

RESEARCH ARTICLE

Accumulated incidence of falls in people hospitalised with cancer and related factors

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Abstract

Aim: To study the accumulated incidence of falls of people hospitalised with cancer and analyse the related intrinsic and extrinsic factors.

Design: A prospective study of people hospitalised with cancer at the Catalan Institute of Oncology.

Methods: Intrinsic factors and extrinsic factors related to the fall have been studied. The data were gathered from the clinical history and a specific adverse events notification programme and patients were followed during hospitalisation.

Results: A total of 117 of 6090 patients admitted during the period of study were included, with an accumulated incidence of falls of 0.019. Mean age 63.4 years (SD 11.5) and 65.5% men. Patients with lung cancer accounted for 25.6% of the total number of falls, followed by haematological cancer at 24.8%. Most falls were without consequences (71.8%). The data reveal that people hospitalised with cancer are at greater risk of falling, even though the accumulated incidence observed in the present study is low.

KEYWORDS

accidental falls, cancer, fall prevention, hospitalisation, incidence, nursing care, patient safety

1 | INTRODUCTION

Falls, which constitute one of the most frequent adverse events in hospital safety (Callis, 2016), are especially frequent among adults with cancer. These patients suffer from them more frequently due to the burden of the disease itself and its treatment, which can be increased by the physiological and pharmacokinetic changes that accompany ageing. Furthermore, the situation tends to be worsened by problems associated with the acute effects of the oncological treatment, such as peripheral neuropathy, fatigue and dehydration (Huang et al., 2019; Sattar et al., 2019, 2020, 2021; Wildes et al., 2015).

Many intrinsic and extrinsic variables increase people's risk of falling (Callis, 2016; Huang et al., 2008). Among the intrinsic, or biological, risk factors that are associated with falls are older age at the time of the diagnosis of cancer (Huang et al., 2019), an advanced stage of cancer (Wildes et al., 2015), being dependent in activities of daily living and previous falls (Callis, 2016; Huang et al., 2019; Sattar et al., 2020), cognitive deterioration and depression, anaemia requiring a transfusion, fever, low blood pressure, fatigue and the presence of metastasis, especially in the central nervous system (Wildes et al., 2015). Extrinsic, or environmental, factors associated with falls by hospitalised patients include chemotherapy and other medicines used in cancer treatment, such as opiates, neuroleptics, benzodiazepines (associated depending

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on the dose) corticoids and antidepressants. Other related medicines that may contribute to orthostatic hypotension and postural weakness, and hence falls, are antihypertensives, analgesics, antiarrhythmics, antiplatelets and diuretics (Callis, 2016; Pautex et al., 2008; Romano et al., 2017; Wildes et al., 2015). Non-medical extrinsic factors include the physical risk associated with the condition of the structure and the design of the patient's room and the human resources, communication, training and teamwork (Najafpour et al., 2019). With regard to room design and layout, it is especially important that the bed area and the bathroom are in optimum conditions in order to better enable both assisted and unassisted ambulation. Full details about these aspects can be found in Piatkowski et al. (2021).

2 | BACKGROUND

The rate of falls among hospital patients in general ranges between 3% (Capone et al., 2012) and 27.5% (Goodridge & Marr, 2002) and older patients with cancer have been found to have a particularly high incidence between 15% and 23% (Wildes et al., 2015). Age and sex have been associated with falls since patients who fell were found to be, on average, 3.5 years older than those who did not. Men were 70% more likely to fall and had greater fear of falling, as well as suffer greater functional deterioration (Wildes et al., 2015). In older cancer survivors, falls are associated with a quality of life related to worse health than the general population and with a decrease in this quality as years go by (Huang et al., 2019). These survivors have a greater risk of falling and hip fracture in comparison with adults without any history of cancer (Fino et al., 2019; Huang et al., 2019).

Patients who had fallen only once have reported a greater symptom burden on the Edmonton Symptom Assessment Scale than those who have fallen repeatedly, suggesting that patients with less distress and, hence, a greater level of activity fall with greater frequency (Wildes et al., 2015). Furthermore, chemotherapy-induced peripheral neuropathy can develop during treatment in up to 90% of patients and can significantly affect mobility and the risk of falling (Fino et al., 2019). Neurotoxic treatments have also been found to be associated with an increase in falls with injuries (Wildes et al., 2015).

The main objective of this study was to investigate the incidence of falls in people hospitalised with cancer and to analyse the intrinsic and extrinsic factors associated with those falls. Apart from being, to the best of our knowledge, the first study in the Spanish territory of falls in hospitalised people with cancer, we investigate a broad range of possible factors, both related to the patients' specific medical diagnosis and the structural environment of the hospital itself, that we believe will be of considerable assistance in designing individualised strategies to avoid such falls in hospital settings.

2.1 | Research question

What is the incidence of falls in people hospitalised for cancer and what are the associated factors?

3 | THE STUDY

3.1 | Design

Prospective observational study of adults hospitalised with cancer.

3.2 | Method

The study was carried out at three centres of the Catalan Oncology Institute in Catalonia, Spain. All patients, consecutively admitted during 2017, who suffered a fall in the participating centres from 1st January to 31st December were included.

The in-patient services of the Catalan Oncology Institute are horizontally structured units free from architectonic barriers with all rooms on the same level such as the corridors and the nursing control areas. Rooms have natural light and artificial light at the bed heads and another light close by to see during the night in case of having to get up. The bathrooms, which are all ensuite, have mobile grab rails at one side of the toilet and in some rooms, there is either a wall or a grab rail next to the bed. The environment favours the safety of the patient since there are established protocols for their treatment both individually and collectively with regard to the prevention of falls and pressure sores, for example, for the safety of medicinal products. The nurse–patient ratio is 1:6–8.

Study variables and data collection.

The sample studied was obtained through the adverse event notification programme (TPSCCloud®) and from the electronic clinical history in which incidents notified as falls at the palliative care, oncology, haematology and bone marrow transplant units of the Catalan Oncology Institute of the hospitals of Catalonia, Spain, were recorded.

Intrinsic factors associated with the falls, such as age, sex, the diagnosis and associated comorbidities, pain, functional state, previous history of falls, pharmacological treatment and the type of oncological treatment, were studied (Huang et al., 2008).

Among the extrinsic factors, the unit where the patient was hospitalised, the day of the week, the time period during which the fall took place, the environment where the incident occurred, the circumstances during the fall, the type of fall, the preventative measures that had been adopted and the presence of an accompanying person at the moment of the fall were studied. The consequences of the falls in terms of injuries, location of the injuries, treatment, diagnostic tests and/or explorations that were performed, transfer to other care units, loss of consciousness and perception of risk of falling on the part of the patient were also analysed.

All of the variables studied were recorded in an ad hoc questionnaire. The risk of falls was studied using the STRATIFY scale (Aranda-Gallardo et al., 2015; Oliver et al., 1997). The sensitivity and specificity of the score to predict falls during the following week were 93% and 88%, respectively, in Phase 2, and 92% and 68%, respectively, in Phase 3 (Oliver et al., 1997). The degree of autonomy with the Barthel Index (Mahoney & Barthel, 1965) and the pressure

ulcer risk with the EMINA scale (the interobserver reliability) were evaluated by an intraclass correlation coefficient for the total score of the scale of 0.93. The kappa index for each of the five-scale criteria ranged from 0.72 for nutrition to 0.92 for mental status and activity. For the validity of the criteria, a ROC curve was made with an area under the curve of 0.822 (Fuentelsaz-Gallego, 2001). Pain assessment was made using the Visual Analogue Scale (VAS) (Breivik et al., 2008). The data were recorded by the study's collaborating nurses. Participants were followed up during the whole period of hospitalisation at the three study centres.

3.3 | Statistical analysis

IBM SPSS StatisticsV25 was used for the analysis of data. Continuous variables are expressed with the mean and standard deviation, and categorical variables with absolute frequencies and their percentage. A bivariate analysis was performed to analyse the diverse factors that were studied, and the differences between groups were studied with the chi-square test or Fisher's exact test as appropriate. Statistical significance was set at $p < 0.05$.

The accumulated incidence of falls (number of falls during the period of study divided by the total number of patients admitted in the same period), incidence of falls/bed/year and the incidence of falls per stay (total number of falls \times 1000/total number of stays) were calculated.

3.4 | Ethical considerations

This study has respected current ethical norms for studies on people. Before beginning the research, the consent and approval of the management of the institution were sought and obtained. It was not necessary to obtain the informed consent of the participants as the data gathered forms part of the habitual activity of the centre and the study did not include any specific test or invasive tests. Data protection and confidentiality were guaranteed through the separation of personal indicators in the data-gathering questionnaires and in their storage. Spanish data protection legislation (LOPED 3/2018 of 5th December) was followed, guaranteeing the anonymity of the participants and of the centres as well as their right to withdraw from the study at any time.

4 | RESULTS

4.1 | Incidence of falls in people hospitalised with cancer

A total of 117 of 6090 patients admitted during the period of the study were included in the study, giving an accumulated incidence of falls of 0.019. The incidence of falls/bed/year was 0.7 (117/165 beds at the 3 centres/year) and the overall incidence of falls by

the number of stays was 2.16×10^0 (117 \times 1000/54,147 stays). By centre, the incidence of falls was 2.23×10^0 (35 \times 1000/15,663) at Centre 1, 1.79×10^0 (48 \times 1000/26,731) at Centre 2 and 2.89×10^0 (34 \times 1000/11,753) at Centre 3.

4.2 | Characteristics of the participants and intrinsic and extrinsic factors associated with falls

The mean age was 63.4 years (SD 11.5) with an interval from 29 to 84 years, and 65% ($n=76$) of falls were men as opposed to 35% ($n=41$) who were women ($p > 0.05$), with weakness and loss of balance being the most common aetiologies of falls in both sexes. 64.7% of the patients studied had a high risk of falls (score equal to or greater than 2). By departments, more than half of the falls, 54.7% of the patients, were in oncology (all with solid organ cancers), whereas the department with the second greatest number of falls was haematology with 24.8%. Patients with lung cancer had 25.6% of all of the falls, whereas patients with haematological cancer had 24.8% (Table 1). The assessment of the functional state by the Barthel Index indicated that patients with moderate or slight dependence on the activities of daily living (ADL) suffered more falls (71.1%) than patients with total dependence or complete autonomy.

With regards to comorbidities, 30.8% did not have any other health problem, 47.9% had one other disease and 21.4% had more than one other disease. 72.5% had not suffered previous falls at home, during other periods of hospitalisation or at healthcare centres. The risk of bed sores was low in 64.1% of patients, medium in 32.5% and high in 3.4%. No significant association was found between comorbidities and having had previous falls at admission. Specifically, among those people who did not present any other disease, 40% ($n=14$) had had a fall before the hospitalisation of the study, 21.2% ($n=11$) of those who had another disease had had a previous fall and 22.7% of those who had two or more diseases ($p=0.132$).

The circumstances and the type of fall are set out in Table 2. Falls occurred with greater frequency among conscious and oriented patients (75.89%), in patients who were unaccompanied (59%), when the person was walking (44%), during the night shift (43.6%) and in the bathroom (28.21%). Most falls did not have consequences (71.79%); in the cases that the patients suffered injuries, these were minor in 22.22% of the cases, moderate in 4.27% ($n=5$) and severe due to a traumatic brain injury (TBI) in 1.71% ($n=2$). Age and the administration of drugs such as psychotropics are liable to increase the risk of falls in the 24h before the fall was found to have been associated with the presence of fall injuries (Table 3).

5 | DISCUSSION

In our study, 117 patients were included to evaluate falls that took place during 2017 from 6090 patients who were admitted to the centres of the Catalan Oncology Institute that year. The results

TABLE 1 Sociodemographic and clinical characteristics and intrinsic factors associated with the fall (N: 117).

	N (%)
Sex	
Male	76 (65)
Oncological diagnosis	
Lung	30 (25.6)
Haematological	29 (24.8)
Stomach	24 (20.5)
Bladder	14 (12)
Head and neck	9 (7.7)
Breast	4 (3.4)
Ovarian/Gynaecological	3 (2.6)
Other	4 (3.4)
Comorbidities	
No disease	36 (30.8)
One disease	56 (47.9)
Two or more diseases	25 (21.3)
Metastasis	
Not present	53 (45.3)
At central nervous system metastasis	18 (15.4)
Other locations	46 (39.3)
Functional state	
Independence	13 (11.4)
Moderate and slight dependence	81 (71.1)
Total and severe dependence	20 (17.5)
Previous history of falls	
No	79 (72.5)
Yes	30 (27.5)
Risk of falling	
Low risk	47 (40.9)
High risk	68 (59.1)

show that the accumulated incidence was low, as was the incidence of falls/bed/year. The study has analysed the intrinsic and extrinsic factors of the sample associated with falls.

With regards to the intrinsic factors, the mean age of the population who fell in our study was 63.4 years, whereas the mean age of people hospitalised for cancer at centres of the Catalan Oncology Institute during the same period was 63 years, which is a similar age to that of the present sample. Other studies have observed falls in older hospitalised people (Enríquez de Luna-Rodríguez et al., 2020). As the population gets older, more adults over the age of 65 are expected to receive a cancer diagnosis. Given that cancer is becoming a disease of older people and the rates of falls are higher in older people who are living with cancer, it is evident that falls in this population group will need to be studied (Morris & Lewis, 2020; Tomczak et al., 2021). With regards to sex, two-thirds of the falls were suffered by men, which is in line with the distribution by sexes during the same year at our centres (58.6% men). This contrasts with previous

TABLE 2 Extrinsic factors associated with the fall (N: 117).

	N (%)
Medical department	
Oncology	64 (54.7)
Haematology	29 (24.8)
Palliative care	24 (20.5)
Day of the week	
Workday	88 (75.2)
Weekend	29 (24.8)
Shift	
Morning	38 (32.5)
Afternoon	28 (23.9)
Night	51 (43.6)
Location	
Bathroom	45 (38.5)
Room	66 (56.4)
Other	6 (5.1)
Circumstances	
Displacement (standing up/sitting down)	38 (32.8)
Resting	21 (18.1)
Dressing/Washing	6 (5.2)
Walking	51 (44)
Type of fall	
Slipping/tripping	30 (25.6)
Fainting	14 (12)
Weakness or loss of balance	57 (48.7)
Other circumstances	16 (13.7)
Accompaniment	
Unaccompanied	69 (59)
Accompanied by a family member	38 (32.4)
Accompanied by healthcare staff	7 (6)

literature that does not include sex as a risk factor for suffering falls, although some studies have described it as a non-significant variable when those who suffer falls and those who do not are compared (Hayakawa et al., 2014; Nassar et al., 2014).

The most common cancers that patients who fell suffered from were, in the first place, lung cancer (25.6%), and in second place haematological cancer (24.8%). However, another study obtained different results, finding that gastrointestinal cancer (33%) and multiple myeloma (19.6%) were the most frequent pathologies in patients who received outpatient treatment for cancer and who suffered falls, but the mean age was higher (Tomczak et al., 2021).

The assessment of the functional state using the Barthel Index showed that 71.1% of the patients who fell in the sample studied showed moderate or slight dependence on the ADL and that there were far fewer falls among patients with total or complete autonomy. In comparison with other studies in adult patients without cancer, 40% of the people were classed as independent by the ADL, whereas 38.3% were considered dependent (Oliveira et al., 2019).

TABLE 3 Factors associated with injury after the fall.

	Presence of injury after the fall		<i>p</i> value
	Yes (<i>n</i> : 33; 28.2%)	No (<i>n</i> : 84; 71.8%)	
Age	67 (8.7)	61.9 (12.2)	0.031
Sex			
Male	19 (57.6)	57 (67.9)	0.389
Women	14 (42.4)	27 (32.1)	
Hospitalisation (days)	21.3 (17.4)	19.8 (13.7)	0.610
Barthel Index			
Independent	3 (9.4)	10 (12.2)	
Mildly dependent	26 (81.3)	55 (67.1)	0.282
Dependent	3 (9.4)	17 (20.7)	
Previous history of falls	6 (29.6)	24 (21.4)	0.470
Fall risk increasing drugs before the fall			
Yes	30 (90.9)	83 (98.8)	0.034
No	3 (9.1)	1 (1.2)	

Note: Continuous variables are presented as mean and standard deviation (SD). Categorical variables are presented as number and percentage (%).

With regards to comorbidities, 30.8% were without associated comorbidities, 47.9% of patients had one other disease and the cancer diagnosis and 21.4% had two or more other pathologies. Other authors have pointed out that the presence of more than three different diseases other than the cancer diagnosis is a factor that increases the risk of falls (Campbell et al., 2018; Wildes et al., 2018). The sample studied is from medical units with chronic patients and complex diagnoses.

Although having suffered from a fall previously is usually one of the predictive factors of suffering a fall, in our sample, the previous history of falls showed that 72.5% of patients did not have antecedents of earlier falls, in line with other studies (Najafpour et al., 2019). Other authors did consider this to be an important risk factor together with the use of walking aids and disability in older people who live in nursing homes or are admitted to hospitals (Deandrea et al., 2013). We suggest that when a patient has had one or more previous falls, the conditions of these falls and their underlying causes should be investigated, as this history could reveal an underlying problem such as deteriorating balance. The importance of this previous assessment has been demonstrated in a study in an outpatient setting using the Timed Up and Go falls risk assessment questionnaire, and the 30s Chair Stand Test found these tests to be suitable for application in older people with cancer (Morris & Lewis, 2020). With regards to the risk of injuries due to pressure ulcers, it was observed that 64.1% of patients who fell had a low risk. No previous studies of falls of people with cancer evaluate the risk of contracting pressure ulcers. Despite this, falls are strongly associated with mobility deficit and the loss of independence in the ADL, two factors that are associated with the risk of injuries due

to pressure ulcers (Lorca et al., 2019). In agreement with the literature, most patients who fell were conscious and orientated (75.89%) (Lorca et al., 2019; Pasa et al., 2017).

With regards to extrinsic factors of the patients, it should be noted that the department with the greatest number of falls was oncology, with 54.7% of the patients, followed by haematology with 24.8%. Falls due to weakness or loss of balance were the most frequent type, making up 48.7% of the total, followed by slipping or tripping at 25.6%. Other authors have also found that the main types of falls were provoked by dizziness and weakness (Tomczak et al., 2021). Cancer and its treatment potentiate muscular weakness, lack of balance, proprioception, cognitive deterioration and functional disability, all of which are important risk factors (Morris & Lewis, 2020). Physical training may improve the strength, flexibility and balance in this population, but the evidence is of very low quality (Williams et al., 2018). Falls are a risk for adults over 65 as they can result in an increase in morbidity. Furthermore, 70% of falls of patients with cancer result in injuries, compared with just 10%–20% in the general population. In this type of patient, falls can have significant consequences in terms of reduction in the quality of life, greater dependence on caregivers and increased mortality (Tomczak et al., 2021). Oncological patients have a greater propensity to suffering fall-related injuries due to anaemia, thrombocytopenia and risk of pathological fractures (Hitcho et al., 2004). A 45% rate of falls with injury has been reported, of which a quarter involved fractures (Sattar et al., 2021). The risk factors of patients with cancer are different from other patients and, as a result, the most commonly reported factors such as pain, the type of cancer, metastasis, antipsychotics, antidepressants and blood transfusions have an influence on the risk of suffering a fall (Capone et al., 2012). In the present study, most falls did not result in physical injuries (71.8%). There were no fractures or deaths as a result of the falls and in just two cases, more severe injuries occurred in the form of a TBI. The injury caused as a result of the falls was less severe, in the form of contusions or cuts and only in 5% of cases did the patient lose consciousness. The main location of the injuries was the head in 48% of cases, followed by the lower limbs in 24%. More than half of the patients were alone at the moment of the fall, which may be consonant with the fact that almost half the falls took place during the night shift when there are fewer health workers and almost no presence of family members. Other authors have observed similar results, finding that most of the patients studied were alone at the moment of the fall (Najafpour et al., 2019; Romano et al., 2017). Furthermore, interventions such as regular nursing rounds and programmed bathroom visits could be effective in fall prevention (Najafpour et al., 2019). In the present sample, 96.6% had been administered drugs of risk in the 24h before the fall. There is a close association between polypharmacy and a significant increase in the risk of falls, especially if five or more drugs are being taken (Romano et al., 2017; Sattar et al., 2021). Psychotropic drugs (benzodiazepines, antipsychotics, antidepressants and sedative hypnotics) have been associated with a particularly high risk and a reduction in motor coordination (Turégano Yedro et al., 2019).

5.1 | Clinical implications

With regards to the applicability of the study to clinical practice, given that the current scientific knowledge concerning falls confirms that most falls in people with cancer can be prevented and that a risk assessment of older patients may permit a timely preventative intervention to avoid such falls, a consensus on predictors of falls should be agreed and adopted to prevent future falls and their complications (Sattar et al., 2021). Further study in this area is necessary.

5.2 | Strengths and limitations

A strength of this study is that it has conducted an intrahospital follow-up of over 6000 patients with cancer, analysing the principal intrinsic and extrinsic factors that are typically studied in people who suffer from falls. However, an important limitation is that the intrinsic and extrinsic factors were only studied in people who had suffered falls, limiting comparison to no more than general characteristics of the people hospitalised in oncology departments at the centres that were studied. Another possible limitation is that despite the identification of adverse events forming part of the safety culture of hospital settings, it is conceivable that some falls without consequences may not have been recorded.

6 | CONCLUSIONS

The data reveal that people hospitalised with cancer have many of the risk factors associated in the literature with falls, even though the accumulated incidence observed in the present study was low. Male sex, loss of balance on walking, suffering from lung or haematological cancer, walking at night and being unaccompanied have been the most frequent factors in the falls studied here.

The results obtained highlight the fundamental importance of continuous monitoring of intrinsic and extrinsic factors from the first day of admission in order to identify the predictors of falls and prevent them in the at-risk population. Many risk factors are susceptible to direct interventions, which can prevent falls and reduce the risk factors that provoke them.

More research is needed to develop a specific evaluation instrument to predict the risk of falls among patients receiving oncological treatment.

With regards to possible interventions to prevent falls and taking into consideration the results obtained, encouraging physiotherapy in people with cancer may promote their mobility and balance, and providing patients with more complete accompaniment and specific material resources would increase safety in their displacements. Efforts should also be made to limit those elements that can cause falls. Due to the multicausal origin of falls, it is necessary to understand their underlying circumstances and personalise the prevention measures while promoting a culture of safety.

AUTHOR CONTRIBUTIONS

Study design—Maria Montserrat Martí Dillet and Cristina Fernández-Rodríguez. Data collection—Maria Montserrat Martí Dillet; Cristina Fernández-Rodríguez and Aniol Ginesta-Guanter. Data analysis—Maria Montserrat Martí Dillet and Rosa Suñer-Soler. Manuscript writing—Maria Montserrat Martí Dillet; Cristina Fernández-Rodríguez; Aniol Ginesta-Guanter and Rosa Suñer-Soler.

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CONFLICT OF INTEREST STATEMENT

The authors have declared that they have no conflict of interest. The research has applied the STROBE checklist for observational research.

DATA AVAILABILITY STATEMENT

The data of this study are available on request from the corresponding author. The data are not publicly available due to ethical restrictions.

ETHICS STATEMENT

The current study was approved by the Centre Management of the Catalan Institute of Oncology (Catalonia, Spain) before the data collection.

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