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The selection of clinical tests to be assessed in a prospective nvestigation aiming at predicting back problems among healthy workers

by

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Abstract

Objectives: To select clinical tests that are able to discriminate between workers with and without back problems. In a second stage, the predictive value of this selection for back problems among current non-complainers, is being assessed in a prospective investigation. This paper only reports on the first (pilot) stage of the study.

Methods: 174 healthy female family care workers underwent a series of clinical tests, possibly related to back problems, and the prevalence of clinical back abnormalities was calculated. Additional data were collected by questionnaire. The association between clinical test results and complaints was examined by means of the chi-square-test and the Mann Whitney u-test. A selection of 32 tests, based on statistical and clinical grounds, was submitted to a discriminant analysis to evaluate the ability to discriminate between complainers and non-complainers.

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Results: The most remarkable result was the statistically significant association between hypermobility and absence of back pain during the last year. The strongest statistical associations existed between back pain and low lumbar, lumbosacral and buttock tenderness. A selection of 32 tests was able to correctly classify persons with current back pain in 83%, with pain during the last year in 89% and with pain during the last year with absence from work in 88% of cases.

Conclusion: Our limited series of tests is sufficient to discriminate the majority of asymptomatic subjects from those with previous or current back pain. However, the predictive value of this selection of tests is now being investigated.

Keywords: back pain, clinical tests, healthy worker

Introduction

In recent years, the prevention of back pain in workers became a major concern in occupational health care. Besides risk factors in the work place, individual risk factors have to be addressed.

In order to propose preventive measures, it is necessary to identify the determinants of low back pain. Little is known about the value of clinical back abnormalities among healthy workers in predicting future back problems. In a recent study of Takala et al. (1) some associations were found between functional tests and future low back pain. They concluded that the power to identify individuals with future low back pain using the investigated tests was poor in a non-patient population.

The final goal of our study is to select clinical tests to predict back pain among non-complainers, or, in other words, to highlight anatomical and/or physiological abnormalities which could turn out to be risk factors of future back pain. One means of selecting suitable tests could be the investigation of the relationship between objective clinical back abnormalities and current or previous back pain in healthy workers. Combined with other criteria, this information could enable us to make a selection of tests that could discriminate between asymptomatic subjects and those with current or previous back pain. This paper reports on this first stage of the research. For the moment, this selection is being validated in a prospective investigation, in which we will assess whether these tests are able to predict back problems in workers without previous back pain and with high physical workload of the back.

Methods

In 1992, a study was set up among a sample of 174 healthy female family care workers. The participants were employees under medical surveillance of the Occupational Health Service IDEWE (Belgium, Flanders). IDEWE is the Dutch abbreviation for Interdisciplinary Service for Wellbeing at Work. This organisation is appointed for the surveillance of the health and safety of workers in various industrial sectors. The workers were examined at the annual mandatory occupational medical examination and not because of medical problems or complaints.

The sample of 174 workers in this pilot study was a random convenience sample of the 4723 employees of the largest Flemish organisation for family care. After informed consent, all subjects completed a questionnaire regarding biometrical variables, working conditions and current or previous back pain. Part of the questions was comparable to the Nordic questionnaires for the analysis of musculoskeletal symptoms (2). The same investigator, a physical therapist, examined all participants, and he was blinded to the answers to the questionnaires. The examination consisted of 36 principal and 19 additional tests and measurements. These were selected from a larger series of tests that were evaluated two years earlier in a pilot study performed among 83 family care workers. Some of these were based on the tests described in the NIOSH Low Back Atlas (3). A detailed description of the tests is published in a manual available as an internal document.

The association between clinical test results and complaints was examined by means of the chi-square-test and the Mann Whitney u-test, because the quantitative variables did not meet the conditions for a parametrical test (4). Normality was tested by means of the Kolmogorov – Smirnov Goodness of fit test. Keeping in mind the retrospective cross-sectional design of the study, a p-value of Ş0.1 was considered significant in order to diminish the type II error or, in this case, to inhibit the elimination of possible important tests because of the absence of a significant association (4).

Using the results of this statistical analysis, a selection of significant tests was made. This selection was extended according to expert advice with tests that were considered clinically important, in spite of the absence of a statistically significant association. The final selection consisted of 32 tests that were used in a discriminant analysis (5). Both quantitative and qualitative variables could be used in this calculation (Table 1).

The purpose of this discriminant analysis was to evaluate the ability of the selected tests to discriminate between complainers and

TABLE 1

List of 32 selected clinical tests and measurements and their statistical association with the prevalence of current or previous (last year) back pain. (n=174)

TEST	LAST YEAR POINT PREVALENCE		PREVALENCE	
QUALITATIVE VARIABLES	Difference	p value*	Difference	p value*
	A		A	
Scoliosis > 10°	2.4	0.83	-2.4	(0.94)
Spinal tenderness (high lumbar)	4.9	0.33	-1.0	(0.86)
Spinal tenderness (low lumbar)	23.9	0.0001#	32.0	0.0001#
Spinal tenderness (lumbosacral)	34.6	0.0001#	41.5	0.0001#
Buttock tenderness right	14.5	0.01#	35.3	(0.0001#)
Buttock tenderness left	14.3	0.01#	26.9	(0.0001#)
Sit-ups	6.2##	0.13	18.9##	0.02#
Comparison of PSIS height	3.0	0.91	-0.8	(0.94)
Comparison of ASIS height	3.0	0.86	-4.6	0.77
Lift iliac bone right	12.4	0.03#	24.5	(0.0009#)
Lift iliac bone left	13.4	0.01#	17.8	(0.01#)
QUANTITATIVE VARIABLES	Difference B	p value**	Difference B	p value**
SSLR right	0.7°	0.60	-0.7°	0.55
SSLR left	-0.2°	0.76	-2.8°	0.25
Schober's test	-0.9 mm	0.75	-3.8 mm	0.02#
Fingertip-to-floor distance	6.7 mm	0.26	8.7 mm	0.28
Measurement total extension	-1.1°	0.71	-1.8°	0.53
Total excursion of motion lateral flexion right	-10.4 mm	0.17	-12.8 mm	0.19
Total excursion of motion lateral flexion left	-11.8 mm	0.09#	-14.8 mm	0.10#
Measurement of pelvic desequilibrium at ASIS	0.1 mm	0.76	0.0 mm	0.63
Thoracolumbar rotation right	-3.2°	0.02#	-2.9°	0.08#
Thoracolumbar rotation left	-2.7°	0.06#	-1.9°	0.24
Stretching of the third MCP joint	-4.2°	0.02#	-0.6°	0.64
Hip joint internal rotation right	-0.9°	0.32	-0.6°	0.79
Hip joint internal rotation left	-1.1°	0.25	-1.0°	0.53
Hip joint external rotation right	-0.3°	0.67	-3.2°	0.02#
Hip joint external rotation left	-0.3°	0.77	-2.1°	0.25
Hip joint abduction, knee bended, foot on table right	-1.3°	0.91	-3.1°	0.63
Hip joint abduction, knee bended, foot on table left	-2.3°	0.23	-4.0°	0.37
Hip joint abduction, knee straight right	-0.9°	0.35	-0.1°	0.77
Hip joint abduction, knee straight left	-1.8°	0.06#	-0.8°	0.46
Hip joint abduction, knee bended, foot below table right	-2.2°	0.08#	-1.1°	0.45
Hip joint abduction, knee bended, foot below table left	-2.6°	0.05#	-1.2°	0.64

* Chi square test with continuity correction
** Mann Whitney u-test
( ) Expected values < 5 in 1 or more cells
$p \leq 0.1$
##: Difference in percentage of persons not able to perform sit ups.
A: Percentage of positive tests in persons with back pain – percentage of positive tests in persons without back pain.
B: Mean value in persons with back pain – mean value in persons without back pain
PSIS: Posterior Spina Iliaca Superior
ASIS: Anterior Spina Iliaca Superior
SSLR: Single Straight Leg Raising
MCP: Metacarpophalangeal

non-complainers of back pain at the moment of the examination or during the past year. This discriminant analysis calculates 'the percent correctly classified' or the percentage of workers with or without back pain that were correctly classified according to the results of the selected tests. Statistical testing was performed using the SPSS 10.0 package (5).

Results

A comparison of the distribution of age, BMI, working hours and years of employment between the sample and the population of family care workers, showed that the sample reflected the characteristics of the population fairly good (6).

The point prevalence, defined as the presence of back pain at the moment of examination, was 19%. The last year prevalence, the lifetime prevalence and the last year prevalence of absence from work due to back pain were 49%, 63% and 20%, respectively.

The tests selected for the discriminant analysis, the differences between persons with and without back pain and the statistical associations of the tests with point and last year prevalence of back pain are shown in table 1. For the stretching of the third metacarpophalangeal (MCP) joint, there was an association between hyperextension and the absence of back pain during the last year.

We performed a discriminant analysis with two sets of tests. The first discriminant function was composed of 10 tests that were comparable to the tests used by Waddell et al. (7) for their final Physical Impairment Scale. The second function existed of the 32 tests, which we selected on statistical and clinical grounds as described in the methods section. When we applied the 10 tests (comparable to the tests of Waddell et al. (7)) to our study population, we were able to discriminate asymptomatic subjects from persons with back pain at the time of the examination in 73%, during the last year in 81% and during the last year with absence from work in 78% of cases. With our series of 32 tests, these figures rose to 83%, 89% and 88%, respectively.

Discussion and conclusion

In our study, the association between back pain and hypermobility was opposite to what could be expected from some opinions in physical therapy, in which hypermobility is seen as a risk factor for the development

of back problems. There was a positive and statistically significant association between hyperextension of the third MCP joint and absence of back pain during the last twelve months. The ability to put the palms of the hands on the ground was also positive and statistically significant associated with the absence of current or previous back pain ($p= 0.03$ and $p= 0.02$ respectively). Hypermobility thus could be protective against back pain. An explanation could be that hypermobile individuals with back problems are not identified as hypermobile, because of the reflectory hypertonia of the extensor muscles of the back to protect hypermobile segments. Another explanation could be that our sample consisted only of women. Biering-Sorensen (8) found that men reporting their first episode of low back trouble had significantly greater flexion of the lumbosacral spine, as measured with the modified Schober test, than did men who reported never having back trouble. No such association existed among women. When examining fingertip-to-floor measurements, the subgroup of women with a history of back problems and subsequent recurrences had less flexibility than those without recurrent problems. There was a similar trend among men (8). However, we did not find an association between decreased spinal mobility and back pain. We only noticed a statistically significant association between Schober's test and actual back pain. The absolute difference of the mean value between complainers and non-complainers, however, was too small to be of clinical significance. Battié et al. (9) found a statistically significant relationship between decreased spinal flexibility and current or previous back problems. They also noted that the differences in flexibility between subjects with and without a history of back problems were too small to be of practical significance.

Low lumbar and lumbosacral spinal tenderness were significantly ($p<0.0001$) associated with both last year and point prevalence of back pain. The importance of spinal tenderness as an indicator for back problems has been underlined by several authors (7, 10). There was also a significant relationship between buttock tenderness and previous back pain.

Sit-ups were only significantly associated with current back pain. Waddell et al. (7) found that malperformance of this test referred to back problems.

Although thoracolumbar rotation tests were not always considered reliable (11), we found a statistically significant association with previous back pain. For this test also, the absolute difference between complainers and non-complainers was too small to be of clinical importance.

In the discriminant analysis, the performance of two sets of tests was compared. Our set of 32 tests statistically predicted better last year and

point prevalence of back pain and last year prevalence with absence from work than the set of ten tests comparable to the tests Waddell et al. (7) selected for their Physical Impairment Scale. Although the tests for the discriminant analysis were limited to 32, the ratio of tests to subjects was still high. Therefore, the results of the discriminant analysis should be interpreted with caution. Nevertheless, our results suggest that our limited series of clinical tests could be sufficient to discriminate the majority of asymptomatic subjects from those with back problems. A large prospective study is going on now to assess the predictive value of this selection of tests.

Samenvatting

Doelstellingen: Klinische tests selecteren die het mogelijk maken om werknemers zonder rugpijn te onderscheiden van werknemers met rugpijn. In een tweede fase zal de predictieve waarde van deze selectie voor het voorspellen van rugproblemen bij aanvankelijk klachtenvrije personen onderzocht worden in een prospectief onderzoek. Dit artikel rapporteert enkel over de eerste pilootfase.

Methoden: 174 gezinshelpsters ondergingen een reeks klinische tests die eventueel verband hielden met rugproblemen. De prevalentie van klinische rugafwijkingen werd berekend. Via een vragenlijst werden bijkomende gegevens verzameld. Het verband tussen klinische testresultaten en klachten werd onderzocht door middel van de chi-kwadraat-test en de Mann Whitney u-test. Een selectie van 32 tests werd onderworpen aan een discriminant analyse om na te gaan in welke mate deze selectie in staat was om personen met rugklachten te onderscheiden van personen zonder rugklachten.

Resultaten: Het meest opmerkelijke resultaat was het statistisch significante verband tussen hypermobiliteit en de afwezigheid van rugpijn gedurende het laatste jaar. De meest significante statistische verbanden vonden we tussen rugpijn en drukpijn laag lumbaal, lumbosacraal en over de sacro-iliacale gewrichten.

Een selectie van 32 tests was in staat een onderscheid te maken tussen personen met en zonder rugpijn op het ogenblik van het onderzoek in 83% van de gevallen en tussen personen met en zonder rugpijn gedurende het afgelopen jaar in 89% van de gevallen. Tussen personen met en zonder rugpijn gedurende het afgelopen jaar met werkverzuim kon dit onderscheid in 88% van de gevallen gemaakt worden.

Conclusie: Een beperkt aantal tests is voldoende om de meerderheid van asymptomatische personen te onderscheiden van personen met actuele of een recente voorgeschiedenis van rugpijn.

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