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Hip fracture surgery in resource-limited environments: a systematic literature review

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Abstract

Purpose: With life expectancies increasing worldwide, there is a concomitant rise in the incidence of fragility fractures. As such, low-income and lower-middle-income countries (LICs and LMICs) will be faced with increased incidences of hip fractures. The care of these fractures is adversely affected by various factors that include under-resourced healthcare systems and large socioeconomic disparities, which disproportionately affect patient care in these regions relative to high-income countries. The purpose of this study was to determine treatment trends and outcomes of hip fracture care in lesser resourced regions as reported in primary literature sources through a systematic review.

Data Sources: The article search was conducted on December 16, 2020, and April 14, 2022, in 3 databases: PubMed, Web of Science, and Embase. A search strategy unique to each database was developed with a research librarian using English search terms.

Study Selection: Studies were selected using DistillerSR systematic review software. Two rounds of screening were performed for inclusion: 1) title and abstract screening and 2) full-text screening. Two researchers independently reviewed all articles. No articles were excluded based on language.

Data Extraction: The extracted information included country, study demographics and design, hip fracture location, treatment, and outcomes.

Data Synthesis: Of the 2533 initially identified abstracts, a total of 24 articles met the criteria for inclusion and were selected for final data extraction after full-text screening.

Conclusion: This systematic review demonstrates a paucity of research evaluating geriatric hip fractures in LICs and LMICs. Additional research is needed to better characterize the preferred treatment by fracture type and associated complications in resource-limited environments.

Keywords: global surgery, orthopaedics, hip fracture, trauma, LMICs

1. Introduction

Management and outcomes of hip fractures in low-income and lower-middle-income countries (LICs and LMICs) are affected by various factors that prevent the application of research from high-income countries (HICs). One such factor is healthcare system differences; 80% of the populations in low-income countries have no form of health insurance.[1] Consequently, those requiring treatment of hip fracture are often expected to purchase surgical supplies, including expensive implants, before surgery.[2] This process contributes to delays in hip fracture repair that result in longer hospital stays, inferior outcomes, and increased costs to patients and families caring for them. Even for insured patients, indirect costs of care can be significant. Understanding common barriers to surgery and determinants of hip fracture outcomes in LMICs can guide efforts to improve orthogeriatric access and quality in these lower resourced settings.

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The worldwide increase in life expectancy is associated with a global upsurge in osteoporosis and fragility fractures and is estimated to reach an annual incidence of 4.5 million by 2050.[3] This increased prevalence in geriatric hip fractures requires a better understanding of problems related to these injuries to inform policy and design effective interventions. Understanding trends in geriatric hip fracture treatment and the related outcomes in low-resourced environments can inform direction for improved patient care pathways, which include surgical timeliness and protocol standardization. The purpose of this study was to determine treatment trends and outcomes of hip fracture care in lesser resourced regions as reported in primary literature sources through a systematic review.

2. Materials and Methods

2.1. Search Strategy

A systematic review was performed according to the Preferred Reporting Items for Systematic review and Meta-Analysis Protocols (PRISMA-P).[4] This project was exempt from IRB review per the University of California, San Francisco, Human Research Protection Program (HRPP). Study inclusion criteria were established a priori to include the following: an original, full-text publication; a primary source containing data from more than 20 subjects (case reports and case series involving ≤20 patients were excluded); publication in English; description of primary hip fractures (not pathologic or periprosthetic) in geriatric patient populations (65 years and older); description of clinical management and/or outcomes; data obtained from low-income or lower-middle-income countries. LMICs were defined as any country listed as a "low-income" or "lower-middle-income" economy according to the 2019 World Bank classification.[5]

2.2. Data Sources

The article search was conducted on December 16, 2020, in 3 databases: PubMed, Web of Science, and Embase. A second search was conducted on April 14, 2022, to identify any additional articles published during the study period. Sources produced outside of the traditional publishing channels (gray literature) were identified by reviewing references from the articles selected for final review, conference abstracts from Embase, and "white papers" or guidelines from Google. A search strategy unique to each database was developed with a research librarian using English search terms (Appendix A, Supplemental Digital Content 1, http://links.lww.com/OTAI/A105).

2.3. Study Selection

Studies were selected using DistillerSR systematic review software (https://v2dis-prod.evidencepartners.com/). Duplicates were detected in Endnote, followed by DistillerSR. Two rounds of screening were conducted for inclusion: 1) title and abstract screening and 2) full-text screening. Two researchers (S.N.K. and V.O.) independently reviewed all articles (N = 1671). The remaining articles underwent full-text screening (N = 443). A reference list of each included study was reviewed to identify any additional studies. Conflicts were resolved by consensus with S.N.K. and V.O. Twenty-four publications were included in the final review.

2.4. Data Extraction

Data extraction was performed in duplicate to ensure accuracy (S.N.K. and V.O.). The extracted information included: 1) country; 2) study demographics: number of participants, age, and sex; 3) study design: hospital or clinic-based convenience sampling or population-based sampling and period of data collection; 4) location of hip fracture: intertrochanteric, femoral neck, both, or unspecified; 5) focus of study: prediction, quantitative assessment, management, and outcomes; 6) hip fracture prediction factors: Fracture Risk Assessment Tool (FRAX), risk factors, and other; 7) quantitative measures: hip fracture prevalence, disability adjusted life years (DALYs), direct economic impact, indirect economic impact, individual economic impact, and societal economic impact; 8) preoperative management: orthogeriatric comanagement, prophylactic antibiotics, anticoagulation, anemia management, pain management, and other; 9) preoperative mobility measures: Harris Hip Score (HHS), Barthel Index for Activities of Daily Living (ADL), Katz Index of Independence in ADL, Timed Up & Go (TUG), Hip Disability and Osteoarthritis Outcome Score (HOOS), 12-Item Short Form Health Survey (SF-12), 36-Item Short Form Health Survey (SF-36); 10) surgical management: plate and screw fixation, intramedullary nail fixation, and arthroplasty; 11) postoperative weight-bearing protocol: yes, no, or not discussed; 12) surgical timing: average time from injury to presentation, average time from presentation to surgery, average time from injury to surgery, optimal timing of surgery, and treatment delays; 13) outcomes: mobility, complications, and radiographic time to healing; 14) postoperative mobility measures: HHS, Barthel Index for ADL, Katz Index of Independence in ADL, TUG, HOOS, SF-12, and SF-36; 15) complications (rates and risk factors): mortality, thromboembolic events, infection, delirium, pressure injuries/bedsores, implant complications, subsequent fractures; reoperations, and interoperative blood loss; 16) secondary fracture prevention: fracture liaison services, steps taken to prevent secondary fracture, and postoperative rehabilitation.

3. Results

A total of 2533 citations (684 from PubMed, 1613 from Embase, and 236 from Web of Science) were identified in the initial search. After duplicate detection, a total of 1671 unique citations were included. After title and abstract review, there were 443 articles included in full-text screening. A total of 24 articles were selected for final data extraction after full-text screening (Fig. 1). An overview of the reviewed articles is given in Table 1.

3.1. Study Demographics

Of the corresponding authors, 1 was affiliated with an institution in a LIC (Sudan), while 23 were affiliated with LMICs. The majority of eligible articles were published in India (n = 14), with similar representation among 7 other countries: Egypt (n = 1), Nepal (n = 1), Pakistan (n = 1), Philippines (n = 1), Sri Lanka (n = 2), Sudan (n = 1), and Vietnam (n = 2). The number of patients collectively evaluated in the eligible studies ranged from 33 to 1045, with an average of 170 individuals. The average patient age from 21 articles was 77 years, ranging from 65 to 105 years. On average, over half of the patients (59%) were female, as reported in all but 2 studies.

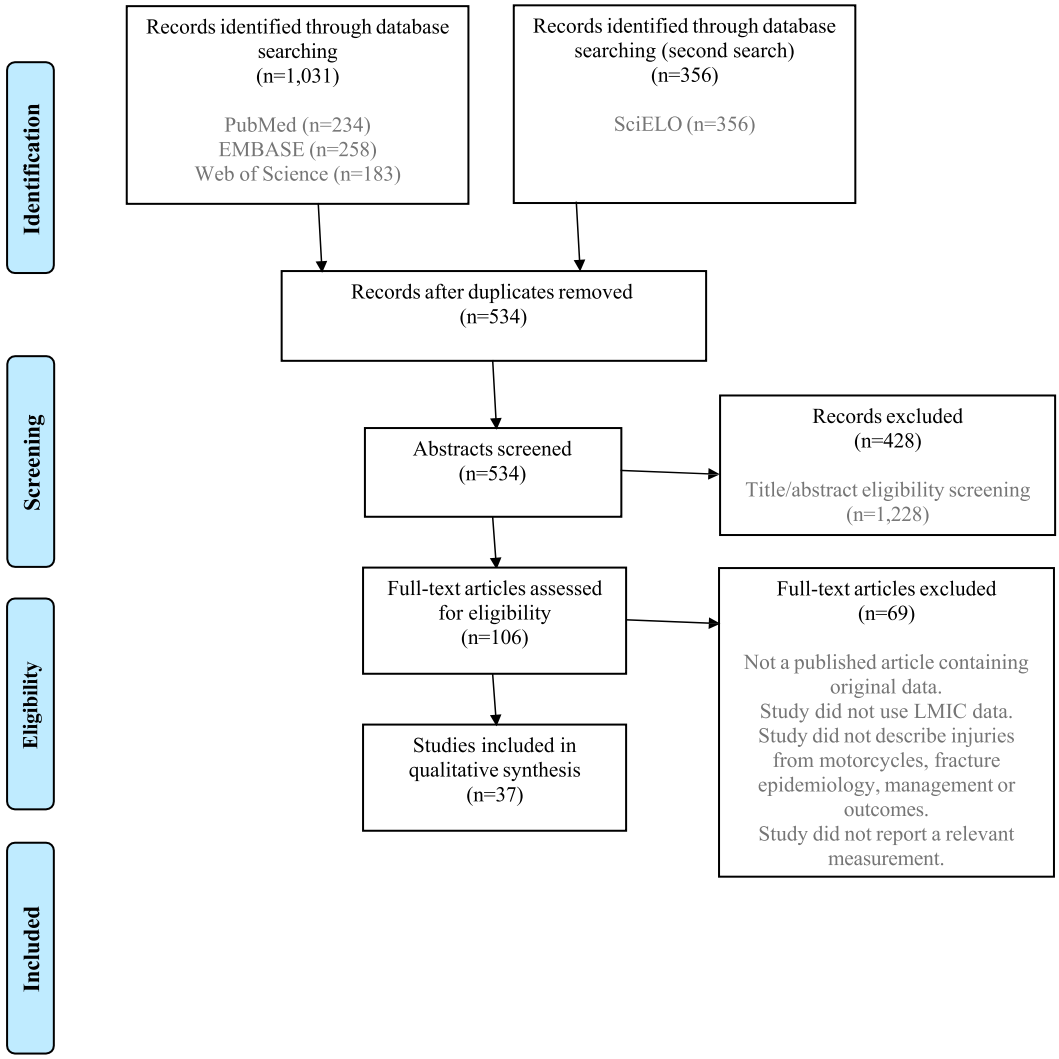

Figure 1. PRISMA flow diagram outlining the study selection process.[4]

3.2. Study Design

All evaluated studies used hospital or clinic-based convenience sampling with an average data collection period of 18 months. Of the extracted articles, 3 studied femoral neck fractures, 12 evaluated intertrochanteric fractures, 5 assessed both femoral neck and intertrochanteric fractures, and 4 investigated unspecified proximal femur fractures.

3.3. Preoperative Management

Nine articles addressed preoperative management, most commonly referencing the administration of prophylactic antibiotics (n = 6) and anticoagulation (n = 3).

3.4. Surgical Management

Twenty-three studies focused primarily on the surgical management of hip fractures. Of the studies that specified treatment by fracture type, all femoral neck fractures were treated with arthroplasty/hemiarthroplasty, while intertrochanteric fractures were treated with a combination of arthroplasty, intramedullary nailing, dynamic hip screw fixation, and external fixation. Sixteen articles addressed an aspect of surgical timing, most commonly reporting the mean operative time (n = 11), time from injury to surgery (n = 7), time from presentation to surgery (n = 5), and time from injury to presentation (n = 2). Delays to surgery were attributed to delayed hospital admissions and adequate management and stabilization of complex comorbidities (n = 3).

3.5. Outcomes

The most prevalently assessed outcome was complications (n = 24), of which mortality (n = 17), infection (n = 12), thromboembolic events (n = 7), delirium (n = 1), pressure ulcers (n = 3), and procedural/implant complications (n = 16) were cited. Mobility (n = 19) and radiographic time to healing (n = 8) were also described. Mobility was most commonly reported as HHS (n = 14). ADLs and return to normal activities were also evaluated in 10 studies.

The cumulative average mortality rate was 14.0%, ranging from 0% to 52.8%. Commonly identified risk factors of increased mortality rates included comorbidities (n = 7), age (n = 5), and reduced mobility preoperatively and postoperatively (n = 5). Infection rates averaged 8.3%, with a range of 0%–60%,

Table 1

Overview of 24 included articles.

Source (first author, y)	Country	Hip fracture type	Fracture treatment	Complications reported
Abeygunasekara, 2020[6]	Sri Lanka	Unspecified	Surgical (not specified) and conservative	Mortality
Dung, 2019[7]	Vietnam	Intertrochanteric	Surgical (arthroplasty)	Mortality, infection, implant complications
Gangadharan, 2010[8]	India	Intertrochanteric	Surgical (IM nail)	Infection, thromboembolic events, procedural/implant complications
Gashi, 2018[9]	Sudan	Intertrochanteric	Surgical (IM nail, arthroplasty)	Mortality, infection, thromboembolic events, pressure ulcers, procedural/implant complications
Gavaskar, 2012[10]	India	Intertrochanteric	Surgical (IM nail)	Mortality, procedural/implant complications
Gavaskar, 2018[11]	India	Intertrochanteric	Surgical (IM nail)	Procedural/implant complications
Gavaskar, 2014[12]	India	Femoral neck	Surgical (arthroplasty)	Mortality, infection, thromboembolic events, procedural/implant complications
Hasan, 2020[13]	Pakistan	Unspecified	Surgical (IM nail, arthroplasty)	Overall complication rate
Jolly, 2019[14]	India	Intertrochanteric	Surgical (IM nail, arthroplasty)	Mortality, infection, thromboembolic events, pressure ulcers, procedural/implant complications
Karn, 2009[15]	Nepal	Intertrochanteric	Surgical (external fixation)	Mortality, procedural/implant complications
Le, 2020[16]	Vietnam	Intertrochanteric	Surgical (arthroplasty)	Infection, delirium, implant complications
Mallya, 2019[17]	India	Intertrochanteric	Surgical (IM nail)	Infection, procedural/implant complications
Marya, 2008[18]	India	Femoral neck	Surgical (arthroplasty)	Infection, thromboembolic events, delirium, procedural/implant complications
Rai, 2018[19]	India	Both	Surgical (IM nail, arthroplasty)	Mortality, infection, thromboembolic events, procedural/implant complications
Ram, 2019[20]	India	Both	Surgical (IM nail, arthroplasty)	Mortality
Sidhu, 2010[21]	India	Intertrochanteric	Surgical (arthroplasty)	Mortality, procedural/implant complications
Thakur, 2016[22]	India	Intertrochanteric	Surgical (arthroplasty)	Infection, procedural/implant complications
Valera, 2014[23]	Philippines	Intertrochanteric	Surgical (IM nail, DHS, arthroplasty)	Mortality, infection
Vasu, 2018[24]	India	Unspecified	Unspecified	Mortality
Abdelnasser, 2021[25]	Egypt	Both	Surgical (DHS, arthroplasty)	Mortality, infection, procedural/implant complications
Abeygunasekara, 2021[6]	Sri Lanka	Unspecified	Unspecified	Mortality, infection, thromboembolic event, pressure ulcers
Chethan, 2022[26]	India	Both	Surgical (IM nail, DHS)	Mortality
Makeen, 2021[27]	Egypt	Femoral neck	Surgical (arthroplasty)	Mortality, procedural/implant complications
Raichandani, 2021[28]	India	Both	Surgical (IM nail, DHS, arthroplasty)	Mortality

whereas the average incidence of thromboembolic events was 3.1%, ranging from 0% to 8%. Prolonged bedrest and restricted weight bearing postoperatively were cited risk factors of both thromboembolic events and infection. Procedural and/or implant complications were discussed in 16 studies. Twelve studies estimated the average interoperative blood volume (160 mL, ranging from 20 mL to 444 mL) and/or blood transfusion rate (51%, spanning a range from 0% to 100% of cases). Outcomes by fracture type are listed in Table 2.

3.6. Postoperative Management

Eight studies reference an aspect of postoperative management, most commonly anticoagulation (n = 8) and antibiotics (n = 4). Fifteen discussed postoperative weight-bearing and rehabilitation protocols. Three studies provided recommendations for secondary fracture prevention by implementing an interdisciplinary care model.

4. Discussion

Despite the relative paucity of literature evaluating geriatric hip fracture management in LICs and LMICs, this review identified basic trends in surgical management and diminished patient outcomes. Collectively, these articles provided insights into the current risk factors, surgical treatments, surgical timing, and outcomes of geriatric hip fractures in LMICs.

4.1. Risk Factors

Nearly half of the cited studies identified risk factors associated with poor hip fracture outcomes. Age was most frequently related with increased hip fracture prevalence and increased hip fracture mortality rates. Although age also exists as a nonmodifiable risk in HICs, challenges arising from nutritional deficiencies, polypharmacy, limited access to healthcare resources, and a relative absence of fall-prevention initiatives remain unaddressed in most LICs and LMICs, thus presenting opportunities for improvements in bone mineral density, fall risks, and overall hip fracture rates.[30,31] Similarly, baseline comorbidities, often positively correlated with aging, were presented as common factors for increased fracture risk and poorer outcomes. With a global rise in obesity and diabetes, along with disparate access to medications or medical management of such comorbidities, the risks associated with low bone mineral density, osteoporosis, and osteopenia continue to be further compounded in LMICs and LICs.[30] Such modifiable risk factors provide targets for intervention and can be promoted through public health and community-level education programs for improving health literacy, nutrition, and general health.[30] Physical impairment, a commonly recognized contributor to mortality, presents another opportunity for systemic improvements.

Overall, in this review, 59% of the patients with hip fractures were reported as female. In the United States, as in many high-income countries, the incidence of hip fractures is almost 4 times

Table 2

Hip fracture outcomes by fracture type.

Source (first author, y)	Fracture type	Surgical management	Mortality rate	Thromboembolic rate	Infection rate	Delirium rate	Subsequent fracture/ dislocation rate	Revision rate	Transfusion rate/ blood loss
Gavaskar, 2014[12]	Femoral neck	Arthroplasty	14.50%	4.80%	0%	Not reported	6.5% (intraoperative fractures) 4.8% (dislocations)	3.2%	Combined blood loss: 420–490 mL Transfusion rate: Cemented THA—71%, uncemented—44%
Marya, 2008[18]	Femoral neck	Arthroplasty	Not reported	2.3%	7.1%	8.3%	3.6% (dislocations)	Not reported	Avg blood loss: 184 mL, range: 100–500 mL
Makeen, 2021[28]	Femoral neck	DMTHA versus BA	6.00%	Not reported	Not reported	Not reported	6% (dislocation)	Not reported	Blood loss: BA—365 mL DM—528 mL
Dung, 2019[7]	Intertroch	Arthroplasty	0%	Not reported	2.9%	8.60%	Not reported	Not reported	Not reported
Gangadharan, 2010[8]	Intertroch	IM nail	Not reported	0%	0%	0%	Not reported	Not reported	Avg blood loss: 20 mL Range: 15–40 mL
Gashi, 2018[9]	Intertroch	Hemiarthroplasty versus DHS	HA-16.7%, DHS-15.8%	HA-3.3%, DHS-5.2%	HA—5% DHS—18.4	HA—5%, DHS—18.4%	Not reported	DHS—24% HA—5%	Transfusion rate: DHS—47.4% HA—61.6%
Gavaskar, 2012[10]	Trochanteric	IM nail (PFNA)	6.60%	Not reported	Not reported	Not reported	Not reported	5.7%	Not reported
Gavaskar, 2018[11]	Trochanteric	PFNA versus InterTan nails	Not reported	Not reported	Not reported	Not reported	Not reported	Combined: 7% PFNA—6% InterTan—1%	Not reported
Jolly, 2019[14]	Intertroch	PFN versus cemented bipolar hemiarthroplasty	PFN—8% CB—4%	PFN—12% CB—4%	PFN—8% CB—24%	Not reported	Not reported	Not reported	Avg blood loss: PFN—46 mL HA—187 mL
Karn, 2009[15]	Trochanteric	External fixation	10%	Not reported	60%	Not reported	Not reported	Not reported	Avg blood loss: 33.33 mL Transfusion rate: 0%
Le, 2020[16]	Intertroch	Bipolar hemiarthroplasty	Not reported	Not reported	2.90%	Not reported	Not reported	Not reported	Transfusion rate: 88.2% Transfusion volume: 250–750 mL
Mallya, 2019[17]	Intertroch	PFN versus PFNA2	6%	Not reported	1.2%	Not reported	Not reported	Not reported	Avg blood loss: PFN—70.24 mL PFNA2—51.35 mL
Sidhu, 2010[21]	Intertroch	Arthroplasty	17%	Not reported	Not reported	Not reported	Not reported	Not reported	Avg blood loss: 295 mL Range: 150–500 mL Transfusion volume: 2 units/patient
Thakur, 2016[22]	Intertroch	Hemiarthroplasty	Not reported	Not reported	2.4%	Not reported	Not reported	0	Avg blood loss: 125 mL Range: 100–250 mL Transfusion rate: 100%
Valera, 2014[23]	Intertroch	CHSF versus DCS versus arthroplasty	17% (only total provided)	Not reported	Not reported	Not reported	Not reported	0	Not reported
Rai, 2018[19]	Both and acetabular	PFN, DHS, hemiarthroplasty	1%	1.4%	2.3%	Not reported	Not reported	0.7% (implant failure)	Not reported
Abdelnasser, 2021[25]	Both and acetabular	Sliding hip screw-troch, cemented hemiarthroplasty-femoral neck	52.8% (1-y)	15%	11.3%	Not reported	Not reported	0.3%	Transfusion rate: 3%
Chethan, 2022[27]	Both	PFNA, DHS, arthroplasty for femoral neck	18.40%	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported
	Both			0.8%		Not reported		Not reported	Not reported

(*continued on next page*)

Table 2 (*continued*)

Source (first author, y)	Fracture type	Surgical management	Mortality rate	Thromboembolic rate	Infection rate	Delirium rate	Subsequent fracture/ dislocation rate	Revision rate	Transfusion rate/ blood loss
Raichandani, 2021[29]		Hemiarthroplasty, total arthroplasty, IMN, DHS	11.2% (2-y)		Not reported		14.3% (periprosthetic)		
Ram, 2019[20]	Both	Total arthroplasty versus hemiarthroplasty versus DHS, versus plate versus nail versus dynamic condylar screw	8.9%	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported
Abeygunasekara, 2021[26]	Unspecified	Conservative versus surgical	18.3%	8.3%	5%	Not reported	Not reported	Not reported	Not reported
Hasan, 2020[13]	Unspecified	Nailing, arthroplasty, DHS	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported
Vasu, 2018[24]	Unspecified	Not reported	11.7%	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported
Abeygunasekara, 2020[6]	Unspecified	Conservative versus surgical	18.3%	Not reported	Not reported	Not reported	Not reported	Not reported	Not reported

higher among women than men. This finding is particularly confusing when noting that there are fewer men than women in low-income and lower-middle-income countries.[32] One possible explanation is that the incidence of hip fractures among women in low-income and lower-middle-income countries is lower than that among men, but this is unlikely given that osteoporosis is more common in women. Another possible explanation is that in low-income and lower-middle-income countries, women still have a higher incidence of hip fractures as compared with men but are less likely to present to healthcare centers. Additional research should expand on these findings to directly compare the rates of female and male hip fractures in high-income versus low-income and lower-middle-income countries and identify causes for any differences found.

4.2. Surgical Treatment

In the studies reviewed, arthroplasty was cited as an intervention for both intracapsular and extracapsular fractures and was performed more routinely than osteosynthesis, which was only used for the treatment of extracapsular fractures. Osteosynthesis procedures in HICs commonly use fluoroscopy with the placement of cephalomedullary nails and sliding hip screws; however, the cost and availability of equipment and implants often limits the performance of these procedures in LICs and LMICs.[33] Of the studies incorporating dynamic hip screws and intramedullary nails, there was an even distribution between their frequencies of use. Nearly one-third of the studies describe the use of arthroplasty in treating extracapsular fractures, despite limited evidence by high-quality clinical biomechanical or cost-effectiveness studies that this treatment modality is most effective for these fracture types.[30] This demonstrates a need for further evaluation throughout LMICs to determine the cost-effectiveness and patient outcomes associated with this particular procedure for those fractures. Various initiatives have been directed at increasing implant accessibility, selection, and utilization, including SIGN Fracture Care International Hip Construct implants, development of consensus guidelines, and publication of standardized equipment recommendations. Nonetheless, additional research in LICs and LMICs is required to generate region-specific guidelines and improved access to critical instruments and implants.[30]

4.3. Surgical Timing

The time from patient presentation to surgery was the most commonly reported aspect of surgical timing. The importance of early surgical intervention was emphasized in several studies; nonetheless, an average delay of greater than 2 weeks between presentation and definitive care was cited in 1 study. This delay was directly correlated with significantly decreased ambulation at 1 year postsurgery.[19] Prompt interventions in LICs and LMICs may be complicated by inadequate surgical resources to meet the demands of overburdened healthcare systems.[30] The resulting delay in treatment has been cited as a major risk factor of increased mortality rates in LICs and LMICs.[30]

4.4. Complications

While the average collective infection rate was estimated around 14%, with upper limits reaching 60%, the general absence of standardized or mandatory reporting in LMICs often confounds a true estimate of infection incidence.[34] Nonetheless, the cumulative results of these articles suggest that the average rates of infection for osteosynthesis were more than double the infection rates for arthroplasty (arthroplasty, 13.5% vs. osteosynthesis, 31%). There is no clear explanation for this difference, although it is possible that when surgeons are more concerned about possible infection, they may elect to proceed with osteosynthesis over arthroplasty given the difficulty of managing prosthetic joint infections. Of the 15 articles citing infection rates, less than a quarter cited prophylactic antibiotic administration. It is also possible that there is a higher rate of antibiotic usage among locations performing arthroplasty, but there are not sufficient data to compare antibiotic usage between the 2 interventions. Patient and healthcare factors unique to LMICs may necessitate alternative or multimodal infection prophylaxis protocols that deviate from the timely preoperative antibiotic administration routine in HICs.[35] Although the risk of complications increases with factors such as preexisting conditions, susceptibility before presentation, and prolonged immobilization, integrated approaches toward prevention and outcomes can yield systematic improvements for hip fracture patients.

Of the studies evaluating arthroplasty, there was an even distribution between the use of and complications associated with hemiarthroplasty versus total hip arthroplasty. A slightly higher

blood transfusion rate was reported for hemiarthroplasty compared with total hip arthroplasty (83.3% vs. 57.5%). This may be related to physicians electing to perform hemiarthroplasty in older and sicker individuals who may be more likely to require a transfusion regardless of treatment. Mortality rates were reported in most of the studies, with evaluation points ranging from 3 months to 3.7 years, with 12 months being the most frequently assessed time point. Reported mortality was similar between the osteosynthesis and arthroplasty interventions, both averaging approximately 10%. While the average mortality rate of 15% derived from the collective studies does not differ drastically from the 1-year mortality rates estimated in HICs (12%–20%), the upper mortality range is nearly 53%. This suggests that hip fracture mortalities indeed remain an important potential focus for improvement in LICs and LMICs.

4.5. Future Research Opportunities

Further contextualizing how treatments reported in LMICs differ from those standards that exist in HICs can help better understand the rationale behind treatment decisions. Studies evaluating the cost and economic implications of orthopaedic interventions in LMICs can provide insight into potential limitations influencing these treatment decisions and support efforts to advocate for additional resources. The information derived in economic analyses can provide the context for shaping future health policies and standardized interventions in LMICs.[36] This review reaffirms many of the known disparities noted in publications from LMICs; however, determining the specific conditions that contribute to disparities remains an important topic for further evaluation.

Addressing resource limitations in developing countries can expand the approaches to orthogeriatric care in lesser resourced environments beyond basic treatment modalities and promote improved postoperative outcomes and quality of life. Integrated and continuous care models such as Fracture Liaison Services have been created in HICs to address the incidence of fragility fractures; however, reports of these programs are scarce in lower resource settings. As such, comprehensive inpatient and community-based rehabilitation and secondary fracture prevention remain areas for future investigation.[37]

4.6. Limitations

Given the lack of literature on the topic, this study is limited in its ability to provide a comprehensive understanding of hip fracture care delivery across LICs and LMICs. The identified studies are from 8 of 79 low-income and lower-middle-income countries, with all but 2 studies based in countries in Asia. By design, the current search was limited to articles in English and 3 of the most commonly used databases, and there may have been an inherent selection bias, with the search missing articles written in other languages or indexed in smaller or regionally based databases or not indexed at all. Some data suggest that approximately 75% of scientific literature is published in English, and in the orthopaedic literature, this number is likely over 90%.[38,39] While there are undoubtedly studies that would have been included if not for the language of publication, it is not clear how many articles were missed in this review. To minimize the nonindexed publications, the gray literature was searched, with no additional reports identified. In addition, some of the articles compared treatments for proximal femur fractures (eg, hemiarthroplasty vs. arthroplasty) and did not focus on the overall options for management of a particular fracture type (eg, arthroplasty vs. internal fixation for a femoral neck fracture). Finally, most of these studies were hospital or clinic based and therefore only included patients who sought medical care, which is only a subset of all hip fracture patients. Future research must further evaluate both the prevalence and treatment of hip fractures in LICs and LMICs.

5. Conclusions

Overall, the findings from this systematic review further demonstrate the need and opportunity for improving hip fracture treatment and outcomes throughout developing countries. Despite LMICs accounting for a significant portion of the overall global burden of geriatric hip fractures, most research on the topic has been conducted in HICs and may not be representative of the current practice or preferred treatment in resource-limited environments. A better understanding of current hip fracture treatment protocols and outcomes in LMICs can improve the allocation of resources, as well as the overall care and outcomes for geriatric hip fractures in LMICs.

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