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Original Research Paper

Surgery

AMBULATORY CHEST DRAINAGE: A COST-EFFECTIVE METHOD USING UROBAG

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ABSTRACT

Background: Intercostal drainage is common procedure to relieve pleural collections. Intercostal drain inserted into pleural cavity with underwater drain (UWD) is efficient in draining out the pleural contents, but it has various disadvantages on prolonged use. Various innovations has led to Ambulatory chest drainage (ACD) methods which has challenged conventional methods. We studied the advantages and efficacy of using Smaller ICD tube with urobag against larger ICD with UNDERWATER DRAINAGE in tertiary care centre.

Material and methods: This prospective, observational study involved the patients needing pleural cavity drainage classifying them as two groups: 16 Fr ICD- One way valve Urobag (ACD group) and (2) ICD-underwater drainage (Non-ACD group). The data was collected and analysis done to evaluate the change in the hospital stay, the total duration of drainage, outcome, residual disease and pain in both groups using unpaired *t*-test and Chi-square test.

Results: 50 patients took part in the study; 24 had 16 Fr ICD- One way valve urobag(ACD group) and 26 had ICD-underwater drainage(Non-ACD group). Among the study group of 50 patients, 22 had pleural effusions and 28 pneumothorax. The ACD and non-ACD groups were similar in etiology. Of the 50 patients, 34 had complete lung expansion, 7 pleural thickening, 8 loculated residual disease, and 1 pleurocutaneous fistulae. In the ACD group, the hospital stay was less as compared to the non-ACD group, i.e., 5.11 and 14.6 days ($P = 0.0008$) respectively. The duration of ICD drainage showed a similar trend, i.e., 15 and 19 days ($P = 0.006$) respectively. In complete lung expansion 19 patients were in ACD group and 15 in Non-ACD group($p<.001$). Pain recorded was lower in ACD than non-ACD group.

KEYWORDS : Intercostal drainage,Ambulatory chest drainage,Pleural effusion,Hydropneumothorax

INTRODUCTION:

Pleural drainage(PD) is an essential procedure done in hospitals as elective or lifesaving emergency procedure to relieve fluids, blood or air from pleural cavity which causes lung collapse [1].Hence to re-establish lung expansion and negative intrapleural pressure(2) required for cardiorespiratory function ,tube thoracostomy is done in various pleural disorders like pleural effusion, pneumothorax, hemothorax, chylothorax, malignant effusions and also post cardiothoracic surgery[3].

The conventional PD system described by lillenthal (4) is intercostal drain (ICD) tube attached to underwater drain which can be a reusable glass bottle or disposable polyvinylchloride bags. Even though this is efficient it has disadvantages like increased pain, restriction of mobility, maintaining ICD bag fluid, bag position below the patient level and Clamping the bag during transport which may cause tension pneumothorax.

Many variation like urobag, Flutter valve, stoma bags, chest seals used for Ambulatory chest drainage (ACD) to avoid those disadvantages. Hence we attempted usage of smaller ICD with one way valve urobag for pleural effusion of various etiologies to find out its effects on clinical outcome and patient comfort

MATERIALS AND METHODS:

A prospective observational study was conducted in our institution . Patient more than 18 years were selected and written informed consent was obtained. Patients are referred to us for ICD insertion from other departments are treated with 28/32 Fr PORTEX ICD with underwater seal were considered as non-ACD group. Patients diagnosed newly by us were inserted with 16Fr ICD with One way valve Urobag and considered as ACD group.50 patients were selected over course of 10 months for the study.

All the patients were monitored throughout the hospital stay for pain and ambulation. Pain was recorded using visual analog scale(VAS)[6].VAS ranges from 0-100 mm as no pain-unbearable pain respectively. Patient is discharged if clinically stable and perform ICD care. ICD was removed when lung fully expands and drain is less than 100 ml with serous output. If ICD required for prolonged period and patient was stable ,then patient was discharged after teaching ICD care.

RESULTS:

The total patients involved in this study is 50 adults with mean age of 41.48 years. 32 men and 18 women were included in the study. ACD and non-ACD group consisted of 24 and 26 patients respectively.22 patients had pleural effusion and etiology as follow: 6 pyogenic,7 tuberculosis,5 traumatic and 4 malignancy.28 patients had pneumothorax and etiology as follow:5 primary spontaneous pneumothorax,22 secondary/ Non traumatic pneumothorax (tuberculosis, COPD, interstitial lung disease, pyogenic) and 1 traumatic pneumothorax.

Table 1: Pleural effusion- Clinical data

Etiology	Number of patients	ACD	Non-ACD
Pyogenic	6	3	3
Tuberculosis	7	3	4
Malignancy	4	1	3
Trauma	5	2	3

Table 2: Pneumothorax-Clinical data

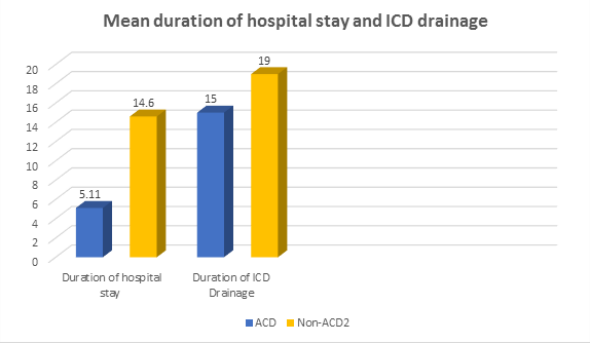
Etiology	Number of patients	ACD	Non-ACD
Primary spontaneous pneumothorax	5	4	1
Secondary pneumothorax/Non Traumatic	22	10	12
Trauma	1	0	1

Table 3: Mean duration of hospital stay and ICD drainage with respect to etiology

Etiology	Mean Duration of hospital stay(days)		Mean Duration of ICD (days)	
	ACD	Non-ACD	ACD	Non-ACD
Pyogenic effusion	6.6	22.6	22	23.3
Tuberculous effusion	5.6	23	32.7	40.6
Malignant effusion	5	14	7	12.6
Traumatic Effusion	5.5	20.3	11	29.3
Primary spontaneous pneumothorax	4	4	4.5	3
Secondary/Non traumatic pneumothorax	5.1	18.4	22.2	24.7
Traumatic pneumothorax	4	-	6	-

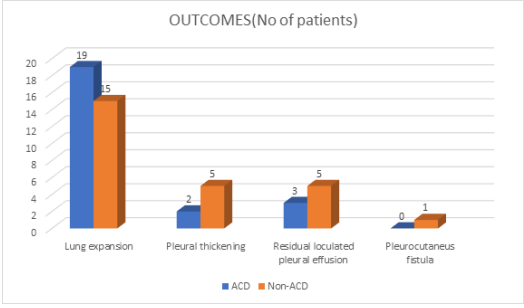
Mean hospital stays in ACD and non-ACD group was 5.11 and 14.6 days respectively. The difference was statistically significant(p=.0007). Mean duration of ICD drainage in ACD and non-ACD group was 15 and 19 days respectively**(Chart 1).** The difference was statistically significant(p=0.040).

Chart 1



The final outcome (**Chart 2**) was complete lung expansion in 34 patients, pleural thickening in 7 patients, Residual loculated disease in 8 patients and 1 had pleurocutaneous fistula. In complete lung expansion 19 patients were in ACD group and 15 in Non-ACD group. The difference was statistically significant(p<.001). In pleural thickening, ACD and non-ACD was 2 and 5 respectively. The difference was statistically significant(p=.006). In residual loculated disease, ACD and non-ACD was 3 and 5 respectively. The difference was statistically significant(p=.008). One patient had pleurocutaneus fistula in non-ACD group. The pain obtained using VAS score was 49mm and 64mm in ACD and non-ACD group respectively. The difference was statistically significant(p<.001).

Chart 2



DISCUSSION:

Tube thoracostomy or Chest tube drainage is a common procedure for hemo/hydro/pneumothorax and stabilizes clinical scenarios like repiratory distress etc[7].This procedure was documented since Hippocrates times ,used in battlefield chest injuries[8].In 1940s,Mcnamara suggested closed thoracostomy was better than open method[9].Early ICD's were made of rubber/malecots catheter with size around 40Fr.Later ICD made of Polyvinylchloride, silicone and polythene were used with varied tips with drainage holes. Such tips can be angled,coiled or straight.

Early age ICD's were bulky. Later smaller ICD's were made as small as 14 Fr. However optimal size is often left for debate. BTS guidelines suggested sizes based on pleural diseases [10-12].Large ICD reduces patients mobility and increases pain on movement. This is further accentuated by underwater seal which requires clamping/unclamping, water level maintenance etc. Henry Heimlich introduced one way valve in 1968 which greatly reduced difficulties of Under water drainage[5].However Heimlich valve cost more than Rs 1500 Whereas ,One way valve Urobag costs maximum of Rs 300 and availability is much wider. It is also disposable, light weight and pre-sterlized. The anti-reflux valve and exit vents drains both fluid and air. Hence can be used for both effusion and pneumothorax. We have used 16 Fr ICD costing less than Rs 200.Hence total cost will be around Rs 500. This method also reduces pain, hospital stay and improves early mobility and patient satisfaction.

Many literatures were published regarding use of urosac with persistent air leak. Cafarotti *et al*. used small calibre tube in many pleural diseases and recorded milder pain.[13].ACD was described with pigtail/urosac by Joshi *et al*. in 29 and 13 cases of pneumothorax and pleural effusion[14] .We have used 16 Fr ICD as it was cheaper alternative to pigtail which costs more than Rs 600. Graham *et al*. described the efficacy, safety, and early mobility of the patients post thoracotomy treated with a chest drainage bag using a one-way flutter valve instead of underwater drainage drains in a randomized control clinical trial of chest drainage systems [15] .Ponn et al . described the efficient use of outpatient ICD management in pneumothorax (176 cases), prolonged postresection air leak (45 cases), and outpatient thoracoscopy pulmonary wedge excision (19 cases) [16]. Kim *et al* described an ambulatory chest drainage and thoracic vent, in the patients of pneumothorax, with decreased mean duration of drainage of 4.7 days[17].Our study demonstrated a significant reduction in the hospital stay in the ACD group. This is consistent with studies by Hussein *et al*. who observed shorter duration of hospital stay using pigtail catheter [18] .

Our study had some limitations. We used only medical cases which required ICD or referred to us with ICD inserted beforehand. we did not use post surgical cases. This could cause un-intentional referral bias.

CONCLUSION:

The main aim of ICD is to relieve the pleural contents and enable lung expansion. Many methods are suggested depending on individual preference. Apart from satisfying the aim of ICD, our Ambulatory chest drainage method also improves patient satisfaction by being cost effective, reducing pain, early ambulation and reduces duration of ICD and hospital stay without compromising clinical outcome.

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Conflict of interest: Nil

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