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ROLE OF ULTRASOUND IN MANAGEMENT OF PATIENTS WITH HEMOTHORAX FOLLOWING BLUNT TRAUMA CHEST

Radiology

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ABSTRACT

Aims: To study the Clinical and Ultrasonographic profile of patients presenting with blunt trauma chest and to compare these findings in patients who underwent either tube thoracostomy or were managed conservatively. **Settings and Design:** This prospective study was carried out in the Departments of Surgery and Radiodiagnosis, Gobind Singh Medical College and Hospital, Faridkot(Punjab). The study was approved by the Institutional Ethics Committee. A total of 60 patients of Blunt Trauma Chest patient presenting to the Department of General Surgery,Guru Gobind Singh Medical College and Hospital,Faridkot were assessed and included in the study based on the Inclusion and Exclusion Criteria of the study. **Methods and Material:**The vitals,symptoms and signs of all patients were recorded. A Frontal Chest X-ray was performed on all patients after which thoracic ultrasound was done using Philips Affinity 70 and Clearview machines using 3.5-5MHz transducers.Based on the quantity of hemothorax,patients were divided into two groups-One group was managed conservatively and the other group with Tube Thoracostomy.Patients with volume of Hemothorax more than 500ml or with Hemothorax less than 500ml but had respiratory distress were managed by Tube Thoracostomy while rest of the patients were managed conservatively.Serial follow up Chest Xrays and Ultrasound examinations were done on days 3,5 and 7. **Results:** The present study inferred that a total of 60 patients, out of which 41 patients were managed conservatively and 19 patients were managed by Tube Thoracostomy . Majority of patients (68.33% in present study) with hemothorax following blunt trauma chest, even those with multiple rib fractures did not require tube thoracostomy and could be successfully managed conservatively. Availability of emergency ultrasound helps in diagnosis and quantification of Hemothorax volume, which aids in conservative management of patients who would have otherwise underwent Tube Thoracostomy. **Conclusions:**Ultrasound significantly changes the management of patients with Hemothorax following Blunt Trauma Chest.Thus,we recommend routine use of ultrasound thorax for assessment of Hemothorax volume in clinically stable patients.

KEYWORDS

Ultrasound,Hemothorax,Blunt Trauma Chest

INTRODUCTION

Trauma, defined as damage to the body which is caused by an exchange with environmental energy, amount of which is beyond the body's resilience. Scenario of trauma consists of various causes such as road traffic accidents (RTAs), railway accidents, drowning, assault, and others, among these RTAs have the highest numbers. Trauma is the disease of young and it is the leading cause of death in the first four decades of life. India ranks fourth in number of RTAs.[1] Chest trauma victims constitute around 50% of all trauma patients and in about 25% it is the cause of death.[2] The chest wall and the soft tissues are the locations most commonly affected by blunt trauma.[3] Most of the fractures of bony thorax can be managed conservatively and even without hospitalisation but at the same time thoracic trauma limited to only thoracic cage can prove to be fatal if not timely managed.[4] Signs and symptoms of thoracic trauma include: facial cyanosis or cyanosis of lips or fingers, dyspnea, tachypnea or bradypnea, contusion, laceration, perforations, distension or other findings pertaining to trauma, hemoptysis, signs of shock (hypoperfusion), tracheal deviation, paradoxical movement of the segment of chest wall, distension of jugular veins, decreased or absent breathing sounds on auscultation, pain especially that related to respiratory function, failure of chest wall expansion on normal inspiration.[5] In 1983, Trunkey gave the trimodal distribution of trauma according to which post trauma 50% of deaths occur immediately or within seconds of injury, 30% occur within few hours and 20% of deaths occur within few weeks.[6] Initial radiological investigation for chest injuries include chest X-rays (CXR) and Computed Tomography (CT) scans. CXR are readily available but their sensitivity for chest trauma is very less.[7] It is difficult to differentiate hemothorax or pneumothorax from lung contusions with a CXR, because mostly such patients undergo a portable supine CXR in the Emergency Department.Multidetector CT of Chest is now considered the gold standard for Radiological Imaging in the emergency department in trauma patients; however, it is difficult to perform for unstable patients and has very limited availability in intensive care units or emergency departments, so patient has to be transported to the Radiology department for scanning.[8] CT also exposes the patients to high doses of the ionising radiations.[9] Emergency Ultrasound (US) was first promoted by the American College of Surgeons in 1993 as part of the Advanced Trauma Life Support (ATLS) course's standard algorithm for the detection of haemoperitoneum.[10] Focused assessment with sonography for trauma (FAST), when done by non-radiologists who are trained for this investigation has provided good outcomes showing accurate and quick evaluation of a trauma patient and evaluating the hemoperitoneum thereby helping in reaching the diagnosis and providing appropriate management to patient.[11] Standard FAST evaluated four regions of abdomen namely pericardial, perihepatic, perisplenic and pelvis. Thereafter it was expanded to include the chest for assessment for Hemothorax.[12,13] Hemothorax is the result of accumulation of blood in pleural cavity following trauma to thoracic cage. It can be associated with pneumothorax in upto 83% of the cases of traumatic thoracic injuries.[14].Hemothorax can result from various etiologies but trauma is the most common cause among them. Hemothorax in blunt trauma is due to the damage to intercostal vessels and interparenchymal pulmonary vessels, resulting from the rib fractures due to the sheer force of trauma.[15] In the emergency department most of the blunt trauma patients present in unstable condition which makes the detection of hemothorax challenging. Using the Ultrasonography in emergency department can help in diagnosis of Hemothorax in such cases, where interpretation of initial supine CXR is uncertain.[16] Tube thoracostomy (TT) is an effective way of managing Hemothorax, but this is associated with number of complications, many of which are potentially serious in nature including iatrogenic injury, retained Hemothorax and empyema in upto 22% of the patients.[17-20]. Selection of patients of blunt trauma chest (BTC) presenting with traumatic hemothorax for management by Tube Thoracostomy is controversial because this is associated with complications.[21,22] To prevent this, it is advocated to quantify the effusion volume on initial presentation and evaluating the volume at regular intervals. It has been found that patients who are managed without tube thoracostomy can recover relatively rapidly and have shorter hospital stay.[23-25]

AIMS & OBJECTIVES

To study the Clinical and Ultrasonographic profile of patients presenting with blunt trauma chest and to compare these findings in patients who underwent either tube thoracostomy or were managed conservatively.

MATERIAL AND METHODS

1) Study Area / Setting:

Department of General Surgery and Department of Radiodiagnosis Guru Gobind Singh Medical College and Hospital, Faridkot.

2) Study Period:
March 2019 – August 2020

3) Study Design:
Prospective study

4) Study Population:
Inclusion Criteria –

i. Adult patients with blunt chest trauma whose chest AIS (Abbreviated Injury Score) score >/=3

Exclusion Criteria –

ii. AIS score >/= 2 for any region except the chest region.
iii. Documented finding of tension pneumothorax or pneumothorax.
iv. Younger than 14 years old.
v. Trauma patients with indications requiring any non-thoracic major operation.

5) Sampling Technique:
Keeping in view of the availability and feasibility of the participants, a non-random convenient sampling technique was adopted whereby consecutively (60) eligible participants were considered for study.

6) Sample Size:
60 cases.

7) Data Collection tools:
i) Chest X-Ray
ii) Ultrasound

8) Methodology:
60 cases of Blunt Trauma Chest patient presenting to the General Surgery Department of Guru Gobind Singh Medical College and Hospital, Faridkot were assessed and based on the Abbreviated Injury Score for Thoracic Trauma (Table 1), were included.

Table 1-ABBREVIATED INJURY SCORE(AIS) FOR THORACIC TRAUMA

AIS	SEVERITY	INJURY DESCRIPTION
1	Minor	Rib contusion/fracture* Sternal contusion
2	Moderate	2-3 rib fractures, stable chest* Multiple fractures of single rib Sternal fracture
3	Severe, Not Life Threatening	Rib fractures open/ displaced/communited >3 rib fractures, stable chest*
4	Severe, Life Threatening	Flail chest (unstable chest wall)
5	Critical, Survival Uncertain	Severe flail (usually requires ventilator support)

After satisfying the study criteria, vitals were assessed. Symptoms and Signs of patients were recorded. A Frontal Chest X-ray was performed on all patients after which thoracic ultrasound was done using Philips Affinity 70 and Clearview machines using 3.5-5MHz transducers. Patients were assessed in sitting position. The ultrasound probe was moved in a cranial direction in the mid-scapular line. The visceral layer moving during each respiratory cycle with a decrease in interpleural separation during inspiration. The lung behind the pleural effusion appearedeither ventilated or consolidated. The maximal distance between mid-height of the diaphragm and visceral pleura (D) was measured after freezing the image in end-expiration. D was measured in mm and it was multiplied by 16 to provide the volume of hemothorax in mL.

Based on the quantity of hemothorax:

a) If volume of hemothorax was more than 500 ml, then patient was managed by tube thoracostomy.
b) If the volume of hemothorax was less than 500 ml but patient had respiratory distress, then patient was managed by tube thoracostomy.
c) Rest all the patients were managed conservatively. The radiology findings were recorded in proforma. Patients thereby were divided into two groups on the basis of management – **Conservative group and tube thoracostomy group.**

1. Conservative (C) group
If the volume of hemothorax was less than 500 ml and there was no respiratory distress then these patients were managed conservatively and kept under observation.

2. Tube Thoracostomy (TT) group
Patients were managed with tube thoracostomy if volume of hemothorax as per ultrasound was more than 500 ml or if there was respiratory distress in patients with volume less than 500 ml.

For those patients who had TT, the chest tube was always inserted by open method as recommended by ATLS. Post-operative pain, saturation and respiratory rate were seen for every individual patient managed with tube thoracostomy. Total volume of hemothorax drained in every individual patient managed with tube thoracostomy was noted over the duration of admission. Pain assessment on initial presentation and after tube thoracostomy (if performed) was done by the means of visual analogue scale (VAS)-**Figure 1**.

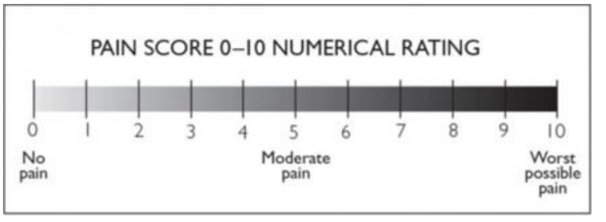

Figure 1-Visual Analogue scale for Pain Assessment

Patients who were managed with tube thoracostomy and the patients who were managed conservatively were followed up by serial plain CXR on days 3, 5 and 7 of admission to monitor progress, serial haemoglobin monitoring was done at 24hrs and 48hrs. Review thoracic ultrasound was done to see the progress of the individual patient on days 3, 5 and 7. Length of hospital stay of patients was compared to see the average duration of hospital stay of the patients who were managed conservatively with those who were managed with tube thoracostomy.

Statistical Analysis:
Data were described in terms of range; mean ±standard deviation (± SD), frequencies (number of cases) and relative frequencies (percentages) as appropriate. Comparison of quantitative variables between the study groups was done using Student t-test. For comparing categorical data, Chi square (x2) test was performed and exact test was used when the expected frequency is less than 5. A probability value (p value) less than 0.05 was considered statistically significant. All statistical calculations were done using (Statistical Package for the Social Science) SPSS 21version (SPSS Inc., Chicago, IL, USA) statistical program for Microsoft Windows.

RESULTS

The present study was conducted in blunt trauma chest patients presenting to Emergency Department in Guru Gobind Singh Medical College and Hospital, a tertiary care hospital in Faridkot, Punjab in which the patients having hemothorax following blunt trauma chest were managed either conservatively or with tube thoracostomy (**Figure 2**) using ultrasound as means to quantify hemothorax. The clinical, laboratory and radiological findings were recorded A total of 60 patients were included in the study. On initial assessment, 42 patients were kept for observation. Failure of conservative management was seen in 1 patient due to progressive symptoms. As a result, patient was managed with delayed tube thoracostomy. Patients were divided into two groups in non-random method based on their definitive management(**Table 2**).

Table 2-Distribution of Patients with Hemothorax in two groups Managed Conservatively and with Tube Thoracostomy(TT)

Group A (n=41)	Group B (n=19)
Patients who were managed Conservatively (C) for hemothorax.	Patients who were managed with Tube thoracostomy (TT) for hemothorax.

The distribution of patients according to age(Table 3),Gender(Table 4),Mode of Trauma(Table 5),Symptoms at Presentation(Table 6),Severity of Chest Pain(Table 7) and signs on Clinical Examination were (Table 8) were calculated.Vital Signs(Table 9),Mean

Hemoglobin(Table 10),Chest X-ray(Table 11) were compared in both groups.Volume of Hemothorax was calculated with Ultrasound(Table 12),Distribution of patients was seen as per Abbreviated Injury score(Table 13),Patients who underwent Tube Thoracostomy were assessed as per the volume of Hemothorax(Table 14),The amount of Hemothorax drained was quantified(Table 15) and length of Hospital Stay was calculated and compared between the study groups(Table 16).The complications of Tube Thoracostomy(Like Drain site Infection and Clotted Drains) were Assessed(Table 17).

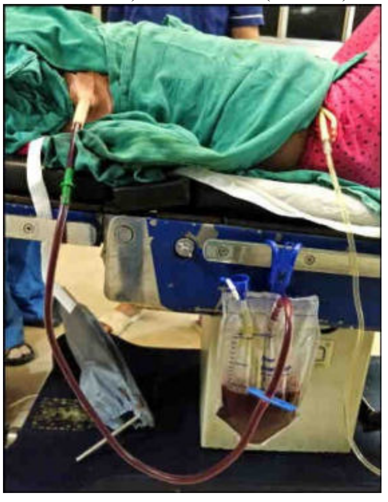

Figure 2- Tube Thoracostomy for Hemothorax and ICD attached with Underwater seal Bag.

Table-3-Age wise distribution of patients

Age Group (in years)	Group A (n=41)		Group B (n=19)		Total	
15-25	8	19.5%	6	31.6%	14	23.3%
26-35	6	14.6%	3	15.8%	9	15.0%
36-45	15	36.6%	6	31.6%	21	35.0%
> 45	12	29.3%	4	21.1%	16	26.7%
Mean ± SD	40.54 ± 12.92		33.58 ± 11.96		38.33 ± 12.95	

Table-4-Gender wise distribution of patients

Gender	Group A (n=41)		Group B (n=19)		Total	
Female	7	17.1%	2	10.5%	9	15%
Male	34	82.9%	17	89.5%	51	85%

Table-5-Distribution of cases according to the mode of trauma

Mode of Trauma	Group A (n=41)		Group B (n=19)		Total (n=60)	
Assault	1	2.4%	0	0.0%	1	1.7%
Fall from height	12	29.3%	6	31.6%	18	30.0%
RSA	28	68.3%	13	68.4%	41	68.3%

Table-6-Distribution of patients according to symptoms at presentation

Symptoms	Group A (n=41)		Group B (n=19)		Total		Chisquare value	pvalue
Chest pain	34	82.9%	19	100.0%	0.086	88.3%	3.672	0.086
Dyspnea	18	43.9%	19	100.0%	0.001	61.7%	17.284	0.001

Table-7-Distribution of patients according to severity of chest pain(VAS)

Chest Pain (VAS)	Group A (n=41)		Group B (n=19)		Total		Chisquare value/t	p-value
0	7	17.1%	0	0.0%	7	11.7%	19.791	0.001
5	2	4.9%	0	0.0%	2	3.3%		
6	12	29.3%	1	5.3%	13	21.7%		
7	10	24.4%	5	26.3%	15	25.0%		
8	10	24.4%	8	42.1%	18	30.0%		
9	0	0.0%	5	26.3%	5	8.3%		
Mean ± SD	5.66 ± 2.74		7.89 ± 0.88		6.37 ± 2.53		-3.468	0.001

Table 8-Distribution of patients based on Clinical signs

Clinical Signs	Group A (n=41)		Group B (n=19)		Total		Chisquare value/t	p value
Tachypnea	8	19.5%	10	52.6%	18	30.0%	6.782	0.015
Tenderness	31	75.6%	19	100.0%	50	83.3%	5.561	0.018
Bony Crepitus	11	26.8%	8	42.1%	19	31.7%	1.4	0.237
Surgical emphysema	1	2.4%	2	10.5%	3	5.0%	1.788	0.181
Paradoxical Chest Movement	1	2.4%	2	10.5%	3	5.0%	1.788	0.181

Table 9-Comparison of vital signs(Pulse,SPO2,Systolic,Diastolic Blood Pressure,Respiratory Rate) of patients in study groups

Vital Signs	Group A (n=41)		Group B (n=19)		Total		t	pvalue
	Mean	SD	Mean	SD	Mean	SD		
PR	87.29	4.43	100.05	5.58	91.33	7.66	-9.546	<0.001
SpO2	97.63	1.55	90.32	3.15	95.32	4.05	12.141	<0.001
SBP	121.71	12.12	106.53	6.99	116.90	12.85	5.069	<0.001
DBP	79.02	7.06	64.74	6.12	74.50	9.49	7.592	<0.001
RR	18.98	2.71	26.16	1.83	21.25	4.16	-10.483	<0.001

Table 10-Comparison of mean Hemoglobin in study groups

Hb values (In gm%)	Group A (n=41)		Group B (n=19)		Total		t	pvalue
	Mean	SD	Mean	SD	Mean	SD		
Hb	11.65	1.37	10.39	0.99	11.25	1.39	3.558	0.001
Hb 24	11.64	1.37	10.11	1.16	11.16	1.49	4.234	<0.001
Hb 48	11.64	1.37	10.43	1.05	11.26	1.39	3.426	0.001

Table 11-Comparison of Chest X-ray in study groups

Chest X-ray Features	Group A (n=41)		Group B (n=19)		Total		Chisquare value	pvalue
Rib #	41	100%	19	100%	60	100%	0.000	1.000
Flail Chest	1	2.4%	2	10.5%	3	5.0%	1.788	0.181
CP angle blunting	26	63.4%	1	5.3%	27	45.0%	17.739	0.001
Lower thoracic Opacification	15	36.6%	18	94.7%	33	55.0%	17.739	0.001

Table 12-Distribution of patients as per volume of Hemothorax

USG Volume Groups (in mL)	Group A (n=41)		Group B (n=19)		Total (n=60)		Chi square value	pvalue
0-250	19	46.3%	0	0.0%	19	31.7%	41.172	0.001
251-500	22	53.7%	5	26.3%	27	45.0%		
501-750	0	0.0%	3	15.8%	3	5.0%		
> 750	0	0.0%	11	57.9%	11	18.3%		
Mean ± SD	271.61 ± 78.59		748.84 ± 215.75		422.73 ± 261.74		-12.573	<0.001

Table 13-Distribution of patients as per ABBREVIATED INJURY SCORE (AIS) for Thoracic Trauma

AIS Score	Group A (n=41)		Group B (n=19)		Total		Chisquare value	p-value
3	23	56.1%	3	15.8%	26	43.3%	9.175	0.010
4	17	41.5%	14	73.7%	31	51.7%		
5	1	2.4%	2	10.5%	3	5.0%		
Mean ± SD	3.46 ± 0.55		3.95 ± 0.52		3.62 ± 0.58		-3.208	0.002

Table 14- Data Analysis of patients who underwent Tube Thoracostomy

Total Hemothorax Drained (in mL)	No. of cases (n=19)	%age
< 300	0	0.0%
300-350	1	5.3%
350-400	3	15.8%
400-450	1	5.3%
450-500	1	5.3%
> 500	13	68.4%
Mean ± SD	661.05 ± 210.10	

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Table 15- Comparison of Total Hemothorax Drained in two subsets of Tube Thoracostomy

	Group B >500 mL (n=14)		Group B <500 mL (n=5)		F	pvalue
	Mean	SD	Mean	SD		
Total Hemothorax Drained (in mL)	761.43	139.77	380.00	33.91	35.240	<0.001

Table 16- Comparison of Length of Hospital Stay (LOS) between study groups

Hospital stay (in days)	Group A (n=41)		Group B (n=19)		Total		Chisquare value	pvalue
3-5.0	26	63.4%	0	0.0%	26	43.3%	33.392	0.001
6-8.0	14	34.1%	8	42.1%	22	36.7%		
9-12.0	0	0.0%	9	47.4%	9	15.0%		
12-15.0	1	2.4%	2	10.5%	3	5.0%		
Mean ± SD	5.56	1.70	9.63	1.92	6.85	2.60	-8.268	<0.001

Table 17 -Complications in patients who underwent tube thoracostomy.

Complications	No. of Cases (n=19)	Percentage
Drain site infection	2	10.50%
Clotted Drain	1	5.20%

DISCUSSION

Tube thoracostomy has been the standard of treatment in patients of hemothorax and pneumothorax associated with trauma. Tube thoracostomy is associated with increase in morbidity, increased costs, complications associated with its insertion, position and infection. To overcome these complications and to decrease the morbidity associated with chest drain, conservative management of chest trauma patients has been studied these days. In the present study ultrasound volume estimation of hemothorax was performed followed by deciding the management of each patient i.e. conservative management or tube thoracostomy, and findings were compared with each other.

In the present study majority of patients in the study i.e. 21(35%) belonged to age group 36-45 years with mean age of study patients being 38.33 ± 12.95 years. In a study by Chung MH et al[26], mean age was 60 years. Liman ST et al[3], in their study had mean age of 45 years with age range of 6 to 91 years. Pramod T et al.[27], in their study found mean age 39 years.. Thus present study is in concordance with other studies in other geographical areas and may be attributable to younger age group involved in reckless driving.

Male preponderance was seen in present study with 85% patients as male and only 15% female patients. Chung MH et al.[26] in their study had 74% patients as male patients, Bailey RC[28] in his study had 74% male patients, Liman ST et al.[3] noted 70.6% male patients. Pramod T et al.[27] in their study had 81.6% male patients This predominance of male patients can be attributed to their involvement in outdoor activities such as driving and mechanics for automobiles or recreational purposes.

In the present study, RSA(Road Side Accidents) were responsible for 68.3% patients of study, 30% due to fall from height, 1.7% due to assault. In a study by Manay P et al.[29] they noted RSA, fall from height and assault as the cause of blunt chest trauma in 55.39%, 27.33% and 11.5% of their study patients respectively. Bhattacharyya DK and Brahma RC[30] found 61.02%, 30.51% and 6.78% patients in their study due to RSA, fall from height and assault respectively and remaining 1.69% patients due to occupational injury.This re-establishes the fact that most of the light motor vehicles or heavy motor vehicles on highways are driven by males and also heavy lifting or working at high altitudes, leading to fall from height. Use of rapid means and lack of obedience to traffic rules is the chief reason behind this.

In the present study 60 patients were included and 41(68.3%) cases were managed conservatively with observation and 19(31.7%) cases were managed with tube thoracostomy. Pramod T et al.[27] in their study managed 53.3% conservatively and 46.7% with tube thoracostomy. Wells et al.[31] in their study noted that 65.55% patients were managed conservatively and 34.45% pateints were managed with tube thoracostomy. In a study by Demetri L et al.[32] they noted that 61% patients were managed with tube thoracostomy and 39% patients were managed conservatively. In a study by Chung MH et al.[26], 34% patients of ultrasound group were managed with tube thoracostomy and remaining 66% were managed conservatively. Thus,the results of present study was consistent with other studies in other geographical areas except with a study by Demetri L et al.[32]

In the present study, 1(1.7%) patient out of overall 42 patients, who were kept for observation on initial assessment, underwent delayed tube thoracostomy due to progressive symptoms. Patient had fall in haemoglobin levels as evident by serial haemoglobin monitoring after admission. Wells et al.[31] and Demetri L et al.[32] in their studies noted 15% and 29% delayed tube thoracostomies respectively due to progressive symptoms. Chung MH et al.[26] reported 6% patients of the conservative group being managed with delayed tube thoracostomy.

In the present study, chest pain was the most common symptom on presentation in 88.3% of patients followed by dyspnea in 61.7%. In a study by Pramod T et al.[27] they noted chest pain was most common presentation, present in 60% patients and dyspnea in 20% patients of study. In the present study, chest pain was assessed using visual analogue scale (VAS) ranging from 0 to 10. 7(11.7%) patients presented without chest pain. Mean VAS was noted as 6.37 ± 2.53 for the study patients. Maximum patients i.e. 18(30.0%) had VAS 8 in the study followed by VAS 7 in 15(25.0%) patients.

In the present study tenderness over chest wall was the most common sign on presentation in 83.3% of patients followed by bony crepitus in 31.4%, tachypnea in 30%, and surgical emphysema in 5.0% and paradoxical chest movement in 5% patients of study. Bhattacharyya DK and Brahma RC[30] in their study noted tenderness over chest wall, bony crepitation and surgical emphysema in 84.74%, 51.69%, 33.1% patients respectively.

In the present study Mean PR(Pulse Rate) of study was 91.33 ± 7.66 beats per minute, Mean SpO2 was 95.32% ± 4.05%, Mean SBP(Systolic Blood Pressure) was 116.90 ± 4.05 mmHg, Mean DBP(Diastolic Blood Pressure) was 74.50 ± 9.49 mmHg and Mean RR(Respiratory Rate) was 21.25 ± 4.16 breaths per minute. Chung MH et al.[79] in their study noted mean PR as 84 beats per min and mean arterial pressure as 102 mmHg. Wells et al.[31] in their study had 38% patients with pulse rate more than 100 beats per min compared to 11.6% in the present study, 6% patients with SBP less than 90 mmHg compared to 3.3% in the present study and 34% patients with RR more than 20 breaths per min compared to 45% in the present study.

In the present study mean Hb(Hemoglobin) of patients was 11.25 ± 1.39 gm%. For patients of the group A and group B, mean Hb was 11.65 ± 1.37 gm% and 10.39 ± 0.99 gm% respectively. On serial monitoring the mean Hb of group A was similar to mean Hb on admission. Mean Hb of group B on serial monitoring demonstrated fall in Hb for first 24 hrs and rise after 48 hrs. Rise in Hb at 48 hrs can be attributed to blood transfusions. 2(3.3%) patients of group B had Hb on admission close to 8 gm% so blood transfusion was done on admission. Mean Hb of group A was on higher side of group B at all times on serial monitoring. Chung MH et al.[26] in their study had mean Hb of 12.97 gm%. This disparity in value can be attributed to geographical variation.

In the present study,all patients included i.e. 60(100%) had rib fractures. One rib fracture was noted in 5% patients, two rib fractures were noted in 43.3% patients. More than two rib fractures were noted in 51.66% cases of study. 3.3% patients of study had bilateral rib fractures. Flail chest was noted in 3 (5%) patients of study of which 1 patient was in group A and 2 patients were in group B. Mean number of rib fractures of study were 2.88 ± 1.29. In a study by Bhattacharyya DK and Brahma RC[30] it was noted that 5.08% patients had one rib fracture, two ribs fractures were present in 13.56% patients, more than 2 ribs fractures were present in 70.34% patients of their study and 8.47% patients presented with flail chest. In a study by Wells et al.[31] they noted 29% patients with flail segment.

In the present study, chest X-ray features were noted and 100% patients included in the study had hemothorax. Among these, 45% patients were observed to have blunting of Costophrenic (CP) angle and 55% patients had lower thoracic opacification as radiological finding showing hemothorax. It was noted that among the 27 patients having CP angle blunting, out of which 26 patients were in group A. 18

patients of group B and 15 patients of group A had lower thoracic opacification as radiological finding of hemothorax.

In the present study, quantification of hemothorax was done using ultrasound. Quantification was done using formula, 16 x D, as used by Usta E et al.[33], where D was distance between mid-height of the diaphragm and visceral pleura after freezing the image in end expiration. It was noted that mean hemothorax volume of study was 422.73 ± 261.74 mL, for group A it was 271.61 ± 78.59 mL and for group B it was 748.84 ± 215.75 mL. 45% patients of the study were in volume group 251-500 mL, majority of which i.e. 22 out of 27 were managed conservatively. Overall,76.66% patients had volume under 500 mL. In a study by Wells et al.[31] 77.95% patients had hemothorax less than 500 mL. Chung MH et al.[26] had mean volume of hemothorax in their ultrasound group as 1018 ± 604 mL. In a study by Demetri L et al.[32] it was noted that 75% of patients had hemothorax less than 300 mL and 98% of these patients were managed with observation.

In present study mean Abbreviated Injury Score for chest (AIS score) was 3.62 ± 0.58. Chung MH et al.[26] had median AIS score of 4 in their study. AIS 3 was present in 43.3%, AIS 4 was present in 51.7% and AIS 5 was present in 5% patients in the study.

In present study, group B was managed with tube thoracostomy. Mean volume of total hemothorax drained for group B was 661.05 ± 210.10 mL. 68.4% patients had drainage volume of more than 500 mL. In a study by Chung MH et al.[26]it was noted that mean volume of drainage was 860 mL. Tube Thoracostomy was done in some patients with less than 500 ml hemothorax volume and in this subset mean volume of hemothorax drained was 380 ± 33.91 mL whereas it was 761.43 ± 139.77 mL in patients with Tube Thoracostomy for more than 500 mL hemothorax.

In the present study, mean length of hospital stay (LOS) was 6.85 ± 2.60 days, for group A it was 5.56 ± 1.70 days and for group B it was 9.63 ± 1.92 days. 97.4% of group A patients had LOS within 3-8 days but only one patient had stay of 14 days which was due to presence of neurosurgical component caused by trauma. In a study by Chung MH et al.[26] mean length of stay for ultrasound group was 6.92 ± 3.79 days and for group A it was 5.38 ± 2.7 days. In a study by Liman ST et al.[3] mean hospital stay was 4.5 days. In a study by Bhattacharyya DK and Brahma RC[30] it was noted that mean LOS for group A and group B was 4.2 days and 13.6 days respectively.

In the present study we managed 41 patients conservatively and 19 patients with tube thoracostomy using 500 mL hemothorax as the criteria. Among those 19 patients, some patients i.e. 5 patients had tube thoracostomy even when the volume of hemothorax was less than 500 mL. These patients had mean pulse rate of 97.20 ± 1.92 beats per minute, mean SpO2 level of 87.20 ± 0.84 %, mean SBP 110 ± 2.83 mmHg, mean DBP 66.40 ± 4.98 mmHg and mean RR of 26.00 ± 1.00 breaths per minute. This shows that these patients had tachycardia, tachypnea, fall in blood pressure and fall in oxygen saturation levels suggesting respiratory distress.

In the present study, overall complication rate was 15.7%. Drain site infection was the most common complication present in 2(10.5%) patients and clotted drain was present in 1(5.2%) patient. In a study by Bailey RC[28] overall complication rate was 30% with 12% as drain site infection and 2% as clotted drain. In a study by Hernandez MC et al.[34] complication rate was 36% with 68.9% of those as clotted drain.In the present study there were no complications in patients managed conservatively.

From the above discussion it can be seen that lower thoracic opacification as a radiological finding of chest x-ray was present in 55% patients. It was that only after ultrasound assessment could almost half of these be managed with observation alone. Management only on the basis of chest x-ray would have resulted in insertion of Tube Thoracostomy in these patients which were otherwise managed conservatively and thereby preventing the morbidity associated with Tube Thoracostomy.

The present study was carried out to evaluate the role of ultrasound in prediction of hemothorax thus allowing conservative management in patients who otherwise would have been managed by Tube Thoracostomy. It was observed that patients with hemothorax can be managed conservatively thereby allowing shorter hospital stay, avoiding increased costs and morbidity associated with Tube Thoracostomy and without any other complications.

SUMMARY

A total of 60 patients with hemothorax following blunt trauma chest presenting to Department of Surgery, GGS Medical College and Hospital, Faridkot were included in the study. Out of 60 patients, 41 patients were managed conservatively and 19 patients were managed by Tube Thoracostomy . Majority of patients (68.33% in present study) with hemothorax following blunt trauma chest, even those with multiple rib fractures ,did not require tube thoracostomy and could be successfully managed conservatively. Previous studies have suggested Hemothorax size to be a singular predictor for Tube Thoracostomy.Availability of emergency ultrasound helps in diagnosis and quantification of Hemothorax volume, which aids in conservative management of patients who would have otherwise underwent Tube Thoracostomy.

CONCLUSION

Ultrasound significantly changes the management of patients with Hemothorax following Blunt Trauma Chest.Thus we recommend routine use of ultrasound thorax for assessment of Hemothorax volume in clinically stable patients.

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