ALPHANUMERIC CODIFICATION IN COMPLEX TRAUMATIC LESIONS OF HAND DISTAL TO CARPAL BONES

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INTRODUCTION

Hand is comprised of many units, fingers, all of which can be influenced by a complex trauma to the hand. Thus we can have complete or incomplete amputation of a finger, devascularization and/or complex fractures of another finger. Complex traumas of hand can be defined as lesions involving more than one functionally important anatomic elements (ex. vessels, nerves, tendons, bones).1

Most of the present classifications were used mainly in orthopedics and aimed at the bone lesions mainly in order to standardise the treatment in relation to the type of fracture. A classification including all forms of fracture was developed by Muller.2,3 For bone lesions of hand there is alphanumeric codification of location as well as severity of the fracture.4 Orthopedic surgeons have long been trying to associate alongwith the bone lesions a classification for concomitant soft tissue injuries without a detailed description though, only in order to individualise therapeutic options. Gustillo’s classification modified in 1984, permitted an evaluation of fractures associated with soft tissue lesions.5,6 Later on, AO/ASIF classification detailed the soft tissue lesions grading them in five levels of severity.7,8

The multitude of anatomic elements involved in such a small surface as well as the variety of lesions makes it difficult for this classification to fulfill all the...
demands for a hand surgeon a detailed and precise description of all lesions along with their severity is compulsory for decision regarding treatment options. Likewise for research, any comparative study requires a comparison within the same category which involves existence of clear formed notions about these categories.

The purpose of this study is to codify the lesions according to an alphanumeric codification based on their location and severity, included in fact into a diagnostic study.

MATERIAL AND METHODS

We performed a retrospective study on 68 patients with complex hand trauma distal to the carpal bones treated in our clinic between 2007-2008, by codifying their lesions according to the algorithm hencementioned. Alphanumeric codification was done according to:
- Initial examination (according to a standard examination chart);
- Initial photographs (all clinical cases in casa austria are pictured);
- Radiographs.

Alphanumeric codification was done including as components: (Table 1)

Table 1. Elements for alphanumeric codification.

<table>
<thead>
<tr>
<th>Ray</th>
<th>Osteoarticular system</th>
<th>Vascular system</th>
<th>Nervous system</th>
<th>Tegument</th>
<th>Musculotendinous system</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Location</td>
<td>Lesion</td>
<td>Location</td>
<td>Lesion</td>
<td>Location</td>
</tr>
</tbody>
</table>

For the same digital ray, multiple lesions for the same anatomic element are codified separately for each location.

Amputation is codified only for vascular system.

Tendon lesions

- T₁ - partial section of a tendon;
- T₂ - complete section of a tendon;
- T₃ - tendon defect/dilaceration;

Location of tendon lesions

It is codified with two numbers, first representing the type of tendon and the second representing the zone of tendon affected.

1. Extensor tendon:
   - 1 - proximal to PIP;
   - 2 - distal to PIP;

2. Deep flexor:
   - 1 - Zone 1;
   - 2 - Zone 2;
   - 3 - Zone 3;

3. Superficial flexor.

Nerve lesions

- N₁ - Contusion
- N₂ - Complete sectioning
- N₃ - Nerve defect

Location of nerve lesions

It is codified with two numbers: 1 for digital nerve and second number representing radial(1) or ulnar (2) border. For motor branches of median and ulnar nerves numbers 2, 3 are used respectively.

1. digital nerve;
2. ulnar border;
3. radial border;
4. recurrent branch median nerve;
5. deep branch of ulnar nerve.

Vascular lesions

- V₁ - without devascularisation;
- V₂ - with devascularisation;
- V₃ - amputation.

Location of vascular lesions

Codification is done as for the bone lesions.

Osteoarticular system

Diaphysis fractures are codified as:

- A₁ - simple fracture;
- A₂ - cominutive fracture;
- A₃ - bone defect.

Joint lesions are codified as:

- C₁ - closed luxation;
- C₂ - open luxation;
- C₃ - intraarticular fracture;
- C₄ - joint surface defect >75%

Location of fracture or joint lesion

Location of fracture is codified in two numbers, first representing the segment of the bone with respect to the digital ray (0 for metacarpal, 1 for phalanx 1, 2 for F2 and 3 for F3).
Second number represents the portion of bone affected: proximal 1, middle 2, distal 3.

**Skin and its appendages**

Cutaneous open lesion (integument open):
- IO₁ - wound < 2 cm;
- IO₂ - wound > 2 cm;
- IO₃ - small skin defect;
- IO₄ - large skin defect.

Cutaneous closed lesion (integument closed):
- IC₁ - contusion without dilaceration;
- IC₂ - abrasion, circumscribed decolation;
- IC₃ - extensive decolation, closed;
- IC₄ - necrosis due to contusion on whole thickness.

Location of skin lesions:
- 1 - palmar surface:
  - 1 - mid-palmar;
  - 2 - fingers till pulp;
  - 3 - pulp;
- 2 - dorsal surface:
  - 1 - hand;
  - 2 - fingers till nail complex;
  - 3 - nail complex.

**EXAMPLES:**

**Case 1:**

**Diagnosis:** Complex trauma through torsion-contusion (chainsaw), left hand (nondominant) with incomplete amputation at F1 index finger, devascularisation injury of middle finger mid-palmar, incomplete diafysis fracture of III metacarpal bone, section of FDP middle finger zone 3, section of FDS middle finger, section of common digital nerves for web space II and III and superficial palmar arcade, mid palmar wound from ray II - ray IV.

**Case 2:**

**Diagnosis:** Complex trauma through gunshot injury with fracture metacarpal bone III, and bone defect metacarpal bone II, soft tissue defects of right hand (dominant).

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<td>II</td>
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<td>V₁</td>
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<tr>
<td>III</td>
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<td>A₁</td>
<td>0,3</td>
<td>V₂</td>
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<td>1,2</td>
<td>N₂</td>
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<tr>
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<td>V₁</td>
<td>1,1</td>
<td>N₁</td>
<td>1,1</td>
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<tr>
<td>V</td>
<td></td>
<td></td>
<td>1,1</td>
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RESULTS

Through codification of the 68 cases we concluded that in 17 cases two digital rays were affected, 22 cases were with involvement of a single digital ray, 5 cases with thumb involvement, 23 cases with injuries to 3 digital rays, 3 cases with 4 rays and one case with involvement of all digital rays.

Out of these 68 cases maximum severity for vascular system (amputation) was noted in 14 cases, maximum severity for bone lesions (bone defect) was noted in 2 cases, maximum severity for skin lesions (large skin defect) in 4 cases. Most frequent associations were dorsal skin/extensor tendon/fracture in 23 cases (3 cases with same association in multiple rays), skin/tendon in 21 cases, skin/nerve in 20 cases, bone/nerve/tendon in 12 cases, devascularisation in 8 cases.

DISCUSSION

Evaluation of complex trauma of the hand is a difficult issue because comparison to existing classifications, is generally unsatisfactory to the complexity of hand as a functional unit comprising of many segments (fingers).\(^1,2,4\) Possible combinations of segmental lesions as well as the severity of lesions for each segment make it possible to compare them with general categories. Alphanumeric codification is an attempt to standardise the diagnosis in unitary pattern so as to have identical categories useful for comparative studies. In literature, there is HISS system for comparing the severity of hand trauma but the diagnosis system does not satisfy all the needs.\(^10-12\)

Present system of codification is a diagnosis system trying to include all the anatomic elements into a classification similar to Muller’s for osseous system.\(^4\) This alphanumeric codification system can be saved in a data base with well established parameters which can later be used in comparative studies, as is the current
trend for fractures.\textsuperscript{13}

Current alphanumeric codification is an adaptation of existing classifications. Thus for the osseous system Muller’s classification was used as the model while for soft tissues lesions used for HISS were modified and AO/ASIF classification of soft tissue lesions was adapted.\textsuperscript{14,15} Muller’s classification offers a complete system of classification of fractures for orthopedic surgeons, thus elaboration of a similar system of classification of soft tissue lesions becomes essential. This codification system can be computerised so we can follow the underlying parameters: location, type of lesion and their severity. This makes it possible to perform comparative studies on any one of the parameters. Acknowledging the severity and anatomic complexity of hand elaborating such a classification becomes highly useful.

\textbf{CONCLUSIONS}

Alphanumeric codification is a new tool as inventory of location of lesions, severity of lesions, as well as the anatomic elements affected allowing the hand surgeon to have a concise and codified diagnostic formula, as well as the possibility of storing and fast access to the information related to complex hand trauma through a database.

This codification system allows a complete evaluation of all the lesions and their utility in comparative studies. Thus, if we have a database according to the system hereby presented (alphanumeric codification) parameters like: number of digital rays involved, ray involved, type of lesion and especially the severity of lesions and their associations can be easily compared.

Present codification system offers possibility of rapid transmission of information between various health centres and thus refer the cases to the centres where they can be treated.

\textbf{ACKNOWLEDGEMENT}

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\textbf{REFERENCES}

3. Nazarian S. Le system integral de classification des fractures de Maurice Muller. MO n°104, Mai 2001