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## Wenlin procedure combined with Wung procedure for treatment of severe pectus carinatum

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### Abstract

Simple pectus carinatum can be corrected by general minimally invasive surgery. However, when the pectus carinatum is serious, because the protrusion is obvious and the bone is rigid, once the protrusion is flattened, there will be secondary depression, and the depression also needs to be corrected. In order to treat this severe deformity satisfactorily, we designed a special surgical method, which is a combined operation of Wenlin procedure and Wung procedure. Our experience shows that this is a very effective surgical method. This paper reports the treatment of a patient with severe pectus carinatum.

**Keywords:** Pectus carinatum, Wenlin procedure, Wung procedure

### Introduction

The minimally invasive surgery of pectus carinatum is mainly to correct the protrusion with the help of special steel bars. At present, the popular method is Abramson procedure, which has some orthopedic effects, but it has many disadvantages [1]. In order to eliminate these disadvantages, we designed a new operation, Wenlin procedure [2]. This operation is simple and safe, and can obtain satisfactory results. However, for some particularly serious pectus carinatum, the effect of Wenlin procedure alone is not well because it cannot eliminate the secondary depression during the operation. In order to treat such a depression, we add a special operation on the basis of Wenlin procedure, namely Wung procedure [3]. When the two procedures are used at the same time, severe pectus carinatum can be treated satisfactorily. Herein we introduce a case of severe pectus carinatum using this kind of operation.

### Case Report

The patient, male, 25 years old, had protrusion of the anterior chest wall since childhood, which was significantly aggravated after puberty. The patient had no symptoms, but was not satisfied with the appearance, so he was admitted to our hospital for surgery. Preoperative physical examination showed that the anterior chest wall was obviously protrusive and the median protrusion was obvious [Fig 1]. Imaging examination showed anterior chest wall was protrusive [Fig 2]. The patient was diagnosed as severe pectus carinatum before operation, and the operation was performed under general anesthesia, with supine position and abduction of both upper limbs. Skin incisions were made on both sides of the chest wall. The incision was located between the axillary frontline and the axillary midline, and the incision was 3cm long. The local muscles in the incision were dissected to expose the surrounding ribs. The Wenlin procedure was completed at the highest plane of the protrusion [2]. Two tunnels between the bone structures and the chest wall muscles and soft tissues were made, and two steel bars were inserted into the tunnels respectively. The central protrusion was pressed with the bars at first, and then both sides of the steel bars were fixed on the ribs. When the secondary depression appeared in the lower part of the chest wall, the third steel bar was inserted into the bottom of the depression to perform the Wung procedure eliminating the depression [3]. After the two procedures, the incisions were closed and the operation was over. The operation was smooth, and there were no complications during and after the operation. The appearance of chest wall returned to normal after operation [Fig 3], and X-ray examination showed that the position of steel bars were satisfactory [Fig 4]. The patient was discharged on the 6th day after operation.

## Discussion

Pectus carinatum is a common thoracic deformity, and surgery is an important treatment. Early surgery was mainly open surgery [4, 5]. In recent years, with the advent of the concept of minimally invasive surgery, it has become the main means of treating pectus carinatum. The first minimally invasive surgery used in clinic is Abramson procedure, which is using a special steel bar to correct the deformity [1]. For patients with mild pectus carinatum, this method has a certain effect. However, due to the shortcomings of the surgical method itself, its use is limited. In order to eliminate the disadvantages of this operation, we designed a new operation, namely Wenlin procedure [2], which is using the template plastic surgery principle to correct the deformity [6]. Due to the rational design, this method is not only simple, but also the effect is very ideal. However, for the serious type of pectus carinatum, secondary depression will inevitably occur when the protrusion is compressed by the steel bar of Wenlin procedure alone. This kind of depression will seriously affect the effect of surgery, so it must be treated. In order to eliminate this depression, we used Wung procedure on the basis of Wenlin procedure, and finally achieved satisfactory results.

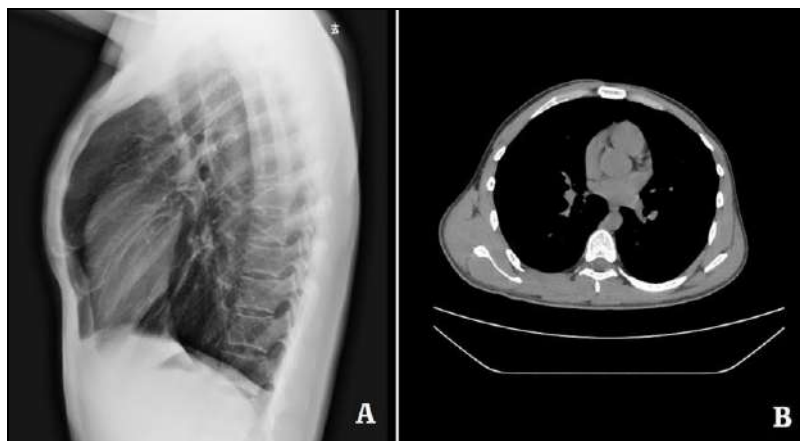
The principle of pectus carinatum surgery is very simple. Many authors believe that as long as the protrusion is compressed, the ideal surgical effect can be obtained. However, this is always not the case. Because the anterior chest wall is a rigid integral structure, when the most protrusive part is flattened, the parts around the protrusion will inevitably sink and form a depression. Therefore, the secondary depression will be a complication that every minimally invasive surgery of pectus carinatum has to face.

If the existence of this complication is ignored, the original protrusion will be replaced with a depression deformity eventually. This will mean the failure of the operation.

For mild pectus carinatum, we usually use Wenlin procedure only. Since there is a reasonable assessment of the intensity of the compression, there is generally no obvious secondary depression. However, for severe pectus carinatum, because secondary depression cannot be avoided, we will resolutely use Wung procedure. Our experience shows that this additional procedure is a very effective remedy.



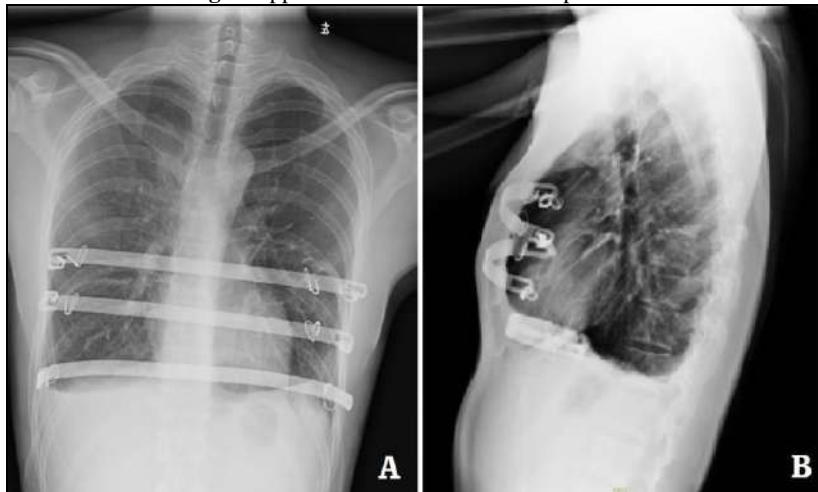
**Fig 1:** Appearance of chest wall before operation.



**Fig 2:** Imaging examination indicates severe pectus carinatum. A, X-ray lateral film; B, CT scan section film.



**Fig 3:** Appearance of chest wall after operation.



**Fig 4:** Postoperative X-ray examination shows the position of the steel bars. A, posterior anterior film; B, Lateral film. a, b, steel bars of Wenlin procedure; c, steel bar of Wung procedure.

### Conclusion

Patients with severe pectus carinatum have severe protrusion of the anterior chest wall, and their chest wall are rigid. When the chest wall is compressed, secondary depression cannot be avoided. At this time, Wung procedure for depression must be used. Otherwise, depression deformity will replace protrusion deformity, and the operation will eventually fail.

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