Review

The 25 highest cited papers in trochanteric fractures. A systematic review.

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ABSTRACT

AIM: Since the elderly population grows, the amount of hip fractures continues to increase. Worldwide, the total number of hip fractures is expected to exceed six million by the year of 2050. Taking these growing trend into account, proximal femoral fractures are a very contemporary and major topic in orthopaedic and trauma surgery. Therefore, numerous papers focussing on this subject have been published in medical literature. The purpose of this study was to determine the most frequently cited scientific articles concerning trochanter fractures and to establish a ranking of the 25 highest cited papers.
METHODS: The 25 highest cited articles related to trochanteric fractures were systematically searched in Thomson ISI Web of Science® by the use of defined search terms. All types of scientific papers with reference to our subject were ranked according to the absolute number of citations.
RESULTS: The 25 most referred articles in trochanteric fractures were cited up to 405 times. Most of these articles were published in the Journal of Bone and Joint Surgery; British Volume (32%). Most of the papers were published in the early nineties (36%). Ten countries contributed to the top 25 list, with USA as leading position.
CONCLUSION: The Journal of Bone and Joint Surgery; British and American Volume published the highest amount of top cited articles regarding trochanteric fractures. The highest cited paper in absolute and relative numbers was published in 1995.
To our knowledge, this is the first systematic review presenting a list of the highest cited papers regarding trochanteric fractures.

KEY WORDS: hip fracture; trochanteric fracture; intertrochanteric fracture; proximal femoral fracture; bibliographic analysis

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Data received: December 27th 2016
Date accepted: February 28th 2017

INTRODUCTION

Since the elderly population grows, the amount of hip fractures continues to increase. Worldwide, the total number of hip fractures is expected to exceed six million by the year of 2050 (1). Literature demonstrates that proximal femoral fractures increase the risk of death and major morbidity in the elderly (2). Circa fifty percent of patients are unable to regain their ability to live independently (3). Hip fractures can be classified into intracapsular hip fractures (femoral head and neck) and extracapsular hip fractures (intertrochanteric and subtrochanteric). Intertrochanteric fractures occur as the result of a fall, usually in elderly people. These fracture types are rare in the younger population although they can occur after high energetic traumata (4,5). Pertrochanteric extracapsular fractures appear three times more frequently in females than in males (6).

The prognosis of hip fractures varies by anatomic location. The intertrochanteric region, between the

greater and lesser trochanters, is well-vascularized and contains a large amount of cancellous bone (7). Therefore, pertrochanteric fractures heal easily if reduction and fixation are performed properly according to the AO (Arbeitsgemeinschaft für Osteosynthesefragen) principles. The ideal implant for treatment of trochanteric fractures is still a controversial subject. The options can vary between dynamic hip screw (DHS) fixation, proximal femoral plating or intramedullary fixation systems such as Gamma nails of proximal femoral nails with anti-rotation (PFNA). In a recently published systematic review and network analysis, Arirachakaran et al. (8) reported that proximal femoral nails appeared to show the least intra-operative blood loss and shorted hospital stay. Percutaneous compressing plating is the treatment of choice in terms of intra-operative outcomes and postoperative complications in treating trochanteric fractures in the elderly population. Peri-operative complications of intertrochanteric fractures are specifically malunion and femoral shortening (7). Obviously, common complications such as infection, thromboembolism and pressure sores can occur and should be prevented.

The purpose of this study was to determine the most frequently cited scientific articles concerning trochanter fractures and to establish a ranking list of the 25 highest cited papers. The present review provides clinicians, researchers, trainees and students a useful list of papers on the topic of trochanteric fractures.

MATERIAL AND METHODS

Search Strategy

On the 29th of August 2016, Thomson ISI Web of Science® was searched for the following search terms "Dynamic Hip Screw", "DHS", "Sliding Hip Screw", "Gamma Nail", "Intramedullary Femoral Nail", "PFNA", "Proximal Femoral Nail Antirotation", "PFN", "Proximal Femoral Locking Plate", "Proximal Femoral Fracture", "Extracapsular Fracture", "Intertrochanteric Fracture" "Peritrochanteric Fracture", "Pertrochanteric Fracture".

After literature search, abstracts were obtained. Articles without direct reference to the topic were excluded. All types of scientific papers with reference to trochanteric fractures were included into the current study and ranked from highest absolute number of citations to lowest. In case of identical absolute numbers of citations, papers with higher citation density were ranked higher. The 25 highest cited articles are enlisted in Table 1.

Data Analysis

The 25 highest cited articles were reviewed for journal title, year of publication and origin of corresponding author in order to create an overview. Each article was assigned to the country of the orthopaedic and trauma department most authors are serving.

The citation density, the number of citations per year since publication, was calculated in order to determine the relative impact of a published paper and thus the position in the overview table.

Results

The 25 most referred articles in trochanter fractures were cited from a maximum of 405 to 111 times. The top five papers were cited at least 210 times. The 25 highest cited papers according to absolute number of citations are presented in Table 1.

Sixty percent of the twenty-five highest cited articles were published in the *Journal of Bone and Joint Surgery; American and British Volume*. Most of these articles were published in the *Journal of Bone and Joint Surgery; British Volume* (32%). Other studies were published in *Injury* (16%), *Journal of Orthopaedic Trauma* (16%) and *Clinical Orthopaedics and Related Research* (8%). The distribution of the highest cited papers in the various journals are shown in Figure 1.

Most of the presented articles in Table 1 were published in the early nineties (36%), followed by the late nineties (20%) and first ten years of the 21st century (20%). None of the articles were published before 1967 or after 2009. The number of highest cited papers ranked according the date of publication are shown in Figure 2.

Ten countries contributed to the top twenty-five list. The United States of America represented the most articles in the top 25 list (32%), followed by United Kingdom (24%), The Netherlands (12%), Switzerland (8%). Japan, Scotland, Belgium, Norway, Spain and Sweden each account for 4% of the papers of the top 25 list. An overview of the countries contributing to the top 25 list is given in Figure 3.

Table 1. The 25 highest cited papers in trochanteric fractures

Rank	Article	Absolute number of citations	Citation density
1.	Baumgaertner MR, Curtin SL, Lindskog DM, Keggi JM. The value of the tip-apex distance in predicting failure of fixation of peritrochanteric fractures of the hip. J Bone Joint Surg Am. 1995;77(7):1058–64.	405	19,3
2.	Bridle, S., Patel, A., Bircher, M., & Calvert, P. Fixation of intertrochanteric fractures of the femur. A randomized prospective comparison of the gamma nail and the dynamic hip screw. J Bone Joint Surg Br. 1991. 73-B(2), 330-334	262	10,5
3.	Lueng K, SO W, Shen W, Hui P. Gamma-nails and dynamic hip screws for peritrochanteric fractures - a randomized prospective-study elderly patients. J bone Joint Surg Br. 1992;74(3):345–51.	239	10,0
4.	Kyle R, Gustilo R, Premer R. Analysis of 622 intertrochanteric hip-fractures - retrospective and prospective-study. J bone Joint Surg Am. 1979;61(2):216–21.	215	5,8
5.	Sadowski C, Lübbeke A, Saudan M, Riand N, Stern R, Hoffmeyer P. Treatment of reverse oblique and transverse intertrochanteric fractures with use of an intramedullary nail or a 95 degrees screw-plate: a prospective, randomized study. J Bone Joint Surg Am. 2002;84–A(3):372–81.	214	15,3
6.	Radford PJ, Needoff M, Webb JK. A prospective randomised comparison of the dynamic hip screw and the gamma locking nail. J Bone Joint Surg Br. 1993;75–B(5):789–93.	201	8,7
7.	Adams CI, Robinson CM, McQueen MM. Prospective randomized controlled trial of an intramedullary nail versus dynamic screw and plate for intertrochanteric fractures of the femur. J Orthop Trauma. 2001;15(6):394.	197	13,1
8.	Haidukewych GJ, Israel T a, Berry DJ. Reverse obliquity fractures of the intertrochanteric region of the femur. J Bone Joint Surg Am. 2001;83–A(5):643–50.	193	12,9
9.	Davis T, Sher JL, Horsman A, Simpson M, Porter BB, Checketts RG. Intertrochanteric femoral fractures. Mechanical failure after internal fixation. J Bone Joint Surg Br. 1990;72(1):26–31.	189	7,0
10.	Hardy DC, Descamps PY, Krallis P, Fabeck L, Smets P, Bertens CL, et al. Use of an intramedullary hip-screw compared with a compression hip-screw with a plate for intertrochanteric femoral fractures. A prospective, randomized study of one hundred patients. J Bone Joint Surg Am. 1998;80(5):618–30.	180	10
11.	Simmermacher RKJ, Ljungqvist J, Bail H, Hockertz T, Vochteloo AJH, Ochs U, et al. The new proximal femoral nail antirotation (PFNA®) in daily practice: Results of a multicentre clinical study. Injury. 2008;39(8):932–9.	170	21,25
12.	Saudan M, Lubbeke A, Sadowski C, Riand N, Stern R, Hoffmeyer P. Pertrochanteric fractures: is there an advantage to an intramedullary nail?: a randomized, prospective study of 206 patients comparing the dynamic hip screw and proximal femoral nail. J Orthop Trauma. 2002;16(6):386–93.	156	11,1
13.	Baumgaertner MR, Curtin SL, Lindskog DM. Intramedullary versus extramedullary fixation for the treatment of intertrochanteric hip fractures. Clin Orthop Relat Res. 1998;(348):87–94.	154	8,6
14.	Anglen JO, Weinstein JN. Nail or Plate Fixation of Intertrochanteric Hip Fractures: Changing Pattern of Practice. J Bone Joint Surg Am. 2008;90(4):700–7.	141	17,6
15.	Simmermacher RK, Bosch AM V der WC. The AO/ASIF-proximal femoral nail (PFN): a new device for the treatment of unstable proximal femoral fractures. Injury. 1999;30(5):327–32	141	8,3

16.	Dimon JH, Hughston JC. Unstable intertrochanteric fractures of the hip. J bone Joint Surg Am. 1967;49(3):440.	141	2,9
17.	Mereddy P, Kamath S, Ramakrishnan M, Malik H, Donnachie N. The AO/ASIF proximal femoral nail antirotation (PFNA): A new design for the treatment of unstable proximal femoral fractures. Injury. 2009;40(4):428–32.	140	20,0
18.	Madsen JE, Naess L, Aune a K, Alho A, Ekeland A, Strømsøe K. Dynamic hip screw with trochanteric stabilizing plate in the treatment of unstable proximal femoral fractures: a comparative study with the Gamma nail and compression hip screw. J Orthop Trauma. 1998;12(4):241–8.	140	7,8
19.	Rosenblum S, Zuckerman, J, Kummer F, Tam B. A biomechanical evolution of the gamma-nail. J Bone Joint Surg Br. 1992;74(3):352–7.	133	5,8
20.	Schipper IB, Steyerberg EW, Castelein RM, van der Heijden FHWM, den Hoed PT, Kerver AJH, et al. Treatment of unstable trochanteric fractures: randomised comparison of the gamma nail and the proximal femoral nail. J Bone Joint Surg Br. 2004;86–B(1):86–94.	126	10,5
21.	Baumgaertner MR, Solberg BD. Awareness of tip-apex distance reduces failure of fixation of trochanteric fractures of the hip. J Bone Joint Surg Br. 1997;79(6):969–71.	122	6,4
22.	Butt M, Krikler S, Nafie S, Ali M. Comparison of dynamic hip screw And gamma nail: a prospective, randomized, controlled trial. Injury. 1995;26(9):615–8.	119	5,7
23.	Halder S. The gamma-nail for peritrochanteric fractures. J Bone Joint Surg Br. 1992;74(3):340–4.	118	4,9
24.	Utrilla AL, Reig JS, Munoz FM, Tufanisco CB. Trochanteric gamma nail and compression hip screw for trochanteric fractures: a randomized, prospective, comparative study in 210 elderly patients with a new design of the gamma nail. J Orthop Trauma. 2005;19(4):229–33.	117	10,6
25.	Ahrengart L, Tornkvist H, Fornander P, Thorngren KG, Pasanen L, Wahlstrom P, et al. A randomized study of the compression hip screw and Gamma nail in 426 fractures. Clin Orthop Relat Res. 2002;(401):209–22.	111	7,9

Figure 1 . Distribution of the highest cited papers according to the published journal

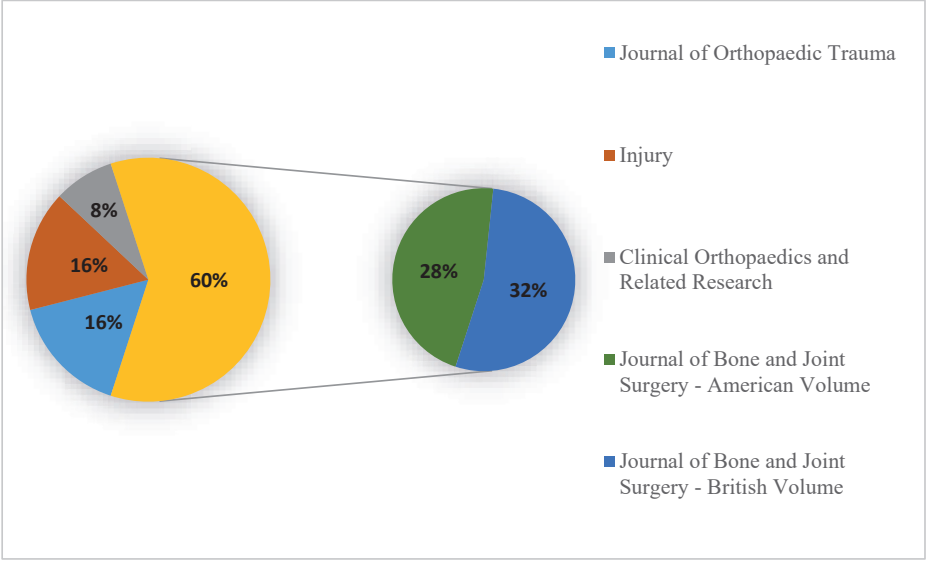


Figure 2 . Number of highest cited papers according to the date of publication

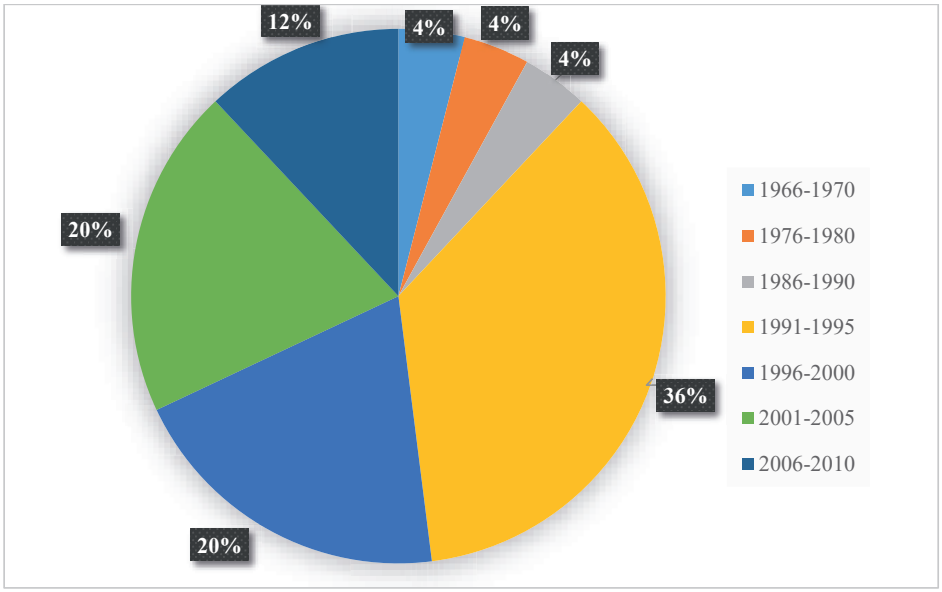
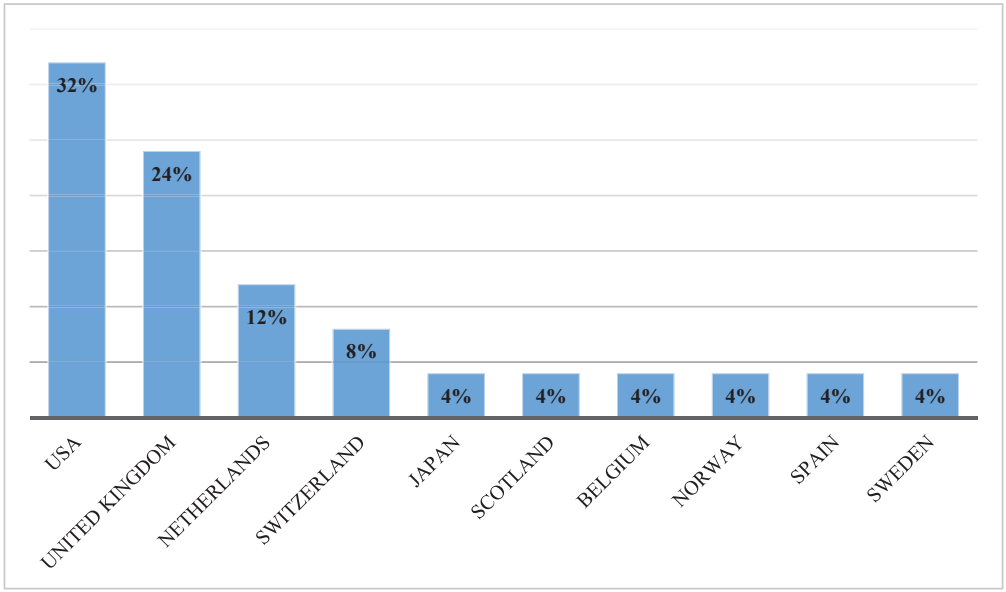


Figure 3 . Countries in order of contributions



Discussion

Hip fractures are extremely common injuries in the elderly population. Due to poorer balance and medication side effects, their risk of falling is higher and fractures occur more easily since their bones consist of weaker quality. According to data from the United States Agency for Healthcare Research and Quality (AHRQ), 310.000 patients were hospitalised with hip fractures in the United States alone in 2003. Therefore, proximal femoral fractures are still a hot topic in orthopaedic and trauma surgery. Since the outspoken interest in this topic and the fact that ideal trochanteric fracture treatment is still a matter of discussion (9), we tried to identify the most significant papers concerning trochanter fractures. After a systematic literature search on Thomson ISI Web of Science®, a list of the highest cited papers was created on that topic.

Lee et al. (10) reported in *JAMA* that the number of total citations is an important parameter to determine the quality score for journal articles. Although it is not the only parameter, the number of total citations can be considered for the scientific relevance on a subject.

An absolute citation number of 405 is in our opinion relatively high in the field of trochanteric fractures. The five highest papers in the ranking showed in Table 1 reach a minimum absolute citation number of more than 210. However, comparing these results to ranking lists of highest cited papers in total hip arthroplasty, the absolute citation number amounts three times higher in arthroplasty topics (11).

Ten countries contributed to the list of the top twenty-five articles (Fig. 3). The United States of America (USA) are enlisted as leading position with a total of eight published papers. Identical geographic results were found in other similar papers concerning different trauma or orthopaedic subtopics (11–15). Furthermore, three out of five journals in the list of the twenty-five highest cited articles are American journals (*Journal of Bone and Joint Surgery; American Volume, Journal of Orthopaedic Trauma, Clinical Orthopaedics and Related Research*). Michael R. Baumgaertner et al. are leading researchers in the field of trochanteric fractures related scientific work. Three papers published by the research team are mentioned in the top twenty-five list (Table 1). Baumgaertner serves as chief of Orthopaedic Trauma Service at New Haven, Connecticut, USA. In our opinion, the United States maintain an exceptionally high level of trauma and orthopaedic research.

The majority of articles have been published in the early nineties (Figure 2). The most recent paper in Table 1 was published in 2009. Overviewing the last five years, no article on this subject has reached a comparably high number of citations. These findings can be explained by the smaller amount of time authors had to refer to a relative recent paper.

By conclusion, similar study designs concerning different trauma or orthopaedic subjects were published in medical literature (11–19). These reviews are a useful tool for clinicians, researchers, trainees and students looking for significant papers reviewing trochanteric fractures. To our knowledge, this is the first systematic review presenting a list of the highest cited papers regarding this topic. Overall, *The Journal of Bone and Joint Surgery; British and American Volume* published the highest amount of highly cited articles regarding trochanteric fractures. The highest cited article in absolute and relative numbers was published in 1995 (Table 1).

Conflict of Interest:

The authors declare that there is no conflict of interest.

Acknowledgments: The authors would like to thank dr. Bakota Bore and the editorial board of the international journal *Biomedicine and Surgery* for giving young researchers and surgeons in training the opportunity to share their scientific work with the rest of the world.

Note: Dauwe Jan and Verhulst Karen contributed equally to this paper

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