

Respiratory Muscle Function and Exercise Capacity in a Stage 4 Head and Neck Cancer Patient Receiving Chemoradiotherapy

Macrina D'Souza, Stephen Rajan Samuel, Santosh PV Rai¹, PU Prakash Saxena², Gopala Krishna Alaparathi³

Department of Physiotherapy and ¹Radio Diagnosis, KMC, ²Department of Radiotherapy and Oncology, KMC, Mangalore, Manipal Academy of Higher Education, Mangalore, Karnataka, India, ³Department of Physiotherapy, College of Health Sciences, University of Sharjah, Sharjah, UAE

Abstract

Background: Reduced physical and functional capacity is one of the main treatment-related side effects of chemoradiation therapy in head-and-neck cancer patients. We evaluated a case of a head-and-neck cancer patient who was undergoing chemoradiation and was assessed for various components of cardiopulmonary function that plays a vital role in the treatment prognosis. The aim of this case report was to evaluate the respiratory muscle function and exercise capacity of a head-and-neck cancer patient receiving chemoradiation therapy. **Settings and Design:** From among the newly diagnosed admitted to the hospital care, a 60-year-old male with supraglottic carcinoma, who was undergoing concomitant chemoradiation for 7 weeks, was evaluated for various components of cardiopulmonary function. **Subjects and Methods:** Outcomes assessed were diaphragm function (mobility and thickness), maximal inspiratory pressure and maximal expiratory pressure, and 6-min walk test at baseline (pre), after 3 weeks, and after 7 weeks of chemoradiation therapy. The data were quantitatively analyzed to interpret the difference of respiratory muscle function and exercise capacity. **Results:** Evaluation of these outcomes showed a significant decrease from the baseline till the end of the 7th week. **Conclusions:** Therefore, concomitant chemoradiation therapy substantially decreased the respiratory muscle function and exercise capacity in the head-and-neck cancer patient.

Keywords: Cancer, chemoradiation, head and neck, respiratory function

INTRODUCTION

Head-and-neck cancer is a broad term that consists of epithelial malignancies that arise in the paranasal sinuses, nasal cavity, oral cavity, pharynx, and larynx. Most head-and-neck cancers are squamous cell carcinomas of the head and neck.^[1] It is the 6th most common type of cancer that represents about 6% of all cases and accounts for an estimated 650,000 new cancer cases and 350,000 cancer deaths worldwide every year.

Clinically, the disease presents with change in voice, swelling, or persistent sore throat that does not heal over a period of time, tongue pain, difficulty swallowing solid food, mouth ulcer, sudden unexplained weight loss, fatigue, cough, occasional breathlessness, and certain pulmonary complications that could be due to chronic smoking history or immunity-compromised complications of long-duration treatment side effect.^[2] Based on signs and symptoms, the disease is diagnosed by physical examination, blood and urine tests, endoscopy, biopsy fine-needle aspiration cytology, X-ray/barium swallow,

ultrasound, computed tomography (CT), magnetic resonance imaging, and positron emission tomography–CT.

Treatment options for head-and-neck cancer depend on the type and stage of cancer, side effects, patients' preference, and overall health. Surgical management in the initial stages of the disease uses laser technology, excision, lymph node dissection or neck dissection, and reconstructive surgery. In the advanced stage of the disease, the treatment protocol is more inclined toward radiation, chemotherapy, or a combination of both.^[3] Although chemoradiation is a fundamental choice of treatment, patients present with a various number of treatment-related side effects that lead to long-term disabilities such as generalized

Address for correspondence: Dr. Stephen Rajan Samuel, Department of Physiotherapy, KMC, MAHE, Mangalore, Karnataka, India. E-mail: stephen.samuel@manipal.edu

Submitted: 29-Nov-19 **Accepted:** 31-Dec-19
Published: 29-Aug-20

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: D'Souza M, Samuel SR, Rai SP, Saxena PU, Alaparathi GK. Respiratory muscle function and exercise capacity in a stage 4 head and neck cancer patient receiving chemoradiotherapy. *Indian J Palliat Care* 2020;26:385-7.

Access this article online

Quick Response Code:



Website:
www.jpalliativecare.com

DOI:
10.4103/IJPC.IJPC_210_19

peripheral muscle weakness, muscle mass loss, poor quality of life (QOL), decrease in functional physical activity, and respiratory complications.^[4] In such cases, physical therapy in view of multimodal exercises to enhance the strength, respiratory functions, and QOL play a vital role in patients' course of the disease being treated.^[5]

SUBJECTS AND METHODS

The patient is a 60-year-old male who was apparently asymptomatic until 6 months back when he started complaining of pain during swallowing, which was insidious in onset and gradually progressive in nature. The pain aggravated while swallowing more of solids than liquids with no relieving factors. There was no associated history of change in voice, swelling in the neck, regurgitation, and ear pain, loss of weight, or appetite. Furthermore, there was no history of difficulty in breathing, cough, or any recent upper respiratory infection. With the above complaints, he visited the hospital where detailed history and initial investigations were done on the basis of clinical presentation. Blood and urine tests showed Hb – 14.0, total lymphocyte count – 6600, platelets – 2.67 lakhs, blood urea – 29, and serum creatinine – 1.00. X-ray showed normal parenchyma with no infiltration. Assessment suggested supraglottic growth for evaluation for which he was posted for direct laryngoscopy and biopsy. Following the biopsy, the patient was diagnosed of Stage 4 Cancer Supraglottis and was planned for chemoradiation therapy from March 2019. Detailed medical history was taken which stated that he was hypertensive for 10 years and controlled with tablet amlodipine 5 mg (1-2-2). With normal vitals and normal body mass index, a radiation therapy dose of 70 Gy/35 fractions for 7 weeks was started from March 28, 2019. The patient underwent 35 fractions of radiation and 7 cycles of chemotherapy – injection kemoplat 65 mg in 250 ml NS IV for 1 h till the date of the report. Before the start of chemoradiation therapy, the patient was evaluated for respiratory pressures [Table 1] (maximal inspiratory pressure [MIP] and maximal expiratory pressure [MEP]) and diaphragm thickness and mobility using the ultrasound [Table 2]. A 6-min walk test (6MWT) was also conducted to test his functional capacity at baseline and 3 weeks [Table 3]. After 3 and 7 weeks of chemoradiation management, he was again evaluated for the above outcomes to see for any significant changes in respiratory muscle function or exercise capacity during and at the end of treatment.

RESULTS

Interpretation: (I) Diaphragm ultrasound – diaphragm mobility from baseline (2.7 cm) to 3 weeks and 7 weeks (2 cm) showed a significant decrease of 0.7 cm while the thickness remained the same. (II) Respiratory pressures showed a decline of almost 15–20 cm H₂O in both MIP and MEP from baseline to 3 weeks and a decline of 2–5 cm H₂O from 3 weeks to 7 weeks. (III) A 30-m decline was noted in 6-min walk distance for exercise capacity at 3 weeks as compared to baseline.

Table 1: Respiratory pressures

	Baseline	3 weeks	7 weeks
MIP (cm H ₂ O)	78	49	40
MEP (cm H ₂ O)	54	36	32

MIP: Maximal inspiratory pressure, MEP: Maximal expiratory pressure

Table 2: Diaphragm ultrasound

	Baseline	3 weeks	7 weeks
Diaphragm mobility (cm)	2.7 cm	2 cm	2cm
Diaphragm thickness (mm)	3 mm	3 mm	3mm

Table 3: Six-minute walk distance

	Baseline	3 weeks
6MWD (m)	420	390
Borg scale	2/10	2/10

6MWD: 6-min walk distance

DISCUSSION

This case study evaluated the impact of treatment-related side effects on the respiratory system and the functional capacity of a patient with head-and-neck cancer undergoing chemoradiation. Many of the previous studies showed significant changes in diaphragm and respiratory functions. However, these studies concentrated on the changes mainly seen postoperatively. A study conducted by Santana *et al.* in 2014 evaluated inspiratory muscle strength and diaphragm function in a head-and-neck cancer patient immediately post neck dissection, after 1 month, and after 3 months. In this study, they noted a decrease in the respiratory strength and diaphragm mobility immediately after the surgery, but a decrease in diaphragm thickness was seen only after 3 months postoperatively, and the reason they stated was decreased physical activity and protein-calorie intake.^[6] Several studies show evidence on side effects of chemoradiation on peripheral muscle weakness, muscle mass loss, cachexia, and fatigue.^[4] However, no studies show evidence on respiratory system complications due to chemoradiation in head-and-neck cancer patients even though many of these patients tend to lean into pulmonary complications clinically that deteriorate their respiratory function and functional capacity to perform basic activities of daily living as well as overcome the poor QOL. In this case study, we noted a decrease in function of the major muscle of respiration, its mobility, respiratory pressures, and minimal decrease in functional capacity with 6MWT which may contribute to the deterioration of the patients' condition over the treatment period. Hence, this study could provide a need for early respiratory care and prevention of respiratory complications associated with chemoradiation. Further research with a higher level of evidence and a larger sample size can help plan a structured protocol in pulmonary care in these patients to improve their respiratory muscle function and exercise capacity.

CONCLUSION

This case report shows that there was decrease in the respiratory muscle function and exercise capacity in a head and neck cancer patient receiving concomitant chemo radiation.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Argiris A, Eng C. Epidemiology, staging, and screening of head and neck cancer. *Cancer Treat Res* 2003;114:15-60.
2. Parkin DM, Bray F, Ferlay J, Pisani P. Global cancer statistics, 2002. *CA Cancer J Clin* 2005;55:74-108.
3. Guillem JG, Wood WC, Moley JF, Berchuck A, Karlan BY, Mutch DG, *et al.* ASCO/SSO review of current role of risk-reducing surgery in common hereditary cancer syndromes. *J Clin Oncol* 2006;24:4642-60.
4. Nakano J, Ishii S, Fukushima T, Natsuzako A, Sakamoto J, Okita M. Factors affecting muscle strength in cancer patients receiving chemotherapy. *J Nov Physiother Rehabil* 2017;1:56-66.
5. Lu YJ, Tsai KL. A multi-modal exercise program ameliorates cardiopulmonary responses in patients with head and neck cancer receiving concurrent chemoradiotherapy. *J Nov physiother* 2018;8:35.
6. Santana AF, Caruso P, Santana PV, Porto GC, Kowalski LP, Vartanian JG. Inspiratory muscle weakness, diaphragm immobility and diaphragm atrophy after neck dissection. *Eur Arch Otorhinolaryngol* 2018;275:1227-34.