Impact of family physician–led hospitalist intervention methods in the multidisciplinary management of hip fracture: A retrospective cohort study

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Background and objective
Hip fractures are associated with high morbidity and mortality. We compared the impacts of a hospitalist consultant model and hospitalist model on morbidity in patients with hip fractures with conventional orthopaedic surgeon–led care.

Methods
This retrospective cohort study included patients who underwent surgery for hip fractures between April 2017 and March 2022. The primary outcome was the rate of perioperative complications. Multivariate analysis was adjusted for age, gender and any significant variables shown in univariate analysis.

Results
Of the 982 patients, 329, 224 and 429 were treated within the orthopaedic department, the hospitalist consultant model and the hospitalist model, respectively. In adjusted analysis, time to surgery was shorter within the hospitalist model (odds ratio [OR]: −0.259; 95% confidence interval [CI]: −0.502 to −0.016), but there were no differences among groups in length of stay, complications or in-hospital mortality.

Discussion
A family physician–led hospitalist model might facilitate earlier surgery for hip fractures than a conventional care model.

HIP FRACTURES are associated with high mortality and morbidity,[1,2] the rates of which can be lowered by comprehensive hospital care.[1,2] Geriatricians can play a major role in the comprehensive care of patients with hip fractures, although specialised geriatricians are limited in number. Hospitalists might therefore assume a useful role in interdisciplinary care; they can respond to consultations for preoperative medical evaluation and the management of postoperative complications, or they can be responsible for the entirety of patient care with an admission of the patient to the Department of General Internal Medicine.

In hospitalist consultant models, a hospitalist works with an orthopaedist during perioperative medical evaluation and management. As the name implies, hospitalists serve as consultants with consideration of the overall care of hospitalised patients. The hospitalist consultant model has been shown to decrease time to surgery and length of stay compared with conventional orthopaedic treatment.[3,4] Meanwhile, in the hospitalist model, the hospitalist team leads the management of perioperative and postacute care. Hospitalist models have also been shown to decrease time to surgery and length of stay compared with conventional orthopaedic treatment, as well as reducing time from surgery to dismissal and postoperative complications.[5–8]

In Japan, some studies have evaluated the effect of the co-management model. A retrospective cohort study of a multidisciplinary model with internists and a geriatrician showed a shorter time to surgery and hospital stay than the national average.[9] Another retrospective cohort study of a hospitalist co-management model showed shorter times to surgery than conventional orthopaedic surgeon–led care.[10] The clinical effects of the different hospitalist intervention methods have not yet been sufficiently investigated. Therefore, this study examined the effect of these two hospitalist intervention methods (hospitalist model and hospitalist consultant model) on morbidity in patients with hip fractures compared with conventional orthopaedic surgeon–led care.

Methods

Study design

We conducted a retrospective cohort study at Akashi Medical Centre (Hyogo, Japan), a community medical support centre in Japan that includes an emergency medical care centre and primary care practice. Patients who

underwent surgery for hip fractures between April 2017 and March 2022 were included in this study, whereas patients with periprosthetic fractures were excluded owing to differences in treatment and patient burden.

The study period comprised two years of a conventional orthopaedic model (OM; between April 2017 and March 2019), then a hospitalist consultant model for one year (HCM; between April 2019 and March 2020), followed by two years of a family physician–led hospitalist model (HM; between April 2020 and March 2022). In the OM, patients were admitted to the orthopaedics department and the medical team, including hospitalists, did not actively manage medical conditions unless asked, so there might be an issue with medical problems not being recognised early. Unnecessary delays in surgery can result in an increased risk of patient, family and staff dissatisfaction.[11] In the HCM, patients were admitted to the orthopaedics department and there was a consultation with the hospitalist team, so, theoretically, medical issues would be found earlier than in the OM. However, delays or errors might occur because of a lack of active coordination. The HM can be said to be a more developed, true co-management within a multidisciplinary team. In the present study, we compared the clinical outcomes between each hospitalist group (HCM and HM) and the OM group as a reference group. Throughout the study period, the hospitalist team included two board-certified family physicians who followed the key recommendations for family physicians: perioperative antibiotic prophylaxis, venous thromboembolism (prophylaxis and early rehabilitation and blood transfusion with a haemoglobin threshold of 8 g/dL).[12,13]

The multidisciplinary team in the HM comprised hospitalists, orthopaedic trauma surgeons, anaesthesiologists, nurses, physiotherapists, ward pharmacists, medical social workers, radiological technologists, ambulatory services and administrative staff. The hospitalist component included three doctors, one resident and one nurse practitioner, and they were responsible for making decisions on admission and when to perform surgery in conjunction with orthopaedists and anaesthesiologists. For patients with hip fractures, orthopaedic surgeons followed a clinical pathway that included directives regarding surgery. Hospitalists performed pre- and post-operative evaluations, as well as medication reconciliation and de-prescribing intervention within a multidisciplinary team.[14] In the event of a nurse calling for assistance, hospitalists were to respond first and manage any complications. A weekly conference of hospitalists and orthopaedic surgeons was held with the goal of resolving any concerns or issues about the design or operation of the co-management of patients with hip fractures.

Hip fracture template

We designed and implemented the hip fracture template (HFT), a computerised flagging and risk stratification algorithm system.[15] The HFT was created in compliance with the Critical Appraisal Checklist for a Questionnaire Study and reflected the views of users.[16] The HFT includes consideration of perioperative management and preventative measures against hip fractures based on previous literature and guidelines (Figure 1).[17–20] The HFT includes items such as falls risk assessment, preoperative assessment, management of complications and prevention of refracture. For example, if the user indicates on the interface that the patient is aged ≥65 years, the 'Order BNP' (B-type natriuretic peptide) icon will be checked automatically. Similarly, if the BNP value is input as ≥92 pg/mL, the box to suggest daily measurement of troponin would be automatically checked. The HFT became part of the clinical pathway after being piloted in practice.

Outcome measures

We retrospectively obtained data on the presence of complications, along with demographic data, type of fracture, months of the year and American Society of Anesthesiologists physical status (ASA-PS) using medical records from initial hospital visits. Data on months of the year were collected because of a seasonal variation of climate variables on hip fractures with a higher risk of hip fractures in cold seasons.[21,22] The primary outcome was the rate of perioperative complications. Secondary outcomes were the time to surgery, length of stay and in-hospital mortality.

Statistical analyses

Univariate analysis was used to identify factors associated with perioperative complications. Fisher's exact test and Student's t-test were used for categorical and continuous variables, respectively. Multiple logistic regression analysis was used to identify factors associated with the perioperative complication rate.

The perioperative complication rate was the dependent variable. Covariates were types of fracture, months of the year, age, gender, ASA-PS and any variables that were significant in the univariate analysis. We selected covariates with $P<0.2$ in univariate analysis for the multivariate regression model. All statistical analyses were performed using R 4.3.0 software (R Foundation for Statistical Computing, Vienna, Austria).

Ethics approval

The study was approved by the Akashi Medical Centre Research Ethics Committee (Approval no. 2022-11). Informed consent was obtained in the form of opt-out on the hospital's website. All procedures were performed in accordance with the 1964 Declaration of Helsinki.

Results

Among 984 patients, 982 had data that could be analysed; the other two patients were excluded. Altogether, 329 patients were managed in the OM, 224 patients within the HCM and 429 patients within the HM (Figure 2). Baseline demographics and clinical characteristics, including in-hospital mortality and length of stay, are presented in Table 1. The characteristics of the HCM and HM groups at baseline were similar. There were more patients with hip fractures in the HM than in OM group. More patients were ASA-PS 3 and 4 in the HM than HCM group (54.1% vs 46.4%). In-hospital mortality and the rate of complications were similar between the two groups.

The number of study subjects was similar between months of the year (Table 2).

The mean total medical costs during a hospital stay were higher in the HM group (JPY 1,611,489 [AUD 16,114; JPY 100=AUD 1]) than in the OM (JPY 1,457,602 [AUD 14,576]) and HCM (JPY 1,466,977 [AUD 14,669]) groups.

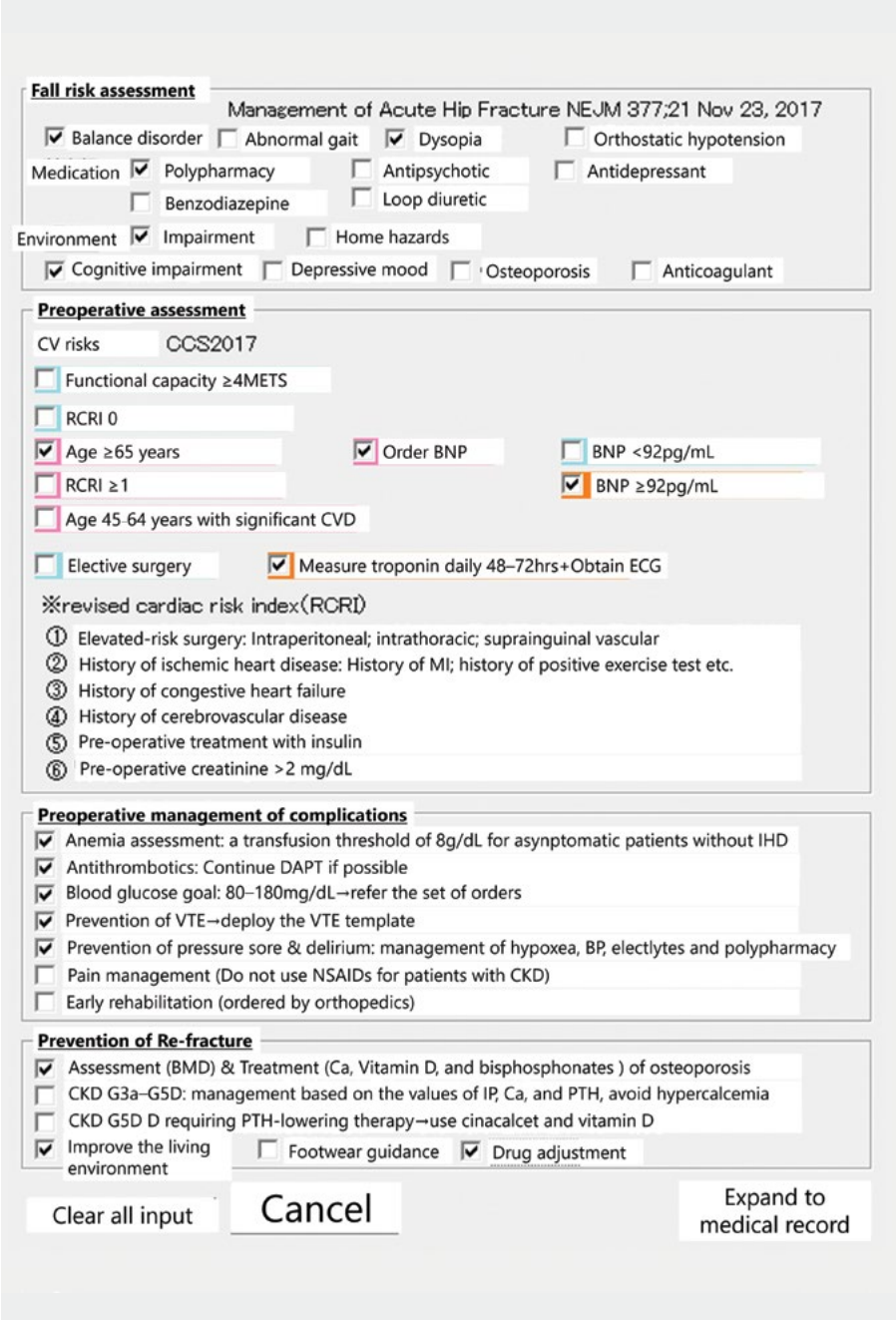

Figure 1. The hip fracture template is a computerised flagging and risk stratification algorithm system[15] that includes items such as fall risk assessment, preoperative assessment, management of complications and prevention of refracture.

BMD, bone mineral density; BNP, B-type natriuretic peptide; BP, blood pressure; CKD, chronic kidney disease; CV, cardiovascular; CVD, cardiovascular disease; DAPT, dual antiplatelet therapy; ECG, electrocardiogram; IHD, ischaemic heart disease; IP, inorganic phosphorus; METS, metabolic equivalents; MI, myocardial infarction; NSAIDs, non-steroidal anti-inflammatory drugs; PTH, parathyroid hormone; RCRI, revised cardiac risk index; VTE, venous thromboembolism.

In adjusted analysis by age, gender, fracture type, month and ASA-PS, patients managed with the HCM were more likely to have a shorter length of stay (log [length of stay] coefficient −0.09; 95% confidence interval [CI]: −0.16 to −0.02; *P*=0.015) and to have fewer perioperative complications (OR 0.63; 95% CI: 0.41 to 0.96; *P*=0.03). Patients managed within the HM were more likely to have a shorter time to surgery (coefficient −0.27; 95% CI: −0.52 to −0.03; *P*=0.028; Table 3). Common complications were deep vein thrombosis in the OM group and aspiration pneumonia in the HCM group. Myocardial injury after non-cardiac surgery (MINS) was detected only in the HM group (Table 4). There were six cases of COVID-19 (1.4%) in the HM group, but there were no deaths and no impact on the surgical waiting period.

Discussion

Summary of main findings

In this retrospective cohort study, time to surgery was shorter if patients were managed within the HM. No impact on morbidity was found. Length of stay was shorter and the rate of complications was lower if patients were managed within the HCM. To the best of our knowledge, this study is the first to investigate the impact of these hospitalist intervention methods on morbidity in patients with hip fractures in a real-world clinical context. Our findings highlight the value of structured management of hip fractures by an HM system.

Differences between studies and strengths of the present study

The time to surgery was shorter in the HM than OM group (1.2 vs 1.4 days). Clinical practice guidelines recommend surgery within 24–48 hours of injury, unless a delay is required to stabilise comorbidities, because early surgical management improves pain control, shortens hospital stays and lowers complications.[23,24] Multidisciplinary care, perioperative evaluations and management of clinical conditions by a hospitalist team including board-certified family physicians, regular hip fracture conferences and the use of a flagging and risk stratification algorithm system might contribute to the shortening of the time to surgery. Importantly, the HM

system was shown to be associated with a reduction in the time to surgery without an adverse effect on rates of complications or death.

Compared with conventional care, perioperative medical care provided by hospitalists is associated with significant reductions in time to surgery and length of stay, with no differences in mortality.[3,5] Our findings support previous results that decreased time to surgery was not associated with an observable effect on mortality. The time to surgery in each of the three groups (OM, HCM, HM) in our analysis was considerably lower than the 48-hour limit, implying that operating within the normally recognised 48-hour time range might have no effect on mortality.

Shorter time to surgery reportedly reduces complications,[25] but we observed no difference in the rate of complications between groups, despite a shorter time to surgery in our HM group. In our study, the complication rate was 30.8% and the in-hospital mortality rate was 1.6% in the HM group, which are lower than the rates in previous reports of HM.[5,26] This might dull the effect of HM on these outcomes.

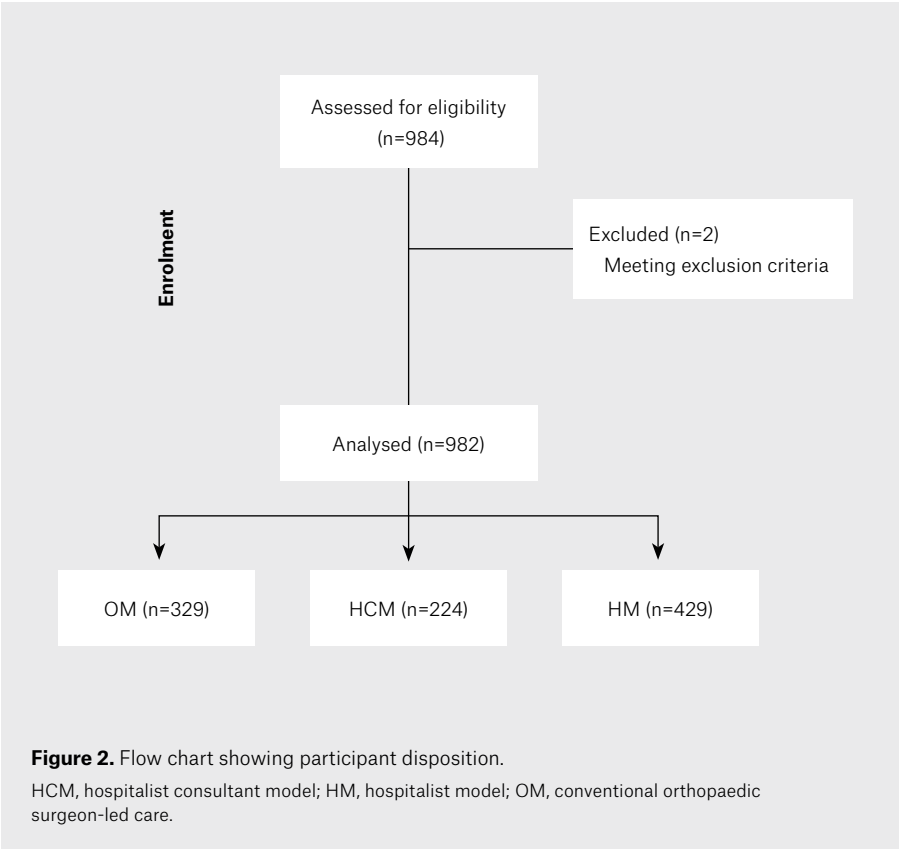

Figure 2. Flow chart showing participant disposition.

HCM, hospitalist consultant model; HM, hospitalist model; OM, conventional orthopaedic surgeon-led care.

Table 1. Characteristics of study subjects

	All (n=982)	OM (n=329)	HCM (n=224)	HM (n=429)
Age (years)	83.8±9.5	82.2±9.6	82.8±10.4	83.9±8.8
Female sex	729 (74.2)	246 (74.8)	175 (78.1)	308 (71.8)
Fracture type, femoral neck	557 (56.7)	185 (56.2)	118 (52.7)	154 (35.9)
ASA-PS				
I+II	503 (51.2)	186 (56.5)	120 (53.6)	197 (46.9)
III+IV	479 (48.8)	143 (43.5)	104 (46.4)	232 (54.1)
Length of stay (days)	19.6±10.1	20.1±9.1	18.8±9.5	19.8±11.1
Time to surgery (days)	1.3±1.7	1.4±2.0	1.2±1.8	1.2±1.4
In-hospital mortality	16 (1.6)	4 (1.2)	5 (2.2)	7 (1.6)
Mortality at 6 months	55 (5.6)	17 (5.2)	9 (4.0)	29 (6.8)
Perioperative complications	273 (27.8)	94 (28.6)	47 (21.0)	132 (30.8)

Categorical data are presented as n (%) and continuous data are presented as the mean±standard deviation.

ASA-PS, American Society of Anesthesiologists physical status; HCM, hospitalist consultant model; HM, hospitalist model; OM, conventional orthopaedic surgeon–led care.

A landmark historical cohort study of a hospitalist model that included similarly elderly patients (mean age 83 years) with hip fractures had a reported complication rate of 16.1% with major complications, 74.3% with intermediate complications and 27% with minor complications, and in-hospital mortality was 4.4%.[5] Another retrospective cohort study of a hospitalist model that included elderly patients (mean age 82 years) with hip fractures had a reported complication rate of 42% for major complications, 36% for intermediate complications and 79% for minor complications, and the rate of in-hospital mortality was reported to be 12%.[26] Common complications seen in the landmark historical cohort study were urinary tract infection (20.4% of patients treated by hospitalists and 17.0% of patients who received non-hospitalist treatment), delirium (17.8% and 32.2%, respectively), and pneumonia (14.4% and 12.3%, respectively).[5] Almost two decades have passed since that study, but it is noteworthy that only 3.0%, 1.4% and 3.7% of patients in the HM group in the present study developed aspiration pneumonia, delirium and pyelonephritis, respectively.

There is another explanation for the similar rate of complications between the groups in our study. MINS was detected only in the HM group when we performed surveillance of MINS with the HFT. The improved detection of complications including MINS might have influenced the similar rate of complications between groups, despite the lesser influence of the orthopaedic team.

Table 2. Number of study subjects according to time of year

	All (n=982)	OM (n=329)	HCM (n=224)	HM (n=429)
January	94 (9.6)	27 (8.2)	25 (11.2)	42 (9.8)
February	88 (9.0)	28 (8.5)	21 (9.4)	39 (9.1)
March	88 (9.0)	35 (10.6)	20 (8.9)	33 (7.7)
April	80 (8.1)	24 (7.3)	19 (8.5)	37 (8.6)
May	74 (7.5)	30 (9.1)	14 (6.3)	30 (7.0)
June	74 (7.5)	30 (9.1)	15 (6.7)	29 (6.8)
July	72 (7.3)	21 (6.4)	21 (9.4)	30 (7.0)
August	78 (7.9)	31 (9.4)	13 (5.8)	34 (7.9)
September	67 (6.8)	24 (7.3)	19 (8.5)	24 (6.8)
October	70 (7.1)	18 (5.5)	20 (8.9)	32 (7.1)
November	85 (8.7)	27 (8.2)	15 (6.7)	43 (8.7)
December	112 (11.4)	34 (10.3)	22 (9.8)	56 (11.4)

All data are categorical and are presented as n (%).

HCM, hospitalist consultant model; HM, hospitalist model; OM, conventional orthopaedic surgeon–led care.

Clinical implications

The present study might have pragmatic implications for the care of patients with hip fractures by hospitalists including family physicians, especially applicable to community hospitals in primary care settings. A certain proportion of family physicians practise in community hospitals.[27–29] Family physicians offer a wide range of holistic medical services, such as acute and chronic care, hospice and palliative care and preventative medicine.[30] Medical teams

Table 3. Differences in outcomes using conventional orthopaedic surgeon-led care as the reference group

	HCM		HM	
	Coefficient (95% CI)	*P* value	Coefficient (95% CI)	*P* value
Log (Length of stay)	−0.09 (−0.16, −0.02)	0.015*	−0.05 (−0.11, 0.01)	0.078
Time to surgery	−0.20 (−0.48, 0.09)	0.18	−0.27 (−0.52, −0.03)	0.028
	OR (95% CI)	*P* value	OR (95% CI)	*P* value
In-hospital mortality	1.59 (0.44–6.00)	0.48	1.10 (0.35–3.87)	0.87
6-month mortality	0.79 (0.32–1.83)	0.59	1.22 (0.65–2.36)	0.54
Perioperative complication	0.63 (0.41–0.96)	0.03**	1.00 (0.72–1.40)	0.99

Covariates were age, gender, fracture type, month and American Society of Anesthesiologists physical status (1: I+II; 0, III+IV).

*Multiple regression analysis was used for selected coefficients with a *P* value <0.2 in a univariate analysis.

**Logistic regression analysis was used for selected covariates with a *P* value <0.2 in a univariate analysis.

CI, confidence interval; HCM, hospitalist consultant model; HM, hospitalist model; OR, odds ratio.

Table 4. Common complications

	All (n=982)	OM (n=329)	HCM (n=224)	HM (n=429)
DVT	60 (6.1)	22 (6.7)	4 (1.8)	34 (7.9)
MINS	56 (5.7)	n/a	n/a	56 (13.1)
Pyelonephritis	39 (4.0)	19 (5.8)	4 (1.8)	16 (3.7)
Aspiration pneumonia	31 (3.2)	8 (2.4)	10 (4.5)	13 (3.0)
Heart failure	26 (2.6)	11 (3.3)	6 (2.7)	9 (2.1)
Haemorrhagic shock	19 (1.9)	7 (2.1)	4 (2.8)	8 (1.9)
Acute kidney injury	18 (1.8)	7 (2.1)	5 (2.2)	6 (1.4)
Atrial fibrillation	11 (1.1)	5 (1.5)	2 (0.9)	4 (0.9)
Delirium	11 (1.1)	3 (0.9)	2 (0.9)	6 (1.4)
Bacteraemia	10 (1.0)	5 (1.5)	2 (0.9)	3 (0.7)

Data are presented as n (%).

DVT, deep vein thrombosis; HCM, hospitalist consultant model; HM, hospitalist model; MINS, myocardial injury after non-cardiac surgery; n/a, not applicable; OM, conventional orthopaedic surgeon–led care.

comprised of family physicians are thought to be useful for hip fracture care with consideration of multimorbidity and polypharmacy. Further studies are needed to investigate whether a family physician–led hospitalist model could reduce morbidity and mortality regarding the management of patients with hip fractures.

Total costs during hospital stays were higher in the HM group, partly due to the increase in the Diagnosis Procedure Combination institutional coefficient for costs during hospital stays from April 2020 in our hospital (Akashi Medical Centre). The higher number of patients requiring bipolar hip arthroplasty also contributed to the increase in the costs in the HM group (46.2%) compared with those for patients in the OM group (32.8%) and the HCM group (32.1%), because bipolar hip arthroplasty (JPY 195,000 [AUD 1950]) is a slightly more expensive treatment than an intramedullary nail (JPY 188,100 [AUD 1881]).

Limitations

Our study has several limitations. First, data were collected from a single institution only, but we suggest that our results are representative of primary care settings. A second limitation is that the data were collected retrospectively, and prospective validation of results in a multicentre study is needed. Third, group allocation was not randomised, so our results might have been partially affected by confounding factors. Nevertheless, the characteristics of the study subjects were similar between the groups. To overcome these limitations, we propose the need for double-blind randomised studies to eliminate confounding variables. Finally, our results might have been skewed by the timing, because some of the study period coincided with the COVID-19 pandemic.

Conclusion

Our results suggest that a family physician–led hospitalist model facilitates earlier surgery for hip fractures than a conventional care model. Reducing surgical waiting times might improve patient experiences and facilitate hospital management. Morbidity was not affected by the family physician–led hospitalist model in our study.

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