Successful use of high dose rate brachytherapy for non-malignant bronchial obstruction

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Abstract
High dose rate (HDR) endobronchial brachytherapy is a palliative treatment for symptomatic airway obstruction by malignant tumours. We report a novel use of HDR brachytherapy for treating non-malignant bronchial obstruction. The patient had a meta-stent placed in a reconstructed airway after a bronchial tear to ensure patency. Granulation tissue formation in and around the stent caused symptomatic occlusion of the airway, necessitating multiple laser applications. A single treatment of HDR brachytherapy (1000 cGy) was delivered following laser therapy. The patient remains well 15 months after treatment with no evidence of recurrent granulation tissue formation on bronchoscopy. HDR brachytherapy is an effective treatment for non-malignant airway obstruction.

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High dose rate (HDR) endobronchial brachytherapy is considered a palliative technique for alleviating dyspnoea resulting from major airway obstruction by primary and secondary malignant tumours. It has the advantage of delivering a high dose of radiation over a short period of time to the obstructed area without significantly affecting the adjacent lung parenchyma.

Radiation therapy, including brachytherapy, is also used to treat a wide range of non-malignant conditions such as pterygium, exophthalmus, plantar warts, and parotitis, as well as benign tumours. Recently, brachytherapy was shown to reduce intimal hyperplasia and prevent restenosis following angioplasty and stenting of the coronary arteries. Like coronary artery stents, bronchial stents can cause a proliferative reaction leading to the formation of granulation tissue and obstruction of the stented airway. The use of radiation therapy for this condition was recently reported by Kennedy et al in two patients with lung transplantation who developed bronchial obstruction in the area of the anastomosis.

We present the successful use of HDR brachytherapy in a patient with non-malignant airway obstruction caused by granulation tissue formation around a bronchial stent.
treatment with radiation. Cardiologists and radiation oncologists have recently successfully used endovascular HDR brachytherapy to prevent restenosis of coronary arteries following stenting or angioplasty balloon dilatation. Animal and human models indicate that radiation therapy prevents the neointimal proliferation which occurs in response to injury to the arterial wall.

Based on this experience we suspected that a similar mechanism of response to injury may play a role in the proliferation of the granulation tissue around the bronchial stent in our patient and that it would therefore be treatable by radiation therapy.

HDR brachytherapy is a very suitable technique for treating benign diseases for two main reasons. Firstly, the volume treated and dose received outside this area is accurately defined in three dimensions by the computer planning system. Secondly, the treatment can be delivered in a single application over a few minutes with minimal toxicity. After performing the procedure we found the report by Kennedy et al which described a similar approach in two patients with lung transplants who developed hyperplastic bronchial obstruction at the site of the anastomosis in whom balloon dilatation, laser application, and stent placement had been unsuccessful. They used a lower dose (3 Gy) than us although in one patient two sessions were required. One patient had died from an unrelated cause but the airways remained patent in both patients 7 and 9 months after the procedure.

This case demonstrates the successful use of endobronchial HDR brachytherapy in preventing formation of granulation tissue in reaction to a bronchial stent. If our assumption is confirmed, this treatment modality could be applied to other malignant conditions as well as non-malignant airway obstruction, as suggested by Phillips. It may also be useful in patients with subglottic stenosis resulting from granulation tissue regrowth following laser therapy.

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