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Review article

The use of skin traction in the adult patients with proximal femur fracture. What are the effects, advantages and disadvantages? A scoping review

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ABSTRACT

Background: Hip surgery is normally the chosen therapy for proximal femur fractures. Surgery within 24–48 h after hip fracture is recommended, but surgery may not always be performed promptly. Consequently, skin-traction is applied to reduce complications. The purpose of this review is to assess both advantages and disadvantages of skin traction.

Methods: A scoping review was conducted. The research question was: which are the effects of skin traction, its advantages and disadvantages in adult patients with proximal femur fractures hospitalised in orthopaedic wards? The search was done in the databases PubMed, CINAHL, Cochrane, Embase, DOAJ, ClinicalTrials.gov and OpenDissertation.

Results: 9 records were included, skin traction effects were summarised in 7 categories: pain, pressure sores, comfort and relaxation, thromboembolism, damage from adhesive, complications and quality of care. The possible advantage is pain reduction between 24 and 60 h, the possible disadvantage is skin damage.

Discussion and conclusion: The routine use of skin traction does not appear recommended, but more consistent evidence is necessary to make clinic decisions. Future RCTs could focus on the effects of skin traction 24–60 h after hospitalisation and before surgery.

1. Introduction

The expression "hip fracture" defines any proximal femur fracture extending from the femur neck to the femur proximal shaft (Li et al., 2020).

Hip fractures primarily affect the elderly, most aged from 70 to 75 and above. Hip fractures are associated to high mortality and morbidity rates, which makes hip fractures public health issues (Li et al., 2020; Piscitelli et al., 2020; Tosun et al., 2018).

In the year 2000 the proximal hip fracture rate was 1,6 million worldwide and, considering the rise in life expectancy as well as the growing number of elderly people worldwide, hip fracture rates are likely to reach 6,3 million by 2050 (Cooper et al., 2011; Sheikh et al., 2017).

Proximal hip fractures fall in two groups based on fracture position to hip articular capsule. A fracture above the hip joint capsule insertion is intracapsular and a fracture under the articular capsule insertion is extracapsular (Li et al., 2020).

Most patients with hip fracture undergo surgery since the advantages outnumber the potential risks connected with non-surgical treatment and prolonged immobilization (Li et al., 2020).

Despite some studies show no connection between the days before hip surgery and mortality rates at 30 days and 12 months (Forni et al., 2019; Morri et al., 2019; Smektala et al., 2008), in order to avoid complications such as pressure sores, deep vein thrombosis, pulmonary embolism and surgery complications, several associations recommend hip surgery within 24–48 h after hip fracture (AO Foundation: Transforming Surgery–Changing Lives, 2010; Meehan et al., 2019; NICE, 2011; Saul et al., 2019; Società Italiana di Ortopedia e Traumatologia, 2017). Furthermore, the guidelines recommend early identification and correction of comorbidities such as anaemia, anticoagulation, volume depletion, electrolyte imbalance, uncontrolled diabetes, correctable

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cardiac arrhythmia or ischaemia, acute chest infection and exacerbation of chronic chest conditions so as not to delay surgery (NICE, 2011).

Different studies confirm that delays in hip surgery increase the risk of complications in 30 and 90 days mortality rates (Nyholm et al., 2015; Rosso et al., 2016; Ryan et al., 2015), even though hip surgery may not always be promptly performed due to organization issues or the need to stabilize patients or patients' underlying health conditions (Endo et al., 2013; Tosun et al., 2018).

In order to reduce/control hip movement, ease patients' pain improving their comfort, help reduce the fracture as well as to avoid complications such as muscle spasms and oedema, a skin traction is normally employed in pre-surgery (Biz et al., 2019; Duperouzel et al., 2018; Yip et al., 2002). The orthopaedic nurse plays a key role in assisting patients with a skin traction to ensure patients' comfort and early detection of possible complications (Biz et al., 2019). The skin traction is usually applied to intracapsular fractures, yet its application is also reported in extracapsular fractures (Biz et al., 2019).

Skin traction kits have adhesive or non-adhesive materials made of two skin tapes attached to a padded spreader plate. A rope attached to weights is linked to the plate (Duperouzel et al., 2018).

Skin traction positive effects and complications have not been proven yet: in a Cochrane systematic review, Handoll et al. (2011) found scarce and methodologically incomplete literature. Two recent reviews focus on pain, but they only include trials (RCT) and detect poor quality literature (Kobayashi et al., 2021; Sammut et al., 2021). Even though systematic reviews are the best evidence (Polit and Beck Tatano, 2018), including only RCTs and excluding grey literature may have caused the loss of useful data from observational studies and/or from other study design.

For these reasons it was decided to undertake a scoping review (Arksey and O'Malley, 2005; Peters et al., 2015; Peters et al., 2020a; 2020b; Pollock et al., 2021), in order to be able to map all the available literature, including all study designs and grey literature, in order to have a clearer and more precise vision of the "skin traction" technique and a guide for future research.

Given the results of previously published reviews, which do not provide firm evidence, the scoping review has the advantage of identifying all types of evidence available in a given field, identifying and analysing knowledge gaps, and examining how research is conducted on a certain topic or field (Peters et al., 2020a; 2020b).

The purpose of this scoping review is to assess skin traction effects, not only as far as pain, but also as to its advantages and/or complications.

2. Methods

2.1. Design

A scoping review was conducted (Arksey and O'Malley, 2005; Peters et al., 2015; Peters et al., 2020a; 2020b; Pollock et al., 2021).

The scoping method was deemed suitable for explorative research in a field where available evidence is scarce and RCT quality is poor (Handoll et al., 2011; Sammut et al., 2021) in order to find evidence of the application of skin traction to adult patients with proximal femur fracture.

The research question was made using keywords such as "Population, Concept and Context" (PCC mnemonic) (Peters et al., 2020a; 2020b; Pollock et al., 2021) and was the following: "Which are the effects of skin traction, its advantages and disadvantages in adult patients with proximal femur fractures hospitalised in orthopaedic wards?"

2.2. Eligibility and exclusion criteria

The inclusion and exclusion criteria of review sources are presented in Table 1.

A ten-year time range was set, considering that a systematic review on the same topic had been carried out in 2011 (Handoll et al., 2011) which meant older studies had already been analysed.

Table 1
Eligibility and exclusion criteria of sources.

Eligibility criteria	Exclusion criteria
Adult patients with femur fracture treated with skin traction	Experts' opinion
Sources on the effects of skin traction on patients	Military context
Qualitative and quantitative research articles, mixed-methods, reviews and grey literature sources	
Presence of full text	

2.3. Information sources

The bibliographical research was carried out in the following online databases and registers: PubMed, CINAHL, Cochrane, Embase, DOAJ, ClinicalTrials.gov and OpenDissertation. Moreover, direct research was carried out in orthopaedic Open Access journals (OA) not indexed in the databases used. In order to find further grey literature sources, internet sites as well as official journals of orthopaedic and traumatology associations were analysed, among them "Associazione Italiana Infermieri Sala Gessi" (AIISG), AO foundations and "Società Italiana di Ortopedia e Traumatologia" (SIOT).

Research of sources ended on December 15, 2021.

2.4. Search

The search question was formulated using the elements of PCC mnemonic (Peters et al., 2020a; 2020b; Pollock et al., 2021) and the keywords were obtained from them (Table 2).

Specific keywords were not used for "context" to avoid excluding articles of interest; in the screening of the results the context where the studies had been carried out was taken into consideration.

The search strategy used in PubMed can be found in Table 3 and strategies used in the other databases derive from it. Grey literature search in scientific societies' sites as well as in OA literature was carried out through free search of single keywords.

2.5. Selection of sources of evidence

Records obtained were filed in Mendeley (a reference manager and academic social network) (Mendeley, 2022) to eliminate duplicate documents.

Once duplicates were erased, a first assessment of records was carried out to improve search strategy, it was then integrated with new keywords connected to the articles found. The final search strategy is presented in Table 3. All strategies were analysed by an expert

Table 2
PCC and keywords.

Population	Concept	Context
Adult patient with femur fracture	Skin traction effects	Orthopaedics
hip fracture OR femur fracture OR proximal femur fracture OR femur neck fracture OR femur head fracture OR pertrochanteric fracture OR pertrochanteric femur fracture OR intertrochanteric fracture OR intertrochanteric femur fracture OR transtrochanteric fracture OR transtrochanteric femur fracture OR transtrochanteric femur fracture	Skin traction	

Table 3
Search strategy for PubMed.

PubMed	**(hip fractur* OR femor* fractur* OR femur* fractur* OR proximal femor* fractur* OR proximal femur* fractur* OR femor* neck fractur* OR femur* neck fractur* OR femor* head fractur* OR femur* head fractur* OR pertrochanteric* fractur* OR per-trochanteric* fractur* OR pertrochanteric* femor* fractur* OR pertrochanteric* femur* fractur* OR per-trochanteric* femor* fractur* OR per-trochanteric* femur* fractur* OR intertrochanteric* fractur* OR intertrochanteric* femor* fractur* OR intertrochanteric* femur* fractur* OR inter-trochanteric* fractur* OR inter- trochanteric* femor* fractur* OR inter-trochanteric* femur* fractur* OR transtrochanteric* fractur* OR transtrochanteric* femor* fractur* OR transtrochanteric* femur* fractur* OR trans-trochanteric* fractur* OR trans- trochanteric* femor* fractur* OR trans-trochanteric* femur* fractur*) AND (skin traction) Filters: in the last 10 years** ((((“hip"[MeSH Terms] OR “hip"[All Fields]) AND “fractur*"[All Fields]) OR (“femor*"[All Fields] AND “fractur*"[All Fields]) OR (“femur*"[All Fields] AND “fractur*"[All Fields]) OR ((“proximal"[All Fields] OR “proximalization"[All Fields] OR “proximalize"[All Fields] OR “proximalized"[All Fields] OR “proximalizes"[All Fields] OR “proximalizing"[All Fields] OR “proximally"[All Fields] OR “proximals"[All Fields]) AND “femor*"[All Fields] AND “fractur*"[All Fields]) OR ((“proximal"[All Fields] OR “proximalization"[All Fields] OR “proximalize"[All Fields] OR “proximalized"[All Fields] OR “proximalizes"[All Fields] OR “proximalizing"[All Fields] OR “proximally"[All Fields] OR “proximals"[All Fields]) AND “femur*"[All Fields] AND “fractur*"[All Fields]) OR (“femor*"[All Fields] AND (“neck"[MeSH Terms] OR “neck"[All Fields]) AND “fractur*"[All Fields]) OR (“femur*"[All Fields] AND (“neck"[MeSH Terms] OR “neck"[All Fields]) AND “fractur*"[All Fields]) OR (“femor*"[All Fields] AND (“head"[MeSH Terms] OR “head"[All Fields]) AND “fractur*"[All Fields]) OR (“femur*"[All Fields] AND (“head"[MeSH Terms] OR “head"[All Fields]) AND “fractur*"[All Fields]) OR (“pertrochanteric*"[All Fields] AND “fractur*"[All Fields]) OR ((“potchefstroom electron law j"[Journal] OR “pediatr endocrinol rev"[Journal] OR “per"[All Fields]) AND “trochanteric*"[All Fields] AND “fractur*"[All Fields]) OR (“pertrochanteric*"[All Fields] AND “femor*"[All Fields] AND “fractur*"[All Fields]) OR (“pertrochanteric*"[All Fields] AND “femur*"[All Fields] AND “fractur*"[All Fields]) OR (“per trochanteric*"[All Fields] AND “femor*"[All Fields] AND “fractur*"[All Fields]) OR (“per trochanteric*"[All Fields] AND “femur*"[All Fields] AND “fractur*"[All Fields]) OR (“intertrochanteric*"[All Fields] AND “fractur*"[All Fields]) OR (“intertrochanteric*"[All Fields] AND “femor*"[All Fields] AND “fractur*"[All Fields]) OR (“intertrochanteric*"[All Fields] AND “femur*"[All Fields] AND “fractur*"[All Fields]) OR (“inter trochanteric*"[All Fields] AND “fractur*"[All Fields]) OR (“inter"[All Fields] AND “trochanteric*"[All Fields] AND “femor*"[All Fields] AND “fractur*"[All Fields]) OR (“inter trochanteric*"[All Fields] AND “femur*"[All Fields] AND “fractur*"[All Fields]) OR (“transtrochanteric*"[All Fields] AND “fractur*"[All Fields]) OR (“transtrochanteric*"[All Fields] AND “femor*"[All Fields] AND “fractur*"[All Fields]) OR (“transtrochanteric*"[All Fields] AND “femur*"[All Fields] AND “fractur*"[All Fields]) OR (“trans trochanteric*"[All Fields] AND “fractur*"[All Fields]) OR (“trans"[All Fields] AND “trochanteric*"[All Fields] AND “femor*"[All Fields] AND “fractur*"[All Fields]) OR (“trans trochanteric*"[All Fields] AND “femur*"[All Fields] AND “fractur*"[All Fields])) AND ((“skin"[MeSH Terms] OR “skin"[All Fields]) AND (“traction"[MeSH Terms] OR “traction"[All Fields] OR “tractions"[All Fields] OR “tractional"[All Fields]))) AND (y_10[Filter])

documentalist.

Next, both title and abstract of the first 30 records were read independently by two blinded researchers (Peters et al., 2015, 2020a, 2020b). In case relevance was not clear after reading both title and abstract, the full-text was analysed. After the blinded analysis of the initial 30 records, a first assessment was carried out and analysis was continued after ascertaining researchers agreed.

Following to the analysis of both title and abstract, the researchers analysed the full-text of articles independently to check whether they had useful data as to the assessment of skin traction effects. In case article relevance was not clear, the supervision of a third researcher was requested.

2.6. Data charting

The data obtained was filled in the table as per “data charting” (Arksey and O’Malley, 2005; Peters et al., 2020a; 2020b; Pollock et al., 2021) using the following titles: (i) Authors, (ii) title, (iii) year of publication, (iv) journal/source, (v) country, (vi) design, (vii) number of patients enrolled/articles included (viii) concept and (xv) results. All variables to extract were defined while writing the protocol, “population” and “context” were not inserted as previously included in the eligibility criteria.

Two groups of researchers independently read the full-text and filled the data in the tables, the tables were then compared and analysed by the other members of the research group to obtain the final table.

2.7. Synthesis of results

The studies were grouped according to the effects analysed and the advantages and disadvantages of skin traction were highlighted. Above studies were also analysed according to study design and geographical origin.

Regarding the reviews included in our research, the studies included by the reviews were checked and compared with our results in order to identify any data loss.

3. Results

167 studies were regarding skin traction found, 112 of them were in the following databases: PubMed, CINAHL, Cochrane, Embase, DOAJ, and OpenDissertation; 55 studies were in Cochrane CENTRAL records and clinicaltrials.gov. 51 articles were discarded as duplicated records, 116 articles were screened and 70 were excluded by reading title and abstract because they were not relevant to the research question, because they concerned surgery or involved fractures other than those of the hip. After that, 46 articles were sought for retrival and 4 were not retrived, so the reports which could be included were 42. Following the full-text analysis 2 records were discarded as they regarded the paediatric field, 5 did not mention skin traction as described by Duperouzel et al. (2018), 26 were not about the outcomes of skin traction.

At the end of the screening 9 records were included.

The website research of medical associations produced no results, whereas 470 articles were found directly searching OA journals not indexed in the databases used. After reading title and abstract, the full-texts of 3 articles were examined, but none was considered suitable for review.

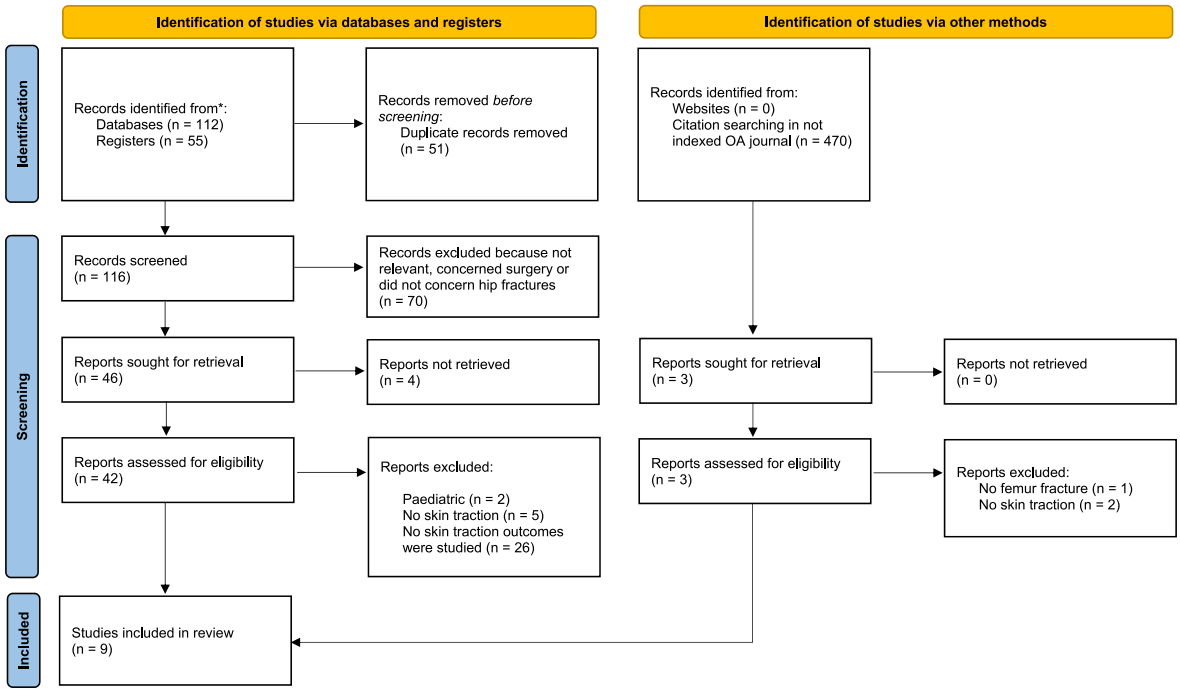
The PRISMA flow diagram (Page et al., 2021) is in Table 4.

The defining features of the 9 studies included were charted and are in Table 5. 3 RCTs were found (Hussain et al., 2015; Manafi Rasi et al., 2015; Tosun et al., 2018), 3 studies were observational, one was prospective (Adib Hajbaghery and Moradi, 2013), one cross-sectional (Biz et al., 2019) and one retrospective (Kobayashi et al., 2020). 1 study was a case reports (Tafti et al., 2013), 2 were systematic reviews (Kobayashi et al., 2021; Sammut et al., 2021). Even if the purpose of the scoping method is to map all the available evidence and not the evaluation of its quality (Arksey and O’Malley, 2005; Peters et al., 2020a; 2020b; Pollock et al., 2021), we still did the critical analysis of the articles included with the CASP checklists (Critical Appraisal Skills Programme, 2022). After filling in the checklists all articles showed substantially valid results relevant to the specific purpose.

As to the geographical origin of the studies, three were carried out in Iran (Adib Hajbaghery and Moradi, 2013; Manafi Rasi et al., 2015; Tafti et al., 2013), one in Italy (Biz et al., 2019), two in Japan (Kobayashi et al., 2020, 2021), one in Malta (Sammut et al., 2021), one in Turkey (Tosun et al., 2018) and one in Pakistan (Hussain et al., 2015).

As far as the effects of the skin traction, considering the nine studies included in the review, seven different categories were formed as per Fig. 1.

Table 4
PRISMA flow diagram (Page et al., 2021).



3.1. Pain

Pain was examined in seven studies (Biz et al., 2019; Hussain et al., 2015; Kobayashi et al., 2020, 2021; Manafi Rasi et al., 2015; Sammut et al., 2021; Tosun et al., 2018).

Biz et al. (2019) and Hussain et al. (2015) do not report any difference in pre-operative pain between patients with skin traction and patients without skin traction. In their study also Sammut et al. (2021) state there is no difference in pre-surgery pain between patients with or without skin traction.

In order to assess pain in the 24 h after hospitalisation, a review shows improvement of pain symptoms within the first hour, even though no differences are reported in the following hours (Kobayashi et al., 2021). Instead, between 24 and 60 h from hospitalisation, patients with skin traction report a relevant decrease of pain (Kobayashi et al., 2020; Manafi Rasi et al., 2015). The Verbal Rating Scale (VRS) value for patients with skin traction vs. patients without skin traction found by Kobayashi et al. (2020) at 24 h, 36 h, 48 h and 60 h was 0.4 ± 0.8 vs. 1.1 ± 1.0, $p < 0.05$; 0.2 ± 0.5 vs. 0.9 ± 0.9, $p < 0.05$; 0.2 ± 0.4 vs. 0.8 ± 0.9, $p < 0.05$; 0.2 ± 0.4 vs. 0.9 ± 0.9, $p < 0.05$. The mean of pain score measured by Visual Analogic Scale (VAS) in the study conducted by Manafy Manafi Rasi et al. (2015) was 2.7 ± 0.8 for the patients with skin traction and 3.3 ± 0.9 for the patients without skin traction ($P = 0.042$) after 24 h from the traction application.

The study by Tosun et al. (2018) shows splints ease pre-operative pain better than skin traction.

In the articles analysed, the main pain assessment scales used were: Numerical Rating Scale (NRS) both for patients with and without skin traction (Biz et al., 2019). VRS was used by Kobayashi et al. (2020), also VAS was used (Hussain et al., 2015; Kobayashi et al., 2021; Manafi Rasi et al., 2015; Sammut et al., 2021; Tosun et al., 2018).

These articles show not only the use of skin traction but also other methods such as position splint (Tosun et al., 2018), pillow (Biz et al., 2019), skeletal traction (Biz et al., 2019; Kobayashi et al., 2021), nerve blockade (Kobayashi et al., 2021), femoral condyle traction and tibial traction (in subtrochanteric fractures) (Biz et al., 2019). The regular use of analgesics is mentioned in one article only (Tosun et al., 2018). Kobayashi et al. (2020) observed that within 24 h from hospitalisation both patients with and without skin traction requested analgesics, while after 24 h patients with skin traction reported less pain than patients without. The use of analgesics to ease pain is not mentioned in the other articles.

3.2. Pressure sores

Five records analyse pressure sores. Biz et al. (2019) report nurses' difficulty in preventing pressure sores in patients with skin traction, and Tosun et al. (2018) report more pressure sore cases in patients with skin traction than in the control group. Kobayashi et al. (2020) do not report any difference in pressure sores onset in skin traction patients compared to the control group. Even though the review conducted by Sammut et al. (2021) focuses on pain, it reports an increase in the risk of complications such as pressure sores in patients with skin traction. In the articles analysed there are no further specifications as to factors causing pressure sores onset connected with skin traction.

3.3. Comfort and relaxation

Comfort and relaxation are analysed in three articles (Manafi Rasi et al., 2015; Tosun et al., 2018). Skin traction seems to favour comfort and relaxation in Manafi Rasi et al. (2015), whereas in Tosun et al. (2018) comfort is higher in the control group.

3.4. Thromboembolism

Thromboembolism is described in Biz et al. (2019), Kobayashi et al. (2020) and Sammut et al. (2021): in two cases skin traction is associated with the risk of thromboembolism (Biz et al., 2019; Sammut et al., 2021), whereas in the third case no differences were reported between patients with skin traction and the control group (Kobayashi et al., 2020). In the articles mentioned no connection between the daily anticoagulant prescribed and the thromboembolic risk is mentioned.

Table 5
Data charting.

Authors	Title	Year	Journal/Source	Country	Study design	Number of patients enrolled/ articles included	Concept	Results
Adib Hajbaghery M, Moradi T	Quality of care for patients with traction in Shahid Beheshti hospital in 2012.	2013	Archives of Trauma Research	Iran	Prospective observational study	100 patients	Assessment of assistance to patients with skin traction and skeletal traction.	Quality of assistance to patients with skin traction is generally medium-low; quality of assistance to patients with skeletal traction is higher.
Biz C, Fantoni I, Crepaldi N, Zonta F, Buffon L, Corradin M, Lissandron A, Ruggieri P.	Clinical practice and nursing management of pre-operative skin or skeletal traction for hip fractures in elderly patients: a cross-sectional three-institution study.	2019	International Journal of Orthopaedic and Trauma Nursing	Italy	cross-sectional descriptive	136 surveys	Assessment of traction use (skeletal or skin traction) occurrences in hip fracture patients in three Italian hospitals. Assessment of patients' perception of care quality.	Pain levels are comparable in patients with and without skin traction. Traction may render assistance more complex. Patient's care and hygiene are better performed without skin traction. Skin traction use may cause unnecessary complications such as pressure sores, discomfort, movement limitations and thromboembolism to vulnerable patients.
Hussain Z, Raza S, Momin A, Ali, N.	Comparison of mean pain score by treatment with and without skin traction to patients with hip fracture	2015	Pakistan Journal of Medical and Health Sciences	Pakistan	RCT	100 patients	Pain assessment in patients treated with and without skin traction in preoperative periods.	There are no differences in pain reduction in the two groups.
Kobayashi T, Ureshino H, Morimoto T, Sonohata M, Mawatari M. Pain	Pain relief differentiated according to preoperative skin traction time in hip fractures: a systematic review and meta-analysis.	2021	International Journal of Orthopaedic and Trauma Nursing	Japan	Review with meta-analysis	5 articles full-text	Preoperative pain assessment in the 24 h after hospitalisation in patients with skin traction compared to patients without skin traction	Pain is lower the first hour after hospitalisation, there are no differences the following hours.
Kobayashi T, Lefor AK, Hotta K, Morimoto T, Sonohata M, Mawatari M.	Pain relief after over 24 h of preoperative skin traction in patients with intertrochanteric fractures: A retrospective comparative cohort study.	2020	International Journal of Orthopaedic and Trauma Nursing	Japan	Retrospective cohort study	56 patients	Preoperative pain assessment after 24 h with skin traction	No difference in pain perception between patients with and without skin traction 12 h before surgery. Pain perception is way lower in skin traction patients 24–60 h before surgery. No differences in complications prevention.
Manafi Rasi A, Amoozadeh F, Khani S, Kamrani Rad A, Sazegar A.	The Effect of Skin Traction on Preoperative Pain and Need for Analgesics in Patients With Intertrochanteric Fractures: A Randomized Clinical Trial.	2015	Archives of Trauma Research	Iran	RCT	40 patients	Skin traction effects on pain based on use of analgesics in patients with intertrochanteric fractures.	No difference in pain perception in the two groups within 24 h after hospitalisation. Pain is way higher in patients without skin traction after 24 h Traction helps relaxation.
Sammut R, Attard M, Mangion D, Trapani J.	The effectiveness of skin traction in reducing pain in adults with a hip fracture: A systematic review.	2021	International Journal of Orthopaedic and Trauma Nursing	Malta	Systematic review	5 studies	Skin traction effects on preoperative pain in hip fracture patients	No effect on preoperative pain. Skin traction use may cause unnecessary complications such as pressure sores, discomfort, movement limitations or thromboembolism to vulnerable patients.
Tafti AA, Sajadi SS, Rafiei H.	A deep wound in left leg as a result of skin traction in 81-old-year woman with hip fracture in orthopaedic ward.	2013	International Wound Journal	Iran	Letter to editor (case report)	1 patient	81 year old female patient with intertrochanteric femur fracture having 7 day skin traction treatment before surgery	Patient had a 10 cm wound where traction was applied.
Tosun B, Aslan O, Tunay S.	Preoperative position splint versus skin traction in patients with	2018	International Journal of Orthopaedic	Turkey	RCT	34 patients	Position splint vs skin traction in preoperative	Preoperative position splint eases pain, avoids complications, helps

(*continued on next page*)

Table 5 (*continued*)

Authors	Title	Year	Journal/Source	Country	Study design	Number of patients enrolled/ articles included	Concept	Results
	hip fracture: An experimental study		and Trauma Nursing				pain, patient's comfort and complications.	comfort and satisfaction in the treatment and care of hip fracture patients compared to skin traction.

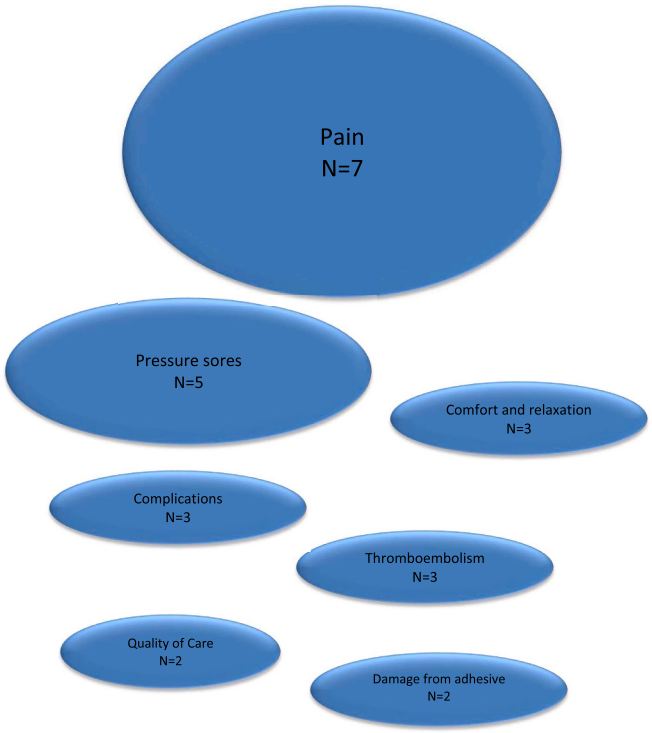


Fig. 1. Results categories.

3.5. Damage from adhesive

Two studies report data of skin damage caused by adhesive tape (Tafti et al., 2013; Tosun et al., 2018). Tafti et al. (2013) include a case report of skin lesion caused by skin traction in an elderly patient, while Tosun et al. (2018) mention the risk of skin damage.

3.6. Complications

Three studies analyse other complications than those reported above: among them are the possible onset of patients' uneasiness, complications related to patients' immobilization as well as the difficulty in patients' care (Biz et al., 2019). Furthermore, a relevant increase of pre-surgery complications were recorded: constipation, pulmonary issues and allergies to adhesive tapes (Tosun et al., 2018). Kobayashi et al. (2020) do not report any differences in complications' onset in skin traction patients compared to control group patients.

3.7. Quality of care

Two articles report difficulties patients' care with skin traction and ensuing decrease in quality of care (Adib Hajbaghery and Moradi, 2013; Biz et al., 2019).

4. Discussion

4.1. Summary of evidence

The publication of two recent systematic reviews on skin traction (Kobayashi et al., 2021; Sammut et al., 2021) shows this topic still constitutes matter of interest. Skin traction use is rather popular in different countries (Biz et al., 2019; Kobayashi et al., 2020; Manafi Rasi et al., 2015; Tosun et al., 2018), whereas its effects are not yet completely clear. The literature shows the use of skin traction is rather frequent in different countries (Biz et al., 2019; Kobayashi et al., 2020; Manafi Rasi et al., 2015; Tosun et al., 2018), whereas its outcomes are not yet completely clear. The articles in this scoping review deal with the use of skin traction and its outcomes in different areas and countries such as Italy, Iran, Japan, Turkey and Pakistan. No studies were identified in other geographic areas such as North America, the United Kingdom or Oceania. This may indicate low use of skin traction in those countries.

As shown in Table 5, the primary studies included in the review enrolled a relatively small number of patients and the reviews included a relatively small number of primary studies. This could affect the conclusions reported.

Kobayashi et al. (2021) and Sammut et al. (2021) analysed the effects of skin traction as far as pain is concerned, the purpose of this review was in fact to answer a broader question: "Which are the effects of skin traction, its advantages and disadvantages in adult patients with proximal femur fractures hospitalised in orthopaedic wards?".

In this study all RCTs included in other recent reviews were also included, except for two studies (Endo et al., 2013; Even et al., 2012) included in Sammut et al. (2021). Endo et al. (2013)' study was also included in Kobayashi et al. (2021). Endo et al. (2013) and Even et al. (2012) were excluded because they refer to a skin traction technique that implies the use of a boot, which shows potentially different effects from skin traction fitted with bandages/adhesive tapes as described in Duperouzel et al. (2018).

In this review a critical appraisal was made using the CASP, while Kobayashi et al. (2021) and Sammut et al. (2021) used a Risk of Bias tool, this could explain the differences found in the quality of the studies included by all the reviews. Furthermore, study designs different from RCTs were also included, according to the scoping method standards (Arksey and O'Malley, 2005; Peters et al., 2020a; 2020b; Pollock et al., 2021), in order to have the widest perspective on the topic.

Most studies included take pain into consideration. The results of this review show an improvement in pain symptoms between 24 and 60 h from hospitalisation, therefore, differently from what is reported in other studies (Kobayashi et al., 2021; Sammut et al., 2021), we could affirm that skin traction application can be considered for those patients who cannot have early surgery due to hospital organization issues or previous morbidity although studies that affirm pain relief after 24 h (Kobayashi et al., 2020; Manafi Rasi et al., 2015) have considered a relatively small number of patients.

Possible damage caused by adhesive tape seems evident, skin traction is therefore not recommended for patients with skin damage, tape allergies, skin fragility, varicose veins or diabetes as reported in Duperouzel et al. (2018).

Despite assistance and care quality are considered only in two studies (Adib Hajbaghery and Moradi, 2013; Biz et al., 2019) it is evident that skin traction makes assistance to patients more complex; this is why specific education and training for nurses assisting skin traction patients is necessary.

A unique answer to other disadvantages of skin traction is not possible because the studies here included show contrasting results.

4.2. Limitation

This scoping review shows limitations: (i) the diversity of the study design included does not permit statistical but only qualitative analysis of the results, (ii), critical appraisal performed without a Risk of Bias assessment could be a limitation in making clinical decisions, finally (iii) the different techniques to fit skin traction are not always clearly mentioned in studies, therefore some articles where boot skin traction was applied may be included.

5. Conclusion

In conclusion, the possible advantage is pain reduction between 24 and 60 h, the possible disadvantage is skin damage.

In agreement with previous reviews (Handoll et al., 2011; Kobayashi et al., 2021; Sammut et al., 2021), routine use of skin traction does not appear to be recommended, we think that the use of skin traction should be focused on producing more consistent evidence, implementing multicenter studies that allow enrollment of a large number of patients.

Studies show a decrease in pain after 24 h from admission (Kobayashi et al., 2020; Manafi Rasi et al., 2015), therefore future research could focus on studying the effects of skin traction between 24 and 60 h after admission and before surgery in situations where surgery can not be carried out within the times indicated by the guidelines. Again, good quality RCTs appear to be needed.

Furthermore, the different effects of skin traction with bandages/tapes and/or boot could be investigated.

Author contributions

MM made substantial contributions to the conception, design and conduction of the study. She wrote the manuscript.

FQ made substantial contributions to the conception and design of the study. He contributed to the writing of the manuscript.

SEA Contributed to the screening of sources and the drafting of the results.

MM Contributed to the screening of sources and the drafting of the results.

EL Contributed to the screening of sources and the drafting of the results.

MCB Performed the literature search on databases.

LS Supervised the entire work and he performed the critical review of the manuscript.

MG made substantial contributions to the conception and design of the study. He supervised the entire work and he performed the critical review of the manuscript.

Ethics

The review does not involve human subjects, therefore approval by an Ethics Committee is not required.

However, we will conduct the study according to Good Clinical Practice and the principles enshrined in the Declaration of Helsinki.

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Declaration of competing interest

The authors declare that they have no conflict of interest.

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