Review Article

Role of external beam radiotherapy in oncologic emergencies.

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Abstract

There has been increased incidence of oncologic emergencies along with diagnosis of malignancy. Prompt evaluation is crucial to avoid worsening of conditions. Complete oncologic evaluation should be planned by tumor board panel and optimal local and systemic approach is to be considered. Not all patients are able to undergo surgery or invasive procedure due to multiple systemic progression and compromised performance status. External beam radiotherapy is beneficial in various conditions; brain metastasis, spinal metastasis, superior vena cava obstruction, tumor hemorrhage and cancer pain.

Key words: Oncologic emergencies, External beam radiotherapy

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Introduction

Oncologic emergency is the clinical presentation of cancer patients that need prompt medical attention. It can be caused by various dysfunction such as metabolic, cardiac, neurological, infectious condition or tumor progression.[1] From an initial presentation to completed curative cancer patient, the manifestation can occur at any time of malignancy course. Multidisciplinary tumor board discussion is ideal for management optimization.[2] Radiation is a modality of great use for curative purpose. But for oncologic emergency conditions, there is still much debate among radiation oncologist whether or not urgent administration of radiation is significant for symptoms control.[3] Available data are mostly retrospective. It is much subjective among physicians to assess if the delay treatment is going to compromise the outcome. Apart from the usual weekday treatment, some were irradiated during weekends according to retrospective analysis of emergency condition from Canada.[4] The three most common oncologic emergencies were the following orders: spinal cord compression, brain metastasis and superior vena cava obstruction. Other conditions were acute airway obstruction and uncontrolled tumor hemorrhage.

Brain metastasis

One of the most common cancer metastatic site. There has been increased incidence of brain metastasis with most common primary site of lung, breast and melanoma respectively.[5] Metastatic cells travel through blood supply to the brain and break the blood-brain barrier. Hematogenous spread tumor is usually found in grey white matter junction with peripheral edema resulting from spherical growing.[6] Clinical presentation of brain metastasis ranges from occult asymptomatic to neurological deficit. Symptomatic brain metastasis such as headache, weakness, seizure or alteration of consciousness needs urgent treatment to prevent further deterioration, especially the life-threatening increased intracranial pressure and brain herniation.[7] Initial corticosteroids (e.g. dexamethasone or methylprednisolone) have been reported to improve brain edema and neurologic deficit up to two thirds of patients.[8, 9] Available randomized study on dexamethasone regimen given with whole brain radiotherapy reported that initiation of 4 mg is effective in patients without impending herniation. Larger tumor or symptomatic patients may benefit from higher dose such as 16 mg and consider tapering upon dynamic clinical status. In asymptomatic patients undergoing whole brain radiation, corticosteroid can be reserved with close clinical surveillance.

Single brain metastasis

Excluding radiosensitive histology such as small cell lung cancer, leukemia, lymphoma or germ cell tumor, local therapy such as surgery or radiosurgery can be considered in appropriate patients with single or oligometastases[10]. Patients with good performance status might be selected for upfront surgery as it can achieve immediate pressure effect relief and definitive tissue diagnosis. After surgery is done, postoperative WBRT is given to increase local brain control at the original site and overall brain metastasis though without survival difference.[11, 12]

Available recommendation whether or not radiosurgery is comparable to surgery in this setting is largely based on retrospective evidences[13 - 16] as most randomized trials were underpowered for conclusions. There is no survival difference between surgery plus WBRT and radiosurgery plus WBRT.

Multiple brain metastasis

Whole brain radiotherapy is considered in brain metastasis with multiple systemic progression, multiple brain metastases, single or oligometastases with large tumor not suitable for radiosurgery, and patient who is inoperable or in poor performance status.[17] However, clinical judgement needs to be reconsidered, especially in poor performance status group, about the risk benefit of radiotherapy.

Recent randomized study[18] found no survival increment combining WBRT with supportive care such as dexamethasone compared to supportive care alone despite minimally increased quality of life.

Treatment consideration

Consensual endpoint such as whether to prioritize brain metastasis control or neurocognition in each patient has to be taken into consideration. However, in an emergency setting, availability of resources and timing of treatment initiation determine the treatment choice.

Target volume definition

Whole whole brain radiotherapy covers the whole skull from vertex inferiorly the field edge line from external auditory meatus to the outer canthus of the orbit with extension 1 - 2 cm lower if there is skull base involvement.[19]

For stereotactic radiosurgery, a pathological based study[20] found microscopic tumor infiltration in each histology and recommend 1 mm margin added to the visible gross lesion.

Dose fractionation for whole brain radiotherapy

Cochrane review[21] on available randomized controlled trials reported no significant difference in overall survival or neurological function between different dose regimen; 30 Gy in 10 fractions, 20 Gy in 5 fractions and 40 Gy in 20 fractions twice daily. Update review comparison between 20 Gy in 5 fractions and 40 Gy in 20 fractions twice daily found no survival benefit (Hazard ratio = 1.18, 95%CI 0.89 - 1.56, P = 0.25). No consensus on the dose fractionation of whole brain radiation has been made, however, shorter fractionation with larger dose per fraction such as 20 Gy in 5 fractions or 30 Gy in 10 fraction in edematous brain metastases may result in acute radiation toxicities.[22] In patients presented with brain metastases as the initial diagnosis, physician should opt for lower dose per fraction as the disease course might be unpredictable and late radiation toxicity is possible.[23]

Spine metastasis

Spinal cord compression may result from primary spine malignancy or metastasis. Most common primary sites are lung, prostate and breast cancer respectively.[24] Mechanism of spreading includes hematogenous, shunting of abdominal venous flow to epidural venous plexus and direct neural foramen invasion.[25] Early detection of disease preferably before symptomatic is critical for treatment decision. MRI is the modality of choice in evaluation of nontraumatic spinal cord emergencies with sensitivity 93% and specificity 97% in distinguishing malignancy from benign condition.[26]

In spinal instability, cord compression or neurological deficit at presentation in ambulatory cases should be considered for choice of surgery first[27]. Indications for surgery include spinal instability, bone impingement from vertebral collapse, previous irradiation given in the area and necessity to acquire pathological tissue.[28] In patient who is inoperable or not suitable for surgery such as poor performance status and advance metastasis, radiotherapy is appropriate to palliate symptoms. Apart from surgery and/or radiation, corticosteroid treatment is usually recommended. Despite being such a common medication used in this setting, the data is still vague. Mechanism[29] of action is to decrease tissue edema by capillary permeability reduction resulting in a decrease in water content. Steroid-induced hyperglycemia is another mechanism to cause osmotic gradient. High dose steroid and prolong duration of treatment more than 3 weeks[30] has been clearly correlated with increased side effect however benefit gain is still controversial.[31, 32] Further studies are needed to determine dexamethasone regimen for both ambulatory and non-ambulatory patients.[33]

The most important prognostic factor to predict post treatment ambulation is pretreatment motor function. Percentage of treatment response between pretreatment ambulatory with or without support versus non-ambulatory group is 97% vs 69% according to studies on vertebral metastatic patient underwent radiotherapy alone.[34] Another important decision is timing of radiotherapy. There have still been much debate on the golden hour of surgery in acute spinal cord injury. Prospective study found that early surgery within 24 hours to 48 hours resulted in better neurological function than later than 48 hours although no survival difference was found.[35] Retrospective data reported that the nonambulatory patients who completely resumed their motor functions after radiation therapy, the time interval between onset of spinal metastasis symptom and radiation initiation can be up to 10 days.[36] Radiation oncologist tend to start radiation early although no consensus has been established. One prospective study found no considerable benefit in neurological outcome when giving emergency radiotherapy within 12 hours to malignant spinal cord compression.[37]

Radiation technique

Time is the determining factor in emergency radiotherapy setting and this indicate the choice of radiation technique. From historical data, Linear accelerator 6 MV, 10 MV and Cobalt-60 have been used in the treatment. To achieve dose coverage, 3D simulation is planned using either single posterior or parallel opposing fields depending on the depth of spinal cord.[38]

Target volume definition

Treatment volume is the gross tumor volume plus that whole spinal vertebrae. In 2D using X-ray or 3D using CT simulation planning, the affected vertebrae is treated with two upward and downward extension. When using MRI planning, one vertebra above and below from the affected spine coverage is adequate. In postoperative cases, the tumor bed and orthopedic prosthesis are included.[39]

Dose fractionation

Various regimen namely 8 Gy single fraction, 20 Gy in 5 fractions, 30 Gy in 10 fractions, 37.5 Gy in 15 fractions and 40 Gy in 20 fractions, had been studied and similar post treatment ambulatory rates were reported.[28] Higher dose did not contribute to better functional outcome[40] while higher fractional dose has been reported to have vascular effect which might lead to cord ischemia.[41] Some studies found that single fraction is associated with higher reirradiation and rate of pathological fractures.[42, 43] As a result, routine single or hypofraction should be avoided unless in a limited survival time patients.

Superior Vena Cava obstruction

Malignant airway obstruction categorized into upper airway obstruction which can be effectively relieved by emergent tracheostomy and lower airway obstruction which can be assessed and treatment by interventional technique[44, 45]. While Superior vena cava syndrome or Superior vena cava obstruction (SVCO) is caused by tumor thrombosis within the vein as a result of extrinsic compression or direct tumor invasion. Majority malignancy causes are lung cancers followed by lymphoma.[46] Diagnosis is usually made by clinical which may present as acute or chronic symptoms depending on degree of SVC narrowing.[47] There are much controversy whether or not SVCO is considered medical emergency.[48] Although studies reported that it is not considered direct cause of patient mortality[49, 50], their possible life-threatening effects like laryngeal edema or cerebral hypoxia suggesting that one should get immediate attention and appropriate care.[51] Before radiotherapy or other modalities given, there should be attempt to have proper histological diagnosis first[52]. As radiation can result in loss of subsequent pathological diagnosis[53]. There was no difference of treatment outcome between patient who were admitted and given treatment on weekdays or weekends according to the study from German tertiary care.[54]

Target volume definition

Define the mediastinal mass that caused SVC obstruction on contrast enhanced CT for gross tumor volume. Microscopic margin is added according to pathological type for CTV. And then add setup margin to create PTV.[39]

Dose fractionation

Although the optimal dose is not yet established, various regimen from single f=raction of 6 Gy, hypofraction 3 - 4 Gy for 3 - 5 fractions, 20 Gy or 30 Gy in 10 fractions have been used in historical data.[55 - 57] Symptom relief following radiotherapy were reported from 63% in NSCLC up to 80% in various histology.

Tumor hemorrhage

When encounter the hemorrhage in cancer patient, it can be caused by local tumor vessel invasion and/or systemic coagulopathy. The presentation ranged from occult bleeding to major life threatening event. A retrospective review from single institute[58] showed that patient who presented with this condition was usually diagnosed of metastatic or locally advanced stage. Various management can be considered for treatment in each patient including dressing, endoscopic embolization, surgery, interventional radiology and systemic treatment[59]. Radiation is considered one of the local modalities to control tumor bleeding. External beam radiotherapy can be applied into many different cancer site such as gastric, uterine cervix, bladder, rectum and skin[60 - 63]. The exact mechanism of how ionizing radiation can stop bleeding is unclear. Possible explanation is that radiation cause endothelial damage of malignant vessels and decrease vascularity[64].

Radiation technique and target volume definition

Conventional 2D or CT-based 3D simulation is recorded in retrospective data with the use of Linear accelerator for external beam radiation treatment.[65] Use clinical information combine with contrast enhanced CT to define the gross tumor volume. Appropriate margin can be added upon physician's discretion. The radiation field aim to cover bleeding tumor burden while limiting dose to adjacent normal organ.

Dose fractionation

Since there is no randomized controlled trial compared between each modalities, it is up to physician's discretion. Retrospective study reported significant improvement of clinical bleeding according to WHO scale in patients with incurable cancer underwent radiotherapy[54]. Various regimen resulted from different clinical cases such as previous irradiation history and chemotherapy treatment. The external beam radiotherapy dose was range from 5 - 45 Gy, median 20 Gy.

Other condition: Cancer pain

Distress from malignant pain requires prompt evaluation. Since pain is multifactorial, complete assessment of disease condition should be considered. A mutual standardized questionnaires is also recommended to assess symptom severity without subjectivity[66]. Necessary diagnostic information such as pathological result is beneficial for radiation response determination[67].

Target volume definition

Clinical correlation is an important step to identify the pain location especially in diffuse bone metastasis patient who might not tolerate large volume radiotherapy.[39] PTV encompass the gross lesion with margin based on setup error and normal tissue sparing modification.

Dose fractionation

To relieve pain caused by bone metastasis, systematic review[68, 31] found that single fraction of 8 Gy is as effective as multifraction radiotherapy; 20 Gy in 5 fractions, 30 Gy in 10 fractions, 40 Gy in 20 fractions. Pain response rate after radiation was 60.7% with complete pain resolution 23.8% Odds ratio between single and multiple fractions is 0.98 (95%CI 0.95 - 1.02). Similar response was reported in another

systematic review with 59% improvement and 33% complete pain resolution. Odds ration between single and multiple fractions is 1.03 (95%CI 0.89 - 1.19). However, there was higher re-treatment rate in single fraction group 21.5% vs 7.4% in multiple fractions (Odds ratio 3.44 with 95%CI 2.67 - 4.43). Higher rate of pathological fracture was also higher in single fraction 3% vs 1.6% in multiple fractions (Odds ratio 1.82 with 95%CI 1.06 - 3.11).

Discussion

Early detection of the emergency condition and multidisciplinary tumor board discussion is ideal for management optimization. Prompt treatment is associated with better outcome. External beam radiation therapy is beneficial in terms of alleviate symptom and delay disease progression in various condition with dose fractionation consideration based upon patient performance status and prognosis

Table 1 Summary of dose fractionation in oncologic emergencies.

Oncologic emergencies	Studies	EBRT dose fraction	Endpoint	Conclusion
Brain metastasis	Tsao MN et al.2012 SR 39 trials, n = 10,835	20 Gy/5Fx 40 Gy/20Fx bid 30Gy/10Fx	● OS (HR1.18, 95% CI 0.89 - 1.56, P = 0.25) ● Neurologic function	No difference in altered dose fractionation WBRT.
Spine metastasis	Rades D et al. 2005 Retrospective n = 1,304	8 Gy single Fx 20 Gy/5Fx 30 Gy/10Fx 37.5 Gy/15Fx 40 Gy/20Fx	● Motor function (26% vs 28% vs 27% vs 31% vs 28%, MVA = NS) ● Ambulatory status (69% vs 68% vs 63% vs 66% vs 74%, P = 0.578) ● 2-Year In-field recurrences (24% vs 26% vs 14% vs 9% vs 7%, P < 0.001)	● Similar functional outcomes. ● Less in-field recurrence in multiple fractions.
Superior vena cava obstruction	Armstrong BA et al. 1987 Retrospective n = 125	9 - 12 Gy/3Fx 20 Gy/5Fx	● Symptomatic relief in 2 weeks between 9-12Gy/3Fx vs 20Gy/5Fx (70% vs 56%, P = 0.09)	No difference in altered dose fractionation.
	Sculier JP et al 1986. [69]Retrospective n = 643	6 Gy single Fx 20 Gy/5Fx 20 - 30 Gy/10Fx	● No comparison	Initial chemotherapy due to good response.
Tumor hemorrhage	Cihoric et al 2012 Retrospective n = 62	Range from 5-45 Gy (median 20 Gy)	● Bleeding control after radiation using WHO bleeding scale (grade 0-4) (p<0.001)	Radiation is effective for incurable cancer bleeding reduction.

Reference

1. Behl D, Hendrickson AW et al. Oncologic emergencies. Crit Care Clin 2010;26:181-205.
2. El Saghir NS, Keating NL, Carlson RW, et al. Tumor boards: optimizing the structure and improving efficiency of multidisciplinary management of patients with cancer worldwide. Am Soc Clin Oncol Educ Book 2014:e461-6.
3. Christian E, Adamietz IA, Willich N, Schäfer U, Micke O Radiotherapy for oncologic emergencies on weekends: examining reasons for treatment and patterns of practice at a Canadian cancer centre. Curr Oncol 2009;16:55-60.
4. Mitera G, Swaminath A, Wong S, et al. Radiotherapy for oncologic emergencies on weekends: examining reasons for treatment and patterns of practice at a Canadian cancer centre. Curr Oncol 2009;16:55-60.
5. Nussbaum ES, Djalilian HR, Cho KH, et al. Brain metastases: Histology, multiplicity, surgery and survival. Cancer 1996;78:1781-8.
6. Nicholas S. Boehling, David C. Weksberg, Jiade J. Lu, Eric L. Chang: Palliative Radiation for Brain Metastases. in: Nancy Y Lee. Target Volume Delineation for Conformal and Intensity-modulated Radiation therapy. New York, NY: Springer; 2005.
7. Larson DA, Rubenstein JL, McDermott MW, Barani I. Chapter 147. Increased intracranial pressure. In: DeVita VT, Lawrence TS, Rosenberg SA, editors. Cancer: Principles and practice of oncology, 9th ed. Philadelphia: Lippincott Williams & Wilkins. 2001;2130-5.
8. Ryken TC, McDermott M, Robinson PD, et al. The role of steroids in the management of brain metastases: A systematic review and evidence-based clinical practice guideline. J Neurooncol 2010;96:103-14.
9. Ruderman NB, Hall TC. Use of Glucocorticoid in the palliative treatment of metastatic brain tumor. Cancer 1965;18:298-306.
10. May N Tsao, Dirk Rades, et al. Radiotherapeutic and surgical management for newly diagnosed brain metastasis(es): An American Society for Radiation Oncology evidence-based guideline. Pract Radiat Oncol 2012;2:210-25.
11. Kocher M, Soffietti R, Abacioglu U, et al. Adjuvant whole-brain radiotherapy versus observation after radiosurgery or surgical resection of one to three cerebral metastases: results of the EORTC 22952-26001 study. J Clin Oncol 2011;29:134-41.
12. Kalkanis SN, Kondziolka D, Gaspar LE, et al. The role of surgical resection in the management of newly diagnosed brain metastases: a systematic review and evidence-based clinical practice guideline. J Neurooncol 2010;96:33-43.
13. Schöggl A, Kitz K, Reddy M, et al. Defining the role of stereotactic radiosurgery versus microsurgery in the treatment of single brain metastases. Acta Neurochir (Wien) 2000;142:621-6.
14. O'Neill BP, Iturria NJ, Link MJ, Pollock BE, Ballman KV, O'Fallon JR. A comparison of surgical resection and stereotactic radiosurgery in the treatment of solitary brain metastases. Int J Radiat Oncol Biol Phys 2003;55:1169-76.
15. Rades D, Kueter JD, Veninga T, Gliemroth J, Schild SE. Whole brain radiotherapy plus stereotactic radiosurgery (WBRT +SRS) versus surgery plus whole brain radiotherapy (OP+WBRT) for 1-3 brain metastases: results of a matched pair analysis. Eur J Cancer 2009;45:400-4.
16. Rades D, Kueter JD, Pluemer A, Veninga T, Schild SE. A matched-pair analysis comparing whole-brain radiotherapy plus stereotactic radiosurgery versus surgery plus whole-brain radiotherapy and a boost to the metastatic site for one to two brain metastases. Int J Radiat Oncol Biol Phys 2009;73:1077-81.

17. Lin X, DeAngelis LM. Treatment of Brain Metastases. J Clin Oncol 2015;33:3475-84.
18. Mulvenna P, Nankivell M, Barton R, et al. Dexamethasone and supportive care with or without whole brain radiotherapy in treating patients with non-small cell lung cancer with brain metastases unsuitable for resection or stereotactic radiotherapy (QUARTZ): results from a phase 3, non-inferiority, randomised trial. Lancet 2016;388:2004-14.
19. Ann Barrett, Jane Dobbs, Stephen Morris, Tom Roques. Central Nervous System. In: Practical Radiotherapy Planning. 4th ed. London. Hodder Arnold; 2009;228-9.
20. Baumert BG, Rutten I, Dehing-Oberije C, et al. A pathology-based substrate for target definition in radiosurgery of brain metastases. Int J Radiat Oncol Biol Phys 2006;66:187-94.
21. Tsao MN, Lloyd N, Wong RK, et al. Whole brain radiotherapy for the treatment of newly diagnosed multiple brain metastases. Cochrane Database Syst Rev 2012;18:CD003869.
22. Young DF, Posner JB, Chu F, et al. Rapid- course radiation therapy of cerebral metastases: Results and complications. Cancer 1974;34:1069-76.
23. DeAngelis LM, Delattre JY, Posner JB. Radiation-induced dementia in patients cured of brain metastases. Neurology 1989;39:789-96.
24. Kim RY, Spencer SA, Meredith RF, et al. Extradural spinal cord compression: analysis of factors determining functional prognosis--prospective study. Radiology 1990;176:279-82.
25. David Schiff, MD. Clinical features and diagnosis of neoplastic epidural spinal cord compression, including corda equina syndrome. https://www.uptodate.com/contents/clinical-features-and-diagnosis-of-neoplastic-epidural-spinal-cord-compression#H6.Updated 2018. Accessed on February 1st ,2019.
26. Li KC, Poon PY. Sensitivity and specificity of MRI in detecting malignant spinal cord compression and in distinguishing malignant from benign compression fractures of vertebrae. Magn Reson Imaging 1988;6:547-56.
27. Loblaw DA, Laperriere NJ. Emergency treatment of malignant extradural spinal cord compression: an evidence-based guideline. J Clin Oncol 1998;16:1613-24.
28. Maranzano E, Latini P, Checcaglini F, et al. Radiation therapy of spinal cord compression caused by breast cancer: report of a prospective trial. Int J Radiat Oncol Biol Phys 1992;24:301-6.
29. Ushio Y, Posner R, Kim JH, Shapiro WR, Posner JB. Treatment of experimental spinal cord compression caused by extradural neoplasms. J Neurosurg 1977;47:380-90.
30. Weissman DE, Dufer D, Vogel V, Abeloff MD. Corticosteroid toxicity in neuro-oncology patients. J NeuroOncol 1987;5:125-8.
31. Sørensen S, Helweg-Larsen S, Mouridsen H, Hansen HH. Effect of high-dose dexamethasone in carcinomatous metastatic spinal cord compression treated with radiotherapy: a randomised trial. Eur J Cancer 1994;30A:22-7.
32. Heimdal K, Hirschberg H, Slettebø H, Watne K, Nome O. High incidence of serious side effects of high-dose dexamethasone treatment in patients with epidural spinal cord compression. J Neurooncol 1992;12:141-4.
33. Skeoch GD, Tobin MK, Khan S, Linninger AA, Mehta AI. Corticosteroid Treatment for Metastatic Spinal Cord Compression: A Review. Global Spine Journal 2017;7:272-9.
34. Quraishi NA, Rajagopal TS, Manoharan SR, Elsayed S, Edwards KL, Boszczyk BM. Effect of timing of surgery on neurological outcome and survival in metastatic spinal cord compression. Eur Spine J 2013;22:1383-8.

35. Saito A.I, Nakashiro M, Kunogi H. et al. Golden hour for emergency spinal cord compression RT: Is it too late to do it after 72 hours? IJROBP. 2011;81:S650-51.
36. Rief H, Heinhold R.C, Petersen L.C. et al. Neurological outcome after emergency radiotherapy in MSCC of patients with non-small cell lung cancer - a prospective trial. Radiat Oncol 2013;8: 297.
37. Rades D, Stalpers LJ, Veninga T, et al. Evaluation of five radiation schedules and prognostic factors for metastatic spinal cord compression. J Clin Oncol 2005;23:3366-75.
38. Ann Barrett, Jane Dobbs, Stephen Morris, Tom Roques. Emergency and palliative radiotherapy. In: Practical Radiotherapy Planning. 4th ed. London. Hodder Arnold; 2009;62-70.
39. Rades D, Karsten JH. A comparison of two different radiation schedules for metastatic spinal cord compression considering a new prognostic factor. Strahlenther Onkol 2002; 178:556-61.
40. St Clair WH, Arnold SM, Sloan AE, Regine WF. Spinal cord and peripheral nerve injury: current management and investigations. Semin Radiat Oncol 2003;13:322-32.
41. Wu JS, Wong R, Johnston M, et al. Meta-analysis of dose-fractionation radiotherapy trials for the palliation of painful bone metastases. Int J Radiat Oncol Biol Phys 2003;55:594-605.
42. Sze WM, Shelley M, Held I, Mason M. Palliation of metastatic bone pain: single fraction versus multifraction radiotherapy-a systematic review of the randomised trials. Cochrane Database Syst Rev 2004;CD004721
43. Ferrell B, Koczywas M, Grannis F, Harrington A. Palliative Care in Lung Cancer. Surg Clin North Am 2011;91:403-ix.
44. Jung B, Murgu S, Colt H. Rigid bronchoscopy for malignant central airway obstruction from small cell lung cancer complicated by SVC syndrome. Ann Thorac Cardiovasc Surg 2011;17:53-7.
45. Talapatra K, Panda S, Goyle S, Bhadra K, Mistry R. Superior vena cava syndrome: A radiation oncologist's perspective. J Cancer Res Ther 2016;12:515-9.
46. Wan JF, Bezjak A. Superior vena cava syndrome. Emerg Med Clin North Am 2009;27:243-55.
47. Schraufnagel DE, Hill R, Leech JA, Pare JA. Superior vena caval obstruction. Is it a medical emergency? Am J Med 1981;70:1169-74.
48. Gauden SJ. Superior vena cava syndrome induced by bronchogenic carcinoma: is this an oncological emergency? Australas Radiol 1993;37:363-6.
49. Ampil F, Caldito G, Previgliano C. Palliative radiotherapy for superior vena caval obstruction by lung cancer: A major issue about timing and a minor issue about efficacy. Ann Thorac Med 2012;7:170-1.
50. Chan RH, Dar AR, Yu E, et al. Superior vena cava obstruction in small-cell lung cancer. Int J Radiat Oncol Biol Phys 1997;38:513-20.
51. Ahmann FR. A reassessment of the clinical implications of the superior vena caval syndrome. J Clin Oncol 1984;2:961-9.
52. Loeffler JS, Leopold KA, Recht A, Weinstein HJ, Tarbell NJ. Emergency prebiopsy radiation for mediastinal masses: impact on subsequent pathologic diagnosis and outcome. J Clin Oncol 1986;4:716-21.
53. Hohloch K, Bertram N, Trümper L, Beissbarth T, Griesinger F. Superior vena cava syndrome caused by a malignant tumor: a retrospective single-center analysis of 124 cases. J Cancer Res Clin Oncol 2014;140:2129-34.

54. Armstrong BA, Perez CA, Simpson JR, Hederman MA. Role of irradiation in the management of superior vena cava syndrome. Int J Radiat Oncol Biol Phys 1987;13:531-9.
55. Rowell NP, Gleeson FV. Steroids, radiotherapy, chemotherapy and stents for superior vena caval obstruction in carcinoma of the bronchus: a systematic review. Clin Oncol (R Coll Radiol) 2002;14:338-51.
56. Ostler PJ, Clarke DP, Watkinson AF, Gaze MN. Superior vena cava obstruction: a modern management strategy. Clin Oncol (R Coll Radiol) 1997;9:83-9.
57. Adewuyi SA, Ajekigbe AT, Campbell OB, et al. Pattern of oncologic emergencies seen in adult cancer patients attending the Radiotherapy and Oncology Centre, Ahmadu Bello University Teaching Hospital, Zaria - Nigeria. Niger Postgrad Med J 2012;19:208-14.
58. Pereira J, Phan T. Management of bleeding in patients with advanced cancer. Oncologist 2004;9:561-70.
59. Hoskin PJ. Radiotherapy in symptom management. Oxford Textbook of Palliative Medicine, 2nd ed. New York, NY: Oxford University Press; 1999.
60. Biswal BM, Lal P, Rath GK, et al. Hemostatic radiotherapy in carcinoma of the uterine cervix. Int J Gynaecol Obstet 1995;50:281-5.
61. Srinivasan V, Brown CH, Turner AG. A comparison of two radiotherapy regimens for the treatment of symptoms from advanced bladder cancer. Clin Oncol (R Coll Radiol) 1994;6:11-3.
62. Tey J, Back MF, Shakespeare TP, et al. The role of palliative radiation therapy in symptomatic locally advanced gastric cancer. Int J Radiat Oncol Biol Phys 2007;67:385-8.
63. Koukourakis MI. Tumour angiogenesis and response to radiotherapy. Anticancer Res 2001;21:4285-300.
64. Cihoric N, Crowe S, Eychmüller S, Aebersold DM, Ghadjar P. Clinically significant bleeding in incurable cancer patients: effectiveness of hemostatic radiotherapy. Radiat Oncol 2012;7:132.
65. Mitera G, Swaminath A, Wong S, et al. Radiotherapy for oncologic emergencies on weekends: examining reasons for treatment and patterns of practice at a Canadian cancer centre. Curr Oncol 2009;16:55-60.
66. Sales L, Rockhill JK. Cancer pain emergencies: is there a role for radiation therapy? Curr Pain Headache Rep 2010;14:483-8.
67. Chow E, Zeng L, Salvo N, Dennis K, Tsao M, Lutz S. Update on the systematic review of palliative radiotherapy trials for bone metastases. Clin Oncol (R Coll Radiol) 2012;24:112-24.
68. Sculier JP, Evans WK, Feld R, et al. Superior vena caval obstruction syndrome in small cell lung cancer. Cancer 1986;57:847-51.

บทคัดย่อ

บทบาทของรังสีรักษาระยะไกลในภาวะฉุกเฉินทางมะเร็งวิทยา

ปรางระวี แสงจันทร์

รังสีรักษาและมะเร็งวิทยา ภาควิชารังสีวิทยา คณะแพทยศาสตร์ มหาวิทยาลัยธรรมศาสตร์

ปัจจุบันมีผู้ป่วยที่ตรวจวินิจฉัยพบว่ามีภาวะฉุกเฉินทางมะเร็งวิทยาสอดคล้องกับอุบัติการณ์โรคมะเร็งที่สูงขึ้น ภาวะดังกล่าวต้องการการดูแลรักษาภายในช่วงเวลาที่เหมาะสม การวางแผนร่วมกันผ่านการประชุมแพทย์สหสาขาโรคมะเร็งวิทยา จะนำมาซึ่งแผนการรักษาที่สมบูรณ์ทั้งในด้านภาวะฉุกเฉินทางมะเร็งวิทยาและแผนการรักษามะเร็งในระยะยาว ในบางสถานการณ์ที่ไม่สามารถผ่าตัดได้ หรือผู้ป่วยมีสภาพร่างกายไม่เหมาะสมต่อการทำหัตถการที่รุกล้ำ การรักษาด้วยการฉายรังสีระยะไกล มีบทบาทในภาวะดังกล่าว เช่น ภาวะมะเร็งลุกลามไปสมอง ภาวะมะเร็งลุกลามไปกระดูกสันหลัง ภาวะหลอดเลือดดำวีนาคาวาอุดกั้น ภาวะเลือดออกจากก้อนมะเร็ง และภาวะปวดจากโรคมะเร็ง

คำสำคัญ: ภาวะฉุกเฉินทางมะเร็งวิทยา, รังสีรักษาระยะไกล