Investigation into the mobility of elderly patients with pneumonia using triaxial accelerometer data

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ABSTRACT. Objective: This study aimed to clarify the levels of physical activity of elderly pneumonia patients. Method: This is a prospective observational study among pneumonia patients who were hospitalized in a clinic within a general and respiratory medicine hospital department, and community-dwelling elderly. Activity levels of 29 elderly patients with pneumonia who were aged >75 years (PP group), and 15 community-dwelling healthy elderly (CD group) were measured. Triaxial accelerometers were attached to the patients’ left chest regions from 48 h until 7 days after hospitalization. Results: The time spent in the upright position was 320.0 min/day in the PP group and 729.0 min/day in the CD group. The time spent walking was 3.8 min/day in the PP group, and 71.0 min/day in the CD group. In the PP group, the times spent in the upright position and walking did not increase during the period studied, that is, from 48 h until 7 days after hospitalization. Conclusion: The time spent in the upright position and walking among elderly patients with pneumonia did not increase, despite gradual improvement of the disease.

Key words: Pneumonia, Elderly, Mobilization, Triaxial accelerometer

Despite the effects of pharmacological agents on pneumonia, many elderly patients with this disease show a decrease in their activities of daily living (ADL) scores as their physical fitness declines during hospitalization and, even after discharge from hospital, the recovery in their ADL scores tends to be slow. Indeed, 35\%\textsuperscript{1} and 49\%\textsuperscript{2} of patients demonstrated declines in their ADL scores following their discharge from general medical wards. A decline in physical function can occur after several days of hospitalization; this phenomenon is called hospital-associated disability (HAD)\textsuperscript{3,4}. HAD can be caused by a combination of many factors, including disease, disuse syndrome, nutritional insufficiencies, and medication, and it can occur in older people during short hospital stays, because their initial capacities are low.

It has been reported that early mobilization (EM) improved stroke patients’ functional prognoses and ADL independence\textsuperscript{5}, and that it shortened hospital stay\textsuperscript{6,7} for patients in intensive care units. Regarding pneumonia patients, EM has reduced hospital stay, helped maintain patients’ ADL independence, and reduced morbidity\textsuperscript{8-10}. However, in these previous investigations EM was implemented between 24 h and 72 h after hospitalization, and it remains unclear when EM should be executed for optimal results. Furthermore, the duration of each EM session requires clarification, and EM for elderly patients with pneumonia is yet to be discussed in depth and validated. It is necessary to establish an EM program for such patients as soon as possible.

To perform EM effectively in elderly patients who have been hospitalized for pneumonia, we must know their levels. A variety of tools and methods, including observation\textsuperscript{11}, patient interviews\textsuperscript{12}, and pedometers\textsuperscript{13}, have been used to measure levels of mobility. In recent years, triaxial
accelerometers have been progressively miniaturized, have become lighter, and their battery times have been extended to facilitate physical activity measurements.

Triaxial accelerometer data have shown that while elderly patients were hospitalized, they were immobile for 17 h/day and for 83% of the day. However, these studies had a number of shortcomings. First, they included elderly patients with a variety of clinical conditions, including pneumonia and heart failure; hence, it was difficult to compare these patients, because policies surrounding their treatment, drip lines, and oxygen administration differed greatly. Second, they included only ADL-independent patients, and little consideration has been given to ADL-dependent patients. Third, the patients’ levels of physical activity were measured over short periods of time; however, longer study periods are necessary to observe the recovery of patients’ physical activities. We hypothesized that patients’ physical activity levels would gradually recover within 1 week of hospitalization, and that ADL independence or dependence before hospitalization is associated with the level of physical activity that occurs after hospitalization and the decline in ADL. This study aimed to clarify the physical activity levels and characteristics of elderly patients with pneumonia.

Materials and Methods

This was a prospective observational study. We evaluated elderly patients with pneumonia who were admitted to the Department of General Medicine and Respiratory Medicine at Tsukuba Medical Center Hospital in Japan between February 2016 and October 2017. The study was approved by the ethics committees of Tsukuba Medical Center Hospital (Approval number: 2015-035) and Ibaraki Prefectural University of Health Sciences (Approval number: 2016-35). This study was conducted in accordance with the principles of the Declaration of Helsinki. Informed consent was obtained from each patient prior to their enrolment in the study.

Population

Patients were included in the study if they were >75 years of age and had pneumonia (PP group). Patients were excluded from the study if (1) they had required help with all of the ADL during the 2 weeks that preceded the study; (2) they had a skin problem or open wounds; (3) they had a pacemaker implanted; (4) they had a severe thoracic deformity; (5) they were admitted to the intensive care unit; (6) they did not provide informed consent within 48 h of admission; (7) the primary doctor was of the opinion that the patient’s life could not be saved after admission; (8) an accelerometer was not available; or (9) the accelerometer data could not be obtained within 24 h. The PP group received physical therapy on every weekday until the day before discharge. Physical therapy starts to receive doctor’s request by clinical condition, but there is no definite protocol of physical therapy, therefore the contents of daily program was decision by each physical therapist. The physical therapy program were composed of mobilization, strength training, ADL training, aerobic exercise, range of motion exercise, and pulmonary rehabilitation. This study did not include existence of comorbidity in the exclusion criteria.

Before admission, patients in the PP group had resided in their own homes. To compare differences according to environment, we established a community-dwelling group (CD group) as a control; the first four aforementioned exclusion criteria did not apply to members of this group. Participants in this group were recruited through flyers posted on university noticeboards. The CD group did not undergo rehabilitation and did not have any fitness routines. Measurements in this group were included as a reference as to how active members of the PP group were before admission.

Descriptive data collection

The patients’ descriptive data were extracted from their medical records, and these included information about the patients’ admission, age, gender, length of stay in hospital, and body mass index (BMI). We also extracted disease-specific data that described the patients’ age (≥75 years), levels of dehydration, respiratory failure, orientation disturbances, and blood pressure (A-DROP score on admission), Charlson comorbidity index (CCI), maximum serum C-reactive protein level during admission, and serum albumin levels on admission. The A-DROP score is used to rate the severity of community-acquired pneumonia (CAP), and it comprises five items that each score one point. Furthermore, we extracted data that described the types and causes of pneumonia. The types of pneumonia were categorized as CAP or nursing and healthcare-associated pneumonia (NHCAP). NHCAP was defined as pneumonia diagnosed in a person who (1) was resident in an extended-care facility or nursing home; (2) had been discharged from a hospital within the previous 90 days; (3) was elderly or disabled and was receiving nursing care; or (4) was receiving regular endovascular treatment as an outpatient. While the A-DROP score categorizes the severity of CAP, it is also useful for predicting the prognosis of NHCAP. The causes of pneumonia were categorized according to the primary doctor’s clinical decision. The information extracted for the control group comprised data that described the participants’ age, gender, BMI, and CCI.

Physical function assessments

A primary physical therapist assessed the patients’ baseline physical functional status according to their grip strength (GS), upper arm and maximum lower leg circumferences, and short physical performance battery (SPPB).
measurest within 1 week after hospital admission. The GS was measured twice while the patient sat, and the maximum value was used in the analyses. The circumferences of the upper and lower extremities were measured twice while the patient sat with their elbow and knee joints flexed at 90°. The circumference of the upper extremity was measured midway between the acromion and olecranon, and that of the lower extremity at the widest point of the leg’s posterior region. An SPPB evaluation objectively assesses lower extremity function in older people. It consists of three items, namely balance, gait speed, and rising from a chair, with a maximum score of 12 points.

The Katz index of independence in ADL (Katz ADL) was used to assess a participant’s ability to perform ADL during their hospital admission, on discharge, and 1 week after discharge. Katz ADL assessments were based on a previous study, with the ADL of 6 items being judged as to whether independent (1 point) or not (0 point). Items which needed surveillance were assigned as dependent. On admission, the patients or their families were asked to rate the patients’ Katz ADL during the 2 weeks before admission. At discharge, the patients or nurses were asked to rate the Katz ADL. One week after discharge, we called the patients’ homes or care facilities and asked for their Katz ADL assessments. The same data were recorded for the control group, whose Katz ADL was assessed once during the study.

Triaxial accelerometer data

The levels of mobility during hospitalization were assessed using wireless triaxial accelerometers (WHS-1; Union Tool Co., Tokyo, Japan). The accelerometers were compact (40 mm × 37 mm) and weighed 13 g. The accelerometers measured the participants’ horizontal (X), vertical (Y), and backwards and forwards (Z) positions with respect to gravity, they monitored the participants’ heart rates, and the sampling frequency was 31.25 Hz. The accelerometers were attached to the participant’s chest by electrocardiogram electrodes (SP-00-S; Ambu Co., Copenhagen, Denmark) placed 8 cm below the center of the left clavicle. Data recording began within 48 h of hospital admission, and the recording period spanned 7 days. Although the measurement period was 7 days, the time lag until the start of measurement differed for each patient. Therefore, patients who started the measurement within 24 hours after admission were recorded as day 1 to day 7, and patients who started the measurement within 24 to 48 hours after admission were recorded as day 2 to day 8. If the recording was terminated halfway, we still used it in the data analysis.

The vertical position and triaxial composite acceleration estimated a participants’ upright posture, which was defined as a Y-axis acceleration ≤−0.7 G, and walking movement, which was defined as an upright posture and a triaxial composite acceleration ≥1.3 G. Acceleration measurements were performed for each heartbeat, and mobilization was defined as the maintenance of an upright posture for ≥1 min, while walking was defined as movement for ≥10 s. The accelerometers and the participants’ skin condition were checked every day, and the data were imported into a computer and analyzed. Three collaborators who were familiar with the method, analyzed the data, and the information generated described the total mobility and time spent walking per hour. We excluded periods that comprised bathing and imaging tests, such as X-rays and computed tomography scanning, from the total mobilization times. The author and the coauthors attached and removed the triaxial accelerometers. If the time excluded was >6 h, we excluded the data or that day from the analyses. The control group’s data were recorded over 1 day only. The author and the coauthors analyzed the data from the triaxial accelerometers using the aforementioned criteria. To remove information bias, we did not inform the primary physical therapist and nurses of the triaxial accelerometer data. Data were anonymized for analysis.

Statistical analyses

The characteristics of the study are presented as medians (interquartile ranges [IQRs]) or numbers and percentages. The Mann-Whitney U test was used to analyze the differences between the PP group and the CD group.

The Friedman test was used to analyze trends in achieving an upright position and the walking times. Because there were few patients for day 1, the data for day 2 to day 8 were used for analysis of the mobilization time. The Mann-Whitney U test and Fisher’s exact test were used to analyze the differences in mobilization times and the decline in ADL between the patients who were ADL-dependent or ADL-independent before admission. All of the statistical analyses were performed using the IBM SPSS software, version 22.0 (IBM Corporation, Armonk, NY, USA), and a value of P<0.05 was considered statistically significant.

Results

Three hundred and twenty-four elderly patients with pneumonia were admitted to the Department of General Medicine and Respiratory Medicine. Of these, 35 patients fulfilled the inclusion criteria, and their mobility data were recorded. However, two patients’ mobility data could not be recorded, because of device malfunctions. Four patients who lived in a nursing home were excluded from analysis. Hence, we used data from 29 patients in the analyses (Figure 1). Two patients died during hospitalization, so changes in ADL could not be measured; therefore, other clinical characteristics such as physical function and mobility data were used. The CD group comprised 15 people.
Participants’ characteristics

Table 1 presents the participants’ characteristics. The PP group’s median age was 85.0 years. The patients’ pneumonia was moderate-to-severe, with A-DROP scores of 2 or 3. Over half of the patients had CAP, with aspiration causing 41.4% and bacteria 51.7% of the case of pneumonia. Patients in the PP group had one or two comorbidities, and had more comorbidities than the CD group. Almost all of the patients were connected to drip lines and oxygen tubes while the accelerometer data were recorded. Physical therapy was performed on all of the participants except one.

All of the pneumonia patients received physical therapy for 20-40 min/day for 5 days/week. The physical therapy comprised a range of motion, strengthening, and aerobic exercises, and practicing ADL occurred at the primary physical therapist’s discretion.

Table 2 presents the participants’ physical function and ADL data. The PP group had a shorter circumference of leg and lower SPPB score than the CD group. Before admission, 17 patients in the PP group were independent regarding all of their self-care ADL. The ADL declined in 44.4% and 25.9% of the patients at discharge and at 1 week after discharge, respectively. The ADL declines occurred in both patients who were dependent and independent regarding their self-care ADL. There was no difference between patients who were ADL-dependent and those who were ADL-independent before hospitalization in relation to the number whose ADL declined during hospitalization (P=0.39).

Mobility data

The patients wore the accelerometers for a median interval of 6.0 days (IQR 4.0-7.0 days). The median time spent in an upright position during the course of 1 week by the participants in the PP and CD groups were 320.0 min/day (IQR 210.3-418.8 min/day), 729.0 min/day (IQR 686.0-853.0 min/day), respectively. Compared with the CD group, the participants in the PP group spent significantly less time in the upright position (P<0.01). The median amounts of time spent walking by the participant in the PP, CD groups were 3.8 min/day (IQR 0.9-7.3 min/day), 71.0 min/day (IQR 26.2-117.9 min/day), respectively. The PP group spent significantly less time walking than the CD group (P=0.01). In the PP group, no significant difference existed between the ADL-independent and ADL-dependent patients in relation to the time they spent in an upright position (P=0.24), but there was a significant difference between the ADL-independent and ADL-dependent patients regarding the time they spent walking (P<0.01).

The time that the patients spent in an upright position from the day of admission were 327.0 min/day (IQR 212.5-349.5 min/day) on day 1, 285.0 min/day (IQR 169.5-405.0 min/day) on day 2, 261.0 min/day (IQR 138.0-320.0 min/day) on day 3, 260.0 min/day (IQR 161.5-350.0 min/day) on day 4, 287.0 min/day (IQR 182.5-424.5 min/day) on day...
Investigation into mobility of elderly pneumonia patients

Table 1. Clinical characteristics of the study population.

<table>
<thead>
<tr>
<th></th>
<th>PP group n=29</th>
<th>CD group n=15</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>85.0 (78.0; 89.0)</td>
<td>80.0 (76.0; 85.0)</td>
<td>0.61</td>
</tr>
<tr>
<td>Male, n (%)</td>
<td>20 (69.0)</td>
<td>5 (33.3)</td>
<td>0.36</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>21.2 (19.0; 24.4)</td>
<td>21.1 (20.8; 23.8)</td>
<td>0.56</td>
</tr>
<tr>
<td>CCI</td>
<td>2.0 (1.0; 2.0)</td>
<td>0 (0; 1)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>A-DROP score</td>
<td>2.0 (2.0; 3.0)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Albumen (g/dL)</td>
<td>3.1 (2.8; 3.8)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>CRP (mg/dL)</td>
<td>12.7 (7.3; 19.3)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Type of pneumonia</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAP, n (%)</td>
<td>20 (69.0)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>NHCAP, n (%)</td>
<td>9 (31.0)</td>
<td>-</td>
<td></td>
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<tr>
<td>Cause of pneumonia</td>
<td>-</td>
<td></td>
<td></td>
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<tr>
<td>Aspiration, n (%)</td>
<td>12 (41.4)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Bacterial, n (%)</td>
<td>15 (51.7)</td>
<td>-</td>
<td></td>
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<tr>
<td>Other, n (%)</td>
<td>2 (6.9)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Hospitalization duration (days)</td>
<td>16.0 (11.0; 24.0)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Line (days)</td>
<td>10.0 (8.0; 15.0)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Received oxygen therapy, n (%)</td>
<td>21 (72.4)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Oxygen therapy duration (days)</td>
<td>7.0 (0; 9.0)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Fasting, n (%)</td>
<td>10 (34.5)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Time until physiotherapy initiation (h)</td>
<td>18.0 (13.5; 23.0)</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

PP: pneumonia group; CD: community-dwelling group; CCI: Charlson comorbidity index; A-DROP: age, dehydration, respiratory failure, orientation disturbances, and blood pressure; CAP: community-acquired pneumonia; NHCAP: nursing and healthcare-associated pneumonia; CRP: C-reactive protein; “Line” denotes the period during which an intravenous line was in position. Data presented are the medians (25th and 75th percentiles) or the numbers (percentages). Statistical significance was set at P<0.05.

Table 2. Physical function characteristics of the study population.

<table>
<thead>
<tr>
<th></th>
<th>Pneumonia group n=29</th>
<th>Community-dwelling group n=15</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand grip</td>
<td>20.5 (17.5; 26.0)</td>
<td>24.0 (20; 31)</td>
<td>0.17</td>
</tr>
<tr>
<td>Circumference</td>
<td>Upper arm (cm)</td>
<td>25.0 (22.6; 26.0)</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>Lower leg (cm)</td>
<td>28.0 (26.0; 33.5)</td>
<td></td>
</tr>
<tr>
<td>SPPB</td>
<td>Balance</td>
<td>2.0 (1.0; 3.5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stand</td>
<td>1.0 (0.5; 3.0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Walk</td>
<td>2.0 (1.0; 3.5)</td>
<td></td>
</tr>
<tr>
<td>Katz ADL</td>
<td>Before admission</td>
<td>6.0 (4.3; 6.0)</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td>All ADL independent, n (%)</td>
<td>17 (58.6)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td></td>
<td>Discharge</td>
<td>4.0 (2.0; 6.0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 week after discharge</td>
<td>6.0 (3.0; 6.0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ADL decline, n (%)</td>
<td>7 (25.9)</td>
<td></td>
</tr>
</tbody>
</table>

SPPB: short physical performance battery, ADL: activities of daily living.

Data presented are the medians (25th and 75th percentiles) or the numbers (percentages). Statistical significance was set at P<0.05.

5, 320.0 min/day (IQR 154.0-459.0 min/day) on day 6, 300.0 min/day (IQR 134.0-428.8 min/day) on day 7, and 176.0 min/day (IQR 122.0-374.0 min/day) on day 8 (Figure 3A). There was no difference between the ADL-dependent and ADL-independent patients regarding the amount of time they spent in an upright position during hospitalization.

The time the patients spent walking from the day of admission were 1.8 min/day (IQR 0.5-4.4 min/day) on day 1, 4.4 min/day (IQR 0.6-6.8 min/day) on day 2, 5.3 min/day
Discussion

Our data suggest that elderly hospitalized adults with pneumonia spend most of the day resting in bed, and that physical activity levels did not recover up to 7 days after admission. Pedersen et al.\textsuperscript{12} and Brown et al.\textsuperscript{13} reported similar or longer times for patient mobilization; however, these studies did not investigate patients with specific illnesses. Our study included only patients with pneumonia.

The elderly patients who were hospitalized with pneumonia had shorter mobilization times than the participants in the CD group. The PP group may have decreased mobilization time due to hospitalization for pneumonia. However, it was difficult to simply compare the PP group and the CD group, because the CD group’s physical function was clearly higher than that of the PP group. Also the PP group may have originally been frail and low in activity. The factors associated with ADL reductions during hospitalization have been described\textsuperscript{11}, and these include the severity of acute illness, environmental factors, restricted mobility, little encouragement to be independent, and enforced dependence. Many factors can reduce mobilization during hospitalization, which will, in turn, promote disuse syndrome.
While these factors were not identified in this study, they require further investigation.

We predicted that the mobilization time would increase as a patient’s physical condition improved with treatment, but there was no significant change during the 7 days that followed admission. Other studies that have investigated the recovery of mobilization have reported similar findings.\(^1\) Pedersen et al.\(^1\) reported about 4.0 h/day of being on the upright position, while Brown et al.\(^1\) showed about 6.2 h/day, similar to the result in this study. Although walking time was not measured separately in other studies, in this study walking time was very short a matter of a few minutes while in previous studies it measured as 1.1 h\(^1\), 55 min\(^2\). In comparison with other medical patients, the patients with pneumonia were receiving oxygen therapy, and the oxygen tubes from the central piping system may have limited their walking.

Even if the patients’ pneumonia improved when they were placed in a hospital environment, their levels of mobility did not improve. These results concur with those from other studies of patients\(^3\), and we speculate that bed rest will continue irrespective of the disease. Possible reasons for the lack of improvement in the levels of physical activity include concerns about patients falling, management of medical instruments, (for example, catheters and drips), a lack of staff and walking aids, and a lack of understanding about the importance of the walking for the patients. Long-term declines in physical activity cause unnecessary disuse syndrome, which can extend hospital stay and lead to a decline in ADL.

Three-quarters of the patients received early physical therapy after admission (within 24 h), but their physical activity did not recover. This result indicates that there was no improvement in the amount of physical activity with physical therapy of limited duration. Physical therapists need to adapt not only physical therapy duration but also the daily activity, according to the physical condition of the patient. Hence, the physical therapists monitor patients’ mobility levels, and they should offer advice to medical staff about implementing appropriate mobilization techniques and procedures that can improve mobility. In this context, physical therapists will be able to mobilize patients more effectively if they can access real-time mobility data generated by accelerometers.

There were no differences between the patients who were ADL-dependent and those who were ADL-independent before hospitalization regarding the time spent in an upright position and the ADL decline. Hence, even if the patients were mobile, they were not mobile during hospitalization. Regardless of their independence in relation to ADL, the patients appeared to continue to rest, except at meal times, and during toilet and rehabilitation requirements. Pedersen et al.\(^1\) reported that nonambulatory patients had shorter mobilization times than ambulatory patients. However, our study, compared the mobilization times of ADL-dependent and ADL-independent patients therefore, patients whose ADL dependence was more severe than they reported may have been included in this study.

This study has several limitations. First, the sample size was small; therefore, factors associated with mobilization could not be considered. Details about the characteristics of the participants who tended to reduce their levels of activity and which mechanisms caused poor outcomes were unclear. Second, this study was not blinded; hence, an information bias may have existed. Attaching accelerometers to the patients may have influenced their mobility and the mobility of the medical staff. If this study had been blinded, the PP group’s mobilization time may have been shorter than this result, because the medical staff would not pay specific attention to patients’ mobilization time. Third, we only recorded data for the first 7 days after admission; therefore, we could not evaluate the patients’ long-term physical activity. Fourth, this study may have selection bias in the CD group, who were considered active and healthy people who decided to participate in this study after seeing a flyer.

**Conclusion**

This is the first report to describe the findings of a study that examined the activity timelines and courses of elderly patients with pneumonia who were hospitalized. The elderly patients with pneumonia rested during hospitalization, and their physical activity levels did not recover after a specific period of time. In addition, the time spent being physically active and the decline in the patients’ ADL after discharge did not differ between patients who were ADL-dependent and those who were ADL-independent before hospitalization.

**Conflict of Interest:** The authors have no conflict of interest to disclose.

**References**

3) Covinsky KE, Pierluissi E, *et al.*: Hospitalization-associated disability: “She was probably able to ambulate, but I’m not sure”. *JAMA.* 2011; 306: 1782-1793.
stroke fast-tracks return to walking: further results from the phase II AVERT randomized controlled trial. Stroke. 2011; 42: 153-158.


Appendix

The accelerometers were attached to the patient’s left chest by electrocardiogram electrodes.