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Q1 Use of hyperbaric oxygen therapy in management of radiation cystitis

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ABSTRACT

Radiation induced tissue injury is a result of progressive endarteritis which leads to hypovascular, hypocellular and hypoxic tissues. This damage begins as soon as patient is exposed to radiation beam. Most patients experience some acute side effects and it is rare and serious event when late side effects develop. Radiation cystitis is a late complication of radiotherapy for pelvic malignancies like prostate and cervix. Although 85% of the cases resolve with conservative management, the remainder become refractory and progress to involve a more extensive area of bony and soft tissue. Hyperbaric oxygen therapy (HBOT) is used to treat various forms of chronic radiation tissue injury and is a potential primary option for management of radiation cystitis by enhancing healing in such cases by increasing vascular density and oxygen levels in irradiated tissues. We report a case of 60-year-old male with radiation cystitis who showed promising improvement and resolution of his symptoms after forty HBOT sessions.

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Keywords: Radiation cystitis, Hyperbaric oxygen therapy, Pelvic cancer, Radionecrosis

INTRODUCTION

Radiotherapy is a major non operative treatment and commonly used in management of a number of malignancies.^{1,2} From past few years, development in delivery of radiotherapy has improved the efficacy and tolerance but adverse effects continue to complicate its use. These effects are commonly categorized as either acute effects that occur during or in immediate post irradiation period and are mostly self limiting or late effects that manifest many months to several years later and are slower to heal.

Depending on patient's sensitivity to radiotherapy, type and dose of treatment, patients experience scarring and narrowing of blood vessels within the treatment area leading to inadequate blood supply which result in damage to soft tissues and bones causing osteoradionecrosis, radiation cystitis and radiation proctitis etc.^{3–6}

Radiation cystitis is not a common complication but occurs in as many as 15–20% of patients receiving

high doses of radiotherapy for management of genitourinary cancers. It occurs at least 90 days after initiation of radiation therapy but may occur in delayed manner even beyond 10 years. Radiation therapy leads to hypovascular, hypocellular and hypoxic tissues causing cellular depletion, fibrosis causing reduction in bladder capacity and patients present with lower urinary tract storage symptoms such as urgency, frequency and dysuria.^{3–9} The treatment of this entity depends on its extent and severity and ranges from simple conservative methods to radical surgery.

Hyperbaric oxygen therapy (HBOT) is a primary treatment option that reverses vascular compromise in such patients by stimulating angiogenesis, fibroblast proliferation and improved tissue oxygenation within the affected areas.^{7,9,10} HBOT for radiation cystitis is non invasive and well tolerated modality with very encouraging outcomes in this complex problem when administered alone or as an adjunctive treatment.

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Table 1 Improvement of symptoms of patient during different phases of treatment.

Symptoms	Before HBOT	After 20 sessions	After 40 sessions
Urinary frequency in a day	14	10	7
Dysuria ^a	5	2	0
Bladder capacity (ml)	200	200–250	>300
Nocturia	6 times	3 times	2 times
Pelvic pain ^a	2	0	0

^a Visual Analogue Scale used for pain estimation (0 means no pain and 10 is maximum pain ever experienced).

CASE REPORT

A 60-year-old normotensive, euglycemic gentleman developed radiation induced cystitis after being treated for management of prostate cancer with 30 fractions of radiation therapy (60 Gy) and radical prostatectomy in 2009.

He presented with a history of increased urine frequency, incontinence and haematuria since 8 months. There was no other relevant medical history. His ultrasound KUB revealed cystitis changes showing clot in urinary bladder with large Post Voidal Urine (445 cc). It also indicated bilateral hydronephrosis and hydroureter. His prostate serum antigen (PSA) level was found to be 0.06 ng/ml. He underwent cystoscopy in January 2011 with 19 F sheath for clot evacuation which revealed patches of radiation cystitis lateral to left ureteric orifice.

Along with the medical treatment, the patient was referred for HBOT for resolution of his symptoms and was scheduled for 20 sessions. He showed slow but promising progress and was advised for further 20 sessions. The patient underwent forty, 90-minute treatment at 2.4 atmosphere absolute (ATA) in a multiplace hyperbaric oxygen chamber at our centre.

On completion of hyperbaric treatment, patient had decreased urinary frequency and daily voiding reduced from 14 to 7 times per day. He reported improvement in pain scale from baseline 5 on Visual Analogue Scale (VAS) to zero after forty HBOT sessions. The patient had no episode of haematuria with reduced pelvic pain. There was increased bladder capacity with reduced urinary frequency at night. Table 1 shows improvement in his symptoms during different phases of HBO treatment.

DISCUSSION

Radiation cystitis is a challenging complication in the management of genitourinary cancer. It manifests as presence of haematuria, incontinence, dysuria and nocturia with tissue ischaemia as its underlying mechanism. It leads to progressive endarteritis, hypovascular, hypocellular and

hypoxic tissue (the 'three-H' tissue) resulting in reduced ability to replace normal collagen and compromised cellular loss which causes difficulty in healing.^{6,8–10} HBO results in an increased diffusion gradient which forces oxygen into the damaged urothelial tissues and also stimulates angiogenesis with fibroblast proliferation in the irradiated areas.^{5,8–10}

The case we treated with HBO showed significant decrease of urinary frequency and pelvic pain along with increased bladder capacity. It was well tolerated and no adverse effects were seen. HBO for radiation cystitis is an effective and safe treatment with encouraging outcomes.

CONCLUSION

HBO therapy is a non invasive modality for treating the underlying changes that occur with radiation injury, resulting in resolution of symptoms in patients with radiation cystitis.

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