

Hip protectors for prevention of hip fractures

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Abstract**Summary and purpose**

Hip fractures are the single biggest cause of hospital bed occupancy in Denmark. The total for hip fractures in Denmark is now about 7,500 cases per year. Over 90% of all hip fractures are caused by falls. The risk of a fall and therefore of a fracture increases with age, and the average age of patients with hip fractures is over 80. The majority of hip fracture patients have one or more simultaneous chronic medical conditions.

Hip fractures therefore particularly affect residents with a previous invalidity, and so a fracture often has serious consequences. If falls can be prevented from resulting in fractures, the risk of both invalidity and mortality can presumably be significantly reduced, and at the same time it will be possible to reduce the number of casualty ward contacts, bed days on admission and rehabilitation courses.

A hip protector can reduce the impact of a fall onto the hip, and thereby reduce the risk of hip fractures amongst elderly and frail people who are at a high risk of falling. The effectiveness of hip protectors in the prevention of hip fractures amongst residents of nursing homes was investigated in the Canadian MTA report "Hip Protectors in Long-Term Care: A Clinical and Cost-Effectiveness Review and Primary Economic Evaluation" (the CADTH report) of 2008. The purpose of this commentary is to carry out a critical evaluation of the CADTH report and its recommendations, and to determine to what degree the conclusions can be applied in a Danish context.

Method

The CADTH report is based in part on a systematic review of literature from January

2003 to March 2008, and partly on an original decision-analytical cost-effectiveness model. This commentary has been added to by an updated search for literature that has been expanded from March 2008 to October 2009, based on the search strategy of the CADTH report.

Results

The authors of the CADTH report recommend that hip protection be included when considering programmes intended to prevent falls amongst residents of nursing homes. Those who would benefit most from the use of hip protectors are elderly residents of nursing homes with a high risk of falling. The conclusion

of the financial model analysis is that combined use of hip protectors and alendronate in 75 to 89-year-old women living in nursing homes is cost-effective at a maximum willingness-to-pay of CAD 50,000 per QALY (» DKK 237,000). The authors also conclude that if the choice is between no prevention and isolated use of hip protectors, then the use of hip protectors is cost-effective at the same maximum willingness-to-pay.

Conclusion for Danish practice

Based on the commentary, the authors of this Annotated Foreign MTA conclude that there is support for the fact that the use of hip protectors is both clinically effective and cost-effective in the prevention of hip fractures amongst elderly residents of Danish nursing homes at a high risk of falling. The effect of the intervention is dependent on supporting procedures being in place and on the training of health professionals. It is also of decisive importance that individual residents be involved in trying out hip protection and deciding on its use in order to ensure good compliance.

The Force Attenuation Provided by Hip Protectors depends on Impact Velocity, Pelvic Size, and Soft Tissue Stiffness

Andrew C. Laing, Stephen N Robinovitch J. Biomech. Eng. -- December 2008 -- Volume 130, Issue 6, 061005 (9 pages) doi:10.1115/1.2979867

Abstract

Wearable hip protectors represent a promising strategy for preventing hip fractures. However, there is lack of agreement on biomechanical testing standards and subsequent uncertainty about the ability of hip protectors to attenuate impact force during a fall. To address this issue, we designed a fall impact simulator that incorporated a "biofidelic" surrogate pelvis, which matched the surface geometry and soft tissue stiffness measured in elderly women ($n = 15$). We then used this system to measure the attenuation in peak femoral neck force provided by two commercially available soft shell protectors (Safehip Soft and Hipsaver) and one rigid shell protector (Safehip Classic). Finally, we examined how the force attenuation provided by each protector was influenced by systematic changes in fall severity (impact velocity), body size (pelvis size), and soft tissue stiffness. With the biofidelic pelvis, the force attenuation averaged over all impact velocities was 27% for Safehip Soft, 17% for Safehip Classic, and 19% for Hipsaver. However, the rank order of hip protectors (and especially the performance of Safehip Classic) varied with the test conditions. Safehip Classic attenuated force by 33% during a low velocity (1 m/s) fall, but only by 8% for a high velocity (4 m/s) fall.

In the latter condition, improved attenuation was provided by the soft shell hip protectors (19% by Safehip Soft and 21% by Hipsaver). As soft tissue stiffness increased from softest to most rigid, the attenuation provided by Safehip Classic increased 2.9-fold (from 26% to 76%), while Safehip Soft increased 1.7-fold (from 36% to 60%) and Hipsaver increased 1.1-fold (from 36% to 38%). As pelvis size decreased from largest to smallest, the attenuation provided by Safehip Classic increased 8-fold, but for a high velocity fall and moderate tissue stiffness, never exceeded that provided by Safehip Soft and Hipsaver. Our results indicate that, under biofidelic testing conditions, the soft shell hip protectors we examined generally provided greater force attenuation (averaging up to 27%) than the hard shell protector. Measured values of force attenuation were highly sensitive to variations in impact velocity, pelvic size, and pelvic soft tissue stiffness. This indicates the need to develop international testing standards to guide market approval, the selection of protectors for clinical trials, and the design of improved hip protectors.

External hip protectors are effective for the elderly with higher-than-average risk factors for hip

T. Koike & Y. Orito & H. Toyoda & M. Tada & R. Sugama & M. Hoshino & Y. Nakao & S. Kobayashi & K. Kondo & Y. Hirota & K. Takaoka,
International Osteoporosis Foundation and National Osteoporosis Foundation
2008

Summary: In this cluster randomised controlled trial for efficacy of hip protector with 672 ambulatory elderly women, a hip protector was more effective for prevention of hip fractures in residents with fall history (n=202; hazard ratio (HR), 0.375; 95%CI, 0.14-0.98; p=0.05) and bodymass index (BMI)≤19.0 (n=206; HR, 0.37; 95%CI, 0.14-0.95; p=0.04) by a Cox proportional hazards regression model.

Introduction: Hip fractures result from both osteoporosis and falling. A potentially cost-effective method of preventing hip fractures involves the use of hip protectors but recent studies have revealed the uncertain effectiveness of hip protectors even in institutional settings.

Methods: This study was a cluster randomised controlled trial with nursing homes. 76 homes with 672 ambulatory but frail elderly women were randomly

assigned. Several risk factors were assessed at baseline and incorporated into a Cox proportional hazards regression model. UMIN Clinical Trials Registry number is UMIN000000467. Research period was between January 2004 and March 2006.

Results: In the intervention group, 19 hip fractures occurred (54.0/1,000 person-years), whereas 39 hip fractures occurred in the control group (78.8/1,000 person-years). Hazard ratio

of hip fracture in the intervention group was 0.56 (95%CI, 0.31-1.03; $p=0.06$) after adjusting for risk factors. In subgroup analysis, hip protectors were more effective for prevention of hip fractures in residents with fall history ($n=202$; HR, 0.375; 95%CI, 0.14-0.98; $p=0.05$) and $BMI \leq 19.0$ ($n=206$; HR, 0.37; 95%CI, 0.14-0.95; $p=0.04$). Overall compliance with use of hip protectors was 79.7%.

Conclusion: Risk of hip fracture can be reduced by hip protectors among elderly women with fall history and low BMI.

Effect on hip fractures of increased use of hip protectors in nursing homes: cluster randomised cont

Meyer G, Warnke A, Bender R, Mühlhauser L. (2003), BMJ

The objective for the study was to assess the effects of an intervention programme designed to increase use of hip protectors in elderly people in nursing homes. The participants were residents with a high risk of falling.

The hip protector used was Safehip and three hip protectors per resident were provided.

The conclusion of the study showed that the introduction of a structured education programme and the provision of free hip protectors in nursing homes increases the use of protectors and may reduce the number of hip fractures.

Risk of hip fractures in soft protected, hard protected, and unprotected falls

Bentzen. H, Bergland. A, Forsén. L. 2008. Injury Prevention.

1236 participants took part in the study in 18 Norwegian nursing homes. The nursing homes were randomized to offer either soft or hard hip protectors. The objective of the study was to compare hip fracture risk in soft and hard protected falls, with the risk in unprotected falls. Then to compare the incidence of hip fractures in nursing homes that provide soft and hard protectors for their residents.

Hip protectors used in the study were SAFEHIP® Soft and SAFEHIP® Hard.

The conclusion of the comparison between hip fractures in soft protected, hard protected, and unprotected falls shows that both types of hip protectors have the potential, when worn correctly, to reduce the risk of a hip fracture in falls by nearly 60 %. Both can be recommended to nursing home residents as a means of preventing hip fractures.

Predictors of Adherence to the Use of Hip Protectors in Nursing Home Residents

Warnke, A, Meyer, G, Bender, R, Mühlhauser, I. 2004. JAGS.
Predictors of Adherence to the Use of Hip Protectors in Nursing Home Residents

The objectives of the main study was to evaluate the effects of an intervention program aimed at increasing adherence to the use of external hip protectors and thereby reducing hip fractures. The use of hip protectors can effectively prevent hip fractures. Trials of hip protectors in nursing homes have reported a reduction in hip fractures of more than 50 %, but adherence to use hip protectors is poor.

The aim of this study is to present an analysis of predictors of adherence as part of a randomized controlled trial under usual- and optimized-care conditions in nursing homes.

Increased Use of Hip Protectors in Nursing Homes: Economic Analysis of a Cluster Randomized, Control

Meyer, G, Wegscheider, K, Kersten, J, Icks, A, Mühlhauser, I. 2005. JAGS. Increased Use of Hip Protectors in Nursing Homes: Economic Analysis of a Cluster Randomized, Controlled Trial

The burden of hip fractures in older people is well recognized. In addition to causing substantial health deterioration, hip fractures have a great economic effect due to the requirement of hospital and follow-up care. Hip protectors appear to be the only nonpharmacological intervention to effectively prevent hip fractures in high-risk populations.

The use of hip protectors was effective in reducing hip fractures. A program consisting of education and provision of hip protectors might produce a slight increase in costs or might even be cost saving if the price of the hip protector could be decreased.

Pelvis fractures and hip protectors

Lauritzen, J.B. Pelvis fractures and hip protectors

It has been suggested that use of hip protectors may increase the rate of other fractures such as pelvic rami or femoral shaft fractures. Such concern has been considered when the hip protectors were introduced, but data have not shown a documented relationship, rather the opposite. The first clinical studies in nursing homes documented a reduced rate of hip fractures with use of hip protectors, and data concerning rates of pelvic rami fractures of femoral shafts fractures did not increase in rates and a tendency for a lower rate was found, although non-statistically significant.

Cost-effectiveness and External Hip Protectors

Lauritzen, J.B, Hindsø, K. 1999. Presented at the international Course on Osteoporosis, Vienna.

Cost-effectiveness and External Hip Protectors Cost-effectiveness analyses are important in the evaluation of intervention programmes, and may influence the strategy of intervention.

The conclusion is that hip protectors are cost-saving in the prevention of hip fractures among elderly orthopaedic patients with fractures or falls. Even with lower cost for treatment of hip fractures among nursing home residents the cost-saving with the hip protectors is still positive.

Uptake and adherence with soft- and hard-shelled hip protectors in Norwegian nursing homes: a cluster

Bentzen, H, Forsén, L, Becker, C, Bergland, A. 20. March 2007.

International osteoporosis Foundation and National Osteoporosis Foundation. Uptake and adherence with soft- and hard-shelled hip protectors in Norwegian nursing homes: a cluster randomised trial.

Hip fractures are a major cause of disability and functional limitation. The average age of persons with hip fractures is 80 years. Females predominate over males by about four to one. Hip protectors have the potential to lower the risk of a hip fracture by more than 50 %.

The aim of this study was to compare uptake and adherence between soft- and hard-shelled hip protectors. The comparison between soft- and hard-shelled hip protectors in nursing homes shows no clinically relevant difference in acceptance and probability of continued use. However, significantly more users of the soft hip protector used the protector 24 hours a day.

Predictors of uptake and adherence to the use of hip protectors among nursing-home residents

Bentzen. H, Bergland. A, Forsén L. 2008.

The aim of the study was to identify predictors for initial uptake and

adherence with the use of hip protectors when offering hip protectors free of charge to nursing-homes residents. An 18 months prospective follow up study was carried out in 18 Norwegian nursing homes with 1236 participants.

The study showed that several risk factors for falls and fractures, such as female gender, previous falls, previous fractures and memory impairment were predictors for a higher uptake with the use of hip protectors among nursing homes residents.

Prevention of hip fracture by external hip protectors: an intervention in 17 nursing homes in two mu

Forsén L, Arstad C, Sandvig S, Schuller A, Røed U, Sjøgaard A. J. (2003). Scand J Public Health.

The study was undertaken to estimate the effect of hip protectors on the incidence of hip fractures when introduced into nursing homes as a regular part of the healthcare for all residents. During the study period all residents (965 beds) were offered free use of hip protectors.

The external hip protectors used in the study were Safehip.

The study showed a 39 % reduction in the hip fracture incidence. It may be possible to achieve higher compliance and a further reduction in the incidence of hip fractures if the producers of hip protectors increase the comfort of the hip protector without reducing its effect. In addition, it is important that health workers encourage more individuals at high risk to use the protector.