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## Long Bone Defect Classification: What It Should Be?

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### Introduction

Dr. Maurice E. Muller said that classification is useful only if it considers the severity of the bone lesion and serves as a basis for treatment and for evaluation of the results. Very useful and practical Muller-AO of long-bone fractures classification was developed on this principle [1]. Unfortunately, the Developed in Ilizarov Kurgan Center classification are intended only for use of the Ilizarov method [2-4]. The other group of classifications [5-9] designed to determine the optimal option of revision arthroplasty.

### Aim

To develop universal classification of long bone defects.

### Methods

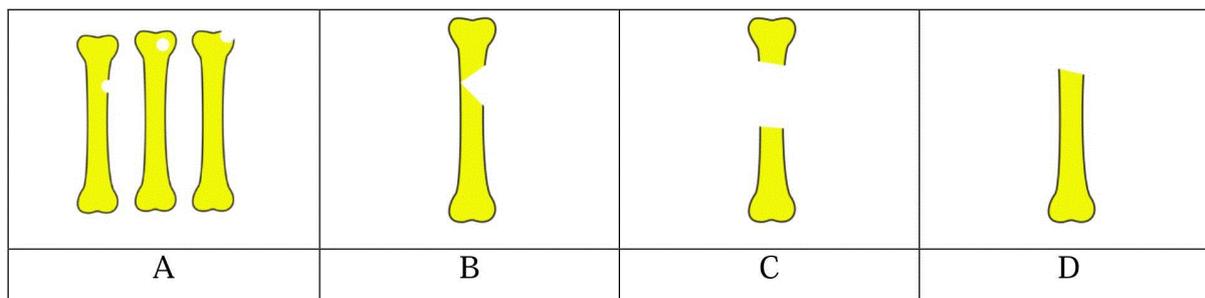
The principles of Muller-AO of long-bone fractures classification were used: from simple to complex, with an alphanumeric designation of a particular type of pathology.

### Results

The defects of each bone segment are divided into four types and with further subdivision into three groups and their

subgroups generating a hierarchical organization in triads (**Figure 1**).

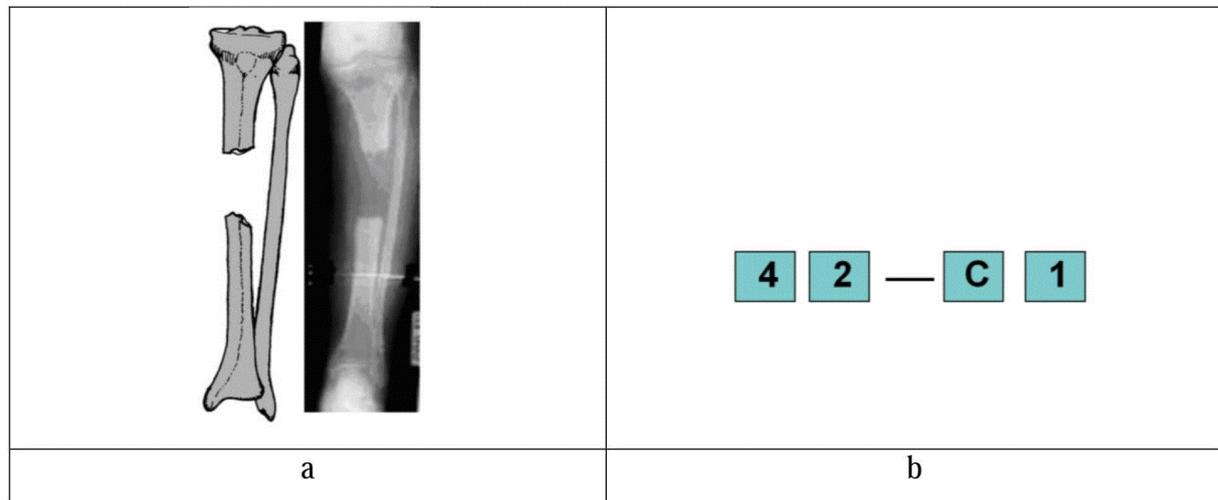
- A - Limited defects (<20%)
  - A1 - Diaphyseal
  - A2 - Metaphyseal
  - A3 - Epyphyseal
- B - Bone fragments have contact
  - B1 - Full contact with the anatomical shortening
  - B2 - Limited contact without anatomical shortening
  - B3 - Limited contact with anatomic shortening
- C - Bone fragments have no contact (segmental defects, "defect-diastrase")
  - C1 - Segmental defects without shortening
  - C2 - Segmental defects with shortening
  - C3 - Subtotal defects
- D - Complete articular defects
  - D1 - Epiphyseal
  - D2 - Epimethaphyseal
  - D3 - Epimethadiaphyseal
  - D4 - Amputation



**Figure 1:** Types of long bones defects. A: Limited defects; B: Bone fragments have contact; C: Bone fragments have no contact (segmental defects, "defect-diastrase"); D: Complete articular defects.

Like in Muller-AO fractures classification numerical designation of bones and segments are used (**Figure 2**). In angular deformity true shortening (defect) should be determined after modeling deformity correction. Bone defects can be associated with soft-tissue defect, infectious process,

neuro-vascular disorders, deformation of the segment, devitalisation of bone fragments, etc. In these cases additional appropriate classifications, including developed by the AO, should be used.



**Figure 2:** An example of the bone defect classification. a: Scheme and roentgenogram; b: Result of classification.

## Conclusion

The proposed classification allows identifying priority treatment methods. For example, for "A" different kinds of free bone grafting, dependent on degree of pathology. For "B" free and vascularized grafting. For "C" a variety of Ilizarov techniques. For "D" arthroplasty and prosthetics. Undoubtedly, the development of methods bone defect treatment will require improving classification that has been happening with the Muller-AO fractures classification.

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