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Original Paper

PREVENTING POSTOPERATIVE DELIRIUM IN OLDER ADULTS WITH HIP FRACTURE: A RANDOMISED CONTROLLED TRIAL OF A REORIENTATION INTERVENTION

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*Postoperative delirium (POD) is a common complication in geriatric patients undergoing hip fracture surgery. This study evaluated the effectiveness of a short postoperative reorientation intervention in reducing the incidence and duration of POD. In this randomised controlled trial, 62 patients aged > 75 undergoing hip fracture surgery were recruited. Preoperative cognitive assessments were conducted using the Montreal Cognitive Assessment (MOCA) and delirium screening with the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU). Daily evaluations using CAM-ICU were performed for seven postoperative days. The intervention group received structured reorientation sessions and a five-minute news briefing daily. The trial was comprised of 62 participants (80.6% female, mean age 82 ± 6 years), with 49% having preoperative cognitive impairment associated with delirium development (*p *= 0.02). Incidence rates of delirium were similar in both groups: 20% vs. 25% in controls (*p *= 0.82). However, the duration of delirium was significantly shorter in the intervention group (4 vs. 6 days,* p *< 0.01). Patients in the intervention group were four times more likely to achieve delirium resolution within 7 days (relative risk (RR): 4.13,* p *= 0.03). The reorientation intervention significantly reduced the duration of delirium post-hip fracture surgery, but did not affect overall incidence rates.*

Keywords: *non-pharmacological intervention, MOCA, CAM-ICU test.*

INTRODUCTION

Hip fractures are a common injury among the geriatric cohort, primarily due to increased risk of falls, syncope, and osteoporosis, particularly in individuals over the age of 75 (Hatoum and Sheldon, 2022; Buzkova *et al*., 2023). The majority of these cases require surgical intervention (Murphy *et al*., 2024). Postoperative delirium (POD) — acute new onset delirium within a week after anaesthesia and surgery — is a significant concern, affecting 40–65% of geriatric patients, and yet it frequently goes unrecognised (Mahanna-Gabrielli *et al*., 2019; Barreto Chang *et al*., 2024). POD is associated with increased 30-day mortality and readmission rates, prolonged hospitalisation, higher healthcare costs, as well as prolonged cognitive impairment, slower functional recovery and cognitive decline after surgery (Card *et al*., 2015; Kapoor *et al*., 2022; Kong *et al*., 2022). It is important to identify POD and its possible risk factors because up to 40% of POD can be prevented (Swarbrick and Partridge, 2022; Barreto Chang *et al*., 2024).

There are various approaches to reducing POD, including identification of high-risk patient groups through risk factor assessment, as well as pharmacological and non-pharmacological interventions. Compared to pharmacological interventions, non-pharmacological strategies offer several advantages — avoid polypharmacy, reduce costs and side effects as well as target multiple risk factors simultaneously (Mc

Neil *et al*., 2018; Hughes *et al*., 2020; Igwe *et al*., 2020). The first studies demonstrating the effectiveness of non-pharmacological interventions in preventing delirium development in medical wards were conducted more than 20 years ago; however, despite this evidence, clear guidelines regarding the optimal timing and implementation of these interventions remain lacking (Inouye *et al*., 1999; Colombo *et al*., 2012; Hughes *et al*., 2020; Jin *et al*., 2020). Several non-pharmacological approaches have been described, primarily targeting specific risk factors such as cognitive impairment, sleep deprivation, immobility, sensory deficits (hearing and vision impairment), and dehydration (Inouye *et al*., 1999; Hsiao *et al*., 2024). The most widely recognised multicomponent interventions include environmental modifications (optimising natural lighting, minimising noise), early mobilisation, timely removal of unnecessary catheters and intravenous lines, ensuring adequate nutrition and hydration, and structured orientation-based communication with patients (Hughes *et al*., 2020; Swarbrick and Partridge, 2022). In high-risk patients, a multicomponent intervention bundle is often recommended, incorporating these strategies along with a multidisciplinary team consisting of physicians, physiotherapists, pharmacists, and respiratory therapists (Hsiao *et al*., 2024). A comprehensive geriatric assessment follows a similar approach but includes an additional structured preoperative evaluation aimed at optimising risk factors and reducing postoperative complications in geriatric patients (Swarbrick and Partridge, 2022). Educational programmes for patients and their families have also been shown to be effective. These programmes provide individualised information on procedures and perioperative care, and reducing anxiety and distress while promoting recovery (Hughes *et al*., 2020). Despite their proven benefits, non-pharmacological interventions are time-consuming and often require additional staff, training, and financial investment, which pose challenges for their routine implementation in daily practice (Inouye *et al*., 1999; Hsiao *et al*., 2024).

Given that non-pharmacological interventions consist of multiple components, it is challenging to evaluate the effectiveness of each component individually, as they are typically implemented as part of an intervention bundle (Hsiao *et al*., 2024). A significant proportion of studies on medical, critically ill or intensive care unit (ICU) patients have focused on risk factor reduction and the application of targeted interventions, including reorientation strategies (Inouye *et al*., 1999; Oh *et al*., 2015). Since patient reorientation often is incorporated into multicomponent interventions, the optimal timing for initiating reorientation remains unclear. Studies report varying initiation times, ranging from hospital or ICU admission to the postoperative period (Inouye *et al*., 1999; Colombo *et al*., 2012; Hsiao *et al*., 2024). Additionally, once initiated, the appropriate duration of the intervention remains uncertain. Existing studies report different approaches, with some continuing interventions for five days postoperatively, while others extend them until hospital or ICU discharge (Hughes *et al*., 2020; Lam *et al*., 2021). Despite the demonstrated effectiveness of non-pharmacological interventions in reducing the incidence of delirium, standardised protocols for their implementation have yet to be established.

We conducted a randomised controlled trial with the aim to investigate whether a short postoperative patient reorientation intervention can effectively reduce the incidence and duration of POD in older adults undergoing hip fracture surgery.

MATERIALS AND METHODS

This randomised controlled trial was conducted from June to October 2024. The study enrolled 62 patients aged 75 years or older undergoing hip fracture surgery. Exclusion criteria included patients under the age of 75, those unable to participate due to a language barrier, patients who refused surgery, and those with cancelled procedures. Participants were randomly assigned to either control group or intervention group using a computer-generated random sequence.

Prior to surgery, all participants underwent cognitive assessment using the Montreal Cognitive Assessment (MoCA) (Nasreddine *et al*., 2005). or MoCA-Blind (Wittich *et al*., 2010) version for individuals with visual impairment (test is considered positive if the MOCA score is at least 26/30 or the MOCA-Blind score is at least 19/22), as well as the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU) (Inouye *et al*., 1990) as a screening method to detect delirium. Both groups were evaluated daily with CAM-ICU for seven consecutive days, starting on the first postoperative day.

The intervention group received structured daily reorientation sessions, each lasting approximately 30 minutes. These sessions included a variety of components designed to address different cognitive aspects. Reorientation was provided in terms of identity, where patients were reminded of their name and age; time, including the day of the week, date, month, year, and location — the name of the hospital, unit, and room. Additional information was given about surgery and recovery, including the timing of the surgery, the postoperative day, updates on the recovery process (patients were interviewed and asked to demonstrate some of their physiotherapy exercises), and follow-up examinations. Patients were encouraged to drink 150–200 ml of water during the reorientation session. Additionally, patients in the intervention group received a daily five-minute news briefing displayed on a tablet as part of cognitive stimulation.

Statistical analyses. Continuous data are presented as median with interquartile range. Differences between continuous data were analysed using the Wilcoxon rank-sum test. Categorical data are presented as frequencies with percentages. Differences between categorical data were analysed using the Chi-squared test. Resolution of delirium is presented as Kaplan–Meier curves and hazard ratios based on univariable and multivariable Cox regression analyses accounting for gender and age. A p value 0.05 was considered statistically significant. The statistical analysis was carried out using R version 4.2.1. (R Foundation for Statistical Computing, Wirtschaftsuniversität Wien, Vienna, Austria).

RESULTS

As shown in Figure 1, a total of 71 patients aged 75 years or older undergoing hip fracture surgery were assessed for eligibility. Sixty-two patients provided informed consent and were randomly assigned into two groups: control (n = 32) and intervention (n = 30). Nine patients were excluded. Preoperative assessment included cognitive evaluation using the MoCA or MoCA-Blind and delirium screening with the CAM-ICU. Postoperatively, the control group underwent daily CAM-ICU screening, while the intervention group received both daily CAM-ICU screening and structured reorientation sessions. All 62 participants completed the study.

Table 1 demonstrates that the majority of participants were female 80.6%, with 81.2% in the control group and 80.0% in the intervention group (p = 0.901), with a median age 82.0 [Q1 = 78.2, Q3 = 87.0] years (p = 0.821). The distribution of education levels did not differ significantly between the groups (p = 0.218).

The prevalence of preoperative neurocognitive impairment was detected by 49% of the total study population, with no significant difference between the intervention and control groups (p = 0.729). Cognitive assessment was not possible in twelve (19%) patients (eight in the control group and four in the intervention group) due to various factors, including severe dementia, preoperative delirium, non-compliance, or hearing impairment.

From the first postoperative day onward, patients were screened for delirium. Postoperative delirium was detected in 22.6% of patients (n = 8 in the control vs n = 6 in the intervention group), with no significant statistical difference between the groups (p = 0.638). Several risk factors were analysed for their potential impact on delirium incidence. Age (p = 0.82) and gender (p = 0.66) did not show a significant association with delirium occurrence. However, preoperative cognitive impairment, as indicated by negative MOCA or MOCA-Blind results, was significantly associated with an increased risk of postoperative delirium (p = 0.02).

Kaplan–Meier survival analyses with long-rank tests showed that the intervention group had a significantly higher probability of delirium resolution within seven days compared to the control group (Fig. 2, log rank $p < 0.01$). Patients in the intervention group had a faster recovery from postoperative delirium (4 days) compared to the control group (6 days).

Analysis using a Cox proportional hazards model (Table 2) showed that patients in the intervention group had a significantly higher likelihood of postoperative delirium resolution compared to the control group, with a HR of 12.21 (95% CI: 2.07–72.16, p = 0.006) after accounting for gender and age. There was no statistically significant effect modification of intervention effect on delirium resolution by presence of preoperative cognitive impairment.

DISCUSSION

Our study aimed to determine whether a short postoperative patient reorientation intervention could reduce the incidence and duration of POD in older adults undergoing hip fracture surgery. Our findings indicate that while the intervention did not significantly impact incidence of POD, it was effective in shortening the duration of POD.

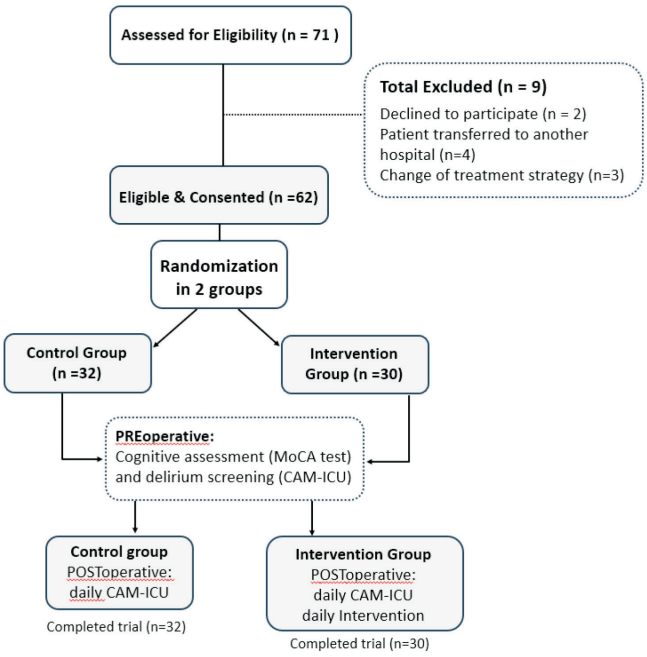

Fig. 1. Flow chart for randomised trial, from eligibility screening (n = 71) to randomisation (n = 62) into the control (n = 32) and intervention (n = 30) groups.

In contrast to other research, our study enrolled patients aged 75 or older undergoing hip fracture surgery, making our population older than those in previous studies (Inouye *et al*., 1999; Colombo *et al*., 2012; Hughes *et al*., 2020; Lam *et al*., 2021; Hsiao *et al*., 2024). Cochrane meta-analysis (Burton *et al*., 2021) reviewed multiple trials with a broader range of hospitalised patients, some including younger populations. Similarly, the RAGA trial (Li *et al*., 2022) included patients aged > 65 years.

Due to the older age of our study cohort, the likelihood of developing POD and its duration may have been higher. Older patients often have multiple comorbidities, particularly those requiring continuous medication use, along with greater number of risk factors for POD development (Smith *et al*., 2017; Kotekar *et al*., 2018; Swarbrick and Partridge, 2022). Additionally, our patient population underwent surgery for hip fracture, which carries a higher risk for POD development compared to other types of surgeries, particularly elective procedures (Bilotta *et al*., 2013; Igwe *et al*., 2020; Jin *et al*., 2020).

Similar to other studies, we assessed the cognitive status before implementing the intervention. Various cognitive assessment tools, such as the Montreal Cognitive Assessment (MoCA) and the Mini-Mental State Examination (MMSE), can be used to determine baseline cognitive function, leading to methodological differences across studies (Inouye *et al*., 1999; Colombo *et al*., 2012; Burton *et al*., 2021; Lam *et al*., 2021; Hsiao *et al*., 2024). However, consistent findings indi-

Table 1. Demographic and clinical characteristics of control and intervention groups

	Control group, n = 32 (%)	Intervention group, n = 30 (%)	Total, n= 62 (%)	*p*-value
Gender				
Female	26 (81%)	24 (80%)	50 (81%)	0.901
Male	6 (19%)	6 (20%)	12 (19%)	
Age				
Median [Q1, Q3]	83.5 [78.0, 87.0]	82.0 [79.0, 86.8]	82.0 [78.2, 87.0]	0.821
Preoperative screening of cognitive impairment				
Cognitive assessment was not possible	8 (25%)	4 (13%)	12 (19%)	0.729
Present	15 (47%)	15 (50%)	30 (49%)	
Absent	9 (28%)	11 (37%)	20 (32%)	
Education levels				
Basic school	2 (6%)	1 (3%)	3 (4%)	0.218
Middle school	4 (12%)	6 (21%)	10 (16%)	
High school	17 (53%)	10 (33%)	27 (44%)	
Bachelor's, Master's, Doctorate	2 (6%)	9 (30%)	11 (18%)	
No information	7(23%)	4(13%)	11 (18%)	
Postoperative delirium screening				
Negative CAM-ICU	24 (75%)	24 (80%)	48.0 (77%)	0.638
Positive CAM-ICU	8 (25%)	6 (20%)	(23%)	

CAM-ICU, Confusion Assessment Method for the Intensive Care Unit

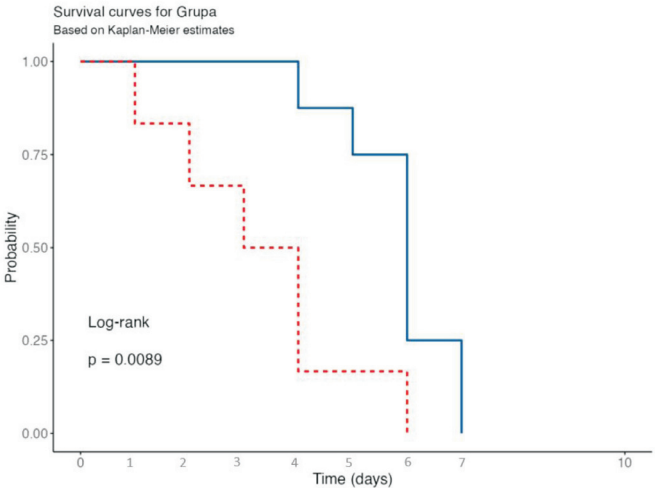

Fig. 2. Kaplan–Meier Survival Curves for Postoperative Delirium Resolution. This Kaplan-Meier survival plot illustrates the probability of postoperative delirium resolution over time in the control group (blue solid line) and the intervention group (red dashed line).

cate that patients with pre-existing cognitive impairment are at higher risk of developing POD (Inouye *et al*., 1999; Bilotta *et al*., 2013; Smith *et al*., 2017; Buron *et al*., 2021; Barreto Chang et al., 2024) which aligns with the results of our study. Evaluating other risk factors for the development of POD, our study did not find a link between age, gender or education level and POD (Bilotta *et al.*, 2013; Smith *et al*., 2017).

Even though our short reorientation intervention did not significantly impact incidence of POD, our findings demonstrate that it significantly reduced the duration of delirium from six days in the control group to four days in the intervention group. In previous studies, the reduction in delirium duration was typically around one day (Burton *et al.,* 2021); however, in our study, the reduction was two days. Additionally, patients in the intervention group were four times more likely to experience a sooner resolution of delirium compared to those in the control group. These findings differ from other studies (Freter *et al*., 2017; Lam *et al*., 2021), who reported both reduced incidence and duration of delirium using multicomponent strategies (Freter *et al*., 2017; Lam *et al*., 2021). Similarly, the Cochrane meta-analysis found a 43% reduction in POD incidence when using multicomponent intervention bundles (Burton *et al*., 2021). These comparisons suggest that reorientation alone may accelerate delirium recovery but lacks sufficient impact on prevention.

Our intervention focused on structured daily reorientation sessions, involving reminders of identity, location, and time, alongside hydration encouragement and cognitive stimulation, which contrasts with multicomponent delirium prevention programmes used in many studies (Inouye *et al*., 1999; Lam *et al*., 2021; Hsiao *et al*., 2024). This approach allowed us to specifically evaluate the impact of a simple, easily applicable reorientation strategy on POD. Multicomponent strategies typically involve a broader range of interventions, incorporating a multidisciplinary team and environmental modifications that begin at patient admission to the hospital or specific ward (Inouye *et al*., 1999; Colombo *et al*., 2012; Hughes *et al*., 2020; Burton *et al*., 2021; Hsiao *et al*., 2024; Lam *et al*., 2021). Some bundles included caregiver education, regional anaesthesia techniques as well as environmental modifications (Lam *et al*., 2021) while other trials as-

Table 2. Univariate and multivariate hazard ratios for postoperative delirium resolution

Dependent variables	Groups of variables	n (%)	HR (Univariable)	HR (Multivariable)
Group	Control	32 (51.6)	–	–
	Intervention	30 (48.4)	4.34 (1.31–14.37, $p = 0.016$)	12.21 (2.07–72.16, $p = 0.006$)
Gender	Male	12 (19.4)		–
	Female	50 (80.6)	0.38 (0.04–3.29, $p = 0.379$)	0.07 (0.00–1.05, $p = 0.054$)
Age	Mean (SD)	83.0 (6.0)	1.01 (0.92–1.11, $p = 0.823$)	0.92 (0.82–1.03, $p = 0.143$)

sessed nurse-led delirium prevention protocols, incorporating pain control, sleep hygiene, and early mobilisation (Korkmaz *et al*., 2021). In contrast to our study, where the intervention was implemented on the first post-operative day, these interventions began before surgery, which may explain differences in POD incidence outcomes.

One limitation of our study is that POD screening using CAM-ICU was performed only once daily. Given the fluctuating nature of POD, future research may benefit from more frequent assessments to enhance detection accuracy. Another limitation was the duration of our study (June to October 2024), which was similar to other single centre randomised controlled trials, although shorter than large-scale meta-analyses and long-term observational studies (Colombo *et al.,* 2012; Burton *et al*., 2021; Hsiao *et al.,* 2024). Our intervention was postoperative only, whereas other non- pharmacological interventions were initiated pre-operatively and continued post-operatively (Korkmaz *et al*., 2021) potentially contributing to their superior reduction in POD incidence. While previous research has found no significant difference in POD incidence between general and regional anaesthesia (Lam *et al*., 2021), implementing non-pharmacological interventions like listening to the radio and receiving updates during surgery under regional anaesthesia, may yield different results.

Although non-pharmacological interventions have proven to be effective in reducing both POD incidence and duration, many uncertainties remain, particularly regarding the optimal timing for initiation, the appropriate duration and the need for standardised guidelines. Compared to existing research, our findings emphasise the benefits of the reorientation intervention while suggesting that it may be most effective when integrated into a broader multicomponent intervention strategy as highlighted by the Cochrane review (2021), which concluded that multifactorial non-pharmacological interventions are the most effective approach, and that reorientation alone may not be sufficient to reduce POD incidence. Multicomponent intervention bundles are typically implemented by geriatricians and multidisciplinary teams, requiring specialised knowledge and resources, whereas reorientation intervention can be easily applied without the need for specialised training and can be carried out by volunteers, caregivers, or even family members, making it a practical and widely applicable approach to reduce POD.

CONCLUSIONS

The reorientation intervention strategy implemented in this study resulted in significant reduction in the duration of postoperative delirium in older patients undergoing hip fracture surgery. The intervention showed no effect on the overall incidence of postoperative delirium.

ETHICS

The study protocol was approved by the Hospital of Traumatology and Orthopaedics Research Ethics Committee (Nr. 32/ 2024/ 1). Patients were invited to participate in the study prior to surgery, and informed consent for participation was obtained from all patients.

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PĒCOPERĀCIJAS DELĪRIJA PREVENCIJA GERIATRISKIEM PACIENTIEM AR GŪŽAS LŪZUMU: RANDOMIZĒTS KONTROLĒTS REORIENTĀCIJAS INTERVENCES PĒTĪJUMS

Pēcoperācijas delīrijs (POD) ir bieži sastopama komplikācija geriatriskiem pacientiem pēc gūžas lūzuma operācijas, ietekmējot līdz pat 40% pacientu. Šajā pētījumā izvērtēta īsas pēcoperācijas reorientācijas intervences efektivitāte POD incidences un ilguma mazināšanā. Pētījumā tika iekļauti 62 pacienti vecumā > 75 gadiem, kam tika veikta gūžas locītavas lūzuma ķirurģiska ārstēšana. Pacienti tika randomizēti sadalīti divās grupās: kontroles grupā (n = 32) un intervences grupā (n = 30). Visiem pacientiem pirms operācijas tika novērtēts kognitīvais stāvoklis, izmantojot Monreālas kognitīvo spēju novērtēšanas testu (MoCA) vai MoCA-Blind (saīsinātu versiju pacientiem ar redzes traucējumiem). Tāpat tika novērtēts apziņas līmenis, izmantojot delīrija skrīninga CAM-ICU testu (*Confusion Assessment Method for the Intensive Care Unit*). Sākot ar pirmo pēcoperācijas dienu, visi pacienti ik dienu tika novērtēti ar CAM-ICU testu. Papildus tam intervences grupa saņēma strukturētu reorientācijas intervenci, iekļaujot reorientāciju laikā, telpā, personībā, pēcoperācijas dienu uzskaiti, sarunu ar pacientu par progresu fizioterapijā, iedrošinājumu uzņemt līdz 200 ml ūdens intervences laikā, kā arī piecu minūšu ziņu sižeta demonstrāciju. Visu pētījumā iekļauto pacientu vidējais vecums bija 82 ± 6 gadi, un 80.6% no pacientiem bija sievietes. Kognitīvo funkciju traucējumi pirms operācijas tika novēroti 49% pacientu, kas ietekmēja delīrija attīstību (p = 0,02). POD incidence abās grupās bija līdzīga: 20% intervences grupā un 25% kontroles grupā (p = 0,82). Savukārt delīrija ilgums intervences grupā bija būtiski mazāks nekā kontroles grupā (4 vs. 6 dienas, p < 0,01). Pacientiem intervences grupā bija četras reizes lielāka iespējamība, ka delīrijs izzudīs 7 dienu laikā, salīdzinot ar kontroles grupas pacientiem (RR: 4,13, p = 0,03). Reorientācijas intervence būtiski samazina delīrija ilgumu pacientiem pēc gūžas lūzuma ķirurģiskas ārstēšanas, taču tā neietekmē POD attīstīšanās incidenci.