

## Case Report

# Interstitial Cystitis and Hyperbaric Oxygen Treatment Case Report and Review of the Literature

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## Introduction

Interstitial Cystitis/Bladder Pain Syndrome (IC/BPS), is a diagnosis of exclusion defined as “an unpleasant sensation perceived to be related to the bladder, associated with urinary symptoms (urgency, frequency, nocturia) for more than six weeks, in the absence of an identifiable cause” [1]. IC/BPS affects approximately 3% of the female population and may lead to serious impairment in all aspects of quality of life [2].

Approximately 10% of patients with IC/BPS have Hunner's Lesions (HL) [3]. These are erythematous areas of inflammation that can be described as scars or fissures [4]. Patients with Hunner's lesions often report more severe urinary symptoms and pain compared to those without such lesions [4]. These lesions are often dealt with effectively using fulguration, or in more refractory cases, formal resection [5]. In recent years, Hyperbaric Oxygen (HBO) treatment has been proposed as a treatment for interstitial cystitis, following its more widespread use for radiation cystitis. In this paper, a patient with refractory Hunner's lesions who underwent HBO and provided appropriate consent is reviewed.

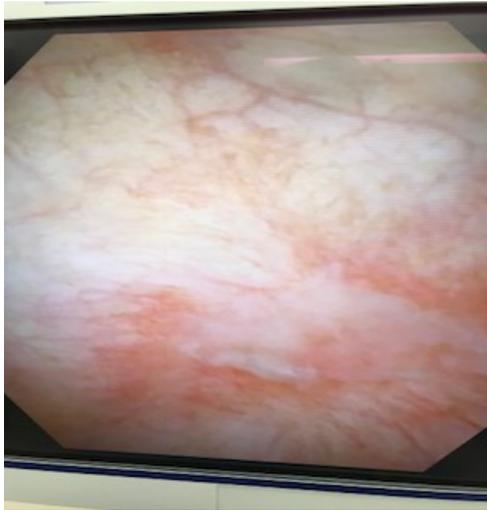
**Keywords:** Bladder pain syndrome; Hunner's lesions; Hyperbaric oxygen; Interstitial cystitis

## Case Report

A 51-year-old female presented with a several-month history of severe lower urinary tract symptoms including initially, right-sided pain perceived to be related to the bladder, followed by urinary frequency and urgency (voiding every 10 to 15 minutes). No gross hematuria or urge incontinence had been experienced. On physical exam, the patient looked well and was in no distress. Her abdomen was benign, with no suprapubic pain or tenderness.

Her past medical history was unremarkable. Initial urinalysis and culture were negative. An unenhanced CT scan was performed to rule out renal colic and was negative. On initial cystoscopy under local anesthetic, Hunner's lesions were detected and fulgurated. A biopsy was not originally completed. Urine cytology was negative. She experienced symptomatic relief for three weeks. Over the subsequent 15 months, she required three resections of recurrent lesions in the OR under general anesthetic and six fulgurations with sedation. Pathology was benign, showing characteristic chronic inflammation typically seen in IC/BPS. Intralesional injections of steroid (triamcinolone 40 mg IU) were performed but did not prevent recurrence. She was then referred for Hyperbaric Oxygen Treatment (HBO) following hospital ethics approval for off-label treatment.

Over two months, the patient received 40 HBO treatments on an elective schedule, up to a maximum of five times per week. A monoplace hyperbaric chamber pressurized on oxygen was used with a face mask provided for air-breaks. Each treatment consisted of 45 minutes on 100% oxygen at 2.4 Atmosphere Absolute (ATA), a five-minute air-break via mask, and a second 45 minutes on 100% oxygen at 2.4 ATA followed by standard decompression. The patient reported a significant symptomatic improvement, including a decrease in frequency, urgency, and pain during the treatment. Unfortunately, three weeks after her treatments, she underwent cystoscopy and was noted to have a recurrent Hunner's lesion (Figure 1), with recurrence of her symptoms. In addition, HBO treatment caused the patient to experience a myopic shift in refraction. Initially, she experienced a myopic shift of approximately -1.75 bilaterally, followed by a hyperopic shift of +1.00 bilaterally on repeat eye exam four months later. This resulted in a net myopic shift of approximately -0.75 bilaterally, affecting her vision and necessitating corrective lenses.



**Figure 1:** Cystoscopic findings of the patient post-HBO treatment reveal recurrence of several Hunner's Lesions.

## Discussion

HBO hyper-saturates the patients' plasma with dissolvable oxygen, creating a concentration gradient which forces oxygen into tissues [6]. More oxygen is available for tissues to utilize, thus better facilitating the process of wound healing. In the hyperbaric chamber, plasma becomes supersaturated with oxygen, allowing for an extended area of increased PO<sub>2</sub> from the capillary bed to diffuse into tissues [6]. With the increased levels of oxygen, tissues are able to promote the growth of healthy granulation tissue [7]. Increased oxygen also allows for better function of phagocytes - helping to ameliorate the inflammatory process - and increases the production of collagen, fibroblasts, and growth factors for angiogenesis [8].

HBO is an investigational treatment option for ulcerative IC [1]. Studies are limited to case series and small RCTs. Tanaka et al described two patients treated with HBO with symptomatic relief for 8-12 months and decreased Hunner's lesions on cystoscopy [9]. A second series found 7/11 patients reported improved frequency, urgency, and pain. Bladder capacity after 2-4 weeks of HBO increased compared to baseline ( $p < 0.05$ ). Symptoms were improved for 12 months [10]. Van Ophoven, et al. conducted a 21-patient double blind RCT comparing HBO treatment to normal air. Three of the 14 patients in the HBO treatment arm responded to HBO, compared to 0/7 in the control arm ( $p < 0.05$ ). Respondents reported a decrease in urgency and pain intensity at three months. An additional five patients in the control arm elected for HBO treatment, and all experienced a relief in symptoms [7]. A small pilot RCT tested HBO treatment in addition to intravesical Dimethyl Sulfoxide (DMSO) to see if HBO would prolong the response to DMSO. All patients reported improvements in frequency, nocturia,

urgency, and pain after DMSO treatment ( $p < 0.05$ ), while patients who received HBO reported a greater reduction of symptoms for a longer period of time ( $p < 0.05$ ), compared to the control arm [11]. A recent pilot study of eight patients reported 83% of patients with ulcerative IC were improved following HBO treatment [12].

In our case, HBO was effective in providing the patient with relief from the symptoms only transiently. This is in contrast to the published literature to date. There may be several factors accounting for this difference, including onset of treatment late in the disease process and the type of chamber used. Our patient experienced a myopic shift in her refraction, leading to blurry vision. This is a known, fairly common, usually transient side effect of monoplace HBO treatment, along with eustachian tube dysfunction and claustrophobia [13]. These changes are usually reversible within weeks to months after cessation of HBO [14]. Myopic shifts in refraction occur in 25-100% of patients undergoing HBO treatment at pressures of 2.0 ATA or more [15]. This is a single case report of a limited response to HBO for the treatment of recurrent, ulcerative IC. Although the symptomatic improvement of HBO in this case was not sustained, it did provide a temporary benefit to the patient and may have prevented further bladder resections/fulgurations. The patient did experience a common side effect that required corrective lenses. Further research is necessary to determine the effect of HBO for these patients, using a standardized approach in a larger number of patients. It remains possible that HBO will provide therapeutic benefit for patients suffering from refractory ulcerative IC.

## Ethics and Consent Statement

Our study did not require ethical approval as Newfoundland's Health Research Ethics Authority does not require ethics approval for case reports. However, appropriate consent was obtained from the patient to write up the case.

## Funding Statement

Not Applicable.

## Conflict of Interest Statement

Not applicable.

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