Technical Note

A reduction clamp for an aiming component in associated acetabular fractures

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Abstract

Background: The treatment of acetabular fractures is complex and requires specialized equipment. However, all currently available instruments have some disadvantages. A new reduction clamp that can firmly enable reduction and not hinder subsequent fixation procedures for some special fracture types is needed.

Materials and Methods: In this study, we introduce a new acetabular clamp and its preliminary clinical application in three T-shaped acetabular fractures.

Results: This new clamp can successfully pull the posterior column back to the anterior column and firmly maintain the reduction. This clamp's aiming plate can facilitate the insertion of long lag screws. The clamp is also easy to assemble and use.

Conclusion: This reduction clamp is a useful instrument that can facilitate open reduction and internal fixation of acetabular fractures.

Key words: Acetabular fracture, open reduction, reduction clamp

MeSH terms: Acetabulum, fracture fixation, internal fracture fixation, clamps, surgical

Introduction

Acetabular fracture is usually caused by high energy trauma. If not properly treated, these fractures result in severe disability. Open reduction and internal fixation is the standard treatment for acetabular fractures displaced more than 2 mm.[1] Poor reduction of the acetabular joint surface foretells poor function of the affected hip joint.[1] Until date, the treatment of complex acetabular fractures remains a challenge even to the experienced trauma surgeons.[2-5] Specialized pelvic implants, instruments and facilities are required for optimal treatment of these fractures. Pelvic clamps developed by the Association for Osteosynthesis/Association for the Study of Internal Fixation (AO/ASIF) group and bone hooks are the most commonly used instruments. Each instrument, however, has its own disadvantages and new instruments are required for some special acetabular fractures. We invented a reduction clamp to facilitate the open reduction and internal fixation of associated acetabular fracture types, such as the complete both column fracture, anterior column and posterior hemitransverse fracture and T-shaped fractures. This clamp is mainly used in the anterior or ilioinguinal approach, for reducing the posterior column to the anterior column and for maintaining reduction. In this study, we present the usage and preliminary information on this reduction clamp.

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Materials and Methods

Our reduction clamp comprises a proximal reduction hook, two female screws, an aiming plate to guide drills in the correct direction, a hexagonal socket set and a main pole, the proximal end of which contains threads and its distal end contains a hook and a handle [Figure 1].

A standard ilioinguinal approach was used with the patient in supine position on a radiolucent table and the acetabular fracture was visualized. The internal obturator muscle is elevated from the quadrilateral surface with a retractor, most of the quadrilateral surface is visualized and the edge of the greater sciatic notch could be palpated by fingers. After hematoma and debris are cleaned up, the fracture configuration could be identified and the acetabular fracture can be reduced. For different fracture configurations, different reduction strategies are adopted and several attempts are

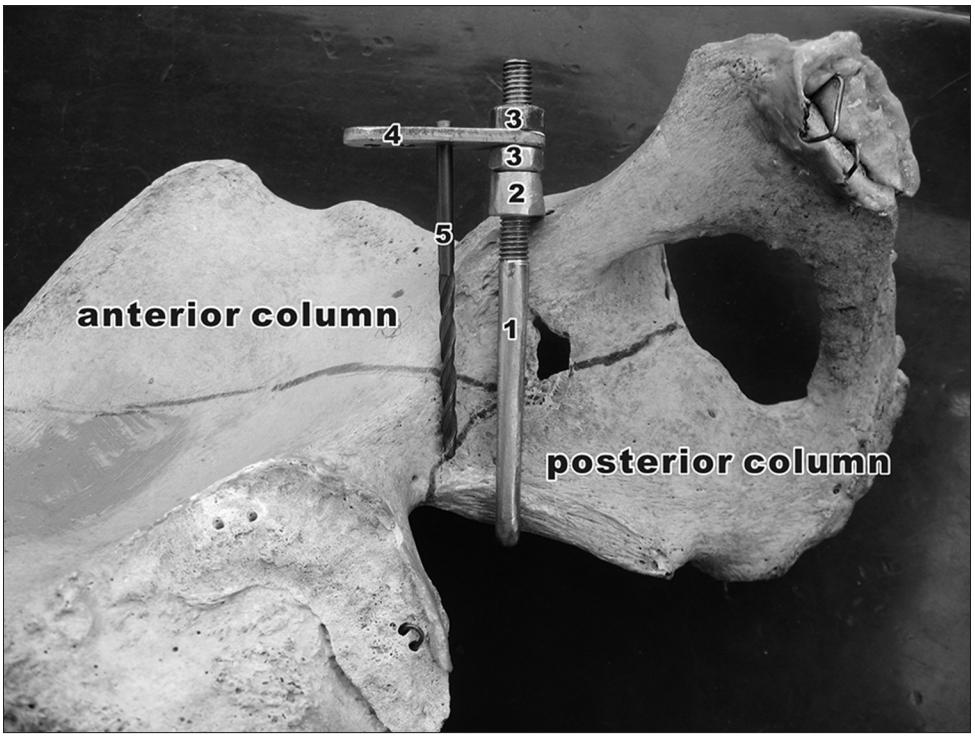

Figure 1: A schematic photograph showing the components of acetabular fracture reduction clamp. 1 main pole, 2 proximal hook, 3 two female screws, 4 an aiming part, 5 the drill

given before the final successful reduction. One of the most commonly adopted strategy is to reduce anterior column to the proximal part of fractured acetabulum and then pull the posterior column onto the anterior column. The detail of this strategy is described as follows. First, the main pole of this instrument was inserted along the quadrilateral surface of the acetabulum. The hook was positioned to catch the greater sciatic notch of the posterior column on the part just below the fracture line. Then, a proximal reduction hook was added along the main pole from its proximal end and was adjusted to hold the anterior column at the arcuate line or iliopubic eminence. A female screw was used and tightened by a hexagonal socket set to close the proximal and distal reduction hooks. Thus, the posterior column was reduced to the anterior column. Any rotation of the fracture fragments was carefully corrected. After the fracture is reduced, the female screw is tightened further to hold the reduction temporally. The aiming plate was added and another female screw was added. A suitable point for inserting a lag screw was selected and the last female screw was tightened by the hexagonal socket set so that the aiming plate was perpendicular to the main pole. A drill was passed through the selected hole in the aiming plate thus, the drill was parallel to the quadrilateral surface to prevent penetration into the acetabular joint. The last female screw was loosened and the aiming plate was rotated aside or taken out after confirming lack of penetration into the joint cavity. A length gauge was used to measure the length of the lag screw and the selected screw was used for fixation. After finishing several long lag screws and some K-wires, the reduction clamp was taken out and a suitable reconstruction plate is selected and adjusted based on the bone shape and surface. After the reconstruction plate was fixed by screws, the reduction and internal fixation was confirmed on C-arm fluoroscopy. The incision closed in layers.

Results

Three T-shaped acetabular fractures were reduced and fixed by this clamp [Figure 2]. The mean operation time was 3.5 h, which is similar to our previous operation time.

Discussion

Associated acetabular fractures are difficult to deal with, even for the experienced trauma surgeon. Reducing and achieving the configuration of the injured acetabular joint is of paramount importance.[6] Open reduction and internal fixation is the standard treatment for displaced ones if no contraindication exists.[7-10] Special tools are needed to facilitate reduction and temporal fixation during the surgical treatment for associated acetabular fractures; these tools, which are currently being used, are still being refined.[11-19] A bone hook is the simplest tool and is used frequently; however, it also possesses obvious disadvantages. First, maintaining consistent pulling of the bone hook requires a strong assistant who will not tire easily. Once the assistant

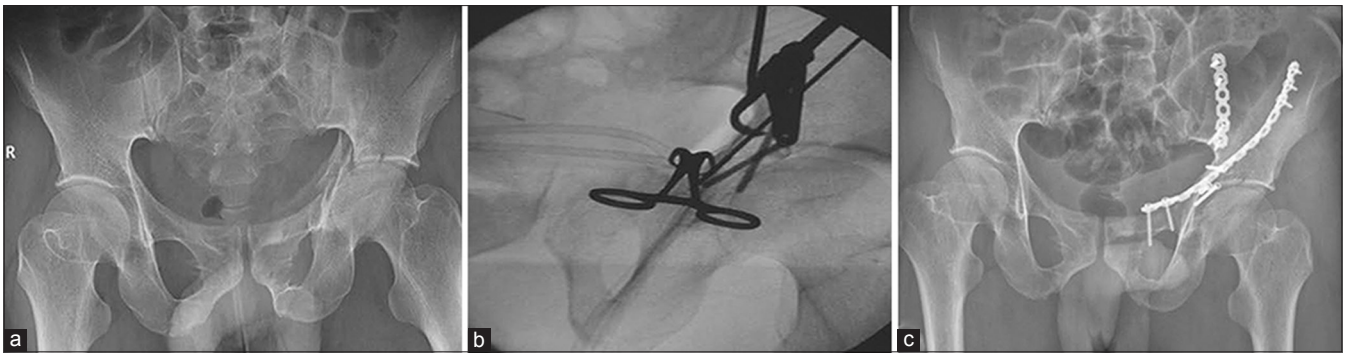

Figure 2: (a) X-ray pelvis with both hip joints anteroposterior view of a man, 46 year-old showing T-shaped acetabular fracture in his left hip. (b) Fluoroscopy image showing the usage of reduction clamp during operation. (c) Postoperative film showing that the fracture is well reduced and fixed with lag screws and reconstructive plates

is fatigued, the reduction of the acetabular fracture will easily be lost during internal fixation. Second, the adjacent neurovascular bundle composed of the sciatic nerve, superior gluteal artery and nerve and obturator artery could be injured if the bone hook accidentally slips off. Pelvic clamps developed by the AO/ASIF group for reduction of fracture fragments are especially helpful.[20] In some occasions, especially in oriental patients with a small body frame work, the bone hook is too large and inconvenient, which may cause some trouble in the process of reduction and plate fixation. Our acetabular reduction clamp, which is smaller than the AO clamp, keeps the reduction firm and persistent. The aiming plate ensures the accuracy of inserting long lag screws to prevent penetration into the hip joint. Our preliminary three cases verify these advantages; however, more number of cases are still needed to demonstrate its advantage. Our reduction clamp may also facilitate the open reduction and internal fixation of other associated acetabular fractures, such as the complete both column fracture, anterior column fracture and posterior hemitransverse fracture.

Conclusion

This acetabular reduction clamp is easy to be use. It can also reduce the posterior column to the anterior column and keep the reduction stable. Moreover, it provides guidance for inserting long lag screws. It facilitates the open reduction and internal fixation of some types of associated acetabular fractures, especially for tiny oriental patients. In comminuted quadrilateral plate fractures or those with acetabular roof/femoral head impaction, this clamp should not be used because compression using the clamp would lead to narrowing or malrotation of the fractured ends and eventual poor results.

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