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Tandem walking exercises to improve balance and reduce the risk of falls in elderly people with dementia

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ABSTRACT

An elderly person will experience a decline in bodily functions, marked by reduced hearing ability, deteriorating vision, and a decrease in muscle strength, which causes slower movements and hampers daily activities. The aim of this study is to provide tandem walking therapy to reduce the risk of falls due to dementia in the elderly at Nishihara Keiaien, Japan. The method used is a case study involving several stages of the nursing care process, starting from assessment, diagnosis, intervention, implementation, and evaluation. The nursing diagnosis was a risk of falling related to balance disorders. The assessment results revealed subjective data of the patient complaining of soreness and fatigue, and objective data including decreased muscle strength, balance disturbances, and changes in cognitive function associated with dementia. Based on this assessment, the nursing diagnosis of risk of falling was established. The nursing intervention provided was ambulation support through tandem walking therapy for approximately 10–15 minutes over 5 days. After evaluation, it was found that the nursing problem of fall risk related to decreased muscle strength had not yet been fully resolved due to age factors, although there was an improvement in muscle strength scores. The outcome of this study, as aligned with national journals, is to improve physical mobility and enhance balance in the elderly.

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1. Introduction

Aging is a life phase that every living being, especially humans, will inevitably experience. This process is unavoidable. A person is considered elderly when they are over 60 years old. According to WHO data, the number of elderly people in Southeast Asia has reached 142 million or about 8% of the total population. This number showed a significant increase in 2020, with the elderly population reaching 28.8 million or around 11.34% of the total population. It is estimated that this number will triple by 2050.

Japan is one of the 65-year-old countries in the world. According to the 2019 world population forecast data, Japan, published by the United Nations, is the highest priority in Japan, with the highest proportion of elderly people at 28.2%. In October 2018, the Japanese government recorded Japan's population of up to 17.6 million between the ages of 65 and 7, or a total population of about 13.9°. Meanwhile, the population at the age of 75 is 17.98 million or a total population of 1.2°. This number is expected to continue to grow to more than 2.6 people, aged 65 and over by 2065 (Handayani & Iskandar, 2021).

Dementia is a general disorder of intellectual functioning that includes Alzheimer's, Lewy body disease, frontal temporal dementia and vascular dementia(Haiga & Chaniago, n.d.). Symptoms that can occur in dementia include: a) Cognitive dysfunction, b) Psychological and behavioral disorders such as apathy, depression, agitation, aggression, wandering, c) Sleep disorders d) Psychotic symptoms (delusions with/without hallucinations)(Chahyani & Hastuti, 2021).

The decline in physical abilities such as weakened muscles, balance disorders, and reduced vision and hearing functions can interfere with the elderly's daily activities and increase the risk of falls. Falling is one of the most common health problems among the elderly and can lead to limited mobility, injuries, and even death. Although approximately 75% of falls do not result in serious injury, in the elderly, falls can cause dependence and disability. About 5% of falls result in fractures, commonly occurring in the hip, pelvis, upper arm (humerus), or wrist. One major cause of vulnerability to falls in the elderly is osteoporosis, a condition where bones become brittle and break easily. However, it is important to note that falls do not only occur in the elderly but can also happen to children, individuals with special needs, and even healthy people (Lilyanti et al., 2022).

Falling is an impact that can occur due to balance disorders, which as a result of the fall can result in quite fatal injuries such as broken bones and spinal fractures, causing limitations in activities (Febri Arifiati et al., 2023).

Falls in older adults can have serious effects ranging from minor injuries to disability. Disability is an impairment characterized by difficulties, which prevent daily activities. As we age, the risk of falls can be fatal. Injuries caused by decreased body function in older adults are a major cause of pain, disability, loss of independence and premature death. Falls are the most common cause of hospitalization for older adults related to trauma, resulting in traumatic brain injury and orthopedic damage such as hip, forearm and upper arm joints (Suparyanto dan Rosad, 2022). The capacity to maintain posture in both static and dynamic situations is known as balance, and it is associated with the interplay of peripheral and central elements, including muscles, motor output, vestibular sensation, somatosensory perception, and vision. These variables will drastically decline with age, impacting older people's mobility and functional capacities and raising their chance of falling itself (Iswati, 2021).

There are two types of risk factors for falls in the elderly: extrinsic and intrinsic variables. Fall history, age, gender, readiness for living alone, medications, health issues, sedentary habit, walking and mobility impairments, psychological state, nutritional inadequacies, cognitive disorders, vision impairments, and foot issues are examples of intrinsic variables. Physical activity and body mass index (BMI) are other inherent factors. Environmental conditions, clothing and footwear choices, and the use of improper walking aids or support gadgets are examples of extrinsic variables (Mustafa et al., 2022).

In Indonesia, the incidence of falls in the elderly is reported to be 17%. The prevalence of fall injuries in the population aged over 55 years in Indonesia reaches 49.4%, while in the elderly over 65 years, the number of fall injuries is higher, namely 67.1%. The incidence of falls that occur in the elderly in the community increases every year, from 25% at the age of 70 years to 35% after the age of over 75 years (Fitri et al., 2022).

Tandem walking is a balance training method carried out by walking along a straight line, where the heel of the front foot touches the toes of the back foot alternately. This exercise is usually done for a distance of 3 to 6 meters and aims to strengthen lateral postural balance, which is crucial in reducing the risk of falls, especially in the elderly. Body balance is influenced by several systems, namely the sensory system, the vestibular system, and the visual system. Tandem walking exercises help train and strengthen all three systems. In addition, this exercise also enhances coordination between muscles and body movements, thereby helping to minimize the musculoskeletal weakening that often occurs in the elderly. In a case study by Gemini (2022) at Panti Werdah Sukacita, tandem walking exercise was implemented and proved effective in reducing the risk of falls among the elderly. This was evidenced by a decrease in the "Timed Up and Go Test" (TUGT) result from 25 seconds to 18 seconds after routine exercises were performed over seven days. Thus, this nursing intervention can be maintained as it has proven helpful in increasing patient independence (Gemini, 2022).

Stating that tandem walking can increase dynamic balance and decrease fall risk in the 74–90 age range. This exercise can improve the lateral postural balance, which is useful in reducing the risk of falls in the elderly. It is performed by moving in a single straight position while the heel of the foot is approaching another toe that is at least three meters apart (Mualif & Wirawati, 2021).

Walking therapy is also a form of physical activity that can reduce stress, by providing walking therapy, especially outdoors and with the sense of sight that views the natural environment around it can provide comfort, this will really help reduce stress levels in the elderly (Sonhaji & Agesti, 2021).

Some other nursing interventions that nurses can take for cases of fall risk include conducting a Morse Fall Scale assessment which aims to provide safety to patients and prevent patients from falling. The actions of this MFS assessment include installing a yellow fall risk patient identification bracelet on the hand, installing a fall risk triangle sign on the bed, adjusting the height of the bed so that it is not too high, and ensuring that the safety rail on the bed is properly installed (Fauziah et al., 2019).

As healthcare professionals providing nursing care, nurses play a vital role in anticipating and preventing fall incidents, whether they cause injuries or not. This role is carried out through initial and ongoing assessments of fall risk in patients, including potential risks related to medication schedules, and by taking appropriate steps to minimize all identified risks (Chotimah, 2021).

In addition to having an effect on the hospital, the losses brought on by a fall incidence may result in unforeseen circumstances including physical and psychological harm. In an effort to reduce the risk of falls, nurses use the Morse Fall Score (MFS) to analyze their work performance in relation to their responsibilities for adherence to standard operating procedures (Nurhayati et al., 2020).

A research study conducted at Iryou Houjin Fukujukai Nishihara Keiaien in Japan found that 75% of the elderly population experienced fall risk as a nursing problem, which necessitates proper management or intervention to prevent falls. This study implemented tandem walking therapy using a specified procedure, which involved offering a guiding hand to the elderly and assisting them in walking for approximately 5–10 minutes, three times daily. After seven days of this exercise regimen, there was visible improvement in leg muscle strength and overall body balance among the elderly participants. This tandem walking therapy is a very effective intervention to be carried out because of the rapid increase in balance from the patient who initially often used a wheelchair but after being given tandem walking training the patient walked more often, this tandem walking training also provides several other benefits such as a sense of happiness like a recreation for the elderly because they can walk, and can increase the enthusiasm for life of the elderly.

2. Method

Type and Design of Case Study

This article uses a descriptive study design aimed at providing a detailed overview of nursing risks in elderly care, specifically in efforts to improve balance through walking therapy. The implementation of this case study includes the assessment process carried out through interviews, observations, and physical examinations. The data obtained is then used to develop a nursing care plan, determine nursing diagnoses, design interventions, implement nursing actions, and evaluate the outcomes of the provided nursing care.

Case Study Subject

The case study subject is Mrs. T, a 99-year-old patient diagnosed with a nursing problem of fall risk, with a focus on improving balance through walking therapy. The following criteria were used to determine the study subject:

a. Inclusion Criteria, Characteristics of the research subject that met the established criteria included: (a) Elderly patients with dementia at Iryou Houjin Fukujukai Nishihara Keiaien, Japan. (b) Elderly patients with dementia who experience balance disorders and are at risk of falling. (c) Elderly patients with dementia who require assistance when walking and performing other activities.
b. Exclusion criteria, consists of situations where the subject of the study is unable to complete the sample because it does not meet the criteria for the study, which is caused by, among other things, the respondent's (Tengah, 2024). In this case study, the exclusion criteria include: (a) Elderly people

at risk of falling who are on bed rest, (b) Elderly people who are still able to carry out activities independently.

Focus of the case study

The focus of this case study is to fulfill the need for improved balance in the elderly through walking therapy.

Time and place of case study implementation

This case study was conducted individually at a nursing home for elderly individuals with dementia at Iryou Houjin Fukujukai Nishihara Keiaien in Okinawa, Japan, over a period of five days, from February 16 to 20, 2024. Tehnik pengumpulan data.

a) Interviews, were conducted in the initial assessment stage to collect subjective data, including the patient's complaints and medical history.

b) Observation and Physical Examination, were conducted to monitor patients with fall risk nursing problems, including daily activities and health developments. Physical examinations were carried out to collect objective data, ranging from vital signs to head-to-toe assessments, to determine muscle function and strength values. Data Collection Method, this study applied data collection methods through preliminary studies, agreements with nurses and patients, explaining tandem walking therapy, and performing the tandem walking therapy consistently over five days.

Data Presentation

The data from this case study is presented in the form of descriptive and narrative texts that are structured in accordance with the scientific paper writing guidebook that has been provided.

3. Results and Discussion

Assessment

Assessment is the initial stage in the nursing process that is carried out systematically in collecting data about individuals, families, and groups. Assessment must be carried out comprehensively, covering biological, psychological, social and spiritual aspects (Polopadang & Hidayah, 2016).

The assessment of Mrs. T was conducted on February 16, 2024 at 12.00 pm, a patient with a medical diagnosis of Alzheimer's dementia was obtained, during the assessment the patient complained of joint pain and fatigue easily, from the patient's medical record data had a history of hypertension, osteoporosis, bronchial asthma, anemia, delusional hallucinations, mild cognitive impairment, and ingrown right toenails. The results of the examination of the patient's vital signs showed Blood pressure: 160/80 Millimeter hydragium, Pulse: 87x / minute, RR: 25x / minute, Temperature: 36 ℃ Celsius. On physical examination of the extremities, there was a decrease in muscle strength with a value of muscle, the patient's gait looked unsteady, the patient was only able to walk approximately 5 meters. The patient's daily activity pattern requires assistance, one of which is in dressing, bathing, and going to the toilet. Assessment of the patient's psychological aspect often experiences hallucinations and agitation for no apparent reason.

Table 1.
Muscle strength values during assessment

Parts of body	Day 1
Right upper extremity	4
Right lower extremity	2
Left upper extremity	4
Left lower extremity	2

Nursing Diagnosis

Determining the right nursing care to assist clients reach their best health requires nursing diagnosis (Kusumaningrum, 2022).

The diagnosis is based on fall risk characteristics, such as age over 60, prior fall history, reduced lower extremity strength, use of mobility aids, and concomitant medical conditions.According to the Na nda International Nursing Diagnosis, these data (Farda et al., 2021).

Based on the results of the assessment above, a nursing diagnosis can be established, namely the risk of falling with the diagnosis code (D.0143) related to decreased muscle strength based on subjective data from patients who complain of joint pain, fatigue, with objective data found a decrease in muscle strength, there is a balance disorder characterized by the patient's gait looking unsteady, the patient's.

Intervention

Based on the nursing diagnosis of the risk of falling related to decreased muscle strength, the author prepared a nursing plan based on (Aprilia et al., 2023), namely:

Table 1.
Intervention

<table>
<tr><th>SLKI</th><th>SIKI</th></tr>
<tr><td>After nursing care is carried out within 3x8 hours, it is expected that:
1. Physical mobilization increases (l.05042)
2. Balance increases (l.05039)
The criteria for the expected output results are:
a. Physical mobilization increased (l.05042) with outcome criteria
<table><tr><th>Indicator</th><th>Beginning</th><th>Objective</th></tr><tr><td>Muscle Strength</td><td>3 (medium)</td><td>5 (increased)</td></tr><tr><td>Anxiety</td><td>3 (medium)</td><td>5 (decreasing)</td></tr><tr><td>Stiff Joints</td><td>3 (medium)</td><td>5 (decreasing)</td></tr><tr><td>Limited Movement</td><td>3 (medium)</td><td>5 (decreasing)</td></tr><tr><td>Physical Weakness</td><td>3 (medium)</td><td>5 (decreasing)</td></tr><tr><td>Range of Motion (ROM)</td><td>4 (quite improved)</td><td>5 (increased)</td></tr><tr><td>Extremity Movement</td><td>3 (medium)</td><td>3 (increased)</td></tr><tr><td colspan="3">b. Balance increases (l.05039) with the following result criteria:</td></tr><tr><td>Balance While Standing</td><td>3 (medium)</td><td>5 (increased)</td></tr><tr><td>Balance While Walking</td><td>3 (medium)</td><td>5 (increased)</td></tr><tr><td>Shaky Feeling</td><td>2 (quite improved)</td><td>5 (decreasing)</td></tr><tr><td>Posture</td><td>3 (medium)</td><td>5 (improved)</td></tr></table></td><td>Fall prevention (I. 14540)
Observation:
a. Identify risk factors for falls.
b. Monitor the patient's ability to transfer from bed to wheelchair and vice versa.
Therapeutic:
a. Ensure that the bed wheels are securely locked.
b. Ensure that the wheelchair is always locked.
c. Install handrails on the bed.
d. Use walking aids.
e. Place the call bell within the patient's reach.
Education:
a. Advise the patient to call the nurse if they need help when moving.
b. Encourage the patient to focus on maintaining body balance.
c. Teach how to use the bell to call the nurse.
Ambulation support (I.06171)
Observation:
a. Identify pain or other physical complaints
b. Monitor general condition during ambulation
Therapeutic:
a. Facilitate ambulation with assistive devices
b. Facilitate mobilization, if necessary
Education:
a. Explain the purpose and procedures of ambulation
b. Encourage early mobilization
c. Teach simple ambulation that must be done</td></tr>
</table>

Execute an action plan to prevent the risk of recurrent falls, which includes the nurse's observation stage to determine the risk of recurrent falls, the therapeutic stage to offer fall prevention techniques, and the educational stage to impart fall risk reduction techniques (Sholehudin & Elmaghfuroh, 2023).

Implementation

With the aid of cognition and the coordination of the muscles of the trunk, lumbar spine, pelvis, hips, abdomen, and ankles, movement in tandem training is one method for forming the habit of controlling body posture. Eyes open, you walk three to six meters in a straight line, touching the toes of one foot with the heel of the other (Jatuh, 2024).

For three days, the interventions given to the patient included monitoring the patient's ability to move between bed and wheelchair, ensuring the bed wheels were locked, installing handrails on the side of the bed, placing a call bell within the patient's reach, adjusting the bed position to the lowest level, evaluating complaints of pain or other physical disorders, advising the patient to maintain body balance, monitoring the patient's general condition while walking, providing an explanation of the purpose and procedures for tandem walking, and training the patient to do tandem walking.

Tandem walking exercises were carried out according to the procedure, starting with ensuring the patient's time contract and willingness, and measuring vital signs. Next, the patient was asked to stand up straight and comfortably with their gaze looking forward. The patient was then directed to walk forward along a straight line for 3-6 meters, with the right foot touching the heel of the left foot, and this exercise was carried out for 5 days with a frequency of 3 times a day, each for 10-15 minutes.

In addition to teaching posture, body position, muscular coordination, and movement, tandem walking is an exercise that may help older adults focus better. By observing foot movements, the angle of the foot's arch, and pressure points on the soles of the feet, tandem walking can be observed. One sign of cerebellar or vestibular problems is slanting to one side (Suci et al., 2024).

In the implementation of tandem walking therapy on Mrs. T is carried out by paying attention to the conditions in the surrounding environment where the measurement of vital signs is not carried out when tandem walking exercises are going to be carried out but sometimes measurements are carried out at certain hours such as after taking a shower, then on a line of 3-6 meters sometimes the exercise does not use this procedure due to limitations in the number and number of elderly populations so that tandem walking exercises only use the helping hand of researchers or nurses to help maintain balance during walking exercises, but this tandem walking exercise is carried out according to the recommended theory which states 3 times a day and for Mrs. T tandem walking exercises are carried out at 08.30 am, 14.30 pm and 16.50 pm.

Evaluation

Evaluation is an assessment by comparing changes in the patient's condition (observed results) with the objectives and outcome criteria created at the planning stage (Hadinata & Abdillah, 2021). According to the study's findings, older adults who have trouble walking with balance can benefit from workouts that strengthen their deteriorating muscles, including tandem walking. Since the quadriceps musculo is one of the body components that is in charge of bending the hips and straightening the knees, the tandem walking method can help strengthen the quadriceps muscle area during workout motions. However, older adults with progressive conditions such diabetes, high blood pressure, rheumatoid arthritis, and osteoarthritis were not included in this study. However, degenerative disorders like RA, OA, DM, and hypertension are particularly common in the elderly (Siregar et al., 2020).

The results of the evaluation of Mrs. T's case for 5 days related to nursing problems of fall risk related to decreased muscle strength showed that several indicators had not been achieved, such as limb movement, balance when standing, balance when walking, feeling shaky, and posture. The failure to achieve these indicators was due to the patient's advanced age, which resulted in decreased physical abilities, as well as decreased vision and hearing function, which are common conditions in the elderly (Lilyanti et al., 2022). However, tandem walking exercises have been shown to be effective in dealing with decreased muscle strength and balance disorders.

Table 4.
The following is a table of progress on day 5 assessed based on the expected output

Indicator	Beginning	Objective	End
Muscle Strength	3 (moderate)	5 (increasing)	5 (increased)
Anxiety	5 (decrease)	5 (decreasing)	5 (decreased)
Joint Stiffness	4 (moderate decrease)	5 (decreasing)	5 (decreased)
Limited Movement	3 (moderate)	5 (decreasing)	5 (decreased)
Physical Weakness	3 (moderate)	5 (decreasing)	5 (decreased)
Range of Motion	4 (moderate increase)	5 (increasing)	5 (increased)
(ROM)	4 (moderate increase)	5 (increasing)	4 (quite increased)
Extremity Movement	3 (moderate)	5 (increasing)	4 (quite increased)
Standing Balance	3 (moderate)	5 (increasing)	4 (quite increased)
Walking Balance	3 (moderate)	5 (decreasing)	4 (quite decreased)
Wobbling Feeling	3 (moderate)	5 (improving)	4 (quite increased)

4. Conclusion

After the implementation for 5 days, the risk of falling has not been resolved with several indicators that have not met the target values, The assessment was conducted using interview, observation, physical examination, and documentation study methods obtained subjective data of the main complaint during the assessment of the patient complaining of aches in the joints and fatigue, and objective data from the patient's medical record had a history of hypertension, osteoporosis, bronchial asthma, anemia, hallucinatory delusions, mild cognitive impairment, and ingrown right toenails. The patient experienced decreased muscle strength with a value of muscle strength of the right and left upper extremities 4, right and left lower extremities 2, the patient often experienced hallucinations and agitation (feelings of anxiety), Based on this assessment, the author has established a nursing diagnosis of risk of falls related to decreased muscle strength as the main diagnosis because it has the potential to cause other nursing problems and the risk of falls which can interfere with and hinder daily activities, From the desired outcomes, the nursing interventions used were fall prevention, ambulation support through tandem walking exercises, and installation of safety devices.

From the intervention, the implementation of monitoring the ability to move from bed to wheelchair and vice versa, ensuring that the bed wheels are always locked, installing bed handrails, installing call bells within the patient's reach, ensuring that the mechanical bed is in the lowest position, identifying pain or other physical complaints, encouraging concentration to maintain body balance, monitoring general conditions during ambulation, providing tandem walking exercises with a frequency of 3x a day for 10-15 minutes, monitoring the ability to move from bed to wheelchair and vice versa, ensuring that the bed wheels are always locked, installing bed handrails, installing call bells within the patient's reach, ensuring that the mechanical bed is in the lowest position, identifying pain or other physical complaints, encouraging concentration to maintain body balance, monitoring general conditions during ambulation, providing tandem walking exercises with a frequency of 3x a day for 10-15 minutes.

Within 5 days of implementation, the risk of falling had not been resolved with several indicators that had not met the target values, namely limb movement, balance when standing, balance when walking, feeling shaky, and posture due to the patient's advanced age. However, in this implementation there are limitations experienced by the author, namely: (a) there was imitation in the physical examination so that several physical examinations had not been carried out thoroughly, such as the examination of the respiratory system, one of which was that tactile fremitus had not been assessed, resulting in ignorance of whether or not there was a problem with the patient's breathing. (b) Limited facilities and infrastructure in the form of a 3-meter iron rope used to implement the nursing plan for tandem walking training, the number of which was only 1, resulting in the implementation of tandem walking training not being in accordance with the schedule that had been prepared because it had to take turns with other elderly people. (d) The limitations of the author's language skills were also an obstacle for the author when collecting data, resulting in minimal information obtained by the

author. (e) Limitations in the implementation which was only carried out for 5 days resulted in several outcomes that had not been met.

From this study, with all its limitations, it is hoped that further researchers can develop interventions and provide broader innovations in handling nursing problems related to the risk of falls and other nursing problems found in patients with dementia.

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