Palliative Radiotherapy: Superior Vena Cava Obstruction, Dyspnea, and Hemoptysis

Effective Date: July, 2016

The recommendations contained in this guideline are a synthesis of currently accepted approaches to management, derived from a review of relevant scientific literature. Clinicians applying these guidelines should, in consultation with the patient, use independent medical judgment in the context of individual clinical circumstances to direct care.

BACKGROUND

Superior vena cava obstruction (SVCO) is a common complication of malignancy. Lung cancer accounts for approximately 50-70% of all cases of SVCO, with extrathoracic malignancies accounting for another 15-20% (1-4). At some point during their disease course, approximately 10% of patients with small cell lung cancer, 2-4% of patients with non-small cell lung cancer (NSCLC), and 2-8% of patients with non-Hodgkin lymphoma will develop SVCO(1,2,5). The average life expectancy for patients who present with malignancy-associated SVCO is six to nine months, but there is wide variability depending on the type and stage of underlying cancer. Where clinical circumstances allow, decisions regarding management of patients with SVCO should be conducted in a multidisciplinary setting, with tissue diagnosis and completion of staging prior to institution of therapy.

The management of airway obstruction depends on many factors, including the urgency of presentation, tumour histology, stage, location, and performance status (PS) of the patient. Malignant airway obstruction is most commonly caused by direct extension from tumour in the mediastinum (i.e., lung cancer, thyroid, thymoma, esophageal) or a primary tumour of the head and neck[6]. Lung cancer is the most common cause of malignant-associated airway obstruction. Airway obstruction occurs in approximately 20 to 30 percent of patients with lung cancer (6). Cancers which have metastasized to the lung or mediastinum can also cause airway obstruction (7).

Hemoptysis, or the expectoration of blood, can range from blood-streaking of sputum to gross blood or clots alone, in the absence of any accompanying sputum. Hemoptysis has a broad differential which includes metastatic cancer to the bronchus or trachea (most commonly from melanoma, breast, colon, or renal cell carcinoma), primary or secondary lung cancer, or terminal hematological malignancy, along with many non-malignant causes. Among patients with cancer, hemoptysis is most common in lung cancer, with approximately 20% of lung cancer patients experiencing hemoptysis during the course of their illness (8).

Recognizing that patients with SVCO, dyspnea and hemoptysis may benefit from a multidisciplinary palliative/supportive care team (including physiotherapy therapy/ occupational therapy/ psychosocial support/ speech-language pathology etc.), the intent of this guideline is to focus specifically on radiotherapy options. Whenever possible, participation in a clinical trial is strongly encouraged. Securing the opinion of an interventional respirologist or radiologist is recommended in certain circumstances (i.e. severe or life threatening SVCO, dyspnea or hemoptysis) (see: www.brit-thoracic.org.uk/document-library/clinical-information/bronchoscopy/advanced-diagnostic-and-therapeutic-bronchoscopy/bts-advanced-bronchoscopy-guideline/).

The most common radiation approach to treatment is external beam radiotherapy (EBRT), in which radiation is delivered from a source external to the patient. Endobronchial brachytherapy (EBB) is a technique whereby radioactive seeds are positioned in close proximity to a malignant lesion to deliver high dose radiation with rapid dose fall-off. Photodynamic therapy (PDT) involves the use of an intravenous photosensitizing agent which is activated at the target location using a low-power laser, resulting in the generation of high-energy oxygen, which causes necrosis through a photochemical effect. Neodymium-doped yttrium aluminum garnet (Nd:YAG) laser therapy vaporizes or coagulates tumour under direct vision with no mechanical stress to surrounding structures. Access to these treatment modalities varies geographically.

GUIDELINE QUESTIONS

What are the recommended strategies for the management and treatment of adult patients with:

- Superior vena cava obstruction?
- Malignant airway compression, obstruction or invasion?
- Hemoptysis?

DEVELOPMENT AND REVISION HISTORY

The original guideline was developed in 2008 by the clinical leaders of the Fast Track Palliative Radiotherapy Clinic for Bone Metastases in Calgary and the Palliative Radiation Oncology program (originally called the Rapid Access Palliative Radiotherapy Program) in Edmonton, with input from provincial radiation oncologists. For the 2010 update, evidence was selected and reviewed by a working group comprised of radiation oncologists from Alberta Health Services – CancerControl and a Knowledge Management Specialist from the Guideline Resource Unit. In 2012, a literature search was conducted but no changes to the guideline were made. In 2014, the larger guideline was converted into several smaller guidelines and updated based on a new literature search. A detailed description of the methodology followed during the guideline development process can be found in the Guideline Resource Unit Handbook.

SEARCH STRATEGY

For the 2016 update, the National Library of Medicine's Pubmed database was systematically searched (January, 2012 to December, 2014) using 2 independent searches (Full details in Appendix A). In brief, articles were excluded if they: were not written or translated into English, were case studies involving less than 10 patients, or if the study involved pediatric patients. The references cited in articles identified through the formal searches were also scanned for additional sources. In total,10 articles were identified and reviewed in detail for relevance to the guideline based on a title/abstract screen. During the production of this guideline, published literature was incorporated as it became available.

TARGET POPULATION

Patients who are at least 18 years of age with malignant SVCO or airway obstruction, compression, or invasion, or those experiencing hemoptysis.

RECOMMENDATIONS

Summary of Recommendations:

Superior vena cava obstruction:

- SVCO should be treated with chemotherapy and/or radiotherapy and/or stent depending on histology, urgency of presentation, and previous treatment, if any.

Airway obstruction:

- Radiotherapy is not routinely required in patients with minimal or no symptoms. However, those at risk of a serious impending event should be considered for upfront RT even in the absence of symptoms.
- Depending on the primary histology, systemic therapy may be option for treatment.

- Patients requiring immediate relief can be referred for consideration of bronchoscopic debulking or surgical resection.
- If intrathoracic symptoms warrant palliative RT, a short course external beam multi-fraction approach alone is preferred over a single fraction.
- EBB could be considered in select patients who have previously been treated with EBRT and developed obstruction due to recurrent or progressive disease; however, this would require a referral to an out-of-province provider. Other potential treatment options in this situation include PDT, endobronchial debulking, Nd:YAG laser, or stenting, where resources allow.

Hemoptysis

- Preferred treatment option depends on whether a causative lesion can be identified, whether other symptoms from intrathoracic malignancy also require palliation, severity of bleeding and whether the patient is cardiovascularly stable.
- In low volume bleeding, particularly where hemoptysis occurs coincident with other symptoms, EBRT should be considered. In higher volume or massive bleeding, interventional approaches under bronchoscopic or open surgical visualization may be required.

I. SUPERIOR VENA CAVA OBSTRUCTION

Recommandations:

1. Typically, for patients with chemotherapy-responsive tumours such as SCLC or lymphoma, systemic therapy is recommended initially (provided the patient is a candidate otherwise), whereas patients with other primary histologies and metastatic lesions, EBRT is typically recommended first.

2. While there is insufficient evidence to guide practice on RT dose fractionation, a retrospective review of SVCO due to any histology reported that an initial dose greater than or equal to 3Gy/fraction yielded a higher rate of symptomatic relief at two weeks than 2Gy/fraction (9).

3. SVC stent insertion appears to provide rapid relief of symptoms, particularly for patients who fail to respond to chemotherapy or RT, patients with relapsed SVCO after initial treatment, and patients with NSCLC (5). The optimal timing of stent insertion is currently uncertain, and the role of RT post-insertion has not been defined, although should be considered especially if the patient is radiation-naïve and the tumour is expected to be radiosensitive (5,10). The need for long-term anticoagulation therapy to prevent stent occlusion also remains unclear. In a prospective cohort study of 104 patients, the use of stents (n=11) for SVCO did not significantly affect survival (3).

4. There is a lack of level one evidence to support the common practice of steroid use in the management of patients with SVCO (5). However, RT-induced edema can transiently exacerbate symptoms. Steroids may temporize this transient worsening of symptoms due to treatment, preventing a serious situation from becoming disastrous. However, consensus on dose and duration has not been reached, and should therefore be considered on a case-by-case basis.

5. For patients with lung cancer, palliative intent chemotherapy or EBRT are effective in relieving SVCO in the majority of cases (11). *A* systematic review of 46 treatment studies documented symptom relief in 77-80% of patients with SCLC and up to 60% in patients with NSCLC treated with either chemotherapy and/or radiation (5).

II. AIRWAY OBSTRUCTION

Recommendations:

1. There is no evidence to support delivery of immediate thoracic RT in patients with minimal to no symptoms secondary to incurable disease (12). RT could be deferred until symptoms warrant, unless a patient is at risk of a serious adverse outcome with disease progression, such as airway compromise. A randomized controlled trial by the Medical Research Council Lung Cancer Working Party reported that early treatment of minimally symptomatic patients with either 17Gy/2 fractions or 10Gy/1 fraction did not improve symptom control, quality of life (QoL), or survival when compared with instituting treatment when symptoms required (13). A Norwegian Lung Cancer Study Group trial which randomized stage III/IV patients between different dose schedules (17Gy/2 , 42Gy/15, 50Gy/25), also reported that immediate thoracic RT delivered to patients with minimal symptom burden did not prevent development of disease-related symptoms and actually diminished QoL due to treatment-related toxicity, compared to patients on active surveillance (14).

2. When indicated to palliate intrathoracic symptoms such as airway compromise, short course external beam multi-fraction RT is preferred over single fraction treatment (15,16). A comprehensive meta-analysis reported that an RT regimen of 30Gy/10 fractions in NSCLC was associated with improved symptom palliation and survival, and minimized the need for further irradiation when compared with lower- or single-fraction regimens, but dose escalation beyond 30Gy did not appear to carry additional benefit (16). Patients treated with higher dose RT (>30Gy) compared to low dose RT (≤30Gy) had similar complete response rates (16.2% vs 10.0%, respectively; p=0.15) and similar overall survival (OS) at 2 years (8.1% vs 6.7%, respectively; p=0.84) (16). Various shorter EBRT dose/fractionation schedules (eg 20Gy/5, 17Gy/2, 10Gy/1) which provide good symptomatic relief with fewer side effects, can be used for patients requesting a shorter treatment course and/or with poor performance status[16]. A more recent Cochrane review and meta-analysis found that when treating major thoracic symptoms, no strong evidence exists that any regimen gives greater palliation, and that higher dose regimens may give more acute toxicity than lower dose regimens (17).

3. There is insufficient evidence supporting concurrent chemoradiotherapy as standard of care for patients with NSCLC treated with palliative intent (18). In a randomized study of RT alone versus RT plus continuous infusion fluorouracil, a statistically significant difference in response rates favouring the chemoradiotherapy group was reported; however this did not translate into significant differences in symptom control, overall survival, or progression-free survival (19). In addition, patients treated with chemoradiotherapy had higher rates of acute toxicity (19). In patients with stage III NSCLC with poor prognostic factors who cannot be treated for cure, a recent phase III trial investigated combined modality therapy which incorporated hypofractionated RT. 191 patients were randomized to concurrent chemoradiotherapy (42Gy in 15 fractions starting with cycle two of chemotherapy) versus carboplatin and vinorelbine alone. The combined modality arm had significantly improved median overall survival (12.6 vs 9.7 months) and long term QoL, but experienced more frequent hospital admissions (49% vs 25%; p<0.01) for treatment-related side effects including esophagitis and infection (20). However, due to the relatively small sample size, further data is needed before concurrent chemoradiotherapy can be recommended in this setting.

4. EBB may be considered in patients with obstructing proximal airway tumours (21) with at least one retrospective study reporting improvements in dyspnea and cough (22). A randomized study reported improved symptom outcomes among patients with obstructing tumours in a mainstem bronchus

treated with RT followed by EBB compared to RT alone (23). EBB was not associated with a higher risk of massive hemoptysis compared to RT alone provided fraction sizes were less than 7.5Gy to 10Gy (24). EBB may also be associated with improved QoL (25). A recent systematic review of high dose-rate EBB alone in previously untreated patients with NSCLC reported reasonable symptom palliation rates with a median survival of four to ten months (26). High-dose-rate EBB delivered in 3 fractions of 7.5Gy improved obstruction in 73.4% (27). A recent Cochrane review did not find conclusive evidence to support symptom relief or survival benefits associated with EBB plus EBRT over EBRT alone (28). However, EBB is unavailable in Alberta and therefore requires referral to an out-of-province provider.

5. EBB may be used in the palliation of patients with NSCLC previously treated with EBRT who become obstructed due to recurrent or progressive disease (21,29). Access to EBB is unavailable in Alberta.

Non-RT Approaches:

1. Bronchoscopic management is an option for symptomatic central airway obstruction, and cases should be discussed with interventional radiology, respirology, or thoracic surgery (30,31).

2. PDT, surgical or bronchoscopic debulking, Nd-YAG laser, and stenting may also be considered for symptom control related to airway obstruction, compression or invasion (12,28,32), with excellent relief of dyspnea demonstrated in retrospective studies of these interventions (33-36). These local modalities should be strongly considered prior to institution of RT if the risk of acute RT-induced edema causing complete obstruction is considered high, and/or in the setting of recurrent or progressive disease post-RT. Antineoplastic modalities such as EBRT or systemic therapy should be considered subsequently, if clinically indicated (33).

III. HEMOPTYSIS

Recommendations:

1. The preferred treatment for hemoptysis depends on whether a causative lesion can be identified radiologically or bronchoscopically, whether other symptoms from intrathoracic malignancy also require palliation, the severity of bleeding and whether the patient is cardiovascularly stable.

2. In low volume bleeding, particularly where hemoptysis occurs coincident with other symptoms, EBRT should be considered. In patients with poor performance status and hemoptysis, a single fraction can be used (15). A recent meta-analysis of 13 randomized studies involving 3473 patients with symptomatic advanced lung cancer reported a greater likelihood of symptom improvement and one year overall survival associated with EBRT schedules of 30Gy/10 fractions versus lower doses (16). The potential benefits associated with this higher dose must be weighed against the risk of higher toxicity and a greater investment of time, however (16). A more recent Cochrane review and meta-analysis found that when treating major thoracic symptoms, no strong evidence exists that any regimen gives greater palliation, and that higher dose regimens may give more acute toxicity than lower dose regimens (17).

2. EBB is an option for managing bleeding in patients who are not eligible for more aggressive treatment and/or after maximal EBRT, where facilities and expertise exist (18,37,38).

Non-RT Approaches:

1. In higher volume or massive bleeding where a patient is unstable, interventional approaches under bronchoscopic or open surgical visualization are usually required.

2. In large volume hemoptysis or in minor hemoptysis which persists or recurs following EBRT and when a central source is suspected, bronchoscopic management can be used. Alternative options include interventional radiology or thoracic surgery (39).

GLOSSARY OF ABBREVIATIONS

Acronym	Description
EBB	Endobronchial brachytherapy
Nd-YAG	Neodymium-dioed yttrium aluminium garnet
NSCLC	Non-small-cell lung cancer
QoL	Quality of Life
RT	Radiotherapy
SVCO	Superior vena cava obstruction

DISSEMINATION

- Post the guideline on the Alberta Health Services website.
- Send an electronic notification of the new guideline to all members of CancerControl Alberta.

MAINTENANCE

This guideline will be reviewed annually for required updates; however, if critical new evidence is brought forward before that time, however, the guideline working group members will revise and update the document accordingly.

CONFLICT OF INTEREST

Participation of members of the working group in the development of this guideline has been voluntary and the authors have not been remunerated for their contributions. There was no direct industry involvement in the development or dissemination of this guideline. CancerControl Alberta recognizes that although industry support of research, education and other areas is necessary in order to advance patient care, such support may lead to potential conflicts of interest. Some members of the working group are involved in research funded by industry or have other such potential conflicts of interest. However the developers of this guideline are satisfied it was developed in an unbiased manner.

REFERENCES

(1) Wan JF, Bezjak A. Superior vena cava syndrome. Emerg Med Clin North Am 2009 May;27(2):243-255.
(2) Rice TW, Rodriguez RM, Light RW. The superior vena cava syndrome: clinical characteristics and evolving etiology. Medicine (Baltimore) 2006 Jan;85(1):37-42.
(3) Chan RC, Chan YC, Cheng SW. Mid- and long-term follow-up experience in patients with malignant superior vena cava obstruction. Interact Cardiovasc Thorac Surg 2013 Apr;16(4):455-458.
(4) Hohloch K, Bertram N, Trumper 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 Dec;140(12):2129-2134.
(5) Rowell NP, Gleeson FV. Steroids, radiotherapy, chemotherapy and stents for superior vena caval obstruction in carcinoma of the bronchus. Cochrane Database Syst Rev 2001;(4)(4):CD001316.
(6) Ernst A, Feller-Kopman D, Becker HD, Mehta AC. Central airway obstruction. Am J Respir Crit Care Med 2004 Jun 15;169(12):1278-1297.
(7) Wood DE. Management of malignant tracheobronchial obstruction. Surg Clin North Am 2002 Jun;82(3):621-642.
(8) Kvale PA, Simoff M, Prakash UB, American College of Chest Physicians. Lung cancer. Palliative care. Chest 2003 Jan;123(1 Suppl):284S-311S.
(9) 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 Apr;13(4):531-539.
(10) Wilson P, Bezjak A, Asch M, Barton R, Wong R, Levin W, et al. The difficulties of a randomized study in superior vena caval obstruction. J Thorac Oncol 2007 Jun;2(6):514-519.
(11) Lepper PM, Ott SR, Hoppe H, Schumann C, Stammberger U, Bugalho A, et al. Superior vena cava syndrome in thoracic malignancies. Respir Care 2011 May;56(5):653-666.
(12) Theodore PR. Emergent management of malignancy-related acute airway obstruction. Emerg Med Clin North Am 2009 May;27(2):231-241.
(13) Falk SJ, Girling DJ, White RJ, Hopwood P, Harvey A, Qian W, et al. Immediate versus delayed palliative thoracic radiotherapy in patients with unresectable locally advanced non-small cell lung cancer and minimal thoracic symptoms: randomised controlled trial. BMJ 2002 Aug 31;325(7362):465.
(14) Sundstrom S, Bremnes R, Brunsvig P, Aasebo U, Olbjorn K, Fayers PM, et al. Immediate or delayed radiotherapy in advanced non-small cell lung cancer (NSCLC)? Data from a prospective randomised study. Radiother Oncol 2005 May;75(2):141-148.
(15) Bezjak A, Dixon P, Brundage M, Tu D, Palmer MJ, Blood P, et al. Randomized phase III trial of single versus fractionated thoracic radiation in the palliation of patients with lung cancer (NCIC CTG SC.15). Int J Radiat Oncol Biol Phys 2002 Nov 1;54(3):719-728.
(16) Fairchild A, Harris K, Barnes E, Wong R, Lutz S, Bezjak A, et al. Palliative thoracic radiotherapy for lung cancer: a systematic review. J Clin Oncol 2008 Aug 20;26(24):4001-4011.
(17) Stevens R, Macbeth F, Toy E, Coles B, Lester JF. Palliative radiotherapy regimens for patients with thoracic symptoms from non-small cell lung cancer. Cochrane Database Syst Rev 2015 Jan 14;1:CD002143.
(18) Rodrigues G, Videtic GM, Sur R, Bezjak A, Bradley J, Hahn CA, et al. Palliative thoracic radiotherapy in lung cancer: An American Society for Radiation Oncology evidence-based clinical practice guideline. Pract Radiat Oncol 2011 Apr-Jun;1(2):60-71.
(19) Ball D, Smith J, Bishop J, Olver I, Davis S, O'Brien P, et al. A phase III study of radiotherapy with and without continuous-infusion fluorouracil as palliation for non-small-cell lung cancer. Br J Cancer 1997;75(5):690-697.
(20) Strom HH, Bremnes RM, Sundstrom SH, Helbekkmo N, Flotten O, Aasebo U. Concurrent palliative chemoradiation leads to survival and quality of life benefits in poor prognosis stage III non-small-cell lung cancer: a randomised trial by the Norwegian Lung Cancer Study Group. Br J Cancer 2013 Sep 17;109(6):1467-1475.
(21) Rodrigues G, Macbeth F, Burmeister B, Kelly KL, Bezjak A, Langer C, et al. Consensus statement on palliative lung radiotherapy: third international consensus workshop on palliative radiotherapy and symptom control. Clin Lung Cancer 2012 Jan;13(1):1-5.
(22) Dagnault A, Ebacher A, Vigneault E, Boucher S. Retrospective study of 81 patients treated with brachytherapy for endobronchial primary tumor or metastasis. Brachytherapy 2010 Jul-Sep;9(3):243-247.
(23) Langendijk H, de Jong J, Tjwa M, Muller M, ten Velde G, Aaronson N, et al. External irradiation versus external irradiation plus endobronchial brachytherapy in inoperable non-small cell lung cancer: a prospective randomized study. Radiother Oncol 2001 Mar;58(3):257-268.

(24) Langendijk JA, Tjwa MK, de Jong JM, ten Velde GP, Wouters EF. Massive haemoptysis after radiotherapy in inoperable non-small cell lung carcinoma: is endobronchial brachytherapy really a risk factor? Radiother Oncol 1998 Nov;49(2):175-183.
(25) Mallick I, Sharma SC, Behera D. Endobronchial brachytherapy for symptom palliation in non-small cell lung cancer--analysis of symptom response, endoscopic improvement and quality of life. Lung Cancer 2007 Mar;55(3):313-318.
(26) Ung YC, Yu E, Falkson C, Haynes AE, Stys-Norman D, Evans WK, et al. The role of high-dose-rate brachytherapy in the palliation of symptoms in patients with non-small-cell lung cancer: a systematic review. Brachytherapy 2006 Jul-Sep;5(3):189-202.
(27) de Aquino Gorayeb MM, Gregorio MG, de Oliveira EQ, Aisen S, Carvalho Hde A. High-dose-rate brachytherapy in symptom palliation due to malignant endobronchial obstruction: a quantitative assessment. Brachytherapy 2013 Sep-Oct;12(5):471-478.
(28) Reveiz L, Rueda JR, Cardona AF. Palliative endobronchial brachytherapy for non-small cell lung cancer. Cochrane Database Syst Rev 2012 Dec 12;12:CD004284.
(29) Cardona AF, Reveiz L, Ospina EG, Ospina V, Yepes A. Palliative endobronchial brachytherapy for non-small cell lung cancer. Cochrane Database Syst Rev 2008 Apr 16;(2):CD004284. doi(2):CD004284.
(30) Oviatt PL, Stather DR, Michaud G, Maceachern P, Tremblay A. Exercise capacity, lung function, and quality of life after interventional bronchoscopy. J Thorac Oncol 2011 Jan;6(1):38-42.
(31) Simoff MJ, Lally B, Slade MG, Goldberg WG, Lee P, Michaud GC, et al. Symptom management in patients with lung cancer: Diagnosis and management of lung cancer, 3rd ed: American College of Chest Physicians evidence-based clinical practice guidelines. Chest 2013 May;143(5 Suppl):e455S-97S.
(32) Yoon HY, Cheon YK, Choi HJ, Shim CS. Role of photodynamic therapy in the palliation of obstructing esophageal cancer. Korean J Intern Med 2012 Sep;27(3):278-284.
(33) Song JU, Park HY, Kim H, Jeon K, Um SW, Koh WJ, et al. Prognostic factors for bronchoscopic intervention in advanced lung or esophageal cancer patients with malignant airway obstruction. Ann Thorac Med 2013 Apr;8(2):86-92.
(34) Murgu S, Langer S, Colt H. Bronchoscopic intervention obviates the need for continued mechanical ventilation in patients with airway obstruction and respiratory failure from inoperable non-small-cell lung cancer. Respiration 2012;84(1):55-61.
(35) Gaafar AH, Shaaban AY, Elhadidi MS. The use of metallic expandable tracheal stents in the management of inoperable malignant tracheal obstruction. Eur Arch Otorhinolaryngol 2012 Jan;269(1):247-253.
(36) Oki M, Saka H. Temporary use of silicone stents for severe airway stenosis in untreated malignant lymphoma. J Bronchology Interv Pulmonol 2013 Jan;20(1):21-27.
(37) Ozkok S, Karakoyun-Celik O, Goksel T, Mogulkoc N, Yalman D, Gok G, et al. High dose rate endobronchial brachytherapy in the management of lung cancer: response and toxicity evaluation in 158 patients. Lung Cancer 2008 Dec;62(3):326-333.
(38) Klopp AH, Eapen GA, Komaki RR. Endobronchial brachytherapy: an effective option for palliation of malignant bronchial obstruction. Clin Lung Cancer 2006 Nov;8(3):203-207.
(39) Morice RC, Ece T, Ece F, Keus L. Endobronchial argon plasma coagulation for treatment of hemoptysis and neoplastic airway obstruction. Chest 2001 Mar;119(3):781-787.

APPENDIX A SEARCH STRATEGY

For the 2014 update, the National Library of Medicine's PubMed database was searched (January 2012 to September 2014) using the following search terms (2 independent searches): (1) ("superior vena cava syndrome"[MeSH Terms] OR ("superior"[All Fields] AND "vena"[All Fields] AND "cava"[All Fields] AND "syndrome"[All Fields]) OR "superior vena cava syndrome"[All Fields] OR ("superior"[All Fields] AND "vena"[All Fields] AND "cava"[All Fields] AND "obstruction"[All Fields]) OR "superior vena cava obstruction"[All Fields]) AND ("superior vena cava syndrome"[MeSH Terms] OR ("superior"[All Fields] AND "vena"[All Fields] AND "cava"[All Fields] AND "syndrome"[All Fields]) OR "superior vena cava syndrome"[All Fields]) AND ("radiotherapy"[Subheading] OR "radiotherapy"[All Fields] OR "radiotherapy"[MeSH Terms]) AND ("radiation"[MeSH Terms] OR "radiation"[All Fields] OR "electromagnetic radiation"[MeSH Terms] OR ("electromagnetic"[All Fields] AND "radiation"[All Fields]) OR "electromagnetic radiation"[All Fields]) (2) palliative[All Fields] AND ("radiotherapy"[Subheading] OR "radiotherapy"[All Fields] OR "radiotherapy"[MeSH Terms]) AND ("airway obstruction"[MeSH Terms] OR ("airway"[All Fields] AND "obstruction"[All Fields]) OR "airway obstruction"[All Fields]). Articles were excluded if they: were not written or translated into English, were case studies involving less than 10 patients, or involved pediatric patients. The references cited in articles identified through the formal searches were also scanned for additional sources. In total, 194 articles were identified, of which 10 were reviewed in detail based on a title/abstract screen.

Copyright © (2016) Alberta Health Services. This material is protected by Canadian and other international copyright laws. All rights reserved. This material may not be copied, published, distributed or reproduced in any way in whole or in part without the express written permission of Alberta Health Services (please contact the **Guideline Resource Unit Manager** at **CancerControl Alberta** at **guru@ahs.ca** . This material is intended for general information only and is provided on an "as is", "where is" basis. Although reasonable efforts were made to confirm the accuracy of the information, Alberta Health Services does not make any representation or warranty, express, implied or statutory, as to the accuracy, reliability, completeness, applicability or fitness for a particular purpose of such information. This material is not a substitute for the advice of a qualified health professional. Alberta Health Services expressly disclaims all liability for the use of these materials, and for any claims, actions, demands or suits arising from such use.