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Audit of geriatric hip fracture care – a Slovenian trauma center analysis

Dejan Krušič · Drago Brilej · Colin Currie · Radko Komadina

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Summary
Background The aim was to describe an audit of hip fracture patient care and outcomes in a Slovenian healthcare setting prior to the implementation of the Geriatric Fracture Center (GFC) model of care.
Methods The Fragility Fracture Network (FFN) hip fracture audit database was used to collect data on hip fracture care in elderly patients. Epidemiological data were submitted as well as fracture type, prefracture residence and mobility prior to the fracture. The timeline of events and acute care data were also collected. Follow-up after 30 days included hip-related readmission, mobility, residence and life status.
Results Included were 495 patients with a mean age of 81 years of which 20% were preoperatively seen by a physician or geriatrician, 93.1% had surgical repair, 58.5% of them within 48 h of admission. The mortality rate in hospital was 5.4% and 10.1% at follow-up, 61.8% patients were able to return to prefracture residency and 23% could walk with minor assistance.
Conclusion This comprehensive and detailed audit report provides baseline data on case-mix, care and outcomes following hip fractures in Slovenia, in advance of planned quality improvement work in geriatric fracture care and provides a strong basis for the assessment of the impact of the GFC model of care.

D. Krušič · D. Brilej (✉) · R. Komadina
Trauma Department, General and Teaching hospital Celje, Oblakova 5, 3000 Celje, Slovenia
drago.brilej@guest.arnes.si

C. Currie
Formerly of Geriatric Medicine Unit, School of Clinical Sciences and Community Health, College of Medicine and Veterinary Medicine, Edinburgh University, Royal Infirmary of Edinburgh, Edinburgh, UK

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Introduction

The treatment of geriatric fractures is an increasing medical challenge all over the world. Hip fractures are by far the most common serious fragility fracture, causing short-term pain and disability and leading to longer term pain and even deformity. Hip fractures result in increased mortality compared to an age-matched population and also a reduction in functional status. As a result such patients may lose the ability to return to their baseline prefracture community [1].

The epidemiology, burden and treatment of osteoporosis in Slovenia was recently reviewed [2]. It was estimated that approximately 3000 new fragility hip fractures were sustained yearly in Slovenia in 2010. When accounting for the demographic projections for 2025, the number of hip fractures is estimated to increase by 1400. When stratifying costs of osteoporosis by fracture type, hip fractures were most costly (26 million €) and already a major challenge to the healthcare system, with costs estimated to rise 37% by 2025.

Professional societies for traumatology, osteology and physiatry have written recommendations for management of acute hip fracture in the elderly in Slovenia, which include acute surgical treatment, medical rehabilitation and secondary prevention with treatment of osteoporosis. The recommendations were adopted by the Board for Surgery at the Ministry of Health of the Republic of Slovenia in June and September 2011 [3].

Good evidence-based guidelines identify recommended good practice, i. e. show what ought to happen. A national or regional audit shows what is

happening, i. e. the realities of care and the implementation of a hip fracture database that measures care against standards of good practice has been shown to improve the quality of care of hip fracture patients. There has been a steady rise in the number of audits of hip fracture care since the launch of the Rikshoft audit in Sweden in 1988. National audits have now emerged or are emerging in Scandinavia, the UK, Ireland, Spain, Australia and New Zealand. Their goal is to measure care, to compare it against agreed clinical standards and to determine areas for improvement [4].

The Fragility Fracture Network (FFN) aims to globally disseminate the best multidisciplinary practice in preventing and managing fragility fractures, to promote research aimed at better treatment of osteoporosis, sarcopenia and fractures and to drive policy change that will raise fragility fractures higher up the healthcare agenda internationally. In 2013 an international group drawn mainly from representatives of established and emerging audits worked to draw up a proposed FFN minimum common dataset (MCD), a concise but robust distillation of key elements of case-mix, care and outcomes which is compatible with the many Rikshoft-based audits now active.

Further work carried out over 2014-2015 towards the development of a FFN hip fracture audit database (HFAD) piloted a web-based international audit using the FFN MCD. The purpose of this pilot audit is to improve care and outcomes and hip fracture audit has been effective in improving the quality of care in trauma units with feedback on case-mix, care and outcomes and the benchmarking of care against clinical standards. In Slovenia we had no established hip fracture audit and have not yet established a fragility hip fracture database. This situation led our traumatology department in the General Hospital of Celje to accept the invitation and participated in the pilot phase of the FFN hip fracture audit database (HFAD).

The aim of the current study was to describe hip fracture patients and their early follow-up results following treatment in a Slovenian healthcare setting, prior to implementation of a new Geriatric Fracture Center model of care of care with a comanaged approach.

Material and methods

Data collection

The pilot phase of FFN HFAD was set up to test the feasibility of a clinically led, web-based, international audit of hip fracture care. We used it in Celje to conduct a cohort study with 1 month follow-up that included all patients treated in the General and Teaching Hospital Celje for a proximal femoral fracture in the 18-month period between July 2014 and December 2015.

The inclusion criteria were patients more than 60 years old with osteoporotic hip fracture. Epidemiological data were submitted as well as fracture type, prefracture residence and patient mobility prior to the hip fracture. Preoperative comorbidity and physical status were determined using the American Society of Anesthesiologists (ASA) physical status classification. The timeline of events in hospital, time to orthopedic ward, time to surgery and length of stay were also recorded. Acute care data were collected, such as the nature of the operation performed, type of anesthesia, geriatrician involvement presurgery and postsurgery, time of mobilization and in-hospital mortality. Follow-up data after 30 days were obtained in outcome clinics and included hip-related readmission, reoperation, mobility, residence and life status. To identify patients who died information was obtained from the primary care provider and local medical information system (BIRPIS).

All data were analyzed by descriptive statistics with standard statistical software (SPSS, IBM, Armonk, NY). Clinical data were compared between the subgroups using the χ^2-test in cases of categorical variables and Student's t-test in cases of continuous variables. A p-value < 0.05 was considered significant.

Definitions

Hip fracture refers to a fracture occurring in the area between the edge of the femoral head and 5 cm below the lesser trochanter (ICD 10 CA diagnosis codes S72.0, S 72.1 and S72.2). These fractures are generally divided into two main groups: those above the insertion of the capsule of the hip joint are termed intracapsular or femoral neck fractures and those below the insertion are extracapsular. The extracapsular group is split further into trochanteric (intertrochanteric or pertrochanteric) and subtrochanteric. Comorbidity and physical status preoperatively were determined using the ASA physical status classification before surgery by anesthesiologists. Early surgery was defined as operations that were carried out within 48 h of admission to hospital. Patients were categorized into good mobility when they were reported as being able to walk without or with minor help, such as walking cane and as poor when there was no outdoor mobility.

Ethical considerations

Data were collected in advance of a planned quality improvement in the clinical setting. The survey was therefore considered as a quality assurance. Despite the fact that informed consent was obtained from all patients involved, data were anonymized prior to storage and analysis. The survey was approved by the responsible ethics committee.

Table 1 Baseline characteristics of the study population

Patient characteristics *N* = 495	
Gender (%)	
Female	70.1
Age groups (%)	
65–69 years	9.3
70–79 years	28.9
80–89 years	49.7
≥90 years	12.1
ASA grade (%)	
≤2	17.8
≥3	81.2
Unknown	1.0
Dementia on admission (%)	16.4
Prefracture residency (%)	
Home	75.4
Nursing home	20.2
Acute hospital transfer	1.2
Unknown	3.2
Prefracture mobility (%)	
Unaided	51.7
One aid	16.2
Two aids	7.3
Some indoor	16.6
No functional mobility	3.6
Unknown	4.6
Side of fracture (%)	
Left	50.1
Type of fracture (%)	
Intracapsular	34.9
Intertrochanteric	54.1
Subtrochanteric	9.9

ASA American Society of Anesthesiologists

Table 2 Acute care parameters of the study population

Acute care parameters *N* = 495	
Time from admission to surgery (%)	
<12 h	6.9
<24 h	26.3
<36 h	38.2
<48 h	58.5
>48 h	42.0
Type of surgery (%)	
No surgery	6.9
Cannulated screw	0.4
Sliding hip screw	41.0
Intramedullary nail	21.0
Hemiarthroplasty	28.3
Total hip replacement	0.4
Other	2.0
Type of anesthesia (%)	
General	41.0
Spinal	50.1
Other	8.9
Physician/geriatrician involvement (%)	
Yes	20.4
First day mobilization (%)	
Yes	78.4
In-hospital mortality (%)	
Presurgery	2.0
Postsurgery	3.4

Results

Study population and physical status before fracture

Included in the study were 495 hip fracture patients with a mean age of 81 years (SD = 7.7), and more than half of all cases occurred in those aged more than 80 years (Fig. 2). The majority of patients were female (70.1%). There was a high percentage of comorbidity amongst the patient population with 81.2% classified as ASA grade ≥ 3 (severe systemic disease that limits activity). A total of 373 patients (75.4%) were community dwelling, while 100 (20.2%) patients were living in a nursing home prior to fracture and 6 patients (1.2%) were admitted from acute care in hospital. For 16 patients (3.2%) data on the original place of residence were missing. With respect to mobility prior to the fracture, 236 patients (67.9%) could walk without help or needed only minor help, such as a walking cane. In 23 cases (4.6%) data about mobility were missing and 81 patients (16.4%) had documented dementia or psychiatric illness prior to the fracture (Table 1). Community dwelling patients were younger (mean 80.3 vs. 83.5 years), had fewer comorbidities (78% with ASA 3-4 vs. 92%) and better mobility (79.5% with good mobility vs. 43.1%).

Fracture classification

Fractures were almost equally distributed between left and right side. The majority of fractures were intertrochanteric (54.1%). The remainder of the cases were intracapsular (34.9%) and subtrochanteric (9.9%) (Fig. 3).

Mode and time of admission to hospital

The day of admission of hip fracture patients was relatively evenly distributed over the days of the week and presented in Fig. 4. Of the patients approximately one third (34%) were admitted during Friday afternoon or over the weekend. Of the patients admitted on weekdays 45% came to the hospital during normal working hours between 7 am and 3 pm, 34.8% in the afternoon and 20.2% overnight between 10 pm–7 a.m. Almost all hip fracture patients were admitted from the ED to the trauma ward as a rule within 4 h. Only 20% of patients

Table 3 Factors associated with early surgery

	Early (<48 h) *N* = 260	Late (>48 h) *N* = 188	*P*-value
Age (years, mean, SD)	80.7 (8.2)	80.9 (6.9)	0.79
Sex – female (no. %)	184 (57.7)	135 (42.3)	0.81
ASA – 4 (no. %)	34 (49.3)	35 (50.7)	0.09
Residence – institution (no. %)	60 (59.4)	41 (40.6)	0.75
Prefracture mobility – good (no. %)	182 (56.9)	138 (43.1)	0.43
Fracture type – intracapsular (no. %)	69 (47.3)	77 (52.7)	**<0.01**
Admission day – Friday, Saturday	32 (24.4)	99 (75.6)	**<0.01**

ASA American Society of Anesthesiologists
Bold type indicates statistical significance

Table 4 Factors associated with death in hospital

	Discharged *N* = 468	Died *N* = 27	*P*-value
Age (years, mean, SD)	80.7 (7.7)	84.6 (1.6)	0.01
Sex – female (no. %)	329 (94.8)	18 (5.2)	0.69
ASA – 4 (no. %)	85 (85.8)	14 (14.2)	<0.01
Residence – institution (no. %)	89 (89%)	11 (11%)	<0.01
Dementia (no. %)	74 (91.4)	7 (8.6)	0.17
Prefracture mobility – poor (no. %)	93 (93%)	7 (7%)	0.44
Fracture type – intracapsular (no. %)	165 (92.7)	13 (7.3)	0.17
Admission day – Friday, Saturday	132 (94.5)	9 (6.4)	0.57

ASA American Society of Anesthesiologists

were seen by a physician (geriatrician) preoperatively, mostly on request.

Surgery

Of the patients 34 (6.9%) did not have surgery but the reasons for not performing surgery were not specified. In-hospital mortality in this group of patients was 29.5%. These patients were less mobile (35.3% of patients with good mobility vs. 70.3% in the group having surgery), were less fit (61.8% classified as ASA 4 vs. 16.7%) and had more intracapsular hip fractures (76.5% vs. 33%). We could identify three subgroups of patients: with intracapsular undisplaced fractures that were freely mobile in 5 patients, with intracapsular fractures without functional mobility in 7 patients and with both types of fractures and very poor health condition in 14 patients. A total of 461 patients (93.1%) had surgery. In 50.1% of cases spinal anesthesia was used. In keeping with the guidelines for extracapsular stable hip fracture the most common operation performed was internal fixation with a dynamic hip screw (DHS) in 73.1%, followed by intramedullary nailing (IMN) in 22%. In unstable subtrochanteric fracture IMN was performed in 89.9% of cases. In intracapsular fractures 80.2% of patients were treated with cemented hemiarthroplasty and 15.1% of this group were treated without surgery (Fig. 5). Of those with a known time to surgery (90.5%), 38.2% of patients had undergone surgery within 36 h of admission and 58.5% within 48 h. (Table 2; Fig. 6). Only 6.5% of cases were operated on outside normal working hours (Monday to Friday, 7 am–3 pm). Table 3 shows patient factors associated with late surgery. Factors significantly associated with late surgery in the bivariate analysis include intracapsular fracture type and admission on Friday and Saturday.

Postoperative care

Postoperative nursing care with pressure ulcer prevention program was good, with only two patients developing this complication during acute care. With physiotherapy on the ward 78.4% of surgically treated patients were able to be mobilized on the day after surgery. Bone protection medication was commenced for all patients. The overall length of hospital stay varied, with a median duration of 9 days. Of all patients 77% were discharged from the hospital within 14 days of admission. Although 75.4% of patients were admitted to hospital from home only37.5% were discharged directly back to home. Of the patients from home, 55.3% received ongoing care in a nursing facility or were transferred to another acute care hospital. Only 1.5% were transferred to a rehabilitation centre.

Mortality in hospital

There were 27 in-hospital deaths in the 495 patients (5.6%), 10 patients died not having undergone surgery

Table 5 Some outcome parameters of study population

Outcome – follow up 1 month	
Readmission, %	3.0
Mobility 30 days after discharge from hospital (%)	
Freely mobile	2.8
With one aid	20.2
With two aids or frame	14.9
Indoor mobility	20.8
No functional mobility	28.7
Mortality (%)	
In-hospital	5.4
At 30 days	10.1
Community dwelling patients (30 days)	48.4%

Table 6 Comparison of data from the UK NHFD 2013 and data of the Irish hip fracture database (IHFD) to results in GH Celje

Comparison of UK NHFD 2013, IHFD 2013 and data from GH Celje in 2015			
	UK NHFD	IHFD	GH Celje
Surgery within 48 h (%)	86	77[a]	58.5
Patients developing pressure ulcers (%)	3.5	4	0.6
Preoperative assessment by physician/geriatrician (%)	49	27	20
Return to prior destination (%)	24.5	29	61.8[b]
30-day mortality rate (%)	8.2	–	10.1

[a]Calculations exclude not known cases
[b]30 days after discharge from hospital

and 17 who had surgery died. The delay to surgery was not associated with an increased risk of mortality in our surgically treated patients. The best predictors of mortality were medical comorbidities (ASA 4), advanced age and prefracture residence in a nursing home (Table 4, 5, 6).

30-day follow-up

All patients discharged from hospital (n = 468) were routinely scheduled to an outpatient clinic 1 month after discharge and 16 patients (3.0%) were readmitted to a trauma ward in less than 30 days. Of these 11 needed surgery: debridement and wash-out in 5, revision of internal fixation in 4, reduction of dislocated prosthesis in 1 and conversion from osteosynthesis to prosthesis in 1 patient. A total of 432 patients (92.3%) came to outpatient clinic 1 month after discharge from hospital. With 23 posthospital deaths identified from local medical information systems, the 1-month mortality after hip fracture was 10.1%. Data for 13 patients were lost for follow up. With respect to mobility, only 23% of patients could walk without help or needed only minor assistance 30 days after discharge from hospital (compared to 77.9% before injury; Table 4). Of the patients 209 (48.4%) were living at home compared to 75.4% before injury.

Discussion

Hip fracture care costs are a substantial economic burden on society and for the patients who suffer a hip fracture the consequences may include morbidity, disability and a significantly increased risk of death. Concerns about the way patients are treated are common. Prolonged waiting times for surgery, poor pain control and inadequate treatment of medical complications are often encountered. The British Orthopedic Association and the British Geriatrics Society jointly published a blue book entitled *The Care of Patients with Fragility Fracture* [5], which recommended close collaboration between orthopedic surgeons and geriatricians and set out six clinical standards: admission to orthopedic care within 4 h, surgery within 48 h of admission, prevention of pressure ulcers, access to orthogeriatric care, bone health assessment and treatment and falls prevention assessment. The Blue Book and the UK National Hip Fracture Database (UK NHFD), launched together in 2007, influenced the development of collaborative care within the UK and also internationally. Parallel developments in interdisciplinary guidelines [6] also served to improve hip fracture care more widely.

Professional societies for traumatology, osteology and physiatry in Slovenia have now written recommendations for management of acute hip fracture in the elderly in Slovenia. These cover acute surgical treatment, medical rehabilitation and secondary prevention with treatment of osteoporosis. The recommendations were adopted by the Board for Surgery at the Ministry of Health of the Republic of Slovenia in 2011 and this was the first step towards the establishment of Geriatric Fracture Centres (GFC) in Slovenia [3]. Before this happens, baseline data about the care and outcomes of hip fracture patients were required and in General Hospital Celje we accepted an invitation in 2013 to join the pilot phase of the HFAD, then under development by the international FFN and participated for 2 years gathering data on 495 patients. The demographic data from our analysis showing that female patients and patients in the 80–89 years age group were most likely to sustain a hip fracture from a fall at home is unsurprising and is similar to the data from the UK NHFD 2013 report [7]. The ASA grade was known for 98.9% of the patients with ASA grade 3 comprising the majority of the patients. The dominant fracture type was intertrochanteric (54.1%), followed by intracapsular fracture type (34.9%) and 49 patients (9.9%) from our cohort had subtrochanteric fractures. There are differences in the hip fracture pattern compared to the UK NHFD, where the dominant fracture type was the intracapsular group (48%). This may reflect a different, perhaps older, hip fracture population in Slovenia.

Of the patients 58.5% were operated upon within 48 h and 93.5% within normal working hours. In the UK 71% of patient surgery was performed within 36 h,

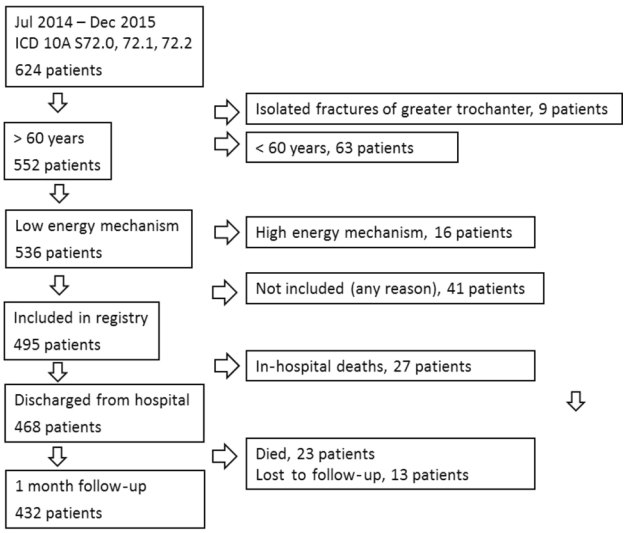

Fig. 1 Flow diagram of selection of the patients included in the study

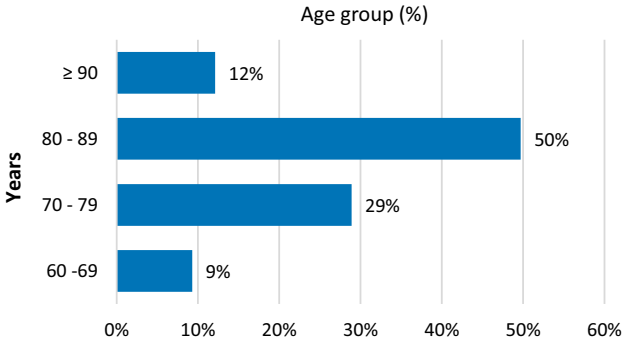

Fig. 2 Age distribution of the patients included into the study

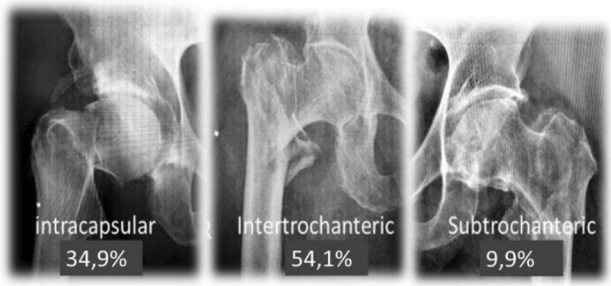

Fig. 3 Classification of hip fractures

as a result of the UK Best Practice Tariff initiative, which sets a more exacting permitted preoperative time than the 48 h blue book standard. Extended preoperative delay has been shown to increase mortality and timely surgery reduces preoperative pain, the risk of developing decubitus ulcers and medical complications and has also been shown to reduce the length of stay. It has been shown that the 30-day mortality risk is 2.5 times higher when surgery is delayed in patients with medical comorbidities [8]. Our analysis could not directly confirm these findings.

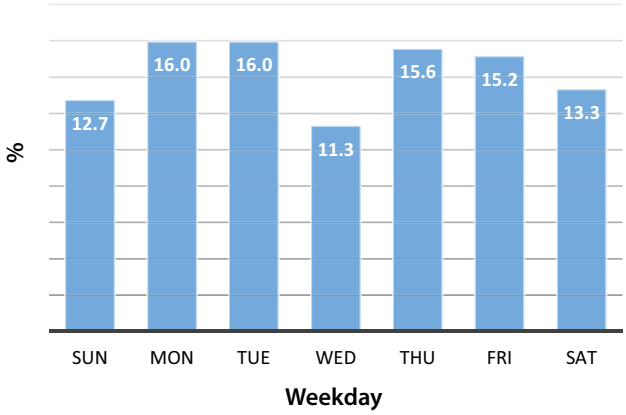

Fig. 4 Presentation of hip fracture patients to the hospital according to the day of the week (%)

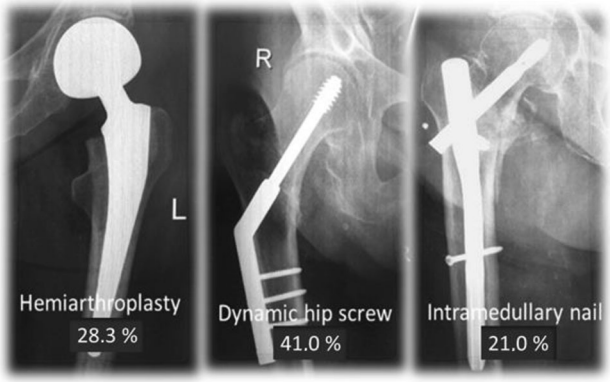

Fig. 5 Types of surgery performed

The two leading causes for delayed surgery in our series were medical fitness awaiting stabilization (35%) and lack of available operating theatre time (26%). The involvement of a geriatrician in the care of hip fracture patients has been shown to not only improve the morbidity and mortality in these patients but also reduce the delay in surgery, the length of stay and the readmission rates [4, 6]. In our hospital we do not have geriatrician and physician input is available only on the request. Almost 80% of our patients were not seen by a physician before the operation. It is important to note that at the time of submission of this article for publication there was no orthogeriatrician appointed in GH Celje, with consequences in terms of delay to surgery. Our analysis identified another problem that could be solved with change of the surgical pathway. Ways to provide prompt surgery for patients (especially those with intracapsular hip fracture) admitted on Friday and Saturday should be sought. A pathway to safe, timely surgery that includes the proper organization and expertise in diagnosis, medical optimization and anesthesia, together with weekend operating theater time, is required. It should be accepted that many patients with hip fractures will be frail and have comorbidities and

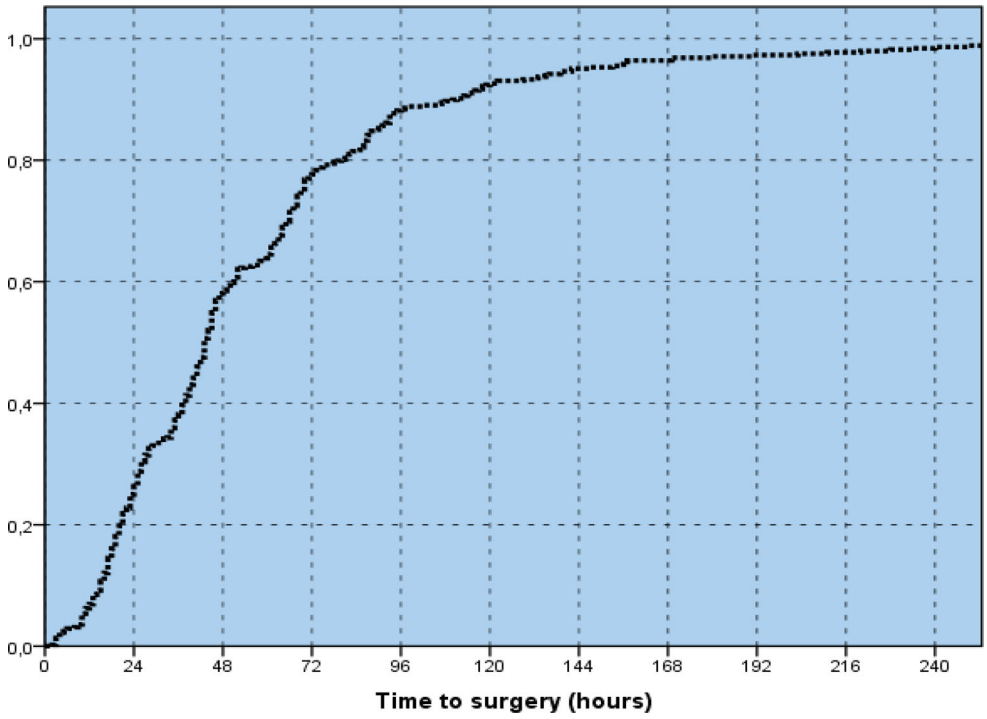

Fig. 6 Cumulative time from admission to surgery

that measures to optimize their medical condition and deliver prompt surgery are needed [9].

In terms of anesthesia most of our patients (50.4%) had spinal anesthesia and 41.1% had general anesthesia, such figures being comparable to those in the UK. It is assumed that spinal anesthesia leads to a better outcome than general anesthesia but prospective analysis of a 65,535 patient national dataset did not find any significant difference in either 5-day or 30-day postoperative mortality between general anesthesia and spinal anesthesia [10].

In our series the most common type of procedure performed was a DHS (42.1%) followed by cemented hemiarthroplasty (27.9%) and is related to the fracture type. An IMN was used in unstable fractures only. Open reduction and internal fixation with screws and total hip arthroplasty were uncommon. The results show that we follow recommendations regarding surgical treatment of hip fractures. The National Institute for Health and Care Excellence (NICE) guidelines recommend performing replacement arthroplasty with cemented implants in patients with a displaced intracapsular fracture (81% in our study) and extramedullary implants, such as a sliding hip screw in preference to an IMN in patients with trochanteric fractures [9]. Reasons for higher rate of nonsurgical treatment in intracapsular fractures (14%) should be further analyzed. The common practice of not doing surgery in intra-articular hip fractures in patients with no functional mobility should be challenged, in view of the pain relief achieved by surgery for patients likely to survive more than a few days.

The in-hospital mortality rate of our centre was 5.4% for the patients with hip fractures. Some authors published much higher values with the rates of up to 8–10% reported for usual care models. Nevertheless, for integrated care models much lower rates up to 1.5% have been reported [6]; however, such variance may simply reflect the variability of acute hospital stay across different service structures.

Regarding functional dependence, the study of Pretto et al. found that 30% of patients reported less independence 1 year after the fracture than before, and the number of patients with good mobility status decreased from 80% before to 57% 1 year after the fracture. One quarter of formerly independent people became at least partially dependent and half of those who already required assistance at home were admitted to nursing homes [1]. Similar results were found in our study where more than half of the patients lost independence in mobility in short-term follow-up. Rehabilitation services should be offered to these patients in order to improve functional status outcomes and enable them to return to the community and in many settings the early provision of rehabilitation at home proved beneficial. More than one half of the patients in our group were able to return to prefracture residency 1 month after discharge from acute care. The number is much lower than the number published by Kammerlander et al. (86%) where superiority of integrated care model was pointed out [6].

This baseline audit report provides a starting point for implementation of GFC. In response to the challenges in the development and provision of high-quality hip fracture care, our audit has provided much information and demonstrated how much we have to do

in order to raise standards of organization and hence clinical care and outcomes.

There is now good evidence that hip fracture audit can improve care, reduce mortality and serve more broadly as a quality improvement initiative [11] This article focuses on what a baseline audit has discovered about current clinical realities experienced by hip fracture patients in Slovenia before the implementation of the GFC. A further audit to be carried out once a GFC is established in Celje, will allow a robust and credible assessment of a major change in service provision as reflected in patient experience, care quality measured against widely recognized standards and key outcomes, such as return of mobility as well as mortality (Fig. 1, 2, 3, 4, 5, 6).

Compliance with ethical guidelines

Conflict of interest D. Krušič, D. Brilej, C. Currie and R. Komadina declare that they have no conflict of interests. declare that they have no competing interests.

Ethical standards For this type of the study formal consent is not required. The Study has been reviewed by ethics committee. Details that might disclose the identity of the patients included are omitted.

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