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Report of three cases

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Multidisciplinary oncoplastic approach to chest wall reconstruction following wide resections. Report of three cases

An advanced cancer or an infection process localized on chest wall often require large full thickness resection to obtain free margins and site sterilization.
Superior skills and expertise can be provided by a multidisciplinary surgical team, overcoming technical difficulties otherwise insurmountable for a single specialist. Only a multidisciplinary approach, providing both skeletal reconstruction and soft tissue coverage, allows to restore chest wall functions and stable coverage of lung and viscera. Furthermore, in case of lung exposition, immediate reconstructive procedure is demanded for stable coverage.
We present 3 complex clinical cases, in which an immediate plastic reconstruction followed a wide resection of thoracic wall, performed by combining synthetic or biologic mesh with large myocutaneous flaps.
Meticulous pre-op planning of every step, integration of reconstructive modalities proper of different specialties, and full cooperation among surgical teams are the backbone of such complex surgery.
The goals consist in reaching margins free of disease and fast healing, so reducing recovery time and promoting an immediate respiratory rehabilitation.
The clinical results of this report supports the importance of multidisciplinary approach in wide chest wall resections.

KEY WORDS: Basal cell carcinoma, Biologic mesh, Chest wall reconstruction, Oncoplastic, Osteomyelitis, Squamous cell carcinoma

Introduction

In Non-melanoma skin cancers (NMSC) and breast tumors, chest wall resection is limited to locally invasive or advanced disease. Similarly, soft tissue malignancies as sarcomas demand wide resection because of the well-known capacity of local recurrence [1,2]. Tissues like costal bone, intercostal muscle and pleura are to be resected in block to get free margins and decrease the risk of tumor cells dissemination [2].
Tissues debridement in suspected osteomyelitis is another indication for full thickness resection. When osteomyelitis is confirmed, mainly by bone core biopsy [3], nonviable bone and soft tissues must be removed [4].
Multidisciplinary approach allows to expand indications to tumors great in dimensions, otherwise judged unresectable [5].
Immediate reconstructive procedure is demanded to restore chest wall functions providing both skeletal reconstruction and stable soft tissue coverage.
Several surgical techniques and flaps are described for this purpose [6]. An accurate preoperative planning is

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ABBREVIATION

BCC: Basal Cell Carcinoma
CT: Computed Tomography
MRI: Magnetic Resonance Imaging
NMSC: Non-Melanoma Skin Cancer
PET: Positron Emission Tomography
RT: Radiotherapy
SCC: Squamous Cell Carcinoma
TRAM flap: Transverse Rectus Abdominis Musculocutaneous flap
VRAM flap: Vertical Rectus Abdominis Myocutaneous flap

essential to define appropriate procedures, timing, anatomical planes and resection limits.
We present 3 different cases of combined surgery, in which oncologic and reconstructive high demands required multidisciplinary approach, from resection planning to complete wound healing. These cases are reported in line with the SCARE criteria [7].

Case Presentation

Case N. 1

A 67-years old non-smoker female presented to our outpatient clinic for chronic fever and cutaneous fistula on left hemithorax. Past medical history included a left Halsted mastectomy followed by radiation therapy, nearly 30 years before, and complicated by post radiation pericarditis.
Physical examination showed a 2 cm skin ulcer at the 7th intercostal space surrounded by a wide lichen-like area, probably due to RT-induced dermatitis.
The left latissimus dorsi muscle showed signs of extensive atrophy after denervation due to previous axilla dissection.
CT scans showed inflammatory process reaching the costal plane (Fig. 1A), thus, upon suspicion of post-radiation osteomyelitis, we performed a PET scan that revealed increased glucose-metabolism involving 7th and 8th left ribs (Fig. 1B).
Long-lasting chronic inflammatory skin processes may lead to squamous cell carcinoma (SCC), also known as Marjolin ulcer [8], so we decided to perform a wide full-thickness resection involving both the 7th and 8th ribs.
Post radiation damages to the internal left mammary artery and thoracodorsal vessels section during mastectomy made vessels inadequate for microsurgical reconstruction. We decide thus to plan a right vertical rectus abdominis myocutaneous flap (VRAM) based on the right superior epigastric artery (Fig. 1C), that was the only blood supply source left undisturbed by previous treatments.
After wide skin and soft tissue excision, both ribs were resected at the anterior axillary line level (Fig. 1D), reaching adequate margins of resection.
Surgery proceeded harvesting right VRAM flap (Fig. 1E). Donor-site was repaired with non-absorbable polypropylene medium-weight mesh prosthesis and the flap was turned and twisted into left chest defect achieving good coverage of the exposed pleura (Fig. 1F).
The post-operative recovery was complicated by atrial fib-

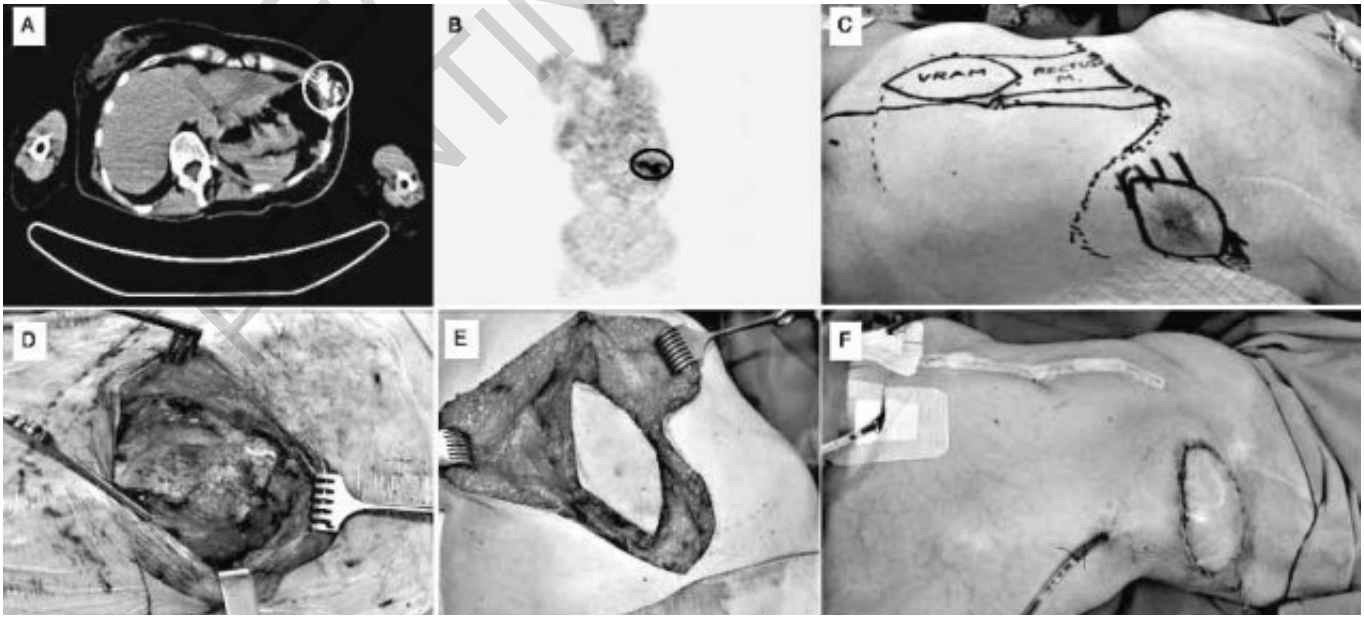

Fig. 1

rillation and left pleural effusion that required intensive care unit admission.
Once solved these complications and after completing respiratory rehab the patient was discharged a month later. Pathologic findings confirmed radio-induced necrosis, excluding any cancer process.

Case N. 2

A 58-years old non-smoker man presented at the Emergency Room of our hospital for a large ulcerated lesion on the left hemithorax that had been progressively developed in the last decade (Fig. 2A).
No medical evaluation was ever been performed and the lesion was treated by patient with daily dressing. He presented asthenia for about 10 days, in absence of fever or any other inflammatory symptom.
Physical examination showed an ulcerated skin lesion of about 10.5 x 5.5 cm, infiltrating subcutaneous layer and fixed on deep plane.
As the blood tests indicated a septic state, the patient was hospitalized.
CT-scan showed a huge double-density lesion (dimensions 14 x 12.5 x 18 cm), diagnosed as abscess, extending from the chest surface to pericardium, sternum, 6th and 7th left ribs, diaphragm muscle, peritoneum, gastric antrum and left hepatic lobe (Fig. 2B).
Gastroduodenoscopy and colonoscopy excluded any fistula with the gastrointestinal system.
A percutaneous drainage was placed for pus drainage and the bacterial culture detected Bacteroides Tethaiotaomicron and Pseudomonas Auriginosa growth so the patient started specific antibiotic therapy.
A diagnostic biopsy of the skin lesion was thus performed, and histology revealed an infiltrating basal cell carcinoma (BCC), nodular and morpheaform subtype.
We decide to perform a wide excision of soft tissues including the 6th and 7th ribs along with the sternum lower third (Fig. 2C). Anterior portion of the diaphragm muscle and adjacent peritoneum were resected as well. Intraoperative histological finding secured free margins.
Two synthetic meshes were used (Gore® Dual Mesh) to restore thoracic and abdominal cavities. The thoracic mesh extended from left to right ribs residual and was fixed superiorly to sternum middle third and inferiorly to diaphragm muscle. The abdominal one was sutured to the limits of peritoneum resection to delimit peritoneal cavity (Fig. 2D).
Mesh inner layer was directed towards lungs and viscera, because of its lower propensity to adhesion formation.
Then, after patient positioning in lateral decubitus, a left latissimus dorsi musculocutaneous flap was harvested and anteriorly rotated to cover meshes exposed and the soft tissue defect (Fig. 2E).
Skin paddle was insufficient to reach a complete cover, so muscle belly was grafted with split-thickness skin meshed with a 1:6 ratio (Fig. 2F).
No complication occurred, chest tubes and drainages were removed early in the postoperative. The flap survival was complete and after 30 days the patient was discharged.
Histology findings confirmed tumor radical resection and the patient is currently free of disease.

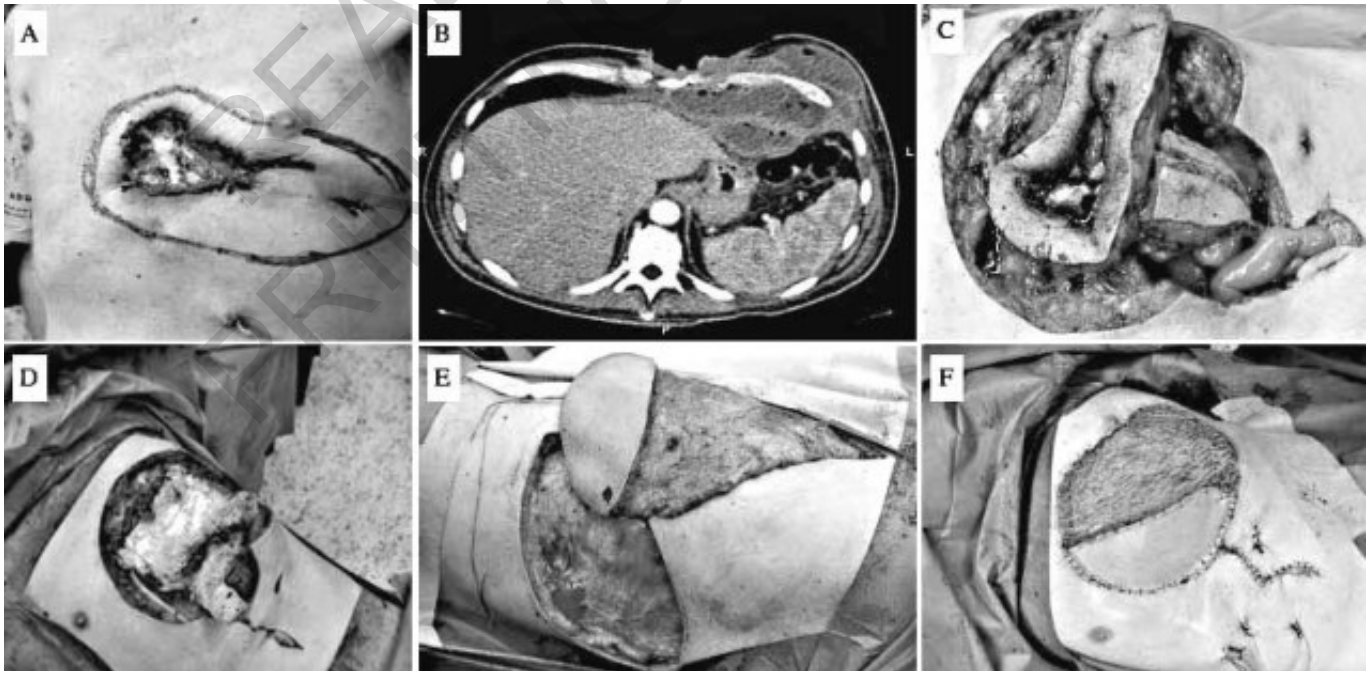

Fig. 2

Case N. 3

A 72-years old female patient presented a 5 cm subcutaneous mass located at the superior part of the right flank (Fig. 3A).
CT scan and MRI revealed neoplasm involving the 8th intercostal space and spreading from lateral chest superiorly throughout the abdominal wall inferiorly, sparing liver and bowel (Fig. 3B). A tru-cut biopsy diagnosed myxofibrosarcoma.
Stating the absence of metastasis and the progressive growth of the mass, the multidisciplinary tumor board suggested to perform irradiation first (50.4 Gy/28F), and then wide resection with immediate reconstruction.
The patient underwent to en-bloc resection of 8th to 12th right ribs, and of the upper half of abdominal wall flank, exposing inferior pole of right lung, liver and bowel (Fig. 3C).
Chest wall reconstruction was realized interposing a porcine-derived biologic acellular matrix (Egis® QuaMedical, 30x21 cm, 1.5 mm thickness), fixed to ribs edges and diaphragm muscle, achieving pleura separation from peritoneum (Fig. 3D).
Complete soft tissue reconstruction was reached harvesting a latissimus dorsi musculocutaneous flap to cover the uppermost part of the defect. The remaining gap was covered by a transverse rectus abdominis musculocutaneous flap (TRAM) based on left superior epigastric vessels (Fig. 3E).
Finally, abdominal wall donor site was repaired by interposing a synthetic prolene mesh (medium weight), fixed to right rectus muscle medial border and left oblique muscles common fascia.
The postoperative course was uneventful and the patient is still under clinical follow-up.

Discussion

Oncologic surgery of chest wall requires reconstruction of inner layers and soft tissue coverage. Reaching complete separation of pleura and mediastinum from peritoneum, avoiding functional lung impairment and viscera migration should be the goal of any stable reconstruction.
Thoracic, general and plastic surgeons have to plan together every step of the surgery, the aim is to realize extremely complex procedures, otherwise damaging and unsafe for patients.
Chest wall is not suitable for simple reconstruction. The use of classic tools in reconstructive armamentarium as latissimus dorsi and TRAM flaps can be favorably combined with synthetic mesh or modern acellular dermal matrix, thus replacing both inner strong stable layers and outer soft layers.
Various combinations of local flaps may replace the need for microsurgical reconstruction with less time-consuming procedure, among other advantages.

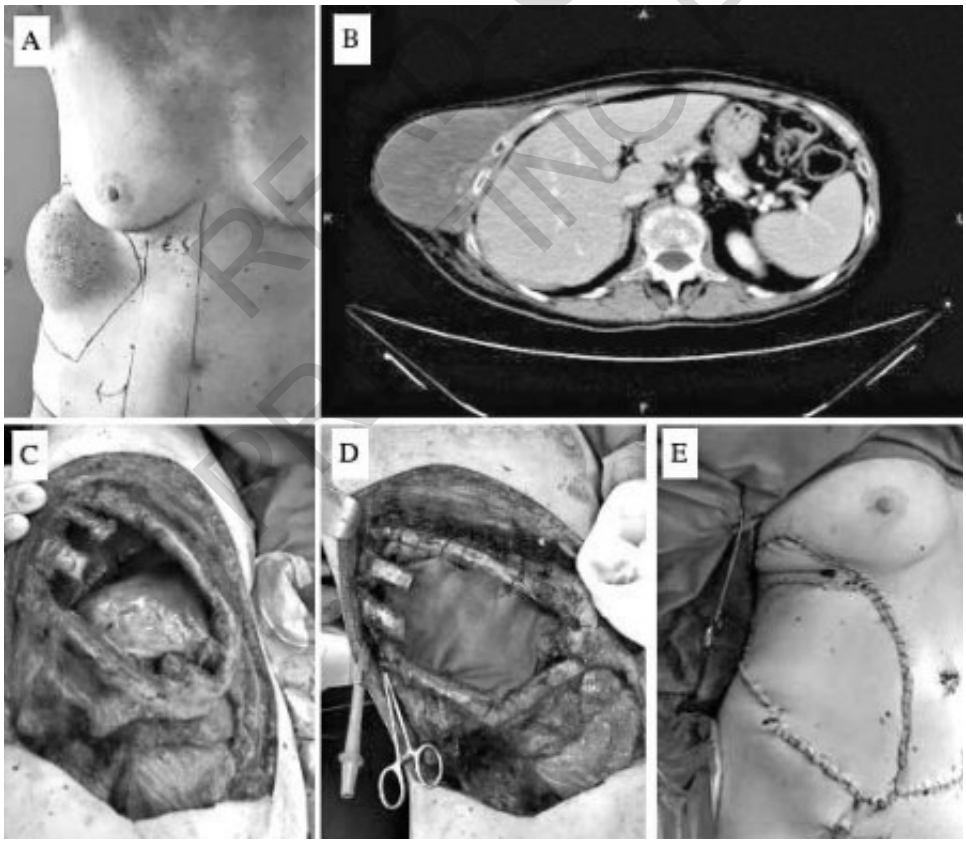

Fig. 2

Accurate patient selection and multidisciplinary pre-operative exams are mandatory, to individuate proper candidates to this challenging surgery.
Surgery starts with wide resection performed by thoracic or general surgeons. Plastic surgeons should start immediately flap harvest, reducing overall surgery time and perioperative risk. Correct patient positioning is crucial to allow resection and simultaneous reconstruction.
Synthetic meshes, usually gore-tex for chest and polypropylene for abdomen, are largely used by thoracic and general surgeons with high rates of success, but when soft tissue coverage is deficient, infection of these devices invariably occurs.
Using synthetic materials, has been also associated with adherence formation in mediastinum or peritoneum. The use of biologic acellular matrix (mainly porcine-derived) or fascia lata from cadaver are becoming consequently more frequent, due to a higher resistance to infection and promoting less adhesions with viscera.
Intraoperative restoring blood, prompt fluid resuscitation and parameters monitoring are mandatory, likewise antibiotic prophylaxis and antithrombotic primary prevention therapy.
Clinical evaluation and daily dressing change are strongly suggested to detect any early signs of local complications.
Chest tubes and extensive wounds often make patients feel the immediate postoperative time as the hardest step. Respiratory rehabilitation, as a crucial component of treatment, should not be delayed and an adequate pain control improves adherence to physiatrist protocol.

Conclusion

Oncoplastic thoracic surgery requires full cooperation of different teams performing wide resections and planning complex reconstructions. A multidisciplinary team including thoracic, general and plastic surgeons may considerably improve treatment reducing surgery time and risk, and consequently optimizing clinical result and survival rate.

Riassunto

Un tumore localmente avanzato, o un processo infettivo come l'osteomielite, localizzato sulla parete toracica, spesso richiede un'ampia resezione chirurgica a tutto spessore per ottenere margini liberi e bonifica del sito.
Un'equipe chirurgica multidisciplinare può fornire abilità superiori e maggiori competenze, superando difficoltà tecniche altrimenti insormontabili per un singolo specialista. Solo un approccio multidisciplinare, ottenendo sia la ricostruzione scheletrica che la copertura dei tessuti molli, consente di ripristinare le funzioni della parete toracica e una copertura stabile di polmone e visceri. Inoltre, in caso di esposizione di pleura o parenchima polmonare, è richiesta una procedura ricostruttiva immediata al fine di ottenere una copertura stabile.
Presentiamo 3 casi clinici complessi, in cui un intervento immediato di chirurgia plastica ricostruttiva ha seguito un'ampia resezione della parete toracica, eseguita combinando reti sintetiche o biologiche con grandi lembi miocutanei.
Una meticolosa pianificazione preoperatoria di ogni fase chirurgica, l'integrazione delle modalità ricostruttive proprie delle diverse specialità e la piena collaborazione tra le équipe chirurgiche rappresentano la spina dorsale di un intervento così complesso.
I target da conseguire consistono nel raggiungere margini liberi da malattia e una guarigione rapida, riducendo i tempi di recupero e favorendo un'immediata riabilitazione respiratoria.
I risultati clinici di questo report supportano l'importanza dell'approccio multidisciplinare nelle resezioni della parete toracica ampia.

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