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## Reoperation after failure of Nuss procedure on severe Wenlin chest

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### Abstract

Wenlin chest is a rare complex deformity. It may be misdiagnosed as pectus carinatum or pectus excavatum due to the presence of both protrusion and depression. In the early years, it was just regarded as a kind of pectus carinatum. Considering the operation of this deformity was Ravich procedure, which was also normally used for pectus carinatum, the diagnosis did not affect the treatment. However, once misdiagnosed as pectus excavatum and treated with Nuss procedure, it would be difficult to obtain good results. We met a 22-year-old female Wenlin chest patient recently. She was misdiagnosed as pectus excavatum and underwent Nuss procedure in local hospital 3 years before. Because of no effect, the patient had to come to our hospital for another operation. We performed Wenlin procedure and Wang procedure for her and achieved satisfactory results.

**Keywords:** Wenlin chest, pigeon breast, pouter pigeon chest, pectus arcuatum, Currarino-Silverman syndrome, chondromal deformation, reoperation, Nuss procedure, Wenlin procedure, Wang procedure

### Introduction

Wenlin chest is a rare thoracic deformity named by us <sup>[1, 2]</sup>. It is easy to be misdiagnosed as pectus carinatum or pectus excavatum due to the presence of both protrusion and depression on the anterior chest wall. In early years, this deformity was mainly regarded as a kind of pectus carinatum <sup>[3]</sup>. Because the operation of this deformity was open surgery, which was the same as that of pectus carinatum, it should not be a real misdiagnosis. However, if it was regarded as simple pectus excavatum and treated with Nuss procedure <sup>[4]</sup>, it would be a actual misdiagnosis and the operation would fail. We received a 22-year-old female Wenlin chest patient recently. She was diagnosed as pectus excavatum and underwent Nuss procedure in the local hospital 3 years before. Unfortunately, her operation failed. We performed reoperation for her and achieved satisfactory results.

### Case Report

The patient was a 22-year-old female. There was no obvious abnormality on the anterior chest wall at young age. From the age of 12, her anterior chest wall began to be slightly protrusive without depression. After the onset of puberty, the protrusion gradually became obvious, and depression appeared right below the protrusion, which became worse with age. When the patient was 19-year-old, she was diagnosed as pectus excavatum and underwent Nuss procedure in local hospital. The surgery had no effect, and deformity had not been corrected, which meant the failure of the surgery. In order to treat the deformity thoroughly, she was admitted to our hospital recently. Preoperative physical examination showed that the upper part of the anterior chest wall was protrusive, and the middle of the lower part was depressed (Fig. 1); there were obvious surgical scars on both sides of the chest wall. Imaging examination showed that the upper half of the chest wall was protrusive, while the middle lower half was sunken; the sternum was thickened, and the side view of it was "S"-shaped; there was a steel bar shadow in the chest, which was located at the bottom of the depression (Fig. 2). The operation of the patient was performed under general anesthesia, and the correction was completed by Wenlin procedure <sup>[5-7]</sup> and Wang procedure <sup>[8, 9]</sup>. Two incisions were made through the scars on the two sides of the chest wall to expose the fixed plates at both ends of the steel bar. After the fixed steel wires were removed, the fixed plates and steel bar were taken out. An incision was made in the middle of

the anterior chest wall to expose the sternal angle, sternal body and xiphoid process, and pre-shaping on the sternum was performed. The sternum was cut by wedge at the sternal angle and the place below it to make the sternum have a certain elasticity. Two tunnels were made through the bilateral chest wall incisions, which located on the surface of the bone structures. The upper tunnel was used to complete Wenlin procedure. A steel bar was put into the upper tunnel with its middle part compressing the protrusion, and both ends of it were fixed to the ribs on the chest wall. The lower tunnel was used to complete Wang procedure. A steel bar was inserted into this tunnel, and the middle part of it was in front of the depression. Steel wires were used to lift the depressed structures and fix them on the steel bar, so that the depression could be corrected. After the drainage tubes were placed on both sides of the thoracic cavities and the surgical field, the incisions were closed and the operation was completed. The operation was smooth without complications. The deformity disappeared completely after operation (Fig. 3). The patient was discharged 9 days postoperatively.



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



**Fig 2:** X-ray examination



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

### Discussion

Wenlin chest is a rare congenital thoracic deformity [1, 2]. Because one of its main lesions is the protrusion on the chest wall, it has been regarded as a kind of pectus carinatum in early years [3]. This cognition did not affect the surgical treatment, because the open surgery, namely Ravitch procedure, was adopted for the treatment of this deformity at that time, and this operation is also used for pectus carinatum [3]. With the deepening of the understanding of the thoracic deformities, the particularity of Wenlin chest has been gradually discovered, especially the existence of the depression, which made the difference between this deformity and the general pectus carinatum being realized. As a result, it gradually has other names. These names include pigeon breast, pouter pigeon chest, pectus arcuatum, Currarino-Silverman syndrome, chondromal deformation, etc [10-12]. With the appearance of these names, more attention has been paid to the pathological features, which directly affects the operation. However, since the main lesion is located in the sternal angle, and the treatment is generally open surgery, in essence, the surgical method of this deformity was still Ravich procedure for a long time [10-12].

Our department is the first independent chest wall surgery department in China. Our main work is to carry out surgical treatment for various chest wall deformities [13-15]. Because we have completed a large number of operations for various deformities, our department is also the largest chest wall deformity correction center in China. The unique position of our department gives us more opportunities to contact with different types of deformities, including many rare deformities. Wenlin chest is one of these rare deformities.

During the clinical work of Wenlin chest patients, we found that the most basic lesion of this deformity came from the sternum itself. Because the sternum is abnormally thickened and hard, the surrounding structures change accordingly, thus forming a special deformity. Our findings are significantly different from those of other authors. In order to facilitate our own clinical work, we made a special name for this deformity, namely Wenlin chest [1, 2]. On this basis, we also made a special design for the operation of it, and achieved satisfactory results.

In essence, Wenlin chest is a complex thoracic deformity. However, this kind of deformity is different from the general complex deformity. In terms of treatment, the common complex deformity can be treated by sandwich technique [16]. However, in Wenlin chest, due to the presence of abnormal sternal lesions, the shape of the sternum cannot be changed by ordinary minimally invasive means, so this deformity cannot be corrected

by sandwich technique. It can be seen that the premise of minimally invasive surgery is to change the shape of the sternum, which can be done actually by the technique of pre-shaping [17]. When the sternum has certain elasticity due to its reduced hardness, it is possible to change its shape by the steel bar, which makes minimally invasive surgery possible.

Nuss procedure is a special surgery designed for pectus excavatum, which also has certain effects on other depression deformities [4]. Since Wenlin chest has obvious depression, Nuss procedure should have some effects for it theoretically. However, because the sternum is extremely hard, and its hardness even exceeds that of the steel bar itself, it is impossible to change the shape of the depression with the bar, which is the root cause of the failure of Nuss procedure. Obviously, if this kind of deformity is regarded as pectus excavatum or general depression deformity, it will be a true misdiagnosis. Then, the subsequent Nuss procedure will not be successful.

Wenlin procedure is for correction of protrusion deformities [5-7, 18-20], and Wang procedure [8, 9, 20-23] is for correction of depression deformities. When they are used together, the two kinds of lesions of Wenlin chest will be corrected at the same time, thus ensuring the effect of surgery.

### Conclusion

Wenlin chest is a special complex deformity, which needs to be corrected for protrusion and depression at the same time [24, 25]. Because the sternal lesion is the root cause of the deformity, the sternum must be pre-shaped before other operations. Wenlin procedure and Wang procedure are minimally invasive operations for the treatment of thoracic deformity. After the obstacle of sternum is eliminated, Wenlin chest can be completely corrected by Wenlin procedure and Wang procedure and ideal results can be obtained.

### Conflict of Interest

Not available

### Financial Support

Not available

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