

## ACETABULAR FRACTURES BEFORE AND AFTER THE INTRODUCTION OF SEATBELT LEGISLATION

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**OBJECTIVES:** To compare the incidence and severity of acetabular fractures and associated injuries before and after seatbelt legislation.

**DESIGN:** A retrospective study.

**SETTING:** Two major trauma centres, which are teaching hospitals.

**PATIENTS:** Three hundred and ninety-three patients who sustained acetabular fractures during the 5 years before and 5 years after seatbelt legislation was enacted. Of these, the fractures in 198 patients (50.4%) resulted from a motor vehicle accident.

**MAIN OUTCOME MEASURES:** The number and severity of acetabular fractures and associated injuries.

**RESULTS:** There has been a significant reduction in the number of acetabular fractures ( $p = 0.005$ ) since seatbelt use became mandatory, and the complexity of the fractures has decreased. There has also been a marked reduction in associated injuries, such as fractures of other bones, and head, chest and abdominal injuries ( $p < 0.001$ ).

**CONCLUSION:** The seatbelt law has been a useful preventive measure, resulting in a reduction in the incidence of acetabular fractures and associated injuries.

**OBJECTIFS :** Comparer l'incidence et la gravité des fractures de l'acétabulum et des blessures connexes avant et après l'adoption de la législation sur le port de la ceinture de sécurité.

**CONCEPTION :** Étude rétrospective.

**CONTEXTE :** Deux grands centres de traumatologie qui sont des hôpitaux d'enseignement.

**PATIENTS :** Trois cent quatre-vingt-treize patients qui ont subi des fractures de l'acétabulum au cours des 5 années qui ont précédé l'adoption de la mesure législative sur le port de la ceinture de sécurité et des 5 qui l'ont suivis. Chez 198 patients (50,4 %), les fractures ont été causées dans un accident de la circulation.

**PRINCIPALES MESURES DES RÉSULTATS :** Le nombre et la gravité des fractures de l'acétabulum et des blessures connexes.

**RÉSULTATS :** Le nombre des fractures de l'acétabulum a diminué considérablement ( $p = 0,005$ ) depuis que le port de la ceinture de sécurité est obligatoire et la complexité des fractures a diminué. On a enregistré aussi une réduction marquée des blessures connexes comme les fractures d'autres os et les plaies au crâne, au thorax et à l'abdomen ( $p < 0,001$ ).

**CONCLUSION :** La loi sur le port de la ceinture de sécurité est une mesure de prévention utile qui a entraîné une réduction de l'incidence des fractures de l'acétabulum et des blessures connexes.

The hope of legislators and health care advocates is to decrease the morbidity and mortality associated with motor vehicle ac-

cidents. One method that has been proposed and widely implemented is the mandatory use of seat belts. The effectiveness and compliance of such

an approach has been controversial. Nevertheless, the Province of Alberta passed legislation in July 1987 that made seatbelt use in motor vehicles

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*Accepted for publication Apr. 21, 1996*

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mandatory. In this paper we examine the impact of this legislation on a significant orthopedic aspect of motor vehicle trauma — acetabular fractures. These fractures usually result from high-energy trauma and are associated with high morbidity and mortality. Seatbelt use has been consistently documented to decrease the death rate and injury severity from motor vehicle crashes.<sup>1</sup>

We review the incidence and severity of acetabular fractures before and after passage of the seatbelt legislation and the type and incidence of associated head, chest, abdominal and spinal injuries and fractures of other bones.

## METHODS

Data were gathered from the Medical Records Department of the University of Alberta Hospital and the Royal Alexandra Hospital, the main trauma hospitals in Edmonton. Charts were reviewed for the 10-year period July 1982 to July 1992. This covers the 5 years before the introduction of legislation and the 5 years after enactment. Patients with acetabular fractures resulting from causes other than motor vehicle accidents were excluded. The following information was obtained from each chart: age, sex, date of admission, details of injuries and intraoperative findings. Plain radiographs and computed tomography scans were reviewed. The severity and complexity of the acetabular fractures were classified according to the Letournel<sup>2</sup> classification into five simple fracture types and five associated fracture types. Statistical analysis was by the *t*-test and the  $\chi^2$  test.

## FINDINGS

During the study period 393 patients with acetabular fractures were

admitted to either the University of Alberta Hospital or the Royal Alexandra Hospital in Edmonton. Of these, 198 (50.4%) patients (128 men, 70 women) had fractures that were caused by motor vehicle accidents, which occurred most commonly between the ages of 20 and 50 years (Fig. 1). Of the 198 patients, the acetabular fractures in 119 (60.1%) patients were sustained in motor vehicle accidents before introduction of the seatbelt law, whereas in 79 (39.9%) patients, the fractures occurred after the seatbelt law was in place. The fractures in the former group were distributed as follows: posterior wall 28, posterior column 8, anterior wall 1, anterior column 8, transverse fractures 23, posterior column and posterior wall 9, transverse and posterior wall 3, T-shaped fractures 13, anterior and posterior hemitransverse fractures 2, and both columns 10. Fourteen patients had pure central dislocation of the hip, a type of fracture that is not included in Letournel's classification. In the latter group (after the seatbelt law was passed), the fractures were distributed as follows: posterior wall 22, posterior column 7, anterior wall 2, anterior column 8, transverse fractures 11, posterior column and poste-

rior wall 7, transverse and posterior wall 6, T-shaped fractures 5, anterior and posterior hemitransverse fractures 0, both columns 5, and 6 patients had a central dislocation of the hip (Fig. 2). Overall there was a significant ( $p = 0.005$ ) reduction in the number of acetabular fractures after introduction of the seatbelt law and a reduction in the number of complex fractures, although this was not statistically significant ( $p = 0.546$ ).

The following associated injuries were found in motor vehicle accidents that occurred before the seatbelt law was enacted: 33 head injuries, 36 chest injuries, 21 abdominal injuries, 83 fractures of other bones and 6 spinal injuries. After passage of the seatbelt law there were 14 head injuries, 23 chest injuries, 15 abdominal injuries, 56 fractures of other bones and 5 spinal injuries (Fig. 3). The overall reduction in associated injuries after introduction of the seatbelt law was significant ( $p < 0.001$ ) ( $p = 0.004$  for head injuries and  $p = 0.02$  for fractures of other bones).

## DISCUSSION

Seatbelt use has been documented to decrease death rate and injury

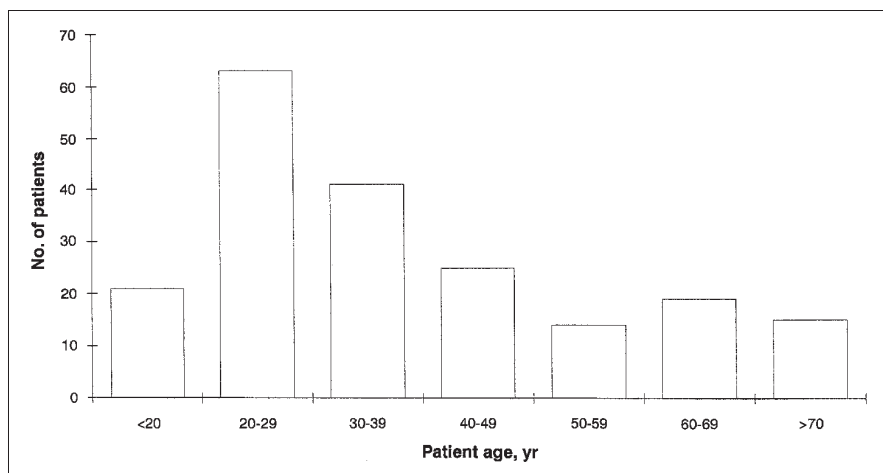


FIG. 1. Age distribution of patients with acetabular fractures due to motor vehicle accidents. Male-to-female ratio was 1.8:1.

severity in motor vehicle accident victims.<sup>3-8</sup> In 1970, Australia became the first to introduce mandatory safety belt use and to document its efficacy. Experiments in other countries had shown a reduction in morbidity and mortality of 25% to 65% associated with victims of car accidents after the introduction of seat-belt legislation.<sup>3</sup>

In 1990, Anderson and associates<sup>1</sup> compared belted and non-belted victims of motor vehicle accidents and found a significant higher mean

length of hospital stay and injury severity score (ISS) for the non-belted drivers. In another study, the National Highway Traffic Safety Administration (NHTSA) analysed 15 000 collisions and found that non-belted occupants were three times more likely to suffer serious injury and three and one half times more likely to be killed in those accidents.<sup>5</sup>

In 1991, Kaplan and Cowley<sup>8</sup> reported that seat belts reduced the total number of injuries by 34%, major injuries by 57% and minor injuries by

20%. The unbelted group had a mean ISS two times as great as the belted group and were hospitalized 1.6 times longer.

In 1988 in Alberta,<sup>9</sup> 61.2% of the fatally injured occupants of vehicles involved in accidents were not restrained at the time of the accident. However, 82% of occupants who were restrained at the time of the accident sustained only minor injuries.<sup>9</sup>

The findings of our study demonstrate that the majority of acetabular fractures related to high-energy trauma in motor vehicle accidents occurred before the introduction of the mandatory seatbelt law. We found a significant reduction in the number of acetabular fractures when seatbelt usage became mandatory in Alberta ( $p = 0.005$ ). Not only has the number of acetabular fractures been reduced, but the number of complex fractures has also decreased, although, because of the small number, the difference in terms of complexity is not statistically significant ( $p = 0.546$ ). The most important finding was the marked reduction in associated injuries ( $p < 0.001$ ). There were fewer head injuries ( $p = 0.004$ ), chest, spinal and abdominal injuries and fewer fractures of other bones ( $p = 0.02$ ) after the seatbelt law passed.

We found that injuries related to motor vehicle accidents are more common in young and middle-aged men. We were unable to compare the severity of injuries between those who used lap belts and those who used the shoulder harness, nor between those in the front seat compared with those in the rear seat.

In conclusion, passage of the seat-belt legislation correlated with a significant reduction in the incidence of acetabular fractures and other injuries.

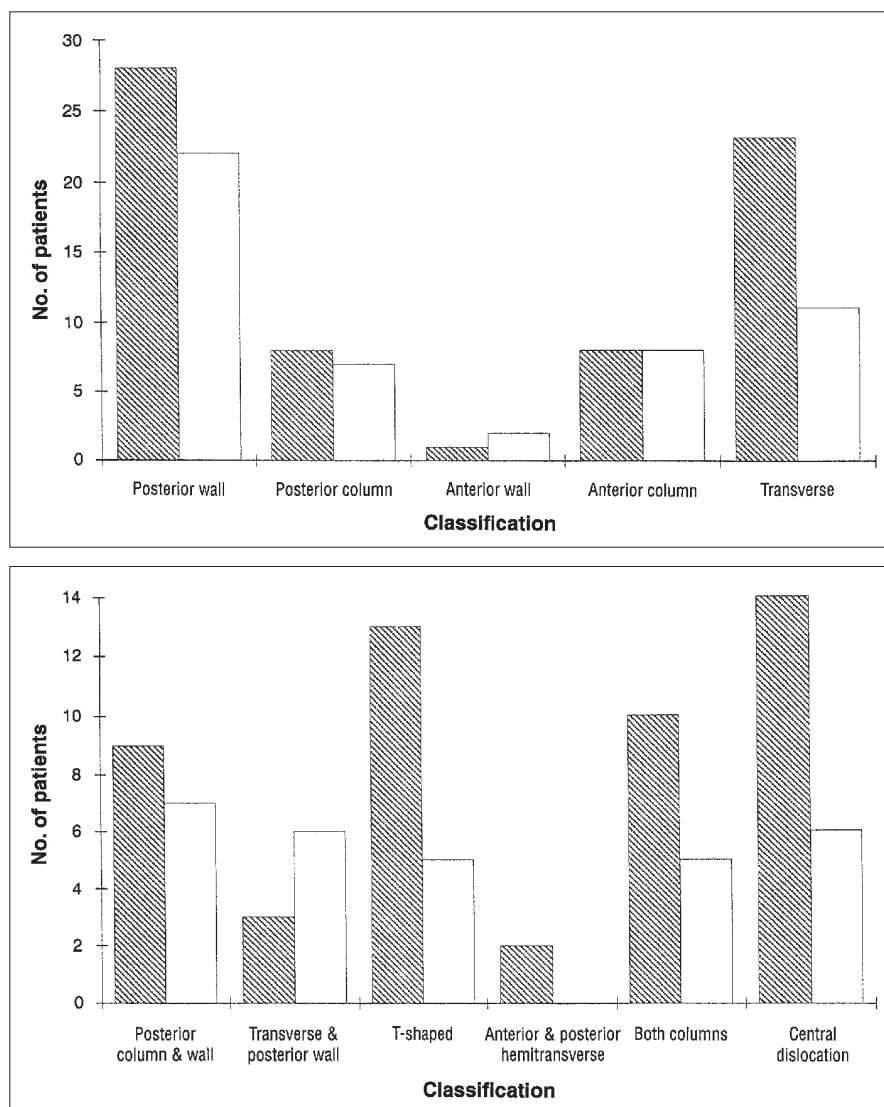


FIG. 2. Classification of simple (top) and complex (bottom) acetabular fractures in patients involved in motor vehicle accidents before (hatched bars) and after (white bars) enactment of seatbelt legislation.

We gratefully acknowledge the assistance of Mr. Jim Raso and Mr. Doug Hill of the Glenrose Rehabilitation Hospital, Edmonton

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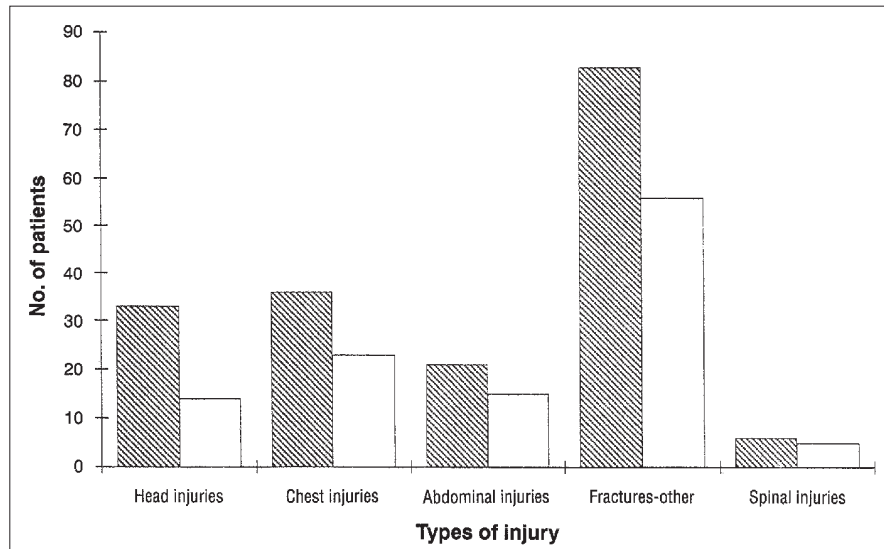


FIG. 3. Distribution of associated motor vehicle injuries before (hatched bars) and after (white bars) application of seatbelt law.