Introduction

The majority of bladder cancer patients present with superficial disease and are managed with conservative measures. Approximately 20–25% present with muscle-invasive bladder cancer that is potentially life threatening and requires radical treatment. Definitive radiation therapy (RT) has been used for muscle-invasive bladder cancer since the early 1900s and there is evidence that patients can achieve durable local control and maintain a functional bladder without a compromise in the overall survival.¹ However, the standard North American approach to the management of muscle-invasive bladder cancer is radical cystectomy.² In the past few decades, radical radiation therapy has been used infrequently and mostly when patients either refused or were not suitable for radical cystectomy. Therefore there is a limited amount of information on the precise role that radiation therapy plays in the management of bladder cancer.

Radiation therapy has been used in the management of bladder cancer in several distinct situations. The most common therapy is radical RT to eradicate muscle-invasive cancer while preserving normal bladder function. Radical RT may also be used to secure local control following chemotherapy that has been given as definitive treatment for
Pre-operative and definitive radiation therapy

locally advanced bladder cancer. In both situations, salvage cystectomy is used in the event of an incomplete response to RT, local recurrence, or development of a new invasive bladder tumour. Pre-operative RT may be considered in locally advanced bladder cancer to prevent local failure. Post-operative RT is rarely used because of toxicity associated with pelvic RT with fixed loops of small bowel present in the RT volume after cystectomy. Palliative RT is useful in selected cases of locally advanced and metastatic bladder cancer.

**Pre-operative radiation therapy**

The goal of pre-operative RT is to prevent pelvic recurrence following radical cystectomy. Therefore, only patients who are at high risk of local recurrence in the pelvis are likely to benefit. Patients with bladder cancer without extravesical extension (T2) are at a low risk of pelvic recurrence (<10%), while those with T3 disease are at higher risk of pelvic recurrence (>30%), but they are also at risk of distant failure. In T3 tumours, distant failure will diminish the impact of pre-operative RT on the overall survival. Since pelvic recurrence has a considerable adverse effect on quality of life, improvement in local control is a worthwhile goal of treatment. The Southwest Oncology Group (SWOG) conducted a phase III randomized trial of pre-operative RT followed by cystectomy versus cystectomy alone and found no difference in survival. In this trial, a low-dose pre-operative RT (20 Gy in five fractions over one week) was used, most patients had T2 tumours and therefore were at a low risk of pelvic failure. A positive study of pre-operative RT was recently reported by El-Wahidi et al. In this trial, patients with schistosomal bladder cancer were randomized to receive pre-operative RT with 44 Gy followed by cystectomy, or cystectomy alone. A significantly higher pelvic failure rate was observed in the surgery alone arm (29%) than in the pre-operative RT arm. This study has been published in abstract form only and no details are available on local control or survival. Huncharek et al. published a meta-analysis of five randomized trials of pre-operative RT and cystectomy versus cystectomy alone (not including the recent El-Wahidi study) and were unable to demonstrate survival advantage for pre-operative RT (odds ratio of 0.71, 95% confidence interval 0.48–1.06), and the impact on local control was not addressed. There is little modern data dealing with the toxicity of pre-operative RT and cystectomy, but the previously conducted randomized