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# Clinical Results Of Treatment Of Distal Humerus Fractures

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# Disclosures:

The study was carried out in accordance with the ethical principles presented by the World Medical Association Declaration of Helsinki, 1964, as amended in 2011.

The study was approved by the local bioethics committee (Bioethics Commission of Oles Honchar Dnipro National University, protocol № 9 of 15.09.2021).

Informed consent was obtained from all patients included in the study.



# INTRODUCTION

- Fractures of the humeral condyle (HC) are common in all age groups and account for 0.5-5.0% of musculoskeletal fractures and about 30.0% of fractures in the elbow joint (EJ). At the same time, intraarticular fractures of the HC are reported in 10.0-24.0% of all intraarticular injuries in adults.
- Treatment of HC fractures is aimed at anatomical restoration of the damaged segment in order to reproduce the adequate function of the EJ necessary for daily life activity of the patient, which is characterized by the value of the Morrey range of motion of 100°.
- Developed numerous ways of operative and conservative treatment of HC fractures indicate the search for optimal treatment tactics. Conservative methods of treatment for HC fractures often lead to the formation of contractures of the EJ and cause treatment complications if used unreasonably and incorrectly. Surgical treatment is used for comminuted fractures, displaced fractures, and intraarticular fracture localization. Currently, the surgical treatment of HC fractures is based on the principles proposed by the AO group.
- Currently, there are various designs and approaches for stable-functional osteosynthesis using plates, screws, wires, wire, and external fixation devices (EFD), which indicates that there are unresolved issues of stable fixation of fracture fragments and early mobilization of movements in the EJ. At present, the predominant methods of surgical treatment are those of the AO group associated with open reduction and the use of plates and screws for osteosynthesis, as well as methods of external fixation with the use of EFD.
- To date, the problem of surgical and conservative treatment of HC fractures cannot be considered solved, since the disability rate due to these injuries ranges from 5.8% to 45.8%. Complications of HC fractures are caused by the intraarticular localization of the fracture and damage to the surrounding structures. Contractures of the EJ, paraarticular ossifications, and pseudarthrosis predominate among the causes of disability.



# Objective

To improve the treatment results of the injured with humeral condyle fractures by developing differential treatment tactics taking into account the biomechanical characteristics of the injured anatomical structures.



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# MATERIAL AND METHODS

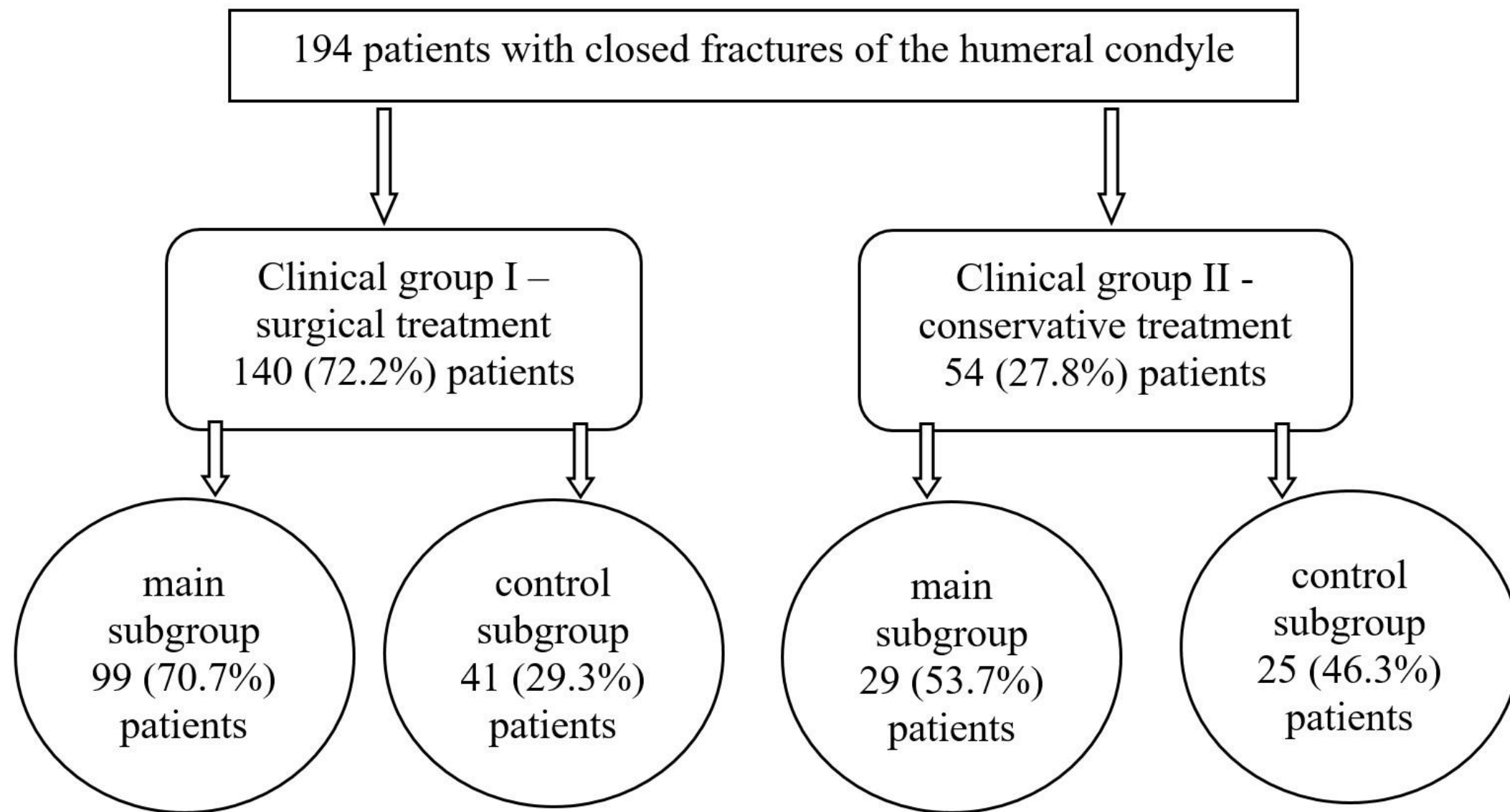
- The study analyzed the results of treatment of 194 patients with closed fractures of the humeral condyle with an average age of 50.2 years (from 19 to 89 years). There were 75 (38.7%) men and 119 (61.3%) women (Table 1).
- Depending on the method of treatment, patients were divided into two clinical groups - I surgical and II conservative treatment. Each group of clinical observation consisted of a main and control subgroup (Fig.).
- The AO classification was used to distribute patients according to the type of fracture. There were 15 (7.7%) patients with extra-articular fractures of type 13A, 40 (20.7%) with partial intra-articular fractures of type 13B and 139 (71.6%) with complete intra-articular fractures of type 13C.
- Methods of treatment in group I were: osteosynthesis with K-wires in 10 (7.1%) patients, osteosynthesis with external fixation devices (EFD) in 10 (7.1%) patients, osteosynthesis with screws in 17 (12.2%) patients, combined osteosynthesis in 49 (35.0%) patients and osteosynthesis with plate in 54 (38.6%) patients. Methods of treatment in group II were: cast immobilization in 43 (79.6%) patients and continuous skeletal traction in 11 (20.4%) patients.
- Statistical processing of the study results was performed using biostatistics methods implemented in the software packages Statistica v6.1 (Statsoft Inc., USA, licensed № AJAR909E415822FA) and MS Excel for Windows®.



# Table 1. Division of patients by gender and age

Gender		Age								Total (n, %)
		up to 20 years	21-30	31-40	41-50	51-60	61-70	71-80	Over 80 years old	
Males	n	0	22	16	11	13	6	4	3	75 (38.7%)
	%	0.0%	29.3%	21.3%	14.7%	17.3%	8.0%	5.3%	4.0%	
Females	n	1	12	17	17	25	20	21	6	119 (61.3%)
	%	0.8%	10.1%	14.3%	14.3%	21.0%	16.8%	17.7%	5.0%	
Total	n	1	34	33	28	38	26	25	9	194
	%	0.5%	17.5%	17.0%	14.4%	19.6%	13.4%	12.9%	4.7%	100%

# Division of patients into clinical groups and subgroups depending on the method of treatment of HC fractures



# RESULTS

- At the end of the follow-up period for 194 patients, the mean range of active flexion/extension movements in the EJ was  $110.5 \pm 1.2^{\circ}$  ( $50^{\circ}$  to  $140^{\circ}$ ), the mean score on the Mayo clinic scale was  $81.7 \pm 0.9$  (45 to 100) and the Score Scale was  $62.7 \pm 0.7$  (38 to 76) (Table 2).
- Excellent functional results were obtained in 95 (49.0%) patients, good in 41 (21.2%), satisfactory in 28 (14.4%), and unsatisfactory in 30 (15.5%) patients (Table 3).
- The best results of treatment and a shorter period of disability were in 55 (28.4%) patients with type 13A and 13B fractures, the worst results of treatment and longer periods of disability were observed in 139 (71.6%) patients with type 13C fractures, which is due to the nature of the injury and the used treatment methods. Type 13C fractures were characterized by a more severe injury and required more intensive treatment than type 13A and 13B fractures. Complications were more often observed in patients of the control subgroups, where differentiated treatment approaches were not used. Unsatisfactory results of treatment were noted in 30 (15.5%) patients with type 13C fractures and were associated with the development of flexion-extension contractures (the range of motion in the EJ at the end of the follow-up period was less than  $100^{\circ}$  (from  $50^{\circ}$  to  $100^{\circ}$ ), in 5 patients the cause of contracture had heterotopic ossification.





# Table 2. Characteristics of the results of treatment of patients of I and II clinical groups (M±m)

Characteristics	I group (n=140)		II group (n=54)	
	Main subgroup (n=99)	Control subgroup (n=41)	Main subgroup (n=29)	Control subgroup (n=25)
The average range of motion, degrees	116,2±1,2	96,6±2,5	121,7±2,9	98,0±2,9
The average duration of rehabilitation treatment, weeks	8,7±0,1	9,7±0,4	7,7±0,3	10,3±0,3
The average duration of time disability, weeks	11,3±0,3	14,3±0,5	8,5±0,4	13,7±0,4
The average score on the Mayo scale, score	84,7±0,9	73,7±1,3	91,4±2,4	71,8±2,2
The average score on the Score Scale, score	64,7±0,6	56,6±1,2	68,9±1,6	57,3±1,8



Table 3. Comparative characteristics of the results of treatment of patients I and II clinical groups (M±m)

Results of treatment	I group (n=140)				II group (n=54)			
	Main subgroup (n=99)		Control subgroup (n=41)		Main subgroup (n=29)		Control subgroup (n=25)	
	n	%	n	%	n	%	n	%
<b>Excellent</b>	48	48,5	15	36,6	22	75,9	10	40,0
<b>Good</b>	26	26,3	8	19,5	3	10,3	4	16,0
<b>Satisfactory</b>	15	15,1	6	14,6	3	10,3	4	16,0
<b>Unsatisfactory</b>	10	10,1	12	29,3	1	3,5	7	28,0
<b>Total</b>	<b>99</b>	<b>100</b>	<b>41</b>	<b>100</b>	<b>29</b>	<b>100</b>	<b>25</b>	<b>100</b>



# CONCLUSIONS

- The treatment of humeral condyle fractures is characterized by unsatisfactory results and complications in 18.0-85.0% of patients and is the cause of disability in 18.0-20.0% of patients. The most frequent cause of complications is the incorrect choice of the treatment method, technical errors in performing osteosynthesis, and prolonged immobilization of the elbow joint, which leads to the formation of contractures, ankylosis, and heterotopic ossification.
- Fractures without fragment displacement or with intraarticular fragment displacement up to 2.0 mm and the perspective of consolidation within 3-4 weeks after injury are indications for treatment with the cast immobilization method. The continuous skeletal traction technique for humeral condyle fractures is of limited use and is indicated for supracondylar fractures with displacement when other interventions cannot be performed.
- The preferred methods of fixation are osteosynthesis with screws, plates, external fixation devices, and combined osteosynthesis. K-wires osteosynthesis is reasonable for non-comminuted fractures of the humeral condyle. External fixation devices are used for non-articular condyle fractures, supracondylar and intraarticular fractures of the humerus. Osteosynthesis with screws is justified for fractures of the condyles, capitulum fractures, and the humerus block. Plate osteosynthesis and combined osteosynthesis - for comminuted fractures of the humeral condyle with fragment displacement.
- The biomechanically justified approach to the choice of treatment method and fixation structures in the surgical treatment of humeral condyle fractures allows us to reduce the risk of complications and provides an opportunity to increase the final functional outcome by 19.2% ( $p < 0.001$ ) compared with the control group.
- The differentiated tactics of conservative and surgical treatment of fractures of the humeral condyle permitted to obtain positive results in 92.2% ( $p < 0.001$ ) of patients in comparison with 89.4% ( $p < 0.001$ ) of the control group and decrease the number of complications by 20.2% ( $p < 0.001$ ).



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