



ISSN (P): 2617-7226
ISSN (E): 2617-7234
www.patholjournal.com
2022; 5(3): 50-53
Received: 16-06-2022
Accepted: 26-07-2022

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

Saddle chest: A special thoracic deformity

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

DOI: <https://doi.org/10.33545/pathol.2022.v5.i3a.483>

Abstract

Saddle chest is a special thoracic deformity named by us. The main feature of this deformity is that there are symmetrical depressions in the lower part of the chest wall on both sides. The depressions on both sides are not connected, and the middle is separated by relative protrusions, whose height is the same as that of the normal chest wall. Because it looks like a saddle, we named it saddle chest. Although saddle chest has depression, it is not suitable for Nuss procedure. The more reasonable choices are Wung procedure and Wenlin procedure, which can generally achieve satisfactory results.

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

Introduction

Thoracic deformity is a common disease in chest wall surgery^[1, 2]. Its main feature is the abnormal shape of the bone structures of the chest wall. The most common deformity in clinic is pectus excavatum^[3, 4], followed by pectus carinatum^[5, 6]. In addition to these two deformities, the well-known deformities are flat chest^[7] and barrel chest^[8-10]. So far, there are only four kinds of deformities that are known most. However, there are many other rare deformities in clinic^[11-16]. These deformities have different shapes, some of which have specific names, and some have no specific names because they have not been noticed specially. Without a proper name, it is difficult to make a correct diagnosis, which will undoubtedly affect the treatment of the deformity. Our department is an independent chest wall surgery department^[1, 2]. We mainly treat five kinds of diseases, namely deformity, trauma, infection, defect and tumor on the chest wall. Among these five diseases, deformity is the main disease we treated. The nature of our work allows us to have more opportunities to contact patients with various complex and rare deformities than ordinary thoracic surgeons. In this process, we have named some special deformities^[11, 12, 17, 19]. Among the deformities we named, there is a kind of deformity with distinctive characteristics, whose lesions are located in the lower part of the lateral chest wall, showing symmetrical depressions. Because it looks like a saddle, we named it saddle chest^[17].

Morphological characteristics

The lesions of saddle chest are different from general depressions and protrusions. It has two depressions at the same time^[17]. The depressions are located in symmetrical parts of the lateral chest wall, and the middle of the depressions is not connected (Fig 1). The median is the relatively elevated lower sternum or xiphoid process, but its absolute height is not high. The upper edge of the depression is the normal chest wall, and the lower edge is the rib arch. The rib arch presents relative protrusion due to the depression above. From the overall appearance, the lesions on both sides are saddle-shaped.

Imaging characteristics

Imaging examination showed symmetrical depression in the lower part of the lateral chest wall, which was shallow without deep depression (Fig 2). The middle part between the depressions is a relative protrusion that continues to the middle through the slope. Here is the lower sternum or xiphoid process. The upper and lower edges of the depression are relatively raised. X-ray examination of posterior anterior position showed no abnormal findings. Lateral X-ray examination showed a concave shadow below the anterior chest wall (Fig 2A). CT examination can clearly reveal the changes of bone structure and the compression on the heart (Fig 2B). Three dimensional reconstruction can clearly show the features of deformity (Fig 2C).

Diagnosis and treatment

The diagnosis of saddle chest mainly depends on the clinical manifestations. Most patients have no obvious symptoms, but a few patients will feel uncomfortable because of heart pressure. The main problem of patients comes from the worry about the appearance of the chest wall, which makes most patients want to undergo surgery. Physical examination will find that the chest wall has an obvious saddle like appearance, which is an important basis for diagnosis. Imaging examination can further clarify the diagnosis.

Saddle chest needs to be distinguished from some special deformities. The first deformity is asphyxiating thoracic dystrophy [14-16, 20, 24] (Fig 3). This kind of deformity generally has a depression in the lateral chest wall, especially in type II patients [20, 22, 24]. In patients with mild type II asphyxiating thoracic deformity, the depression may be in the lower part of the lateral chest wall, but this depression is very deep, and the bottom of the depression is the junction of ribs and costal cartilage, which will extend into the chest. CT examination can differentiate the two deformities [14-16, 20-24]. The second deformity needs to be distinguished is some special type of pectus carinatum (Fig 4). This kind of patient has a protrusion in the middle of the anterior chest wall with depressions on both sides, which is similar to the saddle chest in appearance. But the protrusion of pectus carinatum is absolute protrusive, and the protrusion of saddle chest is relative protrusive, which is an important basis for distinguishing of the two deformities.

In addition to the above two deformities, a special deformity should be noticed, that is, secondary saddle chest (Fig 5). The saddle chest mentioned above is a primary lesion. Clinically, saddle chest can appear after Nuss procedure. Its pathogenesis is mainly related to the compression of steel bar. The more severe the compression of the bar, the deeper the depression, the easier it is to form saddle chest. Secondary saddle chest is an inherent complication of Nuss procedure. Some patients will be relieved after taking out the steel bar, but more deformities are permanent lesions, which cannot be eliminated even after taking out the steel bar. After the diagnosis of saddle chest is clear, treatment should be considered generally. Conservative methods cannot complete the treatment, and surgery is the only effective method. Because the depression is located in both chest walls, it cannot be treated with simple Nuss surgery. We designed two operations for it. The first operation is the Wung procedure [25]. This kind of operation uses special steel bar and technique to support the depressions on both sides through the thoracic cavity [26]. In order to eliminate the depression at the same time, a butterfly-shaped steel bar needs to be used for surgery (Fig 6). If the steel bar is placed in a satisfactory position and fixed firmly, good results can generally be obtained. The second operation is Wenlin procedure [27, 28]. The nature of this procedure is the template plastic surgery [1, 2]. When performing the operation, a steel bar with an arc close to the normal appearance of the chest is selected. The ribs at the bottom of the depression are lifted and fixed to the bar on both sides of the chest wall, so as to achieve the purpose of the operation. The operation is simple and the effect is ideal. If this operation is decomposed, it can be regarded as a combination of two Wang procedures [29, 30]. Its operative method is similar to Wenlin procedure [20, 22, 24, 27], and the nature of the operation is completely the same, that is, template plastic surgery [1, 2].

In the past work, we have received a large number of patients with saddle chest. After operation, satisfactory results were obtained. This shows that our surgical method

is an ideal method. For secondary saddle chest, if it occurs after Nuss procedure, considering the adhesion in the chest, we think Wenlin procedure is an ideal operation. If there is lateral chest wall depression during Nuss procedure, it is necessary to adjust the position of the steel bar to avoid this situation as far as possible. If the depression cannot be avoided, additional surgery can be considered to eliminate it. The treatment concept of secondary saddle chest is completely different from that of general pectus excavatum, but it is obviously a further improvement of the treatment level [31]. The progress of this operation principle is also the progress of the treatment concept of all thoracic deformities [32].



Fig 1: Appearance of saddle chest

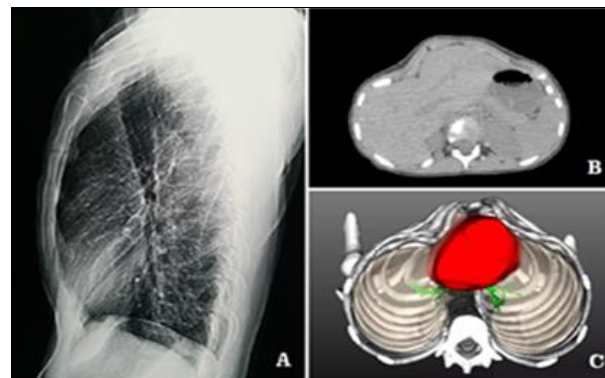


Fig 2: Imaging examination of saddle chest. A, X-ray lateral image; B, CT section image; C, 3D reconstruction image.



Fig 3: Distinguished from asphyxiating thoracic dystrophy. This deformity has a large depression in the chest wall on both sides, which is not limited to the lower part of the chest wall.



Fig 4: Distinguished from some special pectus carinatum. Although this deformity has lateral chest wall depression, the main lesion is median protrusion.



Fig 5: Secondary saddle chest after Nuss procedure for pectus excavatum. After the steel bar is put into the body and turned over, the stress generated by the anterior chest wall is applied to the ribs of the lateral chest wall through the steel bar. If the stress is too large and the ribs are too soft, it may lead to local depression. Since the original protrusion in the middle has been propped up to the normal height, a symmetrical depression of the lateral chest wall will be formed. This is a typical secondary saddle chest



Fig 6: The shape of the butterfly-shaped steel bar used in Wung procedure

Conclusion

Saddle chest is a special thoracic deformity, which is characterized by symmetrical depression in the lower part of the chest wall on both sides. The main damage of this deformity comes from the appearance. If treatment is needed, Wung procedure and Wenlin procedure can be considered. However, because this deformity is different from the general pectus excavatum and pectus carinatum, it is necessary to carefully design the steel bar during the operation, so as to ensure the smooth completion of the operation.

Reference

1. Wang W. Basic theories and concepts of chest wall surgery. *International Journal of Surgery Science*. 2022;6(3):68-71. Doi.org/10.33545/surgery.2022.v6.i3a.909.
2. Wang W. Chest wall surgery: Chest wall plastic surgery or chest wall orthopedics. *International Journal of Orthopaedics Sciences*. 2022;8(3):82-84. Doi.org/10.22271/ortho.2022.v8.i3b.3174.
3. Wang W, Long W, Liu Y, Bin C, Juan L. Wenlin index of pectus excavatum. *International Journal of Surgery Science*. 2022;6(3):84-87. Doi.org/10.33545/surgery.2022.v6.i3b.925.
4. Wang W, Long W, Liu Y, Bin C, Juan L. Wenlin triad of pectus excavatum. *International Journal of Case Reports in Surgery*. 2022;4:16-18.
5. Wang W, Long W, Liu Y, Bin C, Juan L. Application of Wenlin procedure combined with Wung procedure in operation of severe pectus carinatum. *National Journal of Clinical Orthopaedics*. 2022;6:09-16. Doi.org/10.33545/orthor.2022.v6.i3a.368.
6. Wang W, Long W, Liu Y, Bin C, Juan L. Wenlin procedure combined with Wung procedure for treatment of severe pectus carinatum. *International Journal of Case Reports in Surgery*. 2022;4(2):05-07.
7. Wang W, Long W, Liu Y, Bin C, Juan L. Minimally invasive surgery for flat chest: Wung procedure + Wenlin procedure. *International Journal of Case Reports in Surgery*. 2022;4(2):05-7.
8. Wang W. Minimally invasive surgical technique for barrel chest. *Surg Case Rep*. 2018;1:1-2. Doi:10.31487/j.SCR.2018.02.005.
9. Wang W, Long W, Liu Y, Bin C, Juan L. Wenlin procedure for treatment of barrel chest. *International Journal of Orthopaedics Sciences*. 2022;8(3):43-5. Doi.org/10.22271/ortho.2022.v8.i3a.3171.
10. Wang W, Long W, Liu Y, Bin C, Juan L. Wenlin procedure: An ideal minimally invasive surgery for barrel chest. *International Journal of Advanced Research in Medicine*. 2022;4:37-39. Doi.org/10.22271/27069567.2022.v4.i2a.402.
11. Wang W, Long W, Liu Y, Cai B, Luo J. Wenlin chest: an independent thoracic deformity. *International Journal of case reports in surgery*. 2022;4:13-15.
12. Wang W, Long W, Liu Y, Cai B, Luo J. Morphological characteristics of Wenlin chest. *International Journal of Case Reports in Surgery*. 2022;4:22-24.
13. Wang W. Minimally invasive technique for mixed-type asymmetric thoracic deformity. *Surg Case Rep*. 2018; 1: 2. Doi: 10.31487/j.SCR.2018.02.003.
14. Wang W, Long W, Liu Y, Bin C. Bilateral correction of asphyxiating thoracic dystrophy. *Journal of Surgical Case Reports*. 2022 Aug;2022(8):rjac352. Doi.org/10.1093/jscr/rjac352.
15. Wang W, Long W, Liu Y, Bin C. Novel median thoracic expansion for asphyxiating thoracic dystrophy. *Journal of Surgical Case Reports*. 2022;8:1-2. Doi.org/10.1093/jscr/rjac345.
16. Wang W, Long W, Liu Y, Bin C. Median thoracic expansion combined with Nuss procedure for asphyxiating thoracic dystrophy. *Journal of Pediatric Surgery Case Reports*. 2022 Sep;84:102342. Doi.org/10.1016/j.epsc.2022.102342.
17. Wang W. Nomenclature and morphological characteristics of saddle chest. *Journal of practical medicine (Chinese)*. 2017;33(Sup):380-381.
18. Wang W. Nomenclature and morphological characteristics of groove chest. *Journal of practical*

- medicine (Chinese). 2016;32;(2):335-336.
19. Wang W. Nomenclature of lateral chest wall depression. *Journal of practical medicine (Chinese)*. 2015;31(Sup):196.
 20. Wang W, Long W, Liu Y, Bin C. Bilateral correction of asphyxiating thoracic dystrophy. *Journal of Surgical Case Reports*. 2022;8:1-3. Doi.org/10.1093/jscr/rjac352.
 21. Wang W, Long W, Liu Y, Bin C. Novel median thoracic expansion for asphyxiating thoracic dystrophy. *Journal of Surgical Case Reports*. 2022;8:1-2. Doi.org/10.1093/jscr/rjac345.
 22. Wang W. Surgical treatment of a 36-year-old patient with asphyxiating thoracic dysplasia. *Interact Cardiovasc Thorac Surg*. 2022 Jan;34(1):153-5. DOI: 10.1093/icvts/ivab217
 23. Wang W. Surgical treatment of asphyxiating thoracic dystrophy with median thoracic expansion and Nuss procedure. *International Journal of Surgery Science*. 2022;6(3):09-11. Doi.org/10.33545/surgery.2022.v6.i3a.908.
 24. Wang W, Long W, Liu Y, Bin C, Juan L. Wang procedure for treatment of asphyxiating thoracic deformity. *Journal of Pediatric Surgery Case Reports*. 2022 Oct 1;85:102404. Doi.org/10.1016/j.epsc.2022.102404.
 25. Wang W, Long W, Liu Y, Bin C, Juan L. Wung procedure: A minimally invasive operation for pectus excavatum. *International Journal of Case Reports in Surgery*. 2022;4(1):19-21.
 26. Wang W, Long W, Liu Y, Bin C, Juan L. Wang technique: A simple and practical steel bar fixation technique in thoracic deformity surgery. *International Journal of Surgery Science*. 2022;6(3):78-83.
 27. Wang W, Long W, Liu Y, Bin C, Juan L. Wenlin procedure: A novel surgical technique for pectus carinatum. *International Journal of Case Reports in Surgery*. 2022;4(1):10-2.
 28. Wang W, Long W, Liu Y, Bin C, Juan L. Wenlin procedure for treatment of pectus carinatum. *International Journal of Surgery Science*. 2022;6(3):15-8. Doi.org/10.33545/surgery.2022.v6.i3b.923.
 29. Wang W, Chen C, Long W, Li X, Wang W. Wang procedure for treatment of pectus excavatum. *SL Clin Exp Cardiol*. 2018;2(1):113.
 30. Wang W, Chen C, Long W, Li X, Wang W. Wang procedure: Novel minimally invasive procedure for pectus excavatum children with low age. *Case Reports and Images in Surgery*. 2018;1:1-2. Doi:10.15761/CRIS.1000104.
 31. Wang W, Long W, Liu Y, Bin C, Juan L. The highest level of surgical treatment of pectus excavatum. *International Journal of Orthopaedics Sciences*. 2022;8(3):217-9. Doi.org/10.22271/ortho.2022.v8.i3d.3200.
 32. Wang W, Long W, Liu Y, Bin C, Juan L. Wenlin principle in the treatment of pectus excavatum. *International Journal of Surgery Science*. 2022;6(4):72-73. Doi.org/10.33545/surgery.2022.v6.i3b.922.