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A register-based analysis: the impact of contralateral hip fractures in the past six months on geriatric hip fracture patients

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ABSTRACT

Background: Subsequent contralateral hip fractures pose a significant challenge in the management of geriatric patients. This study aimed to evaluate the impact of contralateral hip fractures within the past six months in patients with hip fractures.
Methods: A registry-based cohort study with prospective follow-up was conducted using data from hip fracture patients (femoral neck and pertrochanteric fractures) in Germany, Switzerland, and Austria. Patients with a contralateral hip fracture in the past six months (risk group) were compared to those without (control group). Matching analysis was performed to adjust for confounding factors, including age, sex, American Society of Anesthesiologists (ASA) grade, pre-fracture mobility, and fracture type. The primary outcome was mobility seven days postoperatively, while secondary outcomes included the EQ-5D-5 L index, length of hospital stay, necessity for intensive care unit, reoperation rate, discharge destination, mortality, and complications.
Results: Before matching, patients in the risk group exhibited significantly worse mobility and functional outcomes than those in the control group. However, after adjusting for confounders, no significant differences in mobility or the EQ-5D-5 L index remained. No significant difference was found in the in-house and mid-term mortality rate. The risk group was prone to having a higher risk of delirium and decubitus ulcers without statistical significance. In contrast, the risk of renal failure was significantly lower.
Conclusion: Contralateral hip fractures in the past six months are associated with inferior early mobility and functional outcomes in general. However, this association was not independent.

Introduction

Hip fractures are the most common fractures among German adults [1]. The majority occur in individuals over 65, with incidence rising significantly with each decade of life [2]. Women are more prone to hip fractures than men, and this risk increases with age [3]. One-year mortality following a hip fracture has been reported as high as 30 % in various studies [4,5]. Surgical intervention is typically employed to facilitate rapid mobilization, while non-operative management is associated with a high 30-day mortality rate of 36 % [6]. This high mortality and impaired functional outcomes are linked to prolonged immobility after a hip fracture [7]. Consensus supports the significant benefit of early mobilization restoration in hip fracture patients [8].

Elderly patients with a history of hip fracture may face an increased risk of a second fracture [9]. A retrospective study indicated that approximately 15.9 % experienced a second contralateral hip fracture within two years [10]. Notably, among patients who died within the first two years post-initial fracture, about 43.3 % had suffered a second contralateral hip fracture [10]. The average interval between fractures has been variably reported as 12 to 22 months, with roughly half

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occurring within one year [11]. Further research by Trevisan et al. demonstrated an association between second hip fractures and lower mobility levels, higher rehospitalization rates, and increased mortality [12]. A recent prospective study by Solou et al. highlighted a strong correlation between postoperative mortality and the interval between two hip fractures [13]. This may be attributed to impaired baseline mobility and reduced physiological reserve in geriatric patients following their first hip fracture. Consequently, significant attention is currently focused on the prevention and management of second hip fractures.

Despite the well-documented demographics of second hip fractures, research focusing on their impact on immediate postoperative outcomes and hospital management remains limited. Given the increasing burden of hip fractures in aging populations, identifying factors that contribute to worse outcomes after a second fracture is crucial for optimizing clinical pathways and improving patient prognosis.

Thus, based on a registry database, the current study aims to clarify the clinical impact of a contralateral second hip fracture in the past 6 months on in-hospital management and postoperative outcomes.

Method

Data sources

This study utilizes data from the Registry for Geriatric Trauma (AltersTraumaRegister DGU®, ATR) by the German Trauma Society (DGU) (https://www.alterstraumaregister-dgu.de). The ATR-DGU is a standardized and pseudonymized register contributing data from multiple geriatric trauma centers. It focuses on geriatric patients (≥70 years) with hip fractures, as well as periprosthetic and peri-implant femoral fractures, and an indication for surgery.

The Academy for Trauma Surgery (AUC) manages the ATR-DGU's infrastructure for documentation, data management, and analysis. Scientific oversight is provided by the DGU's Working Committee on Geriatric Trauma Registry (AK ATR). Participation is mandatory for all certified Geriatric Trauma Centers (AltersTraumaZentrum DGU®), which submit pseudonymized data via a web application to a central database. Each patient record comprises approximately 160 data fields.

Currently encompassing data from over 160 hospitals across Germany, Switzerland, and Austria, the ATR-DGU contains >62,000 cases. This study analyzed preoperative data collected upon admission, during surgery, one week post-surgery, and optionally at 120 days postoperatively. The rich dataset includes demographics, pre-operative residential and health status, comorbidities, fracture details, treatment timeline, medication history, and patient outcomes. This research, registered as ATR-DGU project ID ATR-2023–006, adhered to ATR-DGU's publication guidelines and underwent peer review by the AK ATR for scientific data analysis approval. Written informed consent for publication of their clinical details was obtained from the patients.

Analysis approach

The present analysis covered the following data: age, sex, American Society of Anesthesiologists (ASA) grade (from 1 to 5) [14], Clinical Frailty Scale (CFS, from 1 to 9) [15], fracture type, osteoporosis therapy, mobility before latest fracture and seven days after surgery, mortality rate, length of hospital stay, intensive care unit (ICU) necessity, re-operation rate during hospital stay, discharge management. Quality of Life was evaluated using the EuroQol quality of life instrument EQ-5D-5 L [16] measured 7 and 120 days after surgery.

All statistical analyses were performed using R statistical software (version 4.1.2, Foundation for Statistical Computing, Vienna, Austria). The baseline characteristics and outcome variables of the study population are provided using descriptive statistics. The data are presented as mean value and standard deviation for parametric continuous variables, medians with interquartile ranges (IQRs) for non-parametric continuous variables or counts and percentages for categorical variables. Due to missing data for certain parameters, the analyses reflect the number of patients included in each specific assessment. EQ-5D-5 L questionnaire results were converted into a single index using the German Ludwig value set (Version 2.1) [17]. The EQ-5D-5 L index ranges from −0.661 (indicating the poorest health status) to 1 (indicating the best health status).

Group comparisons (contralateral hip fracture within 6 months versus no contralateral hip fracture within 6 months) were conducted using Student's *t*-test or the Wilcoxon test for continuous data, as appropriate, and the Pearson chi-squared test for categorical data. Fisher's exact test was applied for categorical variables with fewer than five expected observations. The p-values of these comparisons should be interpreted with caution; even small differences can be significant in large sample sizes.

Additionally, in order to examine the exact effect of contralateral hip fracture within 6 months alone as a risk factor, a 2:1 propensity score matching was performed and the potential cofactors were neutralized, including age, ASA grade, sex, walking ability before the latest fracture, and type of proximal femur fracture. The matching achieved a good balance with a standardized mean difference < 0.1 for all matching parameters. Statistical significance was defined as $p < 0.05$.

Results

An overview of the patient cohort was depicted using a flowchart (Fig. 1). A total of 30,622 registered hip fractures from the years 2022 and 2023 from 160 clinics were drawn from the register database, from which 25,422 cases were registered as non-pathological fractures. Further, subtrochanteric fractures, periprosthetic fractures, and peri-implant fractures were excluded. Only pertrochanteric and femoral neck fractures were included in the unmatched analysis. The total sample size from the control and risk groups was 22,297 (98.5 %) and 337 (1.5 %), respectively. The 120-day postoperative follow-up information was provided from 86 clinics with 5603 cases, of which 5511 (98.3 %) and 92 (1.7 %) cases were reported from the control and risk groups, respectively.

In the matched analysis (matched variables: age, gender, ASA score, mobility before the latest fracture, and fracture types), 570 and 285 cases were included from the control and risk groups, respectively, in a 2:1 manner. Because of the missing data for the matching procedure, 52 cases were excluded from the risk groups.

Baseline data: age, gender, ASA score, and CFS score

The overview of age, gender, ASA score, and CFS score is demonstrated in Table 1. The average age of patients in both groups was 85.3 years (control group: 85.3 ± 6.5 years vs. risk group: 85.3 ± 6.2 years, $p < 0.01$) in the unmatched analysis. Age was used as a matching criterion, so no difference existed in the matched analysis (control group: 85.1 ± 6.3 years vs. risk group: 85.3 ± 6.3 years, $p = 0.73$).

No significant difference was found in the gender distribution between the control and risk groups in an unmatched setting, with 70 % and 74.9 % of females in the control and risk groups, respectively ($p = 0.08$). As one of the matching criteria, 74.9 % and 73.7 % of female patients were identified in the control and risk groups, respectively, after matching ($p = 0.76$).

In unmatched analysis, the distribution of ASA score in risk groups differed significantly from that of the control group, although the medians were identical (both groups 3.0 [3.0, 3.0], $p < 0.01$). No difference was found after matching between the two groups (both groups: 3.0 [3.0, 3.0], $p = 0.99$) as one of the matched variables.

In unmatched analysis, the mean CFS score was significantly larger in risk groups compared to the control group (control group: 5.0 [3.0, 6.0] vs. risk group: 6.0 [5.0, 7.0], $p < 0.001$). After matching, a significantly higher CFS score could still be found in the risk group (control

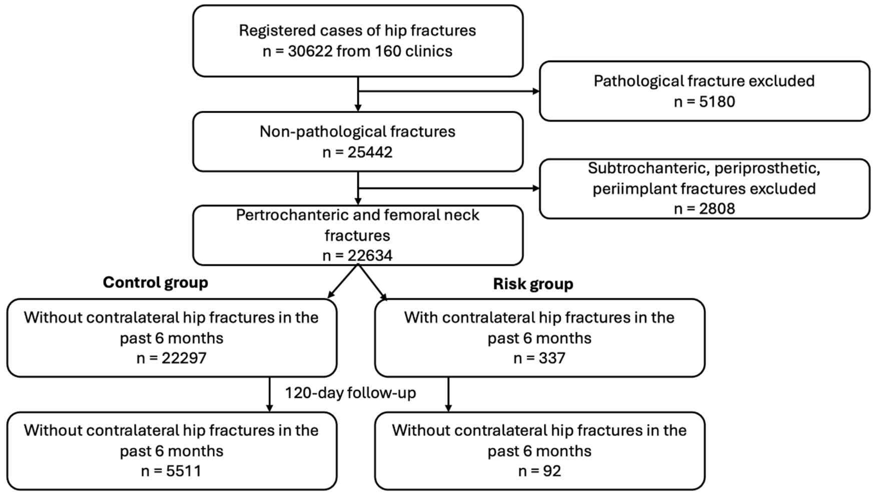

Fig. 1. The Flowchart depicts how the study objects were drawn from the register database.

Table 1
Baseline data.

	Unmatched			Matched		
	Unmatched control (n)	Risk group (n)	p-value	Matched control (n)	Risk group (n)	p-value
Age†	85.3 ± 6.5 (21,623)	85.3 ± 6.2 (327)	< 0.01 *	85.1 ± 6.3 (570)	85.3 ± 6.3 (285)	0.73
Sex (female)†	70.0 % (22,262)	74.2 % (337)	0.08	74.9 % (570)	73.7 % (285)	0.76
ASA†	3.0 [3.0, 3.0] (21,495)	3.0 [3.0, 3.0] (323)	< 0.01 *	3.0 [3.0, 3.0] (570)	3.0 [3.0, 3.0] (285)	0.46
CFS	5.0 [3.0, 6.0] (13,480)	6.0 [5.0, 7.0] (214)	< 0.001 *	5.0 [4.0, 6.0] (570)	6.0 [5.0, 7.0] (285)	< 0.001 *

ASA: American Society of Anesthesiologists, CFS: clinical frailty scale. Age was depicted using mean (SD), while ASA and CFS were described using median [Q1, Q3].
† Matched variables in matched analysis.
* statistically significant.

group: 5.0 [4.0, 6.0] vs. risk group: 6.0 [5.0, 7.0], $p < 0.001$).

Distribution of fracture types

Fig. 2 depicts the distribution of all fracture types. Before matching, the distribution of fracture types between the control and risk groups showed a significant difference ($p = 0.002$). The proportion of femoral neck fractures was almost identical, about 45 %. The rate of pertrochanteric fracture decreased by seven percent in the risk group. Peri-implant and periprosthetic fractures were more frequently encountered in the risk group, with 3.4 % and 8.8 %, compared to the control group, with 0.7 % and 5.0 %, respectively.

Baseline mobility preoperatively

Fig. 3 demonstrates the distribution of baseline mobility before the latest hip fracture in the control and risk groups. Significant differences were found between the distribution patterns of the two groups ($p < 0.001$). The patients' mobility was generally worse in the risk group. The proportion of patients who were mobile outdoors without aids in the control group (37.6 %) was more than two times compared to the risk group (16.9 %). About 27 % of patients in the risk group can only be

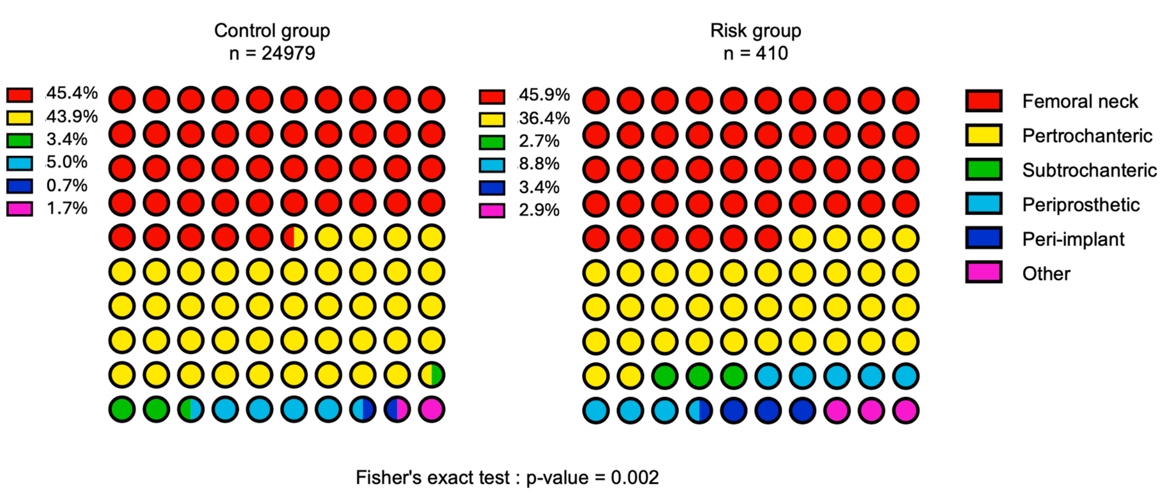

Fig. 2. The distribution of fracture types in the register database after exclusion of pathological fractures. Together, the proportion of femoral neck and pertrochanteric fractures accounts for approximately 89.3 % in the control group and 82 % in the risk group.

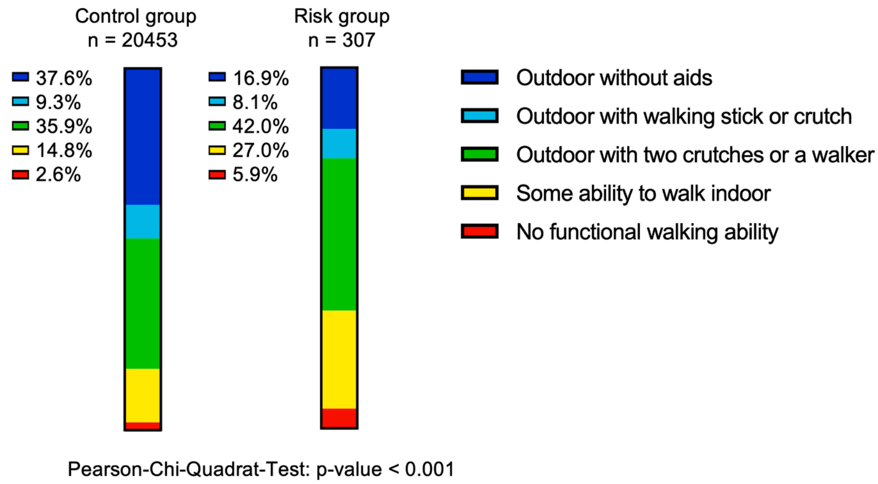

Fig. 3. The mobility before the latest hip fracture. A distinguishing difference was found in the baseline mobility between the control and risk group.

mobilized indoors, compared to 14.8 % in the control group. In matched analysis, the baseline mobility was used as a matching variable so that the two groups had the same distribution pattern of baseline mobility.

Osteoporosis treatment

Fig. 4 shows the treatment of osteoporosis at the time of admission. In both unmatched and matched analyses, more than twice as many patients received vitamin D supplementation, with a significant proportional difference found ($p < 0.001$) when they were treated within 6 months due to hip fractures. >76 % of patients in the control group had no treatment for osteoporosis in comparison with about 30 % less in the risk groups. Only 2.8 % and 5.2 % of patients were found to be positive in the unmatched test with specialized osteoporosis treatment in the control and risk groups, respectively. This difference was minor after matching (4.4 % and 5.0 %, respectively).

Mobility seven days postoperatively

Fig. 5 depicts the distribution of mobility seven days postoperatively in unmatched and matched analyses. The distribution of mobility seven days postoperatively was significantly different between the control and risk groups ($p = 0.04$) in the unmatched analysis. The patients in the control group were more likely to be able to move with crutches (control group: 9.7 % vs. risk group 5.2 %) and walkers (control group: 30.1 % vs. risk group: 28.7 %), whereas more patients in risk group can only be mobilized with the walking frame (control group: 41.0 % vs. risk group: 38.4 %) or were immobile (control group: 21.1 % vs. risk group: 23.9.0 %). After matching, no significant difference was found in the mobility distribution seven days postoperatively ($p = 0.45$).

Length of hospital stay, ICU necessity, and re-operation rate during hospital stay

The overview of the length of hospital stay, ICU necessity, and re-operation rate during hospitalization was depicted in Table 2

In unmatched analysis, no significant difference was found between the two groups regarding the length of hospital stay (control group: 16.0 ± 8.9 days vs. risk group: 15.7 ± 8.4 days, $p = 0.40$). After matching, the length of hospital stay was still similar (control group: 15.8 ± 8.3 days vs. risk group: 15.6 ± 7.9 days, $p = 0.67$).

The rate of ICU necessity was 27.3 % and 22.5 % in the control group and risk group, respectively, and there was no statistical difference in the unmatched analysis ($p = 0.06$). No difference was found in the matched analysis (control group: 29.9 % vs. risk group: 23.7 %, $p = 0.07$).

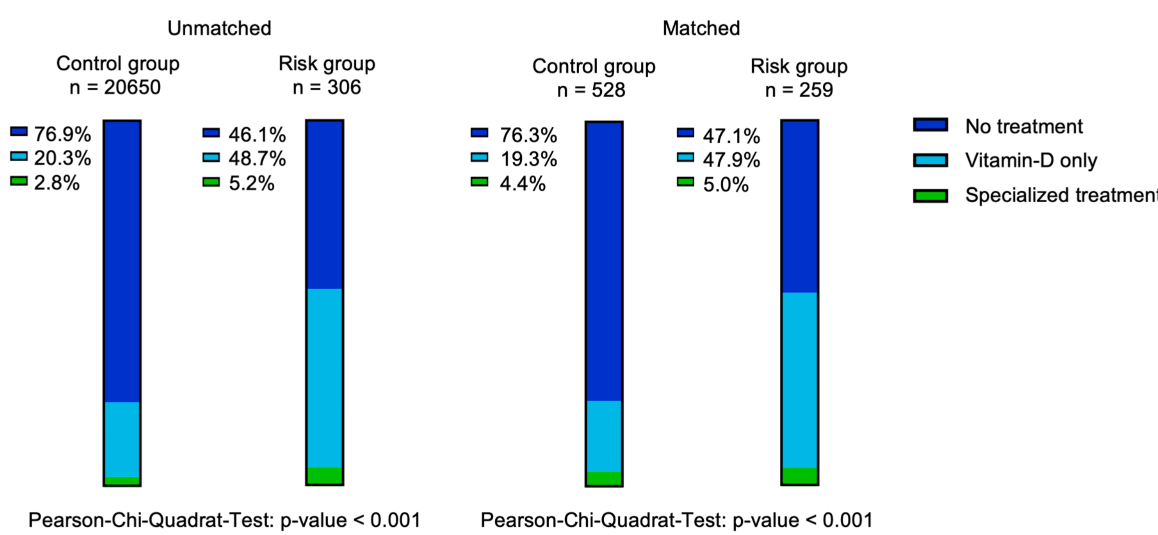

Fig. 4. The ongoing osteoporosis treatment during the admission of patients from the two groups. Significantly better coverage of vitamin D substitution was found in the risk group in both unmatched (left) and matched (right) tests.

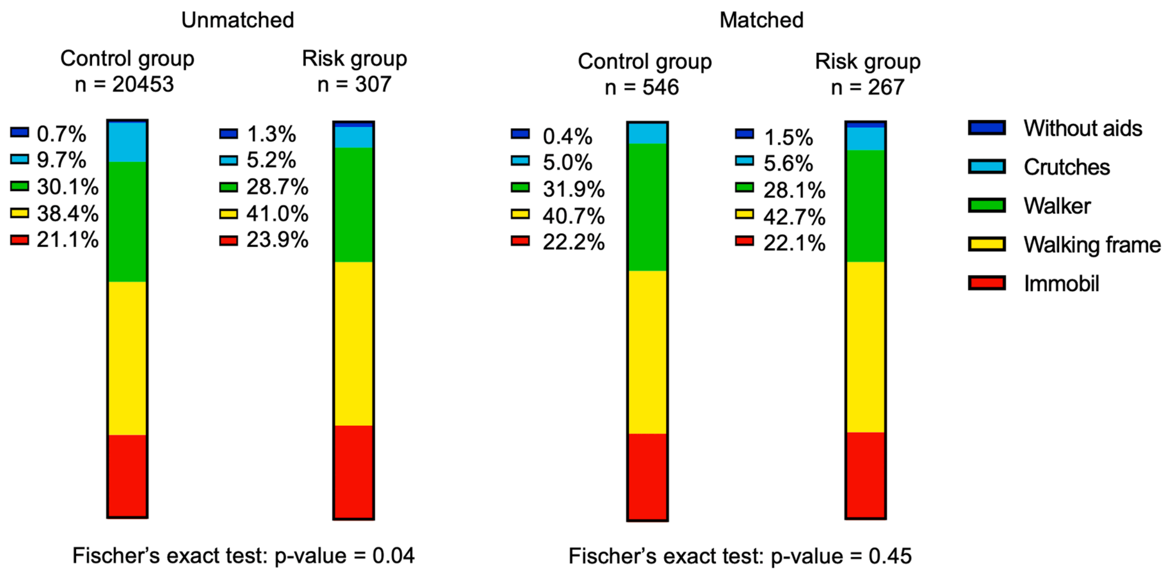

Fig. 5. Mobility 7-day postoperatively. A significant distributional difference was found in mobility 7 days postoperatively in the unmatched test between the two groups. This difference was found to be no longer significant after matching.

Table 2
Summary of postoperative outcomes.

	Unmatched				Matched		
	Unmatched control (n)	Risk group (n)	p-value		Matched control (n)	Risk group (n)	p-value
Hospital stay (d)	16.0 ± 8.9 (20,698)	15.7 ± 8.4 (324)	0.40		15.8 ± 8.3 (527)	15.6 ± 7.9 (275)	0.67
ICU necessity	27.3 % (21,975)	22.5 % (329)	0.06		29.9 % (562)	23.7 % (279)	0.07
Re-operation[†]	2.8 % (21,506)	2.2 % (317)	0.65		4.1 % (556)	2.3 % (267)	0.24
EQ-5D-5 L 7d	0.6 [0.3, 0.8] (15,102)	0.4 [0.2, 0.7] (239)	0.001	*	0.5 [0.3, 0.7] (400)	0.5 [0.3, 0.7] (204)	0.34
EQ-5D-5 L 120 d	0.8 [0.5, 0.9] (4551)	0.7 [0.3, 0.8] (73)	0.004	*	0.7 [0.4, 0.9] (125)	0.7 [0.3, 0.8] (65)	0.11
In-hospital mortality	5.8 % (22,164)	3.6 % (336)	0.10		6.3 % (568)	3.2 % (284)	0.07
Mortality 120 d	10.9 % (5486)	14.1 % (92)	0.42		14.1 % (157)	15.0 % (80)	1.00

ICU: intensive care unit. The length of hospital stay was demonstrated using mean (SD) while EQ-5D-5 L index was presented using median [Q1, Q3],.
[†] *Re*-operation rate during the primary hospital stay,.
[*] statistically significant.

The reoperation rates of the two groups were similar in unmatched analysis (control group: 2.8 % vs. risk group: 2.2 %, $p = 0.65$). In matched analysis, no difference was found between the two groups (control group: 4.1 % vs. risk group: 2.3 %, $p = 0.24$).

EQ-5D-5 L index and mortality rate

In the unmatched analysis, the EQ-5D-5 L index seven-day postoperatively in the risk group was significantly lower compared to the control group (control group: 0.6 [0.3, 0.8] vs. risk group: 0.4 [0.2, 0.7], $p < 0.001$, Table 2). Similarly, the score of EQ-5D-5 L 120-day postoperatively was also significantly lower in the risk group compared to the control group (control group: 0.8 [0.5, 0.9] vs. risk group: 0.7 [0.3, 0.8], $p = 0.004$).

After matching, there was no significant difference between the two groups regarding the EQ-5D-5 L index seven days postoperatively (control group: 0.5 [0.3, 0.7] vs. risk group: 0.5 [0.3, 0.7], $p = 0.34$) or 120 days postoperatively (control group: 0.7 [0.4, 0.9] vs. risk group: 0.7 [0.3, 0.8], $p = 0.11$).

The in-hospital mortality rate of the two groups was not significantly different (control group: 5.8 % vs. risk group: 3.6 %, $p = 0.10$) in the unmatched analysis, so as the mortality rate in the matched analyses (control group: 6.3 % vs. risk group: 3.2 %, $p = 0.07$).

The 120-day postoperative mortality rate was not significantly different between the two groups in unmatched analysis (control group: 10.9 % vs. risk group: 14.1 %, $p = 0.42$) or the matched analysis (control group: 14.1 % vs. risk group: 15.0 %, $p = 1.00$)

Discharge management

Fig. 6 depicts an overview of discharge management in unmatched and matched analyses. In unmatched analysis, the distribution of discharge management in the two groups was significantly different ($p < 0.001$). A larger proportion of patients could be discharged to go home or to non-geriatric or geriatric rehabilitation in the control group, with 27.9 %, 3,6 %, and 17,3 %, compared to the risk group, with 23.5 %, 1.2 %, and 15.8 %, respectively. In contrast, more patients in the risk group were discharged to a nursing home, with 39.0 % in the risk group compared to 24.9 % in the control.

The distinction of discharge management was subtler after matching ($p = 0.132$). Notably, patients in the risk group had over 7 % more chance of being discharged into a nursing home (control group: 29.2 % vs. risk group: 36.6 %). The opportunity to be discharged to go home or to rehabilitation facilities was similar between the control group (41.2 %) and the risk group (41.2 %).

Non-reoperation-associated complications

In unmatched analysis, the non-reoperation-associated complications rate was 38.6 % in the control group and 38.0 % in the risk group ($p = 0.94$). In the matched analysis, the rate was 36.9 % in the control group and 38.9 % in the risk group ($p = 0.45$). No significant differences

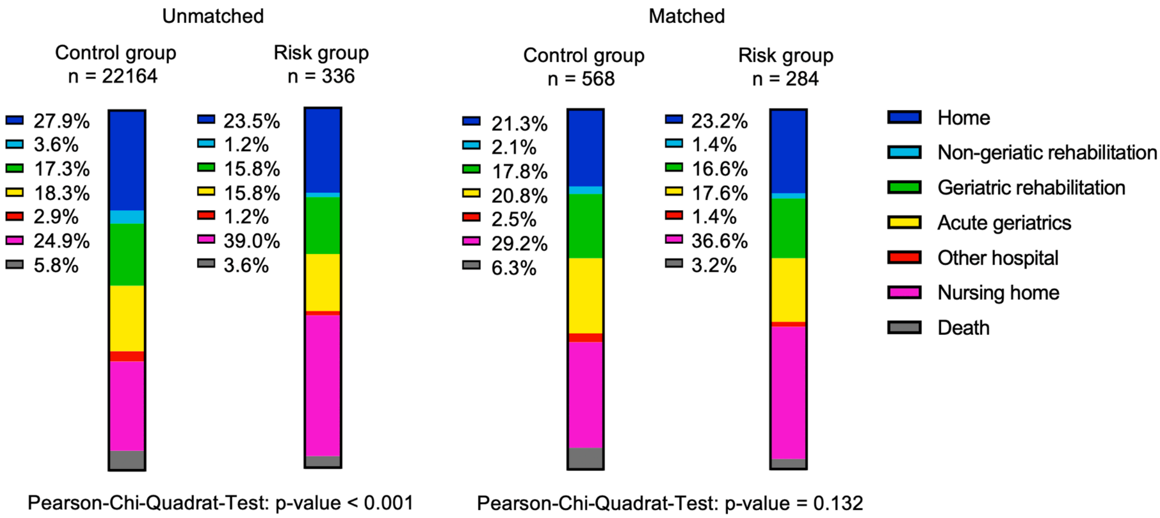

Fig. 6. Discharge management. A significant distributional difference was found in the discharge management in the unmatched test between the two groups. This difference was found to be no longer significant after matching.

were found in either matched or unmatched analyses (Table 3). The patterns of the non-reoperation-associated complications were similar in patients between the two groups. Delirium and urinary tract infection are the leading complications, followed by pneumonia and renal failure.

Further, it was demonstrated that a contralateral hip fracture within the past 6 months was associated with a higher risk of developing delirium (unmatched: risk ratio 1.29 (95 % CI: 0.97–1.73), matched: risk ratio 1.34 (95 % CI: 0.93–1.94)) and decubitus ulcer (unmatched: risk ratio 1.44 (95 % CI: 0.80–2.62), matched: risk ratio 1.38 (95 % CI: 0.67–2.83)). However, the differences were not statistically significant. In contrast, both matched and unmatched analyses showed that the chance of having renal failure was considerably lower (unmatched: risk ratio 0.52 (95 % CI: 0.28–0.98), matched: risk ratio 0.44 (95 % CI: 0.21–0.93)).

Discussion

Our study aimed to evaluate the impact of a contralateral hip fracture within the past six months on the clinical management and outcomes of patients with hip fractures utilizing register data. A key finding was that these patients exhibited significantly worse mobility seven days postoperatively compared to those without a recent contralateral hip fracture (in an unmatched fashion). This aligns with prior research, such as the findings of Steenhoven et al., which reported nearly double the risk of complications and institutionalization following a second hip fracture surgery [18]. Similarly, many recent studies have demonstrated that a second hip fracture is associated with lower mobility levels and higher rehospitalization rate [12,19–22]. These adverse outcomes may be attributed to the diminished physiological reserve in elderly patients, further exacerbated by the stress of surgery and recovery [23].

Interestingly, after adjusting for key confounding factors—including age, ASA grade, sex, pre-fracture walking ability, and fracture type—the initial disparity in early postoperative mobility was no longer evident. A similar trend was observed in the EQ-5D-5 L index, suggesting that a contralateral hip fracture within six months does not independently impair postoperative mobility or mid-term functional outcomes. To our knowledge, this study is the first to assess the independent impact of a recent contralateral hip fracture. The robust sample size from the latest registry dataset enabled matched analysis, enhancing the study's statistical power. One possible explanation for these findings is the high standard of medical care and rehabilitation in the registry region (Germany, Switzerland, and Austria), which may mitigate the expected negative impact of a recent contralateral fracture.

The baseline characteristics of the risk group may account for the observed differences in functional outcomes prior to matching. In the unmatched analysis, ASA and CFS scores were significantly higher in the risk group, indicating a generally frailer patient population. Even after matching, CFS scores remained elevated, further supporting the notion that hip fracture patients with a recent contralateral hip fracture tend to have greater frailty. However, despite this increased frailty, there were no significant differences in length of hospital stay, ICU necessity, or reoperation rates between the groups in the matched and unmatched analyses.

The incidence of contralateral hip fractures within the past six

Table 3
Analysis of non-reoperation-associated complications.

	Unmatched					Matched				
	Control	Risk	p-value		Risk ratio	Control	Risk	p-value		Risk ratio
Total n	21,744	322				554	271			
Complication rate	38.6 %	38.0 %	0.94			38.9 %	36.9 %	0.45		
Decubitus ulcer	2.4 %	3.4 %	0.22		1.44 (0.80–2.62)	2.9 %	4.1 %	0.40		1.38 (0.67–2.83)
Myocardial infarction	0.6 %	0.3 %	0.73		0.49 (0.07–3.47)	0.8 %	0.4 %	1.00		0.50 (0.06–4.38)
Thrombosis	0.3 %	0.0 %	0.63			0.2 %	0.0 %	1.00		
Pulmonary embolism	0.7 %	0.9 %	0.51		1.30 (0.42–4.03)	0.9 %	0.7 %	1.00		0.80 (0.16–4.00)
Renal failure	5.9 %	3.1 %	0.03	*	0.52 (0.28–0.98)	6.7 %	3.0 %	0.03	*	0.44 (0.21–0.93)
Delirium	10.0 %	13.0 %	0.08		1.29 (0.97–1.73)	9.4 %	12.2 %	0.22		1.34 (0.93–1.94)
Urinary tract infection	10.2 %	9.0 %	0.48		0.88 (0.62–1.25)	11.0 %	8.9 %	0.34		0.66 (0.42–1.03)
Pneumonia	5.7 %	7.1 %	0.28		1.25 (0.84–1.86)	6.3 %	7.0 %	0.71		1.11 (0.66–1.87)
Other	17.8 %	15.2 %	0.23		0.86 (0.65–1.13)	18.2 %	15.5 %	0.33		0.85 (0.62–1.17)

[*] Statistically significant.

months in our study was found to be 1.7 %. This finding is relatively low compared to several studies that have reported varying rates of subsequent contralateral hip fractures in different populations [19–21] . In the literature, the overall incidence has been reported to range from 1.8 % to 15 %, regardless of the timeframe following the index fracture; however, the current study used a six-month timeframe [24]. Notably, these incidence rates exhibit substantial regional variation.

Pre-fracture mobility was also significantly worse in the risk group compared to controls, highlighting the challenges of restoring mobility postoperatively. In the control group, 37.5 % of patients could walk outdoors without aids, more than twice the proportion observed in the risk group (16.9 %). Additionally, 27 % of patients in the risk group were limited to indoor mobility, compared to 14.8 % in the control group. These findings underscore the challenges in restoring mobility postoperatively and highlight the need for tailored rehabilitation strategies to optimize recovery and functional outcomes [25].

The mortality rate in the risk group was not inferior to that of the control group in either the matched or unmatched analyses. This is consistent with findings from Schemitsch et al., who reported similar mortality rates following first and second hip fractures in a large dataset from Ontario, Canada. The one-year mortality after index hip fracture was 26.2 % and 25.9 % after second hip fracture [26].

Discharge management revealed another important finding: patients with a recent contralateral hip fracture were significantly more likely to be discharged to nursing homes (14 % more patients). Although the difference was reduced after matching, the 7 % difference still highlights the increased care needs of these patients postoperatively. This finding emphasizes the importance of structured discharge planning, early rehabilitation interventions, and long-term care strategies tailored to this high-risk patient group who already had contralateral hip fractures within the past six months.

Our analysis identified two clinically important patterns in patients with recent contralateral hip fractures: a statistically significant 34 % increased risk of postoperative delirium, likely reflecting mobility limitations in this cohort, coupled with an unanticipated 56 % reduction in renal failure risk. The delirium association reinforces the need for enhanced postoperative rehabilitation protocols in second fracture patients, particularly given their impaired mobilization potential. The renal protection finding remains mechanistically unexplained. Together, these results demonstrate that patients with contralateral fractures present distinct complication profiles, requiring tailored clinical approaches.

Several limitations must be acknowledged. First, as a registry-based study, our data were subject to potential documentation inaccuracies, selection bias, inter-center data quality discrepancies, and unmeasured confounders. Second, the selection of parameters was also restricted by the design of the register. Third, the study was limited to a specific geographic area, which restricts its generalizability to other healthcare settings.

In short, our findings suggest that the presence of a contralateral hip fracture within the past six months is associated with poorer early postoperative mobility and functional outcomes in general. However, it does not independently impair early postoperative mobility or functional outcomes.

Consent to participate and publication

Written informed consent to participate was obtained from the patients.

Ethics statement

Ethical approval: The present study is in line with the publication guidelines of the ATR-DGU and was registered under project ID ATR-2023-006.

CRediT authorship contribution statement

Johannes Gleich: Supervision, Methodology. **Hannah Schmidt:** Software, Methodology, Formal analysis, Data curation. **Christopher Lampert:** Formal analysis, Data curation. **Evi Fleischhacker:** Methodology, Conceptualization. **Bastian Pass:** Validation, Resources. **Carsten Schoeneberg:** Supervision, Resources. **Leon Marcel Faust:** Formal analysis, Data curation. **Kathrin Pfahl:** Formal analysis, Data curation. **Maximilian Lerchenberger:** Visualization, Software. **Wolfgang Böcker:** Validation, Supervision, Resources. **Carl Neuerburg:** Writing – review & editing, Supervision, Resources, Conceptualization. **Yunjie Zhang:** Writing – review & editing, Writing – original draft, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data presented in this study are available upon application in the Registry for Geriatric Trauma (AltersTraumaRegister DGU®, ATR) database, maintained by the German Trauma Society (DGU) (https://www.alterstraumaregister-dgu.de)

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