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LETTER TO THE EDITOR

Hyperbaric oxygen for anastomotic complications following low anterior resection: a report of five cases

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Dear Editor:

The development of anastomotic dehiscence after low and ultra-low anterior resection (ULAR) for treatment of rectal cancer is common, occurring in as many as 10-20 % of cases [1]. Surgeons routinely form a defunctioning loop ileostomy at the time of operation in order to minimise the potentially catastrophic effects of anastomotic dehiscence on health and subsequent rectal function. Depending on the degree of dehiscence of the anastomosis and the general condition of the patient, many patients need a permanent stoma. The role of hyperbaric oxygen (HBO) therapy in the specific setting of anastomotic dehiscence following low and ULAR is not documented in the literature. A case report showed the beneficial effect of HBO therapy in the setting of neoadjuvant chemoradiation therapy (CRT) followed by curative transanal endoscopic microsurgery for rectal cancer complicated by major suture dehiscence [2]. The aim of our study was to examine for the first time the role of HBO therapy in the management of anastomotic complications following ULAR.

A retrospective review on cases 2004–2014 was performed at the Cabrini Hospital Malvern, in Melbourne Australia, a tertiary referral centre for the treatment of colorectal cancer. Cases were identified by examining a database of patients [3] referred from Cabrini Hospital Malvern for Hyperbaric Oxygen Therapy at the Hyperbaric Medical Unit, The Alfred Hospital, Melbourne, Australia. Ethics approval for the project was obtained from the Cabrini Health Ethics Research Committee (CHREC approval number 02-22-04-13). Five patients had a diagnosis of rectal cancer and four received neoadjuvant CRT and were considered for review. All patients underwent ULAR with a covering loop ileostomy and went on to develop anastomotic dehiscence with chronic pelvic sepsis and failure of anastomotic healing and each was managed with HBO therapy. All patients were treated in a multiplace hyperbaric chamber for 90 mins at 2–2.4 atm absolute for 5 days per week for a variable number of treatments. The results are summarised in Table 1 (Supplementary material) and the individual case details are presented below.

Case 1 A 46-year-old male patient with no other comorbidities was diagnosed with a rectal cancer 9 cm in longitudinal dimension, with the lower margin 5 cm from the anal verge. A magnetic resonance imaging (MRI) scan suggested T2 staging; however, neoadjuvant CRT was recommended due to tumour size and prominent perirectal lymph nodes. An ULAR was performed 9 weeks after completion of long course neoadjuvant CRT with a colonic pouch and a covering loop ileostomy. The patient developed sepsis 14 days after surgery, from a 25 % posterior defect in the anastomosis. As a diverting loop ileostomy was in place and a pelvic drain remained in situ, conservative management was continued with antibiotics. Formal examination under anaesthesia (EUA) 24 days postsurgery confirmed an increased anastomotic dehiscence to 50 % and involving the anterior portion of the anastomosis. The patient was referred for 6 weeks of HBO therapy 29 days

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after surgery. An EUA after completion of HBO therapy showed a reduction in the size of the cavity with healing of the anterior portion of the anastomosis and epithelialisation of the posterior portion. The patient was asymptomatic and a further EUA performed 2 months after completion of HBO therapy demonstrated a stable 25 % posterior dehiscence with epithelialisation. A gastrograffin enema performed 3 months after HBO showed anastomotic integrity (Supplementary material Fig. 1). The closure of loop ileostomy was performed 9 months after completion of HBO therapy with no complications. The patient was healthy with no sign of metastatic disease three and half years after ULAR surgery.

Case 2 A 29-year old male with no other comorbidities was diagnosed with rectal cancer located posteriorly, 9 cm from the anal verge. Local staging with MRI demonstrated a T3 tumour and distant staging with a computed tomography (CT) scan revealed a liver metastasis. Six weeks after completion of long-course neoadjuvant CRT, the patient underwent an ULAR and loop ileostomy. The patient went on to have a liver resection 2 months after resection of the rectal primary. Adjuvant chemotherapy was completed 5 months after liver resection. The patient had their loop ileostomy reversed 8 months after the original ULAR, which was complicated by a transient ileus. Three months after reversal of loop ileostomy, this patient developed low-grade sepsis with diarrhoea and urinary retention. A MRI showed thickening in the rectum and fluid in the presacral space suggestive of a local recurrence or anastomotic dehiscence and sepsis (Supplementary material Fig. 2). Five weeks of conservative management failed to relieve the symptoms, and the patient remained unwell with a low-grade sepsis and malaise. An EUA demonstrated the presence of a small posterior anastomotic dehiscence of 10 %. The patient was referred for 6 weeks of HBO therapy which commenced 5 months after closure of loop ileostomy. One month after HBO therapy, CT and positron emission topography (PET) scans revealed nodules in the lung but were not considered to be metastases. The patient responded well to HBO therapy but upon completion the patient experienced pelvic pain and diarrhoea and an anastomotic leak confirmed. Formation of a loop ileostomy was suggested followed by a further course of HBO therapy. The patient underwent formation of a loop ileostomy 16 months after the initial ULAR. The patient showed signs of a reduction of pelvic sepsis during HBO therapy. A PET scan at this time revealed a progression of the pulmonary nodules and the presence of three new nodules which were confirmed as metastatic. Three months after formation of loop ileostomy, the patient commenced chemotherapy for the metastatic disease. Four months later, the patient was generally well with no evidence of local recurrence, and PET imaging showed stable metastatic disease. This patient's chemotherapy remained ongoing 5 months after PET imaging.

Case 3 Rectal cancer was diagnosed in a 35-year-old male with no other comorbidities. After local staging with MRI, the patient proceeded to long course neoadjuvant CRT. This was followed 4 weeks later by an ULAR and covering loop ileostomy, which was complicated by a postoperative bleed. The patient was diagnosed with a 25 % posterior anastomotic dehiscence on routine postoperative follow-up 3 weeks after the original ULAR. This was managed in a conservative fashion with a repeat clinical examination performed 3 months later. This was clinically normal and a gastrograffin enema demonstrated a similar finding. Closure of loop ileostomy was performed a month later, 8 months after ULAR. Subsequent routine surveillance imaging demonstrated the presence of a chronic posterior sinus and cavity that was clinically and radiologically stable for almost 7 years. The patient presented with pelvic and buttock pain and acute pelvic sepsis extending from his anastomosis to the buttocks and the region of the sciatic nerve (Supplementary material Fig. 3). This was managed with intravenous antibiotics and formation of a diverting loop ileostomy. Two days after diversion, the patient was referred for 6 weeks of HBO therapy. The patient made a rapid recovery after HBO therapy and was asymptomatic upon review 2 months after completion of treatment. Eleven months after completion of HBO therapy, an EUA revealed minimal persistence of the posterior sinus, but with resolution of the surrounding sepsis. The short sinus was then marsupialised surgically. HBO therapy was completed 1 month after this operation with the patient reported as feeling very well. Five months later an MRI showed a decrease in presacral sepsis, and a repeat EUA confirmed complete healing. Reversal of the stoma is planned.

Case 4 A 62-year-old male with no other comorbidities was diagnosed with rectal cancer. Local MRI staging suggested T3N1 disease. This was managed with long-course neoadjuvant CRT, followed 6 weeks later by an ULAR and covering loop ileostomy. The postoperative course was complicated by anastomotic dehiscence and sepsis. This was managed conservatively. An EUA performed 6 weeks after the ULAR demonstrated the presence of a 25–30 % posterior anastomotic dehiscence which was confirmed by MRI (Supplementary material Fig. 4). As the patient remained asymptomatic with a covering loop ileostomy, conservative treatment was continued. The patient proceeded to receive adjuvant chemotherapy. An EUA performed 4 months after the initial operation confirmed a persistent 25–30 % anastomotic defect. The patient was then referred for 6 weeks of HBO therapy commencing 4.5 months after initial surgery. A follow-up EUA performed shortly after completion of HBO therapy demonstrated healing with an epithelised cavity. The patient proceeded to reversal of ileostomy 6 weeks after completion of HBO therapy.

Case 5 A 67-year-old woman with no comorbidities was diagnosed with rectal cancer 2 cm in diameter located 5 cm above the anal verge. An abdominal and pelvic CT scan confirmed the presence of the cancer with no local invasion or metastatic disease. An ultrasound 4 days after diagnosis suggested T2N0 staging and neoadjuvant CRT was not indicated. Eight days after diagnosis, the patient underwent an ULAR, formation of a pouch and diverting loop ileostomy. Two months after diagnosis, a CT scan showed a chronic cavity next to the anastomosis suggesting a leak. A broad spectrum of antibiotics was prescribed and 3 days later an EUA confirmed pelvic sepsis and anterior anastomotic dehiscence of about 25 %. The patient was referred for HBO therapy which commenced 8 weeks after surgery. Fourteen weeks after surgery, the HBO therapy was completed and antibiotic treatment ceased with the patient healthy with no further systemic symptoms. Four months after surgery, the patient presented with nonspecific abdominal symptoms, lower abdominal pain, and systemic sepsis. A CT scan showed a further horseshoe-type collection around the anastomosis (Supplementary material Fig. 5). A colonoscopy showed that the anastomosis had fully healed and the presacral abscess was drained through the posterior fornix. Eight months after surgery, an EUA and flexible sigmoidoscopy demonstrated a well-healed pouch with no signs of leakage. The closure of the patient's stoma was completed 9.5 months after surgery with the patient remaining healthy.

Discussion

The cases described demonstrate a series of patients who suffered anastomotic complications following ULAR, and in four cases, this occurred after neoadjuvant CRT. All the cases demonstrated significant improvement in the degree of anastomotic separation and sepsis. Not all cases have achieved stoma closure at the time of writing, but all have demonstrated improvement in a clinical situation where it would normally be expected to create permanent diversion. HBO therapy was well tolerated in all cases with no documented adverse events. Unpublished figures from our colorectal neoplasia database [3], demonstrate an anastomotic leak rate of 3.8 % after a total of 369 low and ULARs between February 2010 and May 2014.

Although there is evidence for the use of HBO therapy in the management of patients with late radiation tissue injury, there is no evidence in the world literature regarding the use of hyperbaric oxygen in the specific clinical setting described by our case series. However, HBO therapy was successfully used to treat nonhealing wounds following excisional biopsy for recurrent or residual anal carcinoma in two patients who had previously received radiotherapy [2]. Beneficially, a systematic literature review showed no evidence to suggest that HBO therapy has a cancer promoting effect and nor does it enhance recurrence [4].

This case series identifies for the first time the potential benefits of HBO therapy for anastomotic complications following ULAR and justifies ongoing prospective evaluation of its role in the management of colorectal anastomotic dehiscence. Further studies are required to establish the complete role and setting for this modality of treatment.

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References

1. Kumar A, Daga R, Vijayaragavan P, Prakash A, Singh RK, Behari A, Kapoor VK, Sexena R (2011) Anterior resection for rectal carcinoma – risk factors for anastomotic leaks and strictures. World J Gastroenterol 17(11):1475–1479
2. Araujo S, Bammann R, Seid V, Nahas S, Nahas C, Cecconello I (2011) Neoadjuvant chemoradiation therapy followed by curative transanal endoscopic microsurgery (TEM) for rectal cancer complicated by major suture dehiscence: avoiding ileostomy through hyperbaric oxygen therapy. Int J Color Dis 26:1359–1361
3. McMurrick PJ, Oliva K, Carne P, Reid C, Polglase A, Bell S, Farmer KC, Ranchod P (2014) The first 1000 patients on an Internet-based colorectal neoplasia database across private and public medicine in Australia: development of a binational model for the Colorectal Surgical Society of Australia and New Zealand. Dis Colon Rectum 57:167–173
4. Feldmeier JJ, Hampson NB (2002) A systematic review of the literature reporting the application of hyperbaric oxygen prevention and treatment of delayed radiation injuries: an evidence based approach. Undersea Hyperb Med 29:4–30