Silastic Versus Conventional Drain For Postoperative Drainage In Thoracic Surgery

Silastic drain in thoracic surgery

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***Abstract*—Background: In thoracic surgery, it is usual to place apical and basal drains for complete drainage of the pleural cavity. The conventional drains are made of plastic. In the last decade use of silastic drains of smaller size without any complications are reported. The authors designed a study to compare the draining properties of the two types of drains.**

Methods: Following approval of the trial, we enrolled patients into one of the groups. In Group I, a 19FR silastic drain was placed as the basal drain, whereas in Group II, a conventional 32FR plastic drain was used. In both groups 28FR plastic drains were placed as apical drains. The data concerning age, gender, diagnosis, side of operation, type of operation, duration of fluid and air drainage, the total amount of fluid drainage, and length of hospital stay were noted.

Results: A total of 100 patients were evaluated. There were 51 patients in Group I with an average age of 44.49±18.6 years. In Group II, the number of patients was 49, and the average age was 53.06±16.3 years. Statistical analysis revealed significant relationship between the type of the drain and duration of air drainage, duration of fluid drainage, the total amount of fluid drainage, and length of hospital stay (p<0.05).

Conclusions: We believe that using the silastic drain may be preferred in thoracic surgery with fewer days of air and fluid drainage, less amount of fluid drainage and shorter hospital stay. We suggest further studies with larger number of patients for certain conclusions.

Keywords— thoracic surgery, resection, drainage, silastic drains.

I. Introduction

Drain placing following thoracotomy is crucial for complete drainage of air and fluid out of the pleural cavity. The standard and widely accepted practice in thoracic surgery is to place apical and basal drains for this purpose. [1] However, this can be done by using a single drain, as well.[1-6] The routinely used drains are so-called conventional drains (CD) and are mainly made of plastic. CDs may lead to increased amounts of fluid drainage, and may be blocked with thrombi during fluid drainage leading to dysfunction. Recently use of silastic drains (SD) of smaller size named Blake drains (Ethicon Inc, Somerville, NJ, USA) is advocated.[7-14] These drains are reported to be at least as effective as CDs.

In order to compare the fluid draining properties of the two types of drains following various operations in thoracic surgery, the authors designed a clinical trial in a prospective and randomized setting.

II. Materials and Methods

Following the Institutional Review Board permission (permission no: 2009/17) we started to recruit patients for the study in June 2009. Pneumonectomy, decortication, and diaphragm plication patients were not included in this study. The patients were consecutively placed in one of the two groups. In Group I, an apical

28FR size CD, and a basal 19FR SD were placed following surgery (Figure 1). In Group II, the apical drain was 28FR, and the basal drain was 32FR CDs. Basal drains were withdrawn when daily serous fluid drainage became 200 ml or less and the apical were withdrawn 48-72 hours following the cessation of air leak. The patients were discharged on the day after drain removal. The data concerning gender, age, diagnosis, operation side, type of the operation, the amount of fluid drainage, duration of fluid and air drainage, length of hospital stay, and complications if any, were noted.

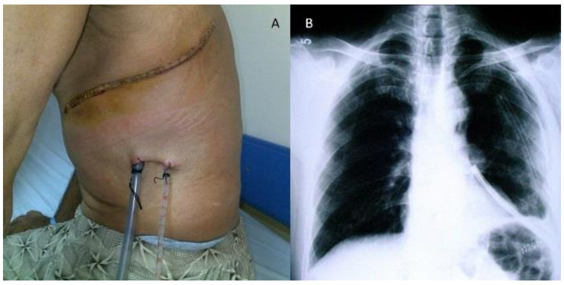

Figure 1. Drain placement in a patient from Group I (A), and chest X-ray of the same patient (B). This patient needed suction applied to the apical drain due to air leak.

All data were evaluated using MedCalc Statistical Software (MedCalc Software bvba, Ostend, Belgium; https://www.medcalc.org). Independent samples t-test was used for statistical analysis. A p value less than 0.05 was taken as statistically significant.

III. Results

Between June 2009 and June 2012, a total of 118 thoracotomy patients were included in this study. In time, 18 patients withdrew their signed written consents leaving a total number of 100 patients for statistical analysis. Of these patients, 51 were in Group I, and 49 were in Group II. The average age was 44.49±18.60 years, and 53.06±16.33 years, respectively. The data concerning age, duration of air drainage, duration of fluid drainage, the total amount of fluid drainage, and length of hospital stay are listed in Table 1 as mean ± standard deviation, minimum, and maximum values.

Table 1. Data gathered from the patients.

Group	Data	Age (years)	DoAD* (days)	DoFD† (days)	TAoFD‡ (ml)	LOS§ (days)
I (n=51)	Mean	44.49	6.25	3.56	585.29	8.25
	Std. Deviation	18.60	3.43	1.66	284.12	3.43
	Minimum	16.00	1.00	2.00	250.00	3.00
	Maximum	78.00	16.00	9.00	1350.00	18.00
II (n=49)	Mean	53.06	8.16	4.97	721.42	10.20
	Std. Deviation	16.33	5.46	3.92	323.07	5.60
	Minimum	20.00	3.00	2.00	300.00	5.00
	Maximum	74.00	32.00	24.00	1850.00	35.00

*DoAD: Duration of air drainage; †DoFD: Duration of fluid drainage; ‡TAoFD: Total amount of fluid drainage; §LOS: Length of hospital stay.

There were 29 male patients in Group I, and 35 male patients in Group II. The operation side was 24 left and 26 right in Group I, whereas in Group II the operation was performed on the left side in 27, and on the right side in the remaining 18 patients. The most frequent diagnoses were lung epidermoid carcinoma (n=13), non-cystic fibrosis bronchiectasis (n=12), and nodular infiltration of the lung (n=12). The most frequent operation types were wedge resection (n=31), upper lobectomy (n=18), and bullae resection (n=15). Data about the diagnoses and the operation types are listed in Table 2.

Table 2. Diagnoses and types of operations.

Data		Group I	Group II	Total
Diagnoses	Lung epidermoid carcinoma	5	8	13
	Bronchiectasis	6	6	12
	Nodular infiltration of lung	6	6	12
	Coin lesion	6	5	11
	Lung adenocarcinoma	6	5	11
	Recurrent pneumothorax	5	5	10
	Hydatid disease of lung	4	3	7
	Lung metastasis	4	3	7
	Posterior mediastinal lesion	4	3	7
	Anterior mediastinal lesion	2	3	5
	Giant bullae	3	2	5
Type of operations	Wedge resection	16	15	31
	Upper lobectomy	7	11	18
	Bullae resection	8	7	15
	Lower lobectomy	8	5	13
	Mediastinal lesion excision with thoracotomy	6	6	12
	Cystotomy and capitonnage	4	3	7
	Bilobectomy inferior	2	2	4

Statistically, the two groups did not have significant differences concerning age, gender, diagnoses, and the type of operations. There were statistically significant differences, however, in length of hospital stay, duration of air drainage, duration of fluid drainage, and the total amount of fluid drainage (Table 3).

Table 3. The t-test results for comparing the outcomes of silastic versus conventional drains.

	Group	N	Mean	Std. Deviation	Df‖	T	p
DoAD*	I	51	6.2549	3.43420	98	2.100	0.038¶
	II	49	8.1633	5.46331			
DoFD†	I	51	3.5686	1.66439	98	2.354	0.021¶
	II	49	4.9796	3.92900			
TAoFD‡	I	51	585.2941	284.12922	98	2.240	0.027¶
	II	49	721.4286	323.07120			
LOS§	I	51	8.2549	3.43420	98	2.105	0.038¶
	II	49	10.2041	5.60870			

*DoAD: Duration of air drainage; †DoFD: Duration of fluid drainage; ‡TAoFD: Total amount of fluid drainage; §LOS: Length of hospital stay; ‖Df: Degree of freedom; ¶: Statistically significant.

IV. Discussion

Following thoracotomies, the widely accepted practice is placing apical and basal 28-32FR CDs for complete drainage of the pleural cavity after any resection. This is based on the natural tendency of the fluid to accumulate at the bottom and air to the apex of the pleural cavity.[1] In time, using single drain has also become popular. [1-6] In recent years, increasing evidence is published about the successful usage of single or double SDs for successful drainage following surgery. [4, 5, 7-14] Since the report by Obney et al. [15] published in 2000, the studies advocating the use of SDs in cardiac surgery increased. [16-18] In thoracic surgery field, the first report was by Kejriwal and Newmann on using 19FR SDs in 37 sequential patients in 2005. [7] They preferred to place the SDs in the posterior basal part of thorax leaving the drain in the paravertebral region. Stolz et al reported on using 24FR SDs as the anterior drain combined with a CD as the posterior one with good results. [8] In published studies, 19-24FR SDs are used in various combinations: single, double, or combined with a CD placed in anterior, posterior, or lateral in the thorax. [4, 5, 7-14] Due to the frequently reported problem of misplacement experienced with SDs, we used 19FR SDs in Group I, and 32FR CDs in Group II patients as posterior basal drains combined with 28FR CDs as apical drains.

Some investigators used SDs in only a selected group of patients with a certain type of operation like wedge resections or lobectomies, whereas others did not discriminate between the operation types. [7-10, 12, 13] The authors excluded pneumonectomy, decortication, and diaphragm plication patients for a better standardizing the patient groups, as well. The most frequent type of operation in this study was wedge resection, followed by upper lobectomy, and bullae resection.

The average amount of air and fluid drainage, duration of drainage, and average length of hospital stay in this study is similar to data reported in literature. [3, 9-11, 13] There were statistically significant differences in all these variables between the two groups using independent samples t-test (Table 3). These results suggest that using a 19FR SD as a basal drain may significantly reduce the total amount of fluid drainage, duration of fluid drainage, duration of air leaks, and subsequently length of hospital stay.

In a study designed to compare the drainage capacities of CDs and SDs *in vitro*, the 28FR CD was reported to drain 9-times more fluid than the 19FR SD. [19] However, there was no difference in drainage capacity between the two drains *in vivo.* This finding suggests that SDs have a drainage capacity which is almost identical to CDs when used in actual patients. SDs are round, flexible, and fluted drains with the capability of constantly draining over the entire length of the fluted portion of the drain with the proximal portion expressing the most draining capacity. The authors believe that this feature may have caused the statistically significant differences in Group I patients.

Due to its non-collapsible nature and long channels for drainage, SDs practically do not occlude with thrombi.[19] In fact the only report on a SD not functioning after the operation was in a patient operated through a median sternotomy for bilateral bullae following talc poudrage.[20] There were no complications due to SD blockage in our study, but in Group II basal CDs were partially occluded in 3 patients.

In order to drain fluid efficiently, suction at a negative pressure of 7-30 cm may be applied to SDs. [5, 9-12, 14] The authors did not apply suction to SDs in this study. In 22 cases in Group I and in 24 patients in Group II, however, we used suction at -20 cm H_2O level to keep the air leak under control, applied only to apical CDs.

V. Conclusion

We conclude that SDs may be used for fluid drainage safely without any problems. In our study use of SDs resulted in less amount of fluid drainage, shorter duration of fluid drainage and air leaks, and shorter length of hospital stay. Whether these drains may be used as a single or a couple of SDs for efficient air and fluid drainage following every thoracic operation requires further studies with larger number of patients in the prospective setting.

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VII. Declaration of conflicting interest

The author declares that he has no conflict of interests.

VIII. Former presentation

This study was presented orally at the National Congress for Lung Health held at Antalya on the 17th of March, 2017.

IX. Protocol registration

The study protocol is registered and made public at www.clinicaltrials.gov with ID: NCT03056716 as of February the 16th, 2017.

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