



The role of cervical CT imaging in primary diagnosis of severely injured patients

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Original article

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Summary

INTRODUCTION. The radiological clearance of cervical spine injuries is a part of Advanced Trauma Life Support protocols. However the value of different methods, plane radiographs versus CT scanning is still discussed.

MATERIAL AND METHODS. The study is a retrospective analysis of cervical spine injuries diagnostics in 109 multiply injured patients based on experience of the Emergency Department of Regional Hospital in Sosnowiec. Authors evaluated the result of 48 cases combining head CT imaging with cervical spine examination down to the Th1 level.

RESULTS. Following this protocol 5 cervical spine fractures were identified. Among them 3 had no preexisting neurological deficits.

DISCUSSION. Results confirmed the value of standard C-spine immobilization and necessity of early radiological clearance.

CONCLUSIONS. Joint examination of cervical spine in head trauma diagnosing is proved to be the good standard in multiply injured patients, however it's use is limited to haemodynamically stable patients.

Key words: C-spine injuries. Cervical CT, Cervical plane radiographs, Multiply injuries, Trauma Team

INTRODUCTION

C-spine injuries are one of the most devastating types of injury patterns. The large majority of these injuries co-exist with other body region injuries. Among them special emphasis should be paid to head injuries. Emergency Department of Regional Specialist Hospital in Sosnowiec accepts trauma patients from Silesia Region. The most severely injured are admitted in the Trauma Room. Assessment and initial treatment is provided by Trauma Team.

The admission criteria were multiple body region injuries, symptoms of hypovolemic shock, posttraumatic respiratory insufficiency or GCS under 9. The primary assessment and treatment were based on ATLS protocols.

The aim of the algorithm is to assess and treat the life threatening conditions in appropriate order.

The criteria of clinical "clearance" of the spine in trauma patients without radiographic imaging includes the patients who:

- Is fully alert and aware without the intoxicating effects of alcohol, recreational drugs, or narcotic pain medication
- Lacks a high-energy mechanism for spinal injury, such as a fall from >3 m or motor-vehicle collision at > 60 km/h
- Denies complaints of spinal pain, provided there is no substantial concomitant injury, such as a femur fracture which can distract the patients perception of spinal complaints.
- Has no neurologic complaints
- Has no neurologic deficits

For patients who do not fulfill all these criteria, radiographic evaluation of the spine is highly recommended.

Among the 112 patients admitted in the ED Trauma Room with multiple or severe isolated injuries. According to the statement of the Spine Trauma Study Group 109 (97,3%) required routine C-spine diagnosis

The basic Trauma Room imaging diagnostics includes chest and pelvic X-ray and abdominal ultrasound examination. The further diagnostic steps depend on patient condition. Trauma Leader takes responsibility for critical decisions. Patient might be transferred directly into Operating Room, ICU or Radiological Department.

The indications for head CT imaging in the initial diagnostic process were morphological or neurological symptoms of severe head injury or haemodynamically stable multiply injured patients, with injury mechanism suggesting possible head trauma.

It is widely accepted method to use CT as a diagnostic tool for C-spine injuries however its sensibility is still compared with plane C-spine X-ray.

In our diagnostic protocol head CT imaging is combined with C-spine CT down to the Th1 level.

MATERIAL AND METHODS

In the period 1 April-30 November 2007 – 112 patients with severe trauma were admitted into ED Trauma Room. In this group in 48 (42,8%) patients met the criteria for head CT examination within first 60 minutes after ED arrival. The CT scans were supplemented by C-spine imaging. The CT-scans were jointly evaluated by experienced radiologists and orthopedic trauma surgeon.

Authors analyzed patient reports focusing on injury kinematics and mechanisms suggesting possible C-spine injury. The primary ED diagnosis was compared with the final discharge diagnosis in context of possible misdiagnosed C-spine injuries.

Results were evaluated in standard statistical methods.

RESULTS

In the group of 112 trauma patients admitted to the Trauma room there were 83 (74,1%) multiple region injuries and 31 (25,9%) isolated. Trauma kinematics suggested necessity of C-spine examination in 109 (97,3%) patients. All those patients had proper C-spine immobilization by EMS team.

35 (29,4%) patients were transferred directly to the operating theater, 11 (9,8%) died in the Trauma Room.

In 48 (42,8%) cases it was possible to perform head and C-spine CT within first hour.

The mean age of the patients was 39,9 years the range 15-87. There were 34 (70,8%) male and 14 (19,2%) female patients. The mean ISS was 22,6 (range 16-66) The mean GCS was 11 (range 3-15).

Two (4,2%) of 48 patients presented neurological symptoms of C-spine injury on admission.

36 (75%) of injuries resulted from motor-vehicle accidents, among them there were 23 car occupants, 3 motorcycle drivers, and 10 pedestrians. 12 (25%) of the injuries resulted from falls from heights.

20 of the patients (41,7%) were intubated and ventilated during the CT-diagnostic.

In examined group, in 5 (10,4%) patients radiological evidence of C-spine fractures were found.

The findings are listed in table below.

Table 1

No	Patient	Injury mechanism	Type of cervical spine injury
1	Male, 34 years old	Road-traffic accident	C5,C6 body fracture, C5 pedicle fracture
2	Male, 18 years old	Fall from height	C5 body fracture
3	Male, 39 years old	Road-traffic accident	C4 facet fracture
4	Male, 35 years old	Road-traffic accident	Fracture through the C2 body
5	Male, 38 years old	Fall from height	C7 spinous processes fracture

50 patients (44,6%) were diagnosed by plane radiographs in lateral and anterior-posterior views, in this group there were no radiological evidence of cervical spine injuries.

In discharge diagnosis in 96 patients there were no misdiagnosed C-spine injuries.

DISCUSSION

Most of the EMS protocols are based on PHTLS (Pre Hospital Trauma Life Support) or equivalent BTLS (Basic Trauma Life Support) standards. One of their basic rules is preventional stabilization of cervical spine using collars and back boards, based on evaluation of injury kinematics.

Following ATLS protocols Trauma Team is keeping the stabilization until the C-spine injury is excluded.

Most of the patients with head injury or multiple trauma with head injury component are of the high risk of coexisting cervical spine fractures or dislocations.

ATLS diagnostic protocol in multiply injured patients includes so called X-ray Trauma Series (chest, pelvis and C-spine in lateral view). The lateral view provided with technical accuracy can identify 74-93% of fractures and dislocations.

The basic tool for diagnosing intracranial injuries is CT-scanning, therefore it can be easily combined with cervical spine evaluation. A standard in Emergency Department is visualization of the C-spine down to the

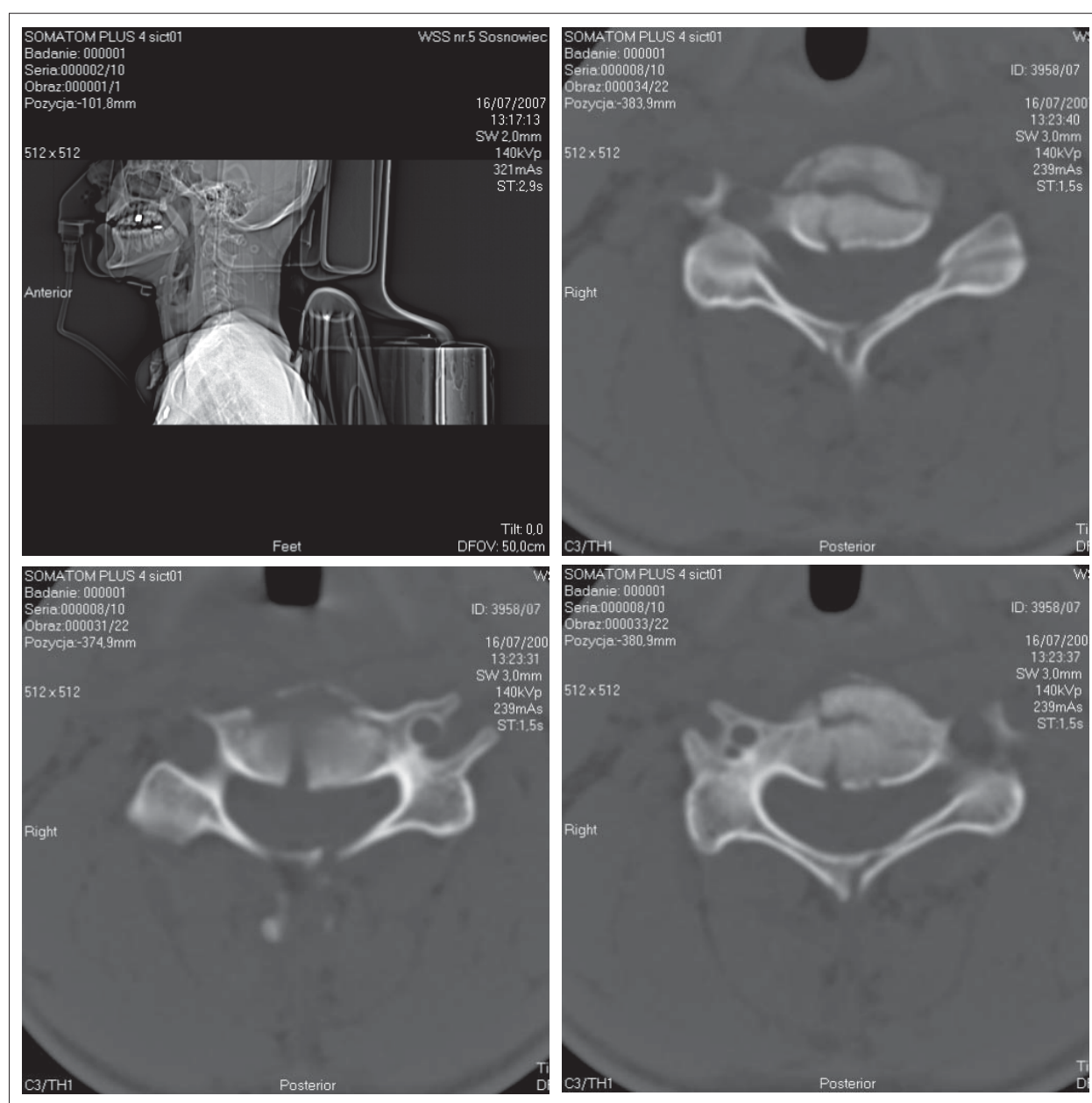


Fig. 1-4. Case nr 2, male 18 years old. C5 body fracture. No neurological deficits

Th-1 level. The scans are performed in lateral and sagittal views.

Cervical spine CT is a method which lowers the risk of secondary dislocations (by moving the patient) and gives better view of lower part of cervical spine compared with plane radiographs.

Some of the authors suggest to expand the standard C-spine CT examination down to the Th-4 level. In our experience we did not find clinical evidence for such kind of examination.

The visualization of the upper level of thoracic spine is relatively poor in both methods, plane radiographs and CT.

The method is limited by patient conditions it can not be used in haemodynamically unstable patients. There-

fore number of severely injured patients is diagnosed secondary after stabilization of life threatening injuries.

Only in two of the patients preexisting neurological findings were reported. This can be explained by difficult neurological examination in unconscious and strongly confirms how important is the role of preventive C-spine stabilization.

In the group with secondary diagnosis of C-spine the rate of detected injuries is much lower. This was probably related with dominating severe injuries of other body regions (mainly thorax, abdomen and pelvis) were initial C-spine immobilization was only a standard method required by the protocols.

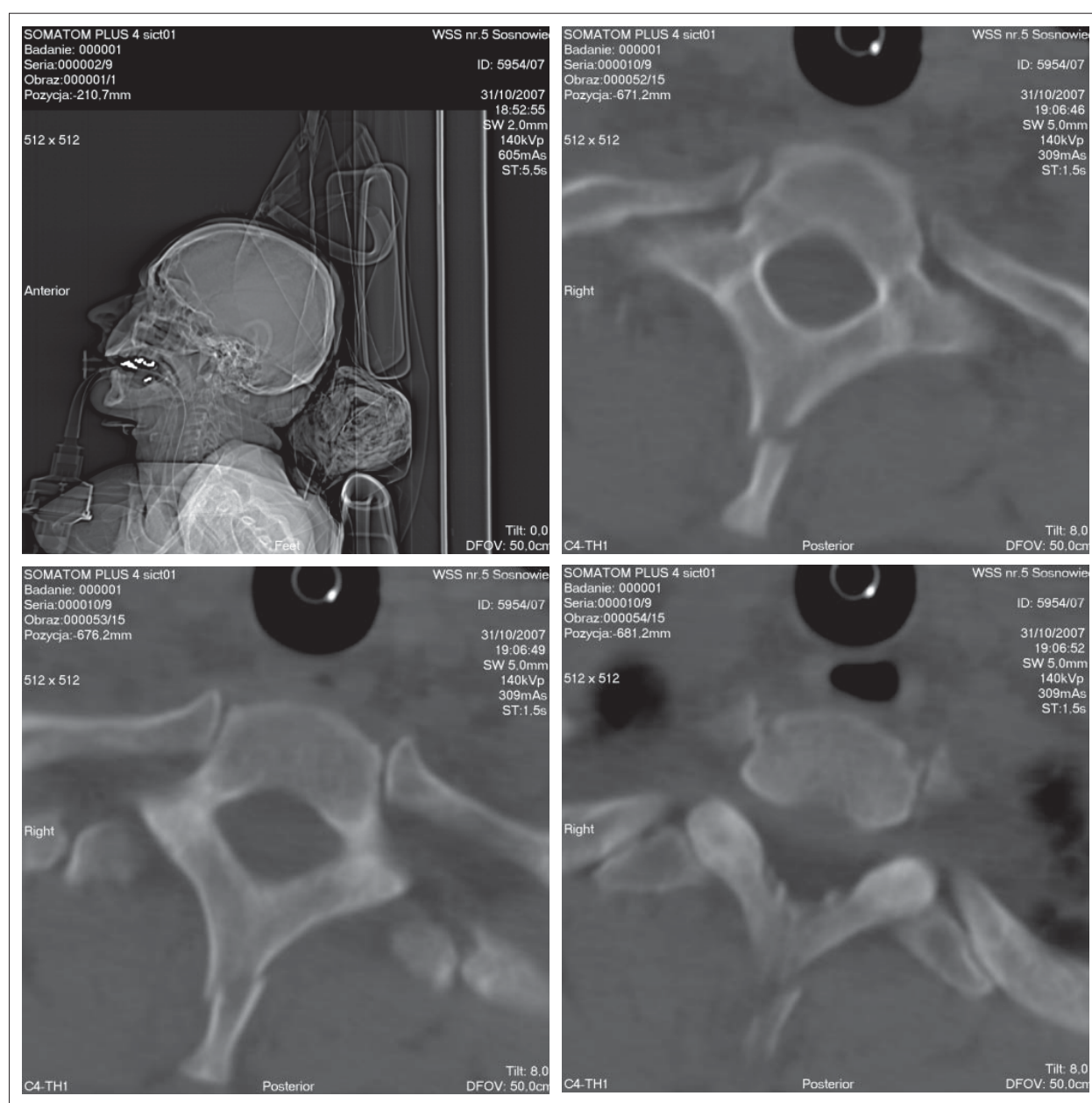


Fig. 5-8. Case nr 5, male 38. C7 spinous processes fracture. No neurological deficits

3 (60%) of the recognized injuries did not impact the spinal canal structures, what is generally similar to the widely known statistics.

CONCLUSIONS

1. Preventive C-spine immobilization by collars and back-board based on evaluation of injury kinematics seems to have deep confirmation by number of detected cervical spine injuries.
2. The component of head trauma in multiply injured or isolated head injuries are of the high risk of coexisting cervical spine injuries.

3. Routine primary head CT scanning should be supplemented by cervical spine examination. This method is valuable for haemodynamically stable patients and has high sensibility in detecting coexisting C-spine injuries.

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