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PROSPECTS FOR THE USE OF A NEWLY DEVELOPED PLATE IN BONE OSTEOSYNTHESIS FOR ACETABULAR FRACTURES

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Abstract. *Acetabular fractures are a common type of injury in orthopedic and trauma practice that can lead to serious complications. These fractures are particularly prevalent among elderly patients, as bone tissue weakens with age and cases of osteoporosis increase. Acetabular fractures often require extensive surgical interventions, followed by long-term rehabilitation for full recovery. This article analyzes the possibilities of effectively treating acetabular fractures using a newly developed surgical fixation method. Compared to traditional methods, the new method offers several advantages. The primary goals of this new approach are to reduce patient pain, shorten the duration of surgery, and expedite overall recovery*

Key words: acetabulum, osteoporosis, surgical fixation.

The urgency of problem: Acetabular fracture treatment is one of the complex processes in orthopedics and trauma care, where the fixation methods and devices used play a significant role in the effectiveness of the recovery process. Therefore, recent literature focuses on developing and studying new fixation methods and materials for fractures, particularly new types of plates with high biocompatibility with bone tissues.

Many recent studies recommend internal osteosynthesis as the primary method for treating acetabular fractures. For example, Ivanov and Kuznetsov (2020) noted the effectiveness of high-strength plates with low toxicity and high biocompatibility. These plates adapt well to the human body and reduce the need for revision surgery.

Research on stainless steel, titanium, and other biocompatible materials has shown that these materials are highly effective due to their stability and low toxicity within the body. Chernyshov and Malyutina (2017) emphasized that plates made from such materials have minimal toxic effects on the body and promote faster recovery.

Classic osteosynthesis procedures often present challenges due to time and complexity. In clinical trials on new plates, Saveliev and Morozov (2012) highlighted reduced surgical time, decreased pain, and shortened rehabilitation periods, which demonstrate the high efficacy of these newly developed plates. Many authors have highlighted the necessity of using new materials for acetabular fracture treatment to improve precision, stability, and reduce the need for revision surgery. Thompson and Smith (2021) conducted a comparative analysis of different types of plates, noting the unique advantages of each. These findings provide a foundation for the potential future application of new plates in clinical practice.

The aim of the study to analyze the effectiveness of using a newly developed plate in the process of bone osteosynthesis for the treatment of acetabular fractures.

Research methods and methodology. rotation." Additionally, it was possible to "remove" the femoral head in the virtual 3D model of the pelvis, which provided a complete view of the acetabular joint surface. This was especially effective for detecting intra-articular displacement of small fragments that could hinder the alignment of the femoral head. These fragment sizes varied from 1x1 cm to 3x2 cm. All of this made it possible to clarify the diagnosis and establish a strategy before surgery.

In the preoperative period, all patients underwent CT with 3D reconstruction. The standard thickness for axial slices in this area was 3 mm for the acetabular region and 5 mm for examining other sections of the pelvis. The study allowed for a more accurate assessment of the nature of joint surface destruction, the displacement and orientation of acetabular fragments, the presence of intra-articular bodies, damage to the greater trochanter, injury to the sacroiliac joint, pelvic hematoma, and the presence of fluid in the abdominal cavity.

The head, chest, and abdominal cavity of the injured patients were examined using CT. To determine the localization of blood vessels, their relationship with bone fragments, and diagnose possible injuries, CT angiography with intravenous contrast agents was performed.

In the postoperative period, the quality of acetabular fragment reposition, joint surface congruence, and the position of metal structures were evaluated based on CT data. This technology also provides information for detecting late complications.

Radiographic measurements were made according to Matta to assess the quality of the reposition:

Anatomic reposition: Displacement of no more than 1 mm in any of the three radiological projections.

Satisfactory reposition: Combined displacement of 2-3 mm in radiological projections.

Unsatisfactory reposition: Displacement of more than 3 mm.

The treatment of patients with acetabular fractures using various surgical methods was distributed as follows:

Group I (35 patients, 41.2%): Bone surface osteosynthesis was performed with a newly developed plate (AO).

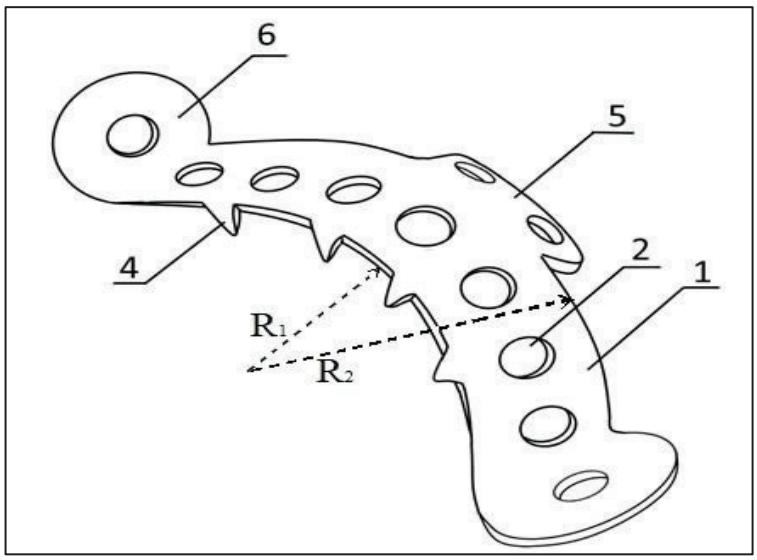
Monolithic edge fractures: Even when the angle of edge defects was large, osteosynthesis was performed using screws and wires. Osteosynthesis with screws and Kirschner wires was applied to 30 patients (35.3%) within 3 to 7 days after the injury.

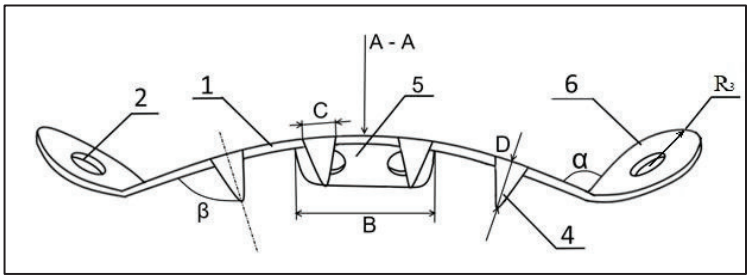
External fixation device (EFD): This was used for 20 patients (23.53%) with a polytrauma diagnosis and applied within 3-5 days post-injury. In patients with unstable injuries of the pelvic and acetabular bones, stabilization was performed using a modular rod apparatus in a "hip-pelvis" configuration to fix the pelvis and injured hip joint. The main task of this surgical method is to align the bone fragments in a closed, non-invasive manner and maintain their correct position.

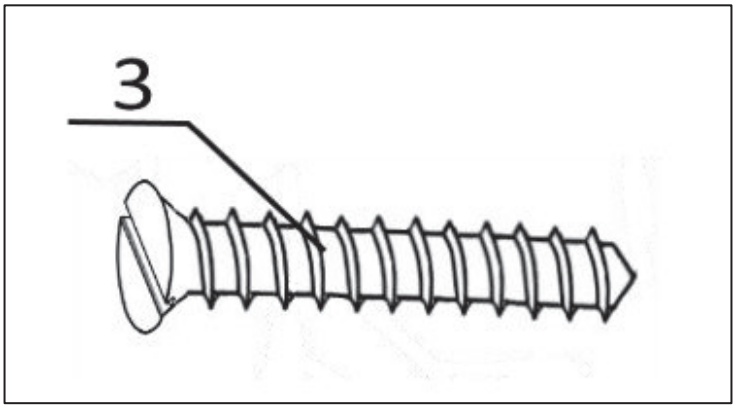
All surgical procedures were carried out under the control of an electronic-optical converter (EOC) in the operating room. Long-term outcomes were studied in 67 patients (78.8%) over a period of 6 months to 5 years post-surgery.

Results of the research: The device for treating acetabular fractures is designed to provide stable and rigid fixation of bone fragments in complex fractures and to create congruence between different parts of the acetabulum. The device includes a smoothly curved, arch-shaped plate with locking holes for screws (Figure 3.2). The plate features four evenly spaced triangular teeth with a base of 1.5 mm and a height of 3 mm, located on the edge of the smaller arch and positioned at a 90-degree angle, providing strong fixation for fragments.

In the center of the larger arch is a plate measuring 15x25 mm, positioned at an angle ranging from 100 to 130 degrees, with additional locking holes for securing to the pelvic bones. At the ends, the plate has ear-shaped flanges with a radius of 10 mm, set at an angle of 125 to 130 degrees, which are also intended for secure attachment to the pelvic bones (fig-1, fig-2, fig-3).







Conclusions:

The newly developed plate provides effective stabilization for acetabular fractures, particularly complex, multi-fragmentary types. The device's design, with locking mechanisms and specialized angles, allows for rigid fixation, which is crucial for ensuring proper alignment and reducing the risk of fragment displacement.

The use of strain gauge sensors allowed for precise measurement of stresses and displacements in the bone structure without impacting the natural biomechanics of the bone. This method contributes to a deeper understanding of fracture dynamics and the effectiveness of osteosynthesis devices, supporting more reliable data collection for future orthopedic treatments.

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