



Surgical hip dislocation for removal of retained intra-articular bullets



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ABSTRACT

Introduction: Surgical hip dislocation with trochanteric osteotomy was introduced for the treatment of femoroacetabular impingement and other intra-articular pathologies of the hip. We expanded the indications to include removal of retained bullets in the hip joint as an alternative to hip arthroscopy. **Patients and Methods:** We present a prospective case series of ten patients that were treated with a surgical hip dislocation for removal of retained bullets in the hip joint between January 2014 and October 2015 in a Level 1 trauma centre. The main outcome measurements were successful bullet removal, blood loss, surgical time and intraoperative complications.

Results: There were 8 males and 2 females with a mean age of mean age 27.3 years (range 20–32). All patients had one whole retained bullet for removal (right side: 8; left side: 2). In all cases the bullet could be removed in its entirety. The average surgical time was 73 min (range 55–125) and the average blood loss 255 ml (range 200–420).

Conclusions: Surgical hip dislocation provides an unlimited view of the acetabulum and femoral head and neck and it therefore allows for easy removal of retained bullets. Osteocartilaginous lesions and concomitant fractures of the femoral head can be simultaneously evaluated and treated.

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Introduction

The incidence of gunshot wounds is increasing in the United States, Africa and in some European countries [1–4]. The buttock has been reported as an entry point in 8% of all gunshot wounds to the extremities [4]. Gunshot wounds to the pelvis and acetabulum require particular attention because of the close anatomic relations to the intra- and extraperitoneal pelvic organs and neurovascular structures of the pelvis. Potential complications are devastating and include deep infection involving the hip, enterocutaneous, enteroacetabular, and vesicoacetabular fistulae, infected non-union, malunion, and injuries to the internal or external iliac vessels [5,6].

Extraction of retained intraarticular bullets has been described mostly via arthroscopic techniques. Thus far only case reports have been published using this technique [7–10]. Due to the minimally invasive nature of hip arthroscopy visibility and accessibility of the

entire acetabulum and femoral head are limited. Removal of whole bullets also poses a challenge in terms of arthroscopic instrumentation available for this.

Surgical hip dislocation (SHD) was first described by Ganz in 2001 [11]. In combination with trochanteric flip osteotomy, it allows controlled inspection of the hip joint and preservation of the vascular supply [12]. Since then it has been widely performed and documented by various surgeons. Over and above its primary indication, which is the treatment of femoroacetabular impingement (FAI), the indications for SHD have been expanded to include the treatment of acetabulum fractures [13], traumatic hip dislocations [14] and femoral head fractures [15] in trauma patients, as well as the excision of benign tumours [16] and open reduction and pinning of slipped upper femoral epiphysis in children [17]. Especially in a clinical environment where hip arthroscopy is not available on a regular basis, either due to a lack of surgical training, the necessary technical equipment or other factors, SHD may be a valid alternative, also to other open surgical approaches with limited access to the hip joint, for a safe removal of retained bullets.

In this prospective case series we present our experience with the removal of retained intraarticular bullets in the hip joint using SHD and a modified trochanteric step osteotomy.

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Patients and methods

Patient sample

We reviewed all patients in our department who were treated using SHD for the removal of retained bullets in the hip joint. Demographic data (age, sex, type of injury, treated side), intraoperative findings and intra- and postoperative complications were assessed. Our institution research and ethics committee approved the study.

Radiological assessment

In all patients an antero-posterior (AP) radiograph as well as a CT scan of the pelvis were performed preoperatively to confirm intraarticular location of the bullet. Postoperatively a standard AP radiograph of the pelvis was performed.

Surgical technique

A surgical hip dislocation as described by Ganz [11], which is based on knowledge of the blood supply to the femoral head [18], was performed. The patient is positioned in lateral decubitus position. A straight direct lateral skin incision is centered over the greater trochanter. The iliotibial band is split longitudinally, proximally following the anterior border of the gluteus maximus muscle. The interval between the gluteus maximus and the tensor fascia lata is developed (Gibson interval) [19].

The gluteus maximus muscle is retracted posteriorly. To expose the structures attached to the posterior aspect of the greater trochanter the bursa must be incised. The posterior origin of the vastus lateralis fascia is released. Then the muscle is lifted from the bone epiperiosteally, leaving the tendinous origin intact. After a modified trochanteric step osteotomy [20] has been performed, which is known to be more stable than the classically described one [21], the joint capsule is exposed by dissection in the interval between the posteroinferior border of the gluteus minimus and the cranial border of the piriformis. A Z-shaped capsulotomy is performed and the ligament capitis femoris is released using a curved scissors. The femoral head is then dislocated anteriorly. This allows full exposure of the acetabulum and the femoral head, which allows several diagnostic and therapeutic options. The trochanteric osteotomy is then refixated with 3 screws. Postoperative partial weight bearing with 15 kg for 6 weeks is mandatory.

Results

Between January 2014 and March 2015 we treated 10 patients with this procedure. There were 8 males and 2 females (Table 1). The average age was 27.3 (range 20–32) years. In all patients just one bullet had to be removed (right side:8; left side:2). All bullets were small calibre. The bullet was successfully removed in its

entirety in all cases. The average surgery time was 73 min (range: 55–125) and the average blood loss was 255 ml (range 200–420).

The approach allows for easy and secure access to the acetabulum (Fig. 1) as well as to the entire femoral head and femoral neck (Fig. 2).

Two patients had concomitant posterior wall fractures. Manipulation of the hip joint under anaesthetic was performed on both cases and there was no instability evident. The posterior wall fractures were therefore not surgically fixed.

One patient had a concomitant femur head fracture with the fracture line exiting above the fovea centralis. This was fixed with subarticular headless screws in the same surgical episode.

One patient had superficial wound infection at the SHD incision (Pat. 2). The infection was successfully treated with topical wound toilet and oral antibiotics and no surgical intervention was necessary.

Discussion

Gunshots to the hip joint are rare and are reported in about 2% of all gunshot injuries [22]. While bullets from low-energy weapons that rest in soft tissues may be treated with antibiotics alone [23], bullets retained in the joint, apart from causing possible infection, may lead to mechanical abrasion and joint destruction. Moreover, lead arthropathy and systemic lead toxicity (plumbism), even if rare, have been reported with intra-articular retained fragments [24–26]. Therefore removal of retained intra-articular bullets is recommended [26].

Bullet removal out of the shoulder [27], the elbow [28], the knee [29] and the hip has been done successfully by arthroscopy. So far only 8 case reports [7–10,30–33] (including 8 patients) have been published regarding bullet extraction using hip arthroscopy. In 1 out of 8 the bullet could not be removed [30]. Even if all case reports state “reduced operation times” as one of the main advantages of hip arthroscopy, none of them reveals their surgical times. Identified complications were the extraction of the bullet through the capsule [32]. While for most of the joints the advantages of arthroscopy are smaller incisions, potentially faster rehabilitation, and better visualization of the joint compared to open arthrotomy, hip arthroscopy is not without limitations.

Some of its disadvantages include prolonged set up time and increased operative time [34,35]. Fluid extravasation has also been reported to lead to intraabdominal compartment syndrome after hip arthroscopy in acetabular fractures. Moreover the amount of fluid that passes through the patient and system has been reported to be up to 30l which has potential to inadvertently cool the patient [36]. The need for a traction table and the very steep learning curve [37] of hip arthroscopy limit its accessibility for most of the regions where gunshots occur. Another important limitation is the limited visualization of the whole hip joint and limited availability of suitable instruments to remove whole bullets [34].

Table 1

Patient characteristics of 10 patients with retained intraarticular bullets of the hip treated with surgical hip dislocation.

Pat	Sex	Age	Days in clinic	Surgey time (min)	Removal successful	Damage location	Associated injuries
1	m	24	10	55	Yes	central femoral head, central acetabulum	No
2	m	36	30	60	Yes	central acetabulum	small bowel, external ilica artery
3	m	23	5	60	Yes	posterior femoral head	No
4	m	26	10	75	Yes	central acetabulum	No
5	m	24	30	90	Yes	anterior femoral head	small bowel, GS head
6	m	27	7	80	Yes	posterior femoral head, posterior wall	posterior wall fracture
7	m	20	14	75	Yes	anterior femoral head	No
8	f	29	3	55	Yes	central femoral head, posterior wall	posterior wall fracture
9	f	26	9	125	Yes	central femoral head, Pipkin fracture	No
10	m	32	10	60	Yes	central acetabulum	Small bowel

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