RISK CHARACTERIZATION OF LOW BACK INJURY DURING MANUAL PATIENT HANDLING

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SUMMARY

Manual patient handling tasks are demonstrated to lead to a potential risk of low back injuries. Most previous researches considered the compression risk, yet neglected the high shear force and moment. The aim of the study was to comprehensively analyze the risk characterization of low back injury during different manual patient handling tasks.

Kinetic data was recorded of nine female caregivers performing six patient-handling tasks with three 'patients'. Based on a multi-segment three dimensional model, the loads on the lowest intervertebral disc of the lumbar spine (L5/S1) were calculated. The results showed that 'Turning task' had the lowest forces and moments on L5/S1, but had cautions for injury risk by cumulative force; 'Moving' and 'Lifting/Lowering' tasks led to injury risk caused by the over limit of 500N peak anterior-posterior force and the highest lateral force, respectively; 'Transferring' task resulted in highest peak compression, twisting and left-right bending moments on L5/S1. These results indicate that manual patient handling tasks will lead to different injury risks on lower back, so that specific protective measures need to be taken according to these risk characterization of low back injury.

INTRODUCTION

Manual patient handling tasks are demonstrated to lead to a potential risk of low back injuries[1]. These stressful tasks accomplished with a forwardly bent or twisted trunk[2], resulting in high shear force on low back spine. However, most previous researches considered the compression risk[3,4], yet neglected the high shear force and bending /twisting moments risk on low back. Since the spine has been reported at much greater risk of sustaining shear injury than compressive injury[5], the aim of the study was to comprehensively analyze the risk characterization of low back injury during different manual patient handling tasks, by evaluating the L5/S1 joint force and moment with mean, peak and cumulative values.

METHODS

The study was approved by the Bioethics Committee from School of Biomedical Engineering, Shanghai Jiaotong University. Nine female caregivers were chosen (48 ± 6 years old, 63.09 ± 5.27 kg, and 160.67 ± 5.66 cm), with 10.22 ± 5.95 years of patient handling experience. Three different weight agent patients in good health with lower body dependence and upper body independence were also chosen.

Caregivers were asked to perform six manual patient handling tasks (*a~f*) with each "patient" three times (Figure 1):
a) Turning away (*a*): turning supine patient away to other side;
b) Moving to bedside (*b*): moving supine patient to bedside;
c) Raising up to sitting(*c*): elevating supine patient to sitting;
d) Lying down to bed (*d*): lying sitting patient down to bed;
e) Moving to bed head (*e*): moving supine patient to bed head;
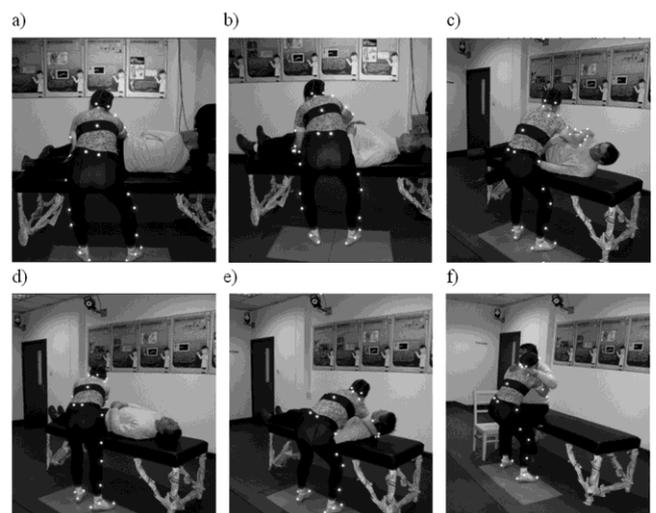f) Transferring (*f*): moving sitting patient on bedside to chair.

Figure 1: Manual patient-handling tasks: a) Turning away; b) Moving to bedside; c) Raising up to sitting; d) Lying down to bed; e) Moving to bed head and f) Transferring..

Vicon® T40 3D Motion Capture with 10 cameras and two forceplates (AMTI® OR6-7) were used to capture caregivers' kinetic data. A linked eight-segment model was

developed for the lower body and trunk. The mean, peak and cumulative reaction forces and muscle moments at L5/S1 joint were calculated by inverse dynamic approach. The effects of each task on L5/S1 load were analysed by two-way repeated ANOVA tests and post hoc test with Turkey HSD.

RESULTS AND DISCUSSION

The highest mean and peak anterior-posterior(A-P) shear force on L5/S1 were found during task *b* and *e*, where the peak value were over the recommend caution level of 500N[6]. The highest lateral shear forces were found in the mean value of task *c* and *d* (Figure 2). The results indicated that 'Moving' and 'Lifting/Lowering' tasks contained high shear injury risk for caregivers who should be caution for long-term flexion and lateral bending.

The highest twisting and lateral bending moments were found during task *f* (Figure 3). The task *f* also resulted in the highest mean and peak axis force on L5/S1. These results indicated that 'Transferring' task exerted dangerous pressures on caregivers who should be caution for explosive injury.

Among the six tasks, task *a* cost the lowest mean and peak load in three directions (AP, lateral and vertical) on L5/S1, and lowest twisting and lateral bending moments. However, the cumulative load resulted by this task were relatively higher (Figure 2) indicating that caregivers should still be caution for injury risk by cumulative force.
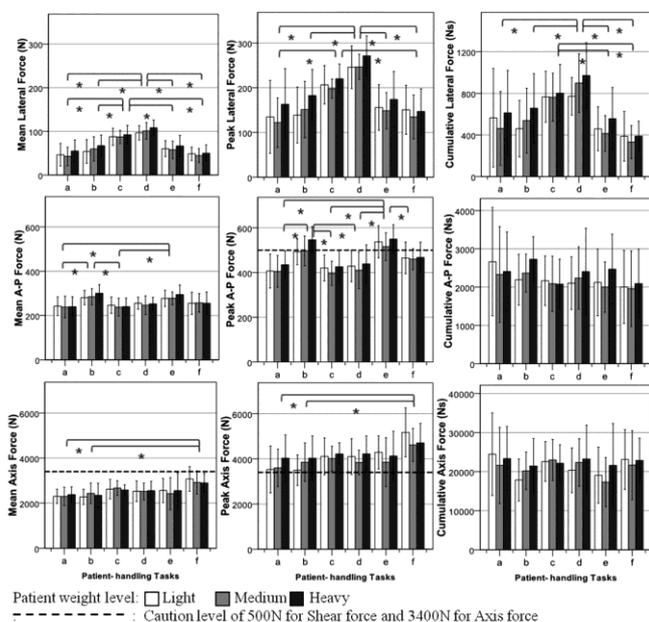

Figure 2: Mean, peak and cumulative forces calculated in six manual patient handling tasks in three directions.
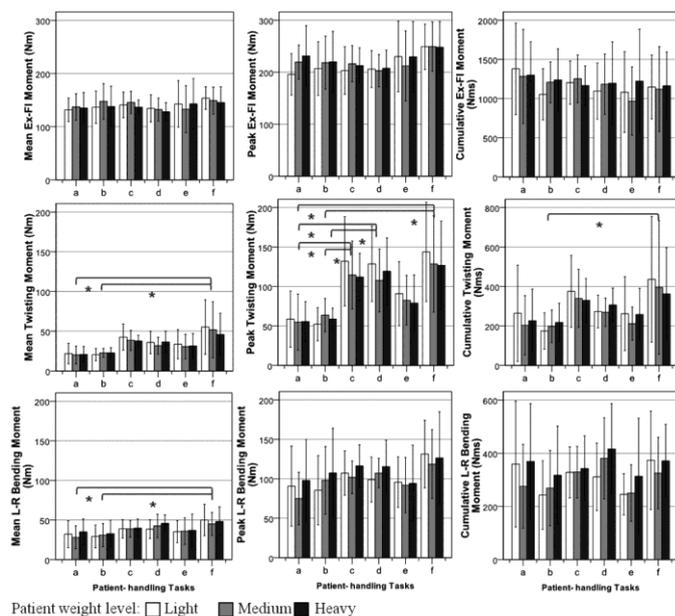

Figure 3: Mean, peak and cumulative moments calculated in six manual patient handling tasks in three directions.

CONCLUSIONS

Manual patient handling tasks will lead to different injury risks on lower back, so that specific protective measures need to be taken according to these risk characterization of low back injury.

ACKNOWLEDGEMENTS

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