



## Surgical technique

# Safety and Efficacy of Using Fracture Tables for Prosthetic Hip Dislocations

Marc-Antoine Tremblay, MD, Garrett K. Berger, PharmD, Jonathan C. Kraus, MD \*

Department of Orthopaedic Surgery, Medical College of Wisconsin, Milwaukee, WI, USA

## ARTICLE INFO

## Article history:

Received 8 January 2021  
 Received in revised form  
 12 March 2021  
 Accepted 4 April 2021  
 Available online xxx

## Keywords:

Prosthetic dislocation  
 Prosthetic reduction  
 Traction table  
 Fracture table  
 Hip dislocation  
 Total hip arthroplasty

## ABSTRACT

The incidence of prosthetic hip dislocation continues to increase because of the overall increase in volume of total hip replacement surgery. Closed reduction is often the preferred treatment, particularly in the first few months after surgery. No matter the closed reduction technique, linear traction is a requirement, thus posing a physically demanding stress opening both surgeon and patient to potential injury. We describe a fracture table closed reduction technique along with outcomes and safety data for a sample of patients. In all 10 reduction procedures, reduction was achieved quickly and without fracture or anesthetic complication. The use of a fracture table for reduction of prosthetic hip dislocation is a viable option, particularly when the surgeon may not have the physical requirements and/or qualified assistance necessary for reduction in the emergency department.

© 2021 The Authors. Published by Elsevier Inc. on behalf of The American Association of Hip and Knee Surgeons. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## Introduction

Secondary to rising rates of arthritic risk factors in the United States, the demand for total hip arthroplasty (THA) continues to increase every year [1]. A known complication of THA is prosthetic hip dislocation (PHD). The incidence of PHD significantly increased from the year 2000 to 2017 and is expected to rise to over 10,000 national cases per year by 2035 [2]. This increase is not intrinsic to the procedure itself, but rather due to the increase in volume, as evidenced by the stable PHD rate [2]. While controversy does exist surrounding the impact of surgical approach on complication rates overall, dislocation rates do not differ significantly with reported rates ranging from 0.14% to 1.28% in primary THA cases [2–4].

Treatment options for PHD vary both in technique and preferred setting. Dislocations occurring within the relative postoperative period (3 months) are primarily attributed to relaxed soft tissues and immature scar formation [5,6]. In such cases, closed reduction is the preferred technique. After PHD in this postoperative period, risk of redislocation increases significantly with rates ranging from 30% to 60% [5–7]. If dislocation events persist, whether due to

component malposition or soft tissue instability, revision surgery is often indicated.

Closed reduction is performed either in the emergency department or operating room (OR). Techniques vary dependent upon whether the physician is performing the reduction alone or with an assistant. After sedation and analgesia, manual flexion, adduction, internal rotation is combined with inline traction for posterior dislocations [8]. Anterior dislocations require the same inline traction, but with external rotation and hip extension [8].

Regardless of specific technique, inline traction is a physically demanding requirement thus posing safety issues for both physician and patient. Authors at our institution use a traction table technique for hip dislocations, regardless of dislocation orientation. We aim to describe this technique and review its reduction success rate along with any potential complications.

## Surgical technique

We performed a retrospective review of 10 patients (11 hips) who sustained PHDs. Of the 11 hips, 10 were posterior dislocations while one was anteriorly dislocated. All but one patient failed closed reduction under procedural sedation in the emergency department and required closed reduction in the OR. A closed reduction under procedural sedation could not be attempted for this patient because of medical comorbidities. One patient had a

\* Corresponding author. 9200 W. Wisconsin Ave. P.O. Box 26099 Milwaukee, WI 53226-0099, USA. Tel.: +1 414 805 7400.

E-mail address: [jkraus@mcw.edu](mailto:jkraus@mcw.edu)

constrained acetabular component (Fig. 1a and 1b) while the remaining patients had standard bearings, with a mixture of metal on polyethylene and ceramic on polyethylene. One patient was taken immediately to the OR due to inability to provide procedural sedation in the emergency department. The choice of anesthetic was left to the discretion of the anesthesiologist. Average procedure time, from start of anesthetic to confirmed reduction, was 9.3 minutes (range: 2 – 28 minutes, median: 4.5 minutes). Patients were placed on a traction table with both legs in traction (Fig. 2). A combination of the Hana orthopedic surgery table (Mizuho, CA) and the OSI modular table system trauma top (Mizuho, CA) was used based on availability. Biplanar fluoroscopy was then used to locate the position of the implant. The extremity was placed in an adducted position. Axial traction and external rotation forces were applied to the limb using the traction table. If needed, either hip flexion or hip extension maneuvers were used for posterior and anterior hip dislocations, respectively. Fluoroscopic image was obtained to confirm the hip had cleared the acetabular rim distal (Fig. 3a and 3b). This step is critical to prevent the proximal femur from levering on the acetabular rim resulting in iatrogenic fracture. An internal rotation maneuver was then performed, and gentle axial pressure was used to reduce the hip in place. Reduction was finally confirmed with clinically and radiographically (Fig. 4a and 4b). If needed, lateral pressure can be used to guide the hip into the acetabular component. Traction was released. The hip was flexed to 90 degrees and externally rotated, followed by extension and external rotation. Fluoroscopic images were obtained to confirm stable reduction. While the figures demonstrate an anterior dislocation, the same technique was also used for all 10 posterior dislocations.

## Discussion

As the demand for THA continues to rise, we expect the rate of PHDs to continue to increase proportionally. While the majority of dislocations can be safely attempted in the emergency room, a large proportion of these fail. Studies have shown that as much as 38% of reduction attempts by emergency room physicians fail [9]; even when orthopedic specialists are involved, the failure rate still approaches 10% [10]. Overweight patients are also far more likely to fail closed reduction, likely because of their body habitus and the amount of force required to overcome their soft tissues [11]. We also believe that these patients pose physical risks to physicians attempting closed reduction. Dislocations presenting in a subacute

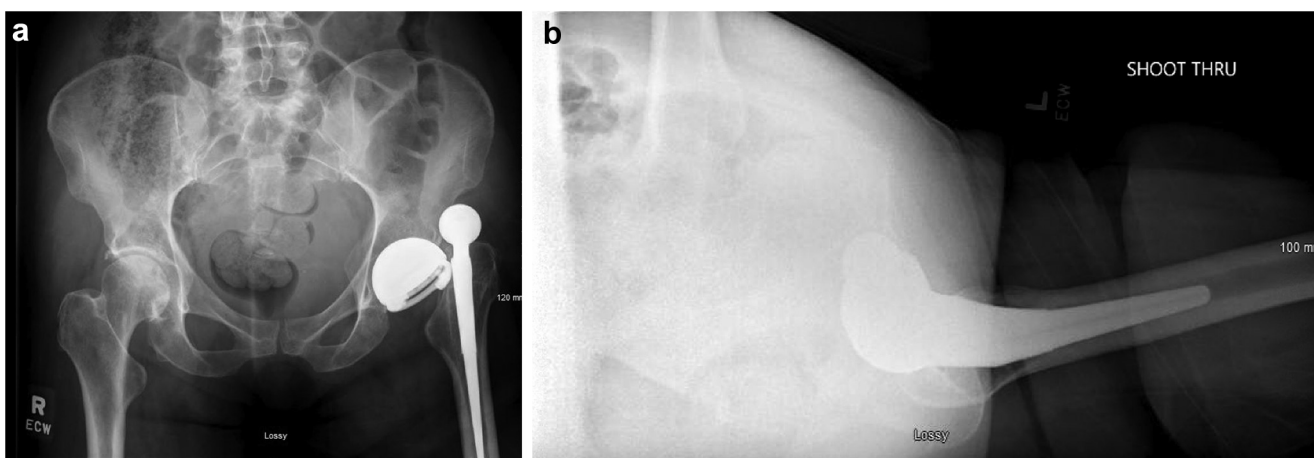


**Figure 2.** Patient under anesthesia placed in traction on the Hana orthopedic surgery table (Mizuho, CA).

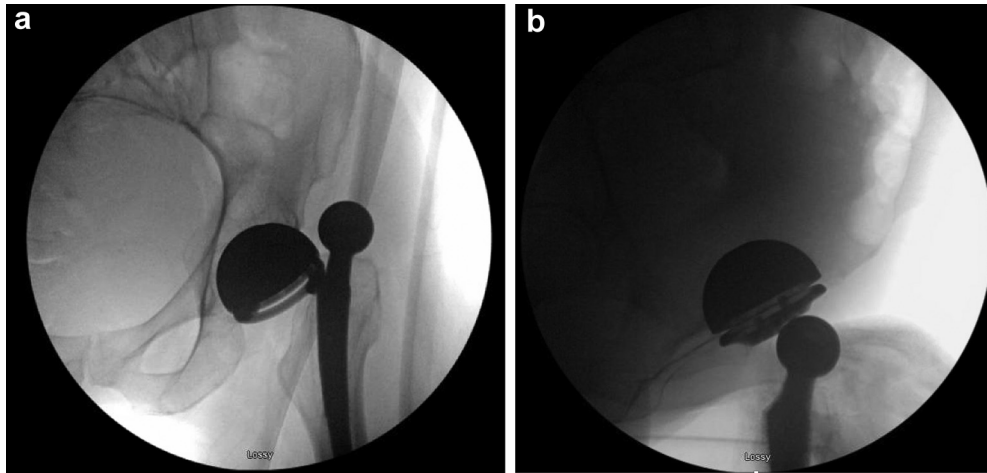
fashion also make closed reduction more difficult, as muscle spasms in these patients may be hard to overcome. This was discussed in a case report by Scanaliato et al., in which a fracture table was used to reduce a posterior dislocation in a patient 2 days out from his injury [12].

In terms of efficacy, it is critical to consider not only success rate but also time to discharge. While closed reduction in the OR is conclusively more successful (100% in our patient cohort), it comes at the cost of time (OR setup times, transport, postanesthetic care unit). One study found that, after failed closed reduction of PHD in the ED, patients who underwent closed reduction in the OR had an average time to discharge of >8 hours [13]. Notably, much of this time was invested in the ED between consulting orthopedic surgery and multiple rounds of conscious sedation setup. By and large, these extended hospital admission times can be attributed to systems-based issues rather than OR time alone (Average operative time from door-to-door in our cohort was 34 minutes.). Further research is needed to look at the cost-benefit of primary OR reductions for complex patients vs failed attempted ED reductions.

Another important factor to consider is the pain and trauma that the patient experiences when undergoing repeated closed reduction attempts in the ED. PHDs are objectively more difficult to



**Figure 1.** Anteroposterior (AP) pelvis (a) and lateral (b) radiograph of a left hip demonstrating an anteriorly dislocation total hip arthroplasty with a constrained acetabular liner.



**Figure 3.** The extremity is externally rotated (a), and axial traction is placed (b) to allow the head to clear the acetabular rim.

reduce and are often prone to multiple repeated attempts. Of the 11 procedures in our cohort, approximately two-third ( $n = 7$ ) failed 2 or more closed reduction attempts in the ED while 3 patients (27%) failed one attempt and one patient (9%) went straight to the OR. If such patients were taken directly to the OR for reduction on a fracture table, they could be saved from a significant amount of pain and trauma associated with ED reductions. Furthermore, repeated attempts at closed reduction with traditional means (ie, Allis maneuver) potentially lead to repeated contact and damage between the bearing surface of the femoral head and the outer rim of the cup. This technique potentially limits the harm done to the prosthesis as only one reduction is attempted, and fluoroscopic guidance is used to confirm acetabular clearance.

The final aim of our review was to assess the safety of fracture table use for the reduction of PHD. Of our 11 procedures, there were no adverse effects related to anesthesia nor to the procedure itself (ie, iatrogenic fracture, nerve injury). Notably, no patient required the use of a paralytic agent. While paralytic may be used, the constant traction by the fracture table easily fatigues the musculature of concern thus allowing reduction. While this sample size is not particularly notable, one can compare this rate to reported rates of complication with attempted reductions in the ED with conscious sedation. One study reported a complication rate of 6% ( $n = 6$ ), 5 of these complications were related to the conscious

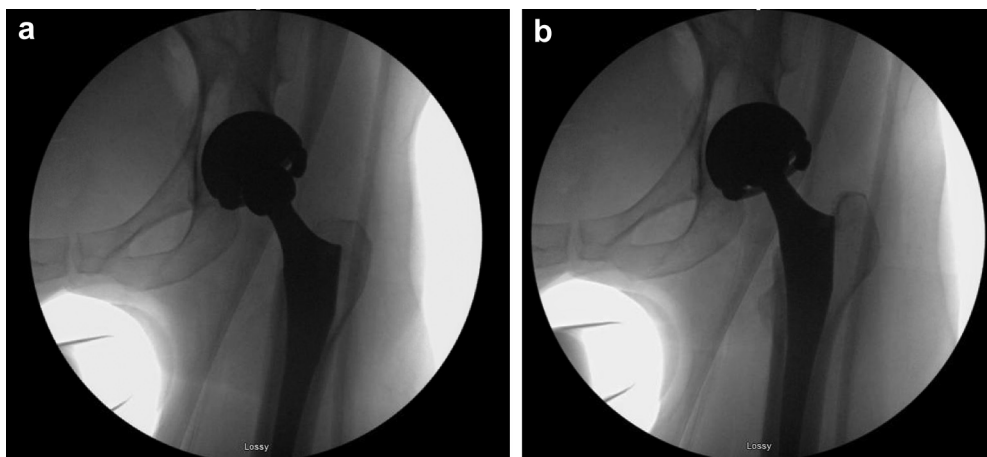
sedation, and one patient experienced foot drop after reduction [9]. A bigger sample size would be necessary to reliably draw conclusions on the safety of this technique.

### Summary

The use of a fracture table in the OR setting is a safe and effective way to handle closed reduction of PHD. While it does come at the cost of time for the patient in the hospital, this is countered by less pain and discomfort and less adverse effects related to anesthesia or reduction maneuvers. Furthermore, while patient admission times are longer, this is largely due to systems-based issues which could be combated with a streamlined process for PHD patients. While most dislocations can be successfully reduced in the ED, patients with complex prosthesis or with significant medical histories may benefit from acute OR reduction. Further research is needed to explore the cost-benefit of acute OR reductions and to identify those patients who would benefit from such pathway.

### Conflicts of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.



**Figure 4.** The extremity is internally rotated (a), traction is released, and gently axial pressure is used to reduce the hip (b).

**References**

- [1] Kurtz S, Ong K, Lau E, Mowat F, Halpern M. Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. *J Bone Joint Surg Am* 2007;89(4):780.
- [2] Pirruccio K, Premkumar A, Sheth NP. The burden of prosthetic hip dislocations in the United States is projected to significantly increase by 2035. *Hip Int* 2020. 1120700020923619.
- [3] Aggarwal VK, Elbuluk A, Dundon J, et al. Surgical approach significantly affects the complication rates associated with total hip arthroplasty. *Bone Joint J* 2019;101-B(6):646.
- [4] De Martino I, D'Apolito R, Soranoglou VG, Poultsides LA, Sculco PK, Sculco TP. Dislocation following total hip arthroplasty using dual mobility acetabular components: a systematic review. *Bone Joint J* 2017;99-B(ASuppl1):18.
- [5] Lu Y, Xiao H, Xue F. Causes of and treatment options for dislocation following total hip arthroplasty. *Exp Ther Med* 2019;18(3):1715.
- [6] Daly PJ, Morrey BF. Operative correction of an unstable total hip arthroplasty. *J Bone Joint Surg Am* 1992;74(9):1334.
- [7] Dargel J, Oppermann J, Bruggemann GP, Eysel P. Dislocation following total hip replacement. *Dtsch Arztebl Int* 2014;111(51-52):884.
- [8] Waddell BS, Mohamed S, Glomset JT, Meyer MS. A detailed review of hip reduction maneuvers: a focus on physician safety and introduction of the waddell technique. *Orthop Rev (Pavia)* 2016;8(1):6253.
- [9] Frymann SJ, Cumberbatch GL, Stearman AS. Reduction of dislocated hip prosthesis in the emergency department using conscious sedation: a prospective study. *Emerg Med J* 2005;22(11):807.
- [10] Germann CA, Geyer DA, Perron AD. Closed reduction of prosthetic hip dislocation by emergency physicians. *Am J Emerg Med* 2005;23(6):800.
- [11] Holdgate A, Taylor DM, Bell A, et al. Factors associated with failure to successfully complete a procedure during emergency department sedation. *Emerg Med Australas* 2011;23(4):474.
- [12] Scanaliato JP, Eckhoff M, Schneider PR, Reich MS. Reducing the "irreducible" total hip arthroplasty dislocation with a fracture table: a case report. *JBS Case Connect* 2019;9(4):e0162.
- [13] Gagg J, Jones L, Shingler G, et al. Door to relocation time for dislocated hip prosthesis: multicentre comparison of emergency department procedural sedation versus theatre-based general anaesthesia. *Emerg Med J* 2009;26(1):39.