Safety Literature 16th January 2022

Acute effect of traditional and adaptive metronomes on gait variability in older individuals with a history of falls

Cronström A, Cole MH, Chalkley D, van Andel S, Pepping GJ, Creaby MW. Aging Clin. Exp. Res. 2022; ePub(ePub): ePub.

Abstract

BACKGROUND: Metronome cueing has been shown to reduce gait variability and thereby potentially reduce falls risk in individuals with Parkinson's disease. It is unclear however, if metronome cueing has a similar effect in healthy older adults with a history of falls.

AIM: To investigate whether a traditional and/or an adaptive metronome, based on an individual's gait pattern, were effective in reducing gait variability in older adults with a history of falls.

METHODS: Twenty older adults (15 women, 71 ± 4.9 years) with a history of falls were included in this cross-over study. Participants received two types of cueing (adaptive and traditional metronome) 1 week apart. The variability of the participants' stride time, stride length, walking speed and duration of double leg support were recorded during three walking conditions (baseline, during feedback and post-feedback gait). Repeated-measures ANOVA was used to assess the possible effects of the two cueing strategies on gait variables.

RESULTS: Compared with the baseline condition, participants had significantly increased stride time variability during feedback ($F_{(2)} = 9.83$, $p < 0.001$) and decreased double leg support time variability post-feedback ($F_{(2)}$ 3.69, $p = 0.034$). Increased stride time variability was observed with the adaptive metronome in comparison to the traditional metronome.

CONCLUSION: Metronome cueing strategies may reduce double leg support variability in older adults with a history of falls but seem to increase stride time variability. Further studies are needed to investigate if metronome cueing is more beneficial for individuals with greater baseline gait variability than those included in the current study.

Language: en

Keywords

Predicting fall counts using wearable sensors: a novel digital biomarker for Parkinson's disease

Greene BR, Premoli I, McManus K, McGrath D, Caulfield B. Sensors (Basel) 2022; 22(1): e54.

Abstract

People with Parkinson's disease (PD) experience significant impairments to gait and balance; as a result, the rate of falls in people with Parkinson's disease is much greater than that of the general population. Falls can have a catastrophic impact on quality of life, often resulting in serious injury and even death. The number (or rate) of falls is often used as a primary outcome in clinical trials on PD. However, falls data can be unreliable, expensive and time-consuming to collect. We sought to validate and test a novel digital biomarker for PD that uses wearable sensor data obtained during the Timed Up and Go (TUG) test to predict the number of falls that will be experienced by a person with PD. Three datasets, containing a total of 1057 (671 female) participants, including 71 previously diagnosed with PD, were included in the analysis. Two statistical approaches were considered in predicting falls counts: the first based on a previously reported falls risk assessment algorithm, and the second based on elastic net and ensemble regression models. A predictive model for falls counts in PD showed a mean $R(2)$ value of 0.43, mean error of 0.42 and a mean correlation of 30% when the results were averaged across two independent sets of PD data. The results also suggest a strong association between falls counts and a previously reported inertial sensor-based falls risk estimate. In addition, significant associations were observed between falls counts and a number of individual gait and mobility parameters. Our preliminary research suggests that the falls counts predicted from the inertial sensor data obtained during a simple walking task have the potential to be developed as a novel digital biomarker for PD, and this deserves further validation in the targeted clinical population.

Language: en

Keywords

Prevalence of fear of falling and its association with physical function and fall history among senior citizens living in rural areas of China

Abstract

BACKGROUND: Fear of falling (FOF) is as significant as a fall, leading to limited physical activity and poor quality of life among senior citizens. This study aimed to investigate the prevalence of FOF and its association with physical function and fall history among the senior citizens (≥75 years old) living in rural areas of China.

METHODS: This was a cross-sectional study conducted in eastern China from June to October 2019. All elderly participants were recruited during their attendance for the free health examinations in villages and towns organized by the local healthcare authorities. Data on sociodemographics, fall history, FOF conditions, self-reported comorbidity and regular medications were collected by face-to-face interview, and the physical function status was evaluated through a field test. Univariate and multivariate analyses were performed to compare the differences in physical function and fall history of senior citizens with/without FOF.

RESULTS: A total of 753 senior citizens (mean age = 79.04) participated in this study. Of these, 63.5% were aged 75-80. FOF was reported in 22.8% of the participants, while 18.5% had a fall in the past year. Among the senior citizens with and without a fall history, the prevalences of FOF were 38.8 and 19.2%, respectively. On multivariate analyses, FOF was independently associated with the Time Up and Go Test (TUG) duration (OR = 1.080; 95% CI: 1.034-1.128), 4-Stage Balance Test score (OR = 0.746; 95% CI: 0.597-0.931), fall history (OR = 2.633; 95% CI: 1.742-3.980), cerebral apoplexy (OR = 2.478; 95% CI: 1.276-4.813) and comorbidities (≥2) (OR = 1.637; 95% CI: 1.066-2.514), while the correlation between FOF and the 30-s chair stand test was only statistically significant in univariate analysis (Z = -3.528, p < 0.001).

CONCLUSION: High prevalence of FOF is observed among the senior citizens living in rural areas of China. FOF is strongly correlated with physical function performance and fall history. Therefore, the implementation of targeted FOF prevention measures is key to improve the physical activity of the senior citizens, which would ultimately lead to fall prevention and improved quality of life.

Language: en

The association of cardio-metabolic risk factors and history of falling in men with osteosarcopenia: a cross-sectional analysis of Bushehr Elderly Health (BEH) program

Fahimfar N, Yousefi S, Noorali S, Gharibzadeh S, Sanjari M, Khalagi K, Mehri A, Shafiee G, Heshmat R, Nabipour I, Amini A, Darabi A, Heidari G, Larijani B, Ostovar A. BMC Geriatr. 2022; 22(1): e46.

Abstract

BACKGROUND: Osteosarcopenia, defined as sarcopenia plus osteopenia/osteoporosis, may increase the risk of fractures and affects morbidity and mortality in the older population. Falling is also common in the elderly and increases the risk of fractures and mortality. We examined the association of cardio-metabolic risk factors with a history of falling in osteosarcopenic men.

METHODS: We used the baseline data of the Bushehr Elderly Health (BEH) program. Osteosarcopenia was defined as having both sarcopenia (reduced skeletal muscle mass plus low physical performance and/or low muscle strength) and osteopenia/osteoporosis (T-score $\leq$ - 1.0). Falling was defined as a self-reported history of an unintentional down on the ground during the previous year before the study. We used logistic regression analysis to estimate the adjusted odds ratio (AOR) with a 95% Confidence Interval (CI) to quantify the associations.

RESULTS: All elderly men diagnosed with osteosarcopenia (n = 341), with a mean age of 73.3(±7.4) years, were included. Almost 50(14.7%) participants reported falling. Age showed a positive association with falling (AOR: 1.09, 95%CI: 1.04-1.14). An increase of 10 mmHg in systolic blood pressure(SBP), reduces the odds of falling by 26%(AOR:0.74, 95%CI:0.62-0.89), while a positive association was detected for fasting plasma glucose (FPG), as 10 mg/dl increase in the FPG, raises the chance of falling by 14%(AOR = 1.14, 95%CI:1.06,1.23). Hypertriglyceridemia was inversely associated with falling (AOR = 0.33, 95% CI: 0.12, 0.89).

CONCLUSIONS: Falling is a major public health problem in rapidly aging countries, especially in individuals with a higher risk of fragility fractures. Older age-raised fasting plasma glucose and low SBP are associated with falling in osteosarcopenic patients. Considering the higher risk of fracture in osteosarcopenic men, comprehensive strategies are needed to prevent fall-related injuries in this high-risk population.

Language: en

The SAFEST review: a mixed methods systematic review of shock-absorbing flooring for fall-related injury prevention

Drahota A, Felix LM, Raftery J, Keenan BE, Lachance CC, Mackey DC, Markham C, Laing AC. BMC Geriatr. 2022; 22(1): 32.

Abstract

BACKGROUND: Shock-absorbing flooring may minimise impact forces incurred from falls to reduce fall-related injuries; however, synthesized evidence is required to inform decision-making in hospitals and care homes.

METHODS: This is a Health Technology Assessment mixed methods systematic review of flooring interventions targeting older adults and staff in care settings. Our search incorporated the findings from a previous scoping review, MEDLINE, AgeLine, and Scopus (to September 2019) and other sources. Two independent reviewers selected, assessed, and extracted data from studies. We assessed risk of bias using Cochrane and Joanna Briggs Institute tools, undertook meta-analyses, and meta-aggregation.

RESULTS: 20 of 22 included studies assessed our outcomes (3 Randomised Controlled Trials (RCTs); 7 observational; 5 qualitative; 5 economic), on novel floors (N = 12), sports floors (N = 5), carpet (N = 5), and wooden sub-floors (N = 1). Quantitative data related to 11,857 patient falls (9 studies), and 163 staff injuries (1 study). One care home-based RCT found a novel underlay produced similar injurious falls rates (high-quality evidence) and falls rates (moderate-quality evidence) to a plywood underlay with vinyl overlay and concrete sub-floors. Very low-quality evidence suggested that shock-absorbing flooring may reduce injuries in hospitals (Rate Ratio 0.55, 95% CI 0.36 to 0.84, 2 studies; 27.1% vs. 42.4%; Risk Ratio (RR) = 0.64, 95% CI 0.44 to 0.93, 2 studies) and care homes (26.4% vs. 33.0%; RR 0.80, 95% CI 0.70 to 0.91, 3 studies), without increasing falls. Economic evidence indicated that if injuries are fewer and falls not increased, then shock-absorbing flooring would be a dominant strategy. Fracture outcomes were imprecise; however, hip fractures reduced from 30 in 1000 falls on concrete to 18 in 1000 falls on wooden sub-floors (OR 0.59, 95% CI 0.45 to 0.78; one study; very low-quality evidence). Staff found moving wheeled equipment harder on shock-absorbing floors leading to workplace adaptations. Very low-quality evidence suggests staff injuries were no less frequent on rigid floors.

CONCLUSION: Evidence favouring shock-absorbing flooring is uncertain and of very low quality. Robust research following a core outcome set is required, with attention to wider staff workplace implications. TRIAL REGISTRATION: PROSPERO CRD42019118834. Language: en

A comparison of balance and fall risk in patients with unilateral and bilateral total knee arthroplasty

Tütüncüler E, Ok N, Güngör HR, Bayrak G, Şavkın R, Büker N. J. Back Musculoskelet. Rehabil. 2021; ePub(ePub): ePub.

Abstract

BACKGROUND: Static or dynamic postural control cannot be fully restored in patients with knee osteoarthritis, even after total knee arthroplasty (TKA), which may contribute to an increased risk of falls in the elderly.

OBJECTIVE: To evaluate balance and the fall risk before and after TKA in patients with bilateral knee osteoarthritis. Secondary outcomes were patient-reported and performance-based activity limitations.

METHODS: A total of 45 patients were separated into two groups as unilateral TKA (UTKA, n= 24) and bilateral TKA (BTKA, n= 21) groups. All the patients received standard postoperative physical therapy for 3 months. Balance and fall risk (Biodex Balance System SD), patient-reported and performance-based functionality (WOMAC, 30-second chair-stand test, 9-step stair climbing test and 40-meter fast-paced walk test) and Short Form-12 (SF-12) were evaluated at preoperatively, and at 3 months postoperatively.

RESULTS: There was no difference between the groups in postoperative fall risk and balance (p> 0.05). The BTKA group obtained better results in the sit-to-stand test and SF-12 physical dimension (p< 0.05).

CONCLUSIONS: UTKA and BTKA interventions and the standard postoperative rehabilitation were seen to improve balance and quality of life, and reduce the fall risk, patient-reported and performance-based activity limitations. However, despite improvements in balance, the risk of falling persists.

Language: en

Keywords

A multicenter cohort study of falls among patients admitted to the ICU

Wu G, Soo A, Ronksley P, Holroyd-Leduc J, Bagshaw SM, Wu Q, Quan H, Stelfox HT. Crit. Care Med. 2022; ePub(ePub): ePub.

Abstract

OBJECTIVES: To determine the incidence of falls, risk factors, and adverse outcomes, among patients admitted to the ICU.

DESIGN: Retrospective cohort study. SETTING: Seventeen ICUs in Alberta, Canada. PATIENTS: Seventy-three thousand four hundred ninety-five consecutive adult patient admissions between January 1, 2014, and December 31, 2019. MEASUREMENTS AND MAIN RESULTS: A mixed-effects negative binomial regression model was used to examine risk factors associated with falls. Linear and logistic regression models were used to evaluate adverse outcomes. Six hundred forty patients experienced 710 falls over 398,223 patient days (incidence rate of 1.78 falls per 1,000 patient days [95% CI, 1.65-1.91]). The daily incidence of falls increased during the ICU stay (e.g., day 1 vs day 7; 0.51 vs 2.43 falls per 1,000 patient days) and varied significantly between ICUs (range, 0.37-4.64 falls per 1,000 patient days). Male sex (incidence rate ratio [IRR], 1.37; 95% CI, 1.15-1.63), previous invasive mechanical ventilation (IRR, 1.82; 95% CI, 1.40-2.38), previous sedative and analgesic medication infusions (IRR, 1.60; 95% CI, 1.15-2.24), delirium (IRR, 3.85; 95% CI, 3.23-4.58), and patient mobilization (IRR, 1.26; 95% CI, 1.21-1.30) were risk factors for falling. Falls were associated with longer ICU (ratio of means [RM], 3.10; 95% CI, 2.86-3.36) and hospital (RM, 2.21; 95% CI, 2.01-2.42) stays, but lower odds of death in the ICU (odds ratio [OR], 0.09; 95% CI, 0.05-0.17) and hospital (OR, 0.21; 95% CI, 0.14-0.30).

CONCLUSIONS: We observed that among ICU patients, falls occur frequently, vary substantially between ICUs, and are associated with modifiable risk factors, longer ICU and hospital stays, and lower risk of death. Our study suggests that fall prevention strategies should be considered for critically ill patients admitted to ICU.

Language: en

Falls in people post-Guillain-Barré syndrome in the United Kingdom: a national cross-sectional survey of community based adults

Abstract

Guillain-Barré syndrome (GBS) has several enduring effects that can lead to further harm and/or lower quality of life. These effects include falling and body pain, neither of which have been fully explored. This study aims to examine the risk factors associated with falling and potential causes of body pain in a post-GBS population. A cross-sectional survey of 216 participants was conducted using an electronic questionnaire that included. Self-report measures for: overall health, balance, anxiety and depression levels, body pain and demographics related to GBS experience and falls. A large proportion of individuals post-GBS experience ongoing problems beyond those expected with ageing. Comparative tests indicated that people reporting falls in the previous 12 months had: poorer levels of mobility, poorer F-scores, higher levels of body pain, poorer balance, poorer anxiety and depression scores and higher levels of fatigue. Gender did not appear to contribute to falls. Injuries following falls were associated with a lack of physiotherapy postdischarge and time since GBS. In a regression analysis of the identified and expected key variables, age and body pain statistically predicted falls. In over a quarter of cases reported here, respondents did not receive community physiotherapy following hospital discharge. In the midst and aftermath of COVID-19, provision of rehabilitation needs to be recalibrated, not just for COVID patients, but the wider community with ongoing needs. Issues around well-being and quality of life in the post-GBS community also need further consideration.

Language: en

Keywords

Osteosarcopenia synergistically increases the risk of falls in patients with rheumatoid arthritis

Abstract

OBJECTIVES: Osteosarcopenia is defined as osteoporosis with sarcopenia. The impacts of osteosarcopenia on falls and fractures in rheumatoid arthritis (RA) patients were investigated using 4 years of data from a longitudinal study (CHIKARA study).

METHODS: The patients were divided into 4 groups by their baseline status: no sarcopenia and no osteoporosis (SP-OP-); only sarcopenia (SP + OP-); only osteoporosis (SP-OP+); and both sarcopenia and osteoporosis (SP + OP+). Survival rates and Cox hazard ratios were analyzed using falls and fractures as endpoints, adjusted by age, sex, and body mass index.

RESULTS: A total of 100 RA patients (SP-OP-: 44%, SP + OP-: 17%, SP-OP+: 28%, and SP + OP+: 11%) were enrolled; 37 patients had falls, and 19 patients had fractures. The fall-free and fracture-free survival rates were significantly lower in SP + OP+ (36.4%, 54.5%) than in SP-OP- (75.0%, 86.4%). The hazard ratio of falls was significantly increased in SP + OP+, by 3.32-fold (95%CI: 1.01-10.9), whereas in SP + OP- and SP-OP+, there were no differences compared to SP-OP-.

CONCLUSIONS: The survival rates with the endpoints of falls and fractures in RA patients with osteosarcopenia were lower during 4-year follow-up. The risk of falls increased with the synergistic effect of osteoporosis and sarcopenia.

Language: en

Strong relationship of muscle force and fall efficacy, but not of gait kinematics, with number of falls in the year after total hip arthroplasty for osteoarthritis: an exploratory study

Lin XB, Wu WH, Weijer RHA, Prins MR, van Dieen JH, Bruijn SM, Meijer OG. Clin. Biomech. 2021; 92: e105551.

Abstract

BACKGROUND: In people with moderate hip osteoarthritis, gait kinematics was reported to be correlated with number of falls in the preceding year. After Total Hip Arthroplasty, subjects generally improve but still fall. The present study explores recovery and correlations with number of falls in the year after Total Hip Arthroplasty.

METHODS: We assessed 12 patients one year after Total Hip Arthroplasty, 12 patients with moderate hip osteoarthritis with at least one fall in the preceding year, and 12 healthy peers. Maximum hip abduction strength, Fall Efficacy Scale - International, Harris Hip Score, pain, and number of falls in the preceding year were assessed. Participants walked on a treadmill with increasing speeds, and gait kinematics were registered optoelectronically. We assessed group differences, and correlations of all variables with number of falls.

FINDINGS: After arthroplasty, subjects tended to score better on variables measured, often non-significantly, compared to subjects with moderate osteoarthritis, but worse than healthy peers. Maximum hip abduction strength together with fall efficacy had a strong regression on the number of falls in the preceding year ($R(2) = 92\%$). Gait kinematics did not correlate with number of falls, and also fall efficacy was not related to gait kinematics.

INTERPRETATION: One year after hip arthroplasty, muscle strength sufficiently recovered for normal walking, but not to avoid falling in risky situations. Rehabilitation should focus on muscle strength. The lack of correlation between the Fall Efficacy International and gait kinematics, suggests that it reflected the experience of having fallen rather than fear.

Language: en

Keywords

The effect that the Otago Exercise Programme had on fear of falling in community dwellers aged 65-80 and associated factors

Abstract

BACKGROUND: Falls are a major public health problem. Fear of falling is highly prevalent amongst community-dwelling older adults who have already fallen and it is also a risk factor for recurrent falls. There has been limited research about the impact that exercises programs have on the fear of falling. The aim of this study was to evaluate whether the Otago Exercise Programme (OEP) reduced the fear of falling in non-institutionalised people aged 65-80 years in Spain. It also evaluated the factors associated with the fear of falling.

METHODS: This was a quasi-experimental study that focused on people aged 65-80 who attended 21 primary healthcare centres, lived in the community, were able to walk independently and provided written, informed consent. They were recruited from September 2017 to December 2019. The OEP sessions took place at the primary healthcare centres and were provided on an individual or group basis by trained OEP instructors. The participants attended five weekly sessions, where they were given exercises to develop their strength, balance and endurance. They then continued the programme at home. The subjects were followed up 12 months after baseline and the analyses included a bivariate analysis and a multivariate analysis with logistic regression.

RESULTS: We enroled 498 patients (67.07% female) with an average age of 71.81 years. More than two-thirds (65.06%) lived with a partner and 42.37% were overweight. Significant reductions were observed in the mean level of fear of falling between baseline and 12 months (p = 0.000). A number of factors associated with fear of falling also showed significant differences. These were: age (p = 0.033), sex (p = 0.000), living alone (p = 0.000), body mass index (p = 0.003) and whether psychotropic drugs were used (p = 0.000). The multivariate analysis showed a moderate to high fear of falling amongst participants who were female (p = 0.000), 72-80 years of age (p = 0.017), obese (p = 0.045) and used psychotropic drugs (p = 0.021).

CONCLUSIONS: Taking part in the OEP reduced the overall fear of falling. There were significant associations between fear of falling and being female, taking psychotic drugs and having a history of falls. This study is a quasi-experimental sign nested an experimental study (randomized controlled trial previously published and registered on ClinicalTrials.org (NCT03320668)). Retrospectively registered on 25/10/2017.

Language: en

Keywords

Using root cause analysis to inform a falls practice change in the home care setting

Abstract

Falls are a significant health problem in community-dwelling older adults, resulting in injuries, deaths, and increased healthcare costs. Falls were a quality concern for a Northeastern home care agency and this project aimed to evaluate the falls prevention process for older adults receiving home care services by determining potential root causes of falls and to identify a practice change. This quality improvement project used a root cause analysis methodology with a retrospective matched case-control design. Records of patients with falls were assessed for falls prevention process fidelity and compared with patients without a fall matched on the Missouri Alliance for Home Care-10 (MAHC-10) assessment, examining plan of care accuracy and patient fall risk factors.

FINDINGS indicated fidelity concerns in the fall prevention process, with gaps in care planning aligned with identified risk factors. Interventions to mitigate identified MAHC-10 risk factors on care plans were present less than 50% of the time for four of the six factors. Polypharmacy (7.46%) and pain affecting function (9.21%) were most frequently unaddressed risk factors in the care plan. Recommendations included implementation of a falls prevention pathway, including standardized falls risk assessment, universal falls precautions in the care plan with tailored interventions based on risk factors, and referral initiation when necessary.

Language: en

Validity and reliability of a smartphone app for gait and balance assessment

Rashid U, Barbado D, Olsen S, Alder G, Elvira JLL, Lord S, Niazi IK, Taylor D. Sensors (Basel) 2022; 22(1): e124.

Abstract

Advances in technology provide an opportunity to enhance the accuracy of gait and balance assessment, improving the diagnosis and rehabilitation processes for people with acute or chronic health conditions. This study investigated the validity and reliability of a smartphone-based application to measure postural stability and spatiotemporal aspects of gait during four static balance and two gait tasks. Thirty healthy participants (aged 20-69 years) performed the following tasks: (1) standing on a firm surface with eyes opened, (2) standing on a firm surface with eyes closed, (3) standing on a compliant surface with eyes open, (4) standing on a compliant surface with eyes closed, (5) walking in a straight line, and (6) walking in a straight line while turning their head from side to side. During these tasks, the app quantified the participants' postural stability and spatiotemporal gait parameters. The concurrent validity of the smartphone app with respect to a 3D motion capture system was evaluated using partial Pearson's correlations (r(p)) and limits of the agreement (LoA%). The within-session test-retest reliability over three repeated measures was assessed with the intraclass correlation coefficient (ICC) and the standard error of measurement (SEM). One-way repeated measures analyses of variance (ANOVAs) were used to evaluate responsiveness to differences across tasks and repetitions. Periodicity index, step length, step time, and walking speed during the gait tasks and postural stability outcomes during the static tasks showed moderate-to-excellent validity ($0.55 \leq r(p) \leq 0.98$; $3\% \leq LoA\% \leq 12\%$) and reliability scores ($0.52 \leq ICC \leq 0.92$; $1\% \leq SEM\% \leq 6\%$) when the repetition effect was removed. Conversely, step variability and asymmetry parameters during both gait tasks generally showed poor validity and reliability except step length asymmetry, which showed moderate reliability ($0.53 \leq ICC \leq 0.62$) in both tasks when the repetition effect was removed. Postural stability and spatiotemporal gait parameters were found responsive ($p < 0.05$) to differences across tasks and test repetitions. Along with sound clinical judgement, the app can potentially be used in clinical practice to detect gait and balance impairments and track the effectiveness of rehabilitation programs. Further evaluation and refinement of the app in people with significant gait and balance deficits is needed.

Language: en

Keywords