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LETTER TO THE EDITOR

Successful use of extracorporeal membrane oxygenation during induction chemotherapy in a patient with mediastinal tumor mass of a T lymphoblastic lymphoma

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Dear Editor,

There is increasing interest on new treatment strategies to improve outcome of critically ill patients with hematological malignancies [1]. Particularly, the specific indications and timing of extracorporeal membrane oxygenation (ECMO) are still under investigation [2, 3]. We here report the favorable outcome of a 20-year-old patient with newly diagnosed T lymphoblastic lymphoma (T-LBL) and a mediastinal tumor mass treated with induction chemotherapy under extracorporeal membrane oxygenation followed by consolidation therapy and allogeneic stem cell transplantation.

In October 2011, the otherwise healthy man was admitted to a local emergency department because of thoracic pain and non-productive cough for 2 weeks. CT scan revealed a large mediastinal mass (22 cm × 12 cm × 15 cm) with compression of the trachea and bronchial tubes and concomitant upper venous congestion, mediastinal shift, and massive right-sided pleural effusion (Fig. 1). There was cervical and intrathoracal lymphadenopathy and hepatomegaly with no evidence of abdominal lymph node enlargement and normal peripheral blood count (WBC 5400/μl with normal differential, Hb 13.9 g/dl, PLT 277,000/μl). Despite chest tube management, which drained 2000 ml of a serous exudate, the respiratory situation rapidly worsened requiring intubation and mechanical ventilation. Nevertheless, the patient developed progressive hypercapnia (paCO2 91 mmHg) and respiratory acidosis (pH 7.07) due to slit-shaped airway compression as confirmed by bronchoscopy. At that time, the patient was referred to our intensive care unit for further diagnostics and treatment.

On admission, the patient was ventilated using intermittent positive pressure (IPPV) with 0.6 FiO_2, 12 cmH_2O PEEP and 42 cmH_2O Pmax without need for vasopressor therapy. The initial pH was 7.23 with paO2 of 247 mmHg, paCO2 of 58 mmHg, and SvO2 of 44 % due to low cardiac output. However, hypercapnia worsened over the next 14 h. For bridging of respiratory failure, we decided to implant an ECMO. As the veins of the upper half of the body were compressed by the tumor mass and could not be cannulated, a femoral access was chosen for both cannulas. In 2011, the limited number of puncturable veins resulted in a veno-arterial ECMO. Nowadays, we would use a venous single-line double-lumen cannula in a similar situation.

After respiratory stabilization, a tumor biopsy for histopathological examination was performed, which revealed T cell lymphoblastic lymphoma/T-ALL (CD1a positive). While bone marrow biopsy was not performed during anticoagulation for ECMO, staging according to Ann Arbor classification was IV X.

For initial debulking of the mediastinal mass, emergency radiation (cumulative 8 Gy) and dexamethasone/cyclophosphamide were applied. The patient was then treated according to the German Multicenter ALL protocol (GMALL 07/2003) [4] with induction therapy consisting of daunorubicin, vincristine, as well as dexamethasone. After debulking of

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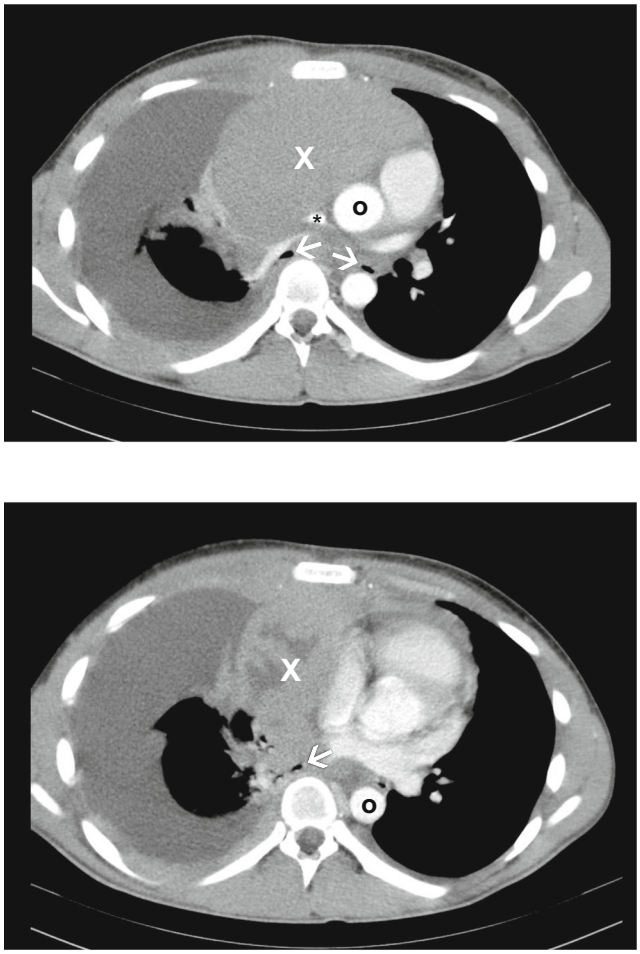

Fig. 1 CT scan with mediastinal mass with compression of the bronchial tubes and concomitant upper venous congestion, mediastinal shift, and massive right-sided pleural effusion (*asterisk* superior vena cava, *o* aorta, *arrow* slit-shaped central airways, *X* mediastinal tumor mass)

the mediastinal tumor and anatomic reconstitution of the upper airways, ECMO could be explanted and conventional ventilation was sufficient by day 7 after admission. However, further courses of chemotherapy (peg-asparaginase, cyclophosphamide, cytarabine) were aggravated accompanied by numerous complications, e.g., hematothorax, transfusion-related acute lung injury, atypical pneumonia, as well as extubation failure. The patient was eventually weaned from the ventilator by day 40. Since induction therapy only resulted in partial remission, salvage therapy with two cycles of nelarabine, etoposide, and cyclophosphamide [5] was applied resulting in complete remission. In April 2012, allogeneic matched-unrelated stem cell transplantation (MUD-PBSCT) was performed after conditioning with TBI (4 Gy)/cyclophosphamide and GvHD prophylaxis consisting of ATG/cyclosporine/methotrexate. Long-term follow-up after 4 years showed a relapse-free survival with 100 % chimerism and without clinical signs of graft-versus-host disease (Fig. 2).

The present report demonstrates a successful ECMO bridging strategy in a patient with T-LBL and a reversible airway compression by a mediastinal tumor mass. ECMO as cardiac or respiratory support is increasingly used in different disorders associated with hypoxia, severe respiratory acidosis, and cardiac failure. Especially for hematologic or oncologic critically ill patients, there is only scarce data concerning indication and timing of ECMO support and the clinical outcome. Literature provides only two case series of hematologic patients with ECMO [2, 3] with indifferent conclusions in distinct patient populations. Patients with mostly lymphomas as underlying disease had a short-term and long-term survival of 50 % but with an incidence of bleeding complications higher than average [2]. The outcome of a Korean population of

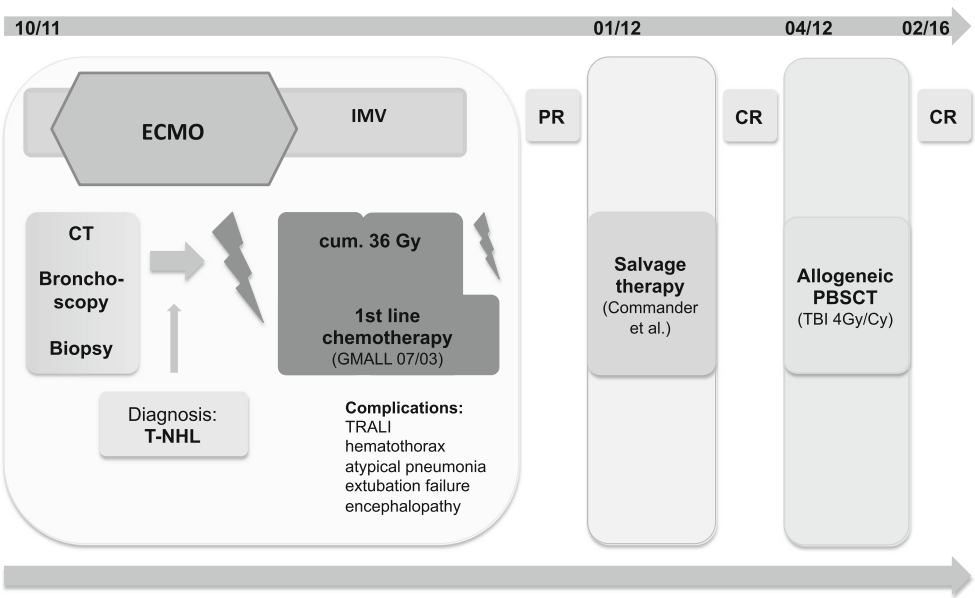

Fig. 2 Treatment course. *CR* complete response, *CT* computer tomography, *ECMO* extracorporeal membrane oxygenation, *GMALL* German multicenter study group for adult acute lymphoblastic leukemia (ALL), *IMV* invasive mechanical ventilation, *IPPV* intermittent positive pressure ventilation, *T-NHL* T cell non-Hodgkin lymphoma, *PBSCT* peripheral blood stem cell transplantation, *PR* partial response, *TBI* total body irradiation, *TRALI* transfusion-related acute lung injury

mostly patients after allogeneic HSCT or AML patients during induction therapy was very poor although the rate of ECMO-associated complications was comparable with the usual ECMO population [3]. There are a few additional cases with extrinsic central airway occlusion caused by newly diagnosed lymphoma and successful ECMO bridging during initiation of anti-neoplasm therapy [6–9]. There is general agreement that in life-threatening airway, heart and vessel compression by a treatable tumor the temporary use of ECMO is a treatment option. The duration of ECMO was no longer than 1 week in the cases with mediastinal mass [2, 6–9].

These cases also underline the urgent need for close cooperation between intensive care physicians and hematologists in order to provide optimal care for highly complex patients under potentially curative anti-tumor therapy.

(va-)ECMO, (veno-arterial) extracorporeal membrane oxygenation; ALL, acute lymphoblastic leukemia; AML, acute myeloid leukemia; ATG, anti-thymocyte globulin; CT, computer tomography; GMALL, German multicenter study group for adult acute lymphoblastic leukemia (ALL); GvHD, graft-versus-host disease; IMV, invasive mechanical ventilation; IPPV, intermittent positive pressure ventilation; MUD, matched-unrelated donor; PBSCT, peripheral blood stem cell transplantation; PEEP, positive end expiratory pressure; TBI, total body irradiation; TRALI, transfusion-related acute lung injury

Compliance with ethical standards

Authorship Contribution: C.L. collected the data. C.L. and G.B. wrote the paper. C.K., M.M.H., M.E., and A.G. revised the manuscript critically for important intellectual content.

Conflict of interest The authors declare that they have no competing interests.

Ethical approval and informed consent All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.

Informed consent was obtained from the patient included in the study.

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