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Low Pressure Suction for Non Resolving Pneumothorax and Pyopneumothorax

Mohd Shameem[1*], Nazish Fatima[2], Naveed Nazir Shah[3]

1. Associate Professor, Department of Tuberculosis and Chest Diseases, Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh, Uttar Pradesh, INDIA 202002
2. Assistant Professor, Microbiology, Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh, Uttar Pradesh, INDIA 202002
3. Assistant Professor, Department of Tuberculosis and Chest Diseases, Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh, Uttar Pradesh, INDIA 202002

[*]Correspondence:
Dr. Mohammad Shameem, Associate Professor, Dept. of Tuberculosis and Chest Diseases, JNMCH; AMU; ALIGARH (U.P), INDIA 202002, E-mail: drshameem123@gmail.com

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ABSTRACT

Background: Expansion of a collapsed lung can be accomplished rapidly by the use of a intercostal catheter attached to a suction apparatus.

Aim of the study: To evaluate the benefit of low pressure suction (LPS) in cases of non resolving pneumothorax and pyopneumothorax.

Material and methods: The prospective study was conducted in the Department of Tuberculosis and Chest Diseases, JNMCH; AMU Aligarh. A total of 100 patients were enrolled in the study. Of the 100 patients, 38 patients had plain pneumothorax (in 21 patients the etiology was tubercular while 17 were non tubercular), while 62 patients had pyopneumothorax (34 patients were tubercular while 28 non tubercular). The inclusion criteria were intercostal tube drainage (ICTD) in situ > 2 weeks, < 10% expansion of lung, and absence of bronchopleural fistula. The patients were randomised into two groups; negative suction was applied in the study group while the control group was treated by ICTD alone. Stastical analysis was done by Chi-square test with continuity correction. A p value of < 0.05 was taken as stastically significant.

Results: Out of a total of 38 patients of pneumothorax, 15(83.3%) patient had full expansion of lung, while 3(16.6%) patient had to undergo decortication. Out of 62 patients who had pyopneumothorax, 8(53.3%) patients had full expansion of lung with LPS, while 7(46.6%) patients had to undergo decortication.

Conclusion: Majority of patients are benefited by LPS (patients with plain pneumothorax are benefited more than patients with pyopneumothorax). LPS is cheap, safe and simple procedure. Every patient with non expanding lung in spite of ICTD in situ for more than 2 weeks should be given a trial of LPS before planning for major surgical intervention.

Keywords: pneumothorax, suction, bronchopleural fistula, pyopneumothorax.

1. INTRODUCTION

Suction to underwater seal is sometimes needed to assist in the drainage of fluid/pus and expansion of lung in cases of non resolving pneumothorax & pyopneumothorax. However the indications for suction are unclear, but it is commonly believed that it improves drainage (Harriss and Graham, 1991). There is little evidence to guide recommendation. Most studies are observational and have used suction applied via the chest tube after flushing to prevent blocking (Laws et al. 2003). Although they have reported success but this has not been compared with cases without suction. Need for application of suction is based on sound clinical and radiological correlation. Failure to achieve adequate expansion of lung after insertion of intercostal tube is the most common indication for suction, but if persistent air leak (i.e. bronchopleural fistula) is present, application of suction can be counterproductive. Usually amount of suction needed varies from 10-20 cm of water. When applying suction, at least 3 bottles underwater seal system is connected to LPS.

2. MATERIAL AND METHODS

The prospective study was conducted in the Department of Tuberculosis and Chest Diseases, and Microbiology; JNMCH; AMU Aligarh. A total of 100 patients were enrolled in the study between January 2004 till Dec 2006.

- The **inclusion criteria** were-(1) pneumothorax or pyopneumothorax (2) intercostal tube drainage (ICTD) in situ > 2 weeks,(3) < 10% expansion of lung (4) Collection of pus > 100 ml per 24 hrs (5) Absence of loculations as evidenced by Ultrasound of thorax.
- **Exclusion criteria** were-(1) Presence of bronchopleural fistula (BPF) as evidenced by air leak in the ICTD bottle on coughing (2) Haemodynamic instability (3) Presence of multiple loculations.

The chest tube drain was connected to a series of water seal bottle (three water seal bottles connected serially (Figure 1)), *high volume/low pressure suction* was connected to the third bottle (Figure 2). Negative suction was applied at a pressure of 10-20 cm of water, and the pressure was increased (more negative) according to the patients compliance (Figure 3 & 4). The benefit of LPS was evaluated after 24hrs by check chest X-ray. Statistical analysis was done by Chi-square test.

3. OBSERVATION AND RESULTS

Of the 100 patients, 38 patients had plain pneumothorax (in 21 patients the etiology was tubercular while 17 were non tubercular), while 62 patients had pyopneumothorax (34 patients were tubercular while 28 non tubercular), (Table 1). The inclusion criteria were intercostal tube drainage (ICTD) in situ > 2 weeks, < 10% expansion of lung, and absence of bronchopleural fistula. The patients were randomised into two groups; negative suction was applied in the study group while the control group was treated by ICTD alone. Stastical analysis was done by Chi-square test with continuity correction. A p value of < 0.05 was taken as statistically significant. A total of 33 patients were recruited to the study. 18 patient had plain pneumothorax (tubercular-3, non tubercular-15). 15 patient had pyopneumothorax (tubercular-6, non tubercular-9). Out of 18 patient of plain pneumothorax, 15 patient had full expansion of lung with LPS (tubercular-2, non tubercular 13, statistically not significant), while 3 patient had to undergo decortication (statistically significant), (Table 2 & 4). Out of 15 patient of pyopneumothorax (6 patients was tubercular, while 9 non tubercular). None of the tubercular patient improve with LPS, whereas all non tubercular patient improved with LPS ($p<0.001$), (Table 3 & 4).

4. DISCUSSION

We conducted a trial to evaluate the benefit of low pressure suction in cases of non resolving pneumothorax and pyopneumothorax. Patient with plain pneumothorax is benefited more than patient with pyopneumothorax, more ever patient who had tubercular pyopneumothorax did not benefit from LPS ($p<0.001$), this may be due to the fact

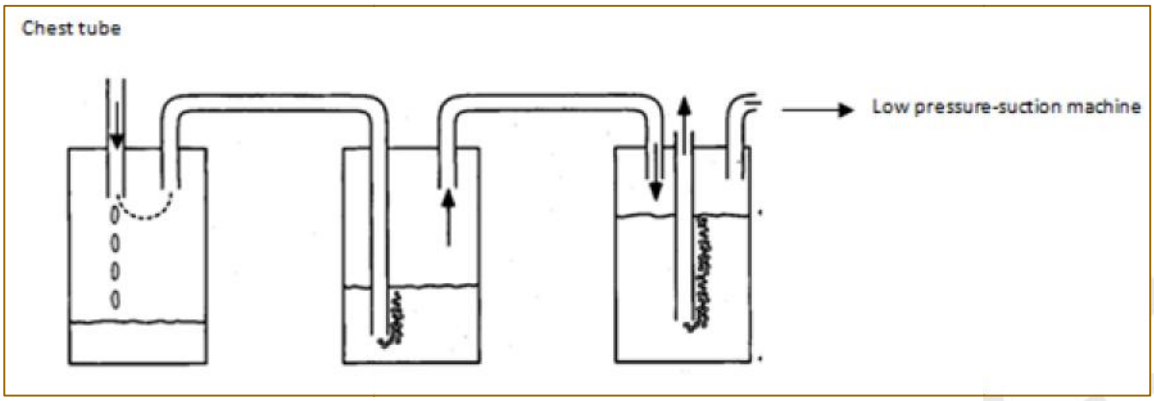

Figure 1

Three water seal bottles connected serially, one end connected to the chest tube, the other connected to LPS

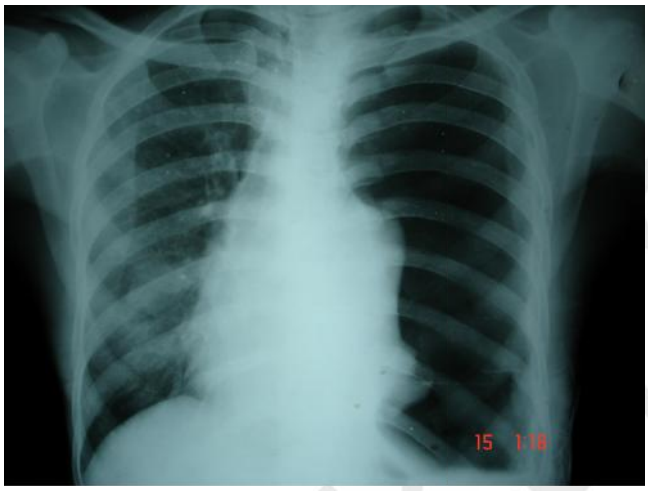

Figure 2

Chest X ray PA view of a patient of left sided pyopneumothorax

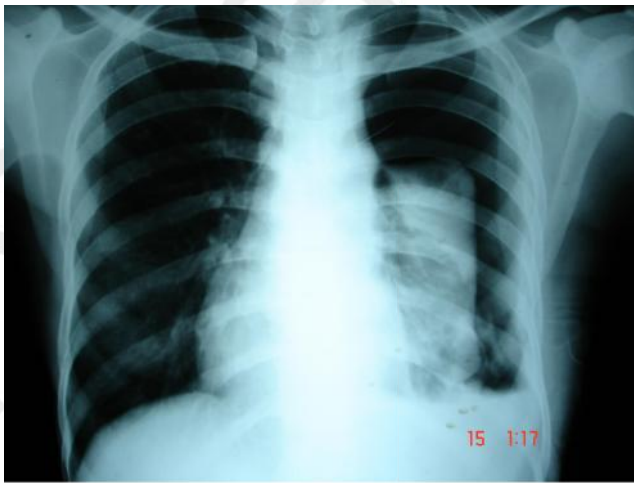

Figure 3

Chest X ray PA view of the patient with partially expanded lung with ICTD in situ

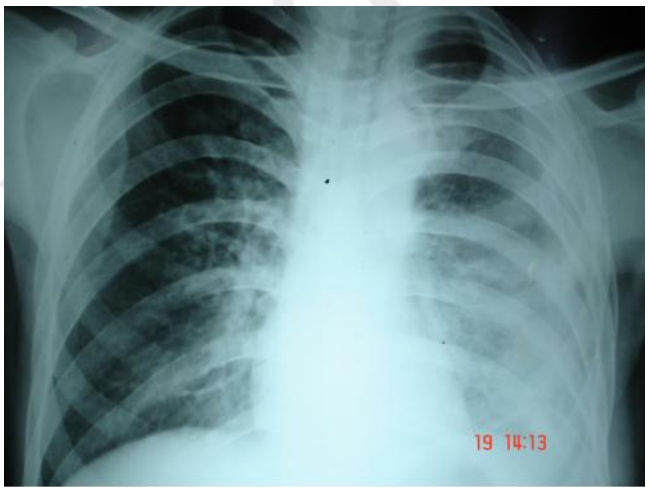

Figure 4

Chest X ray PA view of the same patient with expanded lung after application of low pressure suction

these patient had wide spread fibrosis preventing lung expansion, and decortication is the procedure of choice in such patient.

The use of high volume/low pressure suction pumps has been advocated in cases of non-resolving pneumothorax (Harriss and Graham, 1991), but there is no evidence to support its routine use in the initial treatment of pneumothorax (Laws et al. 2003; Sharma et al. 1988; So and Yu, 1982). If suction is applied as in cases of non resolving pneumothorax, this may be performed via underwater seal at a level of 10-20 cm of water. A high volume pump (e.g. Vernon-Thompson) is required to cope with a large leak. A low volume pump (e.g. Roberts pump) is inappropriate as it is unable to cope with rapid flow, thereby effecting a situation similar to clamping and risking formation of a tension pneumothorax. A wall suction adaptor may also be effective, although chest drains must not be connected directly to the high negative pressure available from wall suction. In the management of pyopneumothorax, the use of suction is unclear. Most studies are observational and have used suction applied via chest tube after flushing to prevent blocking and have reported success, but this has not been compared with cases without suction.

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There is no evidence that briefly disconnecting a drain from suction for pneumothorax or pyopneumothorax is disadvantageous (Laws et al. 2003). Therefore, as long as adequate instruction is given to patient, portering and nursing staff with regard to keeping the underwater seal bottle below the level of the chest, it is acceptable to stop suction for short periods such as for radiography. There was no adverse effect of LPS.

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Table 1

			Patients improving	Patients requiring Decortication	p value
Pneumothorax (n=38)	Tubercular (n=21)	Cases (n=11)	4	7	p=0.518
		Controls (n=10)	6	4	
	Non-Tubercular (n=17)	Cases (n=8)	6	2	p=0.091
		Controls (n=9)	2	7	
Pyothorax/ Pyopneumothorax (n=62)	Tubercular (n=34)	Cases (n=18)	6	12	p=0.877
		Controls (n=16)	4	12	
	Non-Tubercular (n=28)	Cases (n=13)	10	3	p=0.113
		Controls (n=15)	6	9	

Table 2

		Patients improving	Patients requiring Decortication	p value
Pneumothorax/ Pyothorax/ Pyopneumothorax (n=100)	Cases (n=50)	26	24	0.1>p<0.25
	Controls (n=50)	18	32	

Table 3

	Patients improving	Patients requiring Decortication	p value
Pneumothorax (n=19)	10	9	1.00
Pyothorax/ Pyopneumothorax (n=31)	16	15	

Table 4

Etiology	Patients improving	Patients requiring Decortication	p value
Tubercular (n=29)	10	19	0.001>p<0.005
Non- tubercular (n=31)	16	5	