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Awareness of Breast Cancer in Lower Socioeconomic Status Women Attending the Surgery Outpatient Department of a Tertiary Care Teaching Institution

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Abstract

Background: Worldwide breast cancer represents nearly a quarter (25%) of all cancers and is the most common female cancer. Objective: The present study was conducted to check the awareness of breast cancer warning signs & symptoms, available investigations and treatment options among women of a suburban area in Chennai, Tamilnadu (India). Materials and Methods: A cross-sectional, prospective study was conducted amongst women attending the surgery outpatient department of a tertiary care teaching institution in Chennai, Tamilnadu (India), using a semi-structured questionnaire. The questionnaires were administered during one to one interview by trained research assistants. Results: The study population showed poor awareness of warning signs like changes in position of nipple, pulling in of nipple, nipple rash, changes in size of nipple, puckering/dimpling of breast skin colour changes in breast skin, lump under armpit, changes in size and shape of breast. Conclusion: The observations indicated that the level of awareness and knowledge about the presentation and management of breast cancer is sub-optimal among women in Thandalam (suburban Chennai).

Keywords

Breast Cancer, Awareness, Questionnaire, Mammogram, Barriers, Screening, Chennai, Tamilnadu, India

1. Introduction

Worldwide Breast cancer represents nearly a quarter (25%) of all cancers and is

the most common female cancer. The number of cases is slightly higher in less developed regions than in more developed regions [1]. It is now the most common cancer in most cities in India and the second most common in rural area. Breast cancer accounts for 30.7% of all cancers in women in Chennai (National Cancer Registry Programme, based on Population Based Cancer Registry & Hospital Based Cancer Registry).

Breast screening aims at detecting breast cancer at an early stage. Studies have shown that screening has significantly decreased the mortality from breast cancer. Numerous methods are available for early diagnosis of breast cancer including breast self examination (BSE), clinical based examination (CBE), examination by a physician or nurse, mammography, an X-ray of breast and magnetic resonance imaging (MRI) for high-risk women group.

The growing incidence of breast cancer worldwide stresses the greater need for a study of its rise and the need for awareness about it in developing nations. The people reach to the specialist doctor very late because of lack of awareness and low knowledge of breast cancer.

The aims of the present study that is conducted in a suburban area in Chennai are:

1) To check the awareness of the signs and symptoms of breast cancer;
2) To study the religious beliefs of the patients, if any;
3) To analyse the socioeconomic status of the study population;
4) To study the barriers to screening;
5) To analyse if they were aware of the various treatment modalities for breast cancer.

2. Materials and Methods

2.1. Study Design

It is a cross-sectional, prospective study conducted amongst women attending surgery outpatient department of Saveetha Medical College Hospital in Thandalam (a suburban area in Chennai) using a semi-structured questionnaire. The questionnaires were administered during one to one interview by trained research assistants. A Convenient sampling methodology was adopted for the study.

2.2. Questionnaire Design

A semi-structured questionnaire in English was developed after an extensive review of the literature and was validated by two experts. It included questions pertaining to breast cancer signs and symptoms, barriers to screening or treatment and available treatment modalities.

2.3. Data Collection

The study was conducted over 3 months. A total of 210 female subjects belonging to the reproductive age group (15 - 49 years) were included in the study who were outpatients in the department of surgery between January 10, 2019 and

March 31, 2019. The trained research assistants described the purpose and process of the interview to the subjects and emphasised the confidentiality and anonymity of the responses. For the purpose of this study, informed consent was taken from all subjects.

2.4. Data Management and Statistical Analysis

The response to the questions was coded in "yes", "no" or "don't know" format. Age, religion, marital status and socioeconomic status were included as demographic factors. The modified Kuppuswamy socioeconomic scale (2018) was used for assessing the socioeconomic status of the patient, which uses parameters like education and occupation of the head of family along with the per-capita income of the family. The collected data were analysed using Microsoft excel.

The institutional review board of Saveetha Medical College and Hospital (SIMATS) has given approval for the project.

3. Results

Characteristics of subjects

Data were collected from 210 participants. The age of our subjects ranged from 18 - 76 years, of whom 83.3% were married and 16.7% were unmarried. 87.1% of our subjects were Hindus, followed by 7.1% of Muslims and 5.8% Christians (**Figure 1**). As per census 2011, Hindus are a majority in Tamilnadu state constituting 85.58% of Tamilnadu population, followed by 6.12% of Christians and 5.86% of Muslims. The socioeconomic status of all the participants was calculated as per the modified Kuppuswamyscale (2018) and it showed that 54.3% belonged to the lower (V) class, 37.1% belonged to the upper lower (IV) class and the remaining to lower middle (III) class (**Figure 2**). Only 39% of our subjects knew someone who had breast cancer among their friends and family.

The entire details of questions about knowledge of warning signs and symptoms of breast cancer are outlined in **Table 1**.

A lot of women were unaware that nipple changes are a feature of breast cancer. 54.8% of subjects believed that pain is a sign of breast cancer, given that carcinoma breast often presents as a painless lump (**Figure 3**). Only 59.5% of participants were aware that bleeding from the nipple was a sign and only 45.2% were aware that pulling in of nipple was a sign of breast cancer (**Figure 4**), while about 82% were unaware that a nipple rash was a sign and 73% were unaware that a change in size of nipple was a sign of breast cancer. 74.8% of our subjects were aware that a lump in the breast is an ominous sign of breast cancer, while 64.8% of our subjects were unaware of breast skin colour change as a sign and 64.3% of our subjects were unaware that puckering/dimpling of breast skin as a sign of breast cancer. 1.9% of our subjects believed that nipple rash was not a sign of breast cancer and 5% of our subjects believed that breast skin colour change and change in size of nipple were not signs of breast cancer. Similarly,

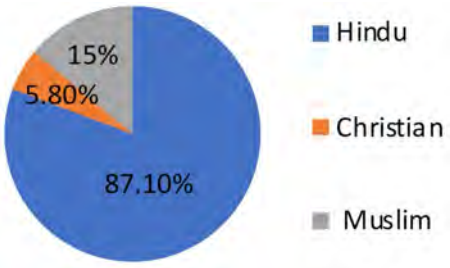

Figure 1. Religion distribution of participants.

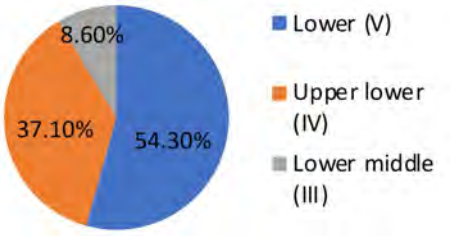

Figure 2. Socioeconomic status of participants.

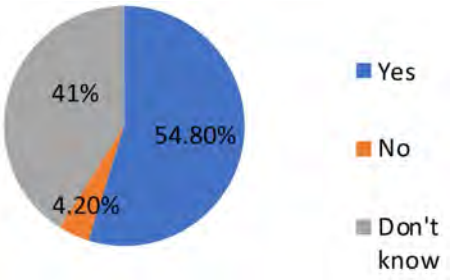

Figure 3. Pain in breast as a sign.

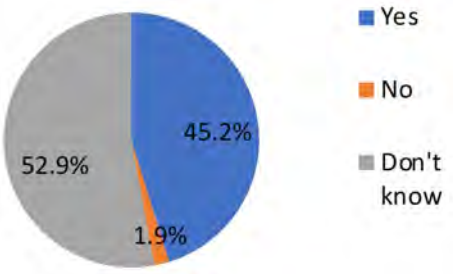

Figure 4. Pulling in of nipple as a sign.

3.3% of our subjects thought that change in shape of the breast was not a sign and 2.8% of our subjects thought that change in Size of the breast was not a sign of breast cancer.

When we analysed the barriers to screening and seeing medical care, we found that "embarrassment" was the most significant barrier, accounting for 35.2% (**Figure 5**). Also, 18.1% of our subjects felt that visiting the doctor would be expensive and that they cannot afford it while 74.8% of our subjects believed otherwise (**Figure 6**).

Table 1. Knowledge about warning signs and symptoms of breast cancer.

Variable	Yes (n)	Yes (%)	No (n)	No (%)	Don't Know (n)	Don't Know (%)
Change in position of nipple	70	33.3	0	0	140	66.7
Pulling in of nipple	95	45.2	4	1.9	111	52.9
Pain in breast	115	54.8	9	4.2	86	41
Puckering/Dimpling of breast skin	75	35.7	0	0	135	64.3
Abnormal discharge from breast	83	39.5	0	0	127	60.5
Bleeding from nipple	125	59.5	0	0	85	40.5
Lump in breast	157	74.8	0	0	53	25.2
Nipple rash	34	16.2	4	1.9	172	81.9
Breast skin colour change	69	32.9	5	2.3	136	64.8
Lump under armpit	73	34.8	1	0.4	136	64.8
Change in size of breast	69	32.9	6	2.8	135	64.3
Change in size of nipple	52	24.8	5	2.3	153	72.9
Change in shape of breast	71	33.8	7	3.3	132	62.9

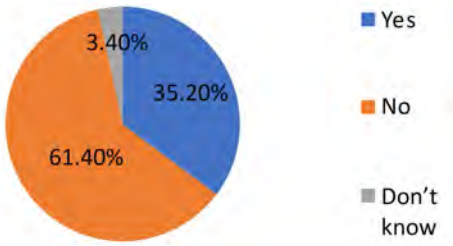

Figure 5. Embarrassment as a barrier.

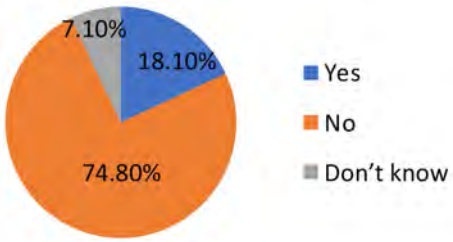

Figure 6. Financial constraints as a barrier.

The details of questions regarding various barriers are outlined in Table 2.

56.2% of our subjects felt that clinical examination of the breasts is the best test for cancer breast, but only about 41.4% of our subjects were aware that mammogram is the best test. Knowledge about the various treatment options for breast cancer was found to be variable. 53.3% of our subjects felt that treatment of cancer breast involved removal of the breast and 39% of our subjects felt the treatment involved removal of the breast lump. The details of questions regarding available diagnostic and treatment modalities are outlined in Table 3.

Table 2. Barriers to screening.

Variable	Yes (n)	Yes (%)	No (n)	No (%)	Don't Know (n)	Don't Know (%)
Embarrassed to go and see the doctor	74	35.2	129	61.4	7	3.4
Scared to go and see the doctor	29	13.8	174	82.9	7	3.3
Worried about wasting the doctors time	0	0	202	96.2	8	3.8
Find doctor difficult to talk to	13	6	187	89	10	5
Difficult to make an appointment with the doctor	0	0	197	93.8	13	6.2
Busy to make time to go to the doctor	0	0	206	98.1	4	1.9
Seeing the doctor would be expensive/not enough money	38	18.1	157	74.8	15	7.1
Difficult to arrange transport	48	22.9	151	71.9	11	5.2
Worried about what the doctor might find	15	7.2	191	90.9	4	1.9
Not feeling confident talking about symptoms	6	3	193	91.9	11	5.1
Significant people in life would not approve	6	2.9	187	89	17	8.1
Doctor would not understand the language	11	5	195	92.9	4	2.1
Doctor would not understand the culture	0	0	204	97.1	6	2.9

Table 3. Awareness of diagnosis and treatment modalities.

Variable	Yes (n)	Yes (%)	No (n)	No (%)	Don't Know (n)	Don't know (%)
Best test for Ca. Breast is clinical examination	118	56.2	3	1.4	89	42.4
Best test for Ca. Breast is mammogram	87	41.1	0	0	123	58.6
Mammogram is a painful procedure	21	10	8	3.8	181	86.2
Treatment for Ca. Breast is removal of the involved breast	112	53.3	1	0.5	97	46.2
Treatment for Ca. Breast is removal of the lump	82	39	1	0.5	127	60.5
Treatment for Ca. Breast is removal of the breast and radiotherapy	71	33.8	1	0.5	138	65.7

4. Discussion

This study was conducted to assess the awareness of breast cancer among women in a suburban area near Chennai.

When we studied the knowledge of our subjects about the warning signs and symptoms of breast cancer, we found that a lump in the breast is the most frequently identified sign by our subjects, followed by pain in the breast. These findings are quite consistent with the study done by Brijesh Sathian, *et al.* [2]. Majority of our subjects were also unaware of signs like lump under armpit, change in colour of breast skin.

When we analysed the various barriers to screening, the most frequently encountered barriers were embarrassment and unavailability of financial support which is supported by a study done by Kanaga, *et al.* 2011 [3]. Difficulty in Communication and Language was also reported as a barrier.

On studying the knowledge of our subjects about the screening methods and treatment options we found that more than 50% of our subjects felt that clinical

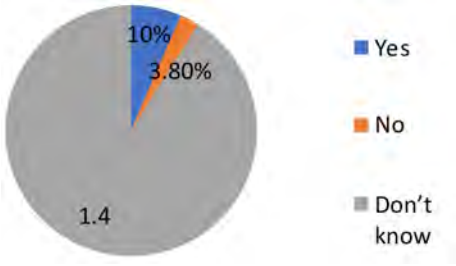

Figure 7. Mammogram is a painful procedure.

examination of the breasts is the best screening method and that the best treatment was removal of the involved breast. Also, 86.2% of our subjects thought that mammogram is a painful procedure (Figure 7).

Early breast cancer (EBC) constitutes only 30% of the breast cancer cases seen at different cancer centres in India whereas it constitutes 60 - 70% of cases in the developed world [4]. The incidence/mortality ratio of breast cancer in India is 0.48 [5]. A major factor for this high mortality is late diagnosis, as the majority of the patients present in advanced stages of the disease [6]. This is attributed to lack of awareness and also cultural taboos which make breast cancer a topic that is not freely discussed in India. The poor awareness about breast cancer is of concern and emphasises the need for increased awareness to be created amongst the population in general. Also, provision of subsidised mammograms to women at risk can be considered. Public health education programs can be initiated by the government and NGO's to generate awareness and also reduce fear, myths and misconceptions about breast cancer among the general population, with special focus on the rural and suburban areas. Breast cancer screening drives can be organised in PHCs in rural areas. Also, mobile breast cancer screening units can be made available for the benefit of women at risk who do not have access to other screening facilities.

5. Conclusion

In conclusion, we can infer from the present study that the women in Thandalam (suburban Chennai) show suboptimal awareness and knowledge of breast cancer warning signs, screening methods and treatment options. Immediate measures need to be implemented to build the capacity of women towards overcoming barriers and showing up for treatment.

6. Limitations of This Study

1) The sample size for a questionnaire-based study is small.

2) The women attending the surgical out-patient department of Saveetha Medical College and Hospital (SIMATS) may not be representative of the general population

Conflicts of Interest

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

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Appendix: Questionnaire

Section A: Sociodemographic Profile

Name: Age:

Religion: Hindu/Christian/Muslim/Others

Marital status: Married/Unmarried

Education of patient: Illiterate/Primary school Certificate/Middle school Certificate/High school certificate/Intermediate or Diploma/ Graduate/Professional

Education of head of family: Illiterate/Primary school Certificate/Middle school Certificate/High school certificate/Intermediate or Diploma/Graduate/ Professional

Occupation of patient: Unemployed/Elementary occupation/Plant & machine operators/Craft & related trade workers/Skilled agricultural or fishery workers/Skilled workers or shop & market sales workers/Clerks/ Technicians/ Professionals/Legislators or senior officials or Managers

Occupation of head of family: Unemployed/Elementary occupation/Plant & machine operators/Craft & related trade workers/Skilled agricultural or fishery workers/Skilled workers or shop & market sales workers/Clerks/Technicians/ Professionals/Legislators or senior officials or Managers

Total monthly income of the family (Rs):
< or = 6323/6327 - 18,949/18,953 - 31,589/31,591 - 47,262/47,266 - 63,178/63,182 - 126,356/ > 126,360

Socioeconomic status: Lower (V)/Upper lower (IV)/Lower middle (III)/Upper middle (II)/Upper (I)
Do you know anyone in your family/friends who has had breast cancer? Yes/No

Section B: Knowledge of Breast Cancer Symptoms

1) Do you think a change in the position of your nipple could be a sign of breast cancer?

a) Yes b) No c) Don't know

2) Do you think pulling in of your nipple could be a sign of breast cancer?

a) Yes b) No c) Don't know

3) Do you think pain in one of your breasts could be a sign of breast cancer?

a) Yes b) No c) Don't know

4) Do you think puckering or dimpling of your breast skin could be a sign of breast cancer?

a) Yes b) No c) Don't know

5) Do you think abnormal discharge from your breast could be a sign of breast cancer?

a) Yes b) No c) Don't know

6) Do you think bleeding from your nipple could be a sign of breast cancer?

a) Yes b) No c) Don't know

7) Do you think a lump in your breast could be a sign of breast cancer?

a) Yes b) No c) Don't know

8) Do you think a nipple rash could be a sign of breast cancer?

a) Yes b) No c) Don't know

9) Do you think if your breasts change skin colour, this could be a sign of breast cancer?

a) Yes b) No c) Don't know

10) Do you think a lump under your armpit could be a sign of breast cancer?

a) Yes b) No c) Don't know

11) Do you think changes in the size of your breast could be signs of breast cancer?

a) Yes b) No c) Don't know

12) Do you think changes in the size of your nipple could be a sign of breast cancer?

a) Yes b) No c) Don't know

13) Do you think changes in the shape of your breast could be a sign of breast cancer?

a) Yes b) No c) Don't know

Section C: Barriers to Screening

1) Would you be too embarrassed to go and see the doctor?

a) Yes b) No c) Don't know

2) Would you be too scared to go and see the doctor?

a) Yes b) No c) Don't know

3) Would you be worried about wasting the doctor's time?

a) Yes b) No c) Don't know

4) Would you find your doctor difficult to talk to?

a) Yes b) No c) Don't know

5) Would it be too difficult to make an appointment with the doctor?

a) Yes b) No c) Don't know

6) Would you be too busy to make time to go to the doctor?

a) Yes b) No c) Don't know

7) Would seeing the doctor be too expensive and you don't have enough money?

a) Yes b) No c) Don't know

8) Would it be too difficult to arrange transport to the doctors clinic?

a) Yes b) No c) Don't know

9) Would worrying about what the doctor might find stop you from going to the doctor?

a) Yes b) No c) Don't know

10) Would not feeling confident talking about your symptoms with the doctor would keep you from seeing him/her?

a) Yes b) No c) Don't know

11) Would significant people in your life (e.g. husband/wife, sibling, relative or friend) not approve of you seeing a doctor or nurse?

a) Yes b) No c) Don't know

12) Would your doctor not understand your language?

a) Yes b) No c) Don't know

13) Would your doctor not understand your culture?

a) Yes b) No c) Don't know

Section D: Investigations and Treatment Plan

1) The best test for cancer breast is clinical examination.

a) Yes b) No c) Don't know

2) The best test for cancer breast is a mammogram.

a) Yes b) No c) Don't know

3) Mammogram is a painful procedure.

a) Yes b) No c) Don't know

4) Treatment for cancer breast is removal of the involved breast.

a) Yes b) No c) Don't know

5) Treatment for cancer breast is removal of the lump.

a) Yes b) No c) Don't know

6) Treatment for cancer breast is removal of breast and radiotherapy.

a) Yes b) No c) Don't know

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Bradycardia Secondary to Negative Suction Pressure Applied to Chest Drain

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Abstract

Positive pressure generated in peritoneal cavity by gas insufflation during laparoscopic procedures can cause hemodynamic instability. There are a few case reports suggesting similar occurrences during thoracoscopic procedures as well. The mechanism behind the conditions above is explained to be due to stretch force applied to peritoneum and pleura which causes vagal stimulation. We wish to present a case where a high negative pressure applied to pleural cavity lead to treatment-resistant bradycardia. The possible mechanism behind this occurrence was traction pressure on pleura which triggered vagal activity. The bradycardia subsided on reducing or discontinuing negative suction pressure. To best of our knowledge this the first case report on bradycardia associated with high negative suction pressure applied to inter costal drain.

Keywords

Chest Drain, High Negative Pressure, Bradycardia, Pleural Traction, Vagal Stimulation

1. Introduction

Very often patients who present with Pneumothorax receive a surgical chest drain and many at times the chest drain doesn't cause complete resolution of pneumothorax. Not infrequently the cardio-thoracic team advises to connect the chest drain to a negative suction pressure. In one of our patient, application of negative suction to chest drain resulted in bradycardia. This bradycardia disappeared each time the negative suction pressure was reduced or discontinued. We wish to share our experience with readers with a case that happened in our Intensive Care Unit which we think occurred secondary to vagal stimulation.

Peritoneal gas insufflation during laproscopic procedures can cause hemody-

namic instability [1] [2]. There are a few reports suggesting similar occurrences during thoracoscopic procedures as well [3] [4]. This instability, which is often associated with bradycardia, is due to stretch force applied to peritoneum and pleura causing vagal stimulation [5].

In this case reported here, a high negative pressure applied to pleural cavity probably caused a traction on pleura which in turn triggered increased vagal tone mediated bradycardia.

2. Case

A 60-year-old female patient presented with Type 1 respiratory failure secondary to chest sepsis. Patient was a recently diagnosed with multiple myeloma and underwent chemotherapy for about 4 months (4 × 28 days cycle of Bortezomib, cyclophosphamide and dexamethasone) before admission to hospital. Initial X-ray chest (**Figure 1**) showed widespread consolidations.

Next day patient was intubated and ventilated due to worsening hypoxia and exhaustion. Arterial blood showed overall improvement in gas exchange. On Day 3, high airway pressures were noticed on ventilator and x-ray chest (**Figure 2**) was done which showed a right-sided pneumothorax. A surgical chest drain placed at that time. Patient remained cardiovascular stable with a reasonable gas exchange on arterial blood gas.

Serial arterial blood gases showed good gas exchange along with other parameters. Over next couple of days, her lung compliance got worse and the chest drain kept on bubbling air which pointed towards continuing air leak. A repeat X-rays (**Figure 3**) and a CT-thorax (**Figure 4**) thereafter showed persisting residual pneumothorax on the same side.

The case was discussed with cardiothoracic surgeons at nearby tertiary referral center and the explanation behind persisting pneumothorax was relatively stiff lungs patient had due to consolidations secondary to chest infection. They also advised to put chest drain under negative suction pressure of −1 KPa (kilo pascals).

Figure 1. X-ray of chest on admission showing widespread consolidations.

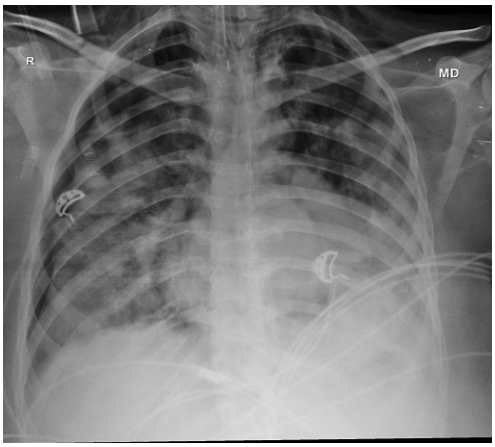

Figure 2. X-ray chest done on Day 3 showing a right-sided pneumothorax.

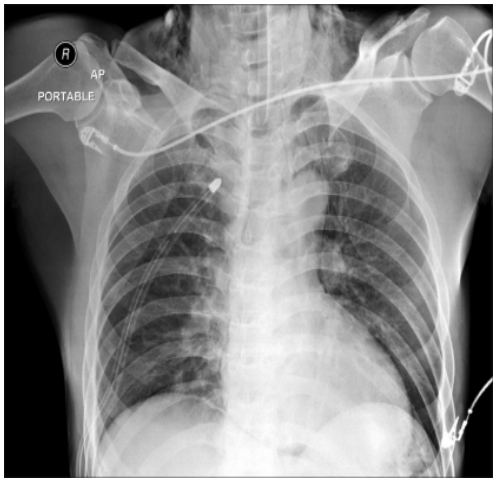

Figure 3. X-ray done after chest drain insertion showed residual pneumothorax on the right side.

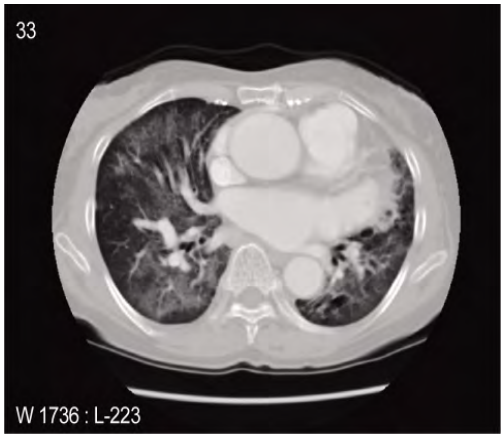

Figure 4. CT thorax done after chest drain insertion confirmed residual pneumothorax on right side and widespread lung consolidations.

An hour after applying negative pressure to chest drain patient started getting bradycardiac. A 12 lead ECG was done which showed sinus bradycardia and no other ST or T wave changes. Patient was reviewed by cardiologist and had emergency ECHO (reported as normal), the cardiologist didn't think of any coronary event (Troponin-i was negative) or any cardiac involvement secondary to multiple myeloma. All the relevant investigations were reviewed including radiological scans, arterial blood gasses, blood reports and they did not point towards any cause for resistant bradycardia.

As bradycardia required frequent boluses of atropine patient was rushed to cardiac.

Intervention lab: during transfer the chest drain was connected to a portable suction apparatus. On way to cardiac lab, the bradycardia resolved. But a temporary pacemaker was inserted as a precautionary measure and on reaching back to intensive care unit and attaching the original suction tubing to chest drain patient again started showing paced rhythms and remained fully pacing dependent for next 24 hours.

In the following days, the chest drain was manipulated on 3 occasions as it would stop swinging or bubbling. A CT scan of chest was considered but cancelled as patient was unstable for transfer to the scanner.

The next night patient continued to have tidal volume loss thru chest drain and on checking the suction pressure settings it was realized that the needle on suction pressure dial was stuck on −1 Kpa although the knob for pressure adjustment was turned to maximum. That means patient was on negative suction pressure much higher than advised. The suction apparatus was changed for a new one and the bradycardia as evident by receding pacing dependency resolved in few minutes.

The temporary pacemaker was removed the very next day and patient was extubated. The air leak resolved with significantly improved lungs and resolved pneumothorax as evident on x-ray chest.

As the case was of equipment malfunction, matter was referred the concerned department. This event was discussed with the unit consultant and was again brought up in morning handover, and again, in department's "mortality and morbidity" meeting.

When assessed to have mental capacity, the patient was informed about the sequence of events happened during the period, and the patient was sedated and ventilated. While patient was under sedation the family was kept updated, events and communications were documented promptly.

As an outcome of this incidence it was agreed to use the other wall-mounted suction apparatus as mentioned above for applying negative pressures to chest drain and to make it sure that suction settings as seen on dial are clearly visible as there is no alarm system and be recorded hourly against the target negative pressure as there is no provision for its automatic entry in "Electronic Patient System". The chest drain insertion is not an infrequent occurrence in intensive care unit and gets audited regularly and would include documenting negative

pressure level as well.

The overall impression is that the high negative suction pressure caused traction on pleura which lead to episodes of bradycardia which is quite similar to bradycardia seen during traction on peritoneum or viscera often encountered during laparoscopy or laparotomies [1] [2].

A standard surgical drain has 5 openings—one apical and other 4 on side walls. Due to high suction pressure probably all these openings got blocked by approximation of visceral and parietal pleura which formed a tight sleeve around them and also caused intermittent stopping of air bubbling through chest drain as happened on Day 4 which was perceived as chest drain being positional and not capturing the pneumothorax.

The formation of tight sleeve of pleura around the tube's opening is more pronounced when the drains tip is towards apex of pleura due to smaller intra-pleural volume as compared to middle and lower zones.

3. Review of Literature

Positive pressure generated in peritoneal cavity by gas insufflation during laproscopic procedures can cause hemodynamic instability [1] [2]. There are a few reports suggesting similar occurrences during thoracoscopic procedures as well [3] [4].

The mechanism behind the above conditions is explained to be due to stretch force applied to peritoneum and pleura causing vagal stimulation [5].

It is well known that stretching of hollow viscera and the body cavity linings trigger vagal response causing bradycardia and hemodynamic instability [6] [7] [8]. Both pleura and peritoneum can trigger vagal activity upon stretching [9]. In this case, the high negative pressure applied to pleural cavity probably caused a traction on pleura causing vagal mediated bradycardia. Other reasons could be due to effect of negative intrapleural pressure on the right and left ventricles [9]. Role of Bezold-Jarish reflex could be another underlying mechanism [10].

Learning point: A new onset bradycardia which has developed after applying excessive negative suction pressure to intercostal drain should raise the suspicion of vagal stimulation secondary to pleural traction when other causes have been ruled out; this case report intends to do the same.

It is advised to keep negative pressure applied to the chest drain at a lower value (−1 KPa was advised in our case), but variations are allowed as per the discretion of treating physicians and cardiothoracic surgeons on individual basis. The suction apparatus needs frequent testing and calibration by biomedical department.

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Conflicts of Interest

"Consent to publish" was obtained and was added to patient's clinical notes. The author declares that there are no competing interests.

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Fall Prevention Education Reduces the Falling Rate on the Osteoporosis Patients Treated with Zoledronic Acid

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Abstract

Objective: Falls are one of the most common direct causes of fractures which are major causes of morbidity and mortality in osteoporosis patient. There are many factors related to falls, by interfering of fall prevention education on the patients with osteoporosis, our study is to investigate whether fall prevention education can reduce the falling rate on the osteoporosis patients treated with zoledronic acid. **Methods:** A total of 178 eligible female patients who first visited our osteoporosis department during January 2016 to June 2017 were invited to participate in this study, and all participants were randomly divided into an observation group (92 cases) and an intervention group (86 cases). All patients were administrated zoledronic acid once and received a questionnaire survey about factors related to falls at the beginning and a year later. The patients in the observation group only received regular orders of adopting a healthy lifestyle while those in the intervention group received fall prevention assessment and education, and a telephone follow-up and reinforced fall prevention education a month after discharge. A year later, relevant data regarding the falls of each patient of both groups during the year and the data of the questionnaire survey were collected for intergroup comparison. **Results:** The difference of the improvement of fall risk factors between the two groups is statistically significant ($P < 0.05$), except the factor of diabetes without treatment. In the intervention group, 5.8% fell at least once, and 19.6% of the patients in the observation group reported the same during the year. Comparing the cases of falls of the two groups, the difference shows statistical significance ($P = 0.006$). **Conclusion:** For an osteoporosis patient treated with zoledronic acid, fall prevention education is an effective method to reduce the risk of falling, which would result in a lower risk of fractures

and a better prognosis.

Keywords

Fall, Prevention, Education, Osteoporosis, Zoledronic Acid

1. Introduction

Osteoporosis is a metabolic bone disease featuring low bone mass and microstructural deterioration of bone tissue, leading to an increased risk of fragile fractures that have high rates of fatality and disability and severely affect a patient's quality of life [1]. Falls are one of the most common direct causes of fractures. It is reported that in China, 21% - 23% males and 43% - 44% females of the community-dwelling population aged 65 and above fall at least once [2]. An osteoporosis patient is exposed to the risk of falling associated with such internal factors as age, and balance problems and underlying diseases caused by osteoporosis, as well as many external factors, like slippery footwear, a dangerous living environment, and intense exercise [3]. Multifaceted podiatric interventions, which include appropriate footwear and importantly patient education, may have the capacity to reduce falls in older adults [4]. Although the elderly perceived that fall could be avoided, they did not know how to prevent it. The intervention that focuses on environmental modification, balancing enchantment, and education on fall prevention is highly required [5]. This justifies the need to provide osteoporosis patients with fall prevention education along with medication. Clinical attention is paid to the treatment of anti-osteoporosis drugs, while the education of preventing falls is often ignored. This study aims at reducing the risk of falling posed to osteoporosis patients based on effective fall prevention education along with zoledronic acid treatment.

2. Materials and Methods

2.1. Clinical Materials

Clinical data of 178 female patients who first visited our osteoporosis clinic from January 2016 to June 2017 were collected. These patients were between the age of 50 to 80, with the mean age of 68.1 ± 9.0. Dual-energy X-ray absorptiometry (DEXA) was used to test each patient's bone mineral density (BMD) of the lumbar spine and the femur before making an initial diagnosis and the test results were considered diagnosis and inclusion criteria. Inclusion criteria: A patient was eligible for inclusion if 1) her bone mineral density T-score was no greater than −2.5 or the T-score was less than −1.0 with preexisting fragility fractures and definite systemic symptoms such as back pain or height loss; 2) she had never been administrated zoledronic acid before; 3) she was a clear-minded and right-thinking individual who agreed to participate in this study and signed the informed consent; 4) she demonstrated proven learning ability.

2.2. Methods

2.2.1. Overview

A total of 178 Eligible participants were randomly divided into an observation group (92 cases) and an intervention group (86 cases). All patients were administrated zoledronic acid once and received a questionnaire survey about factors related to falls at the beginning and a year later. The patients in the observation group only received regular orders of adopting a healthy lifestyle while those in the intervention group received fall prevention assessment and education. Combining with the results of the questionnaire survey, there is rectification guidance to the patients. Then there was a telephone follow-up and reinforced fall prevention education a month after discharge. A year later, relevant data regarding the falls of each patient of both groups during the year and the data of the questionnaire survey were collected for intergroup comparison.

2.2.2. Intervention Plan

1) Assessing Potential Risk Factors with the questionnaire for patients with osteoporosis which is shown at the end of the article.

2) Fall prevention education on the following risk factors to the intervention group, the contents of education are as follows.

Physiological factors: damaged or degenerative gait and functions of the balanced system, sensing system, central nervous system, or skeletal musculature.

Underlying diseases: neurological, cardiovascular, or eye diseases that may affect an individual's balanced system, stability, and physical coordination.

Medication and side effects: medication, dosage, and compound prescriptions possibly associated with a patient's fall(s), such as psychotropic drugs, cardiovascular drugs, hypoglycemic drugs, non-steroidal anti-inflammatory drugs (NSAIDs), antiparkinsonian agents, and dopamine drugs.

Psychological factors: dejection, depression of spirits, anxiety, and other mentalities that may increase the risk of falls and injury. A fear of falling will affect one's capacity, gait, and balance system, thereby increasing the risk of getting injured by a fall.

Environmental risk factors: dim light in a house, slippery/bumpy floor, a bed or another furniture at an inconvenient height, an inappropriate layout of furniture, no handrail in a bathroom, unfitting/slippery footwear, a lack of necessary walking aids, and rough roads in places that an individual visits a lot.

Social factors: a patient's educational background, living status (living alone or not), social communication ability, and social network.

3) Combining with the results of the survey, there is rectification guidance to the patients of intervention group as follows:

a) If your basis disease has not given treatment, you should go to see a specialist, and take the prescribed treatment.

b) If you are inconvenient to walk, you should use the auxiliary device.

c) If you can't see things clearly, you should wear glasses.

d) If your shoes are not appropriate and antiskid, you should wear appropriate

and antiskid shoes.

e) If the light is not bright enough at your home, you should replace the appropriate light tube.

f) If the floor of your house is not anti-skidding, you should use slip-resistant mats in and outside of bathroom to prevent slips and falls.

g) If there is no anti-skidding armrest in the toilet of your house, you should install the slippery armrest.

h) If your home bed is too high, and you are easy to fall down, you should adjust the height of your bed.

i) If the path that you often go out is not smooth, you should choose another safe route.

2.3. Effectiveness Evaluation

Telephone follow-ups were made to investigate the overall incidence of falls of each group in a year, and a comparative analysis was performed on this basis. The results of the questionnaire survey were used to compare the improvement of fall factors between the two groups after one year.

3. Statistical Analysis

The t-test was employed in 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. $P < 0.05$ indicates a difference of statistical significance.

4. Results

According to Table 1 and Table 2, there is no statistically significant difference between the two groups in age, bone mineral density, and underlying diseases and other fall factors according to the questionnaire for patients with osteoporosis ($P > 0.05$), which indicates a high degree of comparability.

As shown in Table 3, the improvement of fall risk factors of the observation group was relatively small; in contrast, the improvement of fall risk factors of the intervention group was obvious. The difference of the improvement of fall risk factors between the two groups is statistically significant ($P < 0.05$), except the factor of diabetes without treatment. In other words, fall prevention education can markedly improve the factors related to falls.

Table 1. Patients' general information.

	Observation Group	Intervention Group	P-Value
Number of Patients	92	86	
Age	68.5 ± 8.7	69.2 ± 9.2	0.564
BMD_{L2-4}	0.787 ± 0.119	0.797 ± 0.110	0.555
BMD_{hip}	0.603 ± 0.144	0.593 ± 0.092	0.580

Note: The age unit is year; BMD unit is mg/cm^2.

Table 2. Comparison of fall factors between the two groups.

	Observation Group (n/%)	Intervention Group (n/%)	X^2	P-Value
Nervous system diseases	18 (19.6%)	15 (17.4%)	0.133	0.716
Nervous system diseases without treatment	8 (8.7%)	9 (10.5%)	0.161	0.688
Cardiovascular diseases	32 (34.8%)	28 (32.4%)	0.098	0.754
Cardiovascular diseases without treatment	12 (13%)	11 (12.8%)	0.003	0.96
Diabetes	25 (24.5%)	26 (30.2%)	0.773	0.379
Diabetes without treatment	5 (5.4%)	4 (4.7%)	0.057	0.812
Inconvenient to walk and no auxiliary device	10 (10.9%)	8 (9.3%)	0.120	0.729
Visual impairment but no glasses	32 (34.8%)	27 (31.4%)	0.230	0.631
Unsuitable shoes	6 (6.5%)	7 (8.1%)	0.172	0.678
Unbright light	5 (5.4%)	3 (3.5%)	0.392	0.531
No anti-skidding floor	8 (8.7%)	10 (11.6%)	0.420	0.517
No anti-skidding armrest	30 (32.6%)	27 (31.4%)	0.030	0.862
Home bed too high	4 (4.3%)	6 (7.0%)	0.579	0.447
Unsmooth and unsafe rout	6 (6.5%)	7 (8.1%)	0.172	0.678

Table 3. Comparison of improvement of fall risk factors between the two groups after one year.

	Observation Group (n/%)	Intervention Group (n/%)	X^2	P-Value
Nervous system diseases without treatment	2 (25%)	7 (77.8%)	4.735	0.03
Cardiovascular diseases without treatment	2 (16.7%)	9 (81.8%)	9.763	0.002
Diabetes without treatment	2 (40%)	4 (100%)	3.6	0.058
Inconvenient to walk and no auxiliary device	3 (30%)	7 (87.5%)	5.95	0.015
Visual impairment but no glasses	4 (12.5%)	23 (85.2%)	31.171	0.000
Unsuitable shoes	1 (16.7%)	6 (85.7%)	6.198	0.013
Unbright light	1 (20%)	3 (100%)	4.8	0.028
No anti-skidding floor	1 (12.5%)	8 (80%)	8.1	0.004
No anti-skidding armrest	2 (6.7%)	17 (63%)	20.267	0.000
Home bed too high	0 (0%)	5 (83.3%)	6.667	0.01
Unsmooth and unsafe rout	0 (0%)	4 (57.1%)	4.952	0.026

As shown in Table 4, the observation group has an incidence of falls of 19.6% during the year; in contrast, the incidence of falls of the intervention group is 5.8%, considerably lower than that of the observation group. The difference between the two groups is statistically significant ($P < 0.05$). In other words, fall

Table 4. Comparison of the two groups' incidence rates of fall events in a year.

	Non-Falling Cases	Falling Cases	Incidence of Falls
Observation Group	74	18	19.6%
Intervention Group	81	5	5.8%

Note: The incidence rates of falls in the two groups are examined by the chi-squared test and the result is $X^2 = 7.47$, and $P = 0.006$.

prevention education can markedly reduce the incidence of falls in elderly patients with osteoporosis who are treated with zoledronic acid.

5. Discussion

As population aging advances, age-related osteoporosis has become a common disease. Against this backdrop, treatment for osteoporosis that increases bone mineral density and reduces the risk of fractures has been heatedly discussed by the mass [6]. Falls act as an independent risk factor of osteoporotic fractures, and fall prevention is considered as an effective method to remarkably lower the incidence of fractures [7]. There are foreign studies reporting that 30% - 40% of the community-dwelling population aged 65 and above in their countries fall at least once every year, and nearly 50% of these individuals fall more than once. In China, up to 41% of the elderly fall more than once a year [8]. Falls in the elderly are a major health problem due to their traumatic and psychosocial complications which may lead to a loss of autonomy and a state of dependency [9]. Accidental falls are a leading cause of injury and death in older adults. Most hip fracture survivors do not regain their former levels of activity or mobility and so are at increased risk of further falls [10]. Osteoporotic proximal femoral fractures associated to falls are a major health burden in the ageing society. In the UK, fragility hip fractures cost NHS approximately £1.1 billion [11]. So falls prevent eduction is very important for the osteoporosis patients, which is in order to reduce the incidence of falls and thus reduce the risk of fracture.

Since there are a great variety of risk factors related to fall events, including both internal and external ones, a fall prevention program should offer elaborate and feasible education to minimize the risk of falls and injury. Considering that an osteoporosis clinic mainly provides services for elderly patients having slow reflexes and varied underlying diseases, detailed professional fall prevention education is required in addition to the order of developing a healthy lifestyle during a consultation. Also, careful rectifications are recommended to protect the patients from relevant risk factors; to this end, a specific rectification plan should be formulated for effective implementation. In this study, factors related to fall which were easy to be improved and also were very important were selected for intervention. The result shows that proper intervention to prevent fall events through education can promote rectifications and reduce the incidence of falls. Comparing to the observation group, the intervention group has a significantly lower incidence of falls, which indicates

favorable outcomes of fall prevention education. Yet, it should be noted that a lower incidence rate was reported by the observation group compared to other studies. This is probably because the anti-osteoporosis drug helps increase bone mineral density and improves the balance system. Zoledronic acid is a third-generation bisphosphonates medication. In Lin et al., it is demonstrated that zoledronic acid, as a once-yearly infusion, has notably increased the bone mineral density (lumbar spine +5.8%; femoral neck +2.9%; Ward's triangle +5.2%; trochiter +5.3%; total hip +3.9%) and reduced the risk of fractures in postmenopausal osteoporosis cases [12].

As prevention is better than cure, health education makes an essential part of clinical nursing. A pertinent, goal-oriented program can help patients broaden their knowledge of healthcare and encourage a shift towards healthy behaviors and a change in lifestyle for their own good, thereby preventing diseases, promoting recovery, highlighting the humanistic spirit, and improving doctor-patient communication [13]. Fall prevention education is an osteoporosis patient-dedicated program that effectively reduces the incidence rates of falls and fractures. Combining anti-osteoporosis drugs, it helps improve patient compliance and prognosis [14].

6. Limitations

The use of a randomized control group may bring a bias to the statistical results because the underlying diseases are less controllable. The answers to the questionnaires used in the study depend on the subjective factors of the patients may be deviations from the results of the study. There are so many factors related to fall that can't all be involved, which may influence the results of the study.

7. Conclusion

Falls are one of the most common direct causes of fractures which are major causes of morbidity and mortality in osteoporosis patient. Reducing the incidence of falls can reduce the incidence of fracture in patients with osteoporosis. There are many factors related to falls, in this study, factors which were easy to be improved were selected for intervention. The result shows that fall prevention education significantly improves the factors related to falls and lowers the incidence of fall events occurring to elderly patients with osteoporosis. A treatment plan including a comprehensive health education program is cost saving and efficacious, thus worth promotion and publicity among osteoporosis clinics. The study reminds medical and nursing staff to pay attention to the education of preventing falling.

Conflicts of Interest

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

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Questionnaire for Patients with Osteoporosis

Name: gender: age:
Contact number: group:

1) Do you have any underlying diseases as follow?
A) Nervous system diseases, such as stroke, Parkinson's dizziness.
B) Cardiovascular diseases, such as hypertension, heart failure.
C) Diabetes.

2) If there are any of the diseases above, is it given specialist treatment?
A) Yes. B) No.

3) Are you convenient to walk? Do you need to use the auxiliary device?
A) Yes, I am convenient to walk, do not need to use the auxiliary device.
B) No, I am inconvenient to walk, and have used the auxiliary device.
C) No, I am inconvenient to walk, but don't want to use the auxiliary device.

4) Do you see things clearly? Do you need to wear glasses?
A) Yes, I can see things clearly, and do not need to wear glasses.
B) No, I can't see things clearly and have worn glasses.
C) No, I can't see things clearly, but I don't want to wear glasses.

5) Do you wear appropriate and antiskid shoes?
A) Yes. B) No.

6) Is the light bright enough at you home?
A) Yes. B) No.

7) Is the floor of your house anti-skidding?
A) Yes. B) No.

8) Is there any anti-skidding armrest in the toilet of your house?
A) Yes. B) No.

9) Is your home bed too high, and you are easy to fall down?
A) Yes. B) No.

10) Is the path that you often go out smooth? Do you often fall down while you go out through the path?
A) Yes, it is smooth.
B) No, it is unsmooth, and I often fall down while I go out through the path.

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Improving Health Care Efficiency with Lower Cost Services

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Abstract

This study described Subacute and Complex Care Programs developed by the Syracuse hospitals to reduce the expenses of extended hospital stays. They focused on the movement of patients for services such as dialysis and complex care. These programs involved costs of approximately $7100 to $10,600 per patient compared with $12,600 to $25,000 per patient for extended stays in hospitals. The study also suggested that substantial savings were generated in the service area of the Syracuse hospitals by reducing inpatient adult medicine and adult surgery hospital rates. The annual savings for these services were substantial, $4,600,000 for 2017 when compared with 2011.

Keywords

Hospitals, Nursing Homes, Health Care Expenses

1. Introduction

Historically, health care expenses have been a major concern for governments, businesses, and individuals in the United States and elsewhere. These expenses have consumed an increasing proportion of national income. Addressing these expenses has been a challenge for the public and private sectors of the economy [1].

Recently, attention concerning health care expenses has begun to focus on the price of care. It has been demonstrated that prices and expenses for health care in the United States are substantially higher than in other developed nations [2] [3] [4].

This discussion concerning health care costs has included a recognition that these expenses will be difficult to reduce. Because health care is a labor-intensive process, it would include reducing large numbers of staff from provider and payer organizations [5].

During the past several decades, numerous efforts to reduce health care costs by shifting expenses among providers have been evaluated. It has been suggested that these initiatives have potential for limiting the actual costs of care [6] [7].

Many efforts to address health care expenses have involved shifting utilization from high-cost providers such as hospitals. It has been suggested that this approach could limit the use of high-cost services and reduce expenses by moving some services to less costly settings such as long term care and ambulatory care [8] [9].

Shifting health care expenses from hospitals to nursing homes has been useful because it includes the opportunity to address patients who require high-cost inpatient care. They include medicine patients who require extended hospitalization for medications and surgical patients who need wound care. They could also include patients with low severity of illness who have been admitted for inpatient care.

In the United States, programs that involve shifting health care expenses to less costly providers have been developed within communities. Because health care is delivered at this level, it offers opportunities for reducing expenses and improving outcomes of care.

2. Population

This study identified examples of approaches to shifting health care from hospital inpatient to other settings of care in the metropolitan area of Syracuse, New York. This area includes three large acute care hospitals, Crouse Hospital (19,611 inpatient discharges excluding well newborns, 2018), St. Joseph's Hospital Health Center (25,394 inpatient discharges, 2018), and Upstate University Hospital 32,877 inpatient discharges, 2018).

The Syracuse hospitals provide primary and secondary acute care to an immediate service area of approximately 600,000. They also provide tertiary services to the eleven county Central New York Health Service Area with a population of 1,400,000. The largest population within this area, 365,763, includes Onondaga County and the City of Syracuse. Counties adjacent to Onondaga include an additional population of 248,508. Counties in the rest of the Central New York Region include a population of 510,310.

Historically, the Syracuse hospitals have worked to improve the efficiency and outcomes of care through a number of approaches. These have included efforts to reduce inpatient lengths of stay and admissions through cooperation with local long term care providers. They have also included support for ambulatory care services through medical observation, ambulatory surgery, and other forms of outpatient care. A number of these efforts have been developed through the Hospital Executive Council, a joint planning organization of the hospitals [10].

3. Method

This study reviewed examples of efforts to improve the efficiency of inpatient

care through substitution of services in the metropolitan area of the Syracuse hospitals. These examples addressed inpatient lengths of stay and admissions/discharges.

During the past several decades, the reduction of inpatient lengths of stay has been a priority of the hospitals because of their impact on organizational expenses. Extended inpatient stays have contributed to health costs through expenses for labor, pharmaceuticals, and tests. Limiting stays have included reduction of these important costs.

Efforts to reduce inpatient stays in the Syracuse hospitals have included shifting portions of inpatient stays to nursing homes and other long term care providers. Nursing homes have offered an opportunity for this process because they provide 24-hour, seven-day care. As a result, they can support extended care for patients who cannot be discharged home.

To address this need, the Syracuse hospitals developed the Subacute and Complex Care Programs through cooperation with area long term care providers. Each of these programs involved shifting some portion of extended inpatient care from hospital to long term care settings.

The Subacute Patient Transportation Program involved movement of patients requiring offsite dialysis from hospital inpatient to nursing home settings. Because existing health care payers did not support the costs of this transportation, most of it was provided by the hospitals.

The Complex Care Programs involved movement of portions of extended inpatient therapies from hospital to nursing home settings. These therapies included intravenous antibiotic care for infections and other conditions. They also addressed extended wound care. The costs of some of these services, including medications, wound care, and other therapies, were provided by the hospitals to the nursing homes through the Hospital Executive Council.

This study identified the impact of these services on inpatient lengths of stay in the Syracuse hospitals during a fourteen-year period. It identified changes in stays and the estimated inpatient expenses saved through this process. Data for this analysis were generated by the Hospital Executive Council.

The Syracuse hospitals have also improved the efficiency of care through limitation and reduction of inpatient admissions. This process has involved the major inpatient services, adult medicine and adult surgery.

Limitation of admissions for adult medicine, the largest inpatient service, has included the use of medical observation to shift short-stay inpatients to outpatient care. It has also included efforts to support additional ambulatory care services. These efforts have resulted in a reduction in the rate of increase of adult medicine admissions/discharges in the hospitals.

For adult surgery, this activity has included the continued development of ambulatory surgery services by hospitals and other providers. This activity has also included shifting some inpatient procedures for relatively healthy patients to ambulatory settings. The programs have resulted in a reduction in inpatient surgery discharges in hospitals.

This study identified the impact of limitation and reduction of inpatient adult medicine and adult surgery admissions in the service area of the Syracuse hospitals between 2011 and 2017. Data for this component of the study were obtained from the New York State Planning and Research Cooperative System (SPARCS). This impact was identified through numbers of inpatient admissions/discharges and through discharges per 1000 resident population.

4. Results

The initial component of the study focused on programs that improved the efficiency of health care by shifting services from inpatient hospitals to nursing homes in the service area of the Syracuse hospitals. Relevant data are summarized in Table 1.

This information includes the utilization of services that were moved from the end of acute care stays to long term care facilities. This process was supported by Program Development Funds provided by the Syracuse hospitals through the Hospital Executive Council. For each service, the expenses of care in the nursing homes combined with the Program Development Funds were considerably lower than the expenses of maintaining these patients in acute hospitals.

Patients for the Subacute and Complex Care Programs were selected by hospital case management staff in cooperation with nursing home admission staff. This process included evaluation of patient needs, Subacute and Complex Care Program resources, and nursing home capabilities.

The most basic of these services was the Subacute Offsite Services Program. This effort focused on patients who remained in hospitals for extended periods because of the need for dialysis and other acute care services. These patients were not candidates for discharge home. Through the program, the Syracuse hospitals provided funds for transportation to dialysis and other services so that these patients could be discharged to long term care facilities, rather than remaining in hospitals. The expenses of this program, approximately $1800 plus

Table 1. Long Term Care Subacute & Complex Care Programs, Syracuse Hospitals, 2004-2018.

	Number of Patients								Total Program Development Funds
	2004	2006	2008	2010	2012	2014	2016	2018	
Offsite Services	-	-	15	27	13	24	41	66	$319,650
IV Medications	72	60	54	40	39	40	-	-	$228,750
Enhanced Medications	-	-	22	14	9	34	11	-	$113,050
Extended Wound Care	-	18	9	7	7	19	2	-	$124,000
Complex Care Programs	-	-	-	-	-	7	23	45	$324,600
Total	72	78	100	88	68	124	77	111	$1,110,050

Source: Hospital Executive Council.

$5300 for nursing home reimbursement per patient, were much less than those of several weeks of additional acute care. The Program is still in operation.

Additional Subacute Programs developed in Syracuse focused on Program Development Funds to reduce hospital stays by moving services from the end of stays in acute hospitals to stays in nursing homes. These programs included funds for intravenous medications, other medications, and extended wound care. The Program Development Funds enabled the hospitals to discharge these patients sooner and the nursing homes to support what would have been the last weeks of their acute care stays.

The additional Subacute Programs included support from the Syracuse hospitals for Intravenous Therapy, $750 per patient, Enhanced Medications, $1256 per patient, and Extended Wound Care, $2385 per patient. For each patient, an additional $3200 would be required for nursing home reimbursement. These expenses were considerably lower than those of maintaining these patients in acute hospitals for several weeks, approximately $12,000 per patient. Eventually, these services were supported completely by the nursing homes and the Subacute Programs were phased out.

The services moved from acute care in the Syracuse hospitals to nursing homes in the community also included Complex Care. Most of these services involved extended care for high-cost medications such as meripenum and daptomycin. The high costs of these medications made it necessary for nursing homes to obtain additional support in order to provide them. The hospitals generated this support through Program Development Funds.

Since implementation in 2014, the Complex Care Programs have cost $4328 in Program Development Funds plus an additional $6300 in nursing home reimbursement cost per patient. These expenses were considerably lower than those of extended stays in acute hospitals would have been, approximately $12,600 - $25,000 per patient. The Complex Care Programs are still in operation.

The increase in efficiency supported by the Subacute and Complex Care Programs was associated with a reduction in adult medical/surgical stays in the Syracuse hospitals from 5.43 to 5.04 days between 2004 and 2018. This reduction in stays resulted in the elimination of 23,000 patient days or an average daily census of 63.

The second component of the study focused on limitation of hospital inpatient adult medicine and adult surgery admissions/discharges per population. Relevant data are identified in Table 2.

This information demonstrated that, between 2011 and 2017, resident inpatient adult medicine and discharges declined in the immediate service area of the Syracuse hospitals, Onondaga County. This reduction amounted to 920 discharges or 3.9 per 1000 resident population. This reduction saved approximately $4,600,000 in health care expenses related to these admissions and discharges between 2011 and 2017.

The data also indicated that, by 2017, adult medicine and adult surgery discharges for Onondaga County were 3.4 per 1000 population lower than in the

Table 2. Resident inpatient hospitalization per 1000 population, medical/surgical discharges, New York state metropolitan areas, 2011-2017.

	2011		2013		2015		2017	
	Number of Discharges	Discharge Rate per 1000 Population	Number of Discharges	Discharge Rate per 1000 Population	Number of Discharges	Discharge Rate per 1000 Population	Number of Discharges	Discharge Rate per 1000 Population
Resident County								
Capital District (Albany, Schenectady, Rensselaer)	40,683	83.6	35,397	72.2	43,780	88.4	48,994	98.5
Erie County (Buffalo)	67,269	93.9	70,233	98.6	66,614	90.9	71,707	97.6
Monroe County (Rochester)	58,315	101.5	53,761	93.2	53,283	90.9	57,933	98.6
New York City (5 Burroughs)	672,497	104.9	628,873	97.5	610,212	90.0	608,803	88.9
Oneida County (Utica)	23,142	126.4	20,899	113.9	20,910	114.9	21,455	118.0
Onondaga County (Syracuse)	35,555	99.0	34,536	95.7	35,058	96.2	34,635	95.1

Data exclude obstetrics (APR DRGs 540-566), neonates (APR DRGs 580-640), mental health/substance abuse treatment (APR DRGs 740-776), rehabilitation (APR DRG 860), and all patients aged 0 - 17 years. Sources: New York Statewide Planning and Research Cooperative System (SPARCS) (resident discharges); Cornell Population Projections (May 2019) (population).

Capital District, 2.5 per 1000 population lower than in Erie County, 3.5 per 1000 population lower than in Monroe County, and 22.9 per 1000 population lower than in Oneida County. This information indicated that the lower admission/discharges rates in the Syracuse area were responsible for a savings of $833,000 - $2,457,000 compared with the other areas.

The data also indicated that the 2017 rates in Syracuse were 6.2 per 1000 population higher than those in New York City. Discharge rates per 1000 population in New York City also declined between 2011 and 2017.

Data collected by the Hospital Executive Council indicated that adult medicine discharges per population in the Syracuse area declined because of the impact of medical observation programs and use of ambulatory care services. For the combined hospitals, medical observation programs accounted for 24 - 26 percent of observation and adult medicine inpatients combined. The use of ambulatory care and primary care services has increased in recent years as a result of competition among the hospitals.

The Syracuse hospitals have used ambulatory surgery programs to limit adult surgery discharges for more than forty years. The ambulatory surgery program at Crouse Hospital was one of the first in the nation. Utilization of these programs continues to increase.

5. Discussion

Health care expenses continue to challenge providers and payers in the United States and elsewhere. Recent literature has demonstrated that the prices of care may constitute much of the problem. The magnitude of the issue suggests that progress in this area will be slow.

An alternative approach to reducing health care expenses may be the substitution of lower-cost services by health care providers. Much of the expenses generated by health care providers come from high-cost services such as inpatient hospital care. Shifting a portion of these expenses to less intense settings has the potential for reducing the costs of care.

This study reviewed examples of approaches to this process at the community level in the metropolitan area of Syracuse, New York. They involved provider-driven programs developed and implemented at the community level. This study was limited to these specific approaches.

The Subacute and Complex Care Programs were developed by the Syracuse Hospitals and the Hospital Executive Council to reduce the expenses of extended hospital stays that are currently provided in hospitals. They focused on movement of patient days for services such as dialysis, intravenous therapy, and expensive medications from inpatient acute care to nursing homes.

These programs involved costs of approximately $7100 - $10,600 per patient compared with costs of $12,600 - $25,000 for extended stays in hospitals. The savings were generated by reducing high-cost stays and were realized by the sponsoring provider hospitals.

The study suggested that substantial savings were generated in the service area of the Syracuse hospitals by reducing adult medicine and adult surgery inpatient hospitalization rates. These savings were produced through the implementation of medical observation and ambulatory care programs for adult medicine patients and ambulatory surgery programs for adult surgery patients.

The annual savings generated by reduction of hospitalization for these services were substantial, $4,600,000 for 2017 compared with 2011. They were realized by the payers who otherwise would have sponsored the inpatient admissions that were avoided.

These programs for reducing health care expenses involved a less comprehensive alternative for reducing prices in this sector of the economy. This approach may have greater potential for implementation by providers and their communities.

Conflicts of Interest

The authors declare there are no conflicts of interests regarding this paper.

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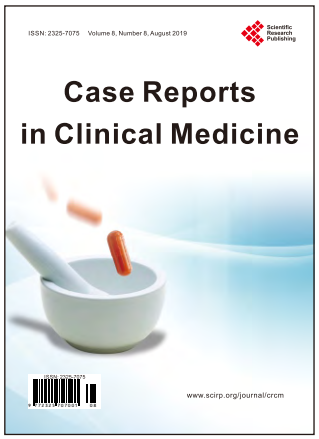

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