

**MUSCULOSKELETAL
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AT
WORK**

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WORKING POSTURES AND SPINAL DISEASES AMONG PORPHYRY
QUARRYMEN

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INTRODUCTION

over 100 porphyry quarries, employing about 1400 workers, are concentrated in a small valley in Northern Italy.

The working postures of the quarrymen were analysed and evaluated and parallelly the occurrence of cervical, thoracic and lumbosacral diseases among 1157 quarrymen were studied by means of a suitably designed questionnaire.

The clinical results obtained in three different groups of quarrymen, each stratified into four age sub-groups, were compared with those obtained in paired control groups consisting of age- and sex-matched subjects who had never been exposed to occupational hazards for the spine.

The aim of the study was to ascertain whether in fact postural and mechanical stresses play an effective role in the etiopathogenesis of spinal diseases in quarrymen. METHODS

The main jobs common to all porphyry quarries were studied: a) caterpillar driver (operating a vehicle for the movement of rough stone and pallets of finished products); b) sorter (sorting and manual loading of porphyry slabs weighing from 10 to 35 Kg on special pallets); stone cutter (cutting stones into required sizes using a power hammer) (Fig. 1).

The study of the work postures and manual handling in these three groups of workers was carried out mainly using biomechanical methods developed by the authors (Colombini et al, 1985). In particular, stresses on lumbar disks during the various phases of work were measured. In parallel, the cardiovascular load and, consequently, the metabolic cost of these three jobs were measured in sample subjects by means of an ECG tracing according to Holter methodic, (The results of these tests will not be reported here

The study of alterations of the spine in three different groups of workers was performed using an appropriate questionnaire developed by the authors (Colombini et al., 1986), which was completed for the subjects under study by specially trained nurses. The questionnaire included the following features:

- a detailed working history, aimed especially at identifying previous exposure to occupational risk for the spine;
- separate identification of acute and peculiar manifestations such as discal hernia and acute attacks of lumbago;
- identification of subjects with pronounced chronic spinal disease (cervical, thoracic and lumbosacral) according to established thresholds of severity;
- description of the type and duration of spinal pain and associated factors (disability, sick absence, necessity of treatment);
- confirmation of the diagnoses on the basis of a more extensive clinical-diagnostic protocol used by the authors (Colombini et al., 1986), which in this case supplied data on the control group.

The questionnaire was distributed to the 1157 quarrymen, consisting of 154 caterpillar drivers, 469 sorters, 450 stone cutters and 89 workers doing various other jobs.

In view of the specific aims of this study, the subjects examined were selected according to the following criteria: a) employment on the same job for more than 5 years; * b) no previous job involving a risk for the spine lasting more than 4 years. 590 subjects complied with these requirements; they were divided into the three jobs under study and in 4 10-year age classes, as shown in Table 1.

The data on the frequency of chronic spinal disease (cervical, thoracic and lumbosacral) in the three groups of quarrymen and in the corresponding age sub-groups were compared with those already available (occhipinti et al., 1985) for a control group matched for sex and age. The comparison was made by analysing a series of 2x2 tables and calculating X² with Yates correction, the rate ratio and the relative 95% confidence limits. The Rate ratios where the lower confidence limit was >1 were considered positive (Comba and Axelson, 1981). In addition, in order to overcome the difficulties arising from the low numbers of some job and age sub-groups, and so as to be able to present concise data for each job group, the standardized morbidity ratio (SMR) (indirect standardization) was calculated and the value was confirmed by the x² test (Armitage, 1973).

RESULTS AND DISCUSSION
Analysis of Work Postures

A) Caterpillar Driver: the posture is mainly seated with frequent twisting of the trunk due to the need to continually change gear in a confined space; the posture is kept for at least 6-7 hours/day. The driver is subject to shocks and whole-body vibrations on account of the rough terrain (accelerations along the Z axis between 0.10 and 0.30 m/sec² for frequencies between 2 and 15 HZ).

B) Sorter: for the whole of the shift, work consists of sorting porphyry slabs (on the ground) using a sledge-hammer or a pickaxe and continually lifting and carrying the slabs (weight 10-35 Kg) to storage pallets (Fig.1). It was estimated that each labourer lifted and carried an average of 250-300 hundred Kg of stone every day. The lumbar loads that develop during these operations vary from 140 to 600 Kg.

C) Stone cutter: the job consists of taking the slab (weight 10-35 Kg) from the storage zone (at a height from the ground of about 1.20 m), with twisting of the trunk; placing the slab under the power hammer (trunk slightly bent, hands stretched away from the body); after cutting, throwing away the cut stones and residual pieces (Fig.1). Each stone cutter handles about 40-80 hundred Kg of stone per day. The resulting lumbar loads that develop vary from 140 to 400 Kg. All workers work on an incentive scheme, which means elevated work rhythms and few pauses. Without considering the detailed factors, all the jobs studied involved a high risk for the lumbosacral spine: in the caterpillar drivers, because of the seated posture, the trunk torsions and the whole-body vibrations; in the other jobs due to considerably high lumbar loads that develop.

Figure 1. Working postures of sorter and of stonecutter.

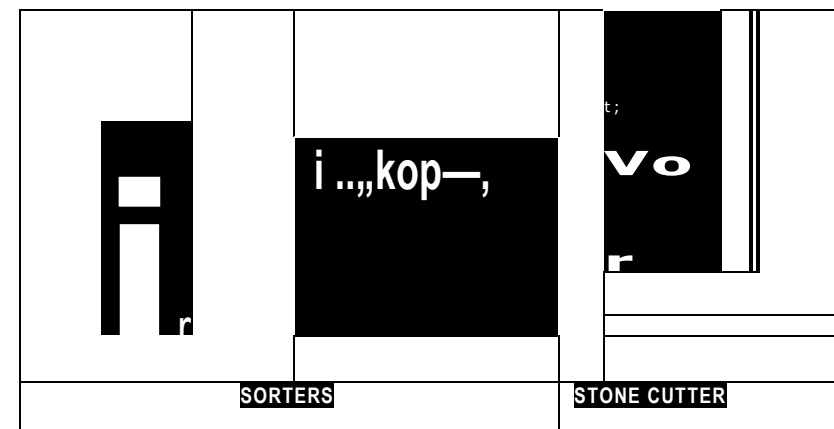


Table 1. Number of subjects examined and mean length of employment in the three groups of quarrymen, by age.

JOB	AGE GROUPS			
	25	26-35	36-45	>45
	N. ; len. Of	N. lem Of	ri fem Of e~R)	N. ;knof
Caterpillar Drivers	15 ■ 6.8	49 11.4	26 22f	17 29.5
Sortemi	56 6.5	95 i 9.7	40 i 15.4	43 ti28.4
Stono Cutt«S	46 6.3	75 10.7	36 2Q2	92i 33.5

Analysis of health data

Only the most significant data obtained from the clinical investigation will be reported here.

Table 2 shows, according to age class and job, the per-cent frequency of cervical, thoracic and lumbosacral spinal diseases in the three groups of quarrymen studied and in the controls. There was a high incidence of lumbosacral alterations particularly in the younger age classes; conversely, the frequency of thoracic spinal alterations was particularly low in the three groups of quarrymen.

Table 3 analyses the qualitative aspects of the disorders in the three districts of the spine. In particular, for the subjects with segmentary spinal disease, data are reported on: the form in which the disorders occurs (chronic, recurrent), type of disorder (segmentary insufficiency, circumscribed acute pain, diffused pain), whether treatment was required. The number of days of work lost for segmentary disorders, multiplied by 100 subjects at work, is also shown. Attention is drawn to the certainly not negligible figure for days of work lost for lumbosacral disorders in sorters and stone cutters (about one day/year per worker).

The statistical comparisons made (χ^2 , rate ratio, SMR) confirmed agreement with the data observed in the controls for the various jobs for the cervical and thoracic segments. The situation was exactly the opposite for the lumbosacral segment. The rate ratios were generally significant in the three jobs, compared with the controls, in the two younger age classes; the same degree of significance was not, however, observed in the two older age classes. Nevertheless the SMR (table 4) which shows that there is a general tendency to suffer from lumbosacral disease in each job involving risk,, compared to controls, was constantly very high and in any case highly significant from a statistical point of view.

Table 2. occurrence M of cervical (A), thoracic (B), lumbosacral (C). spondylarthritis among the quarrymen groups examined and among controls, by age.

JOB	AGE GROUPS			
	25	26-35	36-45	>45
Caterpillar Drivers	13	16	19	35
Sortem	7	14	32	26
stono Cuttem	9	16	28	42
Controla	12	10	32	40
Caterpillar Drivers	13	4	0	0
sorters	2	2	0	0
Stone Cuttem	7	5	2	3
Controls	6	4	10	4
Caterpillar Drivers	47	41	50	53
Sorters	39	48	45	53
Stone Cutters	22	23	42	67
Cont~	6	12	213	50

CONCLUSIONS

Analysis of the work postures in the three main jobs done at the porphyry quarry showed that the lumbosacral segment of the spine was definitely the segment most subject to risk. Parallel health investigations revealed the existence of a significant excess of lumbosacral disease in these groups of workers compared to sex- and age-matched controls. The careful selection of the health data was necessary in order to reduce as far as possible the main confounding variables for the disorder under study, which were age, sex, previous occupational exposure, length of exposure in the specific job. This selection does, however, guarantee greater assurance in making final assessment.

It can therefore be concluded that the porphyry quarrymen contract lumbosacral spinal diseases to a greater extent and at a younger age than in the matched male general population due to the specific working postures.

The only reservation we could have is the fact that we did not find significant rate ratios in the higher age classes. However, these age classes were certainly less represented in the job due to the difficult working conditions,

Table 3. Qualitative aspects of cervical (A), thoracic (B) and lumbosacral (C) disorders; time pattern, type of pain, use of treatment (expressed as a percentage of all cases of cervical spondyloarthropaty); sickness-absence days (n. x 100 workers).

JOB (A)	TIME PATTERN (%)		TYPE (%)			TREAT. (%)	SICKN. ABS days
	chronic	recurring	insufficen.	cervic. p.	c.brach.p.		
Caterpillar Drivers	19	81	33	57	10	14	0
Sorters	41	59	17	49	34	34	50
Stone Cutters	42	58	24	48	28	25	94

JOB (B)	TIME PATTERN (%)		TYPE (%)		TREAT. (%)	SICKN. ABS days
	chronic	recurring	insufficen.	thoracic p.		
Caterpillar Drivers	25	75	0	100	0	0
Sorters	0	100	0	100	33	17
Stone Cutters	31	69	31	69	31	6

JOB (C)	TIME PATTERN (%)		TYPE (%)			TREAT. (%)	SICKN. ABS days
	chronic	recurring	insuffic.	lumbago	sciatica		
Caterpillar Drivers	37	63	29	47	2	24	118
Sorters	37	63	18	53	0	29	118
Stone Cutters	40	60	15	50	3	32	106

Table 4. Lumbosacral disorders: SMR and relative significance for each job group as compared with matched control groups.

JOB	STANDARDIZED RATIO OF MORBILITY
Caterpillar Drivers	217 (P<0.001)
Sorters	230 (P<0.001)
Stone Cutters	153 (P<0.001)

which lead to a high occupational morbidity (silicosis, serious accidents, etc.), so that the workers either change job or continue working at considerably reduced rhythms, work loads (and pay). This selection phenomenon, however, can at the most cause an underestimation of the real incidence of lumbo-sacral spinal disease in these higher age classes; if this is true, the conclusions illustrated above are all the more reliable.

REFERENCES

JOB (A)	TIME PATTERN (%)	TYPE (%)	TREAT. (%)	SICKN. ABS days			
	chronic	recurring	insufficen.	cervic. p.	c.brach.p.	(%)	ABS days
Caterpillar Drivers	19	81	33	57	10	14	0
Sorters	41	59	17	49	34	34	50