Case report - Thoracic oncologic

A suitable system of reconstruction with titanium rib prosthesis after chest wall resection for Ewing sarcoma

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Abstract

The recent improvements in chemotherapy and surgical resection in Ewing sarcoma (ES) increased the overall survival as well as the importance of chest wall reconstruction. These improvements are in order to avoid asymmetrical growth, functional and cosmetic compromise after surgery. Chest wall reconstruction still remains a big issue in young patients with ES. We present a case of ES of the left chest wall, arising from a rib, in a 14-year-old patient. He was admitted after neoadjuvant chemotherapy and radiotherapy. The patient underwent a chest wall resection of three ribs and a wedge lung resection of the upper lobe followed by chest wall reconstruction with Stratos™ rib titanium prostheses. This new device is suitable for reconstruction after major chest wall resection with good cosmetic and functional results. During the follow-up, there was no evidence of local and distant recurrence, the pain was under control and there were no functional alterations in the chest wall.

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1. Introduction

Ewing sarcoma (ES) is the second most common primary bone tumor after osteogenic sarcoma, which is more common in the male gender [1]. ES is an extremely aggressive malignant bone tumor which has a very poor prognosis that typically occurs in children and adolescents.

Approximately 15% of all ES are localized in the chest wall and approximately 10% arise from a rib [2]. The ES of the rib has a better prognosis compared with ES of other sites. The clinical presentation of this tumor includes chest pain, dyspnea and cough. In patients with an ES of the chest wall, presence of a mass is frequently discovered during the physical examination. Multimodality therapy, including neoadjuvant multidrug chemotherapy and complete resection is the treatment of choice. These therapies have increased the overall survival and the local control of the disease [3]. The recurrence rate in patients with localized disease is approximately 20% and these patients have usually a fatal outcome [4].

After wide chest wall resection in young patients, the choice of appropriate reconstruction material has an important role to assure good functional and cosmetic results in order to improve their quality of life. The materials previously used, like Marlex mesh and methyl methacrylate assured a good stability of the chest wall but they did not guarantee good cosmetic and functional results, because they are not easily adaptable to the shape of the patient’s chest. The recent introduction of titanium rib prosthesis contributes to improve the functional and cosmetic results of chest wall reconstruction, thanks to its flexibility and pliability.

2. Case report

A 14-year-old boy was referred to us for a primary ES of the left chest wall, which involved the fourth rib. The patient presented in 2007 with chest pain, shortness of breath and cough. The chest computed tomography and magnetic resonance scan showed a complete opacification of the left hemithorax due to a large soft tissue mass and left lung atelectasis (Fig. 1a and b). The ES was diagnosed by a needle biopsy. The patient underwent chemotherapy and radiotherapy according to Italian Sarcoma Group/Scandinavian Sarcoma Group III protocol (poor responder arm) followed after by an autologous peripheral stem cell transplant. He did well until 2008, when a relapse of sarcoma was diagnosed. In 2008, he underwent anti-insulin-like growth factor-1 monoclonal antibody treatment, followed by radiotherapy (54 Gy) on the left chest wall in 2009. He had a good response to the treatment. In December 2009, PET/CT and chest CT still showed a localized disease on the left chest wall, without any distant metastasis and demonstrated the origin from the fourth rib (Fig. 1c).

In February 2010, the patient was then admitted to our Thoracic Surgery Unit for a chest wall resection of the residual tumor and reconstruction. A sparing muscle posterolateral thoracotomy was performed, latissimus dorsi,
serratus anterior and trapezius muscles were spared. The third, fourth and fifth ribs were isolated. The tumor size was 6 cm and infiltrated also the lingula. A radical resection of third, fourth and fifth ribs was performed, including a wedge resection of the lingula, infiltrated by ES (Fig. 1d).

The margins of the excision were 5 cm away from the tumor in the posterior part and 2 cm in the anterior part, respectively. The microscopic evaluation of the surgical margins was negative. The chest wall defect was reconstructed with a Gore-Tex mesh and titanium rib prostheses to reconstruct the third, fourth and fifth ribs (Stratos™, Strasbourg Thoracic Osteosyntheses System; MedXpert GmbH, Heitersheim, Germany). The anterior and posterior margins of the resected ribs were isolated. We inserted three complete implants using 45° and the straight rib clips for the posterior and anterior rib segments, respectively, and completely serrated connecting bars; two 45° rib clips and a connecting bar were also placed between the second rib and the posterior segment of the third rib to better stabilize the posterior chest wall (Fig. 2a and b). We bent the clips with special bending instruments, included in the set; the connecting bars were cut according to the size of the resection with cutting pliers, and then they were fixed to the rib clips. The wound was closed in the standard fashion in layers with vicryl. The patient was extubated in theater. No postoperative complications occurred. Both chest drains came out on fourth and sixth postoperative days, respectively, and he was discharged home after 10 days. Histology reported an ES of the fourth rib with clear resection margins.

The patient has not developed any local or distant recurrence during his follow-up. The patient has not complained of any pain or discomfort in his normal activities and chest radiograph after three months did not show any deformities of the chest wall (Fig. 2c and d).

3. Discussion

ES is a rare tumor that frequently affects young male patients. The most common clinical course deals with initial biopsy, followed by chemotherapy and partial or complete chest wall resection. Neoadjuvant chemotherapy reduces the tumor dimensions, facilitating a complete removal with negative resection margins, reducing the risk of local recurrence and improving survival, which has also increased the importance of chest wall reconstruction.

In this patient, we removed the ribs involved and the other two adjacent ribs, without cutting any muscles and...
we reconstructed the chest wall with a Gore-Tex mesh and rib titanium prostheses. The ideal graft material should facilitate a symmetrical growth and a natural healing. A lot of different methods have been proposed to stabilize the chest wall after resection. Many studies demonstrated the safety and the good results obtained with synthetic mesh, like Prolene mesh (polypropylene), Gore-Tex (polytetrafluoroethylene) or Marlex mesh, and muscular flaps [5–7]. These meshes are too weak for the lateral chest wall reconstruction and are not predicted to have good cosmetic results in young patients, who are still growing. The additional use of methyl methacrylate allows to obtain a good chest wall stability, but limits the chest wall growth, causing asymmetric deformities [8]. Moreover, the methyl methacrylate is not very easy to handle and to adapt to the chest wall defect.

After extensive chest wall resection in young patients, we suggest the use of these new rib titanium prostheses in the reconstruction to confer adequate stability and a physiological shape with acceptable functional and cosmetic results, due to its flexibility. A Gore-Tex mesh was placed between the lung and the rib prostheses to protect the lung underneath and to avoid the risk of lung herniation.

The pliability of titanium consents to adapt easily the rib clips to the contour of the ribs and avoids the risk of loosening. Titanium maintains a high body tolerance, remaining chemically inert and corrosion-free. We also recommend sparing all the muscles in order to improve the cosmetic results and to avoid functional alterations after surgery.

The rarity of the disease and the lack of multicentric randomized study do not allow a way to establish an optimal and uniform method in the chest wall reconstruction. The advantages of titanium bars in the reconstruction have been previously reported after subtotal sternectomy for primary tumors [9]. Gonfiotti et al. reported the feasibility of these new rib prostheses and the good results obtained in the reconstruction of wide antero-lateral chest wall resections, also in young patients [10].

Only one case in an adolescent with a relatively short follow-up does not permit us to establish the optimal reconstructive strategy and to evaluate the long-term cosmetic and functional results. However, titanium prostheses showed excellent short-term results and represent an additional device useful in the chest wall reconstruction.
References