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Research Article

REVIEWING THE ROLE OF INTRAVENOUS STEROIDS IN BLUNT CHEST TRAUMA-LUNG CONTUSION

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ABSTRACT

Objective: The aim of the study was to see the effect of intravenous steroids in patients with blunt chest trauma-lung contusion and to compare the effect of steroid use based on improvement in oxygen saturation, ABG, and hospital stay, in the study group and control group.

Methods: A prospective and observational study was carried out on patients with blunt chest trauma having lung contusion who were admitted to the multispecialty hospital for 2 years. Data were collected in a predesigned proforma. All patients with radiologically proven lung contusion were observed based on the steroid treatment given or not. Group A was steroid (study) group and Group B was non-steroid (control) group with 25 sample size in each group. Group A patients were treated with steroid (hydrocortisone) 20 mg/kg/day 6 hourly which was tapered over time. Control group patients were treated identically except for steroid use.

Results: Most of the injuries affected the middle age group (25 to 65 years) which accounted for a total of 84%. The percentage of males and females in the study were 76% and 24%, respectively. The most common mode of injury was road traffic accidents which account for 76% as compared to non-road traffic accidents (24%). Statistical analysis showed there was an improvement in both groups in parameters such as Spo2, ABG-Pco2, and ABG-Sao2 and were statistically significant. While other improvements like ABG-Po2, radiological CT, and hospital stays were statistically insignificant.

Conclusions: As both groups were showing improvements and there was no statistically much difference seen in both groups, we concluded that there is no role of intra-venous steroid use in lung contusion. However, every patient must undergo CT for a better assessment of the injury. Objective scoring systems are required in CT assessment of lung injury and studies with increased sample size and carried out at multiple centers are required for better conclusions.

Keywords: Pulmonary, Contusion, Steroids, Chest, Trauma.

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INTRODUCTION

It is the chest trauma which leads to damage to capillaries and results in accumulation of blood and fluids representing as lung contusion. Lung contusion leads to hypoxia because of low oxygen concentration occurring secondary to interference in gaseous exchange. While lung contusion occurs due to blunt trauma, lung laceration is usually result of sharp injury leading to cut or torn of lung tissue leading to change in lung architecture [1,2]. While laceration ultimately leads to collection of blood resulting in hematoma [3], contusion causes alveoli hemorrhages [4]. Chest trauma also causes bleeding or accumulation of air within the pleura leading to hemothorax or pneumothorax, respectively. Although these conditions do not necessary cause damage to lung tissue, it can lead to damage to lung function due to compression of lung from outside. Apart of lung injuries, trauma can cause damage to chest wall in the form of flail chest or rib fractures, again leading to indirect effect on lung functioning [5]. Despite chest wall injuries and lung injuries are different entity, the chest trauma usually consists of mixtures of these conditions and often presents with signs and symptoms of both. Due to low oxygen concentration, and inability to pump out carbon di oxide, both hypoxia and cyanosis conditions are seen. Due to pain and tenderness, dyspnea, and painful breathing, reduced exercise tolerance and tachycardia are often noticed [6-9] Ultimately with severe injuries, the breath sounds are reduced, or wheezes are heard from the chest leading to coughing out bloody sputum [10-12]. Cardiac effects include reduced cardiac output and hypotension due to lack of blood flow to periphery. However, in most of the cases, the individual will be asymptomatic during the initial period, and it takes time to develop the symptoms in a graded fashion and severity dependent. Only in severe cases, symptoms and signs are prominent and occur rapidly. Hypoxemia usually takes time to develop, may be 24–48 h depending on severity of injury [13]. In general, it is seen that lung contusion detorriates very slowly over the period unless there is more severe lung contusion in which case unless treated may lead to death. Given the above background, we carried out this study to see the effect of intravenous steroids in patients with blunt chest trauma-lung contusion and to compare the effect of steroid use based on improvement in oxygen saturation, ABG, and hospital stay, in the study group and control group.

METHODS

A prospective and observational study was carried out on patients with blunt chest trauma having lung contusion who were admitted to the multispecialty hospital for 2 years. Data were collected in a predesigned proforma. History taking, clinical examination, chest X-ray, CT Thorax, use of steroids, and intervention if required were done. Institutional ethical clearance was taken. Appropriate statistical methods were used to analyze of data. All patients with blunt chest trauma due to any cause with radiologically proven lung contusion were in the inclusion criteria. All patients with associated injuries such as blunt abdominal trauma, head injury, or polytrauma patient which increases mortality and increase in hospital stay duration, patients with blunt chest trauma happened before 3–4 days back, patients with age <5 years and >80 years and having other medical complications such as diabetes, COPD and previously underwent thoracic surgery were excluded from the study. All patients with radiologically proven lung contusion were observed based on the steroid treatment given or not. Group A was

Table 1 : Baseline parameters of study participants

	Frequency	Percent
Age group		
5–15	1	2.0
15 –25	2	4.0
25–35	10	20.0
35–45	9	18.0
45–55	14	28.0
55–65	9	18.0
65–75	5	10.0
Gender		
Male	38	76.0
Female	12	24.0
RTA		
Yes	38	76
No	12	24
Total	50	100.0

Table 2: Comparison of SPO2, ABG PCO2, ABG PO2, and ABG SAO2 among steroid and non-steroid group

SPO2		**n**	**Mean**	**Std. Deviation**	**Std. Error**	**p-value**
Steroid	Day 1	25	94.44	3.41	0.68	0.000
	Day 4	25	96.76	1.71	0.34	
Non-steroid	Day 1	25	94.52	2.20	0.44	0.021
	Day 4	25	95.72	1.10	0.22	
ABG PCO2						
Steroid	Day 1	25	39.16	5.63	1.12	0.000
	Day 4	25	32.32	3.95	0.79	
Non-steroid	Day 1	25	38.40	2.39	0.47	0.001
	Day 4	25	35.44	2.98	0.59	
ABG PO2						
Steroid	Day 1	25	99.88	30.64	6.12	0.530
	Day 4	25	104.04	15.46	3.09	
Non-steroid	Day 1	25	98.96	18.72	3.74	0.849
	Day 4	25	99.76	9.14	1.82	
ABG SAO2						
Steroid	Day 1	25	95.24	4.50	0.90	0.036
	Day 4	25	97.12	1.73	0.35	
Non-steroid	Day 1	25	94.88	2.66	0.53	0.008
	Day 4	25	96.44	1.29	0.25	

steroid (study) group and Group B was non-steroid (control) group with 25 sample size in each group. Group A patients were treated with steroid (hydrocortisone) 20mg/kg/day 6 hourly which was tapered over time. Control group patients were treated identically except for steroid use.

RESULTS

The most of the injuries affected the middle age group, that is, from 25 to 65 which accounted for a total of 84%. The percentage of males and females in the study were 76% and 24%, respectively. The most common mode of injury is road traffic accident which accounts for 76% as compared to non-road traffic accidents (24%) (Table 1). The study group and control group were compared for various parameters using repeated measures of ANOVA as a statistical test. In the steroid, group means Spo2 on day 1 was 94.44 and on day 4 was 96.76. In the non-steroid group, mean Spo2 on day 1 was 94.52 and on day 4 was 95.72. Both groups were statistically significant but clinical improvement in the steroid group was more as compared to the control group. In the steroid group, pCO2 values on day 1 and day 4 were 39.16 and 32.32 with a p-value of 0.000 as compared to a non-steroid group with a p-value of 0.001, both were statistically significant. Arterial SaO2 was improved in both groups and had p values of 0.036 and 0.008 for steroid and non-steroid groups both of which were statistically significant (Table 2). Table 3 shows the relation of lung contusion as compared to day 1 radiologically, whether contusion had decreased or increased or the same. In the steroid group out of 25 patients, in 14 patients, there was a decrease in lung contusion, seven patients showed no change and in four patients, there was an increase in contusion. In the non-steroid group, 13 patients showed a decrease in contusion, nine showed no change and three showed an increase in contusion. p-value was 0.857 which is statistically not significant. Hospital days among both groups were compared using an independent t-test which showed a difference of 1 day less in the steroid group (mean value) as compared to control with a p-value of 0.082 which was nearly statistically significant (Fig. 1).

DISCUSSION

Our study was based on 50 patients with blunt chest trauma having lung contusion. In our study design, patients were divided into two groups: Group 1 steroid group – In this group, 25 patients were treated with i.v steroid, given on early admission basis, and Group 2 non-steroid group (control group) – 25 patients in this group were not given any form of steroid but treated identically as Group 1. After statistical analysis of data, there was improvement seen in both groups in parameters such as oxygen saturation (Spo2), ABG-Pco2, and ABG-Sao2 on day 4 as compared to day 1. p-value of Spo2(0.000), ABG-Pco2(0.000), and ABG-Sao2(0.036) for steroid group and p values of Spo2 (0.021), ABG-Pco2(0.001), and ABG-Sao2(0.008) for control group, respectively. There was clinical improvement seen in mean ABG-Po2 on day 4 (104.04) as compared to day 1 (99.88) in the steroid group and on day 4 (99.76) as compared to day 1 (98.96) in the control group with p values of 0.530 and 0.849, respectively, which were statistically insignificant. CT scan was done on day 1 (on admission) and showed lung contusion in both groups which were compared with follow-up CT done on day 4 in both groups to assess radiological improvement. In the steroid group, 56% of patients showed a decrease in lung contusion and in the control group, 52% of patients showed a decrease in lung contusion with a p-value of 0.85 which was statistically insignificant. Mean hospital stay in the steroid group was 6.6 days as compared to the control group in which it was 7.6 days with a p-value of 0.08 which was insignificant.

This study shows that there was no definite role of i.v steroids when used in patients with lung contusion as both groups were showing improvement with no significant radiological difference in the steroid group as compared to the control group. Mean hospital stay is also nearly the same for the steroid and control group (6.6 and 7.6, respectively). Our study is in agreement with the study conducted by Modell *et al*. 1976 [14], who conducted a retrospective study on 80 drowning victims and found that in 38 patients who were not given steroids, two died (5%) while 52 patients given steroids, eight died (15%). Steroids used included methylprednisolone. While acknowledging that this study was not designed to test the efficacy of steroid therapy, the workers concluded that steroids were of no clinical value in this situation.

Our study is not in agreement with the retrospective study conducted by Svennevig *et al*. [15], which showed significantly (p=0.02) lesser mortality of patients who were steroid treated (n=44) than compared to patients not treated with steroids (n=99) wherein study sample size was 143, with 72% patients multi-traumatized and 19% in shock. Furthermore, in steroid treated group, there was lower incidence of septicemia, bronchial infection, and multi-organ failure. In one of the animal studies carried out by Akdemir *et al*. [16] showed that in rats, initial high dose of methyl prednisolone at early stage of blunt chest trauma cases, followed by combined usage of methyl prednisolone with quercetin was more effective. Thus, the authors recommend use of high dose of methyl prednisolone followed by low dose maintenance plus quercetin. In another animal study by Franz *et al*. [17], experimental lung contusion was created and effect of methyl prednisolone after 30 min of injury was seen. It was seen that there was a significant reduction of weight ratio of contused to normal lung in treated animals

Table 3: Comparison of Day one CT scan and follow-up CT scan findings among steroid and non-steroid group

Group	BL_LC	Lt_LC	Rt_LC	LC	Total	p-value
Steroid						
Count	10	7	8	0	25	0.322
% within Group	40.0%	28.0%	32.0%	0.0%	100.0%	
Non-steroid						
Count	11	4	7	3	25	
% within Group	44.0%	16.0%	28.0%	12.0%	100.0%	
Total						
Count	21	11	15	3	50	
% within Group	42.0%	22.0%	30.0%	6.0%	100.0%	
Group	**Decreased**	**Same**		**Increased**	**Total**	**p-value**
Steroid						
Count	14	7		4	25	0.857
% within Group	56.0%	28.0%		16.0%	100.0%	
Non-steroid						
Count	13	9		3	25	
% within Group	52.0%	36.0%		12.0%	100.0%	
Total						
Count	27	16		7	50	
% within Group	54.0%	32.0%		14.0%	100.0%	

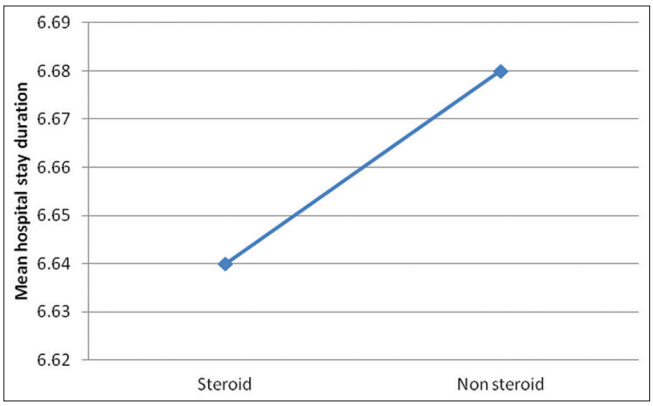

Fig. 1: Comparison of Hospital stay among Steroid and Non-steroid groups

than compared to non-treated animals. It was also seen that the volume of lung injury was less on postmortem than compared to others ($p<0.05$). In one of the largest reviews of literature of studies of over 40 years on the management of pulmonary contusion and flail chest by Eastern association for surgery of trauma practice management guidelines by Simon *et al.* [18] clearly stated that steroids should not be used in therapy of pulmonary contusion.

Limitation

Our study had a major limitation of having a smaller sample size to have a statistically significant conclusion. Another limitation was that it was carried out in a single center.

CONCLUSION

As both groups were showing improvements and there was no statistically much difference seen in both groups, we conclude that there is no role of steroid use in lung contusion.

RECOMMENDATIONS

Every patient must undergo CT for a better assessment of the injury. Objective scoring systems are required in the CT assessment of lung injury. Better scoring systems are required with multiple variables (CT, ABG, CXR, pulmonary wedge pressure, etc.) for better assessment of lung contusion, and studies with increased sample size and carried out at multiple centers are required for better conclusions.

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AUTHORS CONTRIBUTION

All authors have contributed to preparation of manuscript.

CONFLICT OF INTEREST

Nil.

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REFERENCES

1. Collins J, Stern EJ. Chest Radiology: The Essentials. Philadelphia, Pennsylvania: Lippincott Williams and Wilkins; 2007. p. 120.
2. Wicky S, Wintermark M, Schnyder P, Capasso P, Denys A. Imaging of blunt chest trauma. Eur Radiol 2000;10:1524-38. doi: 10.1007/s003300000435, PMID 11044920.
3. Stern EJ, White C. Chest Radiology Companion. Philadelphia, Pennsylvania: Lippincott Williams and Wilkins; 1999. p. 103.
4. Livingston DH, Hauser CJ. Trauma to the chest wall and lung. In: Moore EE, Feliciano DV, Mattox KL, editors. Trauma. 5th ed. United States: McGraw-Hill Professional; 2003. p. 525-8.
5. Costantino M, Gosselin MV, Primack SL. The ABC's of thoracic trauma imaging. Semin Roentgenol 2006;41:209-25. doi: 10.1053/j.ro.2006.05.005, PMID 16849051.
6. Miller DL, Mansour KA. Blunt traumatic lung injuries. Thorac Surg Clin 2007;17:57-61. doi: 10.1016/j.thorsurg.2007.03.017, PMID 17650697.
7. Wanek S, Mayberry JC. Blunt thoracic trauma: Flail chest, pulmonary contusion, and blast injury. Crit Care Clin 2004;20:71-81. doi: 10.1016/s0749-0704(03)00098-8, PMID 14979330.
8. Mick NW, Peters JR, Egan D, Nadel ES, Walls R, Silvers S. Chest trauma. In: Blueprints Emergency Medicine. 2nd ed. Philadelphia, PA: Lippincott Williams and Wilkins; 2006. p. 76.
9. Coyer F, Ramsbotham J. Respiratory health breakdown. In: Chang E, Daly J, Eliott D, editors Pathophysiology Applied to Nursing. Marrickville, NSW: Mosby Australia; 2004. p. 154-5.
10. Boyd AD. Lung injuries. In: Hood RM, Boyd AD, Culliford AT, editors. Thoracic Trauma. Philadelphia, PA: Saunders; 1989. p. 153-5.
11. Gavelli G, Canini R, Bertaccini P, Battista G, Bnà C, Fattori R. Traumatic injuries: Imaging of thoracic injuries. Eur Radiol 2002;12:1273-94. doi: 10.1007/s00330-002-1439-6, PMID 12042932.
12. Yamamoto L, Schroeder C, Morley D, Beliveau C. Thoracic

trauma: The deadly dozen. Crit Care Nurs Q 2005;28:22-40. doi: 10.1097/00002727-200501000-00004, PMID 15732422.

13. Peitzman AB, Rhoades M, Schwab CW, Yealy DM, Fabian TC. The Trauma Manual: Trauma and Acute Care Surgery (Spiral Manual Series). 3rd ed. Philadelphia, Pennsylvania: Lippincott Williams and Wilkins; 2007. p. 223.
14. Modell JH, Graves SA, Ketover A. Clinical course of 91 consecutive near-drowning victims. Chest 1976;70:231-8. doi: 10.1378/chest.70.2.231, PMID 780069.
15. Svennevig JL, Bugge-Asperheim B, Bjørgo S, Kleppe H, Birkeland S. Methylprednisolone in the treatment of lung contusion following blunt chest trauma. Scand J Thorac Cardiovasc Surg 1980;14:301-5. doi: 10.3109/14017438009101016, PMID 7013060.
16. Akdemir HU, Güzel A, Katı C, Duran L, Alaçam H, Gacar A, *et al*. The evaluation of different treatment protocols for trauma-induced lung injury in rats. J Thorac Dis 2014;6:66-73. doi: 10.3978/j.issn.2072-1439.2013.12.54, PMID 24605218.
17. Franz JL, Richardson JD, Grover FL, Trinkle JK. Effect of methylprednisolone sodium succinate onexperimental pulmonary contusion. J Thorac Cardiovasc Surg 1974;68:842Y844. doi: 10.1016/S0022-5223(19)41649-8, PMID 4607745.
18. Simon B, Ebert J, Bokhari F, Capella J, Emhoff T, Hayward T, *et al*. Management of pulmonary contusion and flail chest: An eastern association for the surgery of trauma practice management guideline. J Trauma Acute Care Surg 2012;73:S351-61. doi: 10.1097/TA.0b013e31827019fd, PMID 23114493.