ultrasonography, which revealed only an intrahepatic lesion. However, a subsequent PET/CT scan of the whole body revealed another two incidental foci, which was confirmed by the postoperative pathologic results (i.e., lesions with a high glucose uptake were pathologically malignant: GIST and ICC). In summary, the whole-body PET/CT scan played an important role in guiding further investigation and enhancing an accurate and early diagnosis for this patient.

Pulmonary hamartomas are benign neoplasms that usually present in asymptomatic adult men. Because they often present as a single peripheral nodular lesions radiographically [5], pulmonary hamartomas can be misinterpreted clinically as metastatic lesions, although PET/CT will show no increased FDG uptake. Wedge resection is adequate for these tumors which have little or no risk of malignant transformation or recurrence.

In summary, we have described the first case of a GIST with a simultaneously diagnosed ICC and pulmonary hamartoma. The whole body PET/CT scan can make possible accurate and early detection of these neoplasms, and appropriate treatment strategy (removal of all these tumors and adjuvant imatinib therapy for the GIST) may contribute to a favorable outcome.

Acknowledgements

The authors thank George Y. Wu, M.D., Ph.D., for his critical review of the manuscript.

References

[1] Heinrich MC, Corless CL. Gastric GI stromal tumors (GISTs): the role of surgery in the era of targeted therapy. J Surg Oncol 2005;90:195–207.

[2] NCCN Clinical Practice Guidelines in Oncology™ (Soft Tissue Sarcoma). Available at: http://www.nccn.org/professionals/physician_gls/PDF/sarcoma.pdf. Accessed December 13, 2008.

[3] Nakeeb A, Pitt HA, Sohn TA, Coleman J, Abrams RA, Piantadosi S, et al. Cholangiocarcinoma. A spectrum of intrahepatic, perihilar, and distal tumors. Ann Surg 1996; 224:463–73.

[4] Malhi H, Gores GJ. Cholangiocarcinoma: Modern advances in understanding a deadly old disease. J Hepatol 2006;45: 856–67.

[5] Gjevre JA, Myers JL, Prakash UB. Pulmonary hamartomas. Mayo Clin Proc 1996;71:14–20.

Post irradiation olfactory neuroblastoma (esthesioneuroblastoma): A case report and up to date review

GERARD P. MCVEY[1], DEREK G. POWER[2], NOEL J. AHERNE[1], DAVID GIBBONS[1]& DESMOND N. CARNEY[2]

[1]*St Luke's Hospital, Dublin, Ireland and* [2]*Mater Hospital, Dublin, Ireland*

To the Editor,

Radiation-induced malignancy is a well defined entity, accounting for a reported incidence of 1.4% of radiation-induced cancers in a malignant lymphoma head and neck series and 0.03 to 0.08% of post irradiation sarcomas [2,6]. The incidence for radiation-induced malignancy is likely to increase in the oncology population, as survival rates improve, due to improvements in primary and salvage therapeutic options. Esthesioneuroblastoma (ENB) is an uncommon malignant neoplasm of neural crest origin arising from the olfactory sensory epithelium in the roof of the nasal fossa. It accounts for approximately 0.3% of upper aerodigestive tract malignancies and for less than 5% of all nasal cavity tumours [3,4]. The tumor was first described in 1924 by Berger and Richard [5], who reported in the French literature about "l'esthesioneuroepitheliome olfactif." Schall and Lineback reported the first English literature report in 1951. Since then less than 1 000 cases of ENB have been reported. There has been no docu-

Correspondence: Gerard McVey, St Luke's Hospital, Dublin, Ireland. E-mail: gerardmcvey@gmail.com

(Received 14 January 2009; accepted 16 January 2009)

ISSN 0284-186X print/ISSN 1651-226X online
DOI: 10.1080/02841860902759709

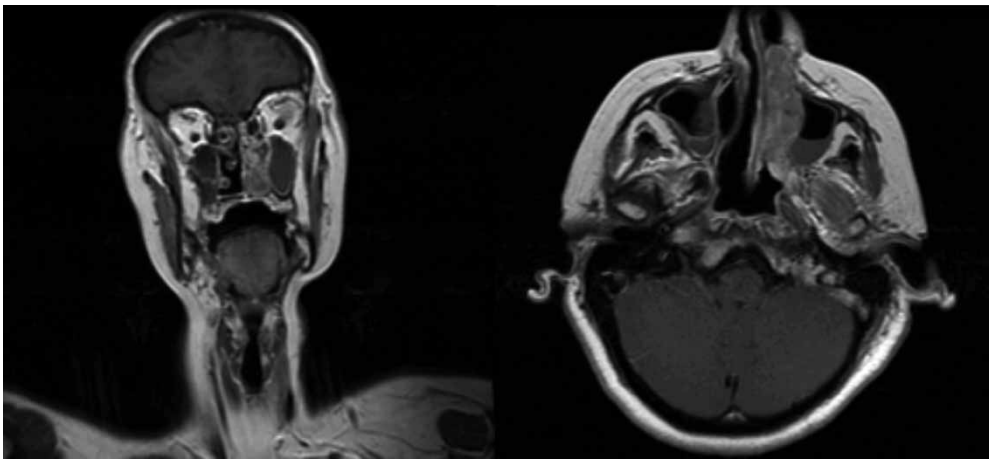

Figure 1. An enhancing mass filling the left side of the nasal cavity, occluding the osteomeatal complex in the left maxillary sinus.

mented aetiological causative factor in humans. A previous case report was reported by Kounami et al. [1] in a child following successful treatment of acute lymphcytic leukemia, which included prophylactic cranial irradiation; we describe the first reported case of radiation induced ENBs in the adult literature.

Case report

P.B. presented in July 1985, aged 36 years and twenty-nine weeks gestation, with a 6 week history of an unresolving tonsillitis. Initial review demonstrated a hardened and ulcerated 5 cm mass arising from the left tonsillar bed, extending to the uvula. Clinical and radiological examination revealed localized disease. A biopsy confirmed a large cell anaplastic tumour considered to be a "diffuse large cell poorly differentiated lymphocytic lymphoma."

She was treated using parallel opposed radiotherapy, using a cobalt-60 source; with field borders corresponding to the level of zygomatic arch superiorly, hyoid bone inferiorly and the tragus

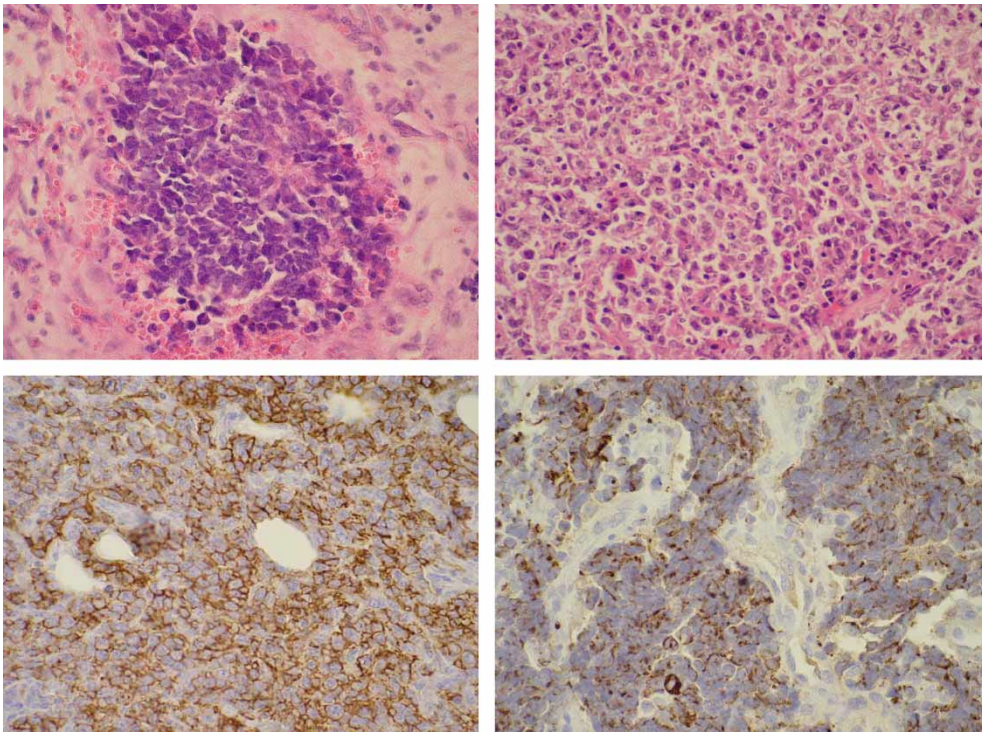

Figure 2. (A) Esthesioneuroblastoma showing haematoxyphilic cells with scant cytoplasm (H&E× 400). (B) Esthesioneuroblastoma showing "dot and membrane" staining pattern with cytokeratin AE1/3 (×400). (C) Lymph node effaced by diffuse population of large malignant lymphoid cells. (H&E ×400). (D) Lymph node showing membranous staining with a B cell marker CD20 (×400).

posteriorly. She received a total dose of 60 Gy in 30 fractions over six weeks. P.B. delivered a healthy baby 4 weeks post therapy.

Shortly after completing her radiotherapy, she developed severe back pain, imaging confirmed a spinal cord compression and she received a further 30 Gy in 10 fractions to her thoracic spine. Complete restaging, outruled other sites of disease and she was commenced on MBACOD for six months [7].

She remained well in the intervening 25 years, until June 2006, when she developed a swelling overlying her left maxillary antrum, with associated left nasal obstruction and increased lacrimation.

An MRI was performed, which demonstrated an enhancing mass filling the left side of the nasal cavity, occluding the osteomeatal complex in the left maxillary sinus (Figure 1). Biopsy confirmed an olfactory neuroblastoma (Figure 2), grade 3-4/4, using the Hyams' histopathological grading system [10]. Restaging included a PET scan, which demonstrated diffuse pulmonary FDG-avid lesions, consistent with metastatic disease. Clinically, she rapidly developed diffuse cervical nodal involvement over a 2 week period. P.B initially tolerated a palliative course carboplatinum-etoposide, but succumbed prior to receiving her 2nd cycle of chemotherapy.

Discussion

Radiation-induced malignancies are well described. Radiation has been shown to induce tumours in nearly all tissues in the irradiated field; the majority of reported cases of radiation induced malignancies are sarcomas and leukemias, however, cutaneous malignancies and meningiomas are also frequently reported. In 1948, Cahan and colleagues, suggested a set of criteria for radiation induced bone tumours that are valid today; namely, a documented history of radiation to the affected site, a histologically proven malignancy in the radiated field, a latency period of at least 5 years and lastly differing histologies. These criteria were specific to sarcomas; however, they are valid for radiation-induced cases such as ours. Cahans' criteria were revised and broadened by Murray et al. in 1999, in relation to the limitations on the latency period and the histological subtypes of radiation-induced second cancers [8]. Murray et al. included soft tissue sarcomas as well as other radiation-associated malignancies, which arose after a latency period of less than five years, to fulfill the criteria for being radiation induced. Although the median latency period in studies reported in the international literature is 10 to 15 years, a case series from Memorial Sloan Kettering reported 15% of their patients developing sarcomas less than 5 years after radiation [9]. The latency period appears to be inversely related to age at initial diagnosis.

Prognosis of radiotherapy induced cancer

The prognosis of radiation induced malignancies is usually worse than primary neoplasms irrespective of site. There are several reasons for this. There is commonly a delay in diagnosis, until the lesion is at a more advanced stage. This is in part due to difficulties in deciphering between radiation induced and neoplastic tissue changes. In a series of 20 patients with second primary malignancies by Murray et al. [8], 80% were poorly differentiated, usually of a higher grade histologically, making them inherently more aggressive. Treatment options for these patients are more limited, as re-irradiation to tumoricidal doses is extremely difficult. Post-irradiation neoplasms of the limbs have a better prognosis, whereas those involving the vertebral column, the pelvis, the shoulder girdle and skull have the least favourable outcome. Peripheral lesions are more amenable to aggressive resection and thus yield a better outlook. Despite, normal tissue recovery occurring within the spinal cord, doses needed for radical intent retreatments would be impossible to be achieved so close to adjacent brain parenchyma.

Despite decreasing indications for the administration of radiotherapy and dose reductions in lymphoma patients, a large percentage of the general oncology population will receive radiation therapy at some point during their illness, either with radical intent or for palliation.

There are few ways of decreasing the risk of radiation-induced malignancies, however increasing awareness and careful long-term follow-up, with an index of suspicion may increase earlier detection of these aggressive lesions. ^{18}F-fluoro-2-deoxy-D-glucose positron emission tomography (PET) allows a greater degree of sensitivity in discriminating between radiation/surgically distorted tissues and neoplastic processes. Moreover, the advent of PET/computed tomography fusion allows an even more optimized correlation of abnormal functional and structural tumour images, improving further the earlier detection of radiation-induced malignancies.

Conclusion

The above patients' case, though not seen as standard management by contemporary standards, illustrates that physicians managing cancer patients need to be cogniscent of radiation-induced malignancies as a long-term complication of treatment. It should be stated that the current standard of care for our patient

would most likely be with chemotherapy whilst pregnant and depending on her response would receive involved field radiotherapy. Radiation induced malignancy, as a pathological entity may be seen more frequently due to improved survival of cancer patients resulting from an increased effectiveness of cancer therapy. The prognosis of radiation induced malignancies is in general is poor and the treatment options are limited, therefore early diagnosis and active lifelong surveillance may lead to a correspondingly better chance of salvage therapy. However, one has to emphasize that the incidence of radiation-induced malignancies is small and that the risk of its occurrence is vastly outweighed by the benefits obtained from radiation therapy by most patients.

References

[1] Cahan WG, Woodard HQ, Higginbotham NL, Stewart FW, Coley BL. Sarcoma arising in irradiated bone: Report of eleven cases 1948. Cancer 1998;82:8–34.
[2] Amemiya K, Shibuya K, Yoshimura R, Okada N. The risk of radiation-induced cancer in patients with squamous cell carcinoma of the head and neck and its results of treatment. Br J Radiol 2005;78:1028–33.
[3] O'Connor TA, McLean P, Juillard GJF, Parker RG. Olfactory neuroblastoma. Cancer 1989;63:2426–8.
[4] Skarsgard DP, Groome PA, Mackillop WJ, Zhou S, Rothwell D, Dixon PF, et al. Cancers of the upper aerodigestive tract in Ontario, Canada and the United States. Cancer 2000;88:1728–38.
[5] Berger L, Luc G, Richard D. L'esthésioneuroépithéliome olfactif. Bull Assoc Franç Étude Cancer 1924;13:410–21.
[6] Mark RJ, Poen J, Tran LM, Fu YS, Selch MT, Parker RG. Postirradiation sarcomas. A single-institution study and review of the literature. Cancer 1994;73:2653–62.
[7] Fisher RI, Gaynor ER, Dahlberg S, Oken MM, Grogan TM, Mize EM, et al. Comparison of a standard regimen (CHOP) with three intensive chemotherapy regimens for advanced non-Hodgkin's lymphoma. N Eng J Med 1993;328:1002–6.
[8] Murray EM, Werner D, Greeff EA, Taylor DA. Postradiation sarcomas: 20 cases and literature review. Int J Rad Oncol Biol Phys 1999;45:951–61.
[9] Brady MS, Gaynor JJ, Brennan MF. Radiation-associated sarcoma of bone and soft tissue. Arch Surg 1992;127:1379–85.
[10] Hyams VJ. Olfactory neuroblastoma. In: Hyams VJ, Baksakis JG, Michaels L, editors. Tumours of the upper respiratory tract and ear. Washington DC: Armed Forces Institute of Pathology; 1988. p. 516–31.

Acute ischemia of the lower limb during chemotherapy for testicular cancer: A report of two cases

HELENE LE HO[1], ELODIE VAULEON[1], EVELINE BOUCHER[1], DANIEL GEDOUIN[1], PIERRE KERBRAT[1,2] & JEAN-LUC RAOUL[1,2]

[1]*Department of Medical Oncology, Centre E Marquis, 35042 Rennes Cedex, France and* [2]*European University in Brittany, France*

To the Editor

Arterial or venous thrombosis is a common complication in cancer patients, particularly during treatment. This is especially true with some anti-angiogenic drugs (bevacuzimab, thalidomide) which are know to favor arterial thrombosis. Arterial complications are also described with chemotherapy regimens using cisplatin (CDDP) alone, particularly for testicular cancer. We report two cases of acute ischemia of the lower limb observed in patients given a CDDP based regimen for testicular cancer.

The first patient was a 36-year-old man with an uneventful personal and familial history, excepting active smoking evaluated at 20 package-years, who consulted for discomfort in the right testicle. Clinical work-up and computed tomography (CT) revealed a tumor of the right testis and lymph node enlargement of the mediastinal and aorta-cava chains. Tumor markers were negative. Right orchidectomy was performed via an inguinal approach and pathology examination of the surgical specimen disclosed exclusive seminoma, staged pT1N2M0 (no vascular

Correspondence: Jean-Luc Raoul, Department of Medical Oncology, Centre E Marquis, 35042 Rennes Cedex, France. Tel: +33 299 253172. Fax: +33 299 253108. E-mail: raoul@rennes.fnclcc.fr

(Received 9 January 2009; accepted 16 January 2009)

ISSN 0284-186X print/ISSN 1651-226X online
DOI: 10.1080/02841860902759030