Ann Thorac Cardiovasc Surg 2024: 30; 24-00121 doi: 10.5761/atcs.cr.24.00121

Case Report

Excision of Giant Chronic Expanding Hematoma of the Thorax Caused by Rib Fractures after Proton Radiotherapy for Lung Cancer

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Chronic expanding hematoma (CEH) is defined as a hematoma that gradually expands over months to years. An 82-year-old female underwent proton radiotherapy for left upper lobe lung cancer 10 years previously. Two years after the therapy, a hematoma developed from the left 3rd to 5th dorsal rib fractures and gradually expanded, causing contraction of the left shoulder. Transcatheter arterial embolization was performed; however, the hematoma continued to expand with thrombocytopenia, and the platelet was decreased to 4.2 × 10^4/μL. Computed tomography showed a 17.2 × 14.0 × 10.0 cm mass between the left scapula and left dorsal ribs. The CEH of the thorax was completely excised with combined resection of the 3rd to 5th ribs, while the brachial plexus was preserved. Postoperatively, the platelet completely recovered and she could raise her left arm. A complete excision with surrounding organs preserved is the strategy used in the treatment of CEH of the thorax.

Keywords: chronic expanding hematoma, proton radiotherapy, rib fracture, thrombocytopenia, brachial plexus

Introduction

Chronic expanding hematoma (CEH) is defined as a hematoma that gradually expands over months to years.[1)] CEH develops due to trauma, surgery, and tuberculosis, especially in the thorax.[2)] Here, we report a surgical case of a giant CEH of the thorax with thrombocytopenia caused by rib fractures after the proton radiotherapy for lung cancer.

Case Report

An 82-year-old female underwent proton radiation therapy (2-beam, 80 Gy/20 fractions) for left upper lobe lung cancer 10 years ago (**Fig. 1A**). Due to the radiation, the left 3rd to 5th dorsal ribs were fractured (**Fig. 1B**), and 2 years after the radiotherapy, a hematoma developed from the fractured ribs (**Fig. 1C**). Needle biopsy was performed 3 years later, and the tumor was diagnosed as a CEH of the thorax. As the hematoma expanded over the next several years, the patient gradually developed thrombocytopenia. Although transcatheter arterial embolization (TAE) for the feeding arteries (the 5th intercostal artery, uppermost thoracic artery, subcostal artery, and supraspinatus artery) was performed (**Fig. 1D**), the tumor still had grown and the platelet

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Received: July 16, 2024; Accepted: August 31, 2024
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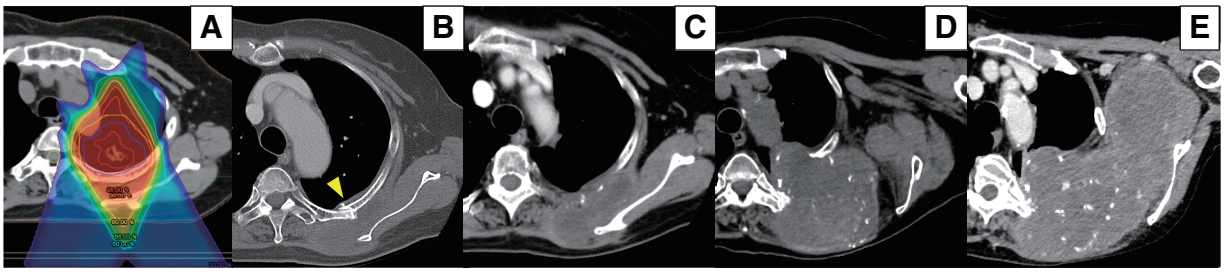

Fig. 1 The clinical course of the hematoma caused by rib fractures after radiotherapy. The dose distribution of the 2-beam proton radiotherapy for left upper lobe lung cancer (**A**). After the radiotherapy, the left 3rd to 5th ribs were fractured (**B**), and a hematoma developed from the fractured ribs (**C**). Although TAE was performed for the feeding arteries (**D**), the hematoma continued expanding, and the platelet count decreased from 20.1 × 10^4/μL to 4.2 × 10^4/μL (**E**). TAE: transcatheter arterial embolization

count was decreased from 20.1 × 10^4/μL to 4.2 × 10^4/μL (**Fig. 1E**). The patient was referred to our department for further surgery.

Physical examination revealed a giant tumor with a thoracic deformity around the left scapula, and the left shoulder was contracted. A computed tomography (CT) scan showed a 17.2 × 14.0 × 10.0 cm mass in diameter between the left scapula and the left 3rd to 5th dorsal ribs (**Figs. 2A** and **2B**). Magnetic resonance imaging (MRI) T1WI showed that the lesion had an external capsule, and a mosaic pattern appeared in its inner region (**Fig. 2C**). ^{18}F-Fluorodeoxyglucose (FDG) positron emission tomography/CT (PET/CT) showed slight accumulation in accordance with the capsule of the hematoma (SUVmax 6.86) (**Fig. 2D**). The laboratory data found that platelet 5.5 × 10^4/μL, hemoglobin 9.7 g/dL, prothrombin time and international normalized ratio (PT-INR) 1.13, activated partial thromboplastin time (APTT) 32.7 s, and D-dimer 201.7 ng/mL. The patient had no family history of thrombocytopenia, splenomegaly, or abnormal blood cell formation.

We cooperated with an orthopedic surgeon about performing a complete excision while preserving the musculocutaneous nerve to flex the elbow joint. We transfused 20 units of platelets before the surgery. The surgery was performed in the right lateral position with neural monitoring of the left upper extremity. First, using a posterolateral approach, we dissected the hematoma from the chest wall and scapula. Next, using a deltopectoral approach, that is, an anterior incision between the pectoralis major and deltoid muscles, we preserved the brachial plexus, including the musculocutaneous nerve (**Fig. 3**), and tunneled between the scapula and the tumor from anterior to posterior. We divided the left 3rd to 5th ribs to reach the thoracic cavity, and excised the tumor

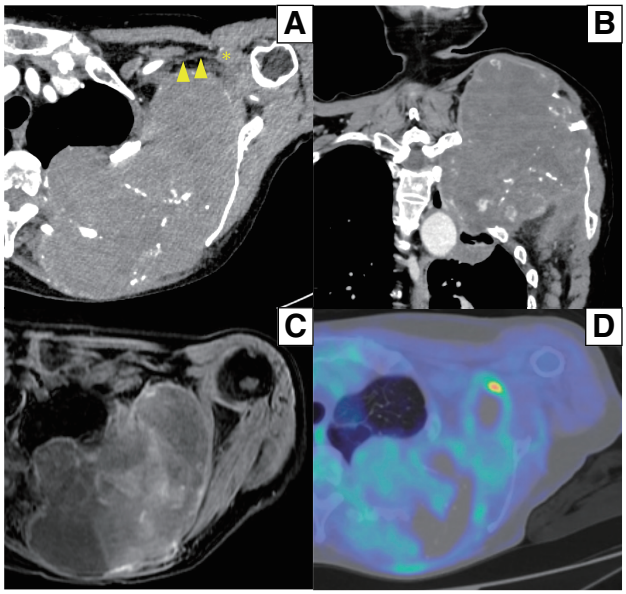

Fig. 2 Images at initial examination. CT scan showed a 17.2 × 14.0 × 10.0 cm mass between the left scapula and the left 3rd to 5th dorsal ribs (**A**) and (**B**). Yellow arrowheads: Musculocutaneous nerve; *: the short head of biceps brachii. MRI T1WI showed that the tumor had an external capsule and a mosaic pattern appearance in its inner region (**C**). PET/CT scan showed slight accumulation (SUVmax 6.86) in accordance with the capsule of the hematoma (**D**). CT: computed tomography; MRI: magnetic resonance imaging; PET: positron emission tomography

en bloc by dissecting slight adhesion between the hematoma and left upper lobe. We reconstructed the chest wall with 12.0 × 12.0 cm polypropylene mesh. The operative time was 244 minutes, and the amount of bleeding was 1890 cc. Microscopically, the 18.0 × 17.0 × 9.0 cm diameter lesion had no malignancy and was consistent with the external capsule and hematoma in its inner (**Fig. 4**).

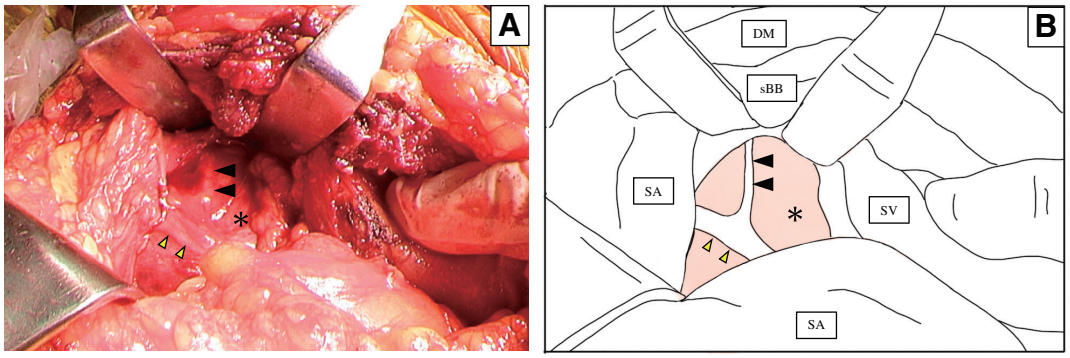

Fig. 3 (**A**) Intraoperative photography and (**B**) the schema of the deltopectoral approach. Using a deltopectoral approach, the anterior incision between the pectoralis major and deltoid muscles, we could identify and preserve the brachial plexus (yellow arrowheads), including the musculocutaneous nerve (black arrowheads) and subclavian artery and vein. *: tumor; DM: deltoid muscles; SV: subclavian vein; sBB: the short head of biceps brachii; SA: serratus anterior

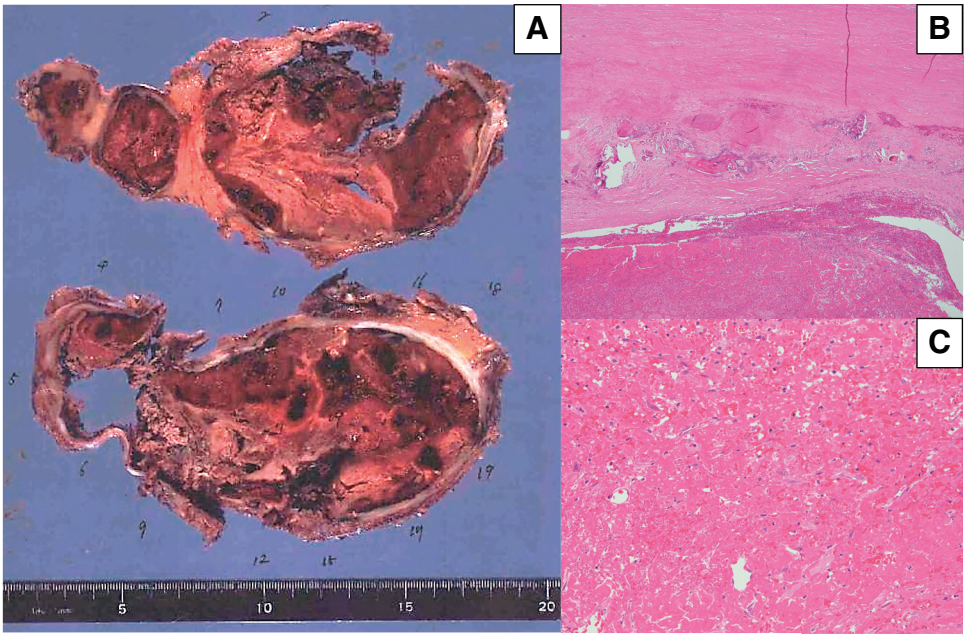

Fig. 4 Pathological findings. The 18.0 × 17.0 × 9.0 cm diameter lesion had no malignancy and was consistent with the external capsule and hematoma in its inner (**A**). Microscopically, there was microvascular growth at the fibroblastic capsule (**B**), and the hematoma consisted of the blood clot and fibrin (**C**).

The postoperative course was uneventful, and the patient was discharged on postoperative day 10. She could raise the left arm, and the platelet recovered to 24.5 × 10^4/μL after the operation. The patient has been disease-free for a year.

Discussion

Most of the patients with CEH of the thorax have a history of tuberculosis, but some develop CEH after thoracic surgery or trauma.[2] Although rib fracture frequently occurs after radiation therapy for lung cancer at the range of 23.1%–27.1%,[3,4] no report of CEH of the thorax was found in the literature. The onset of CEH is considered similar to the etiology of subdural hematomas.[5] In a blood clot, leaked products derived from blood cells induce inflammation, which causes vascular permeability and creates cytokines and fibroblasts. This granulomatous reaction continuously forms membranes and neovascular vessels around the clot, creating a hematoma. Moreover, a tissue plasminogen activator from the neovascular system in the fibrous capsule activates the fibrinolytic system and facilitates subsequent growth of the lesion.

In the treatment of CEH of the thorax, complete excision, including the capsule, is important because there are some reports of recurrence when the capsule remains.[6] CEH often adheres strongly to adjacent organs; therefore, in many cases, combined resection of the surrounding organs is required. In this case, the motion of the left shoulder was restricted due to long-term compression by the hematoma, and the lesion was very close to the musculocutaneous nerve, one of the brachial plexuses used to flex the elbow.[7] We completely excised the hematoma with these nerves preserved. In the postoperative course, the patient could elevate the left shoulder as well as the elbow, and she could hang out laundry by herself.

Although there are no reports of thrombocytopenia in CEH of the thorax, the local consumption of platelets and coagulation factors has been reported to result in thrombocytopenia and systemic coagulopathy in a giant hemangioma or aortic aneurysm,[8] Kasabach–Merritt syndrome is well known for this consumptive coagulopathy.[9] In this syndrome, the platelet count is reported to recover at a normal level by the treatment for hemangioma.[10] In our case, the platelets recovered up to 24.5 × 10^4/μL after half a year from the operation. This change observed before and after the surgery is considered to be similar to these pathologies.

Conclusion

We successfully excised a giant CEH of the thorax with thrombocytopenia following radiotherapy for lung cancer. A complete excision with surrounding organs preserved is the strategy used in the treatment of CEH of the thorax.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

The patient provided consent for the publication of this case report.

Funding

Not applicable.

Data availability statement

Not applicable.

Author contributions

YS conceived and designed the study, acquired and analyzed data, drafted the manuscript and figures, and reviewed and edited the manuscript.

HI, YF, and KO contributed to the study conception and design, analyzed data, and reviewed and edited the manuscript.

All authors approved the final version of the manuscript for publication.

Disclosure statement

None declared.

References

1) Reid JD, Kommareddi S, Lankerani M, et al. Chronic expanding hematomas. A clinicopathologic entity. JAMA 1980; **244**: 2441–2.
2) Sakuma T, Takayashiki N, Iguchi K, et al. Chronic expanding hematoma in the chest: A case report. Exp Ther Med 2018; **15**: 5457–60.
3) Ishikawa Y, Nakamura T, Kato T, et al. Dosemetric parameters predictive of rib fractures after proton beam therapy for early-stage lung cancer. Tohoku J Exp Med 2016; **238**: 339–45.
4) Nagata I, Ogino T, Arimura T, et al. Clinical outcomes of proton beam therapy for ground-glass opacity-type lung cancer. Lung Cancer (Auckl) 2020; **11**: 105–11.
5) Labadie EL, Glover D. Physiopathogenesis of subdural hematomas. Part 1: Histological and biochemical comparisons of subcutaneous hematoma in rats with subdural hematoma in man. J Neurosurg 1976; **45**: 382–92.
6) Matsuge S, Hosokawa Y, Yamazaki S, et al. Five cases of surgically resected chronic expanding hematoma in the chest. Kyobu Geka 2000; **53**: 768–73. (in Japanese).
7) Pejkova S, Filipce V, Peev I, et al. Brachial Plexus Injuries - Review of the anatomy and the treatment options. Pril (Makedon Akad Nauk Umet Odd Med Nauki) 2021; **42**: 91–103.
8) Aboulafia DM, Aboulafia ED. Aortic aneurysm-induced disseminated intravascular coagulation. Ann Vasc Surg 1996; **10**: 396–405.
9) Lewis D, Vaidya R. Kasabach-Merritt Syndrome. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan
10) Liu X, Yang Z, Tan H, et al. Giant liver hemangioma with adult Kasabach-Merritt syndrome: case report and literature review. Medicine (Baltimore) 2017; **96**: e7688.