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## Ludloff's anteromedial approach in disorders other than congenital hip dislocation

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**Abstract** We report our results obtained using Ludloff's anteromedial approach in 17 patients affected by disorders other than congenital dislocation of the hip. These disorders were all localized on the anteromedial aspect of the hip joint and the proximal part of the femur (6 heterotopic ossifications, 3 osteoid osteomas, 2 osteochondromas, 1 aspecific coxofemoral synovitis, 1 chronic epiphysiolysis of the hip, 3 fractures of the femoral head, and 1 malignant fibrous histiocytoma). The treated group comprised 10 males and 7 females with a mean age of 33

years (range, 11–72 years). The anteromedial approach allowed for complete or almost complete removal of the pathological masses, withdrawal of synovial tissue for biopsy purposes, the reduction and fixation of femoral head fractures and even a corrective femoral neck osteotomy. The suitability of this treatment for skeletal disorders has been confirmed by clinical and radiographic controls carried out after a mean period of 7 years (range, 2–10 years).

**Key words** Ludloff • Anteromedial approach • Hip

### Introduction

In 1908 in Germany, Ludloff [1–3] first introduced the anteromedial approach for the treatment of congenital dislocation of the hip (CDH) in infants younger than two years of age. With respect to the wider, anterior Smith-Petersen approach, indicated for older patients [4], this approach allowed for a more direct and less traumatic exposure of the superficial and deep structures of the hip. Ignored for a long time by his own compatriots, from 1957 the Ludloff approach was recommended and largely used by Chiari and associates (Salzer and Zuckriegl [5], Dorr [6], Mau et al. [7]). Salzer and Zuckriegl successively modified the original technique with their suggestion to shift internally, together with the adductor longus muscle, part of the pectineus. In the United States, Ferguson [8] and Weinstein [9–11] (the latter applying minor modifications) used the medial approach for open reduction of CDH.

In Italy, Ludloff's approach for early treatment of CDH was first adopted by one of us (Scapinelli and Ortolani [12]) and, at the National Congress of the Italian Society of Orthopaedics and Traumatology in 1972, our first surgical cases using this approach were presented. In this and subsequent publications [13, 14], we highlighted the advantages of the approach, which allows for surgery to be carried out on very young patients starting from the first few months of life, even bilaterally in the same surgical session, with the intention to re-establish an appropriate articularity as soon as possible in order to encourage remodeling and possibly a normal development of the joint. At the Orthopaedic and Traumatologic Clinic of Padua, 38 hips in 33 infants under the age of 2 years [13, 14] have been operated on using this technique.

Since 1994, we have used the Ludloff approach for disorders other than congenital hip dislocation, in both adults and children. The purpose of this paper is to present the indications and the results obtained in these specific cases.

## Patients and methods

We reviewed the clinical and radiographic data of 17 patients (10 males and 7 females) treated surgically for a range of disorders localized in the anteromedial part of the hip or proximal femur.

### Operative technique

The patient was positioned supine with hip slightly flexed and rotated externally. Using general or spinal anesthesia, we made a skin incision from the pubic insertion of the adductor longus muscle and extending distally along its anterior margin for a variable length. The fascia lata was cut and the great saphenous vein was shifted laterally. After having moved the adductor longus medially, the pectineus muscle was exposed. A few external pudic branches of the femoral artery and muscular branches of the medial femoral circumflex artery and vein, which pass transversely in front of the pectineus, were tied. We then entered the interstitial space between the adductor longus and pectineus: the first is shifted medially together with the branches of the obturator nerve, the second laterally together with the femoral vessels.

According to the modification introduced by Salzer and Zuckriegel, a considerable number of muscular bundles of the pectineus can be shifted medially together with the adductor longus, in order to improve the exposure of the hip. Beneath the pectineus it is almost always necessary to tie the deep branch of the

medial circumflex artery and vein, which is slightly more voluminous than the superficial branch. The tendon of the iliopsoas and the underlying joint capsule may or may not be cut, depending on the type of pathology to be treated. Any incision into the joint capsule is performed along the axis of the femoral neck. In this way the intra-articular structures (head and anatomical neck), the intertrochanteric region, surgical neck and surrounding anatomical formations are all well exposed.

At the end of the operation, drainage was positioned if required and then layered suturing was carried out.

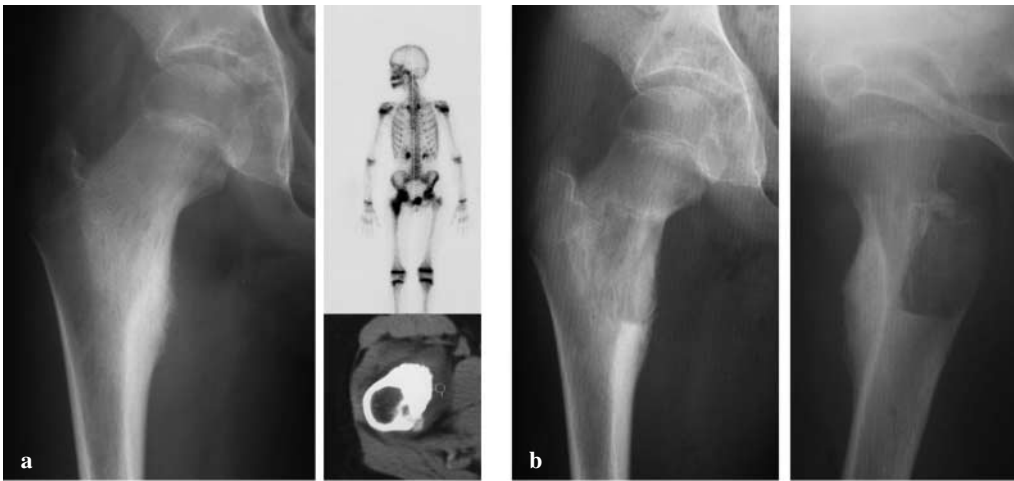
## Results

We used Ludloff's anteromedial surgical approach in 17 patients aged 11–72 years (mean, 33 years) and afflicted by various disorders of the anteromedial part of hip or femur (Table 1).

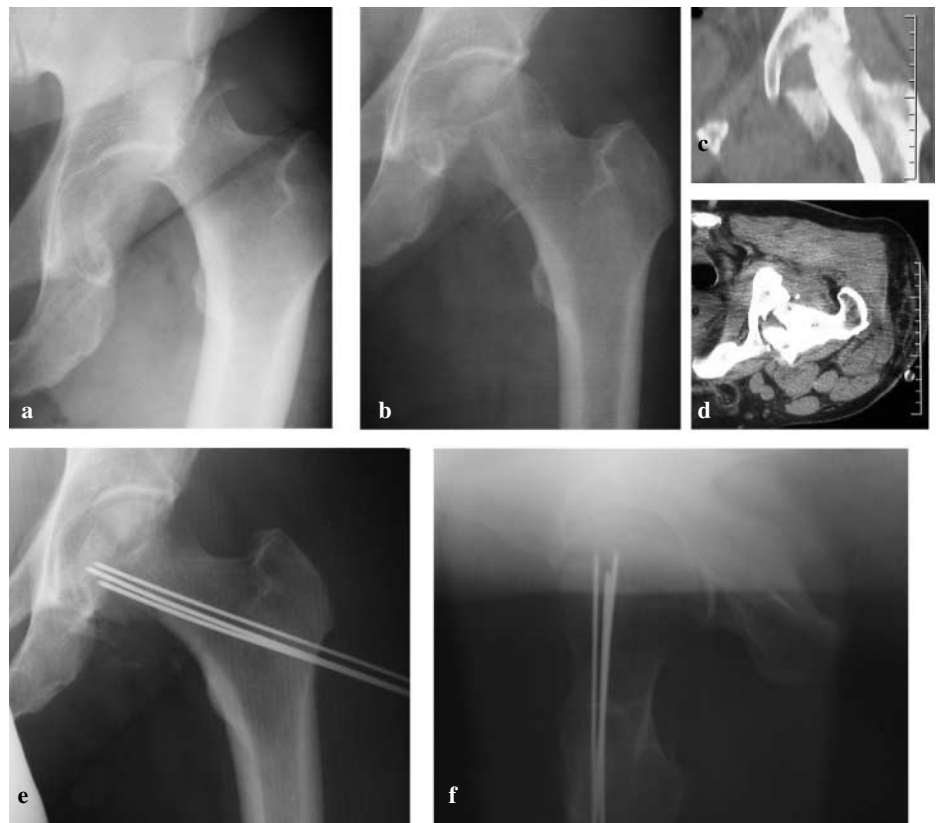
The anteromedial approach has been used in 3 patients to remove benign tumors (Fig. 1), in one patient affected by chronic epiphysiolysis for a derotation osteotomy of the anatomical neck, in 3 patients for fixation of femoral head fractures (Fig. 2) and in one patient for synovial biopsy. In the remaining cases capsulotomy was not required because they were extra-articular disorders, namely: 1 osteochondroma and 1 osteoid osteoma of the

**Table 1** Characteristics of 17 patients treated surgically according to Ludloff's anteromedial approach

Patient	Age, years	Sex	Side	Disorder	Operation
1	24	M	Right	Heterotopic ossifications	Excision
2	19	F	Left	Heterotopic ossifications	Excision
3	17	M	Right	Heterotopic ossifications	Excision
4	50	M	Left	Heterotopic ossifications	Excision
5	28	M	Right	Heterotopic ossifications	Excision
6	24	M	Left	Heterotopic ossifications	Excision
7	11	F	Left	Osteochondroma lesser trochanter	Excision
8	70	M	Right	Osteochondroma femoral neck	Excision
9	21	M	Right	Osteoid osteoma lesser trochanter	Excision
10	11	F	Right	Osteoid osteoma neck of the femur	Excision
11	17	F	Right	Osteoid osteoma femoral neck	Excision
12	72	M	Right	Malignant fibrous histiocytoma	Excision via widened Ludloff's approach
13	59	M	Left	Femoral head fracture	Open reduction. and fixation with Kirschner wires
14	23	F	Right	Femoral head fracture	Open reduction and fixation with 2 screws
15	41	F	Right	Femoral head fracture followed hip dislocation	Open reduction and fixation with 3 Kirschner wires
16	61	M	Right	Non-specific coxofemoral synovitis	Biopsy
17	16	F	Right	Chronic hip epiphysiolysis with subchondral necrosis	Exploration, drillings and intertrochanteric derotation osteotomy



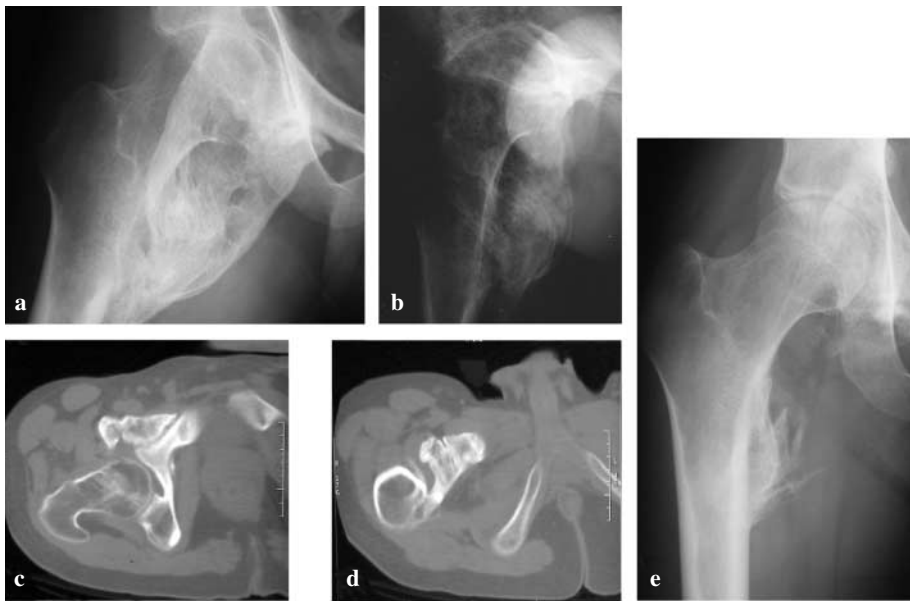
**Fig. 1a, b** An 11-year-old girl with osteoid osteoma of the surgical neck of the right femur, removed through Ludloff's anteromedial approach. **a** Preoperative radiograph, scintigraph and CT scan. **b** Immediate postoperative radiographs (anteroposterior and axial views)



**Fig. 2a-f** A 59-year-old man with traumatic dislocation of the hip and fracture of the femoral head. **a** Preoperative radiograph. **b-d** Manipulative post-reduction radiograph and CT scans show detachment of a large osteochondral fragment. **e-f** Radiographs one month after open reduction via Ludloff's approach and fixation with Kirschner wires

lesser trochanter and 6 anteromedial heterotopic ossifications in patients with a history of prolonged coma following head injuries (Fig. 3). In one patient afflicted by a soft tissue tumour (malignant fibrous histiocytoma), only the distal, extra-articular part of Ludloff's approach was used extending the exposure distally and protecting the main branches of the deep femoral artery.

No intra- or postoperative complications were noted. By applying the Ludloff approach in adult patients, we were able to remove intra- and extra-articular benign bony or cartilaginous tumors, as confirmed by fluoroscopy. In the young patient subjected to derotation osteotomy of the femoral neck for chronic epiphysiolysis, once having applied two intracapsular divaricators, this approach then



**Fig. 3a-e** A 17-year-old boy with hip ankylosis caused by voluminous anterior heterotopic ossification. **a, b** Preoperative radiography (anteroposterior and oblique views). **c, d** Preoperative CT. **e** Postoperative radiography (two months after surgery)

allowed us to expose the femoral neck in its entirety and to carry out the appropriate bony resection and successive fixation with Kirschner wires. This was the only case in which immobilization of the hip by means of a plaster spica was deemed necessary. Both the osteochondroma and the osteoid osteoma of the lesser trochanter were removed completely, allowing for subsequent histological confirmation of the diagnosis. The anteromedial heterotopic ossifications were entirely or partially removed, re-establishing a more than satisfactory mobility on all planes in the operated hip. In the elderly patient afflicted by histiocytoma this approach allowed for total removal of the pathological mass (10 cm x 5 cm), which was then sent for histological examination. Following ventral capsulotomy, in the 3 patients with fractures of the femoral head, Ludloff's approach allowed for a perfect reduction of the main osteochondral fragment, its fixation with Kirschner's wires and the removal of the minor fragments.

The patients underwent clinical and radiographic follow-up examinations after a mean period of 7 years (range, 2–10 years). No recurrence of the skeletal pathology was observed. The surgical scar has always proved to be aesthetically acceptable, not at all disfiguring. Functional recovery has been complete and rapid in all cases.

## Discussion

It is quite clear from our experience, as well as that of others [15], that the Ludloff approach can be easily used to resolve a range of disorders other than the congenital ones for which it was originally employed. With relatively non-traumatic surgery this approach, in fact, provides a clear view of the iliopsoas tendon, the anteromedial aspect of the hip joint capsule, the femoral head and neck and, not least, the pubic part of the acetabulum [1]. Hence this approach allows for open biopsies for diagnostic clarification regarding the hip joint, surgery to the femoral head and neck and exeresis of extra-articular pathologies located anteromedially. The surgical approach is anatomical and does not require detachment of muscles or tendons. These factors permit early joint mobilization and a subsequent functional recovery without any risk of heterotopic ossifications. Blood loss is extremely limited. Postoperative immobilization is unnecessary except in specific cases. The wound is always thin, slightly evident and quite different from the scarring seen, for example, with the Smith-Petersen approach. Therefore we consider that this approach deserves to be better known and to be used more frequently in selected cases that would otherwise be difficult to resolve.

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