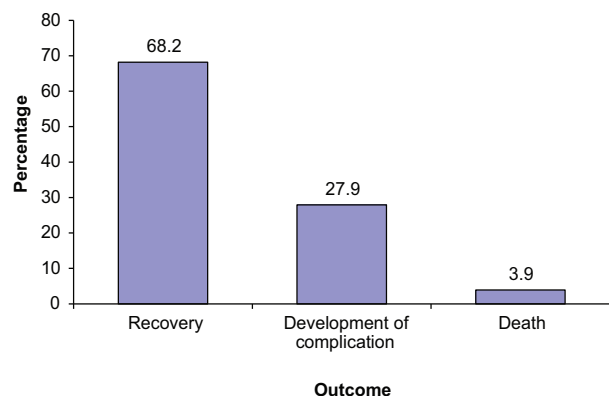


Figure 2. Bar diagram showing outcome of the patients

Figure 2 shows outcome of the study patients, it was observed that more than two third (68.2%) patients were recovered well, 43(27.9%) developed complication and 6(3.9%) patient died.

Table 11. Distribution of the study patients by length of hospital stay (n=148)

Length of hospital stay (day)	No. of patients	Percentage
≤ 10	99	66.9
11-20	43	29.1
>20	6	4.1
Mean \pm SD	11.0	± 8.6
Range (min, max)	1	, 39

*In 6 cases length of hospital stay was not done due to death.

Table 11 shows length of hospital stay of the study patient. it was observed that more than two third (66.9%) patients had length of hospital stay was less than 10 days. The mean length of hospital stay was found 11.0 ± 8.6 days with range from 1 to 39 days.

Discussion

This observational study was carried out with an aim to see the patterns of chest injury and to evaluate morbidity and mortality.

A total of 154 patients of both sex, following chest injury at Casualty units of Chittagong Medical College Hospital, Chittagong from April 2015 to March 2016 were included in this study. Poly-trauma e.g. Head injury, abdominal injury, limb fracture etc were excluded from the study. The present study findings were discussed and compared with previously published relevant studies.

In this present study, it was observed that almost one third (29.9%) patients were in 3rd decade and the mean age was found 32.7 ± 18.1 years with range from 12 to 80 years. Similarly, Khan et al¹³ found the mean age of patients in this study was 36 years with the range of 12-70 years, while Farooq et al¹⁰ shows 37 years and Hanif et al¹⁶ 30 years in their studies, which are comparable with the current study. Mohammadzadeh et al¹² found the mean age of the patients was 24.7 ± 3.1 years. The most frequent age group affected was 20-30 (35%) year old, which is lesser than the current study. On the other hand, Gabal et al¹⁴ found the mean age of the patients was 40 ± 1 years varied from 15-70 years, which is higher with the current study. Similarly, Bailey¹¹ also higher mean age in their study where they found the mean age was 43 years. This may be due to geographical variations, racial and ethnic differences and different lifestyle have influence on chest trauma.

In this current study, it was observed that majority (92.2%) patients were male and 7.8% patients were female. Male female ratio was 11.8:1, which is consistent with Mohammadzadeh et al.¹² study, where they found male was 80.0% and female 20.0%. Similarly, male predominant also observed by Khan et al¹³ and Bailey¹¹, this is probably due to male are more mobile with active participation in high risk tasking behavior.

In this series, the mean time elapsed after trauma was found 6.1 ± 3.1 hours with range from 1 to 72 hours which indicate a lack of pre-hospital management of trauma victims in our country.

In this study, it was observed that one third (35.7%) patients were affected by road traffic accident followed by 27.3% assault, 22.7% stab injury, 9.7% fall and 4.5% gun shot. Gabal et al¹⁴ found the mechanism of injury was road traffic accidents in 65(81.25%) patients, 11(13.75%) fall from height and 4 trauma by heavy object (5%). Mohammadzadeh et al¹² found in the blunt trauma group, the most frequent cause of trauma was car accidents (72%), other cases included falling 5.0%, motorcycle accidents 3.0% and fighting 2.0%. In another study Khan et al¹³ found road traffic accident was 40.0%, assault 20.0%, fall from height was 8.3%, animal related trauma was 5.0%. Shorr et al¹ observed motor vehicle accidents were responsible for 78.0% of the injuries. Improvement and proper application of traffic rules and regulation is needed to reduce road traffic accidents.

In this present study, it was observed that more than three fourth (80.5%) patients were undergone tube thoracostomy followed by 18.2% observation and 1.3% needed ventilator support with tube thoracostomy. No emergency thoracotomy was done but 2 patients were undergone thoracotomy later for management of complication. Khan et al¹³ mentioned that thoracotomy was required in 21% patients, in which only 22% were emergency thoracotomy. All thoracotomies were performed in penetrating injuries. Tube thoracostomy was done in 62.0% and thoracotomy in 9%. Farooq et al¹⁰ also reported that 80% of thoracotomies were performed in penetrating injury because of bleeding vessels. Overall thoracotomy rate was 9% which is same as Hanif et al¹⁶ has mentioned and 8% reported by Farooq et al¹⁰ in their studies. All nine thoracotomies were done in penetrating chest injury patients, which was 21% of penetrating chest trauma, in which only two were emergency thoracotomies which is about 22% of total thoracotomies of trauma patients. Thoracotomies in penetrating injuries in other studies are reported 25% by Bastos et al¹⁷. While Rubikas¹⁸ has reported it less than 3%. Stahel et al¹⁹ have reported this in less than 10% in their study. It shows thoracotomy rate is more in penetrating injury than blunt trauma. Complete pneumonectomy was indicated only in few cases undergoing emergency thoracotomy after penetrating lung trauma²⁰⁻²¹.

Regarding the pattern of injuries, it was observed in this current study that 42 (27.2%) patients was found open pneumothorax followed by 26.6% rib fracture,

20.1% haemopneumothorax, 9% simple pneumothorax, 7.8% haemothorax, 3.9% chest wall injury, 3.2% tension pneumothorax and 1.9% flail chest. Similarly, Mohammadzadeh et al¹² found the incidence of haemothorax was 38% in blunt traumas and 45% in penetrating ones. The incidence of pneumothorax was 43% in blunt traumas and 20% in penetrating cases. Tension pneumothorax was only observed in blunt trauma cases, and 34 of the patients suffered from rib fractures. In another study Khan et al¹³ found rib fracture was 85.0%, lung contusion 6%, haemothorax 5%, pneumothorax 59%, haemopneumothorax 7%, diaphragmatic rupture 5%, flail chest 3% and multiple trauma two systems involvement 19%. Rib fracture were found in 44% of cases in the study by Farooq et al¹⁰ and 76% in Hanif et al¹⁶ while Flail chest was found in 3% in comparison to 20% shown by Farooq et al¹⁰ and 6.6% by Hanif¹⁶ Ventilator support was required by 9% of patients who had flail chest or multiple trauma. In another study Farooq et al¹⁰ detected pneumothorax was in 39.0% of the patients, haemopneumothorax in 29.0%, haemothorax in 12.0%, flail chest in 9.0%. Bailey¹¹ reported that the commonest indications for tube thoracostomy were pneumothorax 54.0% and haemothorax 20.0%.

About the medical information it was observed in this series that 16.2% patients had HTN, 10.4% DM and 2.6% had IHD.

In this study, it was observed that 39.0% patients underwent left sided tube thoracostomy followed by 37.0% in right side, 5.8% both (left & right) side and 18.2% patients needed no tube thoracostomy. Mohammadzadeh et al¹² found in the majority of cases 72.0% fractures occurred in the left ribs. In another study Shorr et al¹ reported on 23 cases of ruptured diaphragms: 69.5% were left sided and 30.5% were right sided, which are similar with the current study.

In this present study, it was observed that among the complications 30% patients had persistent haemothorax followed by 29% tube was found outside triangle of safety, 13.9% tube was kinked, 13.9% port side infection, 4.5% too shallow, 4.5% empyema thoracis and 4.5% broncho-pleural fistula. Mohammadzadeh et al¹² reported that the most frequent cause of trauma in this survey was car accidents 72.0% and the most (54.9%) frequent complication was haemothorax, as has been mentioned by Haratian et al²⁷. In another study Khan

et al¹³ obtained that 29.0% patients had no haemo/pneumothorax and they were managed conservatively without any surgical intervention by sufficient analgesia, chest physiotherapy and clearance of bronchial secretions and antibiotics to prevent respiratory tract infection. Two patients (2%) developed empyema as post-operative complications of chest intubation and required decortications. This is in comparison to 3% by Helling et al²⁶. Complications were experienced in 28% of the patients of which 9% had pneumonias, 14% empyema and 5 % suffered from wound infections observed by Farooq et al¹⁰. The above findings are comparable with the current study.

In another study Bailey¹¹ mentioned that the overall complication rate related to tube thoracostomy was 30.0%. Millikan et al²² did not describe "positional" complications in his series. Etoch et al²³ encountered an overall complication rate of 21% per tube thoracostomy in their series in 1995. However, only one case (0.2%) had an insertional complication (lung laceration which required thoracotomy). A further seven cases (1.5%) developed empyema. Collop et al²⁴ encountered 14 complications in 126 tube thoracostomies (11% complication rate). Only one complication was insertional (lung laceration). Chan et al²⁵ encountered 64 complications in 352 tube thoracostomies (18.2% complication rate), but no insertional complications.

In this current study, it was observed that 51 cases ICT removal information cannot be obtained due to death (6), observation management (28), persistent haemothorax (13), empyema thoracis (2) & bronchopleural fistula (2). As no tube was given on observation management and tube not removed in case of complication like persistent haemothorax, empyema thoracis, bronchopleural fistula and patient referred to higher center. Two third (63.1%) patient's ICT removal was done between 6-10 days. The mean ICT removal information was found 8.8±3.6 days with range from 4 to 18 days. Similarly, Gabal et al¹⁴ observed ICT stayed in their patients from 2 to 15 days with mean duration was 5.91±2.6 days.

In this series, it was observed that (95.3%) patients not needed re-insertion of ICT and 4.7% needed re-insertion of ICT which was managed in this center. But persistence of ICT in 11.6% patient (8.8% persistent haemothorax, 1.2% empyema thoracis, 1.2% bronchopleural fistula) who were referred to higher center for better management.

In this study, it was observed that more than two third (68.2%) patients were recovered, 27.9% developed complication and 3.9% died. Similarly, Battle et al.¹⁵ recorded a total of 31 (6%) deaths. The percentage of patients who would have been correctly managed (admitted to hospital and subsequently developed complications) was 90.0% and those correctly discharged directly from the ED (who had not developed complications) would have been 87.0%.

In this present study, it was observed that 6 cases length of hospital stay was not recorded due to death and found more than two third (66.9%) patients had length of hospital stay less than 10 days. The mean length of hospital stay was found in 11.0±8.6 days with range from 1 to 39 days. Similarly, Mohammadzadeh et al¹² and Gabal et al¹⁴ found hospitalization stay was 12 ± 3.2 days and 9.1±2.73 days respectively.

In this current study, among 29.3% of complications, 47.4% were procedure related (29.0% improper placement, 4.5% too shallow, 13.9% tubes were kinked) and 18.4% were infection related (13.9% port site infection and 4.5% empyema thoracis). So, a good training of the trauma team and a sterile operation theatre and clean ward environment can reduce the infection rate and better outcome of the chest trauma patient.

Conclusion

Chest trauma is a major health problem worldwide and associated with high morbidity and mortality. Most of the victims are young adult males in their productive and reproductive age group. Road traffic accident was the most common cause, open pneumothorax was common presentation and tube thoracostomy was the commonest treatment modality. The pattern of chest trauma and its management and outcome is almost similar to many series. Urgent preventive measures targeting at reducing the occurrences of road traffic accidents and social violence are necessary to reduce the incidence of chest injury.

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