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SHORT COMMUNICATION

USE OF ULTRASOUND IN OCCUPATIONAL RISK ASSESSMENT OF LOW-BACK PAIN

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The aim of the study was to evaluate ultrasound tehnique in preemployment medical assessment of the risk for low-back pain. Volunteers for the study were recruited among agricultural workers employed in the »Agraria Department« of the University of Bologna, Italy. The group consisted of 90 subjects, 52 male and 38 female, aged 25 to 58 years. The subjects filled in a questionnaire on medical history of low-back pain and were examined using an ultrasonograph equipped with a high linear frequency probe (3.5 MHz). The oblique parasagittal diameter of the lumbar spinal canal was measured by transabdominal ultrasonic imaging in the lumbar (L_4–L_5) and lumbosacral (L_5–S_1) region. Individuals with significantly narrower canals (<14 mm) had an increased risk of low-back pain. The paper concludes that ultrasound imaging could become a valuable screening tool in industry, permitting selective job placement for workers at high risk for disorders of the back.

Key words:
ecography, pain, risk factors, spinal canal diameter

Low-back pain is a common condition. The incidence in general population of the USA is 5–14% with the prevalence higher than 70%. It is the main cause of absenteeism in workers under 45 years of age and accounts for up to 4% of sick leaves in employees (1–3). Low-back pain costs the US at least US$ 11 billion each year (4, 5).

The risk factors for low-back pain include occupations that require repetitive lifting (particularly in a forward bent and twisted position) and loading. The Italian legislation (Act No. 626/94) deals with movements involved in lifting and carrying loads and related risks of low-back injury. It also refers to prevention thereof and gives guidelines as to the proper body position.

Various types of investigation have been suggested to identify workers that are exposed to the risk of low-back injury. These are ionising radiation, computerised

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tomography, magnetic resonance imaging, myelography, and radionuclide imaging. All these methods are invasive, potentially harmful (through irradiation), and expensive. Only recently has the ultrasound developed as a safe and non-invasive screening method (6–12).

In 1988, *Anderson and co-workers* (13), using the ultrasound technique, found an association between the diameter of the spinal canal and the impairment of ability to work due to back problems in a small group of hospital employees. Individuals with a canal diameter of less than 14 mm represented the lowest 10^{th} percentile of the population, constituting thus a group at high risk for low-back disorders and consequent absenteeism (13).

Our study attempted to asses the relationship between the spinal canal diameter and low-back pain in agricultural workers. In addition, we tried to evaluate the use ultrasound in preemployment screening and in the risk assessment of the low-back pain development at a later stage.

SUBJECTS AND METHODS

The study included 38 female and 52 male employees aged between 25 and 58 (mean age: 41 years) from an experimental farm of the University of Bologna. Everyday tasks related to their jobs were sowing, grafting, trimming, picking, driving vehicles, repairing, and classification of samples. Individuals with previous low-back surgery were excluded from the study. All subjects were interviewed and gave informed consent for the procedure. They were examined with an ultrasonograph ESAOTE AU4 IDEA, equipped with a high linear frequency probe (3.5 MHz). Transabdominal ultrasonic imaging of the lumbar (L_4–L_5) and lumbosacral (L_5–S_1) region was performed first (14). Canal diameter of 14 mm was the accepted cut-off point. It represented the lowest 10^{th} percentile in workers (13, 15, 16). Satisfactory testing was completed in about ten minutes. Then, each participant filled out a questionnaire on medical history of low-back pain. The questionnaire consisted of ten questions with the aim to reveal earlier traumas, fractures, or diseases of the back.

RESULTS AND DISCUSSION

Traditionally, a diagnostic value of a test is measured by its sensitivity and specificity. The two parameters serve to compare the diagnostic discrimination of a test with a standard. Sensitivity is measured as a rate of correct hits with respect to a predetermined number of subjects with a disease. Specificity is measured as a rate of correct hits with respect to a predetermined number of subjects without a disease.

Twenty-four employees had low-back pain, of which twenty had a canal diameter of less than 14 mm. Sixty-six workers did not have any symptoms, but twenty-six had

Table 1 *Sensitivity and specificity of the ultrasound measurements*

Spinal canal diameter	Subjects	
	Symptomatic (D+)	Asymptomatic (D–)
< 14 mm (T+)	20 (84)	26 (40)
> 14 mm (T–)	4 (16)	40 (60)
Total	24 (100)	66 (100)

Data are presented as absolute numbers (percentages in brackets)
Sensitivity=(T+/D+)=20/24=84%;
Specificity=(T–/D–)=40/66=60%

a significantly narrower canal (<14 mm). Table 1 shows the calculation of sensitivity and specificity of the method. Sixteen employees with a canal diameter of 14 mm represented the »borderline« group that needs monitoring.

Our study corroborates the observations of *Anderson and co-workers* (13) that ultrasound could be used to measure lumbar spinal canal diameter accurately and to determine the association between narrow lumbar canal diameters and low-back pain in workers (8–11, 13, 15, 17). This study could provide new input for the Italian legislation (Act No. 626/94) which considers the problem of low-back pain.

One in four workers in our study (24 of 90, or 27%) had low-back pain. This fact leads us to recommend the use of ultrasound examination of the spinal canal diameter, as the test showed good sensitivity of the method (84%). Ultrasound is a non-invasive procedure, it does not expose individuals to ionising radiation, it takes ten minutes, and is ideally suited to preemployment screening.

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Sažetak

UPORABA ULTRAZVUKA U PROCJENI RIZIKA OD PROFESIONALNOG OBOLJENJA DONJEG DIJELA KRALJEŽNICE

Cilj je ovoga istraživanja bio ocijeniti vrijednost ultrazvuka kao sredstva za ocjenjivanje rizika od oboljenja donjeg dijela kralježnice prilikom pregleda za zaposlenje. Ispitano je 90 dobrovoljaca s Agrarnog odjela Sveučilišta u Bologni, od kojih 52 žene i 38 muškaraca u dobi između 25 i 58 godina.

Ispitanici su popunili upitnik o anamnezi oboljenja donjeg dijela kralježnice te su pregledani s pomoću ultrazvuka s visokofrekventnom linearnom sondom (3,5 MHz). Promjer kanala leđne moždine mjeren je s pomoću transabdominalne primjene ultrazvuka u lumbalnom (L_4–L_5) i lumbosakralnom (L_5–S_1) području. Osobe sa značajnim suženjem kanala leđne moždine (<14 mm) pokazivale su povećani rizik od oboljenja donjeg dijela kralježnice. Autori zaključuju da ultrazvučna dijagnostika može biti vrlo korisna za provjeru radne sposobnosti u proizvodnji, omogućujući selektivan pristup raspoređivanju radne snage s visokim rizikom od smetnji u leđima.

Ključne riječi:
ehografija, promjer kanala leđne moždine, rizični čimbenici

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