Injury, Int. J. Care Injured xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Integrated risk scoring model for predicting dynamic hip screw treatment outcome of intertrochanteric fracture

Cheng-En Hsu[a,b,c], Kui-Chou Huang[d,e], Tzu-Chieh Lin[a,b,f], Kwok-Man Tong[a,g], Mei-Hsuan Lee[c,1,**], Yung-Cheng Chiu[h,i,1,*]

[a] Department of Orthopedics, Taichung Veterans General Hospital, Taichung, Taiwan
[b] Division of Traumatology, Department of Emergency Medicine, Taichung Veterans General Hospital, Taichung, Taiwan
[c] Institute of Clinical Medicine, National Yang-Ming University, Taipei, Taiwan
[d] Department of Orthopedics, Asia University Hospital, Taichung, Taiwan
[e] College of Medicine and Health Science, Department of Occupation Therapy, Asia University, Taichung, Taiwan
[f] Department of Public Health, College of Public Health, China Medical University, Taichung, Taiwan
[g] Chaoyang University of Technology, Taichung, Taiwan
[h] School of Medicine,China Medical University, Taichung, Taiwan
[i] Department of Orthopedics, China Medical University Hospital, Taichung, Taiwan

ARTICLE INFO

Article history:
Accepted 6 September 2016

Keywords:
Intertrochanteric fracture
Dynamic hip screw
DHS
Lateral wall fracture
Prediction model
Garden alignment trabeculae angle

ABSTRACT

Background: Dynamic hip screw (DHS) is a common device for treating intertrochanteric fracture (ITF). Various risk factors have been reported to be associated with the operative treatment outcome. However, an integrated risk scoring prediction model is lacking. In this study, we aimed to develop a prediction model for treatment outcome of intertrochanteric fracture.
Methods: We analyzed 442 AO/OTA 31-A1 and A2 fractures which were treated with DHS during the period January 2000 to June 2014 in a level I trauma center. Risk factors including age, gender, injured side, lag screw position, AO/OTA classification, tip-apex distance, postoperative lateral wall fracture, reduction patterns were analyzed to determine their influence on treatment outcome. Integrated risk scores of significant predictors were used to construct a prediction model.
Results: AO/OTA 31-A2 classification, postoperative lateral wall fracture, posteriorly inserted lag screw and varus reduction pattern were significant risk predictors for DHS failure. The failure risk for low- and high-risk groups were significantly different ($P<0.001$)
Conclusion: AO/OTA 31-A2 classification, postoperative lateral wall fracture, posteriorly inserted lag screw and varus reduction pattern were significant risk predictors for DHS failure. We developed a model that integrates these factors to predict the treatment outcome, which had excellent prediction accuracy and discriminatory ability. The models may provide useful information for orthopedic doctors to identify patients who need early intervention as well as ITF patients who require more frequent follow-up in the postoperative period.

Introduction

As the elderly population grows, the total number of hip fractures is expected to surpass 6 million by the year 2050, which may cost more than 16 billion dollars annually. [1] Intertrochanteric fractures constitute 43% of hip fractures[2], which are mainly treated by surgical reduction and internal fixation. A successful operation helps patients recover quickly. However, a failed operation causes poor capacity of independent walking and self-care, as well as high mortality [3].

Dynamic hip screw (DHS) is a very common internal fixation device for intertrochanteric fracture. The screw telescoping mechanism allows controlled fracture compression which improves

* Corresponding author at: Department of Orthopedics, China Medical University Hospital, Taichung, Taiwan Address: No. 2, Yude Rd., North Dist., Taichung City 404, Taiwan.
** Corresponding author at: Institute of Clinical Medicine, National Yang-Ming University, Taipei, Taiwan Address: 155 Li-Nong Street, Section 2, Peitou, Taipei 112, Taiwan.
E-mail addresses: meihlee@ntu.edu.tw (M.-H. Lee), chouycheng@gmail.com (Y.-C. Chiu).
[1] Yung-Cheng Chiu and Mei-Hsuan Lee contributed equally to this article.

http://dx.doi.org/10.1016/j.injury.2016.09.012
0020-1383/

fracture healing. Though DHS was reported to have a high failure rate in treating fractures with lateral wall involvement (AO/OTA 31-A3 fractures) [3–5], it is still considered an ideal fixation device for treating AO/OTA 31-A1 and 31-A2 fractures [6,7].

AO/OTA classification, postoperative lateral wall fracture, tip-apex distance and reduction quality have been well documented as risk predictors of DHS failure, which are useful references for appropriate intervention in the operative and postoperative period [3,8–11]. However, the relative importance of each risk predictor was less discussed. A risk scoring model that integrates patient profiles, AO/OTA classification, and operation-related factors may help to predict treatment outcome more precisely. In this study, we aimed to [1] investigate the important predictors for DHS treatment failure, and [2] develop a prediction model of DHS treatment outcome for intertrochanteric fracture.

Patients and methods

Patient enrollment

All patients were part of a cohort who had been admitted to a regional level-I trauma center between January 2000 and January 2014 with AO/OTA 31-A1 or A2 intertrochanteric fractures and treated with DHS. The exclusion criteria were pathologic fracture, infections, concurrent other fractures, periprosthetic fractures, obvious postoperative trauma-induced failure, age below 60, follow-up duration less than 3 months. Patients treated with intramedullary nail (n = 70), DHS with trochanter stabilizing plate (n = 127) or other implants (n = 25) were not included in the final analysis. The patient enrollment flowchart is shown in Fig. 1.

Operative technique

All patients were operated under spinal or general anesthesia, according to patients' preference, in the supine position on a fracture table. The standard lateral approach was applied to the proximal femur for the DHS (Synthes, Bochum, Switzerland) implantation. Lag screw was inserted into the femoral head under C-arm fluoroscopy. After the insertion of lag screw, the standard side plate was mounted and fixed. Radiographs were taken immediately after the operation.

With the assistance of well-trained physiotherapists, all patients were mobilized 1–3 days after operation with a walker or crutches. Unrestricted weight-bearing was allowed as tolerated. Clinical and radiological follow-up was mandatory at the 1st month, 2nd month, 3rd month, 6th month, and yearly.

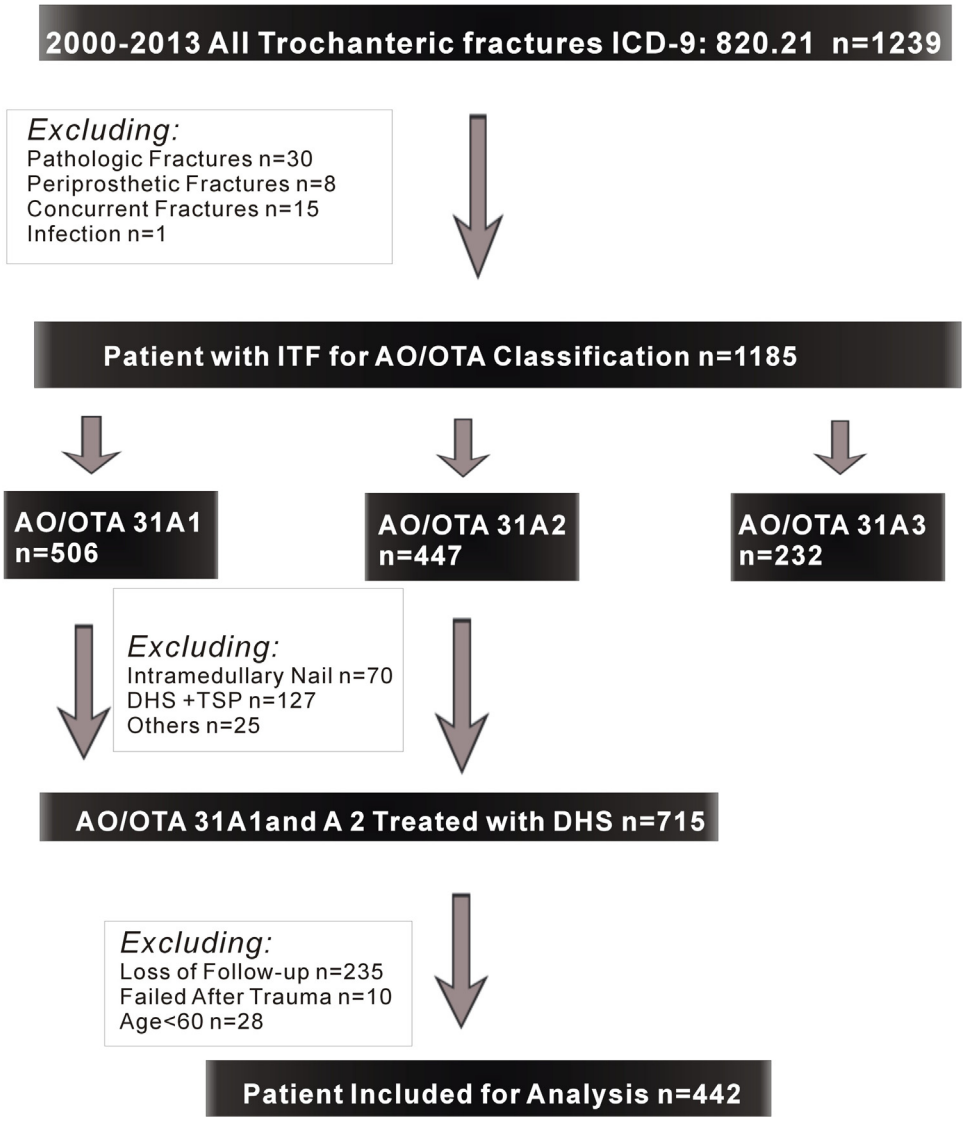

Fig. 1. The flowchart of patient enrollment.

Please cite this article in press as: C.-E. Hsu, et al., Integrated risk scoring model for predicting dynamic hip screw treatment outcome of intertrochanteric fracture, Injury (2016), http://dx.doi.org/10.1016/j.injury.2016.09.012