

Postless Arthroscopic Hip Preservation Can be Adequately Performed Using Published Techniques



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Purpose: To identify and evaluate techniques used for postless hip arthroscopy. **Methods:** A narrative review was performed using Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines to identify surgical technique articles or clinical studies describing techniques for the use of postless hip arthroscopy. Specific items sought for analysis included hip arthroscopy for femoroacetabular impingement including cam or pincer-type lesions, surgical time, traction time, traction force, bed Trendelenburg angle, intraoperative techniques, and postoperative outcomes, including complications. Exclusion criteria included any postless techniques used for open hip surgeries such as periacetabular osteotomy, sports hernia, peritrochanteric work, gluteus medius repair, ischiofemoral impingement, hamstring repair, or need for intraoperative conversion from postless to posted technique. **Results:** Ten studies (1 Level III, 3 Level IV, 6 Level V), published from 2007 to 2021, were analyzed (1,341 hips, 51.5% male, mean age ranged from 16.0 to 66.0 years). In 4 studies, Trendelenburg position with a foam pad (The Pink Pad; Xodus Medical, Inc.) was used at 5 to 20°. Six of 10 studies contained no clinical results. The average traction force and time ranged from 65.0 to 88 pounds and 31.0 to 73.5 minutes, respectively. The remaining studies used the yoga mat technique, the Tutankhamun technique, the beanbag technique, and the Hip Arthroscopy Post-less Procedure Impingement technique. There was only one incident of pudendal neuropathy, which resolved spontaneously at 6 weeks without complication. Sufficient distraction was able to be obtained using postless traction in all cases. **Conclusions:** Postless hip arthroscopy may adequately be performed with a variety of techniques. Obtaining adequate traction and countertraction may be achieved through these postless methods. **Clinical Relevance:** Given the potential serious complications that may result from use of a perineal post, it is important for surgeons to be aware of postless techniques that may be used effectively for hip arthroscopy.

Hip arthroscopy requires distraction of the joint to gain access for arthroscopic visualization and instrumentation.¹ Hip arthroscopy traditionally has been performed with the use of a perineal post, which allows for countertraction to maintain hip distraction while the surgeon performs any central compartment

work. However, use of a perineal post is not without complications. Perineal and groin numbness have been reported to be as high as 41% to 59% while using a perineal post in hip arthroscopy.²⁻⁴ In a systematic review of 24 studies, Habib et al.⁵ reported a rate of pudendal nerve injury of 1.8%. This likely represents

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an underreporting, as Winger et al.⁶ recently found that post-related complications are reported at a significantly greater rate in prospective (7.1%) versus retrospective (1.4%, $P < .001$) studies. While pudendal nerve injuries are often transient, cases of permanent nerve injury have been reported.⁶ Soft-tissue injuries may also occur as a result of a perineal post, including vaginal tears, labial and scrotal skin necrosis, and vulvar hematoma.⁷

To combat the incidence of post-related nerve and/or soft-tissue injuries following hip arthroscopy, surgeons have developed novel techniques to perform hip arthroscopy without a perineal post. Mei-Dan et al.⁷ reported on 1,000 hip arthroscopy cases performed with the patient in the Trendelenburg position and no perineal post. The authors found no groin-related complications in their case series, although with traction times greater than 2 hours complications can arise such as laryngeal edema, mild brachial plexopathy, or posterior ischemic neuropathy.⁷ In a follow-up study, Welton et al.⁸ found that this postless technique resulted in no significant reduction in venous blood flow or alteration of nerve function in the operative leg. Given the significant potential complications that may result from use of a perineal post, it is important for surgeons to be aware of the different postless techniques for hip arthroscopy. The purposes of this study were to identify and evaluate techniques used for postless hip arthroscopy. We hypothesized that postless hip arthroscopy would be performed using various techniques.

Methods

This narrative review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines using a Preferred Reporting Items for Systematic Reviews and Meta-Analyses checklist. Two independent reviewers (A.D., S.M.F.) searched PubMed, Embase, and the Cochrane Library up until December 20, 2021. The electronic search strategy used was “hip” AND “arthroscopy” AND (“perineal post” OR post-less). A total of 49 studies were reviewed by title and/or abstract to determine study eligibility based on inclusion criteria. In cases of disagreement, a third reviewer (M.J.K.) made the final decision. Inclusion criteria included studies that described techniques in hip arthroscopy without the use of a perineal post. Studies were excluded if the authors did not clearly describe their technique for postless hip arthroscopy, the described technique used a perineal post, studies that described postless techniques for procedures other than hip arthroscopy such as hip fracture fixation, and any postless techniques used for open hip surgeries such as periacetabular osteotomy, sports hernia, peritrochanteric work, gluteus medius repair, ischiofemoral impingement, or hamstring repair. Data extraction from each study was performed

independently and then reviewed by a third author (M.J.K.). There was no need for funding or a third party to obtain any of the collected data.

Data Extraction

Data extracted from each clinical study included the country of authorship, number of subjects undergoing postless hip arthroscopy, sex, age, traction force, traction time, and body mass index.

Results

Ten studies (1 Level III, 3 Level IV, 6 Level V) met inclusion criteria (Fig 1), with a total of 1,341 hips in the clinical studies included (Table 1).⁷⁻¹⁶ The average patient age ranged from 16.0 to 66.0 years). The overall percentage of males ranged from 32.0% to 100.0%. The average traction force and time ranged from 65.0 to 88 pounds and 31.0 to 73.5 minutes, respectively. Body mass index was only reported by one study¹¹ with a mean of 26.2 kg/m².

Surgical Techniques

Trendelenburg Position

Five studies⁷⁻¹¹ used a hip arthroscopy table (Pivot Guardian Distraction System, Stryker [Kalamazoo, MI]; Hana table; Smith & Nephew distractor [Andover, MA]; ProFx table, Mizuho OSI [Union City, CA]; Arthrex distractor [Naples, FL]) with the patient in the supine position. Each technique had support beneath the patient to prevent slippage that was either built into or added/added to the operative table, such as a foam pad (The Pink Pad; Xodus Medical Inc., New Kensington, PA). The patient's feet were placed in well-padded boots and the operative table was then placed in 5 to 15° of Trendelenburg at surgeon's preference (Fig 2). The combination of the Trendelenburg position, venting of the hip joint, and the foam pad allowed for enough resistance between the patient's body and the bed to distract the hip joint without the need for a perineal post. No straps were used to fix the patient to the table.

An earlier iteration of the Trendelenburg technique was described by Mei-Dan et al.¹² in 2013. Hip arthroscopy is performed with the patient in the supine position on a traction table. The patient is moved down the table such that their perineum is located 7 to 10 cm proximal to a perineal post, which is located 5 to 10 cm lateral to midline. The operative limb is then placed in a standard traction boot and the operative table is placed in 15 to 20° of Trendelenburg. In this position, enough resistance is generated, via gravity and friction, between the patient's upper body and bed to allow for successful hip distraction without the post contacting the perineum.

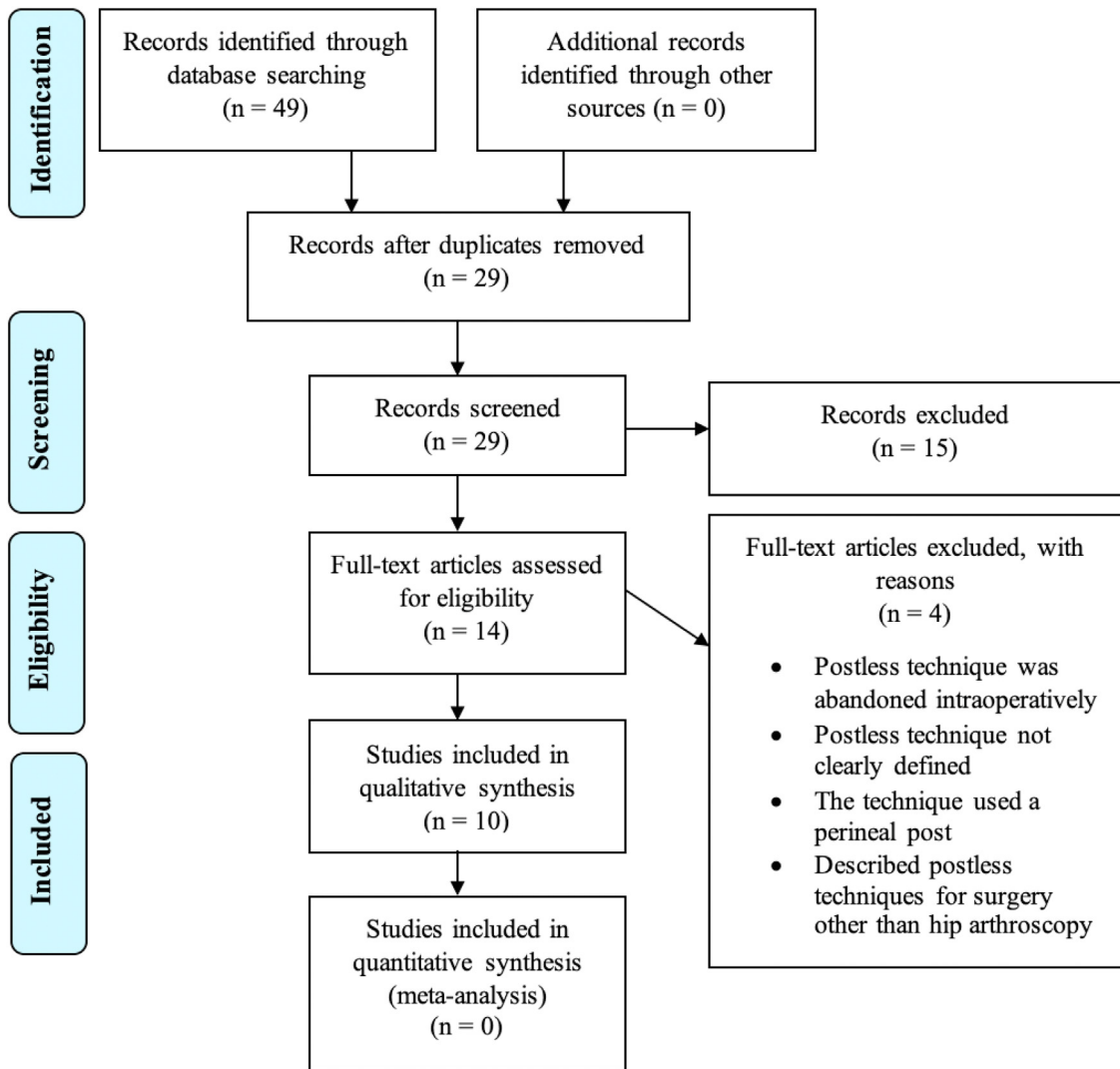


Fig 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram.

Yoga Mat

Salas et al.¹³ described a low-cost, reproducible postless technique that does not require Trendelenburg positioning or any special equipment other than a yoga mat. A yoga mat (Sunshine Yoga, Charlotte, NC), new for each case, is placed on a standard operating table and is cut in half, with one half placed under the posterior trunk/upper body of the patient and the remainder used to pad bony prominences (Fig 3). The hip is distracted with a hip distractor (ArthroMX, San Pedro Garza Garcia, Mexico) or hip fracture table (Maquet GmbH, Rastatt, Germany). The patient is placed in the modified supine position and both arms are placed over the chest in a figure of 8 or "X" position with the thorax and bony prominences protected with the remainder of the yoga mat. The upper body is then wrapped circumferentially with a long blanket and the

arms are secured to the table with duct tape. The yoga mat around the ankles/feet is secured with Coban (3M, Austin, TX) prior to the feet being placed in traction boots to prevent slippage.

Tutankhamun

Similar to the yoga mat technique, the patient is placed in the modified supine position on a standard operating table without Trendelenburg positioning. The hip is distracted with a hip distractor (ArthroMX, San Pedro Garza Garcia, Mexico) or hip fracture table (Maquet GmbH, Rastatt, Germany). The upper body is prepared in the Tutankhamun fashion with both arms placed over the chest in a figure of 8 or "X" position with the thorax and bony prominences well-padded with egg crates (Fig 4).¹⁴ All hands and wrists are left free for intravenous access. A long sheet is placed

Table 1. Studies Included

Study	Level of Evidence	n	Patient Age, y	Sex, % male	Brief Study Description	Author Country	Traction Force, lb	Traction Time, min	Body Mass Index
Merrell et al., 2007 ¹⁶	V	30	NR	NR	Beanbag	U.S.A.	NR	NR	NR
Mei-Dan et al., 2013 ¹²	IV	170	34.0 (16.0-66.0)	65.3	Post located 7-10 cm distal to perineum and 5-10 cm lateral to midline against operative extremity	U.S.A.	NR	NR	NR
Salas et al., 2018 ¹⁴	V	NR	NR	NR	Tutankhamun	Mexico	NR	NR	NR
Mei-Dan et al., 2018 ⁷	IV	1,000	NR	NR	Specialized traction table with 11-15° of Trendelenburg	U.S.A.	65.0 ± 24	61.0 (22-111)	NR
Welton et al., 2019 ⁸	IV	40	32.3	40.0	Trendelenburg	U.S.A.	69.2	73.5	NR
Kollmorgen et al., 2019 ¹⁰	V	NR	NR	NR	Pink Pad, 5-15° of Trendelenburg	U.S.A.	NR	NR	NR
Ellman et al., 2019 ⁹	V	1	36	100	Specialized traction table (Pivot Guardian Distraction System, Stryker with 10° of Trendelenburg)	U.S.A.	40 kg (88 lb)	31.0	NR
Jimenez et al., 2020 ¹⁵	V	NR	NR	NR	HAPPI	U.S.A.	NR	NR	NR
Salas et al., 2021 ¹³	V	NR	NR	NR	Yoga Mat	Mexico	NR	NR	NR
Schaver et al., 2021. ¹¹	III	100	26.9 ± 10.4 (24.9-29.0)	32.0	Pink Pad, 5-10° of Trendelenburg	U.S.A.	NR	40.9 ± 11.1	26.2 ± 5.9

NOTE. n refers to the number of hips that were included in each study. Patient age, traction force, traction time, and body mass index are reported as mean ± SD (range) (when reported), with the "Total" row reported as a weighted mean.

HAPPI, Hip Arthroscopy Post-less Procedure Impingement; NR, not reported; SD, standard deviation.

around the upper body circumferentially and the patient secured to the table by wrapping duct tape (4-6 times) in a figure-of-8 fashion around the bed. Anesthesia observes proper thoracic expansion and ensures adequate intravenous access. Before draping, a trial traction is performed, first manually and then with a hip distractor. As in the Yoga Mat technique, one must alert the anesthesiologist before initiation of traction to carefully observe patient movement.¹⁴ With the Tutankhamun technique, Salas et al.¹⁴ noted only one incident of pudendal neuropathia, which resolved spontaneously at 6 weeks without complication.

Hip Arthroscopy Post-less Procedure Impingement (HAPPI)

As described by Jimenez et al.,¹⁵ the HAPPI technique can be used with all hip distraction tables, although the authors used the Hip Positioning System (Smith & Nephew). A post is applied to the bed for patient safety and initial positioning. The operative-side foot is padded with 4-inch Webril, knee flexed, and placed in Active Heel Traction Boot (Smith & Nephew) and then secured with 6-inch Coban. The nonoperative knee is flexed and placed in a Well Leg Holder with Leather Boot (Smith & Nephew). The operative-side arm is placed across the chest and secured with silk tape. The nonoperative side arm is placed on a well-padded arm board. The post is removed and a pink egg crate (Cardinal Health, Dublin, OH) is positioned over the non-operative proximal, anterior and medial thigh for protection while a safety strap (AliMed, Dedham, MA) is used to secure the protective egg crate on the thigh and to the operative table (Fig 5). A traction trial is performed before prepping and draping with the table in 15° of Trendelenburg. Trendelenburg position is used for the traction trial, prep, drape, venting, and initiation of operative portals but is not required during the procedure.

Beanbag

The Beanbag technique described by Merrell et al.¹⁶ is another inexpensive and accessible method of postless hip distraction. The patient is positioned supine or lateral on a fracture table, initially with the use of a perineal post. After anesthesia induction, a tapered beanbag is contoured to the flank and thorax, then deflated (Fig 6). A folded blanket is placed over the thorax and abdomen and 3-inch tape is used to secure the patient and beanbag in place to the fracture table. Care is taken in the axillary region to avoid compression and to not place the beanbag distal to the iliac crest. The operative side arm is positioned across the chest. The feet are placed in a distraction device, with preference for a footplate rather than padded boots. The perineal post is then removed. Paralysis and use of a 10-inch 15-gauge spinal needle aids in distraction of the hip joint via venting and reduces the distraction force needed.

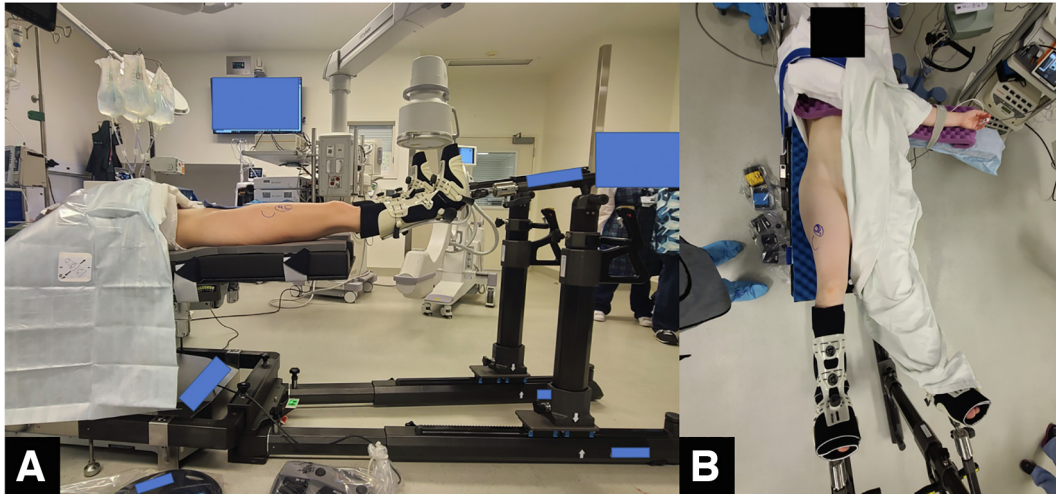


Fig 2. Trendelenburg positioning. (A) Lateral and (B) top-down views of a patient positioned for hip arthroscopy with a specialized distraction table in the Trendelenburg position.

Discussion

The principal finding of this study is that there are multiple techniques that can be used for postless hip arthroscopy without the need for endorsing a particular company/product. There was only one incident of pudendal neurapraxia,¹⁴ which resolved spontaneously at 6 weeks without complication. Eight of the 10 articles included in our review have been published since 2018, which suggests that postless hip arthroscopy has

recently gained popularity in an effort to avoid the potential complications associated with the use of a perineal post.^{6-8,10,11,13-15}

To access the central compartment during hip arthroscopy, traction of the affected limb with countertraction is necessary. Traditional methods to achieve hip joint distraction include placement of a perineal post. Complication rates when using a perineal post range from 0.05% to 59% with associated risks such as

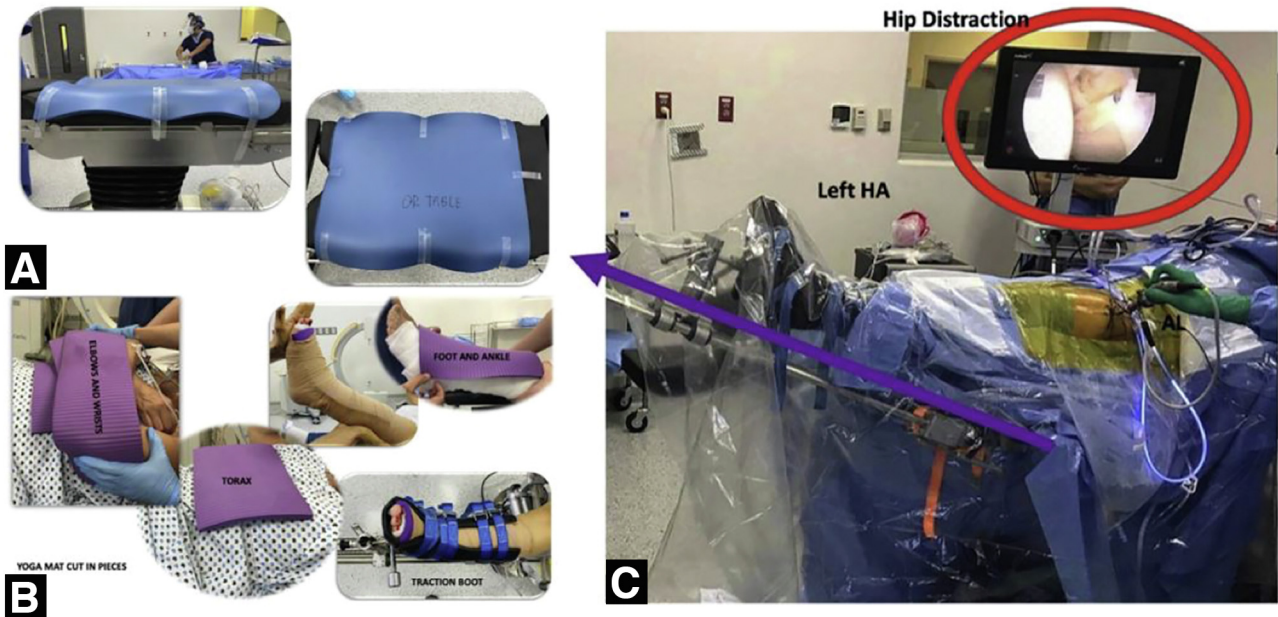


Fig 3. Yoga mat technique. (A) Yoga mat is placed on a standard operating table. (B) The remaining yoga mat material is cut in pieces and placed at the thorax, elbows, wrists, and operative foot to protect bony prominences and avoid iatrogenic lesions and nerve dysfunction. (C) Hip arthroscopy (HA) in the supine position with no Trendelenburg, only flexion of the left hip. Observe the distraction of the femoral head from the acetabulum (red circle) of more than 2 cm. (Reproduced with permission from Salas et al.¹³)

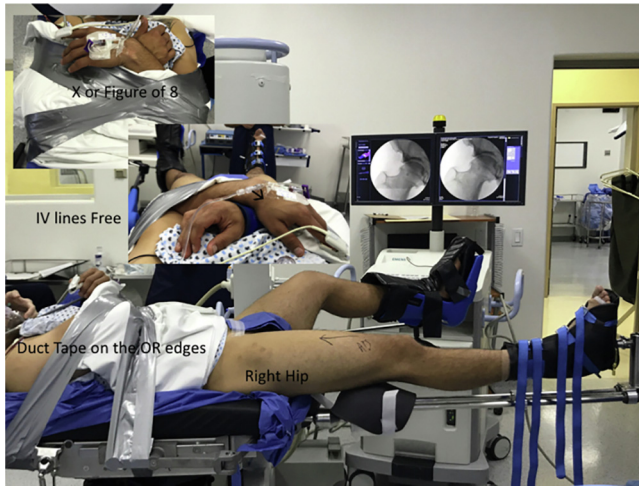


Fig 4. Tutankhamun technique. Supine position for a right hip arthroscopy on a normal operating room (OR) table. Observe the figure-of-8 or “X” on the superior left picture and the intravenous (IV) line placed on the left hand free of the tape and wrapping technique. (Reproduced with permission from Salas et al.¹⁴)

pubdental nerve injury, vaginal tears, labial and scrotal skin necrosis, and vulvar hematoma.^{2,3,7,17} Authors often advocate use of a wide, well-padded post, limiting traction to 2 hours with maximum traction weight up to 50 lbs.^{18,19} Postless hip arthroscopy attempts to avoid these complications through various techniques. Recently, Kraeutler et al.²⁰ performed a prospective comparative study of post-assisted versus postless hip arthroscopy. The authors found a significantly lower risk of groin numbness due to pudendal neurapraxia in the postless group (0% vs 30%, $P < .0001$). The authors also found a lower risk of postoperative foot numbness

due to peroneal neurapraxia in the postless group (12% vs 32%, $P = .04$). In addition to avoiding complications, postless hip arthroscopy has been associated with lower traction time, total operating room time, and time to discharge from the postanesthesia care unit.¹¹ Furthermore, Schaver et al.¹¹ compared postoperative pain after hip arthroscopy with and without a perineal post and found no differences between the 2 groups.

Four of the studies identified in this narrative review¹³⁻¹⁶ successfully obtained joint distraction with low cost, reproducible methods that do not require a specialized table. In the HAPPI technique, Jimenez et al.¹⁵ used 15° of Trendelenburg for initial traction with venting of the hip joint, although the bed is leveled before introducing the arthroscope. In cases of a severe pincer deformity or low body mass index, the authors advocate for adding more Trendelenburg (20°-25°) to assist in joint distraction.¹⁵ On the contrary, the yoga mat, Tutankhamun, and beanbag techniques do not require any Trendelenburg positioning before or during the procedure. Although the specialized hip distraction table described by Mei-Dan et al.⁷ typically requires Trendelenburg positioning, this is dependent on patient body habitus and joint laxity, with some patients (particularly female patients who are overweight) not requiring any Trendelenburg.

For those techniques that do require some degree of Trendelenburg (5-20°) positioning throughout the procedure to maintain hip joint distraction,⁷⁻¹² this type of positioning may theoretically alter venous blood flow. In their prospective cohort study of 35 patients using a postless technique, Welton et al.⁸ noted no significant reduction in venous blood flow in the common femoral or popliteal veins, no significant changes in creatine phosphokinase or D-dimer levels, and no significant

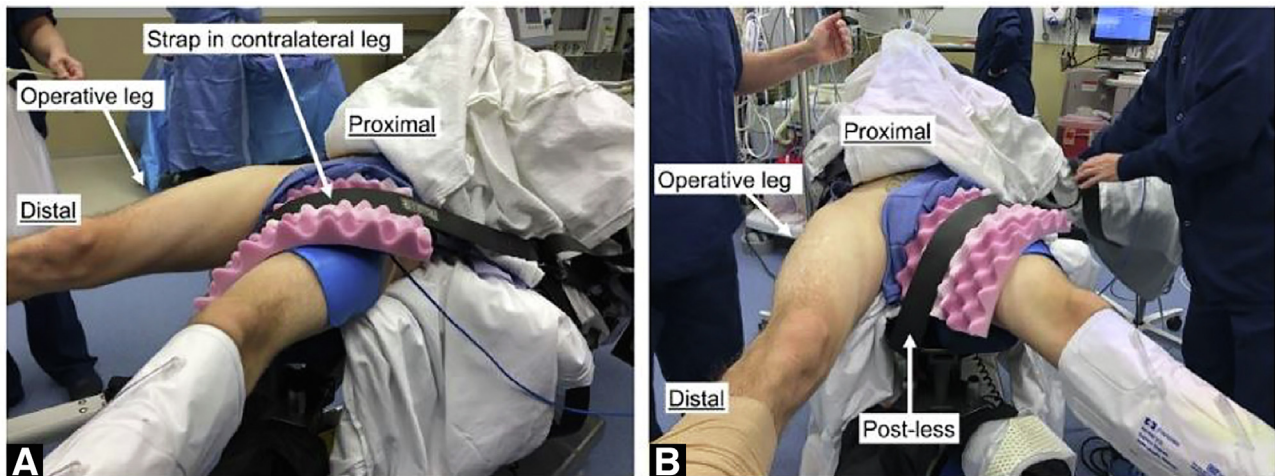


Fig 5. HAPPI egg crate positioning. Proper positioning of the protective egg crate and safety belt to the nonoperative left leg. The operative right lower extremity can be seen free of the egg crate and belt (Reproduced with permission from Jimenez et al.¹⁵). (HAPPI, Hip Arthroscopy Post-less Procedure Impingement.)

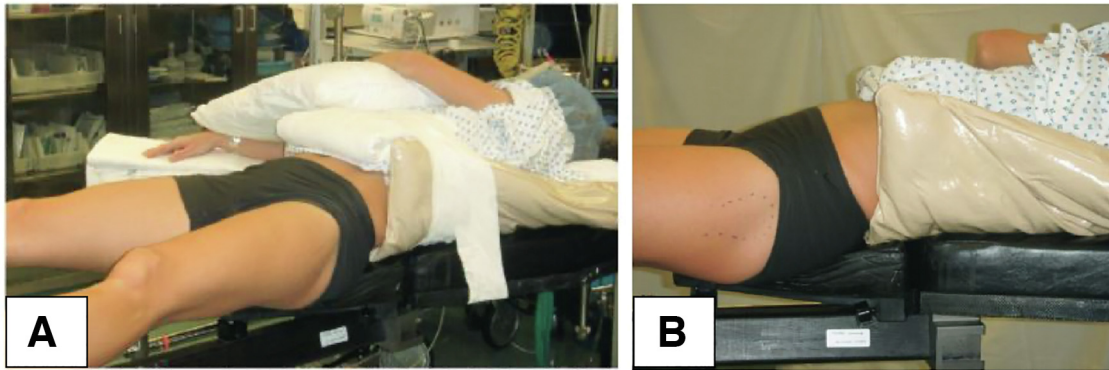


Fig 6. Beanbag technique. (A) Demonstrates the positioning of the folded blanket and beanbag which are secured with tape with the patient in the supine position and left arm placed over a pillow. (B) Side view demonstrating proper positioning of the deflated beanbag around the lateral thorax not extending distal to the iliac crest of the left trunk. (Reproduced with permission from Merrell et al.¹⁶)

changes in somatosensory-evoked potentials or transcranial motor-evoked potentials. A similar study by Martin et al.²¹ using a perineal post demonstrated complete occlusion of the popliteal vein in 100% of cases as well as a reduction in somatosensory-evoked potentials in the superficial peroneal nerve of the nonoperative leg. Traction against the perineal post is the suspected cause of impaired blood flow.

When considering the amount of traction force required against a perineal post to achieve adequate joint distraction, postless techniques have aimed to reduce post-related complications. With the Tutankhamun technique, Salas et al.¹⁴ noted only one incident of pudendal neurapraxia, which resolved spontaneously at 6 weeks without complication. Merrell et al.¹⁶ performed hip arthroscopy using their postless technique with a beanbag in 30 patients and noted no complications of patients falling off the operating table or sustaining pudendal nerve injury. Mei-Dan et al.⁷ reported on 1,000 hip arthroscopy cases performed with a specialized hip distraction table without the use of a perineal post and reported no groin-related complications in their case series. In their retrospective cohort study comparing hip arthroscopy with and without a perineal post, Schaver et al.¹¹ noted decreased traction time and total operative time as well as a quicker time to discharge for the postless group, with similar visual analog scores between groups immediately postoperatively. Despite the adoption of a postless technique, neither group sustained pudendal neurapraxia or groin-related soft-tissue injuries.

While postless techniques reduce perineal complications, these techniques do have their own inherent limitations. In their technique, Kollmorgen et al.¹⁰ report that patients who weigh less may require greater degrees of Trendelenburg to achieve distraction. With greater degrees of Trendelenburg, the surgeon must be aware of significant lumbar lordosis when

achieving postless distraction as the lumbar spine hyperextends. Additionally, some tables are designed for patients no greater than 6'6" in height, thus limiting applicability to patients such as basketball players. However, in their case report, Ellman et al.⁹ successfully achieved distraction in a 7'0" male using a specialized distraction table (Pivot Guardian Distraction System; Stryker) with only 40 kg of distraction force necessary to access the hip joint. Thus, certain postless techniques may be more applicable to taller patients.

Limitations

The limitations of this study also should be noted. Given our strict inclusion/exclusion criteria, only 10 studies were included, with 5 studies each describing very similar techniques with minor changes in equipment used. Furthermore, 5 of the studies were surgical technique articles, and additional clinical studies are necessary to further characterize the potential complications of the described postless techniques.

Conclusions

Postless hip arthroscopy may adequately be performed with a variety of techniques. Obtaining adequate traction and countertraction may be achieved through these postless methods.

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