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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

Reoperation 20 years after Ravitch procedure on pectus excavatum: Wung procedure + Wenlin procedure

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

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Abstract

Pectus excavatum is a common thoracic deformity. The main surgical method in early years was Ravitch procedure. Due to the complexity of the operation itself, it is difficult to ensure the surgical effect. We recently received a 35-year-old male patient with thoracic deformity. When he was 15 years old, he received Ravitch procedure in the local hospital for pectus excavatum. The postoperative effect was not satisfactory, and the deformity became worse with age. Recently, we performed another operation for him. During the operation, we used Wung procedure + Wenlin procedure + Wung procedure for correction, and achieved satisfactory results. This article reports the reoperation.

Keywords: Pectus excavatum, Ravitch procedure, failure, Wung procedure, Wenlin procedure

Introduction

Pectus excavatum is a common thoracic deformity, the main manifestation of which is anterior chest wall depression^[1, 2]. Since the depression may have physiological and psychological damages on patients, most patients need surgical treatments^[1, 2]. The operation of pectus excavatum has a history of many years. In the early years, the operation was an open operation, and the representative operation was Ravitch procedure^[3, 4]. The operation was to correct the deformity under direct vision, which could achieve satisfactory results, but there were often cases of failure. When performing reoperation on failed cases, the operation is extremely challenging due to the existence of retrosternal adhesion^[5-9]. We recently performed a reoperation on a patient with pectus excavatum 20 years after Ravitch procedure. This article reports the operation.

Case Report

The patient was a 35-year-old male. He was found to have pectus excavatum when he was a child. In early years, the deformity was mild without symptoms, and was not treated. After puberty, the deformity became worse. At the age of 15, he received surgical treatment in the local hospital and was corrected by Ravitch procedure. After the operation, the depression was slightly improved, then it became worse, and the operation failed. Considering the risk of reoperation, no further treatment was carried out. Early after the operation, the patient did not feel uncomfortable. Three years ago, he began to suffer from dyspnea after activities, and the symptoms gradually worsened. In order to completely treat the deformity, the patient was admitted to our hospital recently. Physical examination showed that the anterior chest wall was sunken in large area, there was scar in the middle, the rib arches were protrusive, and there were acute angle deformities locally (Fig 1). Imaging examination showed a large area of depression in the anterior chest wall and obvious cardiac compression (Fig 2, 3). After full preoperative preparation, the operation was performed under general anesthesia. Two incisions were made on both lateral chest walls to expose the ribs respectively. Another incision was made under the xiphoid process to expose the dorsal space at the lower end of the sternum. Extensive adhesion of bilateral thoracic cavity and posterior sternum was observed during operation. The adhesion structures behind the sternum and in the bilateral thoracic cavities were separated bluntly. Three tunnels were made to the center through the bilateral chest wall incisions. The uppermost and lowermost tunnels were located behind the sternum, and the middle tunnel was located in front of the sternum. Three steel bars were placed respectively for correction, and Wung procedure^[10-15], Wenlin procedure^[16-18], and Wung procedure were performed from the uppermost to the lowermost.

The uppermost steel bar supported the chest wall as a whole, the middle steel bar corrected the local depressions on both sides of the chest wall, and the lowermost steel bar corrected the lower depression. After the three procedures were completed, the rib arches on both sides were locally raised, showing acute angle deformities ^[19], and the tips were flattened with a rongeur. Drainage tubes were placed in the thoracic cavities and the surgical field, and the incisions were closed to end the operation (Fig 4). The operation was smooth without complications. The postoperative X-ray examination showed that the positions of the bars were normal and the orthopedic effects were satisfactory (Fig 5). The patient was discharged on the 9th day after operation.

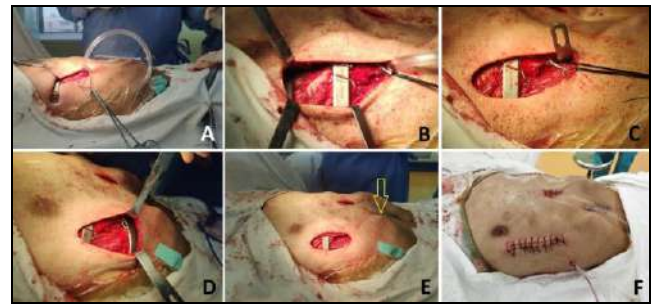


Fig 4: Surgical images. A. The uppermost steel bar is placed; B. The middle steel bar is placed; C. The lowermost steel bar is placed; D. Three steel bars were placed; E. Acute angle deformities of costal arches; F. Appearance of chest wall after operation



Fig 1: Appearance of chest wall before operation



Fig 2: Preoperative CT examination. A. Anterior chest wall depression; B. Local acute angle deformities of costal arches; C. Anterior chest wall depression; D. Heart pressed by sternum

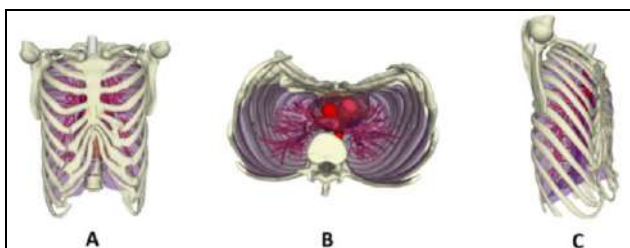


Fig 3: Preoperative three-dimensional images. A. Front view; B. Bottom view; C. Side view



Fig 5: Postoperative X-ray examination

Discussion

There are various surgical methods for correction of pectus excavatum. In the early years, the operation was mainly open surgery, and Ravitch procedure was the standard surgical method at that time ^[1-3, 20-22]. The main contents of this operation were to remove or partially remove the damaged structures in sunken deformity, then fix the local structures together and finally implement the overall correction ^[20-22]. This kind of operation is not an ideal operation because of its long incision, large surgical field, obvious trauma and unsatisfactory surgical effect. After Nuss procedure appeared in 1998, it basically withdrew from the stage of history, and few people used it again ^[1-4]. However, patients who failed Ravich procedure in early years are occasionally encountered clinically. Because these patients generally have serious adhesion and may have new deformities, the reoperation always means high risk, and is difficult and challenging ^[5-9]. The patient underwent reoperation 20 years after the first operation, which was a very extreme case. Due to extensive adhesion of bilateral thoracic cavities and behind sternum after the first operation, large depression area and local acute angle deformities of rib arches ^[19], special technology is required to complete the correction.

The main deformity of the patient before reoperation is still depression, and Nuss procedure should be considered first for the operation. However, due to the severe adhesion, the standard Nuss procedure has a great risk [4-9]. To reduce the risk, we used Wung procedure for correction [10]. We used two steel bars to complete the Wung procedure at two different heights, which corrected the main depression deformity. However, in the correction process, because the patient's anterior chest wall was uneven, when the median chest wall was propped up, there were depressions in both sides of the outer part of the anterior chest wall. If no further correction was made, the overall effect would be significantly affected. In order to obtain perfect results, we have added Wenlin procedure, which can rectify the surface of the bone structures and lift the depressed parts to obtain satisfactory results [16-18]. In addition, because of the local acute angle deformities of rib arches, in order to make the orthopedic effect more perfect, we used bone rongeur to directly bite them flat, and finally eliminated all visible deformities.

After the failure of pectus excavatum operation, various unexpected new deformities may occur. In order to complete the correction, the operation should not be confined to a specific procedure. If all possible materials and methods could be fully used for correction, the result would be perfect.

In the reoperation of this patient, we used three surgical methods, namely Wung procedure, Wenlin procedure and direct bone biting operation. In terms of the nature of deformity correction surgery, these three types of methods correspond to three basic plastic surgeries, namely, mechanical external force plastic surgery, template plastic surgery and destructive plastic surgery [20-22]. This means that we have used all available technologies in the operation of this patient. It is precisely because of the application of these technologies that the operation finally achieved satisfactory results.

Thoracic deformity surgery has been carried out for many years, and there are a large number of doctors doing such operations worldwide. However, the results are not optimistic. At present, most doctors are still unable to get rid of the limitation of some specific surgical methods. The only purpose of them is to complete a specific operation rather than completely correct the deformity. This purpose greatly limits the doctors' thinking, and it is difficult to obtain the most satisfactory effects. In order to break this unfavorable situation, we propose Wenlin principle for thoracic deformity correction [23, 24]. This principle completely gets rid of the limitation of specific surgical methods and focuses on the correction effect of deformity. This change of principle has made revolutionary progress in the treatment of thoracic deformity. In the past year, we have performed corrective surgery on hundreds of patients with thoracic deformities. With the new principle, our surgical effects has made great progress.

Conclusion

The reoperation of pectus excavatum is a very challenging operation. The use of classic Nuss procedure has great risks and difficulties. However, if other effective methods are adopted, the operation can not only be completed safely, but also achieve ideal results.

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Author's Contribution

Not available

Conflict of Interest

Not available

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