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Clinical practice and nursing management of pre-operative skin or skeletal traction for hip fractures in elderly patients: a cross-sectional three-institution study

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ABSTRACT

Background: Femoral fractures are a major healthcare problem worldwide. One of the most difficult issues is their preoperative care, which is still managed by either *skeletal* or *skin traction* in some countries, including Italy. These issues are discussed and compared with the contemporary literature.

Objective: This study aims to analyse the distribution of these treatment options within the orthopaedic community and the reasons for their use, as well as to identify how this may impact nursing care in terms of pain management, hygiene care, venous thromboembolism (VTE)prophylaxis and prevention of pressure ulcers.

Design: For this cross-sectional study, a 12-item survey was administered to the nursing staff, consultants and residents of the Orthopaedic Units in three different hospitals in NorthEastern Italy. The questionnaire investigated the routine use of *skeletal* or *skin traction* for the preoperative management of hip fractures in those settings.

Findings: 136 surveys were completed, providing a response rate of 87.74%. *Preoperative traction* for hip fractures was still in use in the three hospitals, mainly applied by experienced surgeons for *subtrochanteric fractures*. Pain management, VTE and pressure ulcer prevention were perceived as worse only with *skeletal traction*, while hygiene was described as more difficult with both *skeletal* and *skin traction*.

Conclusions and recommendations: Based on the data and the literature revision, *skin* or *skeletal traction* for patients with proximal femoral fractures should be discouraged as standard practice. This is supported widely in the international literature, and consideration of knowledge translation strategies should be made to refine current practice in these settings.

Introduction

Femoral fractures are a major healthcare issue worldwide and the current incidence is about 1.6 million per year (Tosun et al., 2018). According to Benzinger et al. (2016), this will continue to increase by more than 20% by 2025. This is a direct consequence of increased life expectancy and progressive aging of the population (Endo et al., 2013). Hip fractures cause a significant socio-economic burden (Guy et al., 2017; Rapp et al., 2010; Kanis et al., 2012; Saletti-Cuesta et al., 2017), with an average 10% mortality within 30 days and more than 30% within one year (National Clinical Guideline Centre, 2011). Furthermore, 50% of survivors do not recover the functional level they had before the injuries, and 25% of the patients who were independent before the injury require admission to a residential aged care facility (Bertram et al., 2011; Tarazona-Santabalbina et al., 2016).

Usually, hip fractures are classified as *intracapsular* or *extracapsular* fractures (Aksu and Isiklar, 2008). The first include *femoral head* and *neck fractures*, and the second *intertrochanteric* and *subtrochanteric* fractures. The association of multiple comorbidities, such as osteoporosis, anaemia and malnutrition (Drevet et al., 2014; Koren-Hakim et al., 2012), cognitive impairment (Seitz et al., 2011), cardiovascular diseases, depression (Phillips et al., 2013) and renal function

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impairment (Adunsky et al., 2015), increases the risk and associated complications of these injuries. In this clinical context, hip fractures represent a complex problem, requiring a multi-disciplinary approach with close cooperation among all disciplines to limit potential complications and assure the best possible outcome (Gosch et al., 2016). Currently, orthopaedic nurses have a central role in the maintenance of patient comfort from admission to discharge, recognition of any evolution in symptoms or signs and prevention of complications (Foà et al., 2015).

At present, early surgery for patients following hip fractures is widely recommended (Lewis and Waddel, 2016; Matityahu et al., 2014; Wendt et al., 2016). In patients over 80-years of age, ASA class three subjects, it was shown that 30-day mortality is doubled when surgery is delayed beyond day 2 (Simunovic et al., 2011; Pincus et al., 2017). However, several reports have shown that the waiting time before surgery does not affect post-surgery mortality (Orosz et al., 2004; Majumdar et al., 2006; Watanabe and Matsushita, 2007; Smektala et al., 2008). To prevent complications, promote comfort, reduce pain and ease fracture reduction, the affected hip joint must be maintained in a stable position that assists nurses to provide better care during bed mobilisation for hygiene care. Traditionally the use of traction for *intracapsular fractures* was thought to reduce pain (Endo et al., 2013), although nowadays this is debated (Tosun et al., 2018). *Skin* or *skeletal traction* is still used during the preoperative period in many countries, including Italy, remaining a standard practice in some hospitals (Saygi et al., 2010; Matullo et al., 2016). Hence, in contrast with the international literature, this shows that there is no consensus in these countries regarding the use of preoperative traction or a standard protocol about when and how it must be applied and subsequent care.

Background

Type of tractions

The two main methods of traction are *skin a*nd *skeletal*. During routine practice, in Italian Emergency Departments, as well as in those of other southern European nations (Endo et al., 2013; Saygi et al., 2010; Irajpour et al., 2012; Tosun et al., 2018), the first is used mostly for proximal femur fractures also known as “hip fracture”, in particular for *intracapsular* involvement, while the second is applied mainly for femoral diaphyseal fractures and in some cases also for displaced *extracapsular* hip fractures, like *subtrochanteric*. For *skin* or *skeletal traction*, the limb is connected to a rope linked to a variable weight, which exerts the pulling force (Flynn, 2018; Santy-Tomlinson, 2017).

Skin traction

Skin traction enables a pulling force to be exerted on the affected limb via the soft tissues, (Duperouzel et al., 2018). Only a weight inferior to 3 kg can be used in this technique. Otherwise, it risks damage to the skin or slippage of the bandaging. Skin traction kits have adhesive or non-adhesive materials made up of two skin tapes, which are attached to a padded spreader plate. A rope attached to weights is linked to the plate (Fig. 1). This kind of traction is contraindicated in patients with varicose veins, neurovascular disorders, fragile skin and diabetes (Duperouzel et al., 2018).

Skeletal traction

In this technique, traction is transmitted by means of a transosseous pin passing either through the supracondylar region of the femur or the tibial tuberosity using dedicated instrumentation (Fig. 2). Generally, traction at the level of the tibial tuberosity is preferable, avoiding first the possible contamination of the medullary canal of the femur that will be successively operated and second reducing the risk of infection of the metalwork used for the osteosynthesis. The pin (Steinman or Denham pin or thick k-wire) must be placed bicortically and adequately secured in cortical bone (Fig. 3a) to avoid mobilisation, which could lead to a cortical defect that can cause a fracture in that region (Althausen and Hak, 2002). After insertion, the pin is connected to a staple on both extremities and put under tension. The staple is then linked to a rope (Fig. 3b), and the fractured limb is placed on a specialized Zuppinger's support with the hip in about 45° flexion (Fig. 3c and d). The main rationale for the use of this traction is the prevention of possible neurovascular damage and skin lesions, especially in those patients suffering widely displaced fractures. The constant pulling force exerting by applied weights contributes to maintain proper limb and fracture alignment. In bedridden patients, it prevents further fracture displacement and limb shortening which can occur during mobilisation for hygiene care. Finally, it offloads the hip joint, decreasing damage on the articular cartilage (DeFroda et al., 2016), often already compromised in older patients with fragility hip fracture.

Objective of the present study

The main purpose of this research was to ascertain the frequency with which traction is still used as standard practice in the preoperative management of hip fractures, the type of traction applied and the reasons for its application in the Orthopaedic Departments of NorthEastern Italy. The aim is to reconsider the use of traction in hospitals where outdated techniques may be still used. Furthermore, our analysis investigated what impact the application of traction can have on nursing assistance of elderly patients (> 65 years) with these fractures in terms of pain management, hygiene care, prevention of complications, such as venous thromboembolism (VTE) and pressure ulcers. Finally, these issues were compared with the results from the most recent literature in order to verify if the types of traction were applied with the proper indications and, if necessary, promote change in routine clinical practice.

Methods

Design

This three-institution cross-sectional study is a quantitative exploratory analysis based on a descriptive survey.

Setting

The research was conducted in three Orthopaedic and Trauma Units of different public hospitals of the Regional Health Service in NorthEastern Italy. For this research, these hospitals were identified as *Centre 1*, *2* and *3*. *Centre 1* is a level-I healthcare hospital, a 1572-bed multi-disciplinary, multi-specialty regional university teaching hospital, including a Medical and Nursing school, with about 300 people accessing the Emergency Department per day. The Orthopaedic and Trauma Department has 77 beds, and approximately 440 elderly patients with hip fractures are admitted each year. A dedicated operating theatre and staff are available 24 h/day. *Centre 2* is a level-II healthcare district general hospital comprising 400 beds distributed in 28 different wards. Its Orthopaedic Unit has 33 beds and is mainly dedicated to trauma and elective surgery. Approximately 170 patients over 65 years old affected by proximal femur fractures are hospitalised each year. *Centre 3,* a level-III healthcare local general services hospital, has 230 beds and 14 wards, including a 20-bed Orthopaedic Department, whose main surgical activity is trauma, operating approximately 105 hip fractures each year.

Participants

The participants were recruited with non-probability and convenience sampling from the different Orthopaedic Units of the three hospitals. The inclusion criteria were of these three health professional categories:

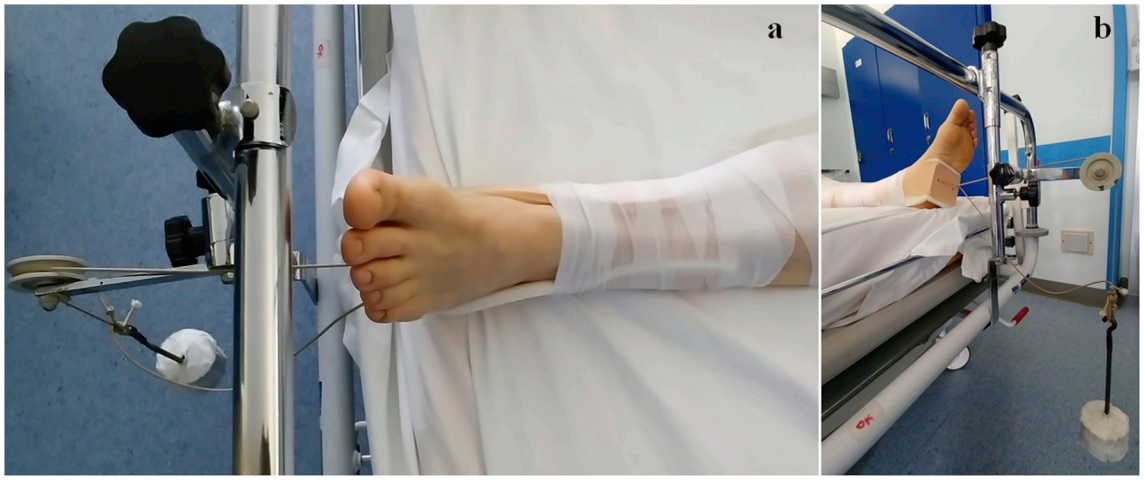

Fig. 1. *Skin Traction.* **(a):** band and tape are applied to the leg, and the weight applies traction to the fracture by gravity. The bandage should reach the tibial tuberosity, while the knee should be left uncovered to avoid stiffness. **(b)**: the rope runs freely through the pulley and reaches the weight. The calcaneal insertion of the Achilles tendon remains exposed to avoid pressure lesions, while ankle support to which the traction is connected is made of soft, elastic material, first to protect the cutaneous region of the malleolus from pressure lesions and second to allow full plantar flexion of the ankle joint.

- Orthopaedic Nursing staff, including: Staff Nurses; Senior Staff Nurses and Ward Managers;
- Orthopaedic and trauma consultants (*OTCs*);
- Orthopaedic and trauma residents (*OTRs*), if present in the institution.

The following were excluded from this investigation:

- Case Managers who were not nurses.
- Medical and nursing students (if present in the institution).

Ethical consideration

Participants for this research were recruited through personal contact of the authors. They received full, written information about the aims of the study and gave their verbal informed consent. Participation was voluntary; there was no adverse consequence for declining or withdrawing from participation, and confidentiality was protected since responses were kept anonymous. Participants received no incentive for their involvement and only a single questionnaire was completed by each volunteer. As patients were not involved directly in this research, the study was granted an exemption by the institutional review board. However, before starting the investigation the approval from the Hospital General Clinical Directorate of each Centre was obtained to distribute the questionnaire and analyse the data.

Instruments and data collection procedure

The authors developed a 12-theme survey, consisting of two sheets, for clinical operators with reference to the existing literature and their respective coordinating academic and clinical practice experience. This questionnaire was designed to evaluate knowledge related to the use of traction for hip fractures and their indication in elderly patients and their preoperative nursing management. At the beginning, the questionnaire was tested for content validity in a pilot test in 2014 for the three-year thesis in nursing of the junior author prior to subsequent distribution; some revisions were made on the basis of feedback. Two years later, in December 2016, the official form of the survey was distributed to those who agreed to participate in the three different Orthopaedic and Trauma Units, and the completed questionnaires were collected in sealed envelopes to guarantee anonymity. The completion of the survey required approximately 15 min. Each participant

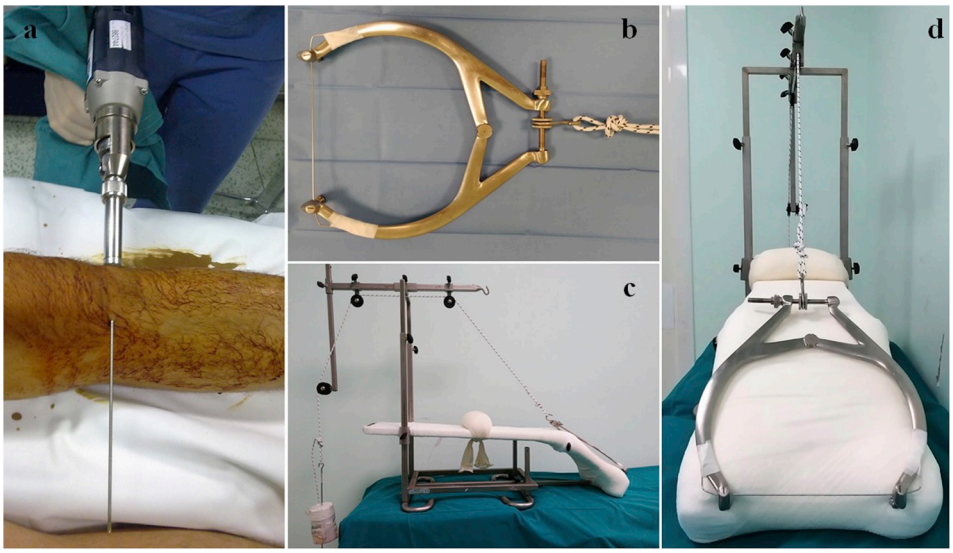

Fig. 2. *Skeletal Traction.*
In the three hospitals, where most part of the patients are operated within 48 h from trauma, the level of the tibial tuberosity is the preferable for applying skeletal traction, as explained into the text. **(a):** after prepping the insertion point with betadine antiseptic solution, a traction pin is inserted with a wire driver through the proximal tibia at the level of the tibial tuberosity from lateral to medial (as there are no neurovascular structures to avoid at this level) perpendicular to the bone. The tip of the pin is covered by bone fragments, confirming that it has crossed the tibial metaphysis after insertion. **(b):** After insertion, the pin is connected to a staple on both extremities and put under tension, and the staple is then linked to a rope reaching the weight. **(c–d):** the affected limb is placed on a specialized Zuppinger's support with the hip in about 45° flexion, while the rope goes through 3 pulleys that change the direction of the force, ending with the weight under gravity. Finally, the leg's position is established and maintained by the Zuppinger's support.

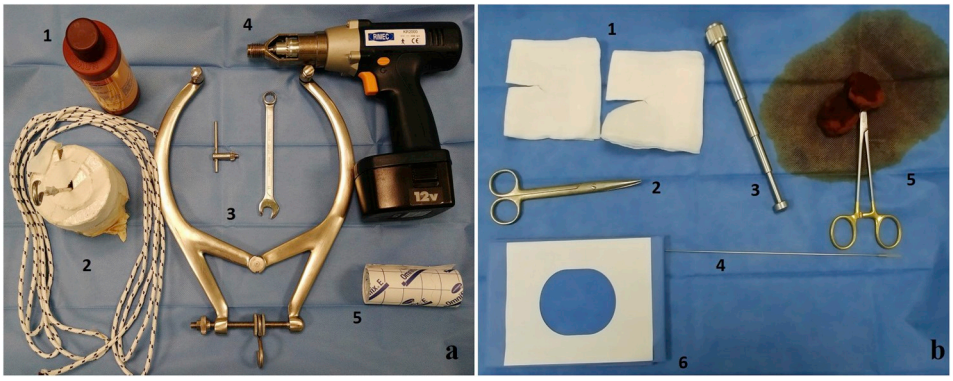

Fig. 3. *Skeletal traction insertion kit.* **(1a):** betadine antiseptic solution; **(2a):** weight and rope; **(3a):** stirrup, chuck key and spanner; **(4a):** drill and pin/k-wire driver adaptor; **(5a):** velband; **(1b):** small dressing gauze; **(2b):** dressing scissors; **(3b):** telescopic guide; **(4b):** pin/thick k-wire; **(5b):** rampley sponge holder with betadine-soaked gauze; **(6b):** small fenestrated sterile drape.

Table 1
The 12-theme descriptive survey. It was composed by a first sheet, divided into three parts, and a second one, only for surgeons, related to the rationale for why skin, skeletal or no traction were used.

Sheet 1

PART 1. GENERAL INFORMATION

Hospital	☐ Centre 1		☐ Centre 2		☐ Centre 3
Category	☐ Staff Nurse	☐ Senior Staff Nurse	☐ Ward Manager	☐ Consultant	☐ Resident
Age	☐ 22-26	☐ 27-30	☐ 31-35	☐ 36-40	☐ > 40
Gender	☐ Male		☐ Female		
Level of Education (Only For Nurses)	☐ University Degree	☐ Post-Graduation Training	☐ Different Training	☐ No Specific Training	
Years of Service	☐ < 5	☐ 6-10	☐ 11-15	☐ > 15	

PART 2. TYPE OF FRACTURE AND ASSOCIATED TREATMENT *(Only for OTCs & OTRs)*

Hip Fracture types	Type of treatment				
	1 = Skin traction	2 = Condylar traction	3 = Tibial traction	4 = Pillow nursing	5 = No device
Femoral Neck	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Trochanteric	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Subtrochanteric	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

PART 3. PRE-OPERATIVE NURSING *(Only for Orthopaedic Nursing staff)*

Pain Management	Skeletal traction	Skin traction	Pillow nursing	No devices
	___ (0–10)	___ (0–10)	___ (0–10)	___ (0–10)
Hygiene and Self Care	☐ Excellent	☐ Excellent	☐ Excellent	☐ Excellent
	☐ Fair	☐ Fair	☐ Fair	☐ Fair
	☐ Difficult	☐ Difficult	☐ Difficult	☐ Difficult
	☐ Unfeasible	☐ Unfeasible	☐ Unfeasible	☐ Unfeasible
VTE Prevention	☐ Excellent	☐ Excellent	☐ Excellent	☐ Excellent
	☐ Fair	☐ Fair	☐ Fair	☐ Fair
	☐ Difficult	☐ Difficult	☐ Difficult	☐ Difficult
	☐ Unfeasible	☐ Unfeasible	☐ Unfeasible	☐ Unfeasible
Pressure Sores Prevention	☐ Excellent	☐ Excellent	☐ Excellent	☐ Excellent
	☐ Fair	☐ Fair	☐ Fair	☐ Fair
	☐ Difficult	☐ Difficult	☐ Difficult	☐ Difficult
	☐ Unfeasible	☐ Unfeasible	☐ Unfeasible	☐ Unfeasible

Sheet 2. Only for OTCs & OTRs.

Type of Injury	Type of Traction	Reasons to use							
		Reduce pain		Preventing complications		Easing fracture reduction		All	
		OTCs	*OTRs*	*OTCs*	*OTRs*	*OTCs*	*OTRs*	*OTCs*	*OTRs*
Intracapsular Hip Fractures	Skin Traction	☐	☐	☐	☐	☐	☐	☐	☐
	Skeletal Traction	☐	☐	☐	☐	☐	☐	☐	☐
	Pillow Nursing	☐	☐	☐	☐	☐	☐	☐	☐
	No Device	☐	☐	☐	☐	☐	☐	☐	☐
Trochanteric Fractures	Skin Traction	☐	☐	☐	☐	☐	☐	☐	☐
	Skeletal Traction	☐	☐	☐	☐	☐	☐	☐	☐
	Pillow Nursing	☐	☐	☐	☐	☐	☐	☐	☐
	No Device	☐	☐	☐	☐	☐	☐	☐	☐
Subtrochanteric Fractures	Skin Traction	☐	☐	☐	☐	☐	☐	☐	☐
	Skeletal Traction	☐	☐	☐	☐	☐	☐	☐	☐
	Pillow Nursing	☐	☐	☐	☐	☐	☐	☐	☐
	No Device	☐	☐	☐	☐	☐	☐	☐	☐

answered a set of multiple-choice questions in a first sheet, divided into three parts, plus a second one, related to the rationale for why skin, skeletal or no traction were used by the surgeons (Table 1).

1) Demographic and professional characteristics of participants.This section divided the participants according to their age, gender, level of education, years of employment, role and affiliation, and other socio-demographic variables.
2) Type of traction or alternative treatment applied and the reasons for its indication (only addressed to OTCs and OTRs).This addressed preferences in the type of support when applied (first sheet: *skin* or *skeletal traction, pillow* or *none)*, and their proper indications (second sheet: *reducing pain*, *preventing complications, easing fracture reduction*) according to the fracture pattern.
3) Preoperative nursing (only addressed to nurses). Based on the chosen treatment (*skin*, *skeletal traction* or *pillow*) when applied, this section aimed to investigate the nurses' perceptions about the effects of traction on:
   - patient pain management expressed by the patients and recorded on a numeric rating scale (NRS; 0–10) (Kumar and Tripathi, 2014);
   - hygiene care provided by nursing staff;
   - prevention of VTE using the application of elastic stockings, pharmacological prophylaxis and mobilisation;
   - pressure ulcer prevention: pressure reducing mattress, frequency of patients' mobilisation, i.e., changing their position in bed.

Statistical analysis

The data collected were statistically analysed by an independent researcher experienced in statistics (M.C.). The data are presented as the mean (plus standard deviation) or median (range) for continuous variables and as numbers for categorical measures. For the statistical evaluation of the scores obtained with the various analysed parameters, the chi-squared test was used. Statistical significance was considered for $p < 0.05$.

Results

A total of 155 surveys were distributed to 83 nurses (32 from *Centre 1*, 27 from *Centre 2*, 24 from *Centre 3*), 46 *OTCs* (19 to *Centre 1*, 16 to *Centre 2* and 11 to *Centre 3*) and 26 *OTRs* (all from *Centre 1*). Overall, 136 surveys were returned completed, providing a response rate of 87.74%.

Demographic and professional characteristics of participants

Surveys were completed by 84.33% of nurses (70/83 subjects), 86.96% of *OTCs* (40/46 subjects) and 100% of *OTRs* (26/26 subjects). Among the responders, participant mean age was 40.12 years (range 22–59 years), the majority was male (78/136; 57.4%) and had a university degree (85.29%). The main characteristics of the sample are summarized in Table 2. Among nursing staff working in the 3 wards, 29.6% of the subjects had postgraduate training for CCM, 43.1% did not have specific training and 27.3% had training different from post-graduation. As for the average age among the surgeons, there were the oldest specialists (mean age 46 years; range 40–57) in *Centre 3*, there was a good balance between surgeons younger or older than 40 years (mean age 41, range 34–48) in *Centre 2*, while in *Centre 1*, the prevalence of surgeons older than 40 was counterbalanced by the presence of *OTRs*, with an average age between 27 and 30 years old. Among staff nurses, in *Centres 1* and *3*, most nurses were older than 40, while in *Centre 2*, half of them were younger than 45. Hence, the majority of the participants were older than 40 (including 31 orthopaedic surgeons and 43 nurses. Among *OTCs*, the majority had been working for more than 15 years (mean working experience 19 years; range 8–33).

The perception of preoperative waiting time for surgery by the three-different health professional roles was > 24 h, but < 48 h for 97.5% of the surgeons, 70% of *OTRs* and 97.1% of the nursing staff.

Table 2
Main characteristics of the sample consisting of Nurses, Orthopaedic Trauma Consultants (**OTCs**) and Residents (**OTRs**).

Age (70 Nurses)	Centre 1 (%)	Centre 2 (%)	Centre 3 (%)
22–26 yrs	8.3 (2/24)	9.1 (2/22)	8.3 (2/24)
27–30 yrs	–	36.4 (8/22)	–
31–35 yrs	25 (6/24)	–	16.7 (4/24)
36–40 yrs	–	18.1 (4/22)	–
> 40 yrs	66.7 (16/24)	36.4 (8/22)	75 (18/24)
Age (40 OTCs & 26 OTRs)			
22–26 yrs	9.5 (4/42)	–	–
27–30 yrs	42.9 (18/42)	–	–
31–35 yrs	9.5 (4/42)	–	–
36–40 yrs	4.8 (2/42)	42.9 (6/14)	–
> 40 yrs	33.3 (14/42)	57.1 (8/14)	100 (10/10)
Professional Experience (70 Nurses)			
< 5 yrs	33.3 (8/24)	9.1 (2/22)	16.7 (4/24)
6–10 yrs	25 (6/24)	36.3 (8/22)	16.7 (4/24)
11–15 yrs	25 (6/24)	27.3 (6/22)	8.3 (2/24)
> 15 yrs	16.7 (4/24)	27.3 (6/22)	58.3 (14/24)
Professional Experience (40 OTCs)			
< 5 yrs	–	14.3 (2/14)	–
6–10 yrs	12.5 (2/16)	28.6 (4/14)	40 (4/10)
11–15 yrs	–	–	–
> 15 yrs	87.5 (14/16)	57.1 (8/14)	60 (6/10)

Type of traction or alternative treatment

Among *OTCs* (Table 3), for *intracapsular hip fractures*, 14 surgeons out of 40 (35%) considered *skin traction*, 15 (37.5%) used a *pillow* under the injured limb and 11 (27.5%) did not suggest any device or support preoperatively. For *trochanteric fractures*, the result was similar with 35% of surgeons using *skin traction*, 35% using a *pillow* and 30% using no device; both measures were primarily thought to reduce pain. For *subtrochanteric fractures*, 2 senior surgeons (5%) employed *condylar traction*, 10 (25%) used *tibial traction*, while the remaining 28 (70%) applied *skin traction*. The main reason to use either *skeletal* or *skin traction* was to ease reduction.

Among the *OTRs* (Table 3), none of them used either type of traction for *intracapsular* hip fractures, with 42.3% of them using a *pillow*, which was mainly thought to reduce pain, and 57.7% using no devices. For *trochanteric* fractures, there was almost equal distribution between *pillow*, used mainly to decrease pain, and no device. Few *OTRs* used either *skeletal* or *skin traction*, mainly to ease reduction. For *subtrochanteric fractures*, most *OTRs* used *skin traction*, mainly to ease reduction, although choices were heterogeneous.

Preoperative nursing

The subsequent section of the survey investigated the perception of the quality of preoperative care by the nursing staff with the application of traction or not in terms of patient pain management, hygiene care, VTE prophylaxis and pressure ulcer prevention (Table 4).

Discussion

Skin or skeletal traction has long thought to be effective preoperative management that reduces pain and muscle spasms and provides proper alignment of the bone fragments. It was believed to make the reduction and the following osteosynthesis easier during surgery, helping to reduce the malalignment of the hip fracture preoperatively, particularly in those widely displaced (Duperouzel et al., 2018). However,

Table 3
Choice of hip fracture preoperative management and reasons for its use. Distribution of the response (% percentage values) given by *Orthopaedic Trauma Consultants* ***(OTCs)*** and *Orthopaedic Trauma Residents* ***(OTRs)*** choosing *Skin Traction*, *Femoral Condylar* and *Tibial Skeletal Traction*, *Pillow* and no device, and the reasons for using them.

Type of Injury	Type of Traction	Results (%)		Reasons to use (%)							
				Decrease pain		Reduce complications		Ease reduction		All	
		OTCs	*OTRs*	*OTCs*	*OTRs*	*OTCs*	*OTRs*	*OTCs*	*OTRs*	*OTCs*	*OTRs*
Intracapsular Hip Fractures	Skin Traction	35	–	55	–	20	–	–	–	25	–
	Skeletal Traction	–	–	–	–	–	–	–	–	–	–
	Pillow Nursing	37.5	42.3	24	41	60	23	–	–	16	36
	No Device	27.5	57.7	–	–	–	–	–	–	–	–
Trochanteric Fractures	Skin Traction	35	7.7	31	20	26	22	28	51	15	7
	Skeletal Traction	–	7.7	–	13	–	18	–	66	–	3
	Pillow Nursing	35	46.1	39	29	28	24	7	18	26	29
	No Device	30	38.5	–	–	–	–	–	–	–	–
Subtrochanteric Fractures	Skin Traction	70	38.5	10	19	8	7	71	62	11	12
	Skeletal Traction	30	30.8	15	11	9	8	68	69	8	8
	Pillow Nursing	–	11.5	–	34	–	27	–	21	–	18
	No Device	–	19.2	–	–	–	–	–	–	–	–

Table 4
Nurses' Perception of traction efficiency. Distribution of nursing staff perception of efficiency of each treatment in terms of *pain reduction* (NRS: 0–10), *hygiene*, *VTE* and *pressure sore prevention* (% percentage values).

Pain (NRS 0–10)		No Traction	Skeletal Traction	Skin Traction
		4.8	5.2	4.9
Nursing (% values)				
Hygiene	Excellent	28.6	–	14.3
	Fair	51.4	28.6	54.3
	Difficult	17.1	71.4	31.4
	Unfeasible	2.9	–	–
VTE Prevention	Excellent	37.1	28.6	37.1
	Fair	51.4	48.6	54.3
	Difficult	8.6	22.8	8.6
	Unfeasible	2.9	–	–
Pressure Ulcers Prevention	Excellent	20	2.9	20
	Fair	62.8	57.1	74.3
	Difficult	14.3	40	5.7
	Unfeasible	2.9	–	–

according to several recent reports (Saygi et al., 2010; Endo et al., 2013; Rasi et al., 2015; Tosun et al., 2018; Merloz, 2018), *traction* for patients with hip fractures has little to no effect on pain relief or reduction of the fracture displacement, or of healing rate. In addition, it does not seem to reduce the need for analgesic medications (Rasi et al., 2015) nor reduce the risk of pressure ulcers (Merloz, 2018*)*. There has been a shift in the practice in relation to traction use for this patient population in recent times, and contemporary literature mostly discourages the standard use of traction for fractures of the proximal femur (Handoll et al., 2011*)*. Alternative measures have been proposed, such as the use of a posterior splint (Tosun et al., 2018; Irajpour et al., 2012) or the simple placement of a pillow under the injured limb (Saygi et al., 2010; Handoll et al., 2011) and the immediate surgical treatment of the fracture. Although this last option is reported the best to minimise the risk of complications (Koval and Cooley, 2005; Beaupre et al., 2005), surgery can be delayed due to other health problems that must be managed, especially in elderly patients with comorbidities (Tosun et al., 2018). In these cases, in Italy, as well as in several other countries, hip fractures are often managed by traction until surgical treatment (Lucki et al., 2012; Endo et al., 2013; Saygi et al., 2010; Resch et al., 2005; Tosun et al., 2018).

As identified in a recent editorial (Santy-Tomlinson, 2017), at present, one significant problem is the lack of research about traction and its impact on patients. In this context, the main purpose of this research was to identify the frequency with which traction is still used as standard practice in the preoperative management of hip fractures, the type of traction applied and the reasons for its application NorthEastern Italy, although this is discouraged by the contemporary literature. Hence, the study aimed to examine the use of traction in three different hospitals of our region. Furthermore, our analysis investigated how traction, when applied, could affect the nursing care for elderly patients with these injuries in terms of pain management, hygiene care and prevention of complications, such as VTE of the lower limbs and pressure ulcers. Finally, these issues were compared with the results from the most recent literature in order to verify if the tractions were applied with the proper indications and, if necessary, promote change in routine clinical practice.

From the data analysis of the first section of the survey, a high degree of participation in the study was recorded, providing a response rate of 87.74%. The majority of the participants were older than 40 years, showing that the sample was formed mostly by experienced staff. In particular, among *OTCs*, the majority had been working for more than 15 years, while among nurses, only 54% of them had more than 10 years of experience. Therefore, the answers of the questionnaire given by the participants can be considered reliable on the whole, reflecting their long experience in the orthopaedic field.

In the second section of the survey, a first distinction was made between senior orthopaedic surgeons and *OTRs* to see how experience might influence the choices in hip positioning for preoperative management (Table 3). These results revealed that currently most of the trauma and orthopaedic surgeons in NorthEastern Italy find that the use of preoperative traction for *proximal femoral fractures* is indicated for specific reasons only, and they prefer skin traction. As expected by the personal work experience of the authors, the use of traction was more common among the senior consultants ($p < 0.001$). It is possible that older orthopaedic specialists are accustomed to using traction in these cases, perhaps a cultural element, after years of practice and have not considered changing their methods. In particular, when treating femoral neck fractures, none of the *OTRs* used either type of traction, while 35% of senior surgeons still considered *skin traction*. A similar result was observed for *trochanteric fractures*, with only 15.4% of *OTRs* applying traction, versus 35% of the *OTCs* ($p < 0.001$). For *subtrochanteric fractures*, 69.3% of *OTRs* used traction, while all *OTCs* used it. Interestingly, for this type of fracture, the *OTCs* preferred *skin traction*

(chosen by 70% of them), while among *OTRs*, equal subdivision between *skin and skeletal traction* (15.4% for each). This imbalance can be explained on the basis of habit and reluctance to change practice. While in the past, traction was commonly adopted in trauma management, it is less used currently, due to the widespread diffusion of early fracture stabilisation in emergency, either by internal or external fixation (Santy-Tomlinson, 2017). Hence, younger surgeons, particularly *OTRs*, are not as skilled with the application and care of these devices as are experienced orthopaedists, who have likely used traction for long periods as standard protocol in the Emergency Room (Duperouzel et al., 2018; Flynn, 2018). Moreover, a lower use of traction by *OTRs* may be a direct result of their more recent medical knowledge and surgical training practices. Although traction is reported to have an additive placebo effect, most of the current literature shows no difference with or without either type of traction either in pain reduction or in secondary outcomes, namely ease of fracture reduction and fixation, complications, operative time and blood loss, and length of hospital stay (Saygi et al., 2010; Handoll et al., 2011; Endo et al., 2013). In our sample, traction was mainly applied with the indication to ease reduction for *trochanteric and subtrochanteric fractures*, as the latter are generally widely displaced, rather than for pain management. However, to the best of our knowledge, there are no studies at present that can prove that dislocation is easier or quantitatively better for reduction when preoperative traction has been applied.

The third section of the questionnaire was aimed at analysing the effects of traction on practical aspects of preoperative nursing. Preoperative management of fractures of the proximal femur is particularly demanding for nurses, as in this phase, bed-bound patients are highly dependent for most activities of daily living (Lucki et al., 2013). Further, these fragile elderly patients need to be carefully monitored due to the increased risk of complications related to immobilisation, such as urinary tract infections, VTE and pressure ulcers, particularly when surgery is delayed (Abou-Setta et al., 2011; Gosch et al., 2016). Although our questionnaire was limited to investigate the potential effects of traction on prevention only of two of these complications, VTE and pressure ulcers, other adverse effects are reported, such as damage to the skin by mechanical shearing, ischemia to the limb from tight bandages or allergy to adhesive strapping, constipation and neuroapraxia (Endo et al., 2013; Saygi, 2010; Tosun et al., 2018).

When examining pain perception, similar values were found without traction (average NRS 4.8) and with *skin traction* (NRS 4.9). On the other hand, *skeletal traction* was associated with greater pain perception (mean NRS 5.2). *Skeletal traction* was associated with the worst outcomes both in terms of pain control and nursing management. The pain associated with skeletal traction can limit movement and increase the difficulty of providing adequate patient care.

In clinical practice, traction has potential disadvantages. It can make delivering nursing care to the patient more difficult, for example, in lifting the patient onto a bedpan or in pressure area care prior to surgery. Adib Hajbaghery and Moradi found nursing to be more difficult with traction, particularly with *skin traction* (Adib Hajbaghery and Moradi, 2013), which seems to lead to an increased risk of VTE (Endo et al., 2013). As a whole, the best solution for comfort and pain management seems to be the use of an ordinary pillow under the injured limb (Tosun et al., 2018) as it places the hip in slight flexion and external-rotation, which provides the lowest intracapsular pressure (Endo et al., 2013) and allows the patient to determine which position is the most comfortable. This type of treatment, besides helping patient comfort, also assists nurses to give better assistance.

A remarkable difference was found for hygiene and self-care (Table 4). It was generally perceived to be better without traction (it was considered good or excellent by 80% of nurses without traction, by 68% of them with *skin traction*). *Skeletal traction* was found to cause greater difficulty than skin traction in this task, with only 29% of good or excellent results. Hygiene and self-care were found significantly better when no device was applied compared to the traction cases ($p = 0.035$).

When *skeletal traction* is used, the point of insertion of the pin can be uncomfortable, and lead to infection (Handoll et al., 2011). Patients with hip fractures are at increased risk of VTE, with incidence rates up to 35% in the pre-operative period (Wang et al., 2018). Hence, nurses who place a high value on VTE prevention appear to be more proactive and determined to deliver care that protects patients from this complication by applying elastic stockings, administering pharmacological prophylaxis according to medical prescription and executing frequent mobilisation (Biz et al., 2016). The survey data showed that there were no differences with or without *skin traction* for prevention of VTE; both methods were considered fair or excellent by 88% and 91% of the participants, respectively. On the other hand, it was slightly more difficult when using *skeletal traction*, being evaluated as fair or excellent by 78% of the interviewees.

As pressure ulcers can develop at any time during hospitalisation, appropriate preventive care for the skin may minimise progression to actual pressure ulcers. In particular, reducing the amount, duration and intensity of pressure exerted on the skin is the most effective strategy for pressure ulcer prevention (Sakai et al., 2009). In this study, prophylaxis of pressure ulcers was evaluated as good or excellent both without traction and with *skin traction*, whereas it was considered difficult by 37% of nurses when *skeletal traction* was used.

Limitations

Several potential limitations and some biases may have influenced this study, mainly linked to the nature of its design and sample size. There were very limited data for pooling and a lack of information about the longer-term consequences of applying or not applying traction, as well as other complications, such as erythema and paresthesia. Finally, the use of closed questions in the data collection instrument may have prevented more detailed responses.

Conclusions

This study shows that *preoperative traction for hip fractures*, although it is less indicated by the new generation of orthopaedic and trauma surgeons, is still in use in three hospitals in NorthEastern Italy.

In our region, there is still a cultural element in applying traction by the older specialists, perhaps not being willing to change their routine clinical practice. However, applying skeletal traction does not improve and may even worsen nursing assistance in terms of patient pain control, hygiene care, VTE and pressure ulcer prevention. Although it is not the nurses' task to propose appropriate preoperative management, they collaborate on its application. Hence, they should feel free to confer with orthopaedic specialists if necessary to prevent possible problems with patient care. In fact, discussing the indications among members of the same staff is very important to promote a higher comfort level and improve nursing and service quality, especially for bedridden elderly patients with fragility hip fractures.

Therefore, in accordance with the recent literature, *skin or skeletal traction* for patients with proximal femoral fractures should be discouraged as standard practice, since there are no favourable effects, even for easing fracture reduction, avoiding unnecessary risks for the patients and unpleasant legal consequences for the health professionals involved. Finally, our data support the need for implementation of knowledge translation strategies by adequate education, targeted at all the stakeholders to encourage, even senior orthopaedic surgeons, to change practice in keeping with the best evidence for the management of these common injuries.

Declarations

Ethical statement

This study has been conducted to a high ethical standard and adheres to local regulations and standards for gaining scrutiny and approval. All subjects participating in this study received a thorough explanation about its nature and gave their oral informed consent to be included in this analysis as well as for publication of the article and anonymous data. As patients were not involved directly in this research, the study was granted an exemption by the institutional review board. However, before starting the investigation, the approval from the Hospital General Clinical Directorate of each centre was obtained to distribute the questionnaire and analyse the data.

Availability of data and materials

The dataset supporting the conclusions of this article is available at our institution.

Conflict of interest statement

The authors declare that they have no conflict of interest related to the publication of this manuscript, and they have not received benefits or financial funds in support of this study.

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Manuscript approval

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Manuscript authenticity

The authors declare that this article represents honest work.

Authors' contribution

C.B. and I.F.: study concept and design; drafting the paper;
N.C., F.Z. and A.L.: data collection;
L.B. and M.C.: analysis and interpretation of data;
P.R.: final approval of the version to be published.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijotn.2018.10.002.

References

Abou-Setta, A.M., Beaupre, L.A., Rashiq, S., Dryden, D.M., et al., 2011. Comparative effectiveness of pain management interventions for hip fracture: a systematic review. Ann. Intern. Med. 155 (4), 234–245 Aug 16.
Adib Hajbaghery, M.A., Moradi, T., 2013. Quality of care for patients with traction in Kashan Shahid-Beheshti hospital in 2012. Arch Trauma Res 2 (2), 85–90.
Adunsky, A., Nenaydenko, O., Koren-Moraq, N., et al., 2015. Perioperative urinary retention, short-term functional outcome and mortality rates of elderly hip fracture patients. Geriatr. Gerontol. Int. 15 (1), 65–71.
Aksu, N., Işıklar, Z.U., 2008. Hip fractures. TOTBID J 7, 8–19.
Althausen, P.L., Hak, D.J., 2002. Lower extremity traction pins: indications, technique, and complications. Am J Orthop (Belle Mead NJ) 31 (1), 43–47 Jan.
Beaupre, L.A., Jones, C.A., Saunders, L.D., Johnston, D.W., et al., 2005. Best practices for elderly hip fracture patients. A systematic overview of the evidence. J. Gen. Intern. Med. 20 (11), 1019–1025 Nov.
Benzinger, P., Becker, C., Todd, C., et al., 2016. The impact of preventive measures on the burden of femoral fractures - a modelling approach to estimating the impact of fall prevention exercises and oral bisphosphonate treatment for the years 2014 and 2025. BMC Geriatr. 16, 75.
Bertram, M., Norman, R., Kemp, L., et al., 2011. Review of the long-term disability associated with hip fractures. Inj. Prev. 17 (6), 365–370.
Biz, C., Buffon, L., Marin, R., Petrova, N., 2016. Orthopaedic nursing challenges in polytraumatised patient management: a critical analysis of an Orthopaedic and Trauma Unit. Int J Orthop Trauma Nurs 23, 60–71.
DeFroda, S.F., Gil, J.A., Born, C.T., 2016. Indications and anatomic landmarks for the application of lower extremity traction: a review. Eur. J. Trauma Emerg. Surg. 42 (6), 695–700.
Drevet, S., Bioteau, C., Mazière, S., et al., 2014. Prevalence of protein-energy malnutrition in hospital patients over 75 years of age admitted for hip fracture. Orthop Traumatol Surg Res 100 (6), 669–674.
Duperouzel, W., Gray, B., Santy-Tomlinson, J., 2018. The principles of traction and the application of lower limb skin traction. Int J Orthop Trauma Nurs 1878–1241 (17) 30119-3.
Endo, J., Yamaguchi, S., Saito, M., Itabashi, T., et al., 2013. Efficacy of preoperative skin traction for hip fractures: a single-institution prospective randomized controlled trial of skin traction versus no traction. J. Orthop. Sci. 18 (2), 250–255.
Flynn, S., 2018. History of traction. Int J Orthop Trauma Nurs 28, 4–7.
Foà, C., Mancini, T., Prandi, R., Ghirardi, L., et al., 2015. Meeting the needs of cancer patients: is there a need for an organizational change? Acta Biomed. 86, 165–173.
Gosch, M., Hoffmann-Weltin, Y., Roth, T., Blauth, M., et al., 2016. Orthogeriatric comanagement improves the outcome of long-term care residents with fragility fractures. Arch. Orthop. Trauma. Surg. 136 (10), 1403–1409 2016 Oct.
Guy, P., Sobolev, B., Sheehan, K.J., Kuramoto, L., et al., 2017. The burden of second hip fractures: provincial surgical hospitalizations over 15 years. Can. J. Surg. 60 (2), 101–107 2017 Apr.
Handoll, H.H., Queally, J.M., Parker, M.J., 2011. Preoperative traction for hip fractures in adults. Cochrane Database Syst. Rev. 7 (12).
Irajpour, A., Kaji, N.S., Nazari, F., et al., 2012. A comparison between the effects of simple and traction splints on pain intensity in patients with femur fractures. Iran. J. Nurs. Midwifery Res. 17 (7), 530–533.
Kanis, J.A., Odén, A., McCloskey, E.V., et al., 2012. A systematic review of hip fracture incidence and probability of fracture worldwide. Osteoporos. Int. 23 (9), 2239–2256.
Koren-Hakim, T., Weiss, A., Hershkovitz, A., et al., 2012. The relationship between nutritional status of hip fracture operated elderly patients and their functioning, comorbidity and outcome. Clin. Nutr. 31 (6), 917–921 Dec.
Koval, K.J., Cooley, M.R., 2005. Clinical pathway after hip fracture. Disabil. Rehabil. 27 (18–19), 1053–1060 Sep 30-Oct 15.
Kumar, P., Tripathi, L., 2014. Challenges in pain assessment: pain intensity scales. Indian Journal of Pain 28 (2), 61–70.
Lewis, P.M., Waddell, J.P., 2016. When is the ideal time to operate on a patient with a fracture of the hip? A review of the available literature. Bone Joint Lett. J 98-B (12), 1573–1581 2016 Dec.
Lucki, M.M., Napier, D.E., Wagner, C., 2012. Preoperative care management of patients with hip fractures during the wait time between emergency department discharge and operating room admission for surgical repair. Orthop. Nurs. 31 (5), 281–286.
Majumdar, S.R., Beaupre, L.A., Johnston, D.W., Dick, D.A., et al., 2006. Lack of association between mortality and timing of surgical fixation in elderly patients with hip fracture: results of a retrospective population-based cohort study. Med. Care 44 (6), 552–559 Jun.
Matityahu, A., Elliott, I., Marmor, M., Caldwell, A., et al., 2014. Time intervals in the treatment of fractured femurs as indicators of the quality of trauma systems. Bull. World Health Organ. 92 (1), 40–50 2014 Jan 1.
Matullo, K.S., Gangavalli, A., Nwachuku, C., 2016. Review of lower extremity traction in current orthopaedic trauma. J. Am. Acad. Orthop. Surg. 24 (9), 600–606.
Merloz, P., 2018. Optimization of perioperative management of proximal femoral fracture in the elderly. Orthop Traumatol Surg Res 104 (1S), S25–S30 Feb.
National Clinical Guideline Centre, 2011. The Management of Hip Fracture in Adults. Royal College of Physicians (UK), London.
Orosz, G.M., Magaziner, J., Hannan, E.L., Morrison, R.S., et al., 2004. Association of timing of surgery for hip fracture and patient outcomes. J. Am. Med. Assoc. 291, 1738–1743.
Phillips, A.C., Upton, J., Duggal, N.A., Carroll, D., et al., 2013. Depression following hip fracture is associated with increased physical frailty in older adults: the role of the cortisol: dehydroepiandrosterone sulphate ratio. BMC Geriatr. 13, 60 Jun 17.
Pincus, D., Ravi, B., Wasserstein, D., Huang, A., et al., 2017. Association between wait time and 30-day mortality in adults undergoing hip fracture surgery. J. Am. Med. Assoc. 318 (20), 1994–2003 Nov 28.
Rapp, K., Cameron, I.D., Kurrle, S., Klenk, J., et al., 2010. Excess mortality after pelvic fractures in institutionalized older people. Osteoporos. Int. 21 (11), 1835–1839.
Rasi, A.M., Amoozadeh, F., Khani, S., Kamrani Rad, A., et al., 2015. The effect of skin traction on preoperative pain and need for analgesics in patients with intertrochanteric fractures: a randomized clinical trial. Arch Trauma Res 4 (2), e12039.
Resch, S., Bjärnetoft, B., Thorngren, K.G., 2005. Preoperative skin traction or pillow nursing in hip fractures: a prospective, randomized study in 123 patients. Disabil. Rehabil. 27 (18–19), 1191–1195.
Sakai, K., Sanada, H., Matsui, N., Nakagami, G., et al., 2009. Continuous monitoring of interface pressure distribution in intensive care patients for pressure ulcer prevention. J. Adv. Nurs. 65 (4), 809–817 2009 Apr.
Saletti-Cuesta, L., Tutton, E., Langstaff, D., et al., 2017. Understanding patient and relative/career experience of hip fracture in acute care: a qualitative study protocol. Int J Orthop Trauma Nurs 25, 36–41.

Santy-Tomlinson, J., 2017. Traction survival skills. Int J Orthop Trauma Nurs 24, 1–2.
Saygi, B., Ozkan, K., Eceviz, E., et al., 2010. Skin traction and placebo effect in the preoperative pain control of patients with collum and intertrochanteric femur fractures. Bull NYU Hosp Jt Dis 68 (1), 15–17.
Seitz, D.P., Gill, S.S., Gruneir, A., et al., 2011. Effects of cholinesterase inhibitors on postoperative outcomes of older adults with dementia undergoing hip fracture surgery. Am. J. Geriatr. Psychiatry 19 (9), 803–813.
Simunovic, N., Devereaux, P.J., Bhandari, M., 2011. Does surgical delay affect outcomes? Indian J. Orthop. 45, 27–32.
Smektala, R., Endres, H.G., Dasch, B., Maier, C., et al., 2008. The effect of time-to-surgery on outcome in elderly patients with proximal femoral fractures. BMC Muscoskel. Disord. 9, 171 Dec 29.
Tarazona- Santabalbina, F.J., Belenguer-Varea, Á., Rovira, E., Cuesta-Peredó, D., 2016. Orthogeriatric care: improving patient outcomes. Clin. Interv. Aging 11, 843–856 Jun 24.
Tosun, B., Aslan, O., Tunay, S., 2018. Preoperative position splint versus skin traction in patients with hip fracture: an experimental study. Int J Orthop Trauma Nurs 28, 8–15 Feb.
Wang, H., Kandemir, U., Liu, P., Zhang, H., et al., 2018. Perioperative incidence and locations of deep vein thrombosis following specific isolated lower extremity fractures. Injury 22 May.
Watanabe, Y., Matsushita, T., 2007. Management of Hip Fracture in Older People: a Clinical Guideline in Japan 2005. Nankodo, Tokyo, pp. 78–79.
Wendt, K., Heim, D., Josten, C., Kdolsky, R., et al., 2016. Recommendations on hip fractures. Eur. J. Trauma Emerg. Surg. 42, 425–431.