Case Report

Pressure ulcer in a man with tetraplegia and a poorly fitting wheelchair: a case report with clinical and policy implications

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Past medical history

The subject is a 39 year-old professional with tetraplegia who had sustained a complete spinal cord injury, functionally, at a C-3–4–5 level with partial sparing of the left biceps. The injury was sustained at the age of 16 from a motor vehicle accident. Functionally, the subject is dependent in all activities of daily living and uses an Invacare Storm Series power base wheelchair with a power tilt mechanism (Invacare Corp, Elyria, Ohio, USA) which was fitted by a wheelchair technician employed by a durable medical equipment (DME) company.

History of the pressure ulcer

In February of 1996, at the age of 39, the subject developed a grade 2^{1,2} right ischial pressure ulcer with partial skin loss into the epidermis and dermis (1 cm diameter shallow crater) that interfered with his ability to sit and work. Although he had been having difficulties with skin breakdowns ever since he received his power wheelchair, the event that precipitated the ulcer was the replacement of his deteriorating gel seat cushion with a new gel cushion, produced using a new formula. The subject did not respond well to the new cushion, developing an ulcer within a few days of using it.

Altering the cushion with other cushions did not improve the condition of the skin. At its worst state, on February 19th, 1997, the open ulcer was approximately 2 cm wide, and with a color that was mostly red and slightly gray. After 3 weeks of complete pressure relief from bed rest, the ulcer had become mostly superficial, though retaining a bright pink color. The subject then resumed sitting in his wheelchair for restricted periods. The skin remained pink and would not heal completely.

Due to the difficulty of locating a physician who was knowledgeable of pressure ulcers in persons with tetraplegia, the subject received little formal medical

advice during the period of his pressure ulcer. Although a local physiatrist prescribed an air-cushion to distribute pressure (Roho Inc, Belleville, IL, USA), the cushion did not resolve the problem.

Wheelchair evaluation and intervention

On April 19, 1997, after 2 months with the pressure ulcer on his right ischium, the subject contacted a physical therapist to evaluate whether his wheelchair had contributed to the problem. The therapist found that the metal seat pan supporting the seat cushion in the subject's power wheelchair was positioned too far forward and the backrest angle was too far reclined.³ Intervention entailed moving the seat pan and cushion backwards and adjusting the backrest to a vertical position so that the subject's pelvis and lumbar spine was supported and positioned toward the rear of the seating system.

Results

Within 2 days of the intervention, reduced erythema (as determined by visual inspection and videotaping) was noted for the first time while the subject sat in his wheelchair for approximately 10 h. Over the following 3 weeks, the pink coloration surrounding the right ischium completely disappeared despite the fact that the subject's sitting time increased to his full 12 h. Three months after the intervention, the only trace of the ulcer was some scar tissue that was barely perceptible to the human eye. One year after the intervention, the subject's skin was in excellent condition. His sitting time had actually increased to 13 h for the first time in his life as a person with a disability.

Discussion

The intervention offers the best explanation for the subject's improvement. There is little doubt that the air-cushion contributed to the individual's improve-

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ment. However, use of that cushion alone, prior to the intervention, did not result in healing of the ulcer (ie, erythema persisted). Consequently, we infer that the wheelchair intervention was the primary and necessary cause of the improvement. The pressure ulcer's persistence appeared to be multifactorial. Although the ulcer first occurred with the introduction of a new gel cushion, resolution only occurred once several factors (ie, type of cushion, angle of sitting, and seat depth) were modified. It is likely that the new gel cushion combined with the long-standing, poorly-fitted seating contributed to the ulceration.

Clinical implications

Despite existing clinical guidelines that recognize postural alignment as important in pressure ulcer prevention,¹ sitting position is still one of the most overlooked factors in the development of pressure ulcers.⁴ Furthermore, the incidence of pressure ulcers in wheelchair users continues to be high despite advances in cushion technology.⁵ Clinicians who work with wheelchair users must be aware of the multiple factors that contribute to pressure ulcer formation, and more specifically, the deleterious biomechanical forces that may be imposed by a poorly fitted wheelchair. Evaluations and fittings should be conducted by competent clinicians and DME technicians with sufficient training and understanding of the relationship between sitting posture and forces acting on the body over time.⁶

Policy implications

The annual cost to care for pressure ulcers in the USA is estimated to be as high as \$1.3 billion.⁷ Beyond direct medical costs, pressure ulcers impose large direct and indirect costs in terms of lost productivity, lost government revenues, increased dependence on caretakers, and lost productivity of family care givers,^{6,8} as well as enormous intangible emotional costs on the disabled person and his or her family.⁹ Therefore, policy makers at all levels should be concerned about pressure ulcers, particularly if such ulcers can be prevented at very little cost through appropriate wheelchair evaluations.^{10,11}

Clinical practice guidelines for the prevention, detection and treatment of pressure ulcers should specifically include wheelchair evaluation and modification as a recommendation.¹ Policy makers should

encourage rehabilitation centers and other appropriate health care providers to establish wheelchair clinics for the proper prescription and fitting of wheelchairs, and the avoidance of pressure ulcers generally. Such clinics have been shown to reduce the incidence of pressure ulcers.¹⁰

Conclusion

The significance of this case report is not that this wheelchair user had a severe pressure ulcer. In fact, his ulcer, although medically serious, was relatively mild as compared with most pressure ulcers that plague people with disabilities everywhere. It is precisely for this reason that this case is important to understand. A pressure ulcer that was entirely preventable with only a little knowledge of wheelchair evaluation almost cost the subject his career and personal life. It is the obligation of clinicians and policy makers to ensure that people with disabilities have access to these interventions to avoid such preventable problems.

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