

The Role of Health Education in Improving Patient Compliance with Zoledronic Acid

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How to cite this paper: Jie, S.M., Deng, J.M., Jie, E.M., Chen, E.J., Lin, C.X., Cai, X.Z. and Cai, D.M. (2018) The Role of Health Education in Improving Patient Compliance with Zoledronic Acid. *Open Journal of Nursing*, 8, 709-716.
<https://doi.org/10.4236/ojn.2018.810053>

Received: September 21, 2018

Accepted: October 15, 2018

Published: October 18, 2018

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Abstract

Objective: To define the role of health education in improving patient compliance with Zoledronic Acid for osteoporosis treatment and management and draw closer attention of patients and physicians to the importance of health education. **Methods:** A total of 198 postmenopausal patients with osteoporosis who were admitted by the osteoporosis outpatient clinic of our hospital and had the first administration of Zoledronic Acid in 2015 were invited to participate in the follow-up visit that involved questions concerning the frequency of health education and the questionnaire survey on osteoporosis in 2015 and the administration of Zoledronic Acid during the past three years. The patients were divided into five groups according to the frequency of health education to compare the survey results of each group in 2015 and 2018 and investigate the differences in the scores and frequency of administration among the five groups. **Results:** Among the 198 patients, there were 182 attending the follow-up visit. In terms of the frequency of health education (FREQ = 0, 1, 2, 3, 4), these patients were divided into five groups of 47, 63, 35, 18 and 19 members respectively. After three years of treatment, the questionnaire score of each group was higher than the pre-treatment level and the difference showed statistical significance ($p < 0.05$, respectively); compared to those who had never received health education (FREQ = 0), the patients who had participated in health education activities at different levels (FREQ = 1, 2, 3, 4) scored significantly higher in the questionnaire survey and increased the frequency of administration of Zoledronic Acid on average; particularly, those who had received health education and Zoledronic Acid treatment twice and above benefited the most. **Conclusion:** Health education is an effective approach to influence a patient's knowledge connected to relevant diseases in a positive way and improve patient compliance with

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Zoledronic Acid treatment. An enhanced health education program can be developed to assist the patients in chronic disease management.

Keywords

Osteoporosis, Health Education, Health Management, BMD, Zoledronic Acid, Compliance

1. Introduction

Osteoporosis (OP) has become a common disease in the aging society. Despite its substantial morbidity, only a small size of the population has knowledge of the disease. Patients with osteoporosis are prone to develop fractures, which leads to high disabling and fatality rates and increases the burden on the patients and the public health sector [1]. Zoledronic Acid is a third-generation bisphosphonate that becomes the first-line therapy for osteoporosis as it only requires one intravenous injection per year, markedly increases a patient's BMD and effectively reduces the risk of fractures [2]. However, it is likely to cause acute-phase responses among the Zoledronic Acid-treated subjects during the treatment course, especially after the first administration—this reduces the patient compliance with a second dose. In addition, it is often recommended that a patient with osteoporosis receive Zoledronic Acid for three consecutive years; for the older patients having poor memories and complicated underlying diseases, they are less compliant with the sequential treatment at wide intervals [3] [4]. As the most economical and effective way to prevent and control osteoporosis, health education has been widely accepted as a fundamental osteoporosis management strategy [5]. A patient having received health education appears to have a clearer understanding of the disease and show greater compliance with the corresponding treatment. Considering that only few reports on the health education designed for the osteoporosis patients treated with Zoledronic Acid are available, the osteoporosis base of the hospital has set up a health education system for our patients. In this study, relevant health education programs were introduced to improve the compliance of the Zoledronic Acid-treated subjects.

2. Materials and Methods

2.1. Clinical Materials

The clinical data of 198 postmenopausal patients with osteoporosis who presented at our osteoporosis outpatient clinic between January and December 2015 were analyzed in this study and 182 out of the 198 patients attended the follow-up visit. These patients were postmenopausal women aged 50 to 80 (mean age = 68.1 ± 9.0). Prior to the initial diagnosis, dual-energy X-ray absorptiometry (DXA) was used to test each patient's bone density (lumbar vertebra and femur) and the measured values were considered to be diagnosis and inclusion

criteria. Patients were eligible for inclusion if bone mineral density T-score was no greater than -2.5 or T-score was less than -1.0 with preexisting fragility fractures and definite systemic symptoms such as back pain or height loss. Other inclusion criteria include: (1) normal blood calcium; (3) creatinine clearance rate (CCR) > 35 ml/min; (4) no medication history connected to Zoledronic Acid; (5) informed consent to participation in this study; (6) clear minded and right-thinking; (7) proven learning ability. Exclusion criteria: 1) Previous use (within six months before treatment) of estrogen, glucocorticoid (GC), calcitonin and other BPs that might influence one's bone metabolism; 2) diabetes and endocrine disorders of thyroid, parathyroid, adrenal gland or gonad; 3) CCR ≤ 35 ml/min; 4) secondary osteoporosis; 5) an allergy to zoledronic acid.

2.2. Methods

Health education program: All patients in this study took part in a questionnaire survey that examined their knowledge of osteoporosis after the initial diagnosis and the survey results were used to set up a database. The patients admitted by the osteoporosis outpatient clinic were notified to receive health education every three months over a year (*i.e.*, four times in total) and the first health education was scheduled in the month following their first visits. To be specific, the health education program consisted four lectures (40 min each, including 20 min for in-class Q&A and 20 min for discussion) and a notification would be sent to every participant before each lecture. The health education mainly covered the topics connected to osteoporosis, such as risk factors, diagnosis, treatment, fall prevention, curative effect of Zoledronic Acid and countermeasures against the adverse reactions brought by Zoledronic Acid. Three years later, the patients attended the follow-up visit via phone. They answered questions about the frequency of their participation in health education and the number of injections of Zoledronic Acid and completed the follow-up visit questionnaires on osteoporosis. According to the frequency of participation in health education, the patients were divided into five groups, with Group 1 never participating in any health education activities (FREQ = 0) and the other four groups having received health education at different levels (FREQ = 1, 2, 3, 4).

2.3. Evaluating Health Education Outcomes

- 1) An intragroup comparison was conducted on the basis of the survey results given by each group after the initial diagnosis and the follow-up visit.
- 2) An intergroup comparison was made to investigate the differences in the questionnaire scores of the five groups after the initial diagnosis and the follow-up visit.
- 3) The number of injections of Zoledronic Acid was used to provide a basis for comparison.
- 4) Statistical Analysis: To identify the differences between Group 1 and the other four groups in their questionnaire scores and Zoledronic Acid administration, the t-test was applied to the intergroup comparison of the patients' general

information and their questionnaire scores before treatment while the chi-square test was used for the intergroup comparison of the enumeration data. $P < 0.05$ indicated a difference of statistical significance.

3. Results

1) The age, BMD and the initial questionnaire score of each group are given in **Table 1** for comparison. As the P-value exceeds the significance level (*i.e.*, 0.05), comparability is assumed.

2) **Table 2** compares the questionnaire scores of each group before and three years after treatment and suggests that the patients have a deeper understanding of the disease three years later. As shown in **Table 3**, the patients having received health education make a marked improvement in the questionnaire survey compared to those without health education. The increase in the questionnaire scores of Group 3 and Group 4 has no statistical significance; for other groups, the questionnaire score is positively correlated with the frequency of health education. This indicates that health education extends a patient's knowledge of the disease and frequent participation in health education activities implies a profounder understanding of the disease.

3) **Table 4** shows the number of Zoledronic Acid injections in each group during the three years. Compared to Group 1, the patients in the other four groups receive significantly more injections ($P < 0.05$). In terms of Zoledronic Acid treatment, it is obvious that the patients who have participated in more than two health education activities have more injections than those having received health education once and the difference is statistically significant. However, there is no statistically significant difference between Group 4 and Group 3 or Group 5. All this indicates that health education improves a patient's compliance with Zoledronic Acid for osteoporosis treatment and management, especially when the patient has attended two or more of the given health education activities.

4. Discussion

Osteoporosis is an age-dependent degenerative bone disease that is highly likely to cause fractures and further lead to disability and even fatality in the elderly

Table 1. Comparison of patients' general information by group.

Group	Group 1 (FREQ = 0)	Group 2 (FREQ = 1)	Group 3 (FREQ = 2)	Group 4 (FREQ = 3)	Group 5 (FREQ = 4)	F-value	P-value
Number of Patients	47	63	35	18	19		
Age	67.9 ± 8.4	69.0 ± 8.6	67.9 ± 7.5	68.4 ± 9.2	70.9 ± 9.3	0.509	0.729
Lumbar Spine BMD	0.797 ± 0.112	0.787 ± 0.118	0.785 ± 0.122	0.776 ± 0.107	0.790 ± 0.132	0.126	0.973
Femur BMD	0.579 ± 0.180	0.618 ± 0.101	0.601 ± 0.081	0.611 ± 0.089	0.610 ± 0.069	0.762	0.551
Score before Health Education	42.7 ± 11.9	42.6 ± 11.3	42.5 ± 11.5	42.5 ± 11.4	43.2 ± 11.2	0.013	0.98

Note: The questionnaire survey used the hundred-mark system.

Table 2. Comparison of survey results of the five groups before and after treatment.

	Number of Patients	Upon Enrollment	Three Years Later	P-value
Group 1 (FREQ = 0)	47	42.7 ± 11.9	46.6 ± 10.9	0.0008
Group 2 (FREQ = 1)	63	42.6 ± 11.3	58.3 ± 8.2	0.0005
Group 3 (FREQ = 2)	35	42.5 ± 11.5	67.9 ± 7.1	0.0004
Group 4 (FREQ = 3)	18	42.5 ± 11.4	69.7 ± 9.5	0.0003
Group 5 (FREQ = 4)	19	43.2 ± 11.2	78.7 ± 7.2	0.0001

Table 3. Intergroup comparison of improvement in knowledge of osteoporosis.

	Number of Patients	Difference in Questionnaire Scores	P1	P2	P3	P4	P5
Group 1 (FREQ = 0)	47	3.93 ± 3.75	--	0.0005	0.0003	0.0002	0.0001
Group 2 (FREQ = 1)	63	15.71 ± 7.51	0.0005	--	0.0005	0.0002	0.0001
Group 3 (FREQ = 2)	35	25.46 ± 10.44	0.0003	0.0005	--	0.487	0.0001
Group 4 (FREQ = 3)	18	27.22 ± 12.39	0.0002	0.0002	0.487	--	0.04
Group 5 (FREQ = 4)	19	35.52 ± 13.01	0.0001	0.0001	0.0001	0.04	--

Note: P1 denotes the comparison between Group 1 and the other four groups; P2 means the comparison between Group 2 and the other four groups; P3 represents the comparison between Group 3 and the other four groups; P4 expresses the comparison between Group 4 and the other four groups; P5 stands for the comparison between Group 5 and the other four groups. $P < 0.05$ indicates a difference of statistical significance.

Table 4. Number of Zoledronic Acid Injections of each group during the three years.

	Number of Patients	Number of Zoledronic Acid Injections	P1	P2	P3	P4	P5
Group 1 (FREQ = 0)	47	1.32 ± 0.63	--	0.029	0.0008	0.0003	0.0001
Group 2 (FREQ = 1)	63	1.63 ± 0.81	0.029	--	0.0008	0.0005	0.0003
Group 3 (FREQ = 2)	35	2.26 ± 0.85	0.0008	0.0008	--	0.168	0.003
Group 4 (FREQ = 3)	18	2.56 ± 0.86	0.0003	0.0005	0.168	--	0.167
Group 5 (FREQ = 4)	19	2.89 ± 0.32	0.0001	0.0003	0.003	0.167	--

Note: P1 denotes the comparison between Group 1 and the other four groups; P2 means the comparison between Group 2 and the other four groups; P3 represents the comparison between Group 3 and the other four groups; P4 expresses the comparison between Group 4 and the other four groups; P5 stands for the comparison between Group 5 and the other four groups. $P < 0.05$ indicates a difference of statistical significance.

patients. This makes the disease a major threat against the elderly [6]. However, the patients pay little attention to the disease due to a lack of medical knowledge. In fact, people generally consider osteoporosis an inevitable degenerative process accompanied with aging and fail to actively prevent and control osteoporosis. In most cases, the patients with osteoporosis are only made aware of the disease when they suffer fractures [7]. Some may visit the osteoporosis outpatient clinic and seek medical advice from physicians. Yet, the consultation period is too short for a physician to elaborate on the prevention against complications, follow-on treatment and monitoring of relevant diseases. Hence, it is imperative to help patients broaden the knowledge of their diseases. In this study, the average

score of the patients upon consultation was relatively low. This shows the lack of understanding of osteoporosis and demonstrates the necessity of health education for the patients.

Jiang, Y. *et al.* analyzed the compliance with alendronate sodium among male patients at advanced ages and indicated that the following factors may lead to poor compliance: 1) the patients were not reminded to take their medicine; 2) the patients lacked awareness of the protective efficacy; 3) the patients worried about relevant side effects; 4) the patients paid little attention to the disease [8]. Although Zoledronic Acid is one of the first-line anti-osteoporosis drugs that substantially improve an osteoporosis patient's BMD and reduce the risk of fractures, it often causes acute-phase responses during the treatment course, especially after the initial treatment. In addition, it is reported that the Chinese are more likely to have such acute-phase responses than westerners [9]. Generally, these adverse reactions disappear after three days and yet, they may lead the patients having little knowledge of Zoledronic Acid to refuse another dose. Health education is an effective solution to prevent fractures and improve a patient's quality of life by helping him/her broaden the knowledge of the disease and develop a healthy lifestyle [10]. Our hospital has attached great importance to health education among our patients since the establishment of the osteoporosis base. This study focused on the health education pertinent to the Zoledronic Acid-treated patients. Compared to the regular health education, it included an introduction of the corresponding drugs and products to reassure the patients and improve their compliance with the treatment. Any defects or problems identified during implementation of the program were solved to produce favorable outcomes.

Liang, Y.H., *et al.* carried out a study on the effects of health education intervention in elderly patients with osteoporosis and concluded that health education is favorable for prognosis as the patients having received health education had a wider knowledge of the disease and a higher BMD level than the control group [11]. Pertinent health education and guidance can effectively increase an intervention subject's knowledge of osteoporosis prevention and control [12]. The patients who had participated in the four lectures of the given health education program in this study had significantly improved their knowledge of osteoporosis compared to those without receiving any health education. In fact, the patients who had attended the health education program, first of all, put a greater emphasis on the disease; after health education, they had gained a deeper understanding of the prevention, diagnosis and treatment of the disease. On this basis, they were highly compliant with the treatment. The most noticeable difference between the patients having received health education and those without health education lies in that the former show relatively higher compliance with the treatment with Zoledronic Acid. In terms of the frequency of health education, the patients having attended more than two health education lectures are clearly more compliant with the treatment. In this study, a total of 47 patients (Group 1) received no health education while another 63 patients (Group 2)

merely attended one of the health education lectures. These patients accounted for 60% of all participants in this study. In other words, only a small number of patients participated in the health education program. In this case, it is necessary to explain to a patient how significant health education is during the initial diagnosis and throughout the treatment course to increase participation in health education and improve patient compliance.

Osteoporosis is age-dependent and associated with an individual's lifestyle. Such unhealthy habits as smoking, alcohol abuse, drinking strong tea and coffee and lack of exercise are also causes of osteoporosis. Appropriate physical exercise plays an important role in maintaining bone health. Lack of exercise is to cause a severe bone loss in the long run [13]. Accidental falls can directly lead to osteoporosis fracture [14]. A patient may develop a healthy lifestyle through health education and prevent accidental falls. In fact, most patients have already shown signs and symptoms of osteoporosis when they consult a physician. Known as a silent disease, osteoporosis generally occurs without overt symptoms. As the aging society approaches, osteoporosis has an increasingly higher incidence. Among the patients suffering from osteoporosis, only few of them actively seek medical attention from osteoporosis outpatient clinics. As the saying goes, "prevention is better than cure". It is reported that health promotion in communities can effectively control the occurrence of osteoporosis [15]. Therefore, except for health education among the patients who actively seek medical attention, competent authorities should provide the elderly with anti-osteoporosis education at community levels. For instance, a leaflet on osteoporosis or the one-minute osteoporosis self-assessment or the osteoporosis self-assessment tool for Asians can be used for health education to achieve early diagnosis and prevent fractures in osteoporosis patients. To actively engage in chronic disease management, it is fundamental that a patient improves the knowledge of relevant diseases through health education.

5. Limitations

This study is a retrospective analysis and thus the study results may be affected by the patients' understanding and interpretation of the questionnaire. Besides, the statistical analysis might be underrepresented because a relatively small number of patients were included in each group due to the careful grouping.

6. Conclusion

Osteoporosis is a chronic disease and a patient with osteoporosis should broaden his/her knowledge of the disease through health education to participate in the disease management. Moreover, the Zoledronic Acid-treated subjects should be provided with a pertinent health education program to improve their compliance with the treatment. Pertinent health education is of increasing importance in osteoporosis prevention and control. As a clinically feasible and effective method, it should gain extensive promotion and wider application.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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