CHANGE PAGE

Advise use of rear facing child car seats for children under 4 years old

Elizabeth A Watson,[1] Michael J Monteiro[2]

[1]Sunny Meed Surgery, Woking GU22 7EY

[2]Department of Oral and Maxillofacial Surgery, Royal Surrey County Hospital, Guildford GU2 7XX

Correspondence to: E A Watson eliwat1@yahoo.co.uk

Cite this as: *BMJ* 2009;338:b1994
doi:10.1136/bmj.b1994

This article reviews evidence for changes in practice by parents, manufacturers, and retailers

The clinical problem

In many countries it is a legal requirement that children under a certain height or age (1 m 35 cm or 12 years, in the United Kingdom) use child restraints appropriate for their weight while travelling in a car. This significantly reduces morbidity and mortality.[1] European car seats for babies and young children are classified as group 0+ (from birth to 13 kg, and all rear facing) and group 1 (9-18 kg, often forward facing but can also be rear facing). Currently, many babies are switched from a rear facing to forward facing seat at 9 kg (age 8 months for a boy on the 50th centile.[2 3] Evidence is mounting, however, that it is safer for young children to travel in a rear facing seat until 4 years of age.[2-8]

The evidence for change

The relatively large head mass and differences in the anatomy of the cervical spine in young children[5] can lead to excessive stretching or even transection of the spinal cord if a child is involved in a frontal (head-on) crash while in a forward facing car seat.[4-6] The younger the child, the lower the crash force required to cause spinal injury.[4] In rear facing car seats, the head, neck, and spine are kept fully aligned, and the crash forces are distributed over all of these body areas.[3 6-8] Additionally, the back seats of a car are safer places for children than the front seats.[9] However, most rear facing car seats can be used on the front seat of a car if there is no active airbag.

A retrospective cohort study involving 870 children aged under 2 years analysed the protection offered by rear facing compared with forward facing child restraints.[3] It concluded that rear facing seats were more effective than forward facing seats in protecting children aged 0-23 months for all crash types (odds ratio 1.76, 95% confidence interval 1.40 to 2.20) (box).

Questionnaires and real life observations have shown that 70-75% of Swedish children aged under 3 years travel in rear facing seats.[10] Swedish crash data support the use of rear facing seats.[2 7] From 1999 to 2006 four children aged under 4 years and restrained in rear facing seats were killed. The deaths were due to fire, drowning, or excessive intrusion and were unrelated to the type of car seat.[2] During the same period six children aged under 4 years in forward facing booster seats were killed. Three of these crashes would have been potentially survivable if the children had been travelling in rear facing seats.[2] There are no direct comparisons between rear facing and forward facing car seats as forward facing car seats are not commonly used in Sweden. Retrospective cohort analysis of all serious crashes reported to Volvo's insurance company from 1976 to 1996 included 421 children in rear facing car seats and 950 in forward facing booster seats. The calculated injury reducing effect of rear facing and forward facing seats was 96% and 77% respectively.[7]

These real life data are supported by crash tests and numerical simulations, which support the use of rear facing seats until age 4. One study conducted 31 frontal crash tests with 12 month, 18 month, and 3 year old dummies restrained in both US and European rear facing and forward facing seats.[8] All rear facing seats resulted in significantly lower injury measures for neck and chest compared with the forward facing seats; the European rear facing seats had the lowest injury risk.[8] Another study conducted numerical simulations comparing a 3 year old dummy restrained in both forward facing and rear facing seats.[11] It found that upper neck forces and neck injury criteria could be greatly reduced

METHODS

We searched the Scopus database (which includes all Medline journals plus additional journals) for the terms "rear-facing car seat", "forward-facing car seat", "rear-facing child safety seat", and "forward-facing child safety seat". We also searched the reference lists of studies. We prioritised studies that directly compared rear facing and forward facing seats or that detailed advantages or disadvantages of either type of seat. We searched child car safety websites (childcarseats.org.uk, car-safety.org, rearfacing.co.uk, safekids.org) for further relevant published evidence.

Change Page aims to alert clinicians to the immediate need for a change in practice to make it consistent with current evidence. The change must be implementable and must offer therapeutic or diagnostic advantage for a reasonably common clinical problem. Compelling and robust evidence must underpin the proposal for change. We welcome any suggestions for future articles (changepage@bmj.com).

Pivotal study supporting rear facing car seats for young children

Methods

A retrospective cohort study by Henary and colleagues used the US National Highway Traffic Safety Administration's vehicle crash database for 1998-2003.[3] The database is representative and allows crash data to be extrapolated to provide national estimates. Of the 870 children studied (all aged under 2 years), 352 were in rear facing car seats and 518 were in forward car facing seats. The study defined injury as an injury severity score of 9 or more, which is considered to represent moderate and severe injuries.

Results and conclusions

It concluded that rear facing seats were more effective than forward facing seats in protecting children aged 0-23 months for all crash types (odds ratio 1.76, 95% confidence interval 1.40 to 2.20). Effectiveness estimates compared with no restraint were 93% for rear facing seats and 78% for forward facing seats. These were calculated using estimates of the percentage reduction in rate of injury if all children changed from being unrestrained to being users of the particular car seat type. In side impacts, children were much more likely to be injured in forward facing seats (5.53; 3.74 to 8.18). When children aged 12-23 months were analysed separately, the findings remained: children in forward facing seats were much more likely to be injured (5.32; 3.43 to 8.24).

by using a seat that was rear facing. The conclusion encouraged manufacturers to develop rear facing seats suitable for children up to 4 years of age.

Barriers to change

Many parents and healthcare providers may be unaware that it is safer to leave children in rear facing seats for as long as possible or that rear facing seats for toddlers exist. Some parents may view the transition from rear facing to forward facing as progress. In many European countries it is more difficult, and can be up to twice as expensive, to obtain rear facing group 1 seats than forward facing group 1 seats. However, many rear facing seats are cheaper than the most expensive forward facing seats. In North America no rear facing seats are available that are suitable for children over 35 lb (15.9 kg).

Concerns that parents may have about using rear facing seats at an older age include motion sickness and the comfort and safety of the child's legs. However, the leg is among the most frequently injured body regions for children in forward facing seats.[6] Group 1 rear facing seats have modifications to provide leg room. No published evidence compares leg injuries or motion sickness in rear facing and forward facing seats.

How should we change our practice?

Healthcare professionals should advise that rear facing seats are safer than forward facing seats for children aged under 4 years.[2,3,6-8,10,11] Always advise that parents and guardians should be shown how to install any child car seat in their own car by a trained fitter at the place of purchase or by a road safety officer. The health review at six to eight weeks and health visitor sessions are ideal opportunities for this counselling.

KEY POINTS

Many babies are switched from a rear facing car seat to a forward facing seat at 9 kg (8 months of age for a boy on the 50th centile)

Excessive stretching or even transection of the spinal cord can result if a child is involved in a head-on crash while in a forward facing car seat

Rear facing seats are safer than forward facing seats for children under 4 years old

Parents and guardians should be advised to keep young children in rear facing seats for as long as possible

If parents do not have a rear facing group 1 seat, they should be advised to keep children in rear facing group 0+ seats up to the maximum weight or height limits for the seat. The American Academy of Pediatrics recommends that "for optimal protection, if a car safety seat accommodates children rear-facing to higher weight limits, the child should remain rear-facing until reaching the maximum weight for the car safety seat, as long as the top of the head is below the top of the seat back."[12]

Manufacturers and retailers need to increase the availability of rear facing car seats for children over 9 kg. The current labelling for weight range used for European child car seats may imply that for children over 9 kg forward facing seats are as safe as rear facing seats. Manufacturers could cooperate with European government agencies to improve labelling.

Contributors: EAW had the initial idea, performed the literature search, and wrote the initial draft. MJM did the literature search and reviewed the article. Both authors have seen and approved the manuscript The guarantor is EAW.

Competing interests: None declared.

Provenance and peer review: Not commissioned; externally peer reviewed.

1 Elliot MR, Kallan MJ, Durbin DR, Winston FK. Effectiveness of child safety seats vs seatbelts in reducing risk for death in children in passenger vehicle crashes. *Arch Pediatr Adolesc Med* 2006;160:617-21.
2 Gloyns P, Roberts R. [Vehicle Safety Consultancy.] *An accident study of the performance of restraints used by children aged three years and under.* 2008. www.anec.eu/attachments/ANEC-R&T-2008-TRAF-003.pdf.
3 Henary B, Sherwood CP, Crandall JR, Kent RW, Vaca FE, Arbogast KB, et al. Car safety seats for children: rear facing for best protection. *Injury Prevention* 2007;13:398-402.
4 Stalnaker RL. Spinal cord injuries to children in real world accidents. (Report No SAE 933100.) In: *Proceedings of Child Occupant Protection 2nd Symposium.* Warrendale, PA: Society of Automotive Engineers, 1993:173-83.
5 Fuchs S, Barthel MJ, Flannery A, Christoffel KK. Cervical spine fractures sustained by young children in forward-facing car seats. *Pediatrics* 1989;84:348-54.
6 Arbogast KB, Cornejo RA, Kallan MJ, Winston FK, Durbin DR. Injuries to children in forward-facing child restraints. *Annu Proc Assoc Adv Automot Med* 2002;46:213-30.
7 Isaksson-Hellman I, Jakobsson L, Gustafsson C, Norin H. Trends and effects of child restraint systems based on Volvo's Swedish accident database. (Report No SAE 973299.) In: *Proceedings of Child Occupant Protection 2nd Symposium.* Warrendale, PA: Society of Automotive Engineers, 1997:43-54.
8 Sherwood CP, Crandall JR. Frontal sled tests comparing rear and forward facing child restraints with 1-3 year old dummies. *Annu Proc Assoc Adv Automot Med* 2007;51:169-80.
9 Smith K, Cummings P. Passenger seating position and the risk of passenger death in traffic crashes: a matched cohort study. *Injury Prevention* 2006;12:83-6.
10 Anund A, Falkmer T, Forsman A, Gustafsson S, Matstoms Y, Sorensen G, et al. *Child safety in cars—literature review.* (VTI report 489A.) Linköping: Swedish National Road and Transport Research Institute, 2003.
11 Emam A, Sennah K, Howard A, Chapman M. A study of injury parameters for rearward and forward facing 3-year-old child dummy using numerical simulation. *International Journal of Crashworthiness* 2005;10:211-22.
12 American Academy of Pediatrics Committee on Injury and Poison Prevention. Selecting and using the most appropriate car safety seats for growing children: guidelines for counseling parents. *Pediatrics* 2002;109:550-3.

Accepted: 30 March 2009

[1]London

[2]Hampstead Group Practice, London NW3 2QU

Correspondence to: G Reeve gereeve2002@yahoo.co.uk

Cite this as: *BMJ* 2009;338:b2072
doi:10.1136/bmj.b2072

A PATIENT'S JOURNEY

The invisible worm: ovarian cancer

Gill Reeve,[1] Stuart Mackay-Thomas[2]

It took nine months for Gill Reeve's GP practice to diagnose her symptoms as ovarian cancer. She wants to know why it took so long

> O Rose, thou art sick!
> The invisible worm,
> That flies in the night,
> In the howling storm,
> Hath found out thy bed
> Of crimson joy;
> And his dark secret love
> Doth thy life destroy.

I was a fit, healthy, active 66 year old writer and peace campaigner, but some indefinable part of me knew that somewhere, somehow, something was seriously wrong. This poem by William Blake came out of the blue in February 2008 when I was asked to write anything I wanted during a neurology test. I had been referred to University College Hospital Neurology Clinic because of the worry that my worsening memory problems might reflect my mother's history of dementia. Nothing of concern was found apart from hypertension. A reading of the loss of a stone in weight never reached my GP practice.

Maze of symptoms

In September 2007 I had felt intermittent twinges of pain in my right side under my ribs. I had no idea which, if any, organ might be involved. I had a steep and protracted learning curve. My GP suspected gallstones and referred me for ultrasound. No gallstones were found, but a benign kidney cyst was suspected of causing my symptoms. In mid-November, when the pains seemed to be spreading, I went back to my GP, who suggested a referral to the urologist if things got worse.

I was busy, tried a wheat free diet, and when in early 2008 I saw my girth was extending I just thought it was middle age spread. But after a visit to Zambia I could ignore the pain no longer, and in early April the GP sent me to the urologist, who offered a procedure to double check the gallbladder. I declined, since I feared needles and being injected with a purple dye. In mid-May I was diagnosed with irritable bowel syndrome and given medication. Soon after there was a bad attack of diarrhoea, which turned out to be caused by campylobacter, and the pains got worse.

Diagnosis—at last

On 20 June 2008 a different GP examined me and noted fluid in my abdomen, enlargement, bloating, and weight loss, and took blood to be checked immediately. Three days later, when I was on holiday in Suffolk, I had a phone call to say there were high levels of non-specific markers for ovarian problems. I would be referred for a consultant appointment and an ultrasound and scan within two weeks. Shocked, I asked if this result could mean cancer. He said it could.

Ten days later, bewildered and unwell, I went through a barrage of tests at the Royal Free Hospital, not helped by the chaotic new CRS computer system, which forced many of the results to be retrieved in person. The consultant told me she strongly suspected ovarian cancer and would refer me for confirmation and treatment to University College Hospital, which had the lead gynaecology/oncology department in the North London Cancer Network.

Because the Royal Free Hospital's results failed to reach University College Hospital and tests had to be repeated, it was not until 22 July that I got confirmation of my diagnosis: stage IVa adenocarcinoma of the ovary. I have since learnt that doctors miss ovarian cancer so frequently that it is usually found only at a late stage, and is known as "the silent killer."

I was admitted the next day to have the toxic fluid removed from my abdomen—reassured that it was my future surgeon on her ward round who elegantly slipped in the drain. As I watched with fascination nine litres of ascites flowing from my grateful body over two days, I realised I had crossed the border from the real world to an alien one of obsession with bodily functions—I had become a Patient.

Thank God for the iPod

The oncology team decided that because of the metastases I should first have three chemotherapy sessions at monthly intervals starting on 5 August to try to shrink the tumour. Because of my funk about needles my niece Charlotte, who was my invaluable escort throughout my medical forays, got me an iPod, stored my favourite music on it, and made sure I got a bed rather than a chair so I could relax during treatment. The nurses were mostly fine at administering the chemo, giving information and calming fears. By my second visit the chemo room almost felt like a home from home.

The prevailing metaphor for cancer, as for most disease, as Susan Sontag has pointed out, is "warfare." The body is a battlefield, and the invading organisms and proliferating cells are an enemy to be destroyed. Even

This is one of a series of occasional articles by patients about their experiences that offer lessons to doctors. The *BMJ* welcomes contributions to the series. Please contact Peter Lapsley (plapsley@bmj.com) for guidance.

the chemo destroys healthy cells. This imagery must contribute greatly to the climate of fear that surrounds cancer, and is a "particularly inapt metaphor for the peace-loving," such as myself. I felt I must approach my chemo in a cooperative way. Discovering the taxol agent was made from yew needles, I accepted it gratefully as a plant cure—and thus began to feel more in control.

Home help

Each chemo session lasted several hours, and I returned home to a range of side effects that continued for up to three weeks. It was thanks to my family and friends that I got through this period. One provided daily fresh fruit and vegetable juice and offered nightly meals on wheels; others brought soup and helped me out for walks. A brilliant Macmillan nurse visited me regularly to help with pain and other problems. My yoga teacher supplied a simple daily routine, and a weekly session of Jin Shin Jyutsu (a traditional Japanese healing technique) helped me cope with the effects of chemo and extreme surgery.

The kindest cut—debulking

Thanks to the chemo my tumour had shrunk enough for me to have the debulking laparotomy on 8 October. This was bearable only because by now I trusted my surgeon, and managed to remove myself from my body to allow the preliminaries. The relief when I woke up in intensive care after a five and a half hour operation to discover I was alive and without a stoma bag—even though my legs seemed to be dead—was exquisite. Apart from one terrifying episode when my pain relief failed in the early hours, I recovered well on the ward. After three further chemo sessions and a month

A DOCTOR'S PERSPECTIVE

A delayed diagnosis of a life threatening illness is one of the most feared events in a doctor's career, and when it happens to a patient known to the practice for decades, there are inevitable feelings of guilt and contrition. Gill's initial symptom of vague right upper quadrant pain was typical in its non-specificity of ovarian cancer—not localised to the pelvis and relatively minor in severity. In the earlier stages, the all too brief consultation time was predominantly focused on her concerns over memory loss, and the nagging, mild pain took back seat. Later, Gill's symptoms of weight loss and increasing abdominal girth were unfortunately more indicative of a later stage of ovarian cancer.

It is one of the side effects of increasing accessibility and perceived decreasing continuity that patients might have to see a different doctor for urgent appointments. This situation allows a fresh clinical acumen to assess the patient. During one such appointment I met Gill for the first time, and the symptoms of weight loss and the signs of ascites alerted me to the likelihood of a more serious problem. Thus this lack of continuity with her usual doctor had an unexpected benefit, one that is not often commented on by those lamenting the changing role of the family doctor.

The problem of how to prevent this personal tragedy repeating itself throughout the world's consulting rooms is an important one. Ovarian cancer is a great mimicker and the symptoms are insidious and variable—they include abdominal pain and bloating, but also changes in bowel habit, urinary symptoms, or pelvic symptoms (SIGN guideline 75). Diagnosis in the early stages hugely increases survival but is, of course, the most difficult to elucidate clinically. Our large practice held a significant event analysis and reviewed the evidence soon after we met with Gill. Gill's previous hormone replacement therapy and nulliparity will have increased the risk of ovarian carcinoma, albeit only to a modest degree. We concluded that increased awareness by our clinicians of this relatively common condition (a typical GP will see one new patient with ovarian cancer every five years), coupled with much lower threshold of investigation (pelvic ultrasound and serum CA125), especially in older women, is crucial, even if there is no evidence to support this at present in those with vague abdominal symptoms. More optimistically, preliminary results of a recent large population screening trial show promise for detecting tumours at an early stage, although 10% of cancers were missed and some patients had surgery that turned out to be unnecessary (*BMJ* 2009;338:b1084).

The feelings of guilt in the doctor will fade slowly—we cannot turn back the clock. For this reason, as a team, we share our knowledge in an attempt to assuage the invisible worm and those others that fly in the night. With extra care and vigilance, and perhaps when the results of the screening study are published in five years, this particular worm may be turned.

Stuart Mackay-Thomas, Hampstead Group Practice, London NW3 2QU
sit@doctors.org.uk

USEFUL RESOURCES

In UK women, ovarian cancer is the fourth most common cancer after breast, bowel, and lung. Each year there are nearly 7000 new cases of ovarian cancer (most in women over 65) and the disease claims more than 4000 lives. If the disease is caught in the early stages, 90% of women will live for more than five years.

www.ovarian.org.uk—Ovarian Cancer Action carries out research and raises awareness of symptoms of ovarian cancer

www.ovacome.org.uk—offers telephone support network for people affected by ovarian cancer

www.cancerbackup.org.uk—information and support offering free services to all affected by cancer

www.cancerresearch.uk—aims to improve quality of life for people with cancer and support them and their families.

www.nhs.uk/Livewell/cancer/Pages/Ovariancancer.aspx—useful information from the NHS

www.macmillan.org.uk—offers free nursing and other support for people with ovarian and other cancers at home to get over them, the CA125 test on 13 January 2009 showed that I was in remission.

Having it out with the practice

Why had it taken so long to diagnose my disease correctly and get me into treatment? Now I could reflect on what had happened, I felt great anger at the GPs who had failed to make the connections between symptoms until the disease had spread, and at the hospital computer system, which had caused my almost unbearable wait to know the truth. Since I was already in the high risk group for ovarian cancer (over 65, had had hormone replacement therapy, no children) surely I should have had a CA125 test at the outset. The irritable bowel syndrome diagnosis was particularly galling. Supported by a friend I asked to see my records and have it out with those most involved at the practice.

The GPs agreed. At our meeting I expressed my anger and sense of betrayal, and the GPs answered in detail. The discussion was long and heartfelt, with several points of agreement, such as: was there a way to get to patients' underlying concerns when there were indefinite pains? Could they use the CA125 test earlier? Could they find a mechanism to ensure weight loss was flagged on file? I appreciated their openness, their willingness to consider change, and—perhaps most importantly—the apology from the doctor who diagnosed irritable bowel syndrome. We felt it would be useful to write about the experience from both points of view.

Only time will tell if I can evict the worm.

Competing interests: None declared.

Provenance and peer review: Not commissioned, not externally peer reviewed.

Vocation: to be prepared to go beyond the call of duty

Of the many specialties through which I had rotated as a senior house officer, I had come to like paediatric surgery the most. I had joined the postgraduate general surgery residency and so was no longer on the paediatric surgery rota. However, I admired the dedicated consultant and had volunteered many of my off-duty hours to work in his wards and scrub up with him in the theatre.

One night, on my way back from a call, I was stopped by a ward-boy with a call book. There were no pagers in our hospital in those days. Instead, doctors were called for emergencies by handwritten messages in a call book, and ward-boys were sent out to find the doctors in their usual hideouts—with many outcomes depending on how quickly the ward-boy could track down the doctor.

That night there was an emergency in the paediatric surgical ward. The houseman was too scared to call the consultant at home. He had sent out the call book to me in desperation, not realising that the staff list on the wall was long outdated and that I was no longer in paediatrics. It was well after midnight when I saw the patient, a young girl with intestinal obstruction.

An exploratory laparotomy had been booked for the next morning, provided the child survived the night and was accepted for theatre by the anaesthetists ... and if blood for transfusion could be made available. Getting blood for transfusion was always the responsibility of the patients' "party"—parents, friends, relatives, or whomever could be found. This little girl had only her parents.

We were the only hospital in the city with a nationalised blood bank, but the staff there claimed to have run out of stocks of her group. The alternative was to buy units from one of the many private blood banks. The young parents were poor and knew no one in the city: to buy even a single unit of blood was beyond their means. In those days I was no richer and, even had I wanted to, I could not have offered them any money.

Would they donate blood themselves? No, the mother thought it would kill them. The father thought it was against their religion. They decided to accept the inevitable; they had three other children. They had given up on the one who was so ill.

The child and I had the same blood group, but I was intensely needle-phobic. Besides, it would be a bad precedent if doctors were to donate their own blood for their patients.

To this day I do not know what made me go down to the blood bank and convince the medical officer to be gentle with the transfusion needle. One unit of my blood was enough for three baby transfusions. To ensure the blood bottles were not "lost" in transit (not unknown for rare blood groups) and so that no one would know the source, I brought the blood up to the ward myself. We transfused one unit that night.

The next morning, my professor called me to say that the consultant in the paediatric theatre wanted to see me and that I was excused from the rest of our theatre list. My heart sank, but, when I reached the theatre, the consultant simply asked if I would scrub up with him. It was the girl I had examined the night before. The anaesthetist had started another blood transfusion.

We prepped and draped the tiny figure in silence. The consultant surprised us all by asking me to swap sides, informed the anaesthetists that I would be the surgeon, and for the first time handed me the knife. It was a small gut volvulus, strangulated as anticipated. I resected it and anastomosed the healthy ends of gut. Every time I looked up I saw the blood transfusion trickling in. Only I knew it was my blood.

As we left the operating theatre, the consultant shook my hands and thanked me for what I had done the night before. He had known after all; the house officer had felt compelled to inform him. We never discussed it again.

Whenever I could, I went up to check on the girl's progress. One day her bed was empty: she had been discharged home. I do not know if she survived or what kind of a life I helped her return to.

What I did learn that night was that a doctor might be the last person who can make a difference between life and death. As long as there is a heartbeat, as long as there is an output, we have to do everything to save that life. It may go beyond our call of duty.

At the end of my career as I look back, I am prouder of my one action of that night than of anything else I have achieved in the profession.

She would be 24 years old this year. I still carry my intense phobia of needles.

Amit Bhattacharyya former associate specialist, Calcutta Medical College, India
awmyth@doctors.org.uk

Patient consent not required (patient anonymised).

Cite this as: *BMJ* 2009;338:b1121