

# Intracranial Extramedullary Hematopoiesis: Brief Review of Response to Radiation Therapy

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**Intracranial deposits of extramedullary hematopoiesis are extremely rare, and limited experience with the treatment of these lesions has been reported. Our review of the literature provides further insights regarding the clinical, radiological, and pathological behavior of these lesions and examines the available treatment strategies. Radiation therapy has proven to be an effective modality for treatment of this rare radiosensitive disease. Am. J. Hematol. 78:151–152, 2005. © 2005 Wiley-Liss, Inc.**

**Key words:** radiation therapy; extramedullary hematopoiesis

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## INTRODUCTION

Extramedullary hematopoiesis is a rare compensatory process associated with many hematologic disorders and bone marrow dysfunction. Cases of EMH are rarely treated in North America and Northern Europe, but more often are diagnosed in patients from Mediterranean and Southern European Countries. It has been reported to occur in approximately 15% of cases of thalassemia, and it also occurs in myelofibrosis and in other anemic conditions [1]. Whereas hematopoiesis normally occurs in the marrow of long bones, the ribs, and the vertebrae of an adult, EMH is described as an ectopic production of myeloid, erythroid, and megakaryocytic elements [1,2]. Ectopic production is believed to be a compensatory mechanism that is subsequent to bone marrow stress and inability to compensate for the body's hematologic demands. Histologically, EMH typically mimics normal bone marrow.

EMH has been reported in virtually every organ, but is most commonly seen in areas which produce fetal hemoglobin, including spleen, liver, and lymph nodes. It has also been reported in numerous other sites, including the lung, gastrointestinal tract, urinary tract, adrenal glands, prostate, peritoneum, skin, breast, central nervous system, and paravertebral areas [1–4].

## INTRACRANIAL INVOLVEMENT

Intracranial extramedullary hematopoiesis is extremely rare [5,6]. The pathway of EMH involvement of the dura is unknown, but it is postulated that the dura has hematopoietic capacity in the fetus and EMH may originate from primitive rests. Others believe that dural involvement results from embolization of hematopoietic stem cells. It is unlikely to result from extrusion of bone marrow from nearby bone in the absence of bony erosions or fractures [6–8]. Symptoms of EMH are secondary to direct mass effect upon adjacent structures. EMH masses present as isointense epidural lesions on both T1- and T2-weighted images, and MRI plays an important role in the diagnosis [8]. Rarely, the epidural masses may be markedly hypointense on T2-weighted images related to large amounts of iron deposition in patients with the ringed sideroblast subtype of myelodysplastic

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Received for publication 12 May 2004; Accepted 18 May 2004

Published online in Wiley InterScience (www.interscience.wiley.com).  
DOI: 10.1002/ajh.20177

syndrome as was recently described [7]. Other entities that could be considered in the imaging differential diagnosis in this patient include lymphoma, dural metastases, meningiomatosis, and neurosarcoïdosis.

## RADIATION TREATMENT

Radiation therapy has proven to be a very effective modality for treatment of this rare disease as the hematopoietic elements are exquisitely radiosensitive. Radiation therapy provides in most cases of intracranial EMH an improved therapeutic advantage over surgery [1,2,7,8]. Total surgical excision is usually not feasible in this disease process due to the diffuse nature of involvement, high probability of recurrence, and frequent close proximity or integral involvement of critical structures. Until the early 1990s, surgical removal followed by radiotherapy was the recommended treatment. It has recently been reported that radiotherapy alone can provide complete neurologic recovery in 70% of cases [3,4]. Although radiotherapy can produce initial worsening of symptoms secondary to tissue edema during the first days of treatment, this can be prevented with administration of steroids. Radiation can also produce marked myelosuppression in rare patients due to a decrease in the extramedullary hematopoietic tissue (upon which they are dependent for blood cell production) or secondary to irradiation of the normal bone marrow in the spine.

The dose–response relationship for radiation therapy has not been clearly defined although much information has been learned from treatment of this rare disease. Various prescribed doses of radiation have been reported (900–3,500 cGy) with varying fraction sizes. Papavasiliou et al. reported on the treatment of 32 patients with 6–26 Gy in 1–2.5 Gy fractions (although in a few cases a single fraction of 6 Gy was administered). The time–dose fractionation (TDF) equaled 8.5–30.5 [1]. Munn et al. also found a therapeutic dose range of 15–30 Gy after a review of the literature [9]. Plataniotis et al. recently suggested that a total radiation dose in the range of 10–25 Gy usually evokes a durable remission and improvement of symptoms [10]. With the availability of CT simulation/treatment planning and MRI, radiation ports can be better limited to the sites of involvement to

achieve a satisfactory clinical response with less toxicity to surrounding normal tissues.

## CONCLUSION

Extramedullary hematopoiesis is a rare compensatory process associated with many hematologic disorders and bone marrow dysfunction. Intracranial deposits of extramedullary hematopoiesis are rare, and limited experience with the treatment of these lesions has been reported. Our review of the literature provides further insights regarding the clinical, radiological, and pathological behavior of these lesions and examines the available treatment strategies. Radiation therapy has proven to be an effective modality for treatment of this rare radiosensitive disease.

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