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Original Article

Adapted Physical Activity with a Walking Platform in Older Inpatients Admitted for Cancer: A Pilot Study

Heidi Solem-Laviec [a], Florian Boismain [a], Priscille Le Bon [a], Bénédicte Clarisse [b], Jean-Michel Grellard [b], Xavier Blaizot [c], Antoine Desvergée [d], Justine Lequesne [b], Bérengère Beauplet [e,f *]

[a] *Supportive Care Unit, François Baclesse Regional Cancer Center, Caen, France,* [b] *Clinical Research Department, François Baclesse Regional Cancer Center, Caen, France,* [c] *Cancer Network Center OncoNormandie, Caen, France,* [d] *Department of Functional Rehabilitation, Centre Hospitalier Universitaire de Caen Normandie, Caen, France,* [e] *Department of Geriatric Medicine, Centre Hospitalier Universitaire de Caen Normandie, Caen, France,* [f] *University of Caen Normandy, Inserm, U1086, Anticipe, Caen, France*

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SUMMARY

Introduction: Hospitalization setting is unfavorable for walking capacity preservation in older patients with cancer, related to prolonged bed rest, which may induce functional loss and increase fall risk. The Ema platform enables walking under safe and entertaining conditions. We experimented with this platform in older patients hospitalized for cancer.
Methods: This prospective interventional French bicentric pilot study, conducted among inpatients aged 70 years and older, admitted for cancer for at least 48 hours, took place from June to October 2018. The main feasibility criterion was reached if 70% of the included patients completed two walking sessions lasting at least six minutes.
Results: Forty-five patients were included, 18 of whom were metastatic and twenty-two were male. The median age was 76 years (range, 70–87 years). Only 31 patients underwent two sessions and 26 underwent at least six minutes (58%). Higher weight (p = 0.025) was significantly associated with feasibility. A non-significant trend to improvement in gait speed was observed during the second session.
Conclusions: The feasibility criterion was not reached, mostly due to patients' unstable acute medical conditions. A study targeting inpatients for cancer-planned surgery would be easier to conduct, with gait data collected before hospitalization. Further improvements in gait speed beyond the second walking session were expected.

1. Introduction

It is important to prevent functional decline in older patients treated for cancer to ensure oncological care plan completion and preserve their quality of life. The cancer care pathway often leads to hospitalization, which may impair functional state. Compared to younger adults, prolonged bed rest in older patients during hospitalization increases the risk of sarcopenia and a decline in muscle strength and function, which may lead to long-term disability.[1–5]

Older patients receiving cancer treatment often present with sarcopenia,[6] which increases the risk of hospitalization and cost of care.[7] Furthermore, sarcopenia is associated with increased chemotherapy toxicity, postoperative complications, and higher mortality rates.[8] It is potentially reversible through a combination of nutritional and physical exercise intervention programs.[9]

Physical activity (PA) may prevent functional decline, improve quality of life and self-esteem, and reduce depression and anxiety symptoms, fatigue, and postoperative complications during cancer treatment.[10] PA is recommended for patients with cancer and cancer survivors by the French National Cancer Institute (INCa)[11] and the American College of Sports Medicine (ACSM).[12] The French National Authority for Health (HAS) recommendations for enhanced rehabilitation after surgery quote the importance of early verticalization to limit complications after surgery.[13] Despite evidence demonstrating the benefits of exercise, numerous barriers exist at the individual, healthcare team, and organization levels. Practicing even adapted PA during hospitalization is not yet common, although bed rest should be reduced when possible.

Walking intensity can be modulated and, therefore, could be a suitable PA for fit or frail older patients. This activity is feasible during hospitalization for patients with medically stable conditions. Unfortunately, the hospital setting is unfavorable to walking practice due to congested corridors, lack of suitable walking accessories, and physical therapists.

The Ema walking platform is a safe device, produced by the Ezygain® start-up, already employed for gait rehabilitation in nursing homes and rehabilitation centers.[14] The computerised balance training using visual feedback is one of the eight efficient exercice programs for improving balance in older people, identified in the Cochrane systematic review.[15] We aimed to evaluate the feasibility

* Corresponding author. Department of Geriatric Medicine, University Hospital Center, avenue Côte de Nacre, 14 033 Caen cedex 9, France.
E-mail address: beauplet-b@chu-caen.fr (B. Beauplet)

of using this walking platform in older inpatients admitted for cancer to prepare a future cost-efficiency study.

2. Methods

2.1. Aim, design, and setting

The main objective of this study was to evaluate the feasibility of walking activity on the Ema platform in older inpatients admitted for cancer. The main criterion was defined as completion of two sessions on two separate days, each lasting six minutes for 70% of the included patients.

The secondary objectives were to describe the walking performance (number and duration of sessions, walking speed, step length, and covered distance) and to analyze potential correlations between performance and patients' social and geriatric characteristics (previous falls, PA level, nutritional state, pain, comorbidities with functional impact, and cognitive status), cancer type, and reasons for hospitalization.

This interventional non-randomized pilot study named APPAHOCA took place successively in the Regional Cancer Center François Baclesse and the Caen University Hospital Center, from May 2018 to October 2018, for six weeks in each center, with a gap during summer. The trial was registered as ID-RCB: 2018-A00031-54 (Agence Nationale de Sécurité du Médicament et des Produits de Santé), ClinicalTrials.gov: NCT03473652, as an interventional study evaluating the medical device Ema, with ethical committee approval (Fifth Francilian Committee for the Protection of Persons, n°17069, on 2018 March the 8th). It was founded by the INCa via the Normandy Interregional Oncogeriatric Coordination Unit (UCOGIR Normandie).

2.2. Patients eligibility criteria

Inpatients aged 70 years and above who were admitted for cancer for at least 48 hours, for whom walking was allowed by medical prescription, were invited to participate. Written informed consent was obtained from all the patients.

Patients who were bedridden for more than a month, in terminal palliative care, were unable to communicate, or had excluded anthropometric criteria according to the European Standard platform (height < 1 m35 or > 2 m, weight > 130 kg) were not eligible.

2.3. Intervention, assessment, and tools

During the inclusion period, each newly hospitalized patient was screened by a clinical research associate and investigators. A health PA teacher was specifically engaged in this study. For each included patient, his role was to collect the following baseline data: social characteristics, pain intensity and location using a verbal scale, fall history, cognitive status (temporospatial orientation and three-word recall memory test), weight and body mass index (BMI), and previous PA using a validated questionnaire (QAPPA).[16] Further cancer and comorbidity medical data were collected by the geriatricians, such as severe comorbidity according to the Cumulative Illness Rating Scale – Geriatric (CIRS-G) at level three or four, which might impair walking ability (visual loss, dizziness, peripheral arterial, neurological, and leg or vertebral rheumatological diseases).

After a daily medical assessment of the walking capacities of each patient, they were invited to use the Ema walking platform for six to 30 minutes.[14] The Health PA teacher brought the patients to the walking platform using a wheelchair, because the walking platform was located in the rehabilitation unit, far from the patient's room. He installed and assisted the patient during the training session while maintaining the required hygienic conditions. The level of pain was evaluated before and during each walking session.

The Ema platform is specifically designed for older and disabled patients, including safety harnesses, automated verticalization, and cognitive and proprioceptive stimulation games. A connected walking mat enables the monitoring and analysis of the walking performance. In the standing position, body weight is compensated from 0% to 100%, according to the patient's capacity. The patient began walking at moderate speed and selected a landscape scrolling on the screen, or chose a cognitive and proprioceptive stimulation game for balance exercises.

In our study, data were collected from the connected pads after each session. Patient satisfaction was also assessed, as well as the fear of falling, using Likert scales out of ten.

2.4. Statistical analysis

To estimate a proportion of 70% of the included patients completing the main criterion, with a confidence interval of 95% and a 25% margin of error, 50 evaluable patients were required. To palliate included patients potentially unable to complete the study, we planned to enroll 60 subjects overall.

Quantitative variables being non-normally distributed, data were described by median and extreme values, and the Wilcoxon Mann Whitney test will be used for comparison as a non-parametric test. The correlation between patient characteristics and walking performance was analyzed by log-binomial regression to directly estimate relative risks.

3. Results

3.1. Patients characteristics

We included 45 patients (22 men, 23 women) during the three months of the study, 23 in the cancer center, and 22 in the university hospital. The median age was 76 years (range, 70–87 years). Social and medical characteristics are presented in Table 1.

Table 1
Patients social and medical characteristics (n = 45).

	n	%
Living place		
Nursing home	1	(2.2%)
Senior residence	1	(2.2%)
Individual	43	(95.6%)
Educational level		
Below elementary school	5	(11.1%)
Elementary school	25	(55.6%)
Middle school	3	(6.7%)
High scool	4	(8.9%)
Universitary degree	2	(4.4%)
Missing data	6	(13.3%)
Last profession		
Farmer	4	(8.9%)
Tradesmen	9	(20%)
Senior	2	(4.4%)
Intermediate occupation	10	(22.2%)
Employee	12	(26.7%)
Worker	4	(8.9%)
Missing data	4	(8.9%)
Medical status		
Metastatic	18	(40%)
Surgical setting	14	(31.1%)
Severe CIRS comorbidity	11	(24.4%)

There were various reasons for hospitalization: assessment of tumor extension, supportive care, scheduled or emergency surgery, oncological treatment (medical or radiotherapy), or complications of oncological treatment. The length of stay for this population was 17 days on average, with a median value of ten days [3–120]. The types of cancer were digestive (n = 18), urological (n = 12), gynecological (n = 9), lung (n = 4), melanoma (n = 1), and head and neck (n = 1), including 18 metastatic cancers.

Concerning patients' abilities, eight patients were at Eastern Cooperative Oncology Group-Performance Status (ECOG-PS) grade 0, eleven at grade 1, twenty at grade 2, and six at grade 3. Eleven patients had a severe comorbidity according to the CIRS-G, of whom ten had a grade 3 comorbidity (mostly neurological and cardiac), and one had grade 4 (almost blindness). The previous level of PA according to the QAPPA was mostly "low" (n = 32), "moderate" (n = 7), and seldom "high" (n = 2). At inclusion visit, in their hospitalization's room, forty patients were able to walk four meters, in median gait speed of 0.4 m/sec [0.07–0.8], 21 without any help, twelve with a walking accessory, five with human aid, and two with both walking accessory and human aid (missing data for three patients). Ten patients had already benefited from physical therapy. Seven patients had a history of falls. Cognitive function was considered normal in 19 patients, based on the ten-points orientation and three points on the three-word recall memory test.

Potential obstacles to performing PA have been thoroughly described: 28 patients had medical equipment during the walking sessions (perfusion, drain or cutaneous tube, urinary catheter, nasogastric tube, or oxygen therapy); four patients with infectious contact isolation were included; 25 patients were receiving analgesic treatment.

3.2. Feasibility

Among the 45 included patients, four withdrew their consent before the first walking session, and ten achieved only one session. Thus, 31 patients completed two sessions (68%), but only 26 patients underwent two sessions for at least six minutes, according to the main criterion (58%). The reasons for not performing the second session were as follows: two further consent withdrawals, three patients left earlier than expected the hospital (admission to a rehabilitation center, transfer to another hospital), and five patients could not continue because of some medical conditions.

Compared to patients who could realize only one walking session, those who completed two sessions had a higher BMI (p = 0.052), a significantly higher weight (p = 0.025), a longer walk session (p = 0.011), a greater number of walking steps (p = 0.0042), and a higher total distance walked on the platform (p = 0.024) (Table 2).

The walking performance on the Ema platform pad during the first walking session (n = 41 patients) and the second one (n = 31 patients) are presented in Table 3. Median walking speed was 0.16 m/sec and 0.25 m/sec during the first and second sessions respectively. Only two patients chose balance exercises instead of walking during the first session. The performance progression between the first and second walking sessions for the 31 patients completing the two sessions is presented in Table 4. The session duration remained of ten minutes, but performances tended toward an improvement with a median walking speed from 0.14 m/sec to 0.19 m/sec (p = 0.34), a total median walking distance from 85 to 124 meters (p = 0.24), and a median step length from 19 to 24 centimeters (p = 0.3).

Among the 31 patients, ten chose to watch the seaside landscape scrolling while walking, five visited Paris, five visited Corsica island, four walked in the mountain, four in safari, and three in visiting Rome.

3.3. Tolerance

As shown in Table 2, pain did not significantly worsen during sessions, according to the verbal scale. Medical equipment was not an obstacle to the completion of these walking sessions.

Median patient satisfaction was scored at 9 out of 10 [8–9.75] for the walking platform and 8.5 out of 10 [8–10] for the connected pad. In the end, only one patient performed six, and one patient performed seven sessions during the hospitalization stay.

4. Discussion

Including 60 participants in our study could have been realistic according to our center's activity. 45 patients were eventually included, which is, nevertheless, quite a good result within three months. Difficulties were mostly due to the short duration of the study and the refusal to sign informed consent without any reflection delay. Several patients wished that they had been given more time to reflect and offer their consent, waiting for their family's advice before committing. However, it would have reduced the possibility of participating and performing two sessions during hospitalization. Furthermore, it was difficult to convince patients to participate because of the optional aspects of these rehabilitation sessions. It seems necessary to fight against the prejudice of having to rest during sickness and against the fear of reactivating pain. Recruiting patients before planned hospitalization for cancer treatment would facilitate inclusion and enable us to collect patients' walking characteristics before treatment. Indeed, we were surprised by the poor walking speed of the sample. Furthermore, some patients found harness stigmatizing, but European safety standards were eventually obtained later for use without harness.

Concerning the minimum duration of sessions, the six-minute choice was inspired by the widely used six-minute walking test.[17] It was unexpected to observe, among some studied patients, their difficulty in reaching the minutes duration for the first walking session. Therefore, taking into account the time required to bring these patients to the platform and have them installed, it could be more relevant to distinguish patients based on their ability, sometimes offering in-bed or in-chair activity.[18] On the other hand, the trend in performance improvement for patients able to perform both sessions is promising and could be significant in a larger sample. Therefore, we think it would be useful for planned surgical rehabilitation, including a first training session on a walking platform before hospitalization for surgery.

While the number and duration of walking sessions performed were also less than expected, no side effects were noticed after the sessions. Different reasons can be cited to explain the low number of sessions realized: some patients went out earlier than expected from the hospital, therefore not able to do the second session; others presented afterward a medical contraindication to walk. Indeed, the unstable medical condition – justifying for some patients the hospital stay – may limit PA due to somatic weakening factors such as hypoglycemia, malnutrition, hypotension, iatrogenic, or anemia. Our sample was a heterogeneous mix of planned hospitalizations and acute medical complications in the context of cancer. In this second setting, a combined oncological and geriatric intervention for older inpatients with cancer would optimize the care of these weakening factors.

Another randomized clinical trial compared the benefits of a

Table 2
Factors associated with two walking sessions completion (n = 41).

	Only one walking session group (n = 10)		Two walking sessions group (n = 31)		p
	Median value	[min–max]	Median value	[min–max]	
Age (years)	78.5	[74–86]	76	[70–87]	0.13
Weight (kg)	55	[42–102]	69.5	[40–127]	0.025*
Body mass index (kg/m^2)	21.27	[14.93–31.48]	25.75	[16.23–41]	0.052
Gait speed at inclusion (m/sec)	0.4	[0.07–0.5]	0.4	[0.07–0.8]	0.56
Session duration (minutes)	2.5	[0.65–12]	10	[1–30]	0.011*
Number of steps	158.5	[5–610]	636	[6–4971]	0.0042*
Median gait speed (m/sec)	0.06	[0.05–0.38]	0.14	[0.05–0.41]	0.064
Maximum gait speed (m/sec)	0.08	[0.05–0.41]	0.19	[0.05–0.41]	0.05
Step length (centimeters)	14.5	[0–28]	19	[6–37]	0.082
Total walking distance (meter)	24	[2–175]	85	[3–751]	0.024*
	n	%	n	%	
Gender					0.48
Men	4	(40%)	17	(54.8%)	
Women	6	(60%)	14	(45.2%)	
ECOG PS					0.54
0	2	(20%)	5	(16.7%)	
1	2	(20%)	9	(30%)	
2	6	(60%)	11	(36.7%)	
3	0	(0%)	5	(16.7%)	
Missing data			1		
QAPPA level					0.8
Low	9	(90%)	22	(73.3%)	
Medium	1	(10%)	6	(20%)	
High	0	(0%)	2	(6.7%)	
Missing data			1		
History of fall	1	(10%)	5	(16.7%)	1
CIRS-G severe comorbidity					0.68
Yes	3	(30%)	7	(23%)	
No	7	(70%)	24	(77%)	
Metastatic disease					0.22
Yes	2	(20%)	15	(48.4%)	
Missing data	0	(0%)	1	(3.2%)	
Surgery hospitalization pattern	8	(80%)	19	(61.3%)	0.45
Walking ability at inclusion					
Alone	3	(30%)	18	(58.1%)	0.16
Accessory	3	(30%)	11	(35.5%)	1
Human aid	3	(30%)	4	(12.9%)	0.33
Orientation (10/10 points)	9	(90%)	23	(74.2%)	0.41
Three words recall memory test (3/3 points)	5	(50%)	14	(45.2%)	1
Perfusion					1
Yes	5	(50%)	15	(50%)	
Drain or cutaneous tube					1
Yes	1	(10%)	4	(13.3%)	
Urinary catheter					1
Yes	1	(10%)	3	(10%)	
Nasogastric tube					0.15
Yes	2	(20%)	1	(3.3%)	
Oxygenotherapy					1
Yes	0	(0%)	1	(3.3%)	
Pain at inclusion (VS $\geq$ 1/4)					1
Yes	6	(60%)	16	(53.3%)	
Pain before walking session	3	(30%)	10	(32.3%)	1
Pain during walking session	3	(30%)	9	(29%)	1

* $p < 0.05$.
CIRS-G: Cumulative Illness Rating Scale-Geriatrics; ECOG-PS: European Cooperative Oncology Group-Performance Status; QAPPA: Questionnaire d'Activité Physique Personnes Agées; VS: Verbal Scale.

Table 3
Walking performance characteristics (n = 41).

	1st session (n = 41)		2nd session (n = 31)	
	Median value	[min–max]	Median value	[min–max]
Session duration (minutes)	8	[0.65–30]	10	[0.28–30]
Walking speed (m/sec)	0.13	[0.05–0.41]	0.19	[0.05–0.41]
Maximum walking speed (m/sec)	0.16	[0.05–0.41]	0.25	[0.05–0.42]
Number of steps	511	[5–4971]	648	[2–5344]
Step lenght (cm)	18	[0–37]	24	[0–39]
Walking distance (m)	63	[2–751]	124	[1–771]

Table 4
Performance progression between both sessions (n = 31).

	1st session		2nd session		p
	Median	[min–max]	Median	[min–max]	
Session time (minutes)	10	[1–30]	10	[0.28–30]	0.49
Median walking speed (m/sec)	0.14	[0.05–0.41]	0.19	[0.05–0.41]	0.34
Maximum walking speed (m/sec)	0.19	[0.05–0.41]	0.25	[0.05–0.42]	0.51
Number of steps	636	[6–4971]	648	[2–5344]	0.97
Step length (cm)	19	[6–37]	24	[0–39]	0.3
Total walking distance (m)	85	[3–751]	124	[1–771]	0.24
Fear of fall (/10)	1	[0–6]	0	[0–4]	0.53

hospital mobility program (walking twice daily) with usual care on functional status and mobility one month after discharge, based on the Activity of Daily Living and Life-Space Assessment (LSA), which included 100 older inpatients.[19] In this study, six of the 50 patients in the interventional group did not complete the study. Feasibility is quite similar to our study, because their intervention group completed only 122 of the potential 238 walks (51.3%), mostly due to patient refusal, patient unavailable because of medical examinations, and staff not available. However, this study revealed that patients in a mobility program were less likely to experience a mobility decline (LSA score, 52.5) than those in the control group (LSA score, 41.6) (p = .02). No change, between admission and one-month posthospitalization LSA scores, was observed in the intervention group, whereas in the control group, the LSA scores decreased by approximately ten points.[19]

In another pilot study, including 24 older adult inpatients with acute myelogenous leukemia, aged 65.1 years (SD 7.8) on average, only 17 patients attended at least one exercise session, and 11 completed post-intervention assessments.[20] During weeks two to five, a total of 12 exercise sessions were offered three times per week in the inpatient ward. Each of the 30- to 45 minutes sessions focused on strength, flexibility, and walking, and were tailored to each participant's level of energy and treatment-related symptoms. Among the baseline characteristics evaluated, the only variable that correlated with the total number of exercise sessions attended was the baseline short physical performance battery (SPPB) score (r = 0.71; p = 0.0006). This could be an accurate screening tool to select patients who can participate in future interventional studies.

Furthermore, it is important to understand patients' lack of motivation for PA in order to find ways to approach and overcome such resistance. Practicing PA during hospitalization can be a great challenge, but reassuring the patients about their physical abilities before returning home is important and could reduce the length of their stay. It is possible to increase older patients' self-efficacy by asking them to perform a specific behavior in a safe environment if encouraged by clinicians, family, or friends.[21]

5. Conclusions

This study provides preliminary information about patient adherence, as well as material and organizational feasibility.

Therefore, according to our study, the use of such a walking platform seems feasible in patients able to walk for at least ten minutes in the first session but not in those with severe malnourishment.

It could be useful with the goal of pre-habilitation before major surgery, for which a future randomized control study is considered, demonstrating its efficiency. This device should be involved in multimodal supportive care, particularly combining PA and nutrition, to fight against acute sarcopenia linked to prolonged bed rest during hospitalization.

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