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Are cervical spine X-rays mandatory in all blunt trauma patients?

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Traumatic cervical spine injuries can result in severe disability or death unless promptly diagnosed and treated. Advanced trauma life support guidelines recommend that three-view cervical spine X-rays should be obtained routinely in all blunt trauma patients. In this retrospective study, we evaluated whether cervical spine X-rays are indeed necessary in all such patients.

The study comprised those patients who were conscious, fully orientated, co-operative and non-intoxicated. Among the 303 blunt trauma patients seen at our emergency department between January and December 1993, a total of 267 patients had well-written charts and met our inclusion criteria. Thirteen (5%) patients who complained of neck pain or had neck tenderness on initial examination were found to harbour cervical spine injuries. Of those patients sustaining cervical spine injuries, examination of three (23%) disclosed abnormal neurological findings. On the other hand, none of the patients without neck pain and tenderness were found to have cervical spine injury.

We conclude that pain and/or tenderness in the neck area are valid criteria with regard to the timely diagnosis of cervical spine injuries, and that routine cervical spine X-rays may be unnecessary for those blunt trauma patients who are conscious, fully orientated, co-operative, non-intoxicated, exhibit no neurological deficits and who do not have neck pain or tenderness. Omitting cervical X-rays speeds up patient evaluation, protects the department staff from unnecessary exposure to ionizing radiation and mitigates treatment costs, while maintaining the quality of the healthcare provided.

Keywords: cervical spine fracture; cervical spine injury; cervical spine radiography; blunt trauma

INTRODUCTION

Patients with blunt trauma have always been among those who tend to spend a long time in emergency departments (EDs). A substantial proportion of these cases are intoxicated and/or unco-operative and/or comatose, and this may contribute to delayed diagnoses which, in turn, may lead to catastrophic consequences (Fischer, 1984; Mc Namara *et al.*, 1984; Bachulis *et al.*, 1987; Roberge *et al.*, 1988; Matsumara *et al.*, 1990; Daffner, 1993). Cervical spine injuries are among the most serious injuries to consider. Both advanced trauma life support (ATLS) rules and the potential risks that would be otherwise assumed mandate that most EDs, including ours, should routinely obtain three-view cervical X-rays (American College of Surgeons Committee on Trauma, 1990). However, due to the relentlessly increasing costs of diagnostic tests and treatment and the clear-cut hazards of ionizing radiation, it has become controversial to obtain 'routine' cervical X-rays in all blunt trauma patients. Authors recommend cervical X-rays only for patients who are unconscious, not fully orientated, unco-operative or intoxicated, and for conscious, co-operative, fully orientated patients complaining of neck pain either in the history or on palpation and exhibiting neurological deficits. These authors do not recommend cervical X-rays in patients who do not have these above mentioned criteria (Fischer, 1984; Mc Namara *et al.*, 1984; Bachulis *et al.*, 1987; Rattner *et al.*, 1987; Roberge *et al.*, 1988; Roberge, 1991, 1993; Daffner, 1993; Saddison *et al.*, 1993; Sweeney and Marx, 1993; Woodring and Lee, 1993).

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Table 1. Characteristics of the blunt trauma patients who were admitted to the study

High speed deceleration motor vehicle accidents
Falls from heights
Motor vehicle accidents in which pedestrians were struck by motor vehicles
Direct cervical region injury
Diving injuries
Significant head or facial injury
Glasgow Coma Scale score > 13

Table 2. Causes of injury

	n	%
Motor vehicle accident	232	87
Fall	29	11
Assault	6	2

This study has been carried out to investigate the accuracy of such criteria by retrospectively assessing charts and pertinent cervical X-rays. The characteristics of the blunt trauma patients included in the study are given in Table 1.

MATERIALS AND METHODS

We retrospectively evaluated the charts of 303 blunt trauma patients seen at our ED between January and December 1993. Excluded from the study were 36 patients who were unconscious, not fully orientated, unco-operative or who had incomplete data. Cervical X-rays of the study patients were reassessed by the author accompanied by a radiologist and a neurosurgeon. We elicited recorded data on age and gender of the patient mechanism of the injury, findings in the history and physical examination, and, if present, the localization of the cervical spine injuries (CSI) and any neurological deficit.

RESULTS

The male-to-female ratio was 7:3, and the age range was from 5 to 83 years. The mean ages of the males and females were 32 and 33 years, respectively. The most common mechanism of injury was motor vehicle accidents, followed by falls and direct blows (Table 2). On the other hand, motor vehicle accidents accounted for 100% of the patients with verified CSI.

Thirteen patients (5%) were diagnosed to have CSI, most commonly located at the level of C6 (Table 3) (Fig. 1). All of the 13 cases with CSI invariably had pain and/or tenderness in the history and/or neck palpation. Three patients (23%) also had neurological deficits. Fifty-two out of the 267 study patients (20%) experienced pain and/or tenderness. Thirteen (25%) of these 52 patients with cervical complaints were found to harbour CSI (Table 4). Only three patients (1%) had neurological deficits relevant to a verified diagnosis of CSI. Four out of the 13 cases (31%) with documented CSI also had additional injuries such as olecranon fracture, rib fracture with haemothorax, thoracic spine fracture, subdural haematoma, or maxillary and mandibular fractures.

Table 3. Site distribution of CSI

Site and type of injury	*n*	%
C1 (Burst fracture)	2	15
C2 (Jefferson fracture)	1	8
C4–5 dislocation[a]	3	23
C5 (Fracture of the right processus transversus)	2	15
C5–6 (Bilateral facet dislocation)	1	8
C6 (All were tear-drop fractures)	4	31

[a]It is possible that these may have been unilateral facet dislocations; in order to make the certain diagnosis additional cervical X-rays were required but were not available as these patients had been taken to the operating theatre.

Regarding the validity of pain in conjunction with radiological findings as utilized in the diagnosis of CSI in patients with blunt trauma, the calculated values of sensitivity, selectivity and consistency were 100%, 85% and 85%, respectively (Table 4).

DISCUSSION

Current management of blunt trauma patients with respect to ATLS guidelines involves routine three-view cervical X-rays. A major contributory factor to this trend may be the potential catastrophic consequences if CSI are missed, including death of the patient and a high risk of liability. However, in 4–67% of all paediatric spinal cord injuries radiological abnormalities are absent, and relevant literature data reveals the heavy disability toll due to spinal cord injury without radiologically proven pathology of the spinal cord (Matsumara *et al.*, 1987). Therefore, it can be concluded that the diagnosis of CSI could not be solely based on radiographical criteria; the emphasis should mainly be on clinical findings. From this point of view, one might wonder why we don't also obtain computed tomography images for all such patients for fear of the poten-



Fig. 1. An example of a C4–C5 dislocation.

Table 4. Association of pain with positive X-rays

Cervical pain and/or tenderness	X-ray positive	X-ray negative	Total
Present	13	39	52
Absent	—	215	215
Total	13	254	267

Sensitivity = 100%; selectivity = 85%; consistency = 85%.

Table 5. Factors associated with a high risk of CSI

Blunt trauma with high velocity vehicles
Trauma to the neck
Falls, diving into shallow water
Severe head and neck trauma and/or injuries
Pathological reflexes and/or abnormal neurological findings on examination
Concomitant thoracic and/or lumbar spine injuries
History of degenerative joint diseases such as cervical arthrosis and ankylosing spondylitis
Cervical pain and/or tenderness

tial outcomes. Some other important pitfalls of 'routine' cervical X-rays are a lengthened stay in the ED for diagnosis and treatment, needless exposure to ionizing irradiation, enhanced costs of care, and overcrowding of radiology departments and EDs.

Due to the aforementioned hazards, there appears to be a global trend towards avoiding unnecessary diagnostic procedures. Recently it was pointed out that it also seems irrelevant to obtain pelvic X-rays for all blunt trauma patients (Ersoy and Enginbaş, in press). Fischer (1995) pointed out the invariable presence of cervical pain and/or tenderness in all 42 (11%) blunt trauma patients with verified CSI out of the 333 who met the inclusion criteria. Daffner (1993) recommended that cervical imaging should be carried out only in those in a high risk group (Table 5), which includes those with cervical pain and/or tenderness. Mc Namara *et al.* (1990) ascertained the presence of CSI in five (2%) out of 286 blunt trauma patients and implied that 'routine' cervical X-rays in the management of patients without cervical pain and/or tenderness is a wasteful practice because of the increased costs of care. Similar results have been expressed in various studies (Bachulis *et al.*, 1987; Rattner *et al.*, 1987; Roberge, 1993; Sweeney and Marx, 1993; Woodring and Lee, 1993). However, Roberge and Wears (1992) declared that a selective approach cannot be afforded and that 'routine' application of cervical X-rays is the proper course of action in cases of blunt trauma.

In this retrospective study we detected CSI sustained by 13 (5%) patients out of 267 blunt trauma patients who had undergone cervical X-ray imaging. It is interesting to note that our patients with CSI had all been injured in traffic accidents, which is in contrast to the pertinent literature, in which falls are the most common mechanism (Fischer, 1984; Mc Namara *et al.*, 1984; Bachulis *et al.*, 1987; Roberge *et al.*, 1988; Roberge, 1991; Saddison *et al.*, 1993; Woodring and Lee, 1993). These 13 patients with CSI invariably had neck pain in the history and/or tenderness on palpation. Three of these

patients had additional neurological findings. Patients in whom CSI had been ruled out did not exhibit any neurological deficits. In 39 patients who had suffered from cervical pain and/or tenderness of varying degrees, CSI were shown to be absent, in accordance with the literature.

Ingego *et al.* (1994) claimed that the irradiation the patient is exposed to during a standard three-view cervical series was less than 1.0 mR and that this is an acceptable dose, but this study did not take into account the additional imaging procedures the blunt trauma patient would probably experience.

From a financial point of view, the cost of three-view cervical X-rays in Turkey is £6 (in 1995). Thus £1602 was spent solely on the three-view cervical X-rays of our 267 study patients. Had the imaging procedure been limited to the 53 patients who had neck pain and/or tenderness, the expenditure would have been cut back to £318, saving £966.

If this approach were adopted more extensively, patient management would not be impaired, the amount of ionizing radiation the patient and the radiology staff are exposed to would be decreased, the time spent for evaluation and diagnosis would be shortened, emergency and radiology department overload would be mitigated, and a considerable amount of money could be saved.

CONCLUSION

The presence of cervical pain and/or tenderness on palpation is a valid criterion with regard to the diagnosis of CSI. Regular application of this guide enables the physician to eliminate unnecessary cervical X-rays in blunt trauma patients. The need for cervical X-rays is not in doubt for high risk patients and for those who are intoxicated, unconscious, not fully orientated or unco-operative. In this study we propose a brief, practical guideline to refer to at any time when cervical X-rays are being considered (Fig. 2). However, routine application of this approach requires broader surveillance and approval.

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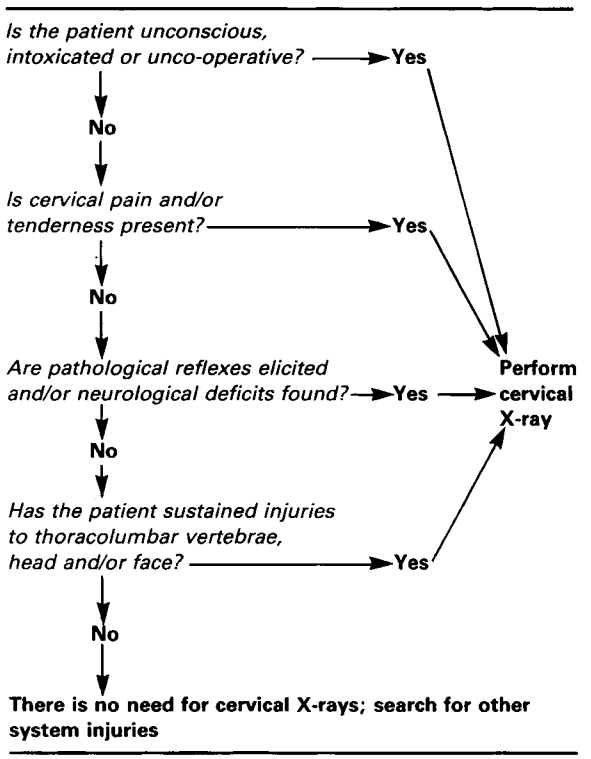


Fig. 2. Proposed decision tree for blunt trauma patients that may be referred to before performing cervical X-rays.

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