Senna Tablet Increases Radiation Dose Excreted at Discharge Time in Patients Who Underwent Iodine Therapy

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Research Article

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Abstract

Introduction: Thyroid cancer is a malignancy accounting for less than 1% of human malignancies. This study aim was to investigate the effect of Senna tablets (C-Lax[®]) in increasing the dose of radiation excreted in patients who underwent iodine therapy in the iodine treatment center of Namazi Hospital of Shiraz University of Medical Sciences at discharge time.

Methods: In this study, 180 female patients aged 30-50 years old with BMI ranges from 22 to 26 and no history of gastrointestinal diseases, especially gastrointestinal ulcers, constipation, and known intestinal diseases, were included in our study into 6 groups of 30 patients. The first three groups received 100, 150, and 200 mCi radiation respectively, and did not receive C-lax tablets. The second three groups received 100, 150, and 200 mCi radiation respectively, and additionally, received 2 C-lax tablets of Dineh Iran Pvt. Ltd.

Results: In all 3 doses studied, more than 50% of reduction in radiation dose at discharge was seen. There is a statistically significant difference between the different doses of iodine intake in each of the two groups. Results show that there is a statistically significant difference between groups with consumption and without consumption of C-Lax tablets in all three doses paired groups

Discussion and Conclusion: The radiation dose of patients at discharge time has an important effect on both patients and their families' health and thereby it should be taken into consideration. C-lax tablets can significantly reduce the radiation dose of patients at their discharge. This can result in better compliance of patients and decreased expenses for the health system and patients

Introduction

Radiation in thyroid cancer

In 2020, new cases of thyroid cancer are estimated to be 52,890 patients with a 2.9% death rate ("SEER Cancer Stat Facts: Thyroid Cancer. National Cancer Institute," 2021). Thyroid cancer is more common in young and middle-aged women. Its one of the most common cancers in humans and papillary and follicular types are its most prevalent types (Petrich et al., 2001).

Surgery, radiation therapy, and chemotherapy are the main treatments for thyroid carcinoma (Petrich et al., 2001). Radiation with ionizing rays has negative impacts on biological tissues, and in certain doses, quantities and intensities can cause irreversible tissue damages, cancer, and even death (Mehrosadat et al., 2015). Despite its negative results, radioactive iodine has been used to treat benign and malignant thyroid cancer since 1940 (Siegel, Naishadham, & Jemal, 2012). Thyroid cancer can be surgically removed after diagnosis and since its remaining cells absorb radioactive iodine, they are eliminated by radioactive iodine after surgery. Beta particles radiating from radioactive iodine destroy the follicular cells and gradually lead to a decrease in remaining thyroid volume and control of thyrotoxicosis. As a result, iodine therapy is usually performed to destroy the remaining cancerous cells of the thyroid or probable

cancer metastasis. An important feature of thyroid cancer cells that differs from other cancer cells is that they considerably absorb iodine, and as a result, the iodine is concentrated in the thyroid remaining cells, which results in cell death. It must be said that most healthy cells of the human body survive as they do not absorb iodine (Petrich et al., 2001). Radiation therapy is performed with radioactive iodine or by external radiation. After thyroidectomy, it must be ensured that no cancer cells are left. In contrast to most cancers, in which chemotherapy is used for the elimination of remaining cells, chemotherapy is not effective for thyroid metastases and thereby these patients are treated with radioactive iodine. It is obvious that iodine therapy maximizes the therapeutic effect of subsequent treatments and it also reduces the recurrence and mortality rates of thyroid carcinoma and even can prevent distant metastasis (Haugen et al., 2016). When radioactive iodine is absorbed by thyroid tissue, its therapeutic effects begin; because of high-energy beta ray emission and eventually will result in cell death within a few weeks (La Perle et al., 2013).

Iodine 131 is one of the radionuclides which accumulate in the thyroid gland. In patients who underwent thyroidectomy, as the thyroid gland has been removed, iodine 131 is distributed to other organs of the body. Iodine 131 or radioactive iodine is a radiant isotope of iodine that has a half-life of 8 days. This isotope is mainly produced artificially and it is often used in imaging procedures or the treatment of hyperthyroidism, thyroid cancer, and some other cancers. In imaging studies such as thyroid scans, the patient receives a small dose of radioactive iodine that accumulates in thyroid tissue or certain types of tumors, and sites of radioactive iodine accumulation can be detected using a scanner. It has been reported that locations, where more radioactive iodine has accumulated, are overactive sites (hot thyroid nodules) (Aschebrook-Kilfoy et al., 2013; Schneider & Chen, 2013).

Senna

Herbal Medicine has been used widely in traditional and ethnic medicine (Ardekani, Askari, & Mohagheghzadeh, 2020). In recent years most of researchers in field of herbal medicine have put an emphasis on clinical trials of such products (Amiri-Ardekani & Tehrany, 2021; Bhosale & Banerjee, 2020). One of these valuable herbs is Senna. Senna (*Senna alexandrina* Mill.) from Genus Senna and Leguminosae family ("The Plant List," 2021) is a valuable plant due to its laxative (Vilanova-Sanchez et al., 2018; Wang et al., 2020), anti-obesity, anti diabetic (Yuniarto, Sukandar, Fidrianny, Setiawan, & Ketut, 2018), and hepatoprotective (Wang et al., 2020) activity. *S. alexandrina* is one of the most popular and important species of this genus, which is mentioned in the world's renowned pharmacopeias (Ahmad, Hassan, Abbasi, & Rehman, 2018). Many species of the Senna genus are sources of tannins, and thereby they have also high economic and therapeutic value (Maia, Trevisan, Silva, Breuer, & Owen, 2017; Oladeji, Adelowo, & Oluyori, 2021).

sennosides are among the major ingredients of Senna. These glycosides (especially A and B sennosides and their active metabolite, rhein-anthrone) are responsible for Senna leaves and fruit laxative activity. Two mechanisms have been proposed for Senna laxative activity. The first mechanism is electrolyte and water absorption from the large intestine that results in higher volume and pressure in the large intestine and eventually increases colon motility. The second mechanism is active chloride secretion mediated by

stimulation of endogenous prostaglandin E2 that results in increased water and electrolyte content of the intestine and eventually increased colon motility(Ramchander & Middha, 2017; Zhao et al., 2016).

Due to the safety and therapeutic aspects of *S.alexandrina* from one hand and the need to increase radiation dose excreted at discharge time in patients who underwent iodine therapy for the first time in the world in this study we evaluate the role of Senna tablets (commercially known as C-Lax®) in increasing radiation dose excreted at discharge time in patients who underwent iodine therapy.

Material And Methods

This clinical trial study was performed in the Iodine Therapy Center of Namazi hospital from 2019 fall to winter of 2020.

Inclusion criteria were female patients aged 30–50 years with BMI range from 22 to 26. The exclusion criteria were history of gastrointestinal disease, especially gastrointestinal ulcers, constipation. finally, based on inclusion and exclusion criteria 180 female patients were included in our study.

In this study, patients of the same sex as females in an age range with close body mass index and no GI problems were included in the study. Thus, for the prescribed dose, the patient was divided into two groups. used C-Lax Tablets as a laxative supplement and the group did not use them. In other words, the choices were not random and were based on the said characteristics. Participants were divided into 6 groups with Excel®.

The first 30 patients received 100 mCi iodine radiation and did not take C-Lax® tablets. The second group of patients received a dose of 150 mCi radiation and did not take C-Lax® tablets. The third group included 30 patients who received a dose of 200 mCi radiation and did not take C-Lax® tablets. The next 3 groups also received 100 mCi, 150 mCi, and 200 mCi radiation dose, respectively. But, these 3 groups were prescribed with 2 C-Lax® tablets made by Dineh Iran Pvt. Ltd. 24 hours before hospitalization and also every night during their hospitalization period. All patients also were asked to drink a enough water.

The groups were compared in pairs based on the amount of radioactive iodine dose received. The criterion for comparison was the radiation dose at discharge time based on the micro Sieverts per hour at a distance of 1 meter.

According to the non-normal distribution of iodine radiation in different doses, the nonparametric test of Kruskal-Wallis was used. Statistical analysis were done using SPSS Ver 22.

Ethical protocol of this study was approved by Ethics Committee of Shiraz University of Medical Sciences under IR.SUMS.MED.REC.1399.367 code.

Results

Table 1 shows that there is a statistically significant difference between the different doses of iodine intake in each of the two groups. Also, the results of paired groups comparisons show that patients who did not take C-Lax®, the mean difference of radiation was different in all groups of iodine radiation doses received, but in the three groups of patients who received C-Lax®, there was only a statistically significant difference between the 100mCi dose and the two other group doses.

Table 1
The mean difference of iodine dose variable in each group

Significance level	Mean ± Standard deviation	Group	Variable
< 0.001*	38.81 ± 5.31 ^{ab}	100 mCi	Radiation dose without C-Lax consumption
	44.00 ± 3.95 ^{ac}	150 mCi	
	40.83 ± 9.64 ^{bc}	200 mCi	
0.038*	13.2 ± 0.98 ^{ab}	100 mCi	Radiation dose with C-Lax consumption
	18.17 ± 1.25 ^a	150 mCi	
	20.30 ± 1.51 ^b	200 mCi	
a: There was a statistically significant difference between the 100 mCi group and 150 mCi group b: There was a statistically significant difference between the 100 mCi group and 200 mCi group c: There was a statistically significant difference between the 150 mCi group and 200 mCi group			

Table 2 results show that there is a statistically significant difference between groups with consumption and without consumption of C-Lax® tablets in all three doses paired groups.

Table 2
comparison of the mean difference of iodine doses in each paired groups

Significance level	Mean $\pm$ Standard deviation	variable	
< 0.001 [*]	38.81 $\pm$ 5.31	Without C-Lax®	100 mCi
	13.2 $\pm$ 0.98	With C-Lax®	
< 0.001 [*]	44.00 $\pm$ 95.3	Without C-Lax®	150 mCi
	18.17 $\pm$ 1.25	With C-Lax®	
< 0.001 [*]	40.83 $\pm$ 9.64	Without C-Lax®	200mCi
	20.30 $\pm$ 1.51	With C-Lax®	

As shown in Figs. 1 and 2, the amount of radioactive material excreted increased in patients who took the C Lax® tablets.

Discussion

Thyroid cancer is one of the most common malignancies in humans and is more prevalent in young and middle-aged women. The most common types of thyroid cancer are papillary and follicular types, respectively. Treatment of thyroid cancer is mainly surgical removal and since thyroid remaining cells absorb radioactive iodine, they can be eradicated by radioactive iodine after surgery. Radioactive iodine destroys the thyroid follicular cells and can control thyrotoxicosis. Thereby, iodine therapy is often done to destroy the remaining cells of the thyroid and even its malignant metastasis. A key feature of thyroid cells is that they markedly absorb iodine, and thereby, the iodine is absorbed by the remaining cells of the thyroid and will eliminate them, and also it is noteworthy that other types of human cells almost do not hurt as they do not absorb iodine(Lee & Park, 2010).

Shaheen Dewji et al. have made some important recommendations on the radiation dosage of iodine in patients admitted for iodine therapy in the United States and also patients' condition, staff conditions, condition of physicians exposed to the patients, and most importantly the radiation protection conditions of the patient's companions during and after iodine therapy in 2017. Since patients should be discharged after 24 to 72 hours of quarantine in the iodine therapy ward, the standard and optimal radiation dose of patients should be less than 70 micro Sieverts per hour at a distance of one meter (Dewji & Hertel, 2017). Report number 63 of the Atomic Energy Organization (IAEA) on the discharge of iodine therapy patients, has stated that the most optimal dose at a distance of 1meter is less than 70 micro Sieverts per hour, based on a comparison of the standards of Germany, Sweden, Finland and Australia (Fard-Esfahani et al., 2015).

Patients are generally admitted in the nuclear medicine wards between 24 and 72 hours, with an average of 48 hours. The radiation dose of the patients at discharge highly depends on the nutrition and also

health condition of the patients' urinary and gastrointestinal system. The aim of this study was the evaluation of laxatives especially Senna herbal medicine on the increase of peristaltic movements of the intestine and intestinal emptying and subsequently, increase in the excretion of radioactive materials. This study showed that the radiation dose of patients at discharge time has an important effect on both patients and their families' health and thereby it should be taken into consideration. C-lax tablets can significantly reduce the radiation dose of patients at their discharge. This can result in better compliance of patients and decreased expenses for the health system and patients. It must be said that since this study was conducted for the first time in the world, there was no similar study for comparison.

Conclusion

Our study shows statistically significant evidence in favor of using C-Lax tablets, which indicates the effect of laxatives in reducing the patient's radiation dose during discharge. This result can facilitate this medical procedure and decrease expenses for both the health care system and patients.

Declarations

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Conflict of interest

The authors have no conflict of interest.

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Figures

Figure 1

Mean comparison between groups

Figure 2

Radiation in each studied group