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ORIGINAL ARTICLE

Quality indicators in the treatment of geriatric hip fractures: literature review and expert consensus

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Abstract

Purpose Even though hip fracture care pathways have evolved, mortality rates have not improved during the last 20 years. This finding together with the increased frailty of hip fracture patients turned hip fractures into a major public health concern. The corresponding development of an indicator labyrinth for hip fractures and the ongoing practice variance in Europe call for a list of benchmarking indicators that allow for quality improvement initiatives for the rapid recovery of fragile hip fractures (RR-FHF). The purpose of this study was to identify quality indicators that assess the quality of in-hospital care for rapid recovery of fragile hip fracture (RR-FHF).

Methods A literature search and guideline selection was conducted to identify recommendations for RR-FHF. Recommendations were categorized as potential structure, process, and outcome QIs and subdivided in-hospital care treatment topics. A list of structure and process recommendations that belongs to care treatment topics relevant for RR-FHF was used to facilitate extraction of recommendations during a 2-day consensus meeting with experts ($n = 15$) in hip fracture care across Europe. Participants were instructed to select 5 key recommendations relevant for RR-FHF for each part of the in-hospital care pathway: pre-, intra-, and postoperative care.

Results In total, 37 potential QIs for RR-FHF were selected based on a methodology using the combination of high levels of evidence and expert opinion. The set consists of 14 process, 13 structure, and 10 outcome indicators that cover the whole perioperative process of fragile hip fracture care.

Conclusion We suggest the QIs for RR-FHF to be practice tested and adapted to allow for intra-hospital longitudinal follow-up of the quality of care and for inter-hospital and cross-country benchmarking and quality improvement initiatives.

Keywords Benchmark · Quality indicators · Hip fracture · Guideline

Introduction

Hip fractures have a devastating impact on the elderly [1] and are regarded as a major public health concern [2]. Moreover, costs related to hip fractures place a high economic burden on health and social systems, surpassing cost estimates for acute coronary syndrome and ischemic stroke [1]. It is anticipated that by 2050, the incidence of hip fractures in the USA may range between 458,000 and 1,037,000. [3]. Even though incidence rates in Europe tend to decline, cumulative 1-year mortality after hip fracture remains high, between 20 and 40% [4, 5], while up to 50% of hip fracture patients become permanently disabled [6]. Patient frailty for the most part accounts for postoperative morbidity and mortality [7] rather than the hip fracture itself.

Tailored multidisciplinary care pathways (CP) and programs have the potential to improve hip fracture efficiency of care [8], adherence to protocols [9], and patient outcomes such as mortality [10, 11], severity of delirium, and health-related quality of life [12].

In general, it is clear that adherence to evidence-based protocols is important to prevent potential complications and to improve patient outcomes [13, 14]. When it concerns geriatric hip fractures, however, an improved care process compliance does not guarantee improved patient

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outcome [9]. This might result from the extensive variety in the existing hip fracture care pathways [12] and clinical practices [15–18] leading to heterogeneous and inadequate care [19] and from the pre-existing differences in adherence to guidelines [20]. These critical findings stress the need to develop and implement a standardized approach in geriatric hip fracture care [21].

This in turn has driven an increasing yet unsystematic development of quality indicators for hip fracture care. The resulting indicator labyrinth makes benchmarking for the purpose of quality improvement fairly complex. This study aims to develop a set of key indicators assessing the quality of care [22], allowing for benchmarking and reducing unwarranted variation [23] in the care for fragile hip fracture patients. As in 2018 the Organisation of Economic Co-operation and Development (OECD), World Bank, and World Health Organization (WHO) stressed the need for international consensus on key indicators that allow for uniform benchmarking across countries to identify best practices [24], this would allow for publication on geographic variations in healthcare use, help shape policies to improve quality of care, and catalyze shared decision-making amongst healthcare providers [25].

Methods

A systematic and transparent approach [26] is necessary to develop key indicators assessing the quality of care, i.e., quality indicators (QIs). QIs need to be scientifically acceptable, feasible, clinically relevant, and usable [27] and allow for discrimination [28]. Therefore, we used the stepwise approach for a guideline-based development of QI proposed by Kotter et al. (Fig. 1) [29].

In a first step, a topic is selected and criteria to narrow down the topic are identified. As a second step, a selection of guidelines from peer-reviewed literature is made. Third, quality indicators from the guidelines and literature are extracted. In a fourth step, QI are selected by an expert panel. For this study, these QI were categorized into structure, process, and outcome indicators according to the Donabedian quality of care model [30]. In a fifth step, a practice test has to be conducted followed by the implementation of the QI. The current study will be limited to the selection of QI, i.e., steps 1 to 4 according to the model of Kotter. However, the clinical relevance of the withheld QIs remains to be determined. It is crucial that their value should be evaluated systematically [29] by means of practice tests and implementation in order to assess the quality and capacity of the potential QIs to finally evaluate [31] and improve quality of hip fracture care [29, 32, 33]. This validation process will be tackled in future research.

Results

Step 1: topic selection

The selected topic as defined by a small group of experts (AS, CS, EC, DS, KV, SN, MP), was "optimal recovery after fragile hip fracture." The targeted patient group includes all non-elective trauma-related admissions for hip fracture (limited to femoral neck, femoral head, trochanteric and subtrochanteric fractures). The following patients are excluded: patients below 65 years of age, patients with additional ipsilateral femoral fractures, and hip fractures resulting from a fall in the hospital where the patient already has been hospitalized for another reason. Finally, patients for whom the hip fracture is not the main reason for admission to the emergency department are excluded as well.

Step 2: guideline selection and literature review

Guideline selection was based on the clinical relevance to improve quality of care for hip fracture patients and has been performed by the same group of experts. Four international guidelines are included: (1) The National Institute for Health and Care Excellence (NICE) [34], (2) Scottish Intercollegiate Guidelines Network (SIGN) [35], (3) Australian and New Zealand Hip Fracture Registry (ANZHFR) guideline for hip fracture care [36], and (4) American Academy of Orthopaedic Surgeons (AAOS) Management of Hip Fractures in the elderly Evidence-based Clinical Practice Guideline [37]. In addition, a snowball and citation search of evidence from 2007 until May 2019 has been conducted across four electronic databases: MEDLINE, Cochrane library, Web of Science, and Google Scholar. The search strategy is based on key words and citations from the selected guidelines, a systematic review [33], and a scoping review [38] on hip fracture QIs.

Step 3: extraction of quality indicators

Based on the guidelines and the results of the additional literature search, a first set of in-hospital recommendations ($n = 555$) was identified and categorized according to the Donabedian quality of care model by the small group of experts. A total of 81 structure, 329 process, and 145 outcome key interventions were identified as potential QIs. In addition, a synthesis of the recommendations of the guidelines used was summarized in a white paper and shared with the experts from the participating centers [39]. The 329 process key interventions were grouped into fourteen categories relevant for optimal recovery after fragility hip fracture care pathways and included in a shortlist to be used during the break-out session of the consensus meeting (see step 4)

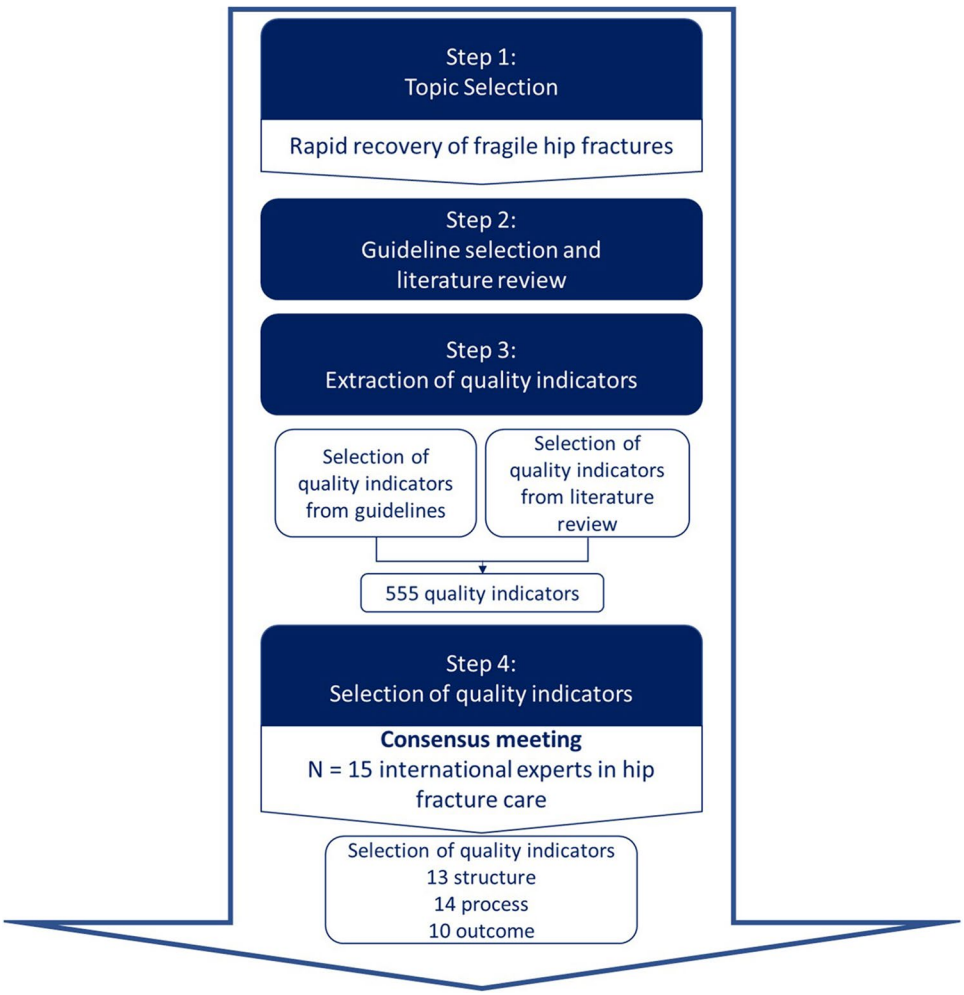

Fig. 1 Study flow chart. Adapted from Kotter et al. 2012: step 1 to 4 of the stepwise approach for a guideline-based development of QI

(Table 1). A discharge protocol is a structure indicator and evaluates if a protocol describing discharge planning is available at hospital level. A discharge planning is an outcome indicator and evaluates if a plan for discharge was available at individual patient level. A discharge planning usually is based on a previously defined discharge protocol.

Step 4: selection of quality indicators

In a fourth step, fifteen European hospitals with expertise in hip fracture care were invited to participate in a 2-day consensus meeting to define QIs relevant for quality improvement of optimal recovery of fragility hip fracture patients. The centers were instructed to appoint a senior clinical expert of the hip fracture care team to participate in this consensus meeting. Our international and interdisciplinary group of experts ($n = 15$) consisted of 11 trauma surgeons, 1 specialized hip fracture care nurse, 1 hip fracture care manager, 1 physiotherapist, and 1 anesthesiologist from 11 countries. None of the participating centers or experts received remuneration to participate in the study.

The participants were allocated to three break-out groups based on their clinical expertise: pre-, intra-, and postoperative care. Each group, moderated by a researcher of the European Pathway Association (EPA) team, was responsible for defining 5 process and structure QIs for their distinct part of the hospitalization period. In addition, participants were instructed to select these indicators that are (1) relevant for optimal recovery after fragility hip fracture, (2) sensitive to change within a specific timeframe, and (3) likely to display a high variation. Besides this, the experts had to keep in mind that all the QI should be applicable for all countries. Participants were allowed to add QIs that were not included in the shortlist that was developed to facilitate the selection process so an expert added the QI "presence and duration of intra-operative hypotension." Next, the relevance and inclusion of the extracted QIs were evaluated in plenary. If necessary, additional information and recommendations were adapted. Besides process indicators, 10 outcome indicators were selected, based on the same procedure at the same time. Inclusion or exclusion of the final set of QIs was based upon a general consensus framework [40]. After the consensus

Table 1 Quality indicators for optimal recovery of fragile hip fractures

	Pre-operative care	Peri-operative care	Post-operative care
1. Diagnosis and comorbidity management			
Time to assessment of pre-fall cognitive status			
Time to assessment of pre-fall mobility status			
2. Blood management			
Presence of blood transfusion protocol			
Measurement of post-operative haemoglobin as a standard procedure			
Availability of anticoagulation reversal protocol			
3. Care model			
Presence of hip fracture care protocol			
Participation in a national hip fracture care audit			
30-day mortality			
3-month mortality			
Length of stay			
4. Management of complications			
Presence and duration of urinary catheterization			
Presence of urinary tract infection (number of patients who developed a urinary tract infection)			
Presence of surgical site infection (number of patients who developed a surgical site infection)			
Presence of post-surgical constipation (number of patients who developed a post-surgical constipation)			
5. Discharge planning			
Presence of a standardized discharge planning protocol			
Presence of discharge protocol			
Presence of discharge planning			
6. Mobility, balance and activities of daily living			
Presence of fall prevention program			
Time to first mobilisation			
Number of in hospital falls			
Mobility status upon discharge			
7. Nutrition - Vitamin D status			
Availability of nutritional assessment protocol			
Time to nutritional assessment			
8. Pain management			
Availability of pain protocol for hip fracture patients			
Time to first pain relief upon admission			
Time to first pain relief postoperatively			
9. Anesthesia			
Use of hemodynamic optimization strategies during surgery			
Time to administration of systemic steroids			
Time to tranexamic acid administration			
Type of anaesthesia			
Presence and duration of intra-operative hypotension[a]			
10. Prevention of secondary fracture			
Presence of secondary fracture prevention protocol			
11. Prevention of pressure ulcers/wound healing			
Presence and duration of wound drain			
Presence of pressure ulcer (number of patients who developed a pressure ulcer)			
12. Screening and prevention of delirium			
Availability of delirium assessment protocol			
Number of days of delirium			
13. Surgery type, techniques and team			
Time to surgery			
14. Thromboprophylaxis			

[a]Systolic blood pressure < 90 mmHg or mean blood pressure < 55–60 mmHg; this indicator was added during consensus meeting

Color code: light gray, structure indicator; dark gray, process indicator; and black, outcome indicator

meeting, 13 structure, 14 process, and 10 outcome QIs were retained from the initial set of 555 QIs (6.7%).All the experts agreed to include these QI.

Discussion

This study aimed to define a set of QI assessing the quality of care in geriatric hip fracture treatment. Different sets of indicators have been used in previous studies [12, 15–18], thereby limiting comparability of findings. The indicator set proposed in this study is based on recent evidence and on expert opinion, and thus presents a huge leap forward. Only the highest level of evidence (guidelines) was used, QIs were classified into categories using the patient trajectory (preoperative, intraoperative, postoperative), and an expert consensus meeting was organized to effectively integrate the expert opinion. In defining the set of QI, several components of the recently developed enhanced recovery after surgery (ERAS) programs play an important role. ERAS programs have shown the potential to improve patient outcomes in elective [41] and emergency surgery as well [42, 43]. In these programs, timeliness plays an important role [44]. It is clear that to improve the outcome of geriatric hip fracture patients, the following components are needed as well: an early comprehensive patient assessment [45], timely surgery [46], early mobilization [47], early weight bearing [48], and early improvement in basic mobility status [49]. In our study, "early comprehensive patient assessment" is fulfilled by "presence of hip fracture care protocol" (process indicator), "time to assessment of pre-fall cognitive status" (process indicator), and "time to assessment of pre-fall mobility status" (process indicator). Timely surgery is covered by the process indicator "time to surgery." Early mobilization is covered by the process indicator "time to first mobilization." Improvement in basic mobility status is covered by the outcome indicator "Mobility status upon discharge." Early weight bearing as such was not covered in our study as we had to limit the number of quality indicators to make the selection a feasible tool for use in daily practice.

Previously conducted studies however show that despite consensus on content, the adherence to guidelines is low [14, 50, 51]. Because the level of evidence to define the QI in the actual study is very high and because of the strong methodology used, we believe that our study might serve as a hinge to improve adherence to guidelines. The first step in improving adherence to guidelines is to agree upon which quality indicators should be measured. With this study, we provide an internationally validated set of quality indicators to be used in future studies. Only the uniform use of these quality indicators will allow for benchmarking on an international level, finally leading to quality improvement projects. As outcome quality indicators can be interpreted on an individual (patient) or hospital (unit) level, it is important to mention the methodology used in any future study.

The indicators listed in our study can serve as building blocks for the development and the implementation of care pathways. Furthermore, the indicators can serve as the basis for the development of organizational specific care pathways and will allow for benchmarking as well.

The strengths of the current study can be summarized as follows: the developed indicator set is built on evidence and based on a multidisciplinary and international expert consensus. Furthermore, the whole hospitalization process is covered from admission to discharge, including hard outcome measures like mortality. Finally, some QI that are not based on evidence but that are evaluated high quality by the experts are included in the set like for instance the method of intra-operative temperature measurement. As an international group of experts defined the QI by consensus, the national levels are passed and the QI are not influenced by area nor region.

Despite the strong methodology used, an additional international Delphi design including a ranking of the defined QIs could have further enhanced the quality of this study. On the other hand, can the actual lack of gradation of importance of the QI be seen as an advantage as all QIs are of equal importance, as one indicator can be easy for one hospital, it can be a challenge for others. Future use of these QIs in (inter)national cross-sectional benchmarking studies or longitudinal intra-hospital quality control studies will help us in understanding the value of measuring specific indicators.

As mentioned in the introduction, the validation of the set of QI defined in our study has to be performed in future clinical research. It is clear that a good registration of the delivered care is of utmost importance for the accomplishment of these future studies [51].

In conclusion, there exists a huge variance in the quality of geriatric hip fracture care and in the hip fracture care guidelines and adherence to. In the actual study, a set of 14 process, 13 structure, and 10 outcome QIs was developed based on a methodology using the combination of high levels of evidence and expert opinion. This QI set will have the potential to (internationally) benchmark geriatric hip fracture care during hospitalization. We suggest this QI list to be practice tested and to be used in quality improvement initiatives.

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Author contribution AS, CS, EC, and DS wrote the article. KV, AS, SN, LB, and MP contributed to the design and implementation of the research, to the analysis of the results, and to the review process of the manuscript. All authors reviewed the article.

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Availability of data and material The shortlist of 306 process recommendations is available upon request.

Code availability Not applicable.

Declarations

Conflicts of interest AS is an associate professor at KU Leuven and trauma surgeon at the University Hospitals Leuven and has no conflicts to disclose. CS is a research assistant at the Leuven Institute for Healthcare Policy and has no conflicts to disclose. SN is a full professor at the KU Leuven and head of traumatology department at the University Hospitals Leuven and has no conflicts to disclose. EC is a postdoctoral researcher at the Leuven Institute for Healthcare Policy, office manager of the European Pathway Association, and has no conflicts to disclose. DS is a postdoctoral researcher at the Leuven Institute for Healthcare Policy and has no conflicts to disclose. LB is a postdoctoral researcher at the Leuven Institute for Healthcare Policy and has no conflicts to disclose. MP is full professor at Università degli Studi del Piemonte Orientale "Amedeo Avogadro" and president of the European Pathway Association. KV is associate professor at the Leuven Institute for Healthcare Policy, Policy Advisor of the Department of Quality, University Hospitals Leuven, Belgium and Secretary General of the European Pathway Association and has received a research grant from Zimmer Biomet to conduct this study.

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