

Application of minimally invasive lateral auxiliary incision technique in AO-OTA 31-A1 intertrochanteric fracture

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Research Article

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Abstract

Objective

This study aimed to explore minimally invasive lateral auxiliary incision technique for the 31-A1 intertrochanteric fracture to correct the coronal plane deformity

Methods

Twelve patients with AO-OTA 31-A1 injury were treated with PFNA fixation using the minimally invasive lateral auxiliary incision. The blood loss, operation time, classification were observed and recorded. Patients were followed up retrospectively with routine post-operation visits for clinical and radiographic examination. The reduction quality was evaluated according to displacements of cortical thickness.

Results

The mean follow-up time was 15 months (range 12–21 months). The mean blood loss and operation time were 21.9 ± 5.7 ml (range 15-28ml) and 45.4 ± 7.5 mins (range 38-52mins) respectively. Patients experienced early weight-bearing ability, no fracture reduction loss. Due to the fracture reduction criterion, the results were good in 9 cases, acceptable in 3 cases.

Conclusion

minimally invasive lateral auxiliary incision technique is helpful for the 31-A1 intertrochanteric fracture to correct coronal plane deformity, which could achieve a good reduction in the coronal plane.

Background

Treatment of Intertrochanteric fractures remains a controversial topic in trauma orthopedics. The majority of these cases(AO-OTA 31-A1)could be successfully managed by close reduction[1, 2]. However, several fracture patterns are not amenable to longitudinal traction and internal rotation, require open reduction. Currently, there is no standard incision for managing irreducible intertrochanteric fractures, although various incisions have been described, including anterolateral approach and extended proximal approach[3, 4]. However, complications of these methods are relatively common, such as artery and vein injuries, limited operating space et al[5, 6]. In order to overcome these problems, The purpose of this study was to provide a small lateral incision to assess the clinical safety and the therapeutic outcomes for the treatment of the intertrochanteric fracture.

Patients And Methods

We reviewed all intertrochanteric fractures treated in our department from June 2018 to January 2020; a total of 12 patients including 10 females and 2 males (range 73-82years) with irreducible intertrochanteric fractures(AO-OTA 31-A1) were treated with open reduction by the auxiliary lateral approach(Fig. 1).

The preoperative radiographs of these patients showed that the fracture was comminuted (AO-OTA 31-A1). A characteristic feature was the loss of reduction during screw blade insertion. The operation was performed under C-arm fluoroscopy on a traction table with the patient in the supine position. A close reduction was performed in this group, however, a medially displaced proximal fragment occurred in AP view (Fig. 2A). After implanting an intramedullary screw, a small skin incision was performed. The incision was started at the point of 5-7cm distal and upward to the greater trochanter,3cm longitudinal incision was made.

We cut the tensor fasciae latae, lateral femoral muscle longitudinally, separated rectus femoris with periosteal dissector bluntly, touched the proximal medial edge of the fracture, pulled the proximal fracture with a gallbladder or a thyroid retractor (Fig. 2B). Good coronary reduction was obtained in the C-arm fluoroscopy, a guide needle of the spiral blade was inserted with pull maintenance (Fig. 2C). Finally, an appropriate length of the spiral blade was implanted (Fig. 2D). The incision shown in Fig. 3.

Postoperative management

Routine postoperative antibiotic medicine was performed on the cases for 24 hours to prevent infection. Low-molecular-weight heparin was used for 30 days to prevent deep venous thrombosis of the lower extremities.

A displacement of cortical thickness displays that there is contact between the proximal and distal fragments. Reductions were classified as good, acceptable, or poor. A good reduction was achieved when both the cortices were in contact on both the AP and lateral views. The reduction was classified as acceptable when there was cortical contact on either the AP or lateral view and as poor when none of the cortices was observed on both views.

The weight-bearing time was due to accompanying injury, the stability of fracture fixation. Patients were permitted to be part weight-bearing at 1 week after the surgery with a walking aid.

Follow-up

Patients were followed up at 1 month,2 months,3 months,6 months, and 1 year postoperatively for clinical and radiographic examinations. A-P, lateral x rays were included. The grade of reduction was evaluated according to the cortical thickness[7].

Results

Baseline data

2 males and 10 females with a mean age of 76.5 ± 3.7 (range 73-82 years) were included in our study. The mean blood loss and operation time were 21.9 ± 5.7 ml (range 15-28 ml) and 45.4 ± 7.5 mins (range 38-52 mins) respectively. According to the AO classification, 8 patients (66%) were categorized as belonging to 31-A1.2, 2 patients (16%) were defined as having 31-A1.3 respectively. General information of the data from the group was summarized in Table 1.

Table 1
Demographic information and clinical outcome measures

Patient number	Gender	Age(years)	Blood Loss(ml)	Operation Time(mins)	Reduction criterion
1	F	77	20	42	good
2	F	80	25	38	acceptable
3	F	73	28	52	good
4	F	76	26	47	good
5	F	82	18	40	acceptable
6	F	75	15	39	good
7	F	77	26	44	good
8	M	78	25	43	good
9	F	79	25	39	good
10	M	81	20	40	good
11	F	78	23	47	acceptable
12	M	76	25	41	good

Postoperative outcomes

Radiologically, the satisfactory reduction was obtained in all cases, no case of the cutout was observed in our group, the union was healed in all cases after 3 months postoperatively. All patients were available for a minimum of 1-year follow-up (average 16 months, range 13–22 months). All patients were permitted to handle part weight-bearing 1 week after operation. No patients asked for implant removed due to implant irritation.

Discussion

For the intertrochanteric fracture, the best location to obtain anatomy stability is medially [8, 9]. However, the medial region is unable to provide stability in comminuted fractures, attempts to reduce the medial buttress are different, we can sometimes obtain the anatomy reduction with closed methods, other

important techniques include Kirschner reduction, enlarge proximal incision, et, al. The one circumstance where these techniques won't work is when there is locked in the medial region of the proximal femur.

The key factors for the successful treatment of intertrochanteric fractures in the elderly are obtaining stable medical support, rigid internal fixation, good reduction, and early mobilization[10, 11]. To achieve these goals, anatomic reduction of the medial area of intertrochanteric fractures was chosen as an important method. Few studies have offered surgical tips to reduce medial displacement during implanting helical blade[12]. After several trial, the fracture could be reduced using a right-angle plier by a small auxiliary incision. Manipulating the right angle plier is required while installing a helical blade. Reduction was achieved in all cases. Although the fracture classifications are different, the fracture time could be reduced by avoiding repeated Steinmann's pins inserted percutaneously and hesitation for closed reduction.

In most cases reduction could be achieved by close reduction with longitudinal traction and slight internal rotation due to fracture classification[13]. However, several fracture patterns should need open reduction. Anterior lateral incision was suggested by Hockman[14], anterior lateral incision can be applied around the fracture to aid fracture reduction, however, long incision and more blood loss were disadvantages.

In our patients, we suggested a small direct lateral incision to expose the fracture and got anatomy reduction according to manipulating a right angle plier. Splitting tensor fasciae latae and vastus lateralis muscle could achieve fracture area safety, subperiosteal dissection is essential to avoid injury femoral artery and nerve.

Although this study was not prospective or randomized. Furthermore, too few patients were involved. A comparison was not designed because of unpredictable surgery. Despite these weak points, this study provided several useful results. The technique was performed only medially displaced occurred in AP view. By adding this simple technique (auxiliary incision technique), it may be possible to get an anatomic reduction in elderly patients with intertrochanteric fractures.

Conclusion

In conclusion, mini-open reduction by auxiliary lateral approach, as described in this article, has advantages in treating irreducible intertrochanteric fractures: making the excellent reduction, minimally invasive incision, permitting full weight-bearing ability early, and getting good functional recovery. However, there still exist several problems regarding sample size, operation time, and radiation exposure.

Declarations

Acknowledgements

Not applicable.

Authors' contributions

Jiakai Zhang contributed to study conception and research design. Yi Zheng, Junlong Wu, Jiakai Zhang performed the operations. Yi Zheng, Xinhua Yuan wrote the manuscript and revised it critically. Junlong Wu, Yihong Yin contributed to this work in postoperative follow-up and imaging data evaluation. Yi Zheng, Junlong Wu, Jiakai Zhang performed the patient perioperative treatment. All authors read and approved the final manuscript. All authors gave consent for publication.

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Availability of data and materials

The datasets used and/or analyzed during the current study available from the corresponding and first author on reasonable request.

Ethics approval and consent to participate

Ethical approval from the Ethics Committee of Hwamei Hospital was obtained for this study. We also followed the Declaration of Helsinki and its later amendments. Written informed consent was obtained from all participants.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Figures

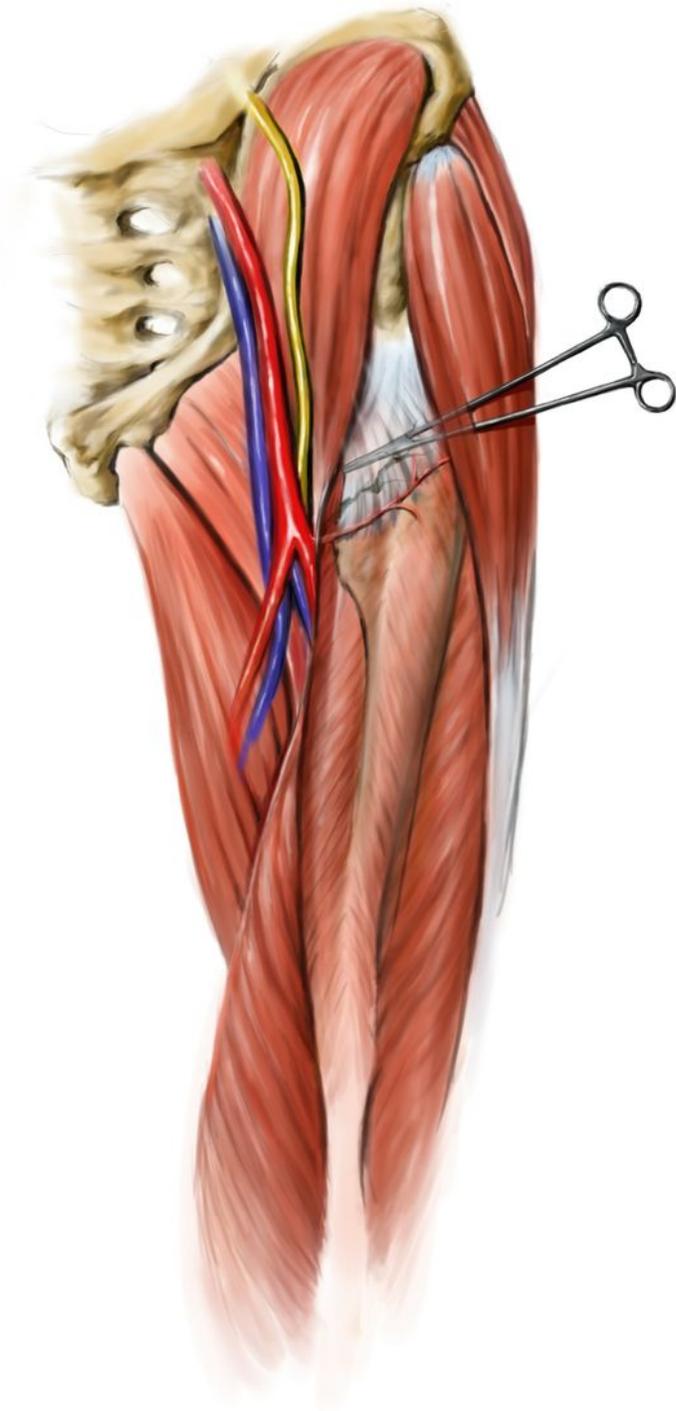


Figure 1

Schematic diagram

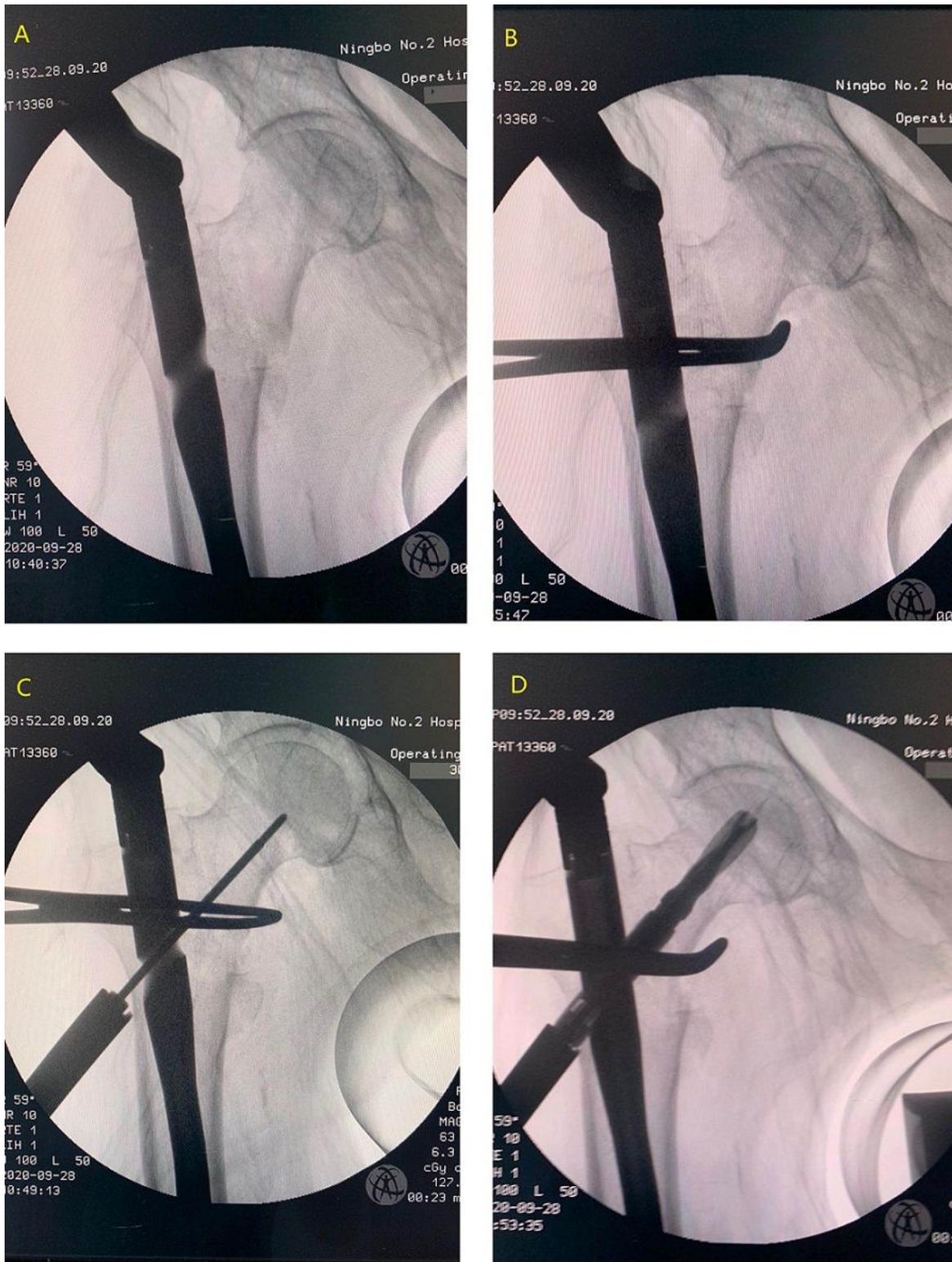


Figure 2

A Intramedullary nail placement with poor coronary reduction; **B** The proximal fracture was pulled with a gallbladder in minimally invasive lateral auxiliary incision to get good coronary reduction; **C** A guide needle of the spiral blade was inserted; **D** An appropriate length of the spiral blade was implanted



Figure 3

Photo of incision