Original Article

EFFECTIVENESS OF MUSCLE STRETCHING IN OCCUPATION RELATED CHRONIC MECHANICAL LOW BACK PAIN IN COMMUNITY NURSES –A SINGLE BLIND STUDY

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ABSTRACT

Background and Objective: Stretching of Lower Back Muscle, Hamstring and Tensor Fasciae Latae have an immediate effect on Chronic Lower Back Pain. Hence the purpose is to find the short term effect of stretching of Lower Back Muscle, Hamstring and Tensor Fasciae Latae on intensity of low back pain, flexibility and functional disability in occupation related Chronic Mechanical Low Back Pain in Community Nurses.

Method: Single blind experimental study design, 40 subjects with Chronic mechanical low back pain randomized 20 subjects into each Study and Control group. Control group received placebo stretching while Study group received stretching of Lower Back Muscle, Hamstring and Tensor Fasciae Latae for 7 sessions for a period of one week and followed up after one week post intervention where no intervention was given during follow up week.

Results: Analysis using RMANOVA found that there was a statistically significant ($p<0.05$) greater percentage of improvement in outcomes measures means of VAS, ODI score and FFD after one week of intervention in Study group when compared with Control Group. During follow-up there is statistically significant greater percentage of maintenance of improvements were found in study group than control group.

Conclusion: It is concluded that stretching of Lower Back Muscle, Hamstring and Tensor Fasciae Latae statistically and clinically shown significant short term effect on improving pain, flexibility and functional disability in occupation related Chronic Mechanical Low Back Pain in Community Nurses.

KEYWORDS: Stretching; Hamstring; Tensor Fasciae Latae; Mechanical low back pain; Community Nurses; Pain Flexibility; Functional Disability.

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INTRODUCTION

Mechanical low back pain (MLBP) is defined as pain between the costal margins and the inferior gluteal folds, usually accompanied by painful limitation of movement, often influenced by physical activities and posture, which may be with or without associated with referred pain in leg.[1] The lifetime prevalence of MLBP is reported to be as high as 84% [2,3]. It is mostly prevalent in positions such as static posture (e.g, in Nurses [4-6], Truck Drivers, Operators), Bending and Twisting (e.g, in Construction workers), Whole body vibration (e.g, in Drillers), Heavy manual lifting (e.g, Coolies).[7]

In community nurses, who work day shift with occasional weekend duties at home care for chronically ill people are more prone to mechanical low back pain as their work focuses on direct care like transfer to bed, chair to toilet, lifting's activities.[8] Physical workload, incorrect lifting and working postures without use of mechanical aids.[9,10] Due to back pain the community nurses reported difficulty even turning over in bed, bending, reaching, walking other than the work.[11]

Muscular imbalances contribute to habitual overuse in isolated joints and faulty movement patterns, creating repetitive micro trauma, dysfunction and chronic injury. Abnormal habitual posture causes tightness in Lumbo-Pelvic-Hip complex musculature causing abnormal stresses that increase shear or compressive forces on the joints that lead to excessive stress on the articular surfaces[12,13] that develops into mechanical low back pain[14] Tensor Fasciae Latae due to muscle spasm shortens which increases the illiotibial band tension and tightness causing anterior inclination of the pelvis.[14,15] In addition due to muscle spasm and shortening of the hamstring results in posterior inclination of the pelvis.[13] Essentially, the simultaneous contraction of the these two muscles reduces flexibility of the pelvis and increases lumbar stress during functional activties.[14] The related muscle involve are trunk extensors which become tightened due to prolonged overstretching of the innervated soft tissue whereas the abdominal and glutei muscle undergoes weakness and atrophy.[13]

The static muscle stretch is a method in which the muscle is slowly elongated to tolerance (comfortable stretch, short of pain) and the position held with the muscle in this greatest tolerated length.[16]

Studies have found that passive and active stretching improves flexibility and increase range of motion in low back pain.[17] Keisuke Ohtsuki, et al in their study they found that the immediate changes in recovery of muscle tissue flexibility, decrease in pain and improvement in circulation following back exercises and direct stretching of Lower Back muscles, Tensor fasciae Latae, the Adductor Magnus and Hamstring muscle in Chronic Lower Back Pain. As the occupational related chronic mechanical low back pain is common among the community nurses[6], this study was with research question whether muscle stretching such as low back muscles, Tensor Fasciae Latae and Hamstring muscle does have short term effect on improving pain, flexibility and functional disability in community nurses.[14] Hence, the purpose of the study is with objective to find the short term effect of muscle stretching such as low back muscle, Tensor Fasciae Latae and Hamstring muscle for a period of one week intervention on improving pain, flexibility and functional disability in occupational related chronic mechanical low back pain in community nurses. The hypothesis stated that there will be a significant short term effect of therapeutic stretching of muscles on improving pain, functional disability and flexibility in occupational related Chronic Mechanical Low Back Pain in community Nurses.

MATERIALS AND METHODS

Repeated measures, single-blind experimental study design. As this study involved human subjects the Ethical Clearance has been obtained from the Ethical Committee of KTG College of Physiotherapy and K.T.G. Hospital, Bangalore and from community centers as per the ethical guidelines for Bio-medical research on human subjects. This study was registered with University No. 09_T031_39003. The study was conducted at community health centres such as Day care Geriatric community centre, Old age home across Bangalore. Subjects included were with age group between 40 to 45 years,[18] both male and female subjects, BMI between 20-25,[14] Lower back pain > 3 months that aggravated during activity and relieved after rest,[18] limited anteflexion and retroflexion of the trunk due to stiffness felt during movement in back muscles,[14] Score of 20-30 in Oswestry Disability index,[19] Finger to floor distance >4cm,[20] Positive Sit and reach test for hamstring tightness.[21] Subject excluded were with specific low back pain, Zung depression score of < 60 for psychological pain, Straight leg raising positive in 10-60^0.[18] Inflammatory diseases[34] of spine, Osteoporosis.[22] History of Spinal fractures, spinal surgery, [2,23] who has undergone exercise therapy prior 3 months.[2]

Procedure of randomization and single blind:

The forty (n=40) subjects were selected based on inclusion criteria. Once the subject agrees to participate in the study, an informed written consent was taken from the subjects. The subjects were randomly allocated using simple random sampling method 20 each into two groups using forty pieces of marked paper were tightly folded and placed in a box. After shaking the box, each subject was asked to withdraw a paper and allotted to groups based on group code. Complete explanations were given to sub-

jects in both the groups separately. Subjects were blinded on either type of intervention and to which group they were belonged. Throughout the treatment sessions, subjects from both the groups were not allowed to have any interaction to each other and the subjects were not aware of what kind of treatment they received and its effects.

Procedure of intervention for study group:

Study group subjects received stretching program for Hamstring muscle, Lower Back Muscle and Tensor Fasciae Latae. 1. Lower Back Stretching: Stretching for Erector spinae muscle and quadratus lumborum that lie within the layers of the thoracolumbar fascia. Firstly the subject was made comfortable and asked to go in supine position; holding right knee with both hands and pulling it into the chest then again pull the left knee to chest while breathing deeply and holding the position for thirty seconds. The back stretching was done for two sets of ten repetition[14]. 2. Hamstring Stretching: The subject was asked to bend their one hip joint at 90^0 from a supine position and slowly extending the knee joint while supporting the popliteal region with both hands and holding for approximately ten seconds at maximal extension. Whereas concentration should be at the muscle-tendon transition, the site is the hard side of the hamstring under palpation. Adding transitive pressure in a vertical direction to the running of the muscle, the method is to stretch the muscle which is directly by passing the joint motion. The position was holded for thirty seconds, stretching was done in two sets of ten repetition on right and let side.[14] 3. Tensor Fasciae Latae Stretching: Passive stretching of Tensor Fasciae Latae was performed with the assistance of a Physiotherapist, extending and internally rotating the hip joint on the stretched side from a lateral recumbent position and holding for approximately thirty seconds. The Tensor Fasciae Latae stretching was done for two sets and ten repetition.[14] Thirty second rests was taken every five minutes during the stretching session.

Procedure of Intervention for control group:

Control group subjects received placebo stretching regimen. Placebo stretching program mild passive movement is performed by the therapist in the direction of stretching of Hamstring muscle, Lower Back Muscle and Tensor Fasciae Latae. The movement was done in two sets of ten repetitions on right and left side.

Outcome Measurements:

Pre, Post-Intervention and follow up outcome measurements were measured in both the using Visual Analogue Scale 100mm (VAS) for pain, Oswestry Disability Index for functional disability and Finger to Floor Distance for flexibility.

Visual Analogue Scale 100mm (VAS): The VAS is a 100mm point scale where the end points are the extremes of no pain and pain as bad as it could be, or worst pain. The VAS can be graphically delivered. The subject is asked to mark the level of their low back pain in the scale.

Oswestry Disability Index (ODI): The patients were given a detailed explanation about the modified Oswestry Disability Index. It consists of 10 multiple-choice questions of LBP included disability in daily function and leisure time activities, for each question the patient select one sentence out of six that best describe their disability.[24]

Finger to Floor Distance (FFD): FFD is a test for flexibility. The subject was asked to bend and reach towards the floor and measurement is taken from the tip of the finger to floor by an inch tape.

Statistical Method:

Descriptive statistical analysis has been carried and presented as mean ± SD. Significance is assessed at 5 % level of significance with p value was set at 0.05 (1 tailed Hypothesis). Repeated Measures Analysis of Variance (RMANOVA) and Friedman's ANOVA was used to analysis within the group and Bonferroni's as post-hoc test was used to find the significance in pair-wise comparison. Independent 't' test as a parametric and Mann Whitney U test as a non-parametric test have been used to compare the means at multiple level measurements between the groups with calculation of percentage of difference between the means. The Statistical software namely SPSS 16.0, Stata 8.0, MedCalc 9.0.1 and Systat 11.0 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

RESULTS AND TABLES

In study and control groups when means of VAS, ODI and FFD were analyzed there is a statistically significant change from pre intervention to post intervention and to follow up measurements within the groups. There is a clinical significance effect with large effect size. When means of VAS and ODI score compared between the groups there is no significance difference in pre-intervention means and there is statistically significance difference in 1st week of post intervention and to follow up means. When pre-intervention means, 1st week of post intervention means and follow up means of FFD were compared there is a significance difference between the groups. However the study groups shown greater percentage of improvement than control group.

Table 1: Basic Characteristics of the subjects studied.

Basic Characteristics of the subjects studied		Study Group	Control Group	Between the groups Significance[a]
Number of subjects studied (n)		20	20	--
Age in years (Mean± SD)		42.35±1.81 (40-45)	42.50±1.82 (40-55)	p= 0.827 (NS)
Gender	Males	9	11	p=0.763 (NS)
	Females	11	9	
	Within Group Significance	P=0.000**	P=0.000**	

Table 2: Analysis of VAS, ODI and FFD within the Study group (Repeated measures analysis).

Study Group	Pre intervention (Mean±SD) min-max	1st week Post Intervention (Mean±SD) min-max	2nd week Follow up (Mean±SD) min-max
VAS in mm	66.25± 3.27 (60- 73)	1.10±1.29 (0-3)	0.90± 1.02 (0-2)
Disability Index ODI in %	53.30± 8.85 (44- 84)	0.50± 0.88 (0-2)	0.20± 0.61 (28-70)
Finger to Floor Distance in Centimeter (FFD)	20.40± 3.89 (15- 28)	1.15± 1.26 (0-4)	0.85± 1.04 (0-3)

** Statistically Significant difference p<0.05; NS- Not significant; a. Friedman's ANOVA.

		Percentage of change	F value[a]	Significance[b] (1-tailed) P value	Effect size r	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
VAS in mm	Pre to post	-98.33%	7885.2	P= 0.000**	+0.99 (Large)	62.99	67.31
	post to follow up	-18.18%	4.75	P= 0.253(NS)	+0.08(Large)	-0.07	0.47
	Pre to follow up	-98.64%	8256.6	P= 0.000**	+0.99(Large)	63.23	67.46
Disability Index in %	Pre to post	-99.06%	750.69	P= 0.000**	+0.97 (Large)	47.12	58.47
	post to follow up	-60%	3.35	P= 0.497(NS)	+0.15 (Large)	-0.18	0.78
	Pre to follow up	-99.62%	738.01	P= 0.000**	+0.97(Large)	47.34	58.85
Finger to Floor Distance in Centimeter (FFD)	Pre to post	-94.36%	499.78	P= 0.000**	+0.61 (Large)	16.71	21.78
	post to follow up	-26.08%	5.516	P=0.179 (NS)	+0.76 (Large)	-0.076	0.676
	Pre to follow up	-95.83%	444.21	P= 0.000**	+0.86 (Large)	-22.28	-16.81

a- Adjustment for multiple comparisons: Bonferroni.

DISCUSSION

It is found from the analysis that the study groups who received stretching and the control group who received placebo stretching significantly shown short term effect on reducing pain, improving flexibility and functional ability in community nurses with chronic mechanical low back pain and the improvement was maintained significantly up to one week follow up. However, the greater percentage of improvements was found in study group than the control group.

In study group the improvement in pre to post intervention is speculated due to the static stretching of hamstring, tensor fascia latae and lower back muscles.[29-31] Biomechanical studies of the spine stated that mechanical loads are transferred through "Lumbo Pelvic Hip Complex" (LPHC) from the hips, pelvis, and low back across the thoracolumbar Fascia, to the upper back, shoulders, and arms in an "X" shaped fashion. Control imbalances resulting from the LPHC musculature leads to improper movement down the kinetic chain. [29-31]

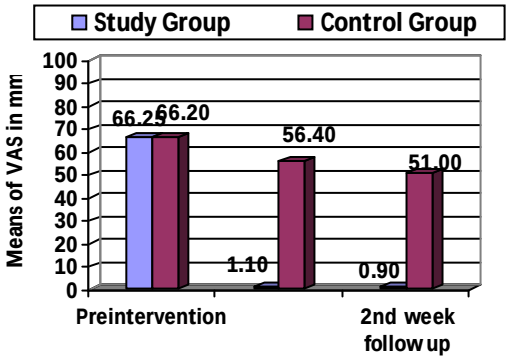
Common compensation patterns leading to LPHCD have been previously described as an "anterior pelvic tilt," "lower cross syndrome," and "excessive lordosis". [29-31] Aberration of posture in community nurses may play an important role in the development of mechanical low back pain[8,14] by decreasing low back muscle flex-

Table 3: Analysis of VAS, ODI and FFD within the Control group (Repeated measures analysis).

Control Group	Pre intervention (Mean±SD) min-max	1st week (Mean±SD) min-max	2nd week Follow up (Mean±SD) min-max
VAS in mm	66.20± 2.64 (60- 70)	56.40± 3.64 (46-61)	51.00± 4.25 (42-58)
Disability Index ODI in %	49.90± 6.53 (40- 60)	41.00± 5.52 (30-50)	32.60± 4.10 (26-40)
Finger to Floor Distance in Centimeter (FFD)	16.65± 2.13 (14- 20)	12.10± 1.91 (10-17)	10.80± 1.88 (8-15)

** Statistically Significant difference p<0.05; NS- Not significant; a. Friedman's ANOVA.

Chart- 1: Comparison of pain –VAS score between the Groups.



Control Group		Percentage of change	F value[a]	Significance[b] (1-tailed) P value	Effect size r	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
VAS in mm	Pre to post	-14.80%	16.52	P= 0.000**	+0.83 (Large)	7.12	12.47
	post to follow up	-9.57%	87.38	P= 0.000**	+0.56 (Large)	3.69	7.1
	Pre to follow up	-22.96%	209.43	P= 0.000**	+0.90 (Large)	12.10	18.29
Disability Index in %	Pre to post	-17.83%	301.6	P= 0.000**	+0.59 (Large)	7.39	10.4
	post to follow up	-20.48%	96.86	P= 0.000**	+0.65 (Large)	5.88	10.91
	Pre to follow up	-34.66%	261.93	P= 0.000**	+0.84 (Large)	14.15	20.44
Finger to Floor Distance in Centimeter (FFD)	Pre to post	-27.32%	499.78	P= 0.000**	+0.74 (Large)	16.71	21.78
	post to follow up	-10.74%	5.516	P= 0.000**	+0.76 (Large)	-0.076	0.676
	Pre to follow up	-34.13%	444.21	P= 0.000**	+0.32 (Large)	16.81	22.28

Adjustment for multiple comparisons: Bonferroni.

Table 4: Comparison of parameter measured between the groups (COMPARATIVE ANALYSIS).

	Perecntage of difference	Effect size D	Z value and non-Parametric Significance [a] P value	t value [a] & Parametric Significance [b] P value	95%Confidence interval of the difference	
					Lower	Upper
Pre intervention						
VAS in mm	-0.07%	0.008 (Small)	-0.082 P=0.934(NS)	0 .053 P=0.958 (NS)	-1.85	1.95
Disability Index ODI in %	-6.58%	0.21 (Large)	-1.229 P=0.219 (NS)	1.381 P=0.175 (NS)	-1.58	8.38
Finger to Floor Distance in Centimeter (FFD)	-36.76%	0.51 (Large)	-3.165 P=0.002**	3.773 P=0.001**	1.73	5.76
1st week of post intervention						
VAS in mm	-19.23%	0.99 (Large)	-5.486 P=0.000**	-63.9 P=0.000**	-57.05	-53.54
Disability Index ODI in %	19.51%	0.98 (Large)	-5.575 P=0.000**	-32.36 P=0.000**	-43.03	-37.96
Finger to Floor Distance in Centimeter (FFD)	16.52%	0.95 (Large)	-5.461 P=0.000**	-21.308 P=0.000**	-11.99	-9.91
Follow up						
VAS in mm	19.30%	0.99 (Large)	-5.686 P=0.000**	-51.203 P=0.000**	-52.08	-48.11
Disability Index ODI in %	19.75%	0.98 (Large)	-5.505 P=0.000**	-34.874 P=0.000**	-34.28	-30.51
Finger to Floor Distance in Centimeter (FFD)	17.08%	0.95 (Large)	-5.485 P=0.000**	-21.308 P=0.000**	-10.92	-8.97

** Statistically Significant difference p<0.05; NS- Not significant a. Mann-Whitney Test; b. Independent t test

Chart- 2: Comparison of ODI score between the Groups.

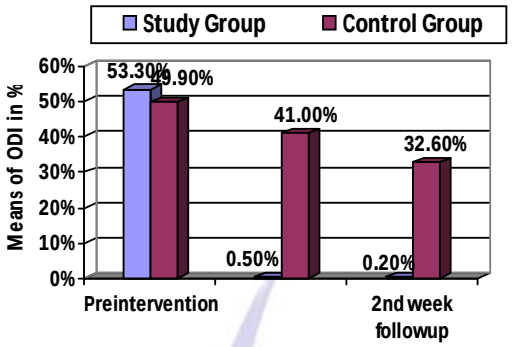
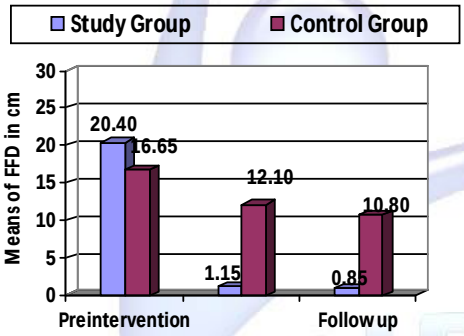


Chart- 3: Comparison of FFD score between the Groups.



ibility such as Erector spinae muscle and quadratus lumborum that lie within the layers of the thoracolumbar fascia. When the long erector spinae muscles get too tight combined with abdominal muscle weakness, causes an excessive lumbar lordosis, often with the pelvis anteriorly tilted[14]. This will compress the lumbar facets and irritate them. Lumbar spine will tend to move more, potentially creating irritation of the discs or facets. The tightness in erector spinae muscle limit certain movements such as bending become very painful affecting functional activities. Tensor Fasciae Latae flexibility reduces due to muscle spasm and increases the illiotibial band tension results in anterior inclination of the pelvis create a sway in the lower back causing unnecessary compression on the lumbar vertebrae.[14] In addition hamstrings shortening due to muscle spasm results in posterior inclination of the pelvis.[25] Essentially, the simultaneous contraction of the two muscles reduces flexibility of the pelvis and increases lumbar stress.[14] When these muscle were stretched during one week program that might have improved the flexibility. When muscles stretch the actin-myosin overlap decreases by increasing the overall sarcomere length and allowing the muscle fibre to elongate. Once the fibre has reached it maximum length, additional stretching places force on the surrounding connective tissue. As the tension increases, collagen fibres align themselves along the same line of force as the tension helps realign any disorganized fibres in the direction of the tension. The realignment is what helps to rehabilitate scarred tissue back to their previous length[26]. Improvement in flexibility measured by Finger floor distance measurements might have corrected the pelvic inclination reducing stress on lumbar spine that reducing pain. The improvement in pain, flexibility increases the working capacity of community nurses. The discomfort due to pain and tightness during forward bending and working might have reduced after giving the stretching program that shows improvement in functional ability. According to Sahrmann's movement balance system approach, active stretching is purported to increases the flexibility of the tight muscles while concomitantly improving function of the antagonistic muscles[17].

In study group there was significant maintenance of improvements obtained in outcome measurements at follow up, it is presumed to be due to the effect of the stretching and concentrating on the muscle tendon transition while giving transitive pressure in vertical direction relaxing the muscle and increasing the expansibility of the muscle[14]. Keisuke Ohtsuki stated that the reason for focusing on extension at the muscle tendon transition during stretching is because flexibility at that location is poor. The short term adapted extensibility in the muscle that maintains the length of the muscle reducing stress on lumbar spine. William D Brandy, et al studied the effect of time and frequency of static stretching on flexibility of the hamstring muscle and they found that thirty second duration is an effective amount of time to sustain a hamstring muscle stretch in order to increase range of motion[27]. William D Brandy, et al studied the effect of time and frequency of static stretching on flexibility of the hamstring muscle to ninety three subjects, age ranging from 21 to 39 years who had limited hamstring muscle flexibility. Stretching was given for five days per week for six weeks. In their study, they found that thirty second duration is an effective amount of time to sustain a

hamstring muscle stretch in order to increase range of motion.[16]

In control group, improvement in pain, functional ability and flexibility is attributed due to the effect of passive movement performed passively with the assistance of a Physiotherapist. Mild passive movement is performed in the same position as of the study group. The studies have shown that passive movement found to be mild stretching effect that relaxes the tightened muscle improving the muscle expansibility and increasing the blood supply to the muscles[29]. As there is no applied force given during the passive movement, there is no marked change in the post to follow up intervention. The overall change from pre intervention to follow up is because of the physiological effect of the passive movement. Nilsson N, et.al stated that passive movement relief temporary pain of musculoskeletal and temporary increases in passive range of motion by relieving the tightness of the muscle[29].

In comparison practical and clinical significance effect of study group with control group, the study group subject's greater percentage of change in improvement with large effect size than the control group. To standardized the effects and avoid placebo effects of stretching there was no bias during the study towards any of the subject in both the groups.

Based on the analysis, this study found that stretching of hamstring, tensor fasciae latae and lower back muscle significantly shown short term effect in reducing pain, improving flexibility and functional disability in chronic mechanical low back pain. Therefore the present study rejects null hypothesis.

LIMITATIONS

The study found only short term effects using outcome measurements on pain, flexibility and functional disability, effects on changes in pelvic inclination, postural changes and quality of life was not measured. Effects were found only on static and placebo Stretching techniques other types of stretching techniques were not used.

RECOMMENDATION FOR FUTURE RESEARCH

Studies to find the long term effects are needed with using measurements such as pelvic inclinations, postural changes, individual muscles flexibility, disability and quality of life in subjects with mechanical low back pain due to occupation. Further study is needed to find the effect of stretching of selective Lumbo Pelvic Hip Complex tight muscles in combination with other intervention in different population with occupational related mechanical low back pain. Studies are needed with different stretching techniques for tight muscles measuring different flexibility measurement techniques on mechanical low back pain.

CONCLUSION

It is concluded that stretching of Lower Back Muscle, Hamstring and Tensor Fasciae Latae statistically and clinically shown significant short term effect on improving pain, flexibility and functional disability in occupation related Chronic Mechanical Low Back Pain in Community Nurses. Implementation of stretching of these muscles in mechanical low back pain due to imbalance in thoracolumbar pelvic hip complex is recommended that can enhances the recovery and decreases the pain, and functional disability.

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Conflicts of interest: None

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