

# Evaluation of cervical spine injuries in polytraumatized patients in Emergency Service

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## ABSTRACT

**Introduction:** The screening for cervical spine injuries in polytraumatized patients has traditionally consisted in neurological clinical examination and radiographic evaluation. In different trauma centers, the initial evaluation of these patients, being awake and conscious, includes neurological clinical examination and radiographs, even if they present a normal semiology. This is due to the belief that clinical examination is insufficient for the detection of these lesions. **Materials and Methods:** This is a cross-sectional and observational study to determine the sensitivity and specificity of the clinical examination for the diagnosis of cervical spine injuries, comparing imaging studies over a 22-month period in an emergency unit. **Results:** During this period, 127 patients were assisted. In 101 patients, the neurological and physical examination was normal. No injuries were recorded when performing radiographs or CT scans on these patients. During examination, 26 patients felt pain after palpation of the spinous processes. After a CT scan, 6 of these patients were found to have a cervical spine injury. The sensitivity of the physical examination was 100% and the specificity was 83%. The false positive rate was 17% and no false negatives were recorded. **Conclusions:** The data from this study shows that the majority of studies by imaging, radiographs or CT scans could be reduced, without losing the sensitivity of cervical spine injuries diagnoses, and thus reducing the costs of care.

**Key words:** Screening; cervical spine injury; polytraumatized; sensitivity; specificity.

**Level of Evidence:** IV

## Evaluación de lesiones de la columna cervical en pacientes con politraumatismos, en el Servicio de Urgencias.

## RESUMEN

**Introducción:** Tradicionalmente se ha recurrido al examen clínico-neurológico y a los estudios por imágenes para identificar lesiones de la columna cervical en pacientes con politraumatismos. En diferentes centros de trauma, la evaluación inicial incluye un examen clínico-neurológico más radiografías obligatorias, independientemente de una semiología normal, en un paciente despierto y consciente. Esto se debe a la creencia de que el examen clínico es insuficiente para detectar estas lesiones. **Materiales y Métodos:** Se trata de un estudio transversal y observacional para determinar la sensibilidad y la especificidad de la evaluación clínica para el diagnóstico de lesiones de la columna cervical comparadas con las de los estudios por imágenes, en un período de 22 meses, en un Servicio de Urgencias. **Resultados:** Durante este período, se asistió a 127 pacientes. El examen físico neurológico fue normal en 101 pacientes; ninguno tenía una lesión constatada en las radiografías o las imágenes tomográficas. Veintiséis refirieron dolor a la palpación de las apófisis espinosas; en 6 de ellos, se constató una lesión de la columna cervical con la tomografía. La sensibilidad del examen físico fue del 100% y la especificidad, del 83%. La tasa de falsos positivos fue del 17% y no se registró ningún falso negativo. **Conclusiones:** La mayoría de los estudios por imágenes, radiografías o tomografías computarizadas podrían disminuirse, sin perder la sensibilidad del diagnóstico de lesiones de la columna cervical, reduciendo así los costos de la atención.

**Palabras clave:** Pesquisa; lesiones; columna cervical; politraumatismos; sensibilidad; especificidad.

**Nivel de Evidencia:** IV

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## INTRODUCTION

A patient is considered to be polytraumatized if they present one or several traumatic injuries, at least one of which can be life-threatening more or less immediately<sup>1</sup>. The patient is usually a person of any age who suffers an external traumatic injury, frequently caused by high-energy trauma.

The screening for cervical spine injuries in polytraumatized patients has traditionally consisted in neurological clinical examination and radiographic evaluation. There are specific clinical prediction rules to help professionals improve their decision-making regarding the use of imaging studies to diagnose this type of lesions. Canadian C-Spine Rule has had a sensitivity of 100% and a specificity of 42.5% in dismissing cervical lesions in stable and conscious patients with cervical spine trauma<sup>2</sup>.

Such rule is based on three high-risk criteria (age >65, dangerous mechanisms, limb paresthesia) and five low-risk criteria (pedestrian hit by motor vehicle; sitting or ambulating; late onset neck pain; absence of pain in the midline of the neck; ability to rotate the neck to 45°). If the patient meets any high-risk criteria, it is necessary to perform a radiograph. If they meet any low-risk criteria and they can rotate the neck, such study may be omitted.

The rule states that imaging studies should be performed on every patient whose results are positive. Thus, a low specificity and a high rate of false positives indicate that a great number of patients without lesions are being subjected to unnecessary studies<sup>3</sup>. Many important schemes of multi-centered implementation have demonstrated the safety and the clinical effect of this instrument, useful to search for cervical spine injuries in stable and conscious patients. Despite such evidence, in several health centers the patient's initial evaluation includes clinical examination of the neck and mandatory radiograph, apart from a regular semiology physical examination in stable and conscious patients. This is due to an assumption that clinical examination is insufficient for the detection of cervical spine injuries.

The first aim of this survey was to describe and examine the effectiveness of a neurological clinical examination of the cervical spine in conscious and responsive poly-traumatized patients. The second aim was to contrast the results of such examination to those of imaging studies.

## MATERIALS AND METHODS

This is a cross-sectional and observational design study, which was conducted in one single medical center. Data were collected prospectively, from December 2016 to October 2018, at the Emergency Service in our regional hospital. The inclusion criteria were: polytraumatized patients; age >18; Glasgow Coma Scale score  $\geq 14$ ; stable patients. Unconscious and intoxicated patients were excluded, as well as pregnant patients and those who were related to the researchers. This study was approved by the hospital's Ethics Committee. Each patient gave informed consent before their participation.

If the patient did not either present spontaneous pain, or upon palpation, or suffered from paresis or paresthesia during the physical examination, the cervical collar was removed and an active motion test was performed on the patient by checking neck rotation, flexion and extension. Regardless of the semiology, a lateral cervical spine radiograph was performed on every patient for purposes of research. In cases where the radiographic diagnosis was in doubt, or there was clinical suspicion of cervical spine bone injury, a CT scan was performed. If the patient presented pain upon palpation or movement, the examination was ended and the cervical collar was put back on the patient. In these cases, the cervical spine was not considered uninjured, thus imaging tests were performed. If no abnormalities were found and the physical examination was normal, the cervical spine was considered uninjured and the collar was removed (Figure 1).

The variables studied were: overall demographic data, age, sex, type of trauma, and mechanism of injury. Regarding the kinematics of trauma, the following categories were grouped: motor vehicle accident (car or motor-bike), suicide attempt, fall from height, crushing, sports accident, and pedestrian accident. Complete data for physical examination, neurological examination and imaging studies were recorded. The images were determined to be pathological or normal depending on the presence or absence of bone injury, and they were evaluated by two medical specialists.

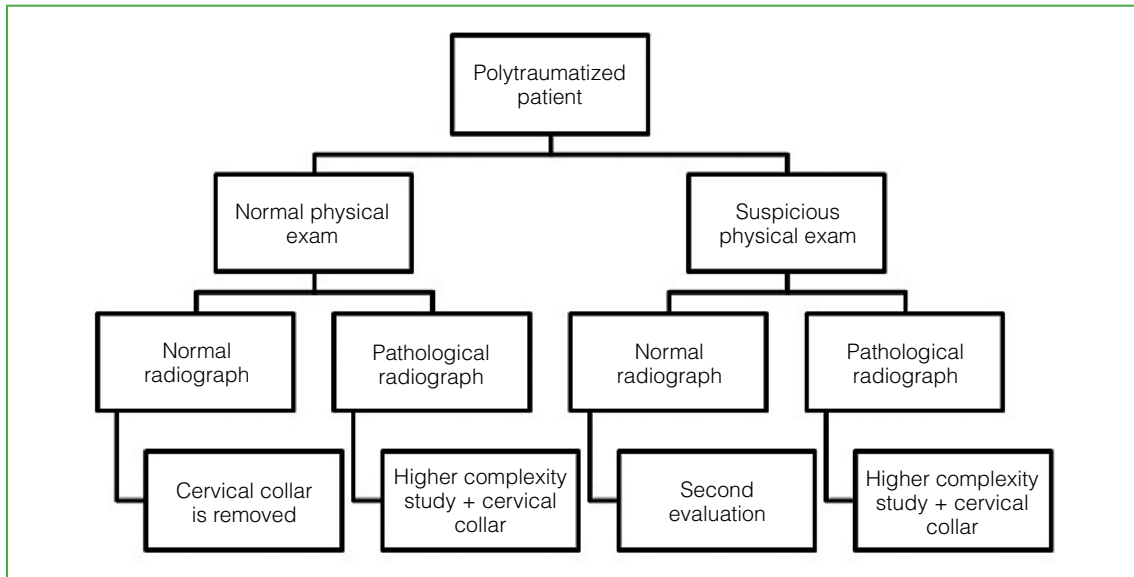


Figure 1. Protocol of management of polytraumatized patients.

## RESULTS

During the period examined, 127 polytraumatized patients, awake and conscious, were assisted. 59% were male. The average age was 35. The most common cause for polytrauma was motor vehicle accident, followed by fall from height (Figure 2). 33 patients presented one or more associated injuries (Figure 3). The most frequent associated injuries were fracture of the radius and ulna in the first place, followed by fracture of the tibia and fibula, and fracture of two or more ribs. All of the patients were subjected to a systematic physical examination of the neck and radiographs. The physical examination of the cervical spine was normal in 101 patients, none of which presented any lesions confirmed by imaging studies.

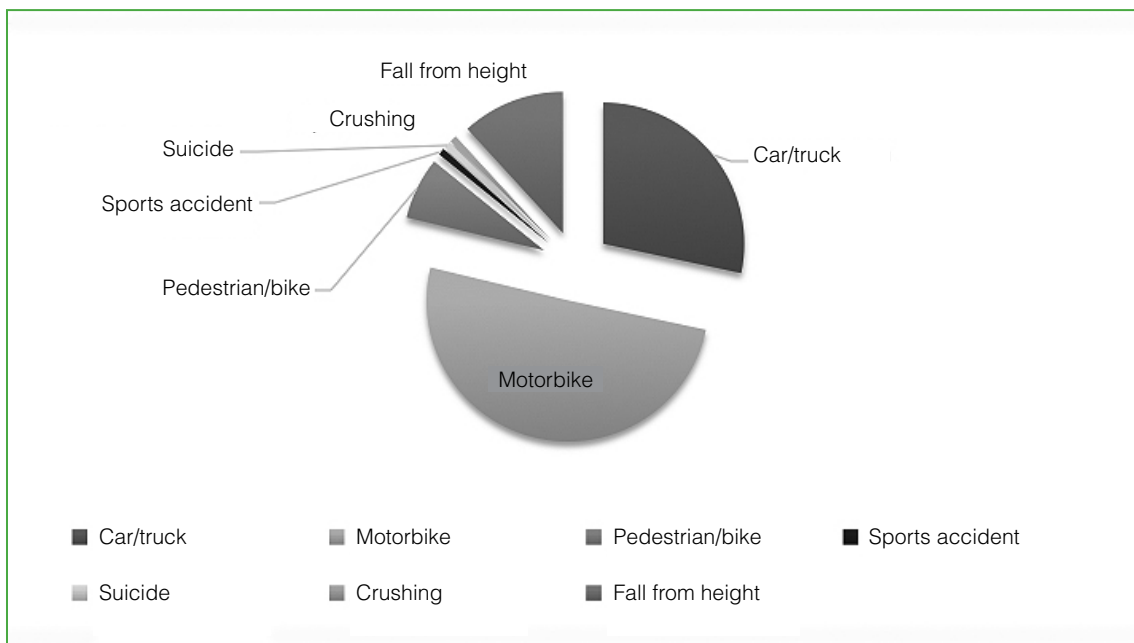
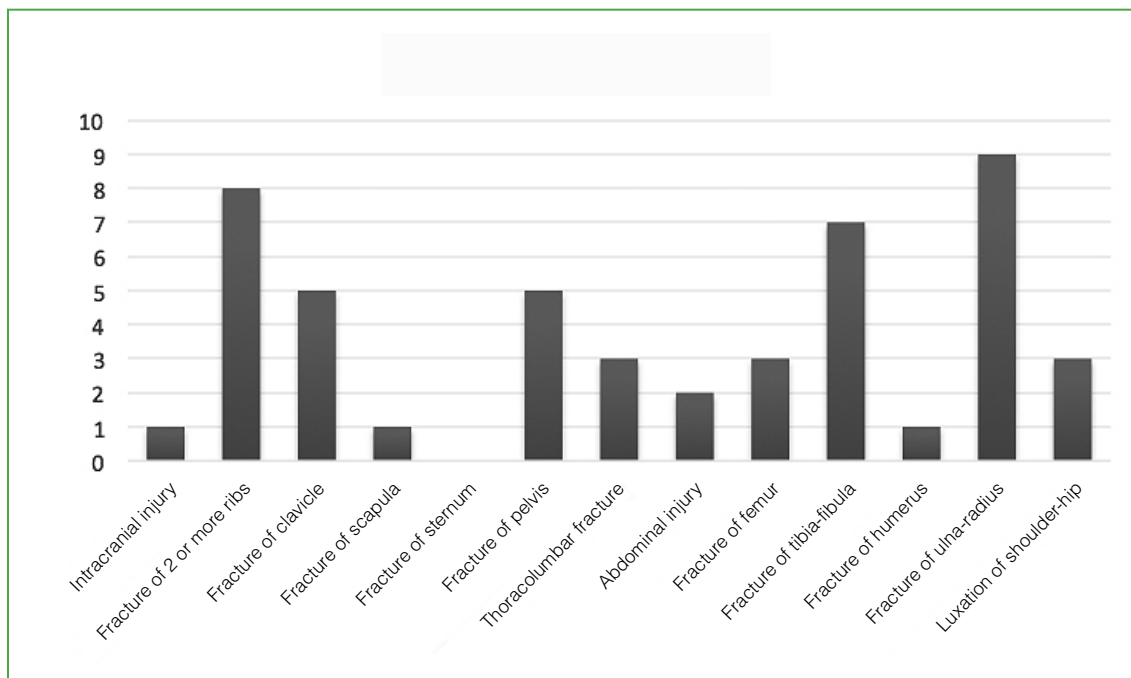


Figure 2. Mechanism of injury.



**Figure 3.** Associated injuries.

26 patients experienced pain during the neck examination. A bone injury of the cervical spine was confirmed in six of them (Table). None of the patients suffered a neurological injury according to the ASIA (American Spinal Injury Association) classification. The physical examination sensitivity for diagnosing cervical spine injuries was 100%, and the specificity was 83%. The false-positive rate for diagnoses was 17% and no false negatives were recorded. A negative predictive value of 100% was estimated. Four patients presented a type-A injury according to the AOSpine subaxial classification system, for which they received conservative treatment. One of them had suffered a type-IIIB fracture of C1, which was treated with halo-vest, and another one had suffered a type-B2 according to the AOSpine subaxial classification, which was treated with instrumented posterior arthrodesis.

**Table.** Semiological examination vs. radiological examination of the sample.

	Normal radiograph	Pathological radiograph	Total
Normal semiology	101	0	101
Suspicious semiology	20	6	26
Total	121	6	127

## DISCUSSION

The incidence of cervical spine fractures in polytraumatized patients is relatively low. For this series it was 4.7%. This piece of data matches the published rates, which vary from 2.8% to 7.7%<sup>4</sup>. The present study shows that clinical examination of the neck has a high sensitivity for diagnosing cervical spine injuries. As well as this series, many publications document that systematic physical examination is an extremely sensitive tool to search for cervical spine injuries in awake and conscious patients<sup>5-9</sup>. Despite this, a great number of unnecessary

radiographs are taken in emergency services. In this case, 94% of the imaging studies have not revealed bone injury, a number similar to those published, which demonstrates that more than 98% of the imaging studies do not show any fractures<sup>10</sup>. Such poor performance is related to significant cost and a misuse of the resources of the health system. Besides, patients are exposed to potentially harmful radiation with no clinical indication or prolonged immobilization. Despite the available evidence, the criteria regarding the use of cervical spine radiograph vary greatly among the health professionals. This may be due to the clinical and legal implications of not diagnosing an injury, and it may also be the reason for an overuse of imaging studies in emergency services<sup>11</sup>. It should be possible to use clinical examination and prediction rules like the Canadian C-Spine Rule<sup>12</sup> to evaluate polytraumatized patients who are awake and do not present neurological deterioration, in order to determine if complementary imaging studies are necessary. Thus, polytraumatized patients could be provided with safe, based on evidence, cost-effective attention.

The present study is the only prospective report on evaluation of cervical spine injuries in polytraumatized patients that has been published in our country. The limitations of the series are linked to the sample size and the number of cervical spine injuries detected. Additionally, this study did not consider isolated disc ligament injuries without fracture or dislocation, which may constitute a bias. Notwithstanding, cervical spine non-skeletal injuries are very infrequent, according to previous research<sup>13</sup>.

## CONCLUSIONS

The data produced by the present study show that systematized clinical evaluation of the cervical spine has a high sensitivity for the diagnosis of bone injury of the spine in responsive conscious patients. Therefore, most imaging studies could be omitted and, as a result, the cost of the service would be reduced, as well as the unnecessary radiation on patients. There is a need for more studies which allow an accurate diagnosis for these injuries, in order to provide better medical assistance and to reduce the cost of health care for polytraumatized patients.

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