Effect of an Inpatient Geriatric Consultation Team on Functional Outcome, Mortality, Institutionalization, and Readmission Rate in Older Adults with Hip Fracture: A Controlled Trial

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OBJECTIVES: To evaluate the effect of an inpatient geriatric consultation team (IGCT) on end points of interest in people with hip fracture: length of stay, functional status, mortality, new nursing home admission, and hospital readmission.

DESIGN: Controlled trial based on assignment by convenience.

SETTING: Trauma ward in a university hospital.

PARTICIPANTS: One hundred seventy-one people with hip fracture aged 65 and older.

INTERVENTION: Participants were assigned to a multidisciplinary geriatric intervention ($n = 94$) or usual care ($n = 77$) during hospitalization after hip fracture.

MEASUREMENTS: End points were functional status, length of stay, mortality, new nursing home admission, and hospital readmission 6 weeks, 4 months, and 12 months after surgery.

RESULTS: Mean length of stay was 11.1 ± 5.1 days in the intervention group and 12.4 ± 8.5 days in the control groups ($P = .24$). Complete adherence to IGCT recommendations was 56.8%. A significant benefit of intervention on functional status in univariate analyses ($P = .02$) 8 days after surgery disappeared in a linear mixed model. Participants with dementia had better functional status in a linear mixed model than those without ($P = .03$), but this effect was no longer significant after Bonferroni correction for multiple testing. After 6 weeks, 4 months, and 12 months, no between-group differences could be documented for mortality, new nursing home admission, or readmission rate.

CONCLUSION: This trial could not document functional benefits of an IGCT intervention in people with hip fracture.

More research is needed to investigate whether a more-intensive approach with more-direct control over patient management, more-specific recommendations, and more-intense education would be effective. *J Am Geriatr Soc* 59:1299–1308, 2011.

Key words: geriatric consultation; inpatient; elderly; hip fracture

The number of older people in Western countries has been increasing over the last decades.¹ In the near future, the number and proportion of older persons in the population will grow rapidly, with baby boomers now in their 50s and early 60s.² Because individuals aged 65 and older experience three to four times as many hospital days as the general population, healthcare workers will increasingly be involved in caring for older persons,³ but specialized healthcare professionals on nongeriatric wards often lack the specific experience and interest required to address the complex needs of older adults effectively.⁴ This “culture and knowledge gap” may have a far-reaching effect on a number of aspects of care. Hospitalized older adults—with their typical frailty profile—are more prone to develop functional decline and more susceptible to cognitive and depressive disorders.^{5,6} Moreover, healthcare professionals often misperceive changes in cognitive and functional status as a normal consequence of aging. This agism stereotype can result (in)directly in negative outcomes, such as an accelerated deterioration of overall health.^{5,6}

A systematic approach based on a comprehensive geriatric assessment (CGA) is the best way to detect geriatric problems and to address the complex and specific needs of frail and hospitalized older adults.^{7,8} CGA is defined as “a multidimensional interdisciplinary diagnostic process focused on determining a frail elderly person’s medical, psychosocial and functional capabilities in order to develop a

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coordinated and integrated plan for treatment and long-term follow-up.”⁷

One of the geriatric assessment programs currently active in daily clinical practice is the inpatient geriatric consultation team (IGCT). The concept of IGCT reached its “peak attention” in the international literature between 1980 and 2000, but studies reporting on the effects of IGCT have varied widely in terms of design, team composition, and assessment of different outcomes. In a 1990 review, intervention of an IGCT showed positive effects in only three of 13 studies, with possible benefits on mental status, short-term survival, and length of stay,⁹ but more-recent randomized controlled trials (RCTs) that have evaluated the effectiveness of consultation teams have had inconclusive findings. Some of these studies have reported significant improvements in 6-month survival, activities of daily living (ADLs), and rate of hospital readmissions.^{10–12} Others have failed to show significant differences in outcomes between control and intervention groups in terms of mortality, hospital readmission, nursing home admission, length of stay, and hospital charges.^{13–15}

Although multidisciplinary IGCTs are considered highly relevant from a practical and clinical perspective, sound and reliable evidence of their effectiveness is lacking.¹⁶ Moreover, most prior studies of inpatient geriatric consultation did not focus specifically on the acute care of older adults with hip fracture. In this context, the aim of the current study was to test the hypothesis that an IGCT-based intervention would improve ADL functioning and reduce length of stay, mortality, nursing home admission, and hospital readmission in a specific subset of older individuals (individuals consecutively admitted to hospital with a traumatic hip fracture).

METHODS

Design and Participants

A single-center, parallel-group trial was conducted in the Leuven University Hospitals (the major university hospital in Belgium; 1,955 beds) from February to December 2007 with follow-ups at 6 weeks, 4 months, and 12 months after inclusion in the study. Verbally competent individuals aged 65 and older consecutively admitted to the emergency department with a traumatic hip fracture were eligible for inclusion. Exclusion criteria were the presence of multiple trauma or metastatic cancer or other known comorbidity expected to reduce the individuals’ life expectancy to less than 6 months.

Intervention

The control group received usual care from the trauma team. Clinical activities in the usual care protocol included evaluation of living conditions before admission by social workers, early mobilization and rehabilitation by the physiotherapist, treatment with anticoagulants and non-opioid pain medication, and a postoperative X-ray of the hip. Participants in the intervention group received usual care as well, but with additional assessment and advice by the IGCT. The IGCT consisted of a geriatrician (JF), three nurses (TB), a social worker, two occupational therapists, and a physiotherapist, all with extensive experience in

geriatric care. Other disciplines were available on call. The intervention by the team included four successive steps: CGA, in-depth multidisciplinary evaluation, formal clinical advice and recommendations, and in-hospital follow-up upon request (Appendix 1). Detailed information on the assessment method and instruments and the implementation of the IGCT have been previously reported.¹⁷

Within 72 hours after the initial comprehensive geriatric assessment or in-depth multidisciplinary evaluation, the IGCT made specific and individualized recommendations in addition to and different from the usual care delivered by the trauma care team. Recommendations were communicated in two ways: a detailed report was included in the participant’s electronic file, and recommended courses of action were discussed between the IGCT nurse and the healthcare team of the trauma ward as part of their weekly team meeting. When additional recommendations were made during subsequent hospitalizations, these were added to the initial structured report and discussed with the trauma team.

Variables and Instruments

Demographic and Baseline Data

The following baseline data were collected: age, sex, living situation, type of hip fracture, number of medications, comorbidity, mental status, and confirmed diagnosis of dementia. Comorbidity was assessed according to the Charlson Comorbidity Index.¹⁸ Mental status was measured using the 12-item Mini-Mental State Examination (MMSE),¹⁹ the Confusion Assessment Method (CAM),²⁰ the Delirium Index (DI),²¹ the Informant Questionnaire on Cognitive Decline in the Elderly (IQ-CODE),²² and the 10-item Geriatric Depression Scale (GDS).²³ The diagnosis of dementia was based on the item “dementia” in the Charlson Comorbidity Index. Baseline data were collected before surgery, through participant interview, by screening the medical and nursing files, or both.

Adherence

The research team systematically and prospectively listed all recommendations made for each participant in the intervention group using a structured check list. As a control measure, these structured checklists were checked retrospectively for correctness and completeness for each participant. To this end, each recommendation was searched for in the participant’s electronic file. Adherence was qualified as an order, report, result, or note in the electronic file that indicated that adherence to the recommendation was planned or that the recommendation had been followed.²⁴ Adherence was evaluated using three measures: complete, partial, and nonadherence rates. Complete adherence rate was defined as the number of recommendations the team of the nursing ward completely adhered to divided by the number of recommendations that the IGCT made.²⁵ To be considered adherent, recommendations had to be initiated within 5 days after communication, unless specified otherwise. Partial adherence rate implied that the participant in the intervention group received only some recommendations or did not receive recommendations in a timely manner, with partial adherence rate defined as the number of recommendations the team partially adhere to

divided by the number of recommendations made.²⁴ Likewise, nonadherence rate was the number of recommendations that the team did not comply with divided by the number of recommendations that the IGCT made. The effect of each specific recommendation was further estimated by multiplying its frequency with the complete adherence rate.²⁶ For instance, the recommendation to perform additional blood tests was made in 40.1% of the intervention group, with 63.6% complete adherence. Thus, in 63.6% of 40.1%, or 25.5% of the intervention group, additional blood tests were performed based on the recommendations of the IGCT.

Outcome Measures

The primary end point was in-hospital functional status. Functional status was measured using the 6-item Katz Index of activities of daily living (ADLs).²⁷ Dependence in bathing, dressing, transfer, toileting, incontinence, and feeding was assessed on a 3-point scale (1 = independent, 2 = partially dependent, 3 = fully dependent), resulting in a continuous total score ranging from 6 to 18.

Additional outcomes were length of stay and mortality, unplanned readmission, and new nursing home admission rate. Length of stay during the acute phase was defined as the number of postoperative days on the trauma ward until discharge or death. The day after surgery was defined as the first postoperative day. For participants transferred to a geriatric or rehabilitation ward, the total length of stay was defined as the number of days on the trauma ward and the number of days on the geriatric or rehabilitation ward until discharge or death.

Mortality was defined as the number of events (death) from the first day after surgery until 6 weeks, 4 months, and 12 months.

An unplanned readmission was defined as a subsequent or repeat hospitalization that followed the initial hospitalization and could not be foreseen at the time of discharge, regardless of whether readmission occurred on a nonemergency or emergency basis.²⁸ It was measured 6 weeks, 4 months, and 12 months postoperatively.

A new nursing home admission was defined as the number of events (new admissions in a nursing home) from the initial hospitalization until 6 weeks, 4 months, and 12 months postoperatively. By definition, new nursing home admissions were measured only in participants who had not been living in a nursing home before the hip fracture occurred.

Procedure

Participants were recruited consecutively in the emergency department. Inclusion and exclusion criteria were checked, and informed consent was obtained. Functional status and GDS scores of eligible participants were assessed retrospectively for up to 2 weeks before admission. For cognitively impaired participants, premorbid status was assessed by interviewing a proxy or relative. Baseline characteristics (e.g., age, sex, living situation, number of medications, and type of fracture), cognitive status (MMSE, CAM, DI, and IQ-CODE), and Charlson Comorbidity Index were assessed within the first 24 hours after admission and before surgery. On the first, third, fifth, and eighth day after surgery, functional status and mortality were evaluated.

From 8 days after surgery on—and depending on the participant's length of stay—functional status and mortality were assessed weekly (e.g., day 15, day 22). Discharge destination, length of stay, and mortality were assessed when the participant was scheduled for discharge. Six weeks, 4 months, and 12 months after the index admission, the participant (or relatives in case of cognitive impairment) were interviewed over the telephone, and a selection of questions and self-completion instruments (ADLs, instrumental ADLs) was mailed to assess functional status, mortality, living situation, and unplanned readmissions.

A doctoral student (TB) and his supervisor (KM) trained all three data nurses who gathered information and assessed the participants. The Medical Ethics Committee of the Leuven University Hospitals approved the study. After written and oral information was provided, informed (proxy) consent was obtained for every participant before inclusion. Consent continued to be checked at the different assessment times.

Sample Size

According to a power analysis using a two-tailed test of significance with an alpha of 0.05 and a beta of 0.10 to detect a difference of two points in ADL functional status (standard deviation = 4), a sample size of 70 participants was required in each group.²⁹ Taking into account a possible dropout rate of approximately 15% to 20% after 1 year of follow-up, this corresponded to 80 to 85 participants in each group.

Assignment

All eligible participants were allocated to one of the two trauma wards of the hospital (one intervention and one control ward). The assignment of participants was imbedded in the normal procedures of the hospital's admission service. After admission to the emergency department, the admission service determined on which of the two trauma wards the participant would be hospitalized, a decision based solely on the availability of beds.

Blinding

Neither participants, healthcare professionals on the trauma wards, nor members of the IGCT could be blinded to the intervention, because it was based on face-to-face contact between participants and the IGCT. Collected data were analyzed blinded to the group allocation of the participant.

Statistical Methods

Data gathered as part of the study were coded and analyzed anonymously. Descriptive analyses were done for the control and intervention groups; continuous variables were expressed as means and interquartile ranges and categorical variables as number of cases and percentages. The effect of the intervention on ADL functioning was tested in a linear mixed model for repeated measures. All ADL measurements were included to fit a linear model, with baseline ADL score, group, time, and an interaction between group and time as explanatory variables. A transformation of time (1/log (time)) led to the best model fit. In addition to analyses of the available ADL scores of all participants,

different mortality analyses were done: one with participants who died was excluded from the analyses and a second one in which participants who died were given the worst possible (maximum) ADL score once they had died. All analyses were repeated for the following subgroups of participants: participants with a baseline ADL score of 6 (independent for all aspects), 7 or greater (dependence for at least one aspect), and 12 or greater (most dependent participants) and participants with and without dementia.

All analyses were performed on an intention-to-treat principle. Univariate analyses were performed using SPSS version 17.0. (SPSS, Inc., Chicago, IL); the linear mixed model was performed using the MIXED procedure in SAS version 9.2 (SAS Institute, Inc., Cary, NC). Statistical significance was established as $P < .05$, with all tests being two-tailed.

RESULTS

Study Population

During the study, 287 people with hip fracture were consecutively admitted to the study hospital; 116 were excluded from the study (Figure 1). All 171 consenting participants were successfully assigned to the intervention ($n = 94$) or control group ($n = 77$). Table 1 compares

prefracture participant characteristics of both groups. There were no statistically significant differences in any of the baseline characteristics examined.

Content of Recommendations Made by the Geriatric Consultation Team

Recommendations were made for 79 of the 94 participants in the intervention group (84.0%). No recommendations were given to 15 participants because no need for additional advice on top of usual care could be identified. Of the 338 recommendations made for these 79 participants, adherence could not be determined for nine recommendations, leaving 329 recommendations for study (97.3%). The occupational therapist had made the nine recommendations with unknown adherence, suggesting walking aids or adapted footwear. The mean number of recommendations per participant was 4.3 ± 2.1 , ranging from one to 10. Complete and partial adherence rates were 56.8% (187/329) and 10.6% (35/329), respectively. The healthcare team on the trauma ward did not comply with 107 (32.5%) recommendations.

Table 2 gives a structured overview of the recommendations that the IGCT made, reporting their frequency, adherence rates, and effect. The frequency of particular

Figure 1. Flowchart of individuals with hip fracture.

Table 1. Baseline Characteristics of Intervention and Control Groups

Characteristic	Intervention (n = 94)	Control (n = 77)	P-Value
Age, mean $\pm$ SD	80.4 $\pm$ 7.0	81.1 $\pm$ 7.2	.49*
Female, n (%)	69 (73.4)	57 (74.0)	.93 [†]
Living situation, n (%)			.78 [‡]
At home alone	33 (35.1)	22 (28.6)	
At home with others	32 (34.0)	31 (40.3)	
Nursing home	26 (27.7)	20 (26.0)	
Other (service flat, cloister)	3 (3.2)	4 (5.2)	
Type of surgery, n (%)			.38 [‡]
Proximal femur nail antirotation	46 (48.9)	43 (55.8)	
Bi-articular hip prosthesis	28 (29.8)	24 (31.2)	
Total hip prosthesis	10 (10.6)	3 (3.9)	
Other	10 (10.6)	7 (9.1)	
Number of medications taken at home, mean $\pm$ SD	5.8 $\pm$ 3.9	5.8 $\pm$ 3.2	.98*
Katz activity of daily living score, mean $\pm$ SD (range 6–18)	8.7 $\pm$ 3.3	9.3 $\pm$ 3.2	.07 [‡]
Dementia, n (%)	16 (17.2)	18 (24.0)	.28 [‡]
Informant Questionnaire on Cognitive Decline in the Elderly score, mean $\pm$ SD (range 1–5)	3.6 $\pm$ 0.7	3.6 $\pm$ 0.8	.62 [‡]
Charlson Comorbidity Index, mean $\pm$ SD	2.4 $\pm$ 2.1	2.1 $\pm$ 1.9	.28 [‡]
Mini-Mental State Examination score, mean $\pm$ SD (range 0–12)	7.3 $\pm$ 3.9	7.2 $\pm$ 3.9	.96 [‡]
Confusion Assessment Method, n (%)			.46 [‡]
No delirium	73 (78.4)	56 (73.7)	
Delirium	20 (21.6)	20 (26.3)	
Missing	1	1	
Delirium Index, mean $\pm$ SD (range 0–21)	4.8 $\pm$ 4.0	5.2 $\pm$ 4.4	.62 [‡]
Geriatric Depression Scale score, mean $\pm$ SD (range 0–10)	2.8 $\pm$ 2.4	2.5 $\pm$ 2.4	.30 [‡]

*Unpaired *t*-test.[†]Chi-square test.[‡]Mann-Whitney *U*-test.

SD = standard deviation.

recommendations and their adherence rates varied widely. Recommendations frequently made and overall well adhered to (>80%) were screening for and treatment of low hematocrit or hemoglobin and organizing a transfer to a rehabilitation center. The recommendations least adhered to (<45%) were planning an appointment for bone densitometry, performing additional cognitive testing in the geriatric day hospital, planning an appointment for a fall risk assessment and fall preventive measures in the geriatric day hospital, eliminating redundant medication, and prescribing calcium and vitamin D supplements upon discharge. Recommendations with the highest effect (balancing frequency and complete adherence) were screening for and treatment of low hematocrit or hemoglobin (27.2%), organizing a transfer to a rehabilitation center (26.0%), and performing additional blood tests (25.5%).

Care Received According to Intervention and Control Group

Table 3 compares the care given to the intervention and control groups. No statistically significant differences were found, except that the intervention group received more interventions from the occupational therapist ($P < .001$) and more opioid pain medication ($P = .004$).

Effect of the Intervention on Outcome Parameters

Functional Status

In the univariate analysis, participants in the intervention group were significantly less dependent 8 days after surgery than controls (ADL score 12.0 ± 2.7 vs 12.9 ± 2.5 , $P = .02$), but ADL status was not significantly different at any of the other time points (Table 4). The linear mixed model for repeated measures, with two ways of treating missing due to death, showed no difference between the groups on ADL scores.

Subanalyses were performed in completely independent participants based on ADL status at baseline (ADL score before admission of 6) and dependent participants (ADL score ≥ 7 and ≥ 12), but no effect of the intervention ($P = .31$ to $.99$) could be documented in any of the subgroups of participants. (Data not shown, but available upon request.) Similarly, subanalyses were performed in participants with and without dementia. In participants without dementia (mean IQ-CODE 3.4 ± 0.05), there was no evidence of a difference in ADL functioning between the intervention and control groups. In the 34 participants with dementia at baseline (mean IQ-CODE 4.6 ± 0.11 , $P < .001$), no significant difference in baseline ADL functioning was observed between the groups ($P = .25$), although a significant effect in favor of the intervention

Table 2. Structured Overview of the Recommendations Given by the Inpatient Geriatric Consultation Team (N = 329)

Recommendation	n (%)				Effect, % ^S
	Recommended [*]	Complete Adherence [†]	Partial Adherence [‡]	Nonadherence	
Fluid and electrolyte balance					
Treat fluid overload or dehydration detected by examination or blood test	1 (1.2)	1 (100)			1.2
Treat electrolyte imbalance	8 (9.9)	7 (87.5)		1 (12.5)	8.7
Additional tests and investigations					
Perform additional blood tests	33 (40.1)	21 (63.6)	5 (15.2)	7 (21.2)	25.5
Perform additional technological investigations (X-ray, Holter monitoring, computed tomography scan, echography)	6 (7.4)	2 (33.3)	1 (16.7)	3 (50.0)	2.5
Prevention, early detection, and treatment of postoperative complications					
Myocardial infarction or ischemia—electrocardiogram—cardiac enzymes	2 (2.5)	2 (100)			2.5
Supraventricular arrhythmias or atrial fibrillation—appropriate rate control, electrolyte adjustments, anticoagulation	3 (3.7)	2 (66.7)		1 (33.3)	2.5
Pneumonia, chronic obstructive pulmonary disease—screening treatment including chest therapy	3 (3.7)	3 (100)			3.7
Pulmonary embolus—appropriate anticoagulation	1 (1.2)	1 (100)			1.2
Screening for and treatment of urinary tract infection	3 (3.7)	3 (100)			3.7
Adequate oxygen delivery					
Screening for and treatment of low hematocrit or hemoglobin (e.g., transfusion)	26 (32.1)	22 (84.6)		4 (15.4)	27.2
Supplemental oxygen to keep saturation > 90%, preferably > 95%	6 (7.4)	4 (66.7)	1 (16.7)	1 (16.7)	4.9
Medication					
Discontinue or minimize benzodiazepines, anticholinergics, antihistamines	15 (18.5)	6 (40.0)	2 (13.3)	7 (46.7)	7.4
Eliminate drug interactions, adverse effects, modify drugs accordingly	10 (12.3)	7 (70.0)	1 (10.0)	2 (20.0)	8.6
Eliminate medication redundancies	21 (25.9)	7 (33.3)	1 (4.8)	13 (61.9)	8.6
Start up new medication	17 (21.0)	11 (64.7)	2 (11.1)	4 (22.2)	13.6
Regulation of bowel or bladder function					
Bowel function: bowel movement by postoperative Day 2 and every 48 hours	3 (3.7)	1 (33.3)		2 (66.7)	1.2
Remove urinary catheter by postoperative Day 2, screen for retention or incontinence	3 (3.7)	2 (66.7)	1 (33.3)		2.5
Treat skin problems for patients with established incontinence	1 (1.2)	1 (100)			1.2
Nutritional intake					
Call in dietitian (based on results mini nutritional assessment)	1 (1.2)			1 (100)	0
Osteoporosis and falls					
Prescribing calcium and vitamin D supplements	26 (32.1)	8 (30.8)	3 (11.5)	15 (57.7)	9.9
Recurrent falls: appointment at falls clinic	8 (9.9)	1 (12.5)	1 (12.5)	6 (75.0)	1.2
Planning appointment for bone densitometry	11 (13.3)			11 (100)	0
Cognitive status					
Pharmacological treatment of agitated delirium (according to hospital guideline)	14 (17.3)	2 (14.3)	8 (57.1)	4 (28.6)	2.5
Additional cognitive testing in geriatric day clinic	7 (8.6)			7 (100)	0
Information or sensibilization when dementia suspected	3 (3.7)	2 (66.7)		1 (33.3)	2.5
Call in gerontopsychiatrist	11 (13.6)	8 (72.7)		3 (27.3)	9.9

(Continued)

Table 2. (Contd.)

Recommendation	n (%)				Effect, % [§]
	Recommended*	Complete Adherence [†]	Partial Adherence [‡]	Nonadherence	
Living situation and discharge destination					
Organizing temporary/definitive alternative to living at home	7 (8.6)	7 (100)			8.6
Organizing transfer to rehabilitation center	25 (30.9)	21 (84.0)	2 (8.0)	2 (8.0)	26.0
Organizing professional home care	16 (19.8)	8 (50.0)	3 (18.8)	5 (31.3)	9.9
Expanding existing professional home care	5 (6.2)	4 (80.0)		1 (20.0)	5.0
Evaluating burden informal caregiver	5 (6.2)	5 (100)			6.2
Preventive measures and nursing recommendations					
Prevention of pressure ulcers	2 (2.5)	1 (50.0)	1 (50.0)		1.3
Nursing recommendations	3 (3.7)	2 (66.7)	1 (33.3)		2.5
Rehabilitation					
Occupational therapist: providing aids	10 (12.3)	7 (70.0)	1 (10.0)	2 (20.0)	8.6
Other					
Adequate treatment of severe pain	3 (3.7)	3 (100)			3.7
Call in other disciplines (neurology, speech therapist, dermatology, ophthalmology, endocrinology)	8 (9.9)	4 (50.0)	1 (12.5)	3 (37.5)	5.0
Transfer to emergency unit	1 (1.2)	1 (100)			1.2
Clear documentation of do-not-resuscitate order	1 (1.2)			1 (100)	0

* Intervention patients in whom the recommendation was made.

[†] Recommendations with which the care team of the intervention group completely adhered to divided by the number of recommendations made.

[‡] Recommendations with which the care team of the intervention group partially adhered to divided by the number of recommendations made.

[§] Patients in the intervention group in which the recommendations made by the geriatric consultation team are performed completely and correctly.

group ($n = 16$) was found when using a linear model on surviving participants only ($P = .048$) and on all participants when participants who had died were given a maximum ADL score of 18 ($P = .03$). This result was not found in the linear model analyses on all participants ($P = .17$). Including the premorbid living situation as a covariate in the model did not alter the results. (Data not shown, but available upon request.)

Length of Stay

There was no statistically significant difference between the intervention and control groups in mean length of stay on the trauma ward (11.1 ± 5.1 days vs 12.4 ± 8.5 days, $P = .24$) or for the number of participants transferred to a geriatric or rehabilitation unit (30, 31.9% vs 26, 33.8%; $P = .80$). Mean total length of stay for participants transferred to a geriatric or rehabilitation unit was not

Table 3. Care Received by Intervention and Control Groups During Hospitalization

Clinical Activity	n (%)		P-Value
	Intervention (n = 94)	Control (n = 77)	
Preoperative electrocardiogram	92 (97.9)	74 (96.1)	.66
Postoperative hip X-ray	92 (97.9)	76 (98.7)	.99
Postoperative anticoagulation	94 (100)	77 (100)	1.00
Nonopioid pain medication	94 (100)	76 (98.7)	.45
Opioid pain medication	86 (91.5)	58 (75.3)	.004
Calcium and vitamin D	21 (22.3)	21 (27.3)	.46
Blood transfusion	40 (42.6)	38 (49.4)	.38
Early mobilization and rehabilitation	64 (68.1)	56 (72.7)	.51
Additional blood tests (> 5)	40 (42.6)	30 (39.0)	.64
Additional electrocardiogram (> 1)	21 (22.3)	20 (26.0)	.58
Additional technical investigations	46 (48.9)	41 (53.2)	.58
Occupational therapy	65 (69.1)	32 (41.6)	$< .001$
Consult social work	75 (79.8)	65 (84.4)	.43
Consult geropsychiatrist	11 (11.7)	9 (11.7)	1.00
Consult other disciplines	25 (26.6)	23 (29.9)	.64

significantly different ($P = .90$) between the intervention (56.3 ± 43.7 days) and control (55.1 ± 25.5 days) groups either.

Mortality, Readmission Rate, and New Nursing Home Admission

No statistically significant difference in all-cause mortality rate was found 6 weeks, 4 months, or 12 months after surgery. The number of participants with unplanned readmission to the hospital did not differ significantly between the two groups at 6 weeks ($P = .47$), 4 months ($P = .47$), or 12 months ($P = .77$) postoperatively, nor did the mean total number of readmission days (intervention: 20.9 ± 17.6 days vs control: 18.8 ± 13.1 days; $P = .64$). The proportion of participants newly admitted to a nursing home was not significantly different at any time point either (Table 4).

DISCUSSION

In this study in older adults with hip fracture, no impact of an IGCT was found on length of stay, mortality, hospital readmission, or the need for institutional care. One week after surgery, the intervention group had significant improvement in ADL functioning in univariate analyses, but the effect disappeared in linear mixed model analyses. The only benefit that persisted in the linear mixed model analyses was improved functional status in participants with dementia, although this apparent benefit should be interpreted with caution. To address the complexity of missing data, three different models (linear model on all participants and two ways of treating missing values due to death) were fitted, and the benefit in participants with dementia was not consistently observed across all models. Similarly, when performing a Bonferroni correction to adjust for multiple testing, the effect was no longer significant. This study should be interpreted as negative, despite the focus on a well-defined frail population with advanced age and functional impairment.

Methodological problems may have contributed to the lack of a difference between the control and intervention groups. First, it cannot be excluded that the care given on both wards in the study setting—a tertiary university hospital—was already relatively effective. With more than 300 people with hip fracture admitted to the trauma wards each year, healthcare professionals have experience with frail older adults with hip fracture. The fact that physical therapy was given as standard care to all participants may also have reduced any effect of the intervention on ADL functioning. Second, lack of adherence to the IGCT recommendations is likely to have contributed to the negative findings. With approximately one-third of the recommendations not adhered to and approximately 10% only partially adhered to, in line with previous studies,^{24–26} there is room for improvement. Of particular concern is that recommendations to refer for comprehensive fall assessment and prevention and to supplement participants with calcium and vitamin D were hardly adhered to at all, despite their proven efficacy in older adults.^{30,31} In addition, when comparing the actual care given of the intervention and control groups, a significant difference was found in the percentage of participants receiving occupational therapy. Although ADL functioning is one of the main focuses of occupational ther-

apists, no significant differences were observed in ADLs between the groups. This could reflect the lack of intensity of the intervention because the occupational therapist of the IGCT intervened only one or two times per participant during the hospitalization period but could also be due to the lack of continuity because the adherence rate to the advice given or the therapy started was low. Finally, participants, IGCT members, and healthcare professionals on the trauma ward could not be blinded to the intervention, although observer bias was minimized by using structured questionnaires and scales to evaluate the outcomes of interest.

Despite limitations intrinsic to the design of the study, the findings do not support this model of a geriatric consultation team as an effective tool to improve outcomes. Part of the appeal of the concept of IGCT is that IGCTs have some important advantages over increasing the capacity of Acute Care for the Elderly units; they are less expensive and more flexible, can be implemented within a short period of time, and can reach a larger number of individuals,^{13,32} but a number of studies, including the present one, have failed to demonstrate the effectiveness of IGCTs, at least on functional status, length of stay, readmission rate, or need for institutionalization.^{11–13} Although these parameters are important in this population, it is possible that the intervention would significantly affect more-clinical outcomes, such as delirium and pain. After all, significantly more intervention participants than controls received occupational therapy (cognitive interventions included) and pain medication. Future research should therefore investigate whether the IGCT model as described in this article affects such outcomes. More importantly, future studies should investigate whether and to what extent alternative IGCT approaches are more effective. Instead of an advisory model based on recommendations, the multidisciplinary IGCT should probably be used more directly in management of older adults on nongeriatric wards. Bedside education by the IGCT, to familiarize healthcare workers on nongeriatric wards with the specifics of geriatric care and the expression and implications of the major geriatric syndromes (e.g., falls, delirium, depression, dementia, sleeping disorders), could make a difference. An educational unit-centered model, instead of a recommendation-based patient-centered model, would also ultimately allow the IGCT to reach out to more individuals by transferring geriatric expertise to nongeriatric wards. In addition, more attention should be given to communication and collaboration between healthcare workers across settings (e.g., hospital staff, but also caregivers at home and in long-term care facilities). To optimize outcomes in older adults, any IGCT model should affect not only in-hospital care, but follow-up care as well (e.g., referral for specific assessments after discharge, organizing specific support after hospitalization).³³ This may be particularly important to reduce the risk of readmission to hospital or the need for institutional care.

Based on these negative findings, in older persons with a recent hip fracture, a recommendation-based and patient-centered IGCT model has no significant effect on major outcome parameters such as functional status and length of stay. Future studies should address the effectiveness of an educational approach that allows the IGCT to have more direct control over patient management on nongeriatric wards.

Table 4. Univariate Analysis

Time Between Hip Fracture Replacement and Assessment	Activities of Daily Living			Mortality		Unplanned Readmission		New Nursing Home Admission	
	Intervention (n = 94)	Control (n = 77)	Mean ± Standard Deviation	Intervention (n = 94)	Control (n = 77)	Intervention (n = 94)	Control (n = 77)	Intervention (n = 68)	Control (n = 58)
			P-Value	n (%)	P-Value	n (%)	P-Value	n (%)	P-Value
Day 1	13.7 ± 2.3	14.3 ± 2.5	.11*						
Discharged	0	0							
Day 3	13.5 ± 2.7	13.9 ± 2.8	.42*						
Discharged	0	1							
Day 5	12.8 ± 2.9	13.4 ± 2.8	.16*						
Discharged	3	5							
Day 8	12.0 ± 2.7	12.9 ± 2.5	.02*						
Discharged	24	14							
6 weeks	11.2 ± 3.4	11.9 ± 3.1	.13*	4 (4.3)	3 (3.9)	3 (3.2)	5 (6.5)	4 (5.9)	3 (5.2)
4 months	10.0 ± 3.8	10.8 ± 3.9	.19*	15 (16.0)	9 (11.7)	10 (10.6)	11 (14.3)	8 (11.8)	7 (12.1)
1 year	9.8 ± 3.8	10.0 ± 3.4	.34*	20 (21.3)	17 (22.1)	25 (26.6)	22 (28.6)	9 (13.2)	7 (12.1)

* Mann Whitney U-test.

† Fisher exact test.

‡ Chi-square test.

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Flowchart Outlining the Interventions Performed by the Inpatient Geriatric Consultation Team (IGCT).

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