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Dr. Wenlin Wang
Professor, Department of Chest Wall Surgery, Guangdong Second Provincial General Hospital, Guangzhou, China

Dr. Weiguang Long
Associate Professor, Department of Chest Wall Surgery, Guangdong Second Provincial General Hospital, Guangzhou, China

Dr. Yang Liu
Resident Doctor, Department of Chest Wall Surgery, Guangdong Second Provincial General Hospital, Guangzhou, China

Dr. Bin Cai
Resident Doctor, Department of Chest Wall Surgery, Guangdong Second Provincial General Hospital, Guangzhou, China

Dr. Juan Luo
Resident Doctor, Department of Chest Wall Surgery, Guangdong Second Provincial General Hospital, Guangzhou, China

Corresponding Author:
Dr. Wenlin Wang
Professor, Department of Chest Wall Surgery, Guangdong Second Provincial General Hospital, Guangzhou, China

Minimally invasive surgery of Wenlin chest

Dr. Wenlin Wang, Dr. Weiguang Long, Dr. Yang Liu, Dr. Bin Cai and Dr. Juan Luo

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Abstract
Wenlin chest is a special thoracic deformity, which contains both protrusion and depression, but it is not a common complex deformity. Because of the abnormal thickening of the sternum, the ordinary sandwich technique cannot complete the correction. For young patients, because the sternum hardness is not large, minimally invasive surgery can be used for treatment. We report the operation of 4-year-old Wenlin chest boy. We used minimally invasive surgery, combining with Wenlin procedure and Wung procedure, to implement correction, and achieved satisfactory results.

Keywords: Wenlin chest, minimally invasive surgery, wenlin procedure, wung procedure, currarino-silverman syndrome, pectus acuatum, pouter pigeon chest

Introduction
Wenlin chest is a very rare thoracic deformity [1, 2]. In early years, it was regarded as a kind of pectus carinatum [3], and some people even directly called it type 2 pectus carinatum. With the deepening of the understanding of this deformity, some special names have gradually appeared in the clinic, including Currarino-Silverman syndrome, pectus arcuatum, pouter pigeon chest and chondromanubrial deformation [1-6]. Because the deformity has both protrusion and depression on the chest wall, some people also directly call it the mixed deformity of pectus excavatum and pectus carinatum. This deformity is not a very common deformity, but there are a lot of names in reality, which not only cause confusion on the cognition of deformity, but also affects the treatment. Our department is the first independent chest wall surgery department in China, and our works mainly include surgeries for various chest wall diseases [7-9]. Among these surgeries, thoracic deformity surgery is the most work we have completed. Our department is also the largest thoracic deformity correction center in China. Because there are many opportunities to contact different types of deformities, we have encountered many cases of such a special deformity. In order to facilitate our own work, we named this deformity Wenlin chest and completed a large number of operations [1, 2]. In the early stage, we designed a special operation for this deformity. Although it is not an open operation, it has relatively obvious trauma. In the later work, we gradually made improvements to reduce the trauma and finally formed a minimally invasive surgery. In this paper, the minimally invasive surgery of a 4-year-old Wenlin chest boy is introduced.

Case Report
The patient was a 4-year-old boy. At birth, he was found that his anterior chest wall was slightly depressed without obvious protrusion. At the age of 2, protrusion began to appear near the sternal angle, and the depression gradually deepened. After that, the deformity became severe, forming obvious chest wall deformity. In order to take surgical treatment, the boy was admitted to our hospital. Preoperative physical examination revealed that the anterior chest wall presented obvious complex deformity. The upper chest wall was protrusive, and the lower chest wall was depressed, which was located directly below the middle part of the protrusion. The imaging examination showed that the sternum was in "S" shape, the sternal angle and the surrounding costal cartilage were protrusive, and the lower part of the sternum was depressed. The preoperative diagnosis was Wenlin chest. After full preparation, the operation was performed under general anesthesia. The operation included two basic procedures, namely Wenlin procedure [10-12] and Wung procedure [13, 14]. Two small incisions were performed on both sides of the chest wall respectively. The subcutaneous tissues and muscle tissues were separated to expose the ribs on the protrusion and depression planes.

A tunnel was made at the highest plane of the protrusion, which was located on the surface of the bone structures. Another incision under the xiphoid process was made. After the posterior sternal space was exposed, a thyroid hook was used to lift the lower sternal depression, while the assistant compressed the protrusion of the anterior chest wall at the same time, which was the pre-shaping of the deformity. Another tunnel was made through the incision on both sides of the chest wall, which was located in the deepest plane of the depression. Two steel bars were placed respectively in the two tunnels, and their radians were designed in advance according to the needs of orthopedics. The steel bar in the upper tunnel was used to complete the Wenlin procedure. The central protrusion was compressed at first, and then the two ends of the steel bar were fixed on the two ribs on both sides of the chest wall. The steel bar in the tunnel below was used to complete Wung procedure. After the steel bar was placed, it was rotated 180 degrees to support the depression, with its two ends fixed on a rib on both sides of the chest wall. The drainage tubes were placed on both thoracic cavities, and the incision was closed to end the operation. The operation was smooth without complications. The thoracic deformity was completely eliminated after operation, and the appearance of chest wall returned to normal. The patient was discharged 6 days after operation.

Discussion

Wenlin chest is a distinctive thoracic deformity [1, 2]. The most obvious feature comes from the sternum. The sternal angle is obviously protrusive, leading to the costal cartilage connected with it also to be protrusive. The sternum body is depressed, and the whole sternum presents a distorted shape [1-6]. Because there are protrusion and depression at the same time, it can be regarded as a complex thoracic deformity, but not the general complex deformity. The common complex deformity is a random combination of protrusion and depression, while that of Wenlin chest have obvious rules and characteristics. Because of this, it should be regarded as a special deformity.

For general complex deformities, the so-called sandwich technique can be selected, that is, compressing the protrusion at first, and then supporting the depression. Wenlin chest includes both protrusion and depression, which should be treated in this way in theory. However, because the sternum of this kind of deformity is too thick and hard, and its hardness even exceeds the mechanical strength of ordinary steel bar, it is impossible to use simple sandwich technique to complete the correction. In the literature, almost all of these deformity was treated by Ravich procedure [3-6]. This is a typical open operation, which is not an ideal operation due to obvious trauma. In the early stage, we designed a special operation for the deformity. We first perform pre-shaping [15], used Wenlin procedure to complete the treatment of protrusion, and then used Wung procedure or Wang procedure [16, 17] to complete the treatment of depression. This operation required a large incision near the sternal angle, which had obvious defects. However, considering the sternum is too hard, the defects of this operation cannot be completely eliminated.

In the later work, we found that the sternum hardness of young children was not serious, and the pre-shaping could be completed by pulling depression through the incision under the xiphoid process, without directly processing the sternum angle. This provides a possibility for the implementation of minimally invasive surgery. We directly used Wenlin procedure and Wung procedure in the treatment, and the trauma is minimized.

Fig 1: Appearance of chest wall before operation

Fig 2: Preoperative chest X-ray.

Fig 3: Appearance of chest wall after operation (front view)

Fig 4: Appearance of chest wall after operation (lateral view)

Conclusion

Our experience shows that minimally invasive surgery is difficult to be performed for adults or older Wenlin chest patients. However, for young Wenlin chest patients, since the sternum hardness is not large, it provides a possibility for minimally invasive surgery. The early treatment of Wenlin chest can not only significantly reduce trauma, but also greatly simplify the surgery and achieve good results.

Conflict of Interest

Not available

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Reference

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