

“Z” Chest Drainage and Modified Incision and Closure Techniques for Uniportal VATS

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Abstract

BACKGROUND: To research the application of “Z” chest drainage and modified incision and closure techniques for uniportal VATS.

METHODS: The 422 patients by uniportal VATS were divided into three groups: 282 in experimental group (“Z” Chest drainage with two 16 F chest tube), male 156, female 126, median age is 55 years old; 100 in control group 1 (traditional Chest drainage with two 16 F chest tube), male 58, female 42, median age is 53 years old; 40 in control group 2 (traditional Chest drainage with two 34 F chest tube), male 24, female 16, median age is 52 years old. The age, sex and surgical method of the three groups has no **statistical significance**. To compare the incidence rate of Incision exuding, Poor healing of incision and debridement between the 3 groups.

RESULTS: Incidence rate of Incision exuding of experimental group, control group 1 and control group 2: 5 (1.8%), 5 (5%), 5 (12.5%) and 6 (15.0%) (6/40); Poor healing of incision of the three groups: 0 (0%), 1 (1%), 3 (7.5%), 3 (7.5%), 3 (7.5%); debridement of the three groups: 0 (0%) and 3 (7.5%), 3 (7.5%). For the healing of incision, control group 1 was better than control group 2; and experimental group was better than control group 1.

CONCLUSIONS: “Z” Chest drainage and Modified Incision and Closure Techniques decreased the incidence rate of Incision exuding, Poor healing of incision and debridement, which would be useful to obtain a better cosmetic effect after uniportal VATS.

Introduction

In recent years, uniportal thoracoscopic surgery has become one of the routine choices for thoracoscopic surgery, because it can effectively reduce postoperative incision pain, numbness of the chest wall, and has a good cosmetic effect. Compared to multi-incision thoracoscopy or open surgery, one feature of uniportal thoracoscopy is the indwelling of the chest tube. Indwelling the 30F thick chest tube directly in the incision may cause incision exudation, poor healing, and even air leakage in some patients [1–6].

After preliminary exploration, we improved the incision management and suture techniques, and adopted the “Z”-shaped tube placement method. After a large number of practical verifications, the effect was good and the incidence of poor wound healing and exudate was effectively reduced. The summary report is as follows.

Patients And Methods

This study was approved by the Institutional Ethics Committee of Tongji Hospital. Consent was obtained from each patient before data collection. Informed consent was obtained from all individual participants involved in the study.

Patient Data

From September 2017 to February 2018, a total of 422 cases of uniportal VATS were performed, which were divided into three groups according to the catheterization methods and models: the experimental group adopted the "Z" shape thin tube catheterization method, the control group 1 was the common thin tube (16F gastric tube) catheterization, and the control group 2 was the common thick tube (34F thoracic tube) catheterization. The age, gender and surgical methods of the three groups were shown in Table 1, and the differences were not statistically significant ($P > 0.05$).

Table 1
Comparison of general information of patients with different tube placement methods and models in uniportal VATS (case)

Category	experimental group (282cases)	control group 1 (100cases)	control group 2 (40cases)
Median age (years)	55	53	52
Sex			
Male	156	58	24
Female	126	42	16
surgical methods			
lobectomy	220	72	31
Pulmonary segmentectomy	28	16	6
Mediastinal disease	22	8	2
Benign disease of esophagus	12	4	1

Note: the "Z" shape thin tube catheterization method was adopted in the experimental group, the control group 1 was the ordinary thin tube (16F gastric tube) catheterization, and the control group 2 was the ordinary thick tube (34F thoracic tube) catheterization.

Technique

The 5th intercostal midline is generally selected at the incision site to ensure the maximum exposure space. Subcutaneous and muscular incisions were slightly larger than skin incisions (about 0.5 cm), leaving enough space for catheterization. When closing the incision, 7# silk thread was used for Simple intermittent suture of muscle tissue, which was not tied before placing the chest tube. If necessary, a thyroid hook was used to ensure that there are no gaps on both sides of the incision. The 16F chest tube was used, which was thin, soft, and similar in drainage, and more suitable for uniportal thoracoscopic surgery. Place the chest tube from the outer edge of the 1st stitch, straighten the chest tube directly under thoracoscopy, and tie the suture. Suture the skin and subcutaneous tissue with 4# silk thread by

interrupted vertical mattress suture. Place the chest tube between the first and second needles, this is how to place a "Z" shaped tube; Tie the suture to close the incision and secure the chest tube (Figs. 1, 2). Depending on the surgical situation, if two chest tubes are needed, place them at both ends of the incision. According to the surgical situation, if two chest tubes are needed, they should be placed at both ends of the incision, the same method as above. After postoperative chest tube extubation, gently massage the incision without reserving thread and vaseline gauze.

In both control groups, the incision was sutured after placement of the tube, and the chest tube went straight in and out, with no "Z" shape effect.

Observe, record and compare the incision exudation, poor incision healing and incidence of secondary debridement and suture in the three groups.

Statistical Methods

The obtained data were statistically analyzed using SPSS19.0. The age of the groups was compared using independent sample t-tests, and the rest were analyzed by chi-square tests.

Results

The proportions of incision exudate, poor incision healing and secondary incision in the experimental group, control group 1 and control group 2 were compared and shown in Table 2.

Table 2
comparison of incision healing in patients with different catheterization methods and models of single-orifice thoracoscopic surgery [case (%)]

Group	Total	Incision exudate	Poor healing	Secondary suture
experimental group	282	5(1.7)	0	0
control group 1	100	5(5)	1(1)	0
control group 2	40	6(15)	3(7.5)	3(7.5)
<i>P1</i>		0.082	0.093	1.000
<i>P2</i>		0.047	0.037	0.006
Note: <i>P1</i> is the comparison between experimental group and control group 1, and <i>P2</i> is the comparison between control group 1 and control group 2				

The results of the three indicators in the experimental group were better than those in the control group 1 and 2. The ratio of infiltration and poor healing of the incision in the control group1 was better than that in the control group 2.

There was no significant difference in the ratio of secondary incision suture between the two control groups.

Discussion

In recent years, with the continuous improvement of equipment and continuous progress of technology, the application range of uniportal VATS is gradually expanding. Gonzalez-rivas reported uniportal sublobectomy for VATS in 2011^[7]. Subsequently, uniportal thoracoscopy was comprehensively developed and applied in lobectomy and pulmonary segmentectomy, mediastinal tumor and benign esophageal disease, etc., which proved that it had significant effect in improving postoperative incision pain and numbness of patients, and had the same surgical effect and prognosis as porous thoracoscopy and open surgery^[1-6].

Compared with the above advantages, a shortcoming of small uniportal thoracoscopic surgery is that the thoracic drainage tube is directly placed in the incision. This may cause difficulty in sutures, muscles may not be easily sealed, and sutures may be sutured to the chest tube^[8]. The placement of the drainage tube may also face problems, such as position shifting during suture, peri-tube crevasse causing exudation or air into the pleural cavity, the chest tube compressing the intercostal nerve and increasing pain, etc. Placing a traditional 34F thick chest tube through a small single hole is more likely to cause the above problems. Postoperative incision exudation may have a higher incidence than three-hole thoracoscopy, and it is more likely to cause scarring.

In order to solve the above problems as much as possible and guarantee the minimally invasive advantages of uniportal thoracoscope, we have made some improvements and innovations.

The first is the choice of chest tube. When using the 34F thick chest tube, we found that it is difficult to close the muscle layer sutured after the incision is placed in the chest tube, and there is an unsealed gap between the thick chest tube and the upper and lower mating muscles, which leads to incision leakage. Compression of the intercostal nerve by the thick tube can still cause obvious pain after surgery; wound healing after thick chest tube is easy to form large scars, which reduces the aesthetic advantages of uni-VATS; the wall of the thick chest tube is hard and Poor plasticity, often difficult to adjust to the ideal drainage angle. After continuous exploration, we tried the 16F gastric tube as a closed drainage tube of the chest tube, which has a small diameter and a soft wall, which is easier to shape and has a better drainage effect. It is more suitable for uni-VATS^[5].

However, with the accumulation of cases, we found that there were still a small number of patients with wound exudation and rare cases of air leakage. We found that the current chest tube is thin and smooth, which may be the cause of the leak. In view of this characteristic, we further improved the incision suture and catheterization methods, and adopted the "Z" shape catheterization method to effectively control the occurrence of leakage. The exit and inlet of the chest tube in the "Z" shape catheterization method are on different planes, which significantly reduces the probability of seepage and air leakage around the chest

tube. Son^[8] et al. applied similar principles to improve the treatment of incision and chest tube: The skin and subcutaneous tissue were incised at the lower margin of the 6th costal region. When it came to the muscular layer, the subcutaneous tissue and chest wall muscle were separated by stealth upward, and the protective device was placed in the incision. After the operation, a mosquito vascular clamp was used to place the drainage tube through the skin incision through the chest wall muscle to the intercostal incision.

We have tried this method before, but for the single hole of 3 cm, the incision is too small and narrow, and the exposure of the surgical field is poor. Therefore, combining with our own surgical methods, we created the original "Z" shaped catheterization method. Its characteristics are :(1) while ensuring the drainage effect, the chest tube is thinner and softer, reducing the impact on the incision, and easier to indwelling and extraction; (2) the thoracic canal runs stealthily between subcutaneous tissue and muscle tissue, so it is difficult for water leakage, air leakage, thoracic tube prolapse and other events to occur, and the incision is easier to heal; (3) suture the muscle first and then place the tube to make the suture operation easier, especially the first stitch at both ends; After the thoracic tube was identified by thoracoscopy, it was knotted directly without any more operation, which reduced the influence on the thoracic tube, and the thoracic tube was not easy to shift. It will not be sewn to the chest tube; (4) the skin and subcutaneous tissues were sutured by vertical mattress valgus to make the tissues more cohesive and the incision more beautiful.

In conclusion, the optimized suture and catheterization techniques have been proved to be easy to operate and effective by a large number of practices.

Declarations

Declarations

Ethics approval and consent to participate

All procedures performed in studies involving human participants were in accordance with the 1964 Helsinki declaration and its later amendments or comparable ethical standards and was approved by Tongji Hospital Ethics Committee of Tongji Hospital, Tongji medical college, Huazhong University University of Science and Technology.

Informed written consent(not separate, but included in the preoperative consent) was obtained from all individual participants included in the study.

Consent for publication

Not applicable.

Availability of data and materials

All data generated or analysed during this study are included in this published article and its supplementary information files.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

RZ, ZH, NZ, and XF contributed to the design of the study and the performing of the procedure. RZ, ZH and NZ acquired and analyzed the data. RZ and XF drafted the manuscript. RZ, ZH, NZ, and XF revised and edited the manuscript. All authors read and approved the final version of the manuscript.

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Not applicable

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Figures

Fig 1

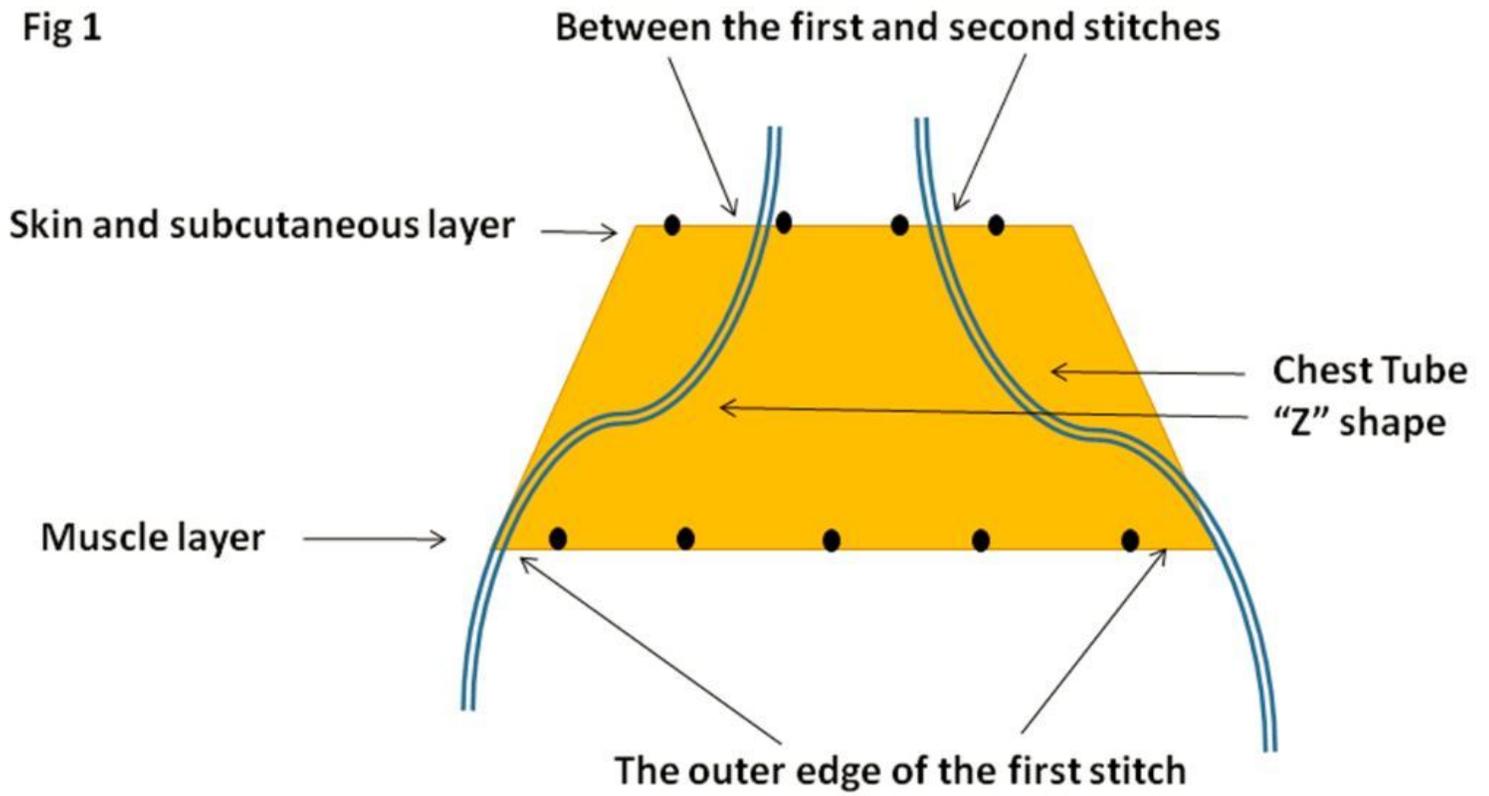


Figure 1

schematic diagram of "Z" shaped tube placement.

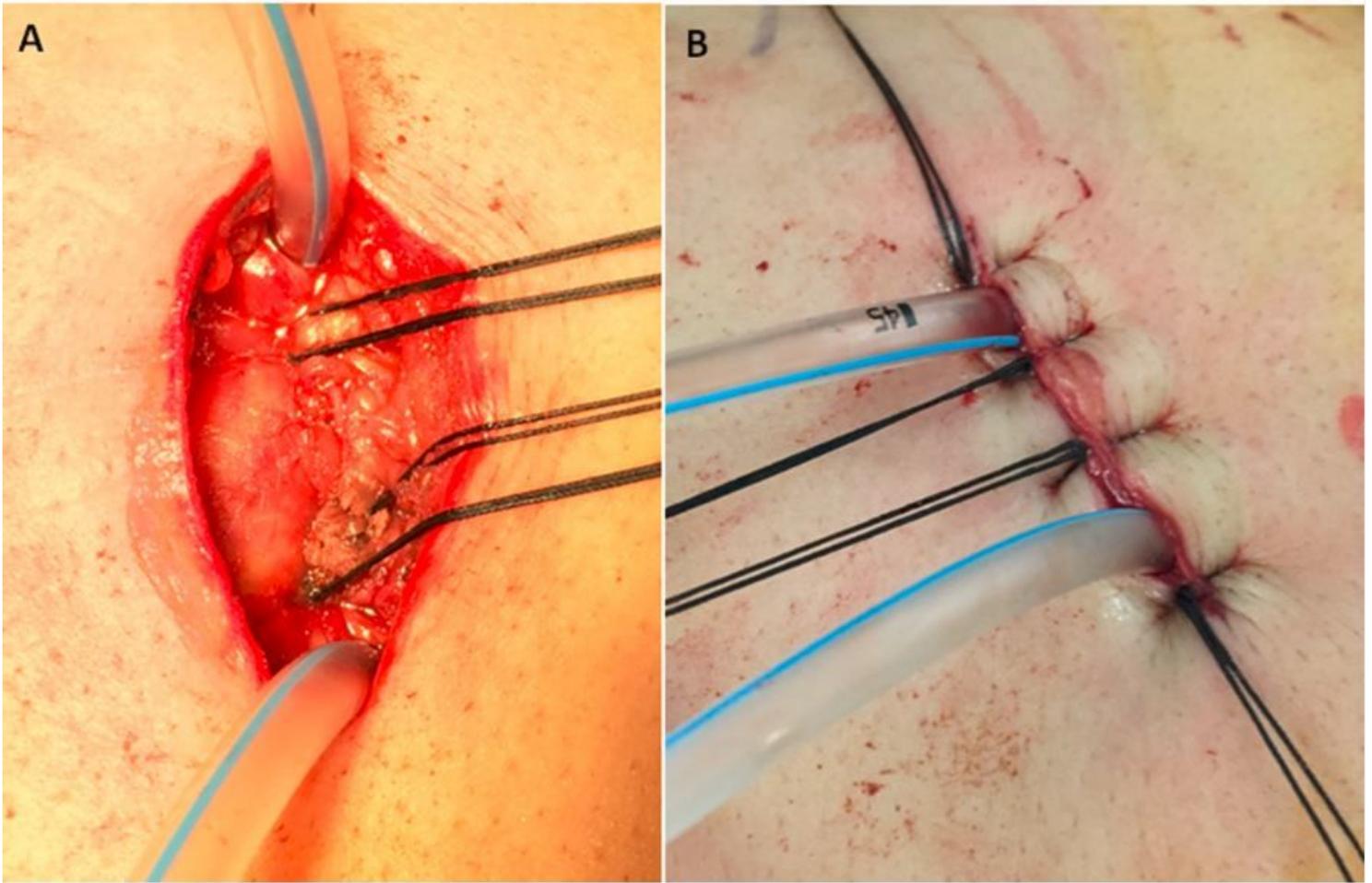


Figure 2

"Z" shape catheterization suture: (A) muscle layer suture, chest tube located at the outer edge of the first needle (B) skin and subcutaneous layer suture, chest tube placed between the first needle and the second needle.