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TRAUMA SURGERY

What is the impact of a fast-track pathway on length of stay for adult patients with a hip fracture? A systematic review

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Abstract

Introduction In orthopaedic surgery, hip fracture patients represent one of the largest cohorts. Hip fracture is a serious injury commonly occurring in frail and elderly patients. Fast-track admission pathways aim to streamline patients through accident and emergency departments, resulting in shorter wait times and less negative patient outcomes.

Aim To examine the impact of a fast-track pathway on length of stay for adults admitted to an acute hospital with a hip fracture.

Methods CINAHL Plus with Full text (via EBSCO host), MEDLINE, Cochrane Library, and Embase database searches were carried out in January 2021, to find all relevant literature for this review, as well as through searching additional sources. Eligible studies were quantitative primary research, focusing on the use of fast-track admission pathway care versus usual care, for adults with a hip fracture. The assessment of study suitability, data extraction, and critical appraisal was carried out by two independent authors. A narrative analysis of the data was conducted, and data were meta-analysed using RevMan where possible. Quality appraisal of the included studies was undertaken using the EBL checklist.

Results Seven studies reporting data on 5723 patients were included. Length of stay, time to surgery, and mortality did not differ significantly between the fast-track care, and usual care. One study reported on delirium and found statistically significantly fewer encounters of delirium in fast-track care versus usual care. Four of the seven studies satisfied rigorous quality appraisal (> 75%) using the EBL.

Conclusion The fast-track pathway avoided unnecessary delays in emergency departments due to faster X-rays, direct admission to orthopaedic wards, and reduced delirium rates. However, results were unable to show the impact of fast-track on length of stay, time to surgery, and mortality.

Keywords Hip fracture · Fast-track · Length of stay · Mortality · Time to surgery · Delirium

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Introduction

In orthopaedic surgery, hip fracture patients represent one of the largest cohorts. A hip fracture is a serious injury and requires prompt medical and surgical care. This injury is associated with frail and elderly patients [1] and high mortality and morbidity rates [2, 3], with one-year mortality rates in Ireland at 23–25% [4]. The older population has become the fastest-growing population in recent times. Due to this, the number of hip fractures is projected to rise significantly over the coming years, posing a growing public health problem. The 2016 Census of Ireland highlights this rapid rise with an increase of 19.1% since 2011 [5]. This trend can be seen globally, with the population aged over 65 expected to double by 2060 [6, 7]. This aging population will, in turn, increase the projected incidence of hip fractures (Verma et al. 2010). Each year, approximately 1.6–2 million hip fractures occur worldwide [8], by 2050 it is estimated to increase to 4.5 million [9].

There are currently major advances being made in orthopaedics and hip fracture care, with the addition of specialised units, specialised nursing staff, improvements in analgesia, the introduction of fast-track pathways, early surgery, early ambulation, the development of orthogeriatric involvement, and international audit [10]. Studies show that long waits in the emergency room can be associated with adverse outcomes for patients, in particular for patients with hip fractures [11].

Fast-track admission pathways aim to streamline patients through the emergency room (ER), resulting in shorter wait times and less of these negative outcomes [12]. Fast-track admission pathways are used through multiple disciplines in healthcare [13, 14]. In the past two decades, orthopaedic surgery has implemented fast-track admission pathways worldwide, while the pathways differ slightly, the overarching aims remain similar. These commence pre-hospital by ambulance personnel and are completed in the hospital and include analgesia, pressure area care, intravenous (IV) access, electrocardiogram (ECG), bloods and oxygen therapy, direct transfer to X-ray and orthopaedic wards, and early surgery (NICE 2011). In Ireland and the United Kingdom (UK), hip fracture fast-track pathways are modelled on the British Orthopaedic Association's Blue Book Standard for hip fractures [15]. However, recently Ireland has moved away from the BOA standards and has developed its own standards of care called, Irish Hip Fracture Standards (IHFS) [16]. This consists of several standards for hip fracture care, incorporating fast-track care.

In the past, hip fractures were not a top priority in the emergency room. Patients waited long periods for analgesia, X-rays, and clinical assessment. Fast-track pathways accelerate admission and increase priority. Studies have shown that a reduction in the time spent in the emergency room or bypassing the emergency room altogether improves patient outcomes [17]. Prompt blood tests, X-ray and ECG allows for early recognition of conditions such as electrolyte imbalances, pre-operative anaemia and cardiac or respiratory changes. It also allows for medical optimisation to commence without delay, therefore, not effecting time to surgery. Time spent in the emergency room is further reduced as patients are reviewed by the admitting orthopaedic surgeon on the orthopaedic ward. There is vast literature reporting on fast-track care for patients in orthopaedic surgery. However, how fast-track care affects the length of stay (LOS) for suspected hip fracture patients is unclear. Importantly, LOS impacts hip fracture patients socially, physically, and financially.

Materials and methods

Design/search strategy

A systematic review (SR) of all available research was performed in accordance with the Cochrane Handbook for Systematic Reviews of Interventions [18] and guided by the Moher et al. [19] PRISMA (Preferred Reporting Items for Systematic Review and Meta-analysis) checklists. The research question was structured using the PICO framework as shown below:

- P (population): adults, 18 years and older with a hip fracture;
- I (intervention): fast-track pathway;
- C (comparison): usual care;
- O (outcome): LOS post-implementation of fast-track.

Secondary outcomes included time to surgery (TTS), mortality, and delirium.

Literature search

The following electronic databases were searched; CINAHL Plus with Full text (via EBSCO host), MEDLINE, Cochrane Library and Embase. The search terms were derived from the PICO framework, as guided by Bettany-Salticov and McSheery [20]. These searches were carried out in January 2021. The three search terms were hip fracture, fast-track and length of stay. These were searched independently and combined using boolean operators, such as 'AND' and 'OR' and the truncation operation tool (asterisk symbol (*)). Medical subject headings were used where appropriate. Studies were not limited by language, year of publication or geographical location. Further searches of the grey literature were undertaken using OpenGrey and Google Scholar. Trial registers were searched to identify any unpublished or ongoing trials (www.clinicaltrials.gov and www.who.int/trialsearch). A manual 'hand-searching' of reference lists was also carried out. Records of all searches were documented throughout the search for transparency and presented on a Prisma Flow Diagram [19] shown in Fig. 1. Moher et al. [19] PRISMA Checklist was used to guide the author in writing this review.

Study selection

Studies were excluded from the review if they did not meet the inclusion criteria. Studies were considered for inclusion if they employed a quantitative research method. All randomised control trials (RCT's), non-randomised control

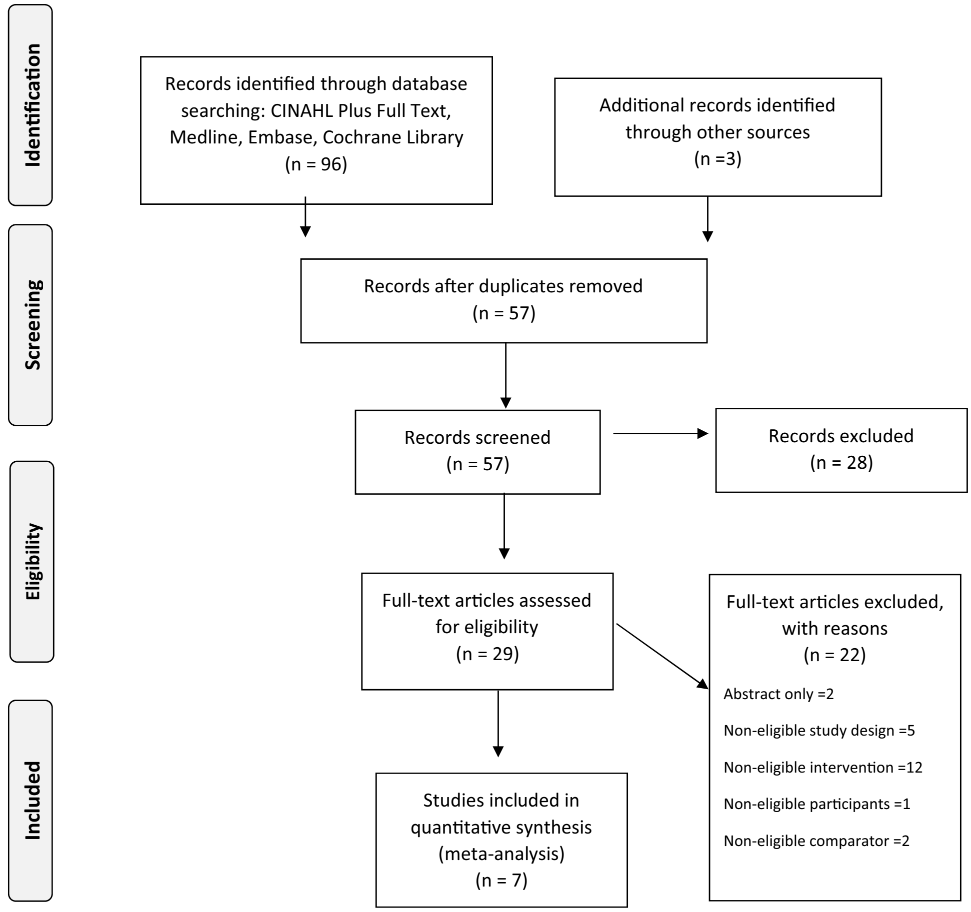

Fig. 1 Preferred Reporting Items for Systematic reviews and Meta-analyses (PRISMA) flow diagram of the identification and selection of the studies included in the systematic review

trials, original studies, observational studies, cohort studies, before and after studies, retrospective, and prospective studies. Study participants were all adult patients ≥ 18 years of age undergoing surgery for a hip fracture. Type of fractures included intracapsular and extracapsular fractures (intracapsular, which involves the femoral head and neck, and extracapsular, which includes intertrochanteric, trochanteric, and subtrochanteric fractures).

Exclusion criteria included participants under 18 years old, multiple fractures, pathological fractures, missed fractures, in-hospital fractures, periprosthetic fractures, no surgery, and critically ill patients e.g. myocardial infarction/stroke/intensive care admission. Included studies examined the use of fast-track pathways intending to streamline/bypass the emergency room. They began prehospital/on arrival and included the following investigation: prompt laboratory tests, ECG's, analgesia, and direct transfers to X-ray and specialised wards. Studies were excluded if they explored integrated-care plans (ICP's) as this study is focused on the pre-operative admission phase. Included studies examined 'usual care' as a comparator. This consisted of patients arriving at the emergency room via ambulance with a suspected hip fracture and triaged in the emergency room according to existing hospital guidelines. Studies that examined ICP's were excluded. All studies had researched the primary outcome (LOS) as either their primary or secondary outcome.

Data collection, extraction, analysis, and synthesis

Titles and abstracts of all available studies were screened for inclusion in the SR followed by obtaining relevant full-text versions. All relevant studies obtained were included. A regimented data extraction approach was established and implemented. All necessary data about study characteristics and findings from the included articles were extracted and presented on a populated data extraction table adapted from Bettany-Salticov and McSheery [20]. The data extracted included author, date of publication, country, setting, research design, participants, aims, inclusion and exclusion criteria, intervention, comparator, primary and secondary outcomes measured, analysis, results, conclusions, and EBL (Evidence-Based Librarianship) scores. As recommended best practice [21], two authors, Sarah Maher and Zena Moore independently extracted the data, this minimises the risk of bias and errors [22]. Due to the heterogeneity of the data extracted from the included studies, a complete meta-analysis was not possible, therefore, a narrative analysis of the data was conducted and some data meta-analysed using RevMan where possible. The results are presented on summary tables and in a narrative form on forest plot diagrams.

Assessment of methodological quality

Each of the included studies was appraised using a critical appraisal tool known as the EBL checklist. This tool was chosen, in discussion with a second reviewer, due to the heterogeneity of the included studies. This tool consists of a series of 26 questions, distributed under four headings (population, data collection, study design, and results). These questions aim to identify possible threats to the validity of the studies by attempting to determine applicability, appropriateness, and rigour. Each question is answered as 'yes', 'no', 'unclear' or 'non-applicable'. A study is valid if the 'yes' answers are $\geq 75\%$ or if 'no/unclear' answers $\leq 25\%$. Therefore, invalid studies will score $\leq 75\%$ 'yes' answers and $\geq 25\%$ of 'no/unclear' answers. This process was completed by two reviewers to reduce the risk of bias.

Results

Search results

Following an extensive search of the literature, 96 articles with potential for inclusion were identified. Through 'hand-searching' and searches of the 'grey' literature, three more articles were identified for inclusion. Duplicates were removed through an online reference manager, Endnote, and a thorough manual screen. Following the removal of duplicates 57 articles remained. Titles and abstracts of these 57 articles were screened, 28 articles were excluded (did not meet inclusion criteria or were secondary research). Out of the 29 remaining articles, full-text copies were obtained and assessed for suitability. The authors of two studies [23, 24] were contacted via email to request a full-text copy. There was no reply from both authors. As only the abstract of both studies was available, these studies were excluded from the review. A further 20 articles were excluded as they did not meet the inclusion criteria (excluded articles $n=22$) The main reasons for exclusion include, no comparator ($n=2$) [25, 26]; literature review ($n=1$) [27]; audit ($n=4$) [28–31]; incorrect participants ($n=1$) [32] and inappropriate intervention ($n=12$) [33–44]. Seven studies were considered suitable and included in this review. These data are presented on PRISMA flow diagram (see Fig. 1). A summary of the included studies, with their characteristics and their EBL scores, is presented in Table 1.

Study characteristics

Study design

Among the included studies three studies were retrospective [17, 45, 46], three studies were prospective [47–49] and one RCT [50]. Of the seven included studies, three were observational [45, 47, 49]. All studies were single-centre studies except for Turesson et al. [45], which took place in two different hospitals.

Geographical location

Of the seven studies included in this review, four were conducted in Sweden [17, 45, 47, 50], two in Norway [46, 49] and one in Lithuania [48]. These studies are all conducted from Northern Europe, with no studies from the rest of Europe or the world. Five studies were conducted in a University hospital [45–50], one was conducted in a county hospital [17] and one [45] study was conducted in both, university and county hospital, comparing both.

Population/sample size

The total number of participants/patients in this review was $n=5723$. The number of patients in the control groups is $n=2783$ and the number of patients in the intervention group is $n=2940$. The mean number of participants is 818 (SD: 847; min 74, max 2230). The study participants in this review were in the majority female participants, 70.3% ($n=4024$). Even though the inclusion criteria stated that participants were 18 years and older, the participants in all studies were elderly patients, with a mean age of 82 years old (to the nearest year) (see Table 2).

Intervention

The fast-track pathways in the included studies had variations in fast-track elements. The fast-track pathways are outlined in Table 3. The most frequently included fast-track elements were early interventions (analgesia, immobilisation, pressure sore prevention, IV fluids, oxygen therapy, ECG, bloods), direct transfer to the X-ray department, direct transfer to ward when fracture confirmed and orthopaedic surgeon review on an orthopaedic ward.

Outcomes measured

A summary of the outcomes in each study reviewed is illustrated in Table 4. LOS was the primary outcome for four studies [17, 45, 48, 50] secondary outcomes for three studies

Table 1 Characteristics of included studies

Author	Year	Country	Setting	Research design	Participants	Intervention	Comparator	Primary outcomes measured	Secondary outcomes measured	Results	Ebl score
Larsson and Holgers [17]	2011	Sweden	County hospital	Retrospective study	74 patients ≥ 65 years old	Prehospital, preoperative fast-track care	Usual care	Lead times and LOS	Postoperative complications	Fewer complications and shorter hospital stay	57.1%
Eriksson et al. [17]	2012	Sweden	University hospital	Prospective observational cohort study	415 adult patients with a hip[a]	The 'Ambulance Process'	Usual care: The 'Hip Process'	TTS	3-month mortality, LOS, incidence of adverse events and serious adverse events	Shorter TTS	81.8%
Turesson et al. [45]	2012	Sweden	1 University hospital and 1 County hospital	Retrospective observational cohort study	549 patients ≥ 65 years old with a hip[a]	'Pathway Group'	'Non-pathway Group'	Lead time gains and LOS	TTS	University hospital: time gain from arrival to X-ray in pathway group. County hospital: all lead times were shorter in pathway group	76.2%
Dobozins-kas et al. [48]	2015	Lithuania	University hospital	Prospective	235 patients aged > 18 years with a hip[a]	Fast-track protocol	Usual care – before Fast-track protocol	LOS and interventions performed during patient's hospitalisation periods	TTS,	Significant improvements in intervention recording were observed after fast-track. Also, significant reductions were observed in both waiting time for surgery and for LOS	72.7%

Table 1 (continued)

Author	Year	Country	Setting	Research design	Participants	Intervention	Comparator	Primary outcomes measured	Secondary outcomes measured	Results	Ebl score
Larsson et al. [50]	2016	Sweden	University hospital	Randomised Control Trial	400 adult patients with a hip[a]	Prehospital Fast-track Care	Usual care: Traditional care pathway	TTS LOS, postoperative complications, and mortality	lead times (admission to X-ray, X-ray to surgery)	Improved time to X-ray and admission to ward	90.9%
Haugan et al. [46]	2017	Norway	University hospital	Retrospective single-centre study	1820 patients aged ≥ 65 years with a hip[a]	Fast-track care	Usual care	Mortality and readmission to hospital, within 1 year follow-up	LOS	No impact on mortality or readmission rates. LOS and TTS were shorter	72.7%
Pollmann et al. [49]	2019	Norway	University hospital	Prospective observational cohort study	2230 patients ≥ 18 years, who were operated on for a hip[a]	Fast-track hip fracture care	Usual Care	Mortality	Reoperation, SSI, 30-day outcome, readmission, TTS, LOS	Mortality, SSI's, LOS and reoperations within 1 year did not differ significantly. TTS, 30-day reoperation rates and 30-day composite outcomes improved in fast-track group	94.7%

LOS length of stay, *SSI* surgical-site infection, *TTS* time to surgery

[a]Fracture

Table 2 Distribution of participants in control groups and intervention groups; gender, age and type of fracture

Characteristic	Larsson and Holgers [17]		Eriksson et al. [47]		Turesson et al. [45]		Dobozinskas et al. [48]		Larsson et al. [50]		Haugan et al. [46]		Pollmann et al. [49]	
Control/ intervention group	CG	IG	CG	IG	CG	IG	CG	IG	CG	IG	CG	IG	CG	IG
Gender														
Male	14	6	108	15	62	81	25	42	70	63	214	296	350	351
Female	30	24	227	65	162	244	72	96	135	132	574	734	740	789
Type of fracture														
NOF	n/a	n/a			n/a	n/a								
Intertrochanteric			186	40			97	94	97	110	512	646	647	645
Subtrochanteric			118	33			n/a	40	85	72	234	325	306	383
Other			31	7			n/a	4	23	13	42	61	37	42
			n/a	n/a			n/a	n/a	n/a	n/a	n/a	n/a	50	70

CG control group, *IG* intervention group, NOF neck of femur

Table 3 Elements of the fast-track pathways and the studies that included them

Author	1	2	3	4	5
Larsson and Holgers [17]	+	+ (by ambulance staff)	+ (by ambulance staff)	+	Over the phone handover from ambulance nurse to ward nurse, ambulance nurse contacts reception to order X-ray, ambulance staff deliver blood tests to lab
Eriksson et al. [47]	– *Immediately on ward	+	+	+	Four beds reserved on orthopaedic ward for fast-track
Turesson et al. [45]	+	+	+	+	Ambulance personnel contacts orthopaedic surgeon who orders X-ray and contacts the ward
Dobozinskas et al. [48]	– *Immediately after X-ray	+	–	+	Returned to A&E after X-ray for max 2 h for analgesia, IV fluids, O2, blood tests, ECG, pressure sore prevention
Larsson et al. [50]	+	+	+	+	Ambulance personnel contacts triage and ward nurse and surgeon, X-ray ordered, blood sampling on ward
Haugan et al. [46]	+	+	+	+	
Pollmann et al. [49]	+	+	+	+	

1: early interventions in ambulance; 2: direct transfer to the X-ray department; 3 direct transfer to orthopaedic ward; 4: orthopaedic surgeon review on ward; 5. other components of fast-track pathways

Table 4 Summary of the outcomes measured in each study

Outcomes	Larsson and Holgers [17]	Eriksson et al. [47]	Turesson et al. [45]	Dobozinskas et al. [48]	Larsson et al. [50]	Haugan et al. [46]	Pollmann et al. [49]
Primary outcome							
Length of stay	+	+ (*)	+	+	+	+ (*)	+ (*)
Secondary outcomes							
Time to surgery	+	+ (**)	+	+	+ (**)	+	+
Delirium/acute confusion	+						
Mortality	+	+			+ (***)	+ (***)	+ (***)

(*) LOS secondary outcome, (**) TTS primary outcome, (***) Mortality primary outcome

[46, 47, 49]. These outcomes were analysed, and the results are presented narratively, in a tabular form and using forest plots as follows.

Primary outcome

Length of stay

The primary outcome of this SR was LOS, and all seven studies in this review measured the LOS as a primary or secondary outcome. LOS was defined in Haugan et al. [46] as "the number of days between admission and discharge from the hospital". Three studies reported that a fast-track pathway has a statistically significant impact on LOS between intervention and control groups [17, 46, 48]. The remaining four studies report no statistically significant difference [45, 47, 49, 50]. According to the study authors, *p*-values ranged from 0.000–0.942.

Analysis of the data from all studies (see Table 5), except for that of Pollmann et al. [49] was undertaken using SPSS 25, entering the mean LOS for each setting. The mean LOS in the intervention group was 9 days (SD ± 2 days) and the mean LOS in the control group was 11 days (SD ± 4 days). As can be seen in Table 6 the mean difference in LOS is −1.8 days (95% CI: −5.3 to 1.7; $p = 0.288$). This indicates that although the mean LOS is shorter in the intervention group, it is not statistically significantly different from that of the control group. Pollmann et al. [51] reported that there was no statistically significant difference in LOS between the intervention group who received fast-track care and the group who received usual care (5.3 days VS 5.2 days). No *p*-value was reported in this article for LOS.

Secondary outcomes

Time to surgery

All seven studies reported on the impact of fast-track pathways on TTS. Analysis of the data from five studies (see Table 7), except for that of Larsson and Holgers [17] and Pollmann et al. [49] was undertaken using SPSS 25, entering the mean TTS for each setting. The mean TTS in the intervention group was 25 h (SD ± 8 h) and the mean TTS in the control group was 33 h (SD ± 16 h). As can be seen in Table 8 the mean difference in TTS is −8 h (95% CI: −24 to 8; $p = 0.276$). This indicates that although the mean TTS is shorter in the intervention group, it is not statistically significantly different from that of the control group.

Larsson and Holgers [17] reported that there was no statistically significant difference in TTS between the intervention group and the control group, but that both groups went to surgery within 24 h of arrival at the hospital. On the other hand, Pollmann et al. [49] reported that TTS was statistically significantly shorter in the intervention group compared to the control group with a median TTS 23.6 h in the intervention group and 25.7 h in the control group ($p < 0.0001$).

Table 6 Independent samples test for difference in mean LOS

Study group	Mean (days)	Std. deviation
Intervention	9	2
Control	11	4
Independent samples test		
Mean difference	95% CI	*P*
− 1.8	− 5.3 to 1.7	0.288

Table 5 Comparison of the mean, median and range length of stay between the intervention group and control group within each study, measured in days

Study	Population (*n*)		Mean (days)		Median (days)		Range (days)		*p*-value
	IG	CG	IG	CG	IG	CG	IG	CG	
Larsson and Holgers [17]	*n* = 30	*n* = 44	10.7	18.1	10	13.5	N/A	N/A	0.022
Eriksson et al. [47]	*n* = 80	*n* = 335	6	6	N/A	N/A	2–37	1–51	0.60
Turesson et al. [45]: (a) Lund[a] (b) Hbg[b]	(a) *n* = 104 (b) *n* = 52	(a) *n* = 172 (b) *n* = 221	(a) 10.8 (b) 10.5	(a) 11.1 (b) 10.8	N/A	N/A	(a) 2–50 (b) 1–91	(a) 3–47 (b) 3–30	(a) 0.942 (b) 0.708
Dobozinkas et al. [48]	*n* = 138	*n* = 97	10	11.5	9	11	3–23	6–43	0.02
Larsson et al. [50]	*n* = 195	*n* = 205	9.71	9.29	N/A	N/A	1–28	2–40	0.34
Haugan et al. [46]	*n* = 1032	*n* = 788	6.1	9.5	5	8	0–50	1–120	0.001

IG intervention group, *CG* control group

[a]Lund University Hospital

[b]Helsingborg County Hospital

Table 7 Comparison of the mean, median and range time to surgery between the intervention group and control group within each study, measured in hours

Study	Population (*n*)		Mean (h)		Median (h)		Range (h)	
	IG	CG	IG	CG	IG	CG	IG	CG
Eriksson et al. [47]	$n=80$	$n=335$	18	21	N/A	N/A	4–47	4–72
Turesson et al. [45] (a) Lund[a] (b) Hbg[b]	(a) $n=104$ (b) $n=52$	(a) $n=172$ (b) $n=221$	(a) 25.73 (b) 21.97	(a) 26.95 (b) 35.22	N/A	N/A	(a) 3.7–64.03 (b) 3.15–100.28	(a) 3.98–98.1 (b) 8.1–196.51
Dobozinkas et al. [48]	$n=138$	$n=97$	39	64	17	44	1–385	2–355
Larsson et al. [50]	$n=195$	$n=205$	18.9	20.76	18	20	3–53	1–65
Haugan et al. [46]	$n=1032$	$n=788$	25.2	31.2	21	25	1–236	0–289

IG intervention group, *CG* control group

[a]Lund University Hospital

[b]Helsingborg County Hospital

Table 8 Independent samples test for difference in mean TTS

Study group	Mean (h)	SD
Intervention	25	8
Control	33	16
Independent samples test		
Mean difference	95% CI	*P*
−8	−24 to 8	0.276

Delirium

One study reported delirium as an outcome of the impact of a fast-track pathway on the care of a patient following a hip fracture. Larsson and Holgers [17] conducted a retrospective study comparing an intervention group (fast-track pathway) to a control group (usual care) and found that there were statistically significantly fewer encounters of delirium for patients in the fast-track group (1 patient diagnosed with delirium) when compared to usual care (16 patients diagnosed with delirium), where $p=0.012$.

Mortality

The impact of fast-track pathways on mortality rates was measured in three studies [46, 49, 50] Larsson et al. [50] reported that there was no significant difference in mortality rates between the two groups in relation to in-hospital mortality and mortality after four months. The intervention group reported a 5% mortality rate for in-hospital mortality and the control group reported a 3% mortality rate, ($p=0.35$). In addition, the mortality rate at four months for the intervention group was 18% and 15% in the control group, ($p=0.58$).

Haugan et al. [46] and Pollmann et al. [49] reported mortality rates at 30 days, 90 days, and 1 year. Due to the homogeneity of these studies a meta-analysis was completed using RevMan. The odds ratio of mortality within the study groups, at 30 days was determined. In the fast-track (FT) group, there was a 7% mortality (151/2172), whereas there was an 8% mortality (149/1828) in the usual care (UC) group. The odds ratio of mortality is 0.86 (95% CI: 0.68–1.09; $p=0.22$) (see Fig. 2). This suggests that there is a 14% reduction in the odds of mortality in the FT group; however, this is not statistically significant. Data were also meta-analysed using RevMan to determine the odds ratio of mortality within the study groups, at 90 days. In the FT

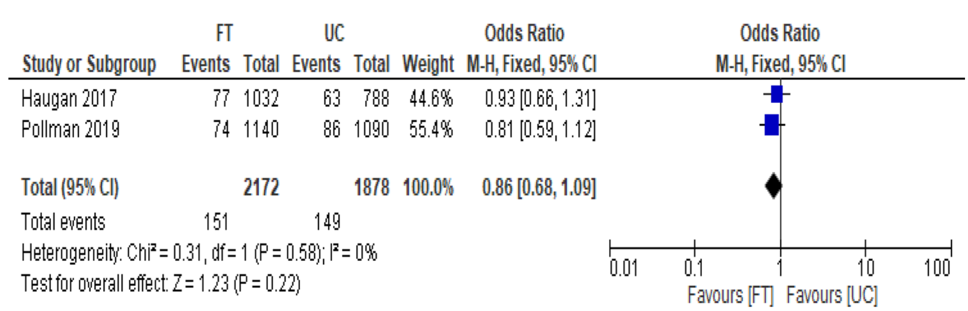

Fig. 2 Forest plot comparing mortality at 30 days after usual care and fast-track care. *FT* fast-track, *UC* usual care

group, there was a 13% mortality (280/2172), whereas there was a 14% mortality (262/1828) in the UC group. The odds ratio of mortality is 0.91 (95% CI: 0.76–1.09; $p=0.30$) (see Fig. 3). This suggests that there is a 9% reduction in the odds of mortality in the FT group, however, this is not statistically significant. Finally, data were meta-analysed using RevMan to determine the odds ratio of mortality within the study groups, at 365 days. In the FT group, there was a 24% mortality (519/2172), whereas there was a 25% mortality (462/1828) in the UC group. The odds ratio of mortality is 0.95 (95% CI: 0.83–1.10; $p=0.51$) (see Fig. 4). This suggests that there is a 5% reduction in the odds of mortality in the FT group, however, this is not statistically significant.

Methodological quality of included studies

Quality appraisal was conducted by two reviewers to minimise the risk of bias. "Bias is a systematic error or deviation from the truth" [52], it can compromise the validity of a SR. Bias can occur from poor database searching, but also from the quality of primary data available from the included studies. Validity is defined as the degree to which a scale measures what it is intended to measure [53], and this was determined using the EBL critical appraisal tool.

The validity scores in the seven studies ranged from 57.1% to 94.7%, with a mean score was 78% (SD: 12.6%). Four studies were deemed valid as they met the validity score of 75% or above [45, 47, 49, 50]. The following studies were deemed not valid [17, 46, 48]. Larsson and Holgers [17], scored and overall validity score of 57.1%. This was due to the small sample size of 74 participants, (control group (CG) = 44 and intervention group (IG) = 30). In addition, the inclusion and exclusion criteria for this study would have to be revised to achieve external validity and reduce the chance of population bias. Larsson and Holgers [17] excluded patients in wheelchairs/ on Warfarin. This study was undertaken over two different time periods; therefore, randomisation of participants did not occur (CG 2004–2005, IG 2006–2007). It is also unclear if informed consent was obtained in this study.

Dobozinskas et al. [48], scored 72.7% on the EBL. The participants were not randomised into two groups, the study consisted of 235 patients with hip fractures prospectively investigated during two different time periods, (CG: 01/01/09 to 30/06/10 and IG: 01/06/11 to 31/05/12). Furthermore, one the data collection methods are not clearly outlined. Haugan et al. [46] also scored 72.7% on the EBL. The researchers were unable to randomise their participants, this is due to the retrospective design and that both care models could not run simultaneously. However, the researchers ensured that there were no differences in patient baseline characteristics between the groups, to justify comparisons over the two time periods.

Discussion

A comprehensive search of the databases resulted in seven studies for inclusion, these studies were of varied methodologies and all explored LOS as a primary or secondary outcome. These seven studies explored the effects of fast-track

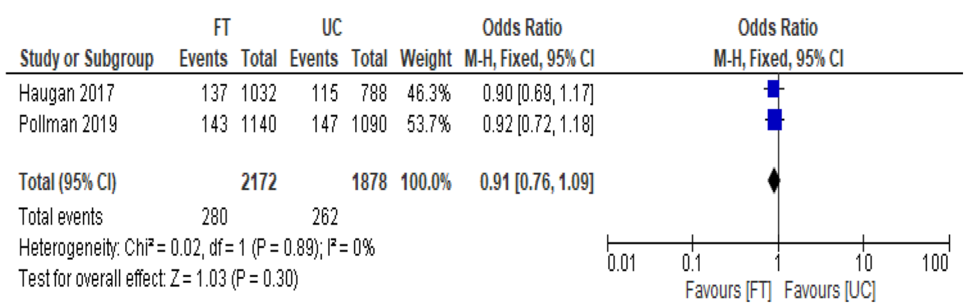

Fig. 3 Forest plot comparing mortality at 90 days after usual care a d fast-track care. *FT* fast-track, *UC* usual care

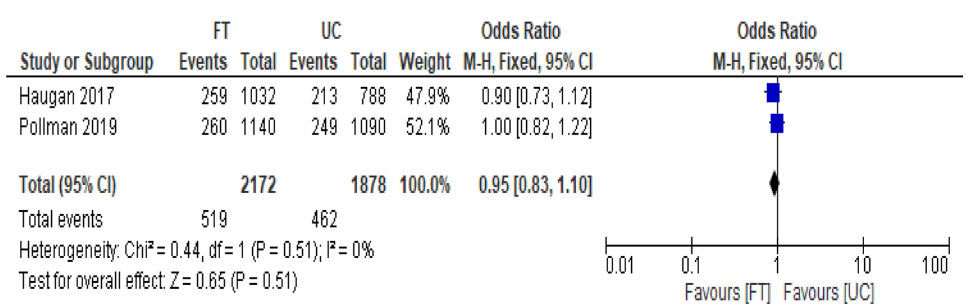

Fig. 4 Forest plot comparing mortality at 365 days after usual care and fast-track care. *FT* fast-track, *UC* usual care

versus usual care on adult patients with hip fractures. LOS was shorter in the fast-track group but was not statistically significantly different. These findings support previous findings of individual studies where fast-track did not impact on LOS in hip fracture patients [45, 47, 49, 50].

The reasons for these conflicting results may be due to how authors define LOS. Studies such as Gomez et al. [40], which was excluded from this review consider LOS as the time spent in orthopaedic wards, some describe it as time in post-op care units or acute rehab units. This can artificially inflate or deflate LOS. This review only concerned itself with studies measuring LOS as the time from admission to discharge, however, it did not discuss the discharge location. Reasons for increased LOS are multifactorial, they can depend on comorbidity burdens [54], some patients may be fit for discharge but may spend further days in the hospital due to shortages in bed availability in nursing homes. Other reasons include delays in installing home care packages, occupational therapist assessments, and the availability of physiotherapists. Pre-operative mobility status also has significant effects on LOS [55].

Secondary outcomes of this review explored the impact fast-track had, if any, on TTS, mortality, and delirium. This review found that fast-track pathways did not produce statistically significant impacts on TTS for patients with hip fractures when compared to patients who received usual care. This was in line with current literature except that of Pollmann et al. [49], who found it had a statistically significant difference. While there was no statistically significant impact on TTS, there is an abundance of literature that discusses the benefits of early surgery for this patient group. Of the included studies, most patients went to the operating room within the recommended time.

Early surgery as a definition changes from country to country. In Ireland and the UK, NICE [56] and BOA [57], define 'early surgery' as 48-h after presenting to the hospital, whereas northern Europe, USA and Canada consider 24-h as 'early surgery' [11]. These recommendations for early surgery are still discussed controversially [58, 59], some researchers believe it does not allow enough time to adequately optimise patients medically before surgery, resulting in an increased risk of post-operative complications such as venous thromboembolism and infections [60]. However, there are situations where delays to surgery cannot be avoided. This is when patients need to be optimised due to poor health status or due to anticoagulation therapies. A limitation of this review is that all included studies excluded patients on anticoagulation therapy or patients needing optimisation in critical care facilities. Other reasons for delays can be due to hospital personnel, availability of theatres, or due to the weekend or holiday admissions. Cha et al. [61], states that hospital factors are accountable for 75% of surgical delays.

This SR also found that fast-track did not impact mortality rates for hip fracture patients at 30-days, 90-days and one year. Factors affecting mortality rates are multifactorial and fast-track pathways alone cannot determine the outcome. An SR by Klestil et al. [62], found that early surgery for hip fracture patients reduced mortality rates. Cognitive status, co-morbidities, pre-fracture residence, pre-fracture mobility, and post-discharge destination also have an impact on mortality rates. However, there are studies that incorporate the fast-track admission in their multidisciplinary pathways or ICP's, that have shown to reduce the rates of mortality for this patient group [34]. RCT's are needed to confirm the results and elucidate the elements of the program that have the greatest effect on mortality.

The final outcome of this SR found that the fast-track pathway did have an impact on the development delirium in hip fracture patients. The American Psychiatric Association defines delirium as; "A disturbance of consciousness, alteration, cognition, and perception which develops over a short period of time (usually hours to days) and tends to fluctuate during the course of the day" [63]. Delirium frequently occurs in elderly orthopaedic patients, and this can be associated with severe adverse health outcomes and an increased LOS in acute hospitals [64]. Delirium is three times more prevalent in orthopaedic, than non-orthopaedic surgeries [65], and is the most common postoperative complication following hip surgery [66]. A limitation of the finding from the current review is that only one study reported on delirium as an outcome of fast-track care. The study by Larsson and Holgers [17], was impeded by its small study size and a retrospective design, thus, further studies are needed in this area. The differences in delirium may be attributed to the shorter chain of care and patients having fewer encounters with fewer healthcare workers, resulting in patients feeling more secure and this may likely reduce the risk of delirium. Emergency rooms can be very busy environments, they are loud and bright, which can be mentally stressful for elderly patients. These frail patients also benefit from direct admission to the specialised orthopaedic wards where they will encounter fewer sleep disturbances.

This SR did not find that fast-track care had any statistically significant effect on the most outcomes, however, included studies did discuss the humanitarian benefits of fast-track care. Fast-track care allows for direct transfer to orthopaedic wards and these benefits patients as it decreases the time spent in the disorientating environment of the emergency room, reduces the amount of time spent on uncomfortable trolleys resulting in less chance of pressure sores or confusion. It also increases patient satisfaction; with studies showing that healthcare workers found that patients and their relatives were more satisfied and made fewer complaints than those receiving usual care [67]. It also benefits staff as it reduces the workload in busy A&E's, which can lead to better continuity of care [17].

This SR has its limitations. The use of the EBL checklist highlighted that some of the studies were substandard which means that the confidence in the findings is limited. Three studies were 'invalid' as they scored below the 75% [17, 46, 48] and one other study [45] was graded as 'valid', however, they were just above the 75% threshold at 76.2%. Reasons for this included small sample sizes, strict inclusion criteria, and due to the lack of randomisation. This SR only reported on one RCT, the remaining six studies were retrospective, prospective, and observational. As confounding's could not be eliminated, these results must be interpreted with caution. To overcome these limitations more RCT's on this topic is needed in the future. Further studies should include multidisciplinary team integrated care programs.

Conclusion

This SR aimed to examine the effects of fast-track care on LOS for adult hip fracture patients. Its results were inefficient in showing the impact of the fast-track admission pathway on LOS, TTS, and mortality. Reductions in delirium were noted for patients following fast-track care, however, further studies are needed in this area. These outcomes may be affected by other hospital factors. Fast-track pathways can be recommended as an addition to hip fracture care in acute hospitals howbeit, the consensus drawn from this SR is that further research on this topic is needed in the form of RCT's incorporating post-op complications, pre- and post-fracture mobility, morbidity, and discharge destination.

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Declarations

Conflict of interest The authors of this review declare no conflicts of interest in this research.

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Informed consent This study is a systematic review. Not required informed consent.

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