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Groove chest: An independent thoracic deformity

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Abstract

Thoracic deformity can be roughly divided into two categories, one is depression deformity the other is protrusion deformity. In general, depression deformity is called pectus excavatum. In the era of open surgery, there is no big problem with this nomenclature. However, in the era of minimally invasive surgery, because the general minimally invasive surgery cannot be used to treat some depression deformities, it is necessary to further classify these deformities. After a long time observations, we found that there was a type of deformity with distinct characteristics, which was the transverse groove in the anterior chest wall, and was significantly different from the hollow of the typical pectus excavatum. This deformity cannot be corrected with standard Nuss procedure. In order to better understand and treat this special deformity, we named it groove chest. We also made a special design for its operation, and finally designed an effective surgical method. Our experience shows that the surgery we designed is an effective technique, which also proves the necessity of treating groove chest as an independent deformity.

Keywords: Groove chest, thoracic deformity, Wung procedure, Wenlin procedure

Introduction

Thoracic deformity is the most common type of thoracic wall disease ^[1,2]. Generally, all thoracic deformities can be divided into two categories, one is depression deformity the other is protrusion deformity ^[3]. The most common type of depression is pectus excavatum ^[4,5]. Pectus excavatum has definite harm, so it generally needs surgical treatment ^[6,7]. Early treatment of it was all open operation. Since the operation is completed under direct vision, the same principles and methods can be used to correct all types of depression deformities, and it is not necessary to further subdivide each type of depression deformities. However, with the introduction of the concept of minimally invasive surgery, especially after the Nuss procedure became the gold standard for the treatment of pectus excavatum ^[8], it is necessary to further classify the depression deformities because some special cases cannot be treated by this procedure. Our department is an independent chest wall surgery department. Our main work is to perform surgery for various chest wall surgical diseases ^[1,2]. Among these operations, thoracic deformity operation is our most important work. We often encounter some cases of Nuss procedure failure. In these cases, there was almost no clear change in the appearance of the chest wall before and after operation. After analyzing the reasons for the failure of these operations, we found that the root cause was the special abnormal structures. Because these deformities are structurally different from the standard pectus excavatum, they are not suitable for Nuss procedure. This made us realize the difference between this kind of deformity and the standard pectus excavatum. In order to better understand and treat this kind of deformity, we think it is necessary to rename it. After careful consideration, we named it groove chest (Fig. 1) ^[9].

Morphological characteristics

Groove chest is a kind of depression deformity with distinctive features. The depression is in the lower part of the anterior chest wall, which involve the chest wall on both sides and the lower end of the sternum. The overall appearance is like a groove. The upper and lower edges of the groove were raised and the left and right sides were opened (Fig.1). The left groove bottom compresses the heart, and the heart beats can be seen. In imaging examination, the lower part of the anterior chest wall can be found depressed. The depression is located in the lower chest wall transversely, involving the left and right chest walls. The heart is obviously left shifted and compressed.

Diagnosis and treatment

The diagnosis of groove chest mainly depends on clinical manifestations. The patient may have compression symptoms due to the presence of depressions, such as flustered, chest tightness, shortness of breath, etc. Mild patients can be asymptomatic. The main signs were groove like depression located transversely below the anterior chest wall. According to these symptoms and sign, the diagnosis can be basically made.

Groove chest needs to be distinguished from some deformities. The first deformity was pectus excavatum^[4, 5]. In the past, groove chest was generally regarded as pectus excavatum, so they were easy to be confused. The key point of identification is the shape of the depression. The depression of the groove chest is a transverse groove, while the depression of pectus excavatum is a hollow located in the middle. There is a clear distinction between the two shapes. The second deformity that needs to be identified is saddle chest^[10]. The depressions of saddle chest are located on both sides of the chest wall, and the middle part between the depressions is not connected, which is equivalent to two depressions. This characteristic is obviously different from that of groove chest. The third deformity that needs to be identified is some types of flat chest^[11]. Flat chest is a large-area depression of the anterior chest wall, which involves the whole anterior chest wall, but the depression of groove chest is only limited to the lower chest wall, so the difference between them is obvious.

After the diagnosis is completed, the treatment need to be considered. Groove chest cannot be treated conservatively, and the only effective treatment is surgery. Simple minimally invasive surgery cannot complete the treatment (Fig. 2, 3, 4). The method we designed is a comprehensive surgical method. First, Wung procedure^[12] was performed to change the groove chest into saddle chest, and then Wenlin procedure^[13-16] was performed to eliminate the depression on both sides. In this way, the deformity can be completely corrected (Fig. 4, 5).

Discussion

Thoracic deformity is the abnormal shape of the bone structures of the chest wall^[3], which generally has two aspects of harm, one is physiological harm, the other is psychological harm^[4, 5]. Since both harms may affect the health of patients, thoracic deformities generally require treatment.

The clinical cognition of thoracic deformity has a long history, and their treatment also has a history of more than 100 years^[12]. The early operations were all open operations, which were completed under direct vision and characterized by direct correction of the deformity. Because different deformities can be treated with similar principles and methods, there is no need to excessively subdivide the types of deformities. For example, the protrusion deformity in early years is generally called chicken breast, pigeon breast or pectus carinatum. No one has further subdivided the structural characteristics of different individuals^[17-20]. The same is true for depression deformity. In the past, all depression deformities were called pectus excavatum. This rough appellation did not affect the results of open operation. However, with the emergence of the concept of minimally invasive surgery, especially when the treatment of the most common deformities is gradually standardized, the treatment of some uncommon deformities will have problems. This problem makes people rethink the characteristics and diagnosis of deformities^[9, 21]. Take protrusion deformity as an example, in the past, all protrusion deformities can be treated with open operation. However, when minimally invasive surgery, such as Abramson procedure^[22] and Wenlin procedure^[13, 14], are used for treatment of typical pectus carinatum, those protrusion deformities that cannot use these operations, such as Wenlin chest, have to be noticed, and should have a new name^[19, 20].

Similarly, the depression deformities are the same. For typical pectus excavatum, minimally invasive surgery, such as Nuss procedure^[8], Wung procedure^[12] and Wang procedure^[6, 7], can achieve satisfactory results. However, some other depression deformities cannot be treated by these simple procedures. This indicates that the features of these deformities are no longer the standard pectus excavatum, but should be new types of deformities. In order to better diagnose and treat these deformities, it is necessary to give them new names.

Among all the depression deformities, the groove chest is the new deformity we noticed^[9]. This deformity was initially noted because some cases of Nuss procedure failure were often encountered in the clinic (Fig. 2, 3, 4). These patients had a depression in the anterior chest wall, but after Nuss procedure, the depression was not significantly improved. That is to say, simple Nuss procedure has little effect on this deformity. This result made us realize that this deformity should not be typical pectus excavatum. Because its appearance is like groove obviously, we directly named it groove chest.

The most distinctive structural feature of groove chest is the transverse groove depression. This depression is different from that of pectus excavatum. The depression of pectus excavatum is like a hollow, which has an obvious bottom, with the periphery of the bottom is raised (Fig. 1). This hollow is located at the lower part of the anterior chest wall. The depression of the groove chest also has a clear bottom, but the four sides are not closed. Only the upper and lower sides are raised, and the left and right sides are open. This is the biggest difference between groove chest and pectus excavatum.

The basic principle of Nuss procedure is the lever principle. One of the bases for the success of this operation is to find a suitable fulcrum for the steel bar. The edge of the pectus excavatum depression is relatively high and can serve as the fulcrum, but for the groove chest, the height of the ribs on both sides of the chest wall is the same as the height of the chest wall at the center. It is impossible to support the middle part with such ribs as fulcrum. Therefore, Nuss procedure is unlikely to achieve satisfactory results in the treatment of this deformity. In order to make a good result, we designed the operation with a new concept, i.e. a comprehensive operation^[23, 24]. We first treat it with Wung procedure to change the groove chest into saddle chest, and then correct it with Wenlin procedure, which will finally achieve satisfactory results. In the past work, we have used this technology to complete a large number of operations on groove chest, and all these patients have been treated satisfactorily.

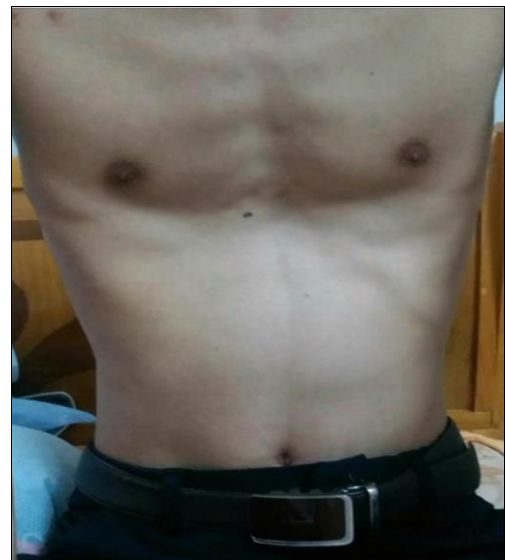


Fig 1: Appearance of groove chest.



Fig 2: Nuss procedure of groove chest failed, and the abnormal appearance did not improve.

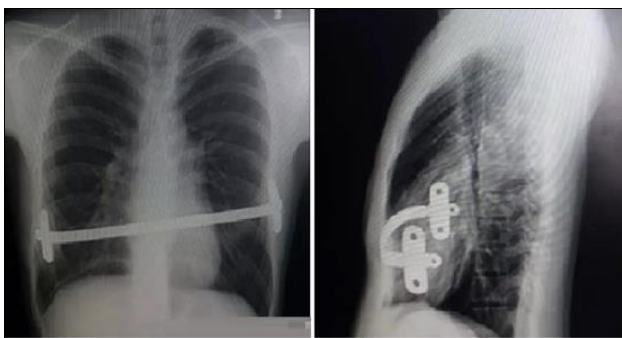


Fig 3: X-ray examination of patients with groove chest undergoing Nuss procedure.

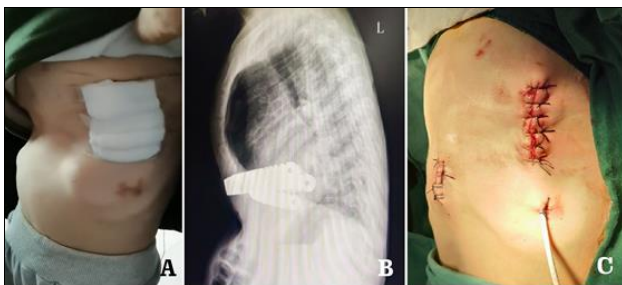


Fig 4: Reoperation of patient with groove chest after failure of Nuss procedure. A. Failed Nuss procedure; B. Position of Nuss steel bars; C. The second operation was performed with Wung procedure combined with Wenlin procedure, and satisfactory results were obtained.



Fig 5: The patients with groove chest obtained satisfactory results by using Wung procedure combined with Wenlin procedure.

Conclusion

Grooved chest is a special depression deformity of the anterior chest wall, which is a transverse grooved depression in the lower part of the anterior chest wall. This depression is obviously different from the typical pectus excavatum, and cannot be treated with Nuss procedure. The ideal method is to use comprehensive operation for treatment. The combined application of Wung procedure and Wenlin procedure can achieve perfect results.

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