

ORIGINAL ARTICLE

Whiplash associated disorder in children attending the emergency department

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Aims: To determine the incidence, severity, and clinical course of whiplash associated disorder (WAD) in children aged 4–16 years involved as passengers in car crashes.

Methods: Prospective surveillance of all paediatric attendances to three English urban emergency departments after car crashes over an eight month period. An initial structured telephone interview at day 2 after the car crash was performed. This was followed by clinical review of symptomatic patients on day 5 after the crash using the Quebec Task Force criteria for outcome assessment, with subsequent clinical review at 14, 28, and 56 days or until earlier symptom resolution.

Results: 105 children were identified as having been involved in car crashes as passengers. Forty nine children (47%) experienced symptoms of a WAD. Twenty nine children developed symptoms within 24 hours with the remainder developing symptoms by 48 hours. Forty children experienced a WAD grade 1 and nine children suffered a WAD grade 2 injury. The mean duration of symptoms was 8.8 days (range 3–70, SD 10.7). WAD grade 2 symptoms lasted significantly longer than WAD grade 1 symptoms.

Conclusions: The incidence of WAD in children in this series was higher than in other studies. The clinical course was more favourable than that reported for adults.

Acute neck sprains after car crashes, now termed whiplash associated disorders (WAD), have been described as a “modern epidemic”¹ with reported incidence rates of up to 62% in adult populations.² “Whiplash” has classically been described as a cervical soft tissue hyperextension injury after a rear end impact car crash³ but recently the term has been more loosely ascribed to all cervical sprain injuries incurred in car crashes.

Recent consensus work by the Quebec Task Force⁴ has produced a reproducible and comprehensive methodology to guide the clinical examination and severity grading in soft tissue cervical injuries following car crashes. Previous WAD literature has largely pertained to adults. Only one study has specifically examined WAD in the paediatric population. This quoted an incidence of 29% in children involved in car crashes as passengers⁵ but relied exclusively on telephone survey data and did not extend to clinical examination. Some insurance claim evidence suggests a 41% rate for WAD in children after involvement in a car crash.⁶ This paucity of evidence is surprising given that the problem was initially identified nearly 15 years ago.⁷ This study was designed to look exclusively at the problem of WAD in children.

The objective of the study was to determine the incidence, severity, and clinical course of WAD in children aged 4–16 after involvement in car crashes as passengers.

METHODS

The study was undertaken after approval from the relevant local research ethics committees. Sequential paediatric attendances presenting to three urban emergency departments in the North West of England conurbation, after involvement as a passenger in a car crash were prospectively studied, over an eight month period from May 1999 to January 2000.

Children aged 4–16 accompanied by a responsible carer were approached and asked to participate in the study. Consent was gained from the responsible adult and assent from the child. Children requiring resuscitation or inpatient admission for their injuries were excluded.

Table 1 Quebec Task Force criteria for whiplash associated disorder

Grade 0 =	Nil symptoms
Grade 1 =	Complaint of pain on motion but no pain on physical examination
Grade 2 =	Complaint of pain on motion with pain on physical examination
Grade 3 =	As grade 2 but with neurological symptoms
Grade 4 =	Fracture or dislocation

The responsible parent or adult was contacted at 48 hours after discharge from the emergency department and a structured interview was performed, by telephone, using a structured questionnaire. A single researcher (RB) made telephone contact using a standardised questionnaire using a “template” sequence of closed questions to elicit “Yes/No” answers. These questions were directed to elicit the presence or absence of any of the following—complaint of neck pain, objective evidence of neck discomfort, reduced range of motion in the neck/upper trunk, time taken off from school, or evidence of restricted physical activity. The order and wording of each telephone interview was identical. If symptoms of neck pain, discomfort, or decreased motion were reported on direct questioning an appointment for formal clinical review was made for approximately five days after the initial car crash. If no symptoms of pain, discomfort or decreased motion were elicited on direct questioning then, in accordance with the Quebec Taskforce criteria, a grade of WAD grade 0 was given.

Clinical review of symptomatic children was performed at day 5 after the car crash by a single researcher (RB) to avoid interobserver variability. A structured clinical examination of the cervical spine (occiput to the clinical cervicothoracic junction) and history was taken as per the minimum dataset suggested by the Quebec Task Force group.⁴ A clinical grading of the WAD was also made using the Quebec Task Force criteria

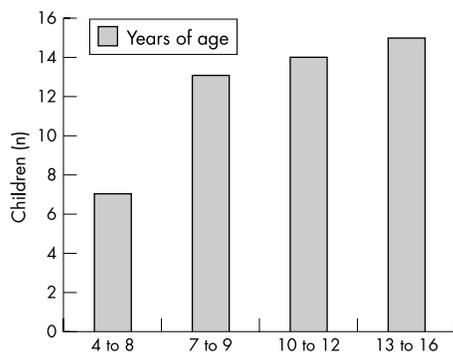


Figure 1 Age distribution of children with WAD.

(table 1). Further clinical review for those with WAD of grade 1 or greater was then arranged for 14 days, 28 days, and 56 days. Patients were discharged from follow up when they became asymptomatic, namely, WAD grade 0. A further telephone follow up was then performed after clinical discharge to confirm the child's continued asymptomatic state. Follow up was completed for all children included in the study. Chart reviews were undertaken to ascertain the use of radiological investigation and the formal radiologist report for those investigations was obtained. Radiographs were ordered in accordance with existing protocols at each site.

Data were analysed using a SPSS statistical package for PCs using the χ^2 test, the Mann-Whitney U test, and Kaplan-Meier survival graphs.

RESULTS

Altogether 110 sequential attendances were identified and included in the study over an eight month period. Five attendances were excluded as consent or assent was not given.

Thirty nine per cent of children studied were front seat passengers, with 61% as rear seat passengers. Ninety one per cent were reported as being suitably restrained in either, 3 point/4 point or "lap strap" restraints. Thirty two per cent were involved in frontal impacts, 18% in side impacts, and 50% in rear impact car crashes.

The overall incidence of WAD was 47% (49 of 105). Sixty per cent (29 of 49) of the children with WAD were symptomatic on the day of presentation to the emergency department with the remaining 40% of children with WAD becoming symptomatic the following day.

Fifty five per cent (27 of 49) of the WAD affected children were girls. There was no statistical difference in terms of incidence of WAD between the male and female groups on χ^2 testing.

Children who developed WAD symptoms were distributed over the age range studied as shown in fig 1. There was a non-significant trend to an increased number of WAD symptomatic patients in the older age groups.

Radiological investigation was performed in nine children of which four had WAD grade 1 and five had WAD grade 2. There was a significant difference using χ^2 testing in terms of the use of radiology between the children with WAD grades 1 and 2 ($p < 0.05$). All cervical spine radiographs were reported as showing no abnormality by consultant radiology staff.

Clinical examination of the WAD group demonstrated nine children with Quebec Task Force WAD of grade 2 and 40 children with a WAD of grade 1. The overall mean duration of symptoms for children with WAD was 8.8 days (range 2–62). The mean duration of symptoms for the WAD grade 2 children was 19.7 days (range 2–62). The mean duration of symptoms for the WAD grade 1 children was 6.4 days (range 2–18). There was a significant difference in duration of symptoms between the WAD grade 1 and 2 groups on testing with the Mann-Whitney U test ($p = 0.034$). Figure 2 is a Kaplan Meier

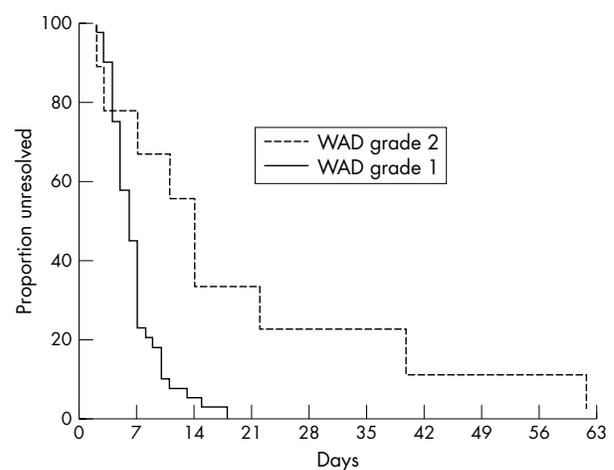


Figure 2 Clinical course of WAD grades 1 and 2 in children.

survival graph showing the resolution of symptoms against time for the WAD grade 1 and grade 2 groups. No children reached the accepted criteria for chronicity of WAD namely pain lasting more than two months, as defined by the Quebec Task Force group.⁴

DISCUSSION

WAD has until now almost exclusively been reported as an adult phenomenon with very few children identified in previous cohorts. This study is the largest clinically assessed group of children with WAD to date. Recent work from the UK⁵ had alluded to an appreciable incidence of WAD in children but had not been able to clinically confirm this. Hadfield *et al* suggested an incidence of 29.5%, a figure somewhat lower than that oft quoted for the incidence of WAD in adults. Our figure of 47% is appreciably higher than many previous adult emergency department reports and also higher than previous insurance company data.⁶ One obvious factor responsible for this may be the "positive" reporting bias inherent in patients attending emergency departments. Measures were taken, as far as practicable, to reduce the use of leading questions in the initial structured telephone questionnaire to avoid an over-reporting bias. Such high rates of WAD were unexpected given the paucity of previously published evidence and does suggest a hidden incidence that may not be being recorded in children presenting after car crashes.

The well known time delay before the onset of symptoms in adults⁸ was reflected also in our paediatric population. Forty per cent of children with WAD experienced the onset of symptoms over 24 hours after the car crash. As before it is not fully understood why such a delay in onset of symptoms should occur but may reflect the soft tissue injury aspect of WAD with late muscle stiffness and pain.

Cervical spine radiographs are taken infrequently in children. In our series only nine cervical spine series were requested in children with WAD grade 1 and 2. Radiographs were ordered according to local practice guidelines. Of note is the increased rate of use in WAD grade 2 but that being so, not all this group did in fact have radiographs performed. Applying the Quebec Task Force guidelines for radiography in WAD⁴ would significantly increase the number of radiographs performed in children as it suggests that all patients with a WAD grade 2 or above should have cervical spine radiographs performed. Further work is necessary to evaluate if this is in fact beneficial in children.

The clinical course for WAD in children would seem to be much more favourable than that in adults. The Quebec group suggested a mean time to resolution of 28 days. Our cohort had a mean time to resolution of 8.8 days. Intuitively one

would have expected that the more severe WAD, grade 2 would take longer to resolve and this was borne out in our study. The reasons for the much more favourable outcome are probably multifactorial and almost certainly include both physical and psychological factors. Recent work has shown that children are susceptible to and do experience significant psychological trauma after being involved in a car crash.⁹ This study did not attempt to differentiate the physical from psychological components of the reported symptoms after the car crash, more quality research is needed to elucidate this.

Contributors

RB and DWY initiated and designed the study. RM, RB and LD prepared the patient and guardian information and participated in the ethics committees stage. RB collected the data with telephone and clinical interviews. RB analysed the data and wrote the paper with DWY. All authors have contributed to the drafting of the submitted paper. RB acts as guarantor for the paper.

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