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A Comparative Study Between-Small Bore and Large Bore Tubes for Therapeutic Pleural Drainage

[1]Muhammad Ramzan, [2]Talha Mahmud, [2]Muhammad Saqib, [3]Abdul Saeed Khan, [4]Qazi Abdul Saboor, [5]Ali Rafique Mirza

[1]*Department of Pulmonology, Gulab Devi Chest Hospital, Lahore*
[2]*Department of Pulmonology, Shaikh Zayed Medical Complex, Lahore*
[3]*Department of ENT, Shaikh Zayed Medical Complex, Lahore*
[4]*Department of Cardiology, Shaikh Zayed Medical Complex, Lahore*
[5]*Department of Plastic Surgery, Shaikh Zayed Medical Complex, Lahore*

ABSTRACT

Introduction: Pleural effusions due to various pulmonary and extra pulmonary causes are common clinical problems. Some pleural diseases require therapeutic pleurocentesis to decompress the pleural space like in malignant and benign pleural effusions, pyothorax, chylothorax, pneumothorax, complicated parapneumonic effusion and haemothoraces. Traditionally large bore tubes have been used with trocar or through blunt dissection. Nowadays small-bore catheters are gaining popularity, as they are less painful and believed to be equally efficacious as compared to large bore tubes. **Aims & Objectives:** To compare the success rate of small bore tubes with standard large bore chest tubes in therapeutic pleural drainage and to compare complications rate between small bore and large bore drains. **Place and duration of study:** The study was conducted at Department of Pulmonology of FPGMI, Shaikh Zayed Hospital, during one year (2015-2016). **Material & Methods:** Total 152 patients who required therapeutic evacuation of pleural space suffering from pneumothorax, empyema, parapneumonic and malignant effusion, were enrolled and underwent therapeutic drainage with small bore (< 20 F size) and large bore tubes (> 20 F size), randomized by lottery method. **Results:** The mean duration of drain placement for large bore drain was 7.9±3.8 days, which was significantly higher than small bore drains with a mean value of 3.0±1.6 days (p-value <0.001). The pain score was also quite high in large bore group with mean value 5.67±1.68 as compared to small bore 1.07±0.81(p-value<0.001). Similarly the mean bleeding during the procedure was significantly higher in large bore group as compared to small bore with mean values 11.9±7.8 and 0.1±0.2 ml respectively (p-value<0.001). The wound infection which is a significant complication was found only in large bore group with 14.5% cases as compared to none in small bore group (p-value 0.001). In large bore group surgery was required for 9(11.8%) cases while in small group there were 2(2.6%) patients referred for surgical intervention. **Conclusion:** Small bore thoracostomy drains are more effective than large bore tubes, for the treatment of pleural disorders requiring therapeutic drainage and they are associated with minimal pain and other complications.

Key words: Small bore drain, large bore drain, Tube Thoracostomy

INTRODUCTION

An abnormal collection of fluid in the pleural space is called pleural effusion which shows inequality in formation of pleural fluid and its removal.[1] There are certain reasons of pleural effusion but mostly tuberculosis, pneumonia, malignancy, connective tissue disorders, or pulmonary embolism cause pleural effusions.[2] Exudative fluid is typically produced by inflammatory conditions (lung infection, malignancy); and is usually more serious and difficult to treat. About 40% of hospitalized pneumonia patients have an associated parapneumonic effusion.[3] TB is an important cause of pleural effusion in the developing world, and in immunocompromised people.[4] Management of pleural fluid depends on underlying etiology of the effusion.[2] Like pleural effusion the management of pneumothorax also depends on a number of factors, and treatment options include, immediate needle decompression or insertion of a chest tube and discharge with early follow-up.[5]

The pleural diseases like empyema, parapneumonic effusions and pneumothorax are common clinical conditions that have conventionally been treated by insertion of a large bore intercostal tube. However, the use of a thoracostomy tube has its own risks because these tubes are placed either by trocar assistance or by blunt dissection and might have

considerable morbidity.[6,7,8] Many complications like pain, bleeding, septic shock, empyema, visceral injury, malposition and death are associated with large bore chest tubes.[9] With advancement in medical sciences, minimally invasive surgical procedures involving image-guided small percutaneous chest drainage tubes (6-14 FR) have been used in patients with pleural effusions because of their effectiveness in drainage of pleural fluid and the significantly low morbidity associated with the procedure.[5,6,7] For the past few years, these least invasive small bore tubes have gained increasing recognition.[9] The traditional surgical teaching still emphasizes that large bore chest tubes placement via blunt dissection technique with or without trocar should be used for successful drainage of viscous fluid collections.[8]

There are many western studies on this topic but not even a single study has been conducted in Pakistan to supplement the foreign data. In most of our hospitals, larger chest drains via intercostal dissection method are still in use due to paucity of local data. If success rates are same or close for both small & large drains but a small bore tubes having less complications, then priority should be given to small bore. The aim of this research is comparison between large and small size tubes in various pleural disorders requiring therapeutic drainage like empyema, complicated parapneumonic, malignant pleural effusions and pneumothorax.

MATERIAL AND METHODS

Ethical approval of this randomized control trial was obtained from Institutional Ethical Review Committee. Informed written consents were taken from all volunteer participants. The study was conducted at Department of Pulmonology of FPGMI, Shaikh Zayed Hospital, during one year (2015-2016). Total 152 patients who were suffering from pneumothorax, empyema, parapneumonic and malignant effusion were enrolled from pulmonology ward and underwent therapeutic drainage with small bore and large bore tubes selected through lottery method. Patient chest radiograph were utilized to assess the pleural collections either fluid or air; and to quantify the volume of pleural collection as small, moderate, large or massive for pleural effusion; and for pneumothorax as small or large. The chest tube thoracostomy (large bore chest tube or small-bore tube) was performed under full aseptic protocol after onsite localization of pleural effusion by bedside thoracic ultrasonography.

Statistical analysis:

Statistical Package for Social Sciences (SPSS) version 20 was used for data analysis.

RESULTS

The study was conducted with 152 cases with various pleural disorders, randomly allocated to the two groups. In one group small bore drains were inserted and in the other group large bore drains. After random allocation there were 59 (77.6%) males and 17 (22.4%) females in large bore, while 52 (68.4%) males and 24 (31.6%) females in small bore group and were not different with p-value 0.273. The age distribution was also similar for the two groups (p-value=0.231). Mean age for large and small bore groups was 43±15 years and 46±16 years respectively. The diagnostic categories were almost similarly distributed between two groups at random and no significant difference was found (p=0.364) (Table-1). Sites of effusion distributed between two groups were also not significantly different, except the 4 bilateral cases in which all received large bore drain. Among small drains, in 3 patients 8mm bore drain was placed and in remaining 73 patients drain size was 10 mm. In large bore group 24 mm drained was passed in 9 patients and in remaining 67 patients 26 mm drain was passed. The mean duration of drain placement for large bore drain was 7.9±3.8 days, which was significantly higher than small bore drains with a mean value of 3.0±1.6 days and p-value <0.001. Similarly, the duration for hospital stay was also significantly higher in large bore as compared to small bore with mean values 8.7±4.0 and 3.8±1.8 respectively and p-value <0.001 (Table-2).

The effusion sizes were though significantly different between two groups with p-value 0.009; still the moderate sizes were most common in both groups with respective percentage of 48.7 and 53.9. Success was studied in both groups by each effusion size so that no difference is ignored. It was noted that in small effusion size both bores were 100% effective and successful. In large effusion sizes the success rate for large and small bore was 96.8% and 100.0% respectively. The major difference was found between the two groups in case of moderate effusion sizes. Here the large bore had 75.7% success rate while the small bore has 92.7%. The pain score was also quite high in large bore group with mean value 5.67±1.68 as compared to small bore 1.07±0.81 with a p-value <0.001 (Fig-1). Similarly, the mean bleeding during the procedure was significantly higher in large bore group as compare to small bore with mean values 11.9± 7.8 and 0.1± 0.2 ml respectively and p-value <0.001(Fig-2). The wound infection which is a significant complication was found only in large bore group with 14.5% cases as compared to none in

small bore group with p-value 0.001. Surgical emphysema was seen in 10 (13.2%) of large bore cases as compared to 2 (2.6%) in small bore drain with p-value 0.016. There was one case in large bore group with malposition as compared to none in small bore, though, insignificantly different with p-value 0.316. No death was recorded in any of the case in both groups. In large bore group surgery was required for 9(11.8%) of cases while in small group there were only 2(2.6%) cases (Table-3). One case in small bore group required fibrinolytic as further management. The difference for further management and success was significantly different between two groups with p-value 0. 040.

		Large Bore		Small Bore	
		N	%	N	%
Age	≤ 30	25	32.9	17	22.4
	31 - 45	12	15.8	22	28.9
	46 - 60	35	46.1	22	28.9
	> 60	4	5.3	15	19.7
Gender	Male	59	77.6	52	68.4
	Female	17	22.4	24	31.6
Diagnosis	Empyema	29	38.2	34	44.7
	Malignant effusion	7	9.2	8	10.5
	Para pneumonic effusion	6	7.9	10	13.2
	Pneumothorax	34	44.7	24	31.6
Hemithorax involved	Left	35	46.1	34	45.3
	Right	37	48.7	42	54.7
	Bilateral	4	5.3	0	0.0
Drain Size (mm)	8	0	0	3	4.1
	10	0	0	73	95.9
	24	9	11.8	0	0
	28	67	88.2	0	0
Effusion Size	Small	4	9.5	13	25.0
	Moderate	20	47.6	27	51.9
	Large	18	42.9	16	23.1

Table-1: Various characteristics of patients requiring therapeutic drainage in both groups

Duration (days)		Group		Mann Whitney U	P-value
		Large bore	Small bore		
Drain removal	Mean	7.9	3.0	530.0	< 0.001
	SD	3.8	1.6		
	Min.	2.0	1.0		
	Max.	19.0	8.0		
Hospital stay	Mean	8.7	3.8	624.0	< 0.001
	SD	4.0	1.8		
	Min.	2.0	1.0		
	Max.	20.0	9.0		

Table-2: Duration of drain and hospital stay in days by the bore size

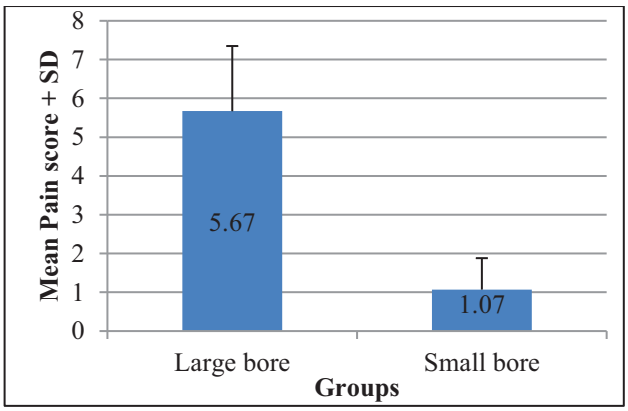

Fig-1: Pain scores for the two bore sizes

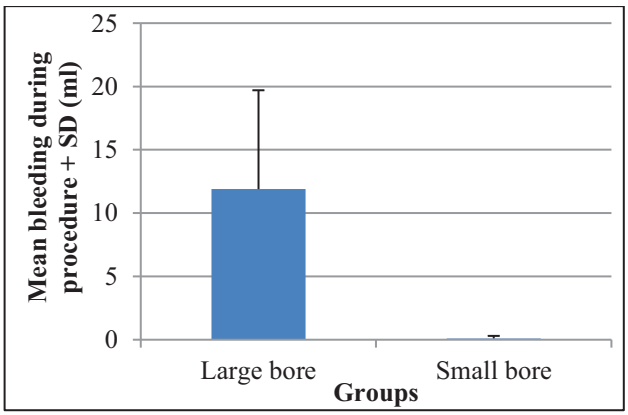

Fig-2: Mean bleeding duration procedure for two bore size

		Large bore N = 76		Small bore N = 76		P-value
		n	%	n	%	
Complications	**Wound infection**	11	14.5	0	0.0	0.001
	Surgical emphysema	10	13.2	2	2.6	0.016
	Malposition	1	1.3	0	0.0	0.316
	Fever	0	0.0	0	0.0	-----
	Sepsis	0	0.0	0	0.0	-----
	Septic shock	0	0.0	0	0.0	-----
	Empyema	0	0.0	0	0.0	-----
	Visceral injury	0	0.0	0	0.0	-----
	Death	0	0.0	0	0.0	-----
Further management	**Not required**	67	88.2	73	96.1	
	Surgery	9	11.8	2	2.6	
	Thrombolytic	0	0.0	1	1.3	

Table-3: Complications& further management among the cases by bore size

DISCUSSION

Thoracostomy tubes are frequently used for the therapeutic removal of air or fluid from the pleural space. The use of small size drains in place of conventional large size tubes for thoracostomy and pleural drainage is increased to reduce the complications. Many studies had demonstrated that insertion of small size tube was as beneficial as large size chest tubes in the management of pleural effusions.[10,11] The underlying reasons to use small bore catheters for the drainage of pleural effusions were lesser invasive procedure than large bore tubes, better tolerated by the patients, and with no compromise in efficacy.[12] The better results with small size tubes used among hospitalized patients ranged from 62-95%.[13] In studies conducted in Spain & Nigeria it was seen that small bore tubes were as efficacious as large bore drains.[14,15] The success rate of small-bore tubes ranged from 92.7% to 100.0%; and of large tubes ranged from 75.7% to 100.0% in present study. In case of small size effusions, both small and large bore tubes were 100.0% effective and successful. Similarly, in large size effusions, success rate of small-bore tube remained at 100.0% but it was slightly decreased to 96.8% for large bore tubes.

Maromet al.[16] assessed the efficacy of small size tubes and concluded that the small size tubes were as successful as a large size chest tubes. In the present study, mean drain duration of small-bore group was significantly lower as compare to large bore group (3.0±1.6 vs 7.9±3.8 days; p-value <0.001). Mean duration for small bore drain in present study was little lesser than duration reported by Marom et al. Likewise drain duration, hospital stay was also significantly shorter in small bore group than large bore group (3.8±1.8 vs 8.7±4.0 days; p-value <0.001). Patzet al.[17] also reported shorter drain duration (mean 5.1 days) but were higher than of present study. Conversely, Louis et al.[18] reported same drain duration for both groups. However, studies concluded that using small-bore tubes were safe and effective alternative in management of pleural effusion in hospitalized patients. Sourouret al.[19] also reported that the small size catheter was comfortable, safe, effective, well tolerated and had satisfactory response rates with low complications. A study conducted by Wendy et al [12] reported that small bore chest drains were as successful as large bore chest drains in patients with pneumothorax similar results were seen in our study.

In different studies it has been seen that small size tubes are having less complications.[13,17,20] In current study, wound infection which is a significant complication was found only in large bore group with 14.5% cases as compared to none in small bore group with p-value 0.001. Surgical emphysema was also commonly present in large bore group compared to small bore group (13.2% vs. 2.6%; p-value 0.016). There was one case with malposition in large bore group and none in the other (p-value 0.316). In the present study, comparison of pain score showed that small bore catheters had significantly lower mean pain score than large bore group (1.07±0.81 vs. 5.67±1.68; p-value <0.001). Similarly, mean values of bleeding were also significantly lower in small bore group as compare to large bore group (0.1±0.2 vs. 11.9±7.8 ml; p-value <0.001). No severe complications or death was seen in both groups.

In current study no mortality occurred related to pleural catheter placement. Specifically, no emergency operation for bleeding or intra-thoracic injury occurred. Similar findings were reported in some other studies.[13,17,20]

CONCLUSION

Small size tubes are beneficial for the management of empyema, parapneumonic effusion, malignant pleural effusion and pneumothorax. The small-bore tubes are more secure and better tolerated than large bore tubes.

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The Authors:

Dr. Muhammad Ramzan
Senior Registrar,
Department of Pulmonology,
Gulab Devi Chest Hospital, Lahore.

Prof. Talha Mahmud
Head, Department of Pulmonology,
Shaikh Zayed Medical Complex, Lahore.
E-mail: drmtalha@hotmail.com

Dr. Muhammad Saqib
Assistant Professor,
Department of Pulmonology,
Shaikh Zayed Medical Complex, Lahore.

Dr. Abdul Saeed Khan
Assistant Professor,
Department of ENT,
Shaikh Zayed Medical Complex, Lahore.

Prof. Qazi Abdul Saboor
Head, Department of Cardiology,
Shaikh Zayed Medical Complex, Lahore.

Prof. Ali Rafique Mirza
Head, Department of Plastic Surgery,
Shaikh Zayed Medical Complex, Lahore.

Corresponding Author:

Prof. Talha Mahmud
Head, Department of Pulmonology,
Shaikh Zayed Medical Complex, Lahore.
E-mail: drmtalha@hotmail.com