

Role of Incentive Spirometry in Trauma Patients Managed with Tube Thoracostomy

Naveed Ali Khan, Ata-ur-Rehman, Iqra Khan, Khursheed A. Samo and Amjad Siraj Memon

ABSTRACT

Objectives: To assess the role of incentive spirometry in trauma patients managed with tube thoracostomy in preventing postoperative pulmonary complications.

Trauma injury accounts for 30% of all life years lost in the U.S.⁴ Chest trauma constitutes the major part of trauma. The majority of chest trauma requires careful surveillance and no surgical intervention. Tube thoracostomy may be required in the treatment of chest trauma. Incentive spirometer as a mechanical device helps in the lung expansion and encourages the residual collection either fluid or air to come out of the pleural space and drain it out through the chest tube.

Materials and Methods: The study was conducted on patients coming with chest trauma to accident and emergency department of Civil Hospital Karachi, from January 2013 till July 2014. A total of 100 patients with chest trauma admitted through A&E department were enrolled in this research after taking written consent for tube thoracostomy and agreed to be the part of this research protocol. After assessment and consent the patients underwent tube thoracostomy under local anesthesia. The patients were divided into two groups by envelope technique, group A (n=50), who were advised to use incentive spirometer post procedure and the other was group B (n=50) who were not advised the use of incentive spirometer. Both the groups were then managed on same protocol of antibiotics and pain killers and were observed for the recovery in terms of removal of chest tube.

Results: Out of a total of 100 patients, 68% were males and 32% were females. 73 % of the patients were young ranging from 21 to 50 years of age with the peak incidence of 31% in the age group of 31-40 years of age. The length of hospital stay was with mean of 5 days in group A, as compared to the length of the stay in group B is a mean of 8.5 days. Out of 100 patients 8 patient developed drain site infection [group A, n=2(25%), group B n=6(75%)]. 4 patients developed empyema thorax [group A, n=1(25%), group B, n=3(75%)].

Conclusion: The study shows that the use of incentive spirometer reduces the post operative pulmonary complications, length of hospital stay and also the cost and morbidity related to it. Incentive spirometer is a cost effective device to be used in post operative patients with no harmful effects.

How to cite this article: Khan NA, Rehman A, Khan I, Samo KA, Memon AS. Role of incentive spirometry in trauma patients managed with tube thoracostomy. J Dow Uni Health Sci 2015; 9(3): 117-120.

INTRODUCTION

Trauma medicine is the study of medical problems associated with physical injury. Each year trauma accounts for 41 million emergency department visits and 2.3 million hospital admissions across the world¹⁻³. Trauma injury accounts for 30% of all life years lost in the U.S.⁴. Traumatic events affect all age groups, the impact on life years lost is equal to the combined life

years lost from cancer, heart disease and HIV. Trauma is the third cause of death overall and the most common cause of death between the ages of one and 44 years worldwide⁵. Chest trauma constitutes the major part of traumatic injuries and leads to serious consequences. It ranks third after head and extremity trauma^{1,3}. The majority of chest trauma requires careful surveillance and no surgical intervention.

In Pakistan, as the populations is growing, people are at high risk of trauma in the form of RTA because of lack of facilities. Though not much local data is available on chest trauma, only few studies have been done on chest trauma. One study done locally reported mortality rate of 7% and another reported the mortality rate of 11.8%^{18,19}. Tube thoracostomy may be required in the

Surgical Unit 3, Civil Hospital Karachi, Dow University of Health Sciences, Karachi, Pakistan.

Correspondence: Dr. Ata-ur-Rehman, Surgical Unit 3, Civil Hospital Karachi, Dow University of Health Sciences, Karachi, Pakistan.

Email: dr_ata_rehman@hotmail.com

treatment of chest trauma. Hence, it increases the morbidity by introduction of microorganisms in pleural cavity or by incomplete lung expansion².

However, incentive spirometer is a device used to improve the functioning of lungs. It helps to minimize the chance of fluid build-up in the lungs and also improves air flow in lungs. The patient breathes in from the device as slowly and as deeply as possible, and then holds his/her breath for 2–6 seconds offering visual feedback. This provides back pressure which opens alveoli.

As incentive spirometer helps in the lung expansion so it can be used as a mechanical device for the expansion of lungs so as to encourage the residual collection either fluid or air to come out of the pleural space and drain it out through the chest tube in the underwater seal bottle and hence can help in early removal of chest drains. This type of physiotherapy is recommended and considered important in the care of thoracostomy patients, but high quality evidence remains lacking. The purpose of this study was to offer this type of chest physiotherapy with incentive spirometer in patients treated with tube thoracostomy to promote early lung expansion and removal of the chest tube much earlier to prevent the patients to develop complications versus those who were not offered such physiotherapy with incentive spirometer.

MATERIALS & METHODS

The study was conducted on patients, presenting with chest trauma to accident and emergency department of Civil Hospital Karachi, from January 2013 till July 2014. The patients were managed as per ATLS protocol in the A&E department by the member of on-call general surgical team and were shifted to emergency operation theater for tube thoracostomy. After counseling about the condition of the patient written and informed consent was obtained.

Tube thoracostomy was performed following standard protocol in emergency operation theater. Post operatively patients were managed in general surgical ward, V, Civil Hospital Karachi for further management until discharged. Once the patients were discharged after satisfactory recovery they were followed up in the OPD every week for a month to assess for any complication like wound infection or pain at thoracostomy site.

The patients were divided into two groups by envelope technique, group A (n=50), who were advised to use incentive spirometer after tube thoracostomy and the other was group B (n=50) who were not advised the use of incentive spirometer after tube thoracostomy.

Both the groups were then standardized with respect to antibiotics and pain killers and were observed for the recovery in terms of lung expansion, removal of chest tube or any chest tube related complications.

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008. Informed consent was obtained from all patients for being included in the study.

RESULTS

Out of a total of 100 patients, males were 68% and females were 32%. From a total of 100 patients, 73 % of the patients were young ranging from 21 to 50 years of age. The highest numbers of patients were in the age group of 31-40 years of age group. The mechanism of injury was road traffic accidents in 71%, fire arm injury in 26% and 3% of the total patients came with stab wound on the chest.

The different indications for which the patients underwent tube thoracostomy are shown in figure 4. The total length of the stay in hospital was three to seven days in group A, with a mean of five days as compared to the length of the stay in group B which was 4 to 13 days with a mean of 8.5 days as shown in figure 3.

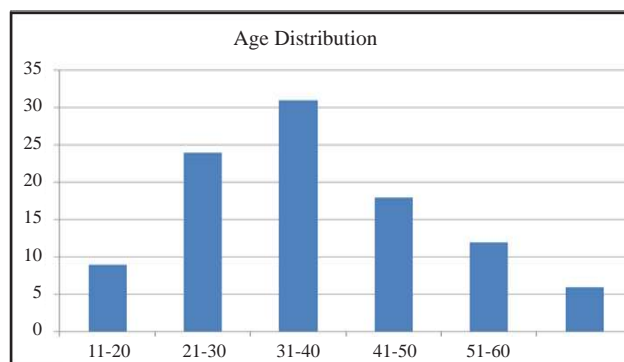


Figure 1: Age Distribution.

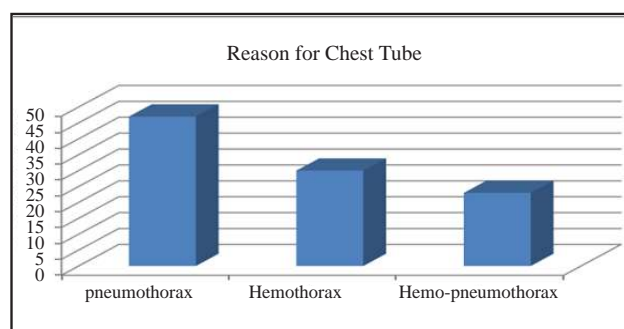


Figure 2: Reasons for Tube Thoracostomy

The results clearly shows that the patients who were advised to use incentive spirometer have less post operative complications in terms of wound infection, pain at drain site and developing empyema thorax, summarized in figure 4. Two patients were referred to thoracic surgery department for further management [group A, n=0(0%), group B n=2(100%)]. In follow up visit 64.7% (n=11) of the patients of group B complained of pain at the drain site after 14 days as compare to 35.29% (n=6) of the patients of group A complained of pain at the drain site after 14 days.

DISCUSSION

Chest trauma constitutes the major part of major trauma. Most of the exposed patients need tube thoracostomy as an immediate intervention to save their lives along with resuscitation.

There are different schools of thoughts regarding the use of incentive spirometer in post operative period of penetrating chest trauma for evacuation of blood, expansion of lung, prevention of clotted haemothorax⁷⁻⁹, empyema and post operative pneumonia¹⁴.

Our study has showed reduction in hospital stay with the use of incentive spirometry as 3 to 7 days in group A, with a mean of 5 days as compared to the length of the stay in group B which was 4 to 13 days with a mean of 8.5 days as compared to other study showed the length of hospital stay was 7.2 +/- 2.07 days and 12.4 +/- 3.63 days in group I and II respectively⁷.

Hence the use of incentive spirometer helps in early recovery of the patient and decreasing the length of hospital stay and thus decreasing the financial and psychological burden on the patients.

The risk and severity of postoperative pulmonary complications can be reduced by the judicious use of therapeutic maneuvers that increase lung volume. Our objective was to assess the effect of incentive spirometry compared to no therapy⁸. Pertinent data is lacking regarding the use of incentive spirometer and there is need to conduct well-designed trials to define the evidence based benefit of the use of incentive spirometer^{8,12,15,16}. The device was well tolerated by patients, and there were no complications associated with its use. It is a safe device to be used in future studies^{6,13}. This study has shown marked reduction in drain site infection, empyema and need to refer to thoracic surgery department which has made its effect to use it as cost effective device.

Postoperative pulmonary complications have a significant clinical and economic impact associated with increased observed number of deaths, morbidity, length of stay and associated cost¹⁷. In view of this study incentive spirometer can be recommended to the patients undergoing tube thoracostomy for early recovery and preventing complications.

CONCLUSION

Our study has shown that the use of incentive spirometry reduces post operative pulmonary complications, length of hospital stay and also the cost and morbidity related to it. Incentive spirometry is a cost effective method to be used in post operative patients with no harmful effects.

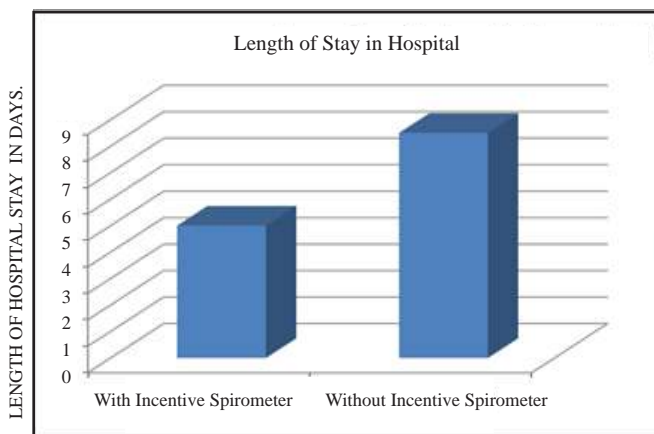


Figure 3: Length of Hospital Stay in Days

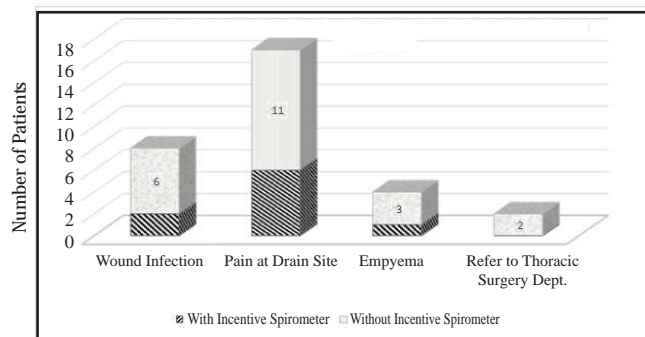
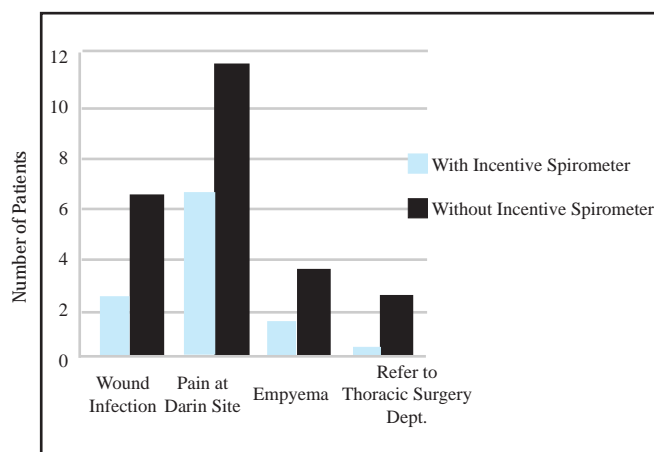


Figure 4: Complications seen in comparative groups

REFERENCES

1. LoCicero J 3rd, Mattox KL. Epidemiology of chest trauma. *Surg Clin North Am* 1989; 69:15-9.
2. Helling, Thomas S, Gyles, Nicholas R, Eisenstein, Caren L, et al. Complications Following blunt and penetrating injuries in 216 victims of chest trauma requiring tube thoracostomy. *J trauma* 1989; 29:143-64.
3. Kish G, Kozloff L, Joseph WL, Adkins PC. Indications For early thoracotomy in the management of chest trauma. *Thorax* 1976; 22:23-8.
4. Centers for disease control and prevention, national center for injury prevention and control. Web-based injury statistics query and reporting system. [Internet]. Atlanta: Centers for disease control and prevention, national center for injury prevention and control; 2012 [cited 2014 Feb 17]. Available from: <http://www.cdc.gov/injury/wisqars/>
5. William NS, Bulstrode CJK, Connell PR. Bailey and Love. 26th ed, Florida : CRC Press ; 2013
6. Agostini P, Naidu B, Cieslik H, Steyn R, Rajesh PB, Bishay E, et al. Effectiveness of incentive spirometry in patients following thoracotomy and lung resection including those at high risk for developing pulmonary complications. *Thorax* 2013; 68:580-5.
7. Muslim M, Bilal A, Salim M, Khan MA, Baseer A, Ahmed M. Tube thorocostomy: management and outcome in patients with penetrating chest trauma. *J Ayub Med Coll Abbottabad* 2008; 20:108-11.
8. Guimarães MM, El Dib R, Smith AF, Matos D. Incentive spirometry for prevention of postoperative pulmonary complications in upper abdominal surgery. *Cochrane Database Syst* 2009; 8.
9. Renault JA, Costa-Val R, Rossetti MB. Respiratory physiotherapy in the pulmonary dysfunction after cardiac surgery. *Rev Bras Cir Cardiovasc* 2008; 23:562-9.
10. Edelen C, Perlow M. A comparison of the effectiveness of an opioid analgesic and a nonpharmacologic intervention to improve incentive spirometry volumes. *Pain Manag Nurs* 2002; 3:36-42.
11. Gale GD, Sanders DE. The Bartlett-Edwards incentive spirometer: a preliminary assessment of its use in the prevention of atelectasis after cardio-pulmonary bypass. *Can Anaesth Soc J* 1977; 24:408-16.
12. Crowe JM, Bradley CA. The effectiveness of incentive spirometry with physical therapy for high-risk patients after coronary artery bypass surgery. *Phys Ther* 1997; 77:260-8.
13. Goldstein GH, Iloreta AM, Ojo B, Malkin BD. Incentive spirometry for the tracheostomy patient. *Otolaryngol Head Neck Surg* 2015; 147:1065-8.
14. Wren SM, Martin M, Yoon JK, Bech F. Postoperative pneumonia-prevention program for the inpatient surgical ward. *J Am Coll Surg* 2014; 210:491-5.
15. Westwood K, Griffin M, Roberts K, Williams M, Yoong K, Digger T. Incentive spirometry decreases respiratory complications following major abdominal surgery. *Surg* 2007; 5:339-42.
16. Reeve JC, Nicol K, Stiller K, McPherson KM, Birch P, Gordon IR, et al. Does physiotherapy reduce the incidence of postoperative pulmonary complications following pulmonary resection via open thoracotomy? A preliminary randomised single-blind clinical trial. *Eur J Cardiothorac Surg* 2015; 37:1158-66.
17. Agostini P1, Cieslik H, Rathinam S, Bishay E, Kalkat MS, Rajesh PB, et al. Postoperative pulmonary complications following thoracic surgery: are there any modifiable risk factors?. *Thorax* 2015; 65:815-8.
18. Farooq U, Raza W, Zia N, Hanif M, Khan MM. Classification and management of chest trauma 2006; 16:101-3.
19. Saaq M, Shah SA. Thoracic Trauma: Presentation and Management Outcome. *J Coll Physicians Surg Pak* 2008; 18:230-3.

