

## THE PREVALENCE OF PALPABLE FINGER JOINT NODULES IN DIFFUSE IDIOPATHIC SKELETAL HYPEROSTOSIS (DISH). A CONTROLLED STUDY

By P. SCHLAPBACH\*, CH. BEYELER\*, N. J. GERBER\*, S.J. VAN DER LINDEN\*, U. BÜRGI†, W. A. FUCHS‡ AND H. EHRENGRUBER§

Departments of \*Rheumatology, †Internal Medicine, ‡Radiology, and §Data Processing, University of Berne, Inselspital, 3010 Berne, Switzerland

### SUMMARY

The presence of clinically palpable finger joint nodules (Heberden's and Bouchard's nodes) was documented in 123 consecutive cases with diffuse idiopathic skeletal hyperostosis (DISH) of the thoracic spine and 191 matched DISH negative controls. The prevalence of palpable finger joint nodules was almost twice as frequent in cases with spinal DISH compared to controls (46% versus 31%,  $\chi^2 = 7.67$ ,  $P < 0.01$ ; multivariate adjusted odds ratio OR = 1.84; 95% CI: 1.14-2.98). This increase was most marked at the proximal interphalangeal joint, in males and in patients up to the age of 65 years. In addition and independent of other variables such as hyperostotic features, age and sex, the prevalence of palpable finger joint nodules was about twice as high in probands with a history of physically heavy work compared to those without (43% versus 26%,  $\chi = 9.18$ ,  $P < 0.005$ ; multivariate adjusted odds ratio OR = 2.10; 95% CI: 1.26-3.52). From these results we conclude that DISH should be considered as an independent risk factor in the development of finger joint nodules.

KEY WORDS: Heberden's nodes, Diffuse idiopathic skeletal hyperostosis (DISH), Controlled study.

DIFFUSE idiopathic skeletal hyperostosis (DISH) is a well defined systemic condition, characterized by spinal and extraspinal hyperostotic calcification and ossification of ligaments, tendons and joint capsules [1-5]. Radiological changes in the hands include broadened and arrowhead distal phalangeal tufts, increased cortical width of tubular bones, prominent enthesopathy of the proximal phalanges, exostoses and new bone formation in joint capsules [6, 7]. In addition, clinically palpable finger joint nodules have been described [2, 3, 5, 8, 9]. However, the prevalence of finger nodules in cases with DISH and their association with osteoarthritic nodules remains unknown. As part of a controlled study of hospitalized patients with or without spinal DISH, we examined the prevalence of palpable finger joint nodules in both groups. The main objective was to confirm our hypothesis, that DISH is associated with the development of palpable finger joint nodules, irrespective of age, sex and the history of strenuous manual labour.

### MATERIAL AND METHODS

One hundred and twenty-three consecutive unselected cases with spinal DISH, based on routine lateral chest X-ray, were compared with 191 age- and sex-matched controls without spinal DISH. All were inpatients of two departments of internal medicine and one of cardiovascular surgery, referred to for problems not related to the locomotor system. They were interviewed for an occupational history during the previous 6 months and before by two blinded rheumatologists.

Submitted 6 February; revised version accepted 30 August 1991.

Correspondence to P. Schlapbach, Department of Rheumatology, University of Berne, Inselspital, CH-3010 Berne, Switzerland.

Occupational activities were classified as physically heavy or light by consensus of the two interviewers. Palpable finger joint nodules, defined as fixed bony expansions at the dorsolateral and dorsomedial aspect of the distal and proximal interphalangeal joints were documented by two observers blind to the X-ray findings. The lateral chest X-rays were graded as follows:

- Grade 0: No ossification
- Grade I: Prevertebral and/or prediscal ossification at one or two vertebral bodies of the thoracic spine or one bridging ossification between vertebrae
- Grade II: Continuous flowing prevertebral and/or prediscal ossification along three or more vertebral bodies of the thoracic spine or two bridging ossifications
- Grade III: At least three bridging ossifications along the thoracic spine

As proposed by Resnick *et al.* [2], the intervertebral discs of the hyperostotic segments showed no degenerative, dysplastic or inflammatory abnormalities. Probands with grades 0 and I were classified as spinal DISH negative (controls), those with grades II and III as spinal DISH positive (cases).

Intra- and interobserver reliability of X-ray grading was documented as previously described [10]. Statistical calculations were based on the chi-square test for dichotomous variables and the Student's *t*-test for continuous variables. Multiple regression analyses were performed with the Statistical Analysis System (SAS Institute Inc., Cary, NC, USA) under licence of the University of Berne. Logistic procedures with step-down regression analyses of four independent variables were used. Calculation of odds ratios (OR), multivariate adjusted odds ratios and 95% confidence

TABLE I  
DEMOGRAPHIC DATA AND PREVALENCE OF PALPABLE FINGER JOINT NODULES

	Spinal DISH cases ( <i>n</i> = 123)	DISH negative controls ( <i>n</i> = 191)	<i>P</i>
Mean age, years ( $\pm$ SD)	71 $\pm$ 9.4	68 $\pm$ 9.9	<0.05
Males	96 (78%)	126 (66%)	
Females	27 (22%)	65 (34%)	<0.05
History of heavy work	79 (64%)	120 (63%)	NS
DIP joint nodules	42 (34%)	47 (25%)	NS
PIP joint nodules	40 (33%)	36 (19%)	<0.01
DIP or PIP joint nodules	57 (46%)	59 (31%)	<0.01

DIP, distal interphalangeal joint; PIP, proximal interphalangeal joint.

intervals (95% CI) were carried out according to standard procedures [11, 12]. The level of statistical significance was set at  $P = 0.05$ .

### RESULTS

Demographic data of the 314 probands studied are shown in Table I. Palpable finger joint nodules were significantly more prevalent in spinal DISH positive cases than in DISH negative controls (OR = 1.93; 95% CI; 1.21–3.09; Table I). Analysing the distal and proximal interphalangeal joints separately, the difference was marked at the proximal joint level (OR = 2.08; 95% CI: 1.23–3.50) but only slight at the distal joint level (OR = 1.59; 95% CI: 0.97–2.61). This variation resulted from an increased prevalence of distal over proximal interphalangeal joint nodules in DISH negative controls, whereas no difference was detectable in DISH positive cases (Table I).

The prevalence of palpable finger joint nodules was significantly higher in probands with a history of physically heavy work compared to those without (43% versus 26%; OR = 2.16; 95% CI: 1.31–3.56). This increase was similar in DISH positive cases (OR = 2.19; 95% CI: 1.02–4.71) and DISH negative controls (OR = 2.16; 95% CI: 1.09–4.27; Table II). These results underline the contribution of mechanical factors to the development of finger joint nodules.

The prevalence of palpable finger joint nodules was similar in females and males (41% versus 35%; OR = 1.30; 95% CI: 0.79–2.14). However, taking spinal DISH rating into account, an interesting difference was revealed. Whereas in DISH positive cases finger

joint nodules were found as often in females as in males (OR = 0.91; 95% CI: 0.38–2.14), in DISH negative controls finger nodules were found more frequently in females than males (OR = 1.88; 95% CI: 1.0–3.55; Table III).

The prevalence of palpable finger joint nodules increased with age (21% in probands up to 55 years, 31% in 56–65 years old, 41% in 66–75 years old, 42% in 76–85 years old and 50% in over 85 years old respectively). It was higher in DISH positive cases than DISH negative controls in most age groups (Table IV). Because of a considerable interaction between age, sex, occupational history and finger nodules, multiple regression analyses were performed (Table V). All the results were in agreement with the univariate analyses presented above. The multivariate adjusted odds ratios for the presence versus the absence of palpable finger joint nodules were 1.84 (95% CI: 1.14–2.98) for DISH and 2.10 (95% CI: 1.26–3.52) for a history of heavy work. Finally, there was a strong association between distal and proximal interphalangeal joint nodules ( $\chi^2 = 64.44$ ,  $P < 0.0005$ ).

### DISCUSSION

In DISH the presence of palpable finger nodules at the distal and proximal interphalangeal joints has been described in about one-third of the examined cases ([2, 3, 5, 8, 9]; Table I). Our data support the hypothesis that DISH is associated with the development of palpable finger joint nodules. The prevalence of nodules at the distal or proximal interphalangeal joints was almost twice as high in spinal DISH positive cases com-

TABLE II  
PREVALENCE OF PALPABLE FINGER JOINT NODULES IN PROBANDS WITH AND WITHOUT A HISTORY OF HEAVY WORK

Spinal DISH grading	History of heavy work		Finger joint nodules	
	Yes	<i>n</i>	Yes	<i>n</i>
DISH positive cases ( <i>n</i> = 123)	Yes	79	Yes	42 (53%)
	No	44	No	37
DISH negative controls ( <i>n</i> = 191)	Yes	120	Yes	15 (34%)
	No	71	No	29
	Yes	120	Yes	44 (37%)
	No	71	No	76
	Yes	120	Yes	15 (21%)
	No	71	No	56

\* $\chi^2 = 4.13$ ,  $P < 0.05$ .  
\*\* $\chi^2 = 5.05$ ,  $P < 0.25$ .

TABLE III  
PREVALENCE OF PALPABLE FINGER JOINT NODULES IN FEMALES AND MALES

Spinal DISH grading	Sex	<i>n</i>	Finger joint nodules	
			Yes	<i>n</i>
DISH positive cases ( <i>n</i> = 123)	Females	27	Yes	12 (44%)
	Males	96	No	15
DISH negative controls ( <i>n</i> = 191)	Females	65	Yes	45 (47%)
	Males	126	No	51
	Females	65	Yes	26 (42%)
	Males	126	No	39
	Females	65	Yes	26 (42%)
	Males	126	No	39

\* $\chi^2 = 0.05$ , NS.  
\*\* $\chi^2 = 3.83$ , NS.

TABLE IV  
PREVALENCE OF PALPABLE FINGER JOINT NODULES IN DIFFERENT AGE GROUPS

Spinal DISH grading	Finger joint nodules	Age up to 55	55-65	66-75	76-85	86 and older
DISH positive cases (n = 123)	Yes	3 (50%)	15 (44%)	16 (40%)	20 (51%)	3 (75%)
	No	3	19	24	19	1
DISH negative controls (n = 191)	Yes	3 (13%)	12 (23%)	28 (41%)	15 (34%)	1 (25%)
	No	20	40	40	29	3
		(OR = 6.67)	(OR = 2.63) $\chi^2 = 4.23$ P < 0.05	(OR = 0.95) $\chi^2 = 0.01$ NS	(OR = 2.04) $\chi^2 = 2.52$ NS	

pared to spinal DISH negative controls, irrespective of the history of heavy work at present or in the past. However, this difference was prominent only at the proximal interphalangeal joint level, in males and up to the age of 65 years. This could be due to mixed aetiopathogenetic mechanisms for the development of nodules at the distal interphalangeal joint level, in females and the elderly. Indeed, it has been shown that finger joint osteoarthritis is more common in females than in males over the age of 55 years, mainly affecting the distal finger joints [13-17]. Further, our data support the hypothesis that heavy physical work is associated with the development of palpable finger joint nodules. The prevalence of nodules at the distal or proximal interphalangeal joints was about twice as high in patients with a history of heavy work at present or in the past, irrespective of spinal DISH grading, sex and age. We are well aware that this relationship has to be interpreted with caution. It is difficult to judge objectively whether work has to be considered as strenuous or not. In addition, time factors might play an important role. However, our findings are in agreement with previous studies, suggesting occupational and traumatic factors such as repetitive impulsive loading [18, 19] to be aetiopathogenetically relevant for the development of finger joint nodules [13-15], as shown for judoka [20] and cotton mill workers [21].

From the presented results we conclude that DISH is

a separate but discrete risk factor for the development of finger joint nodules. It has to be considered as aetiopathogenetically relevant especially in situations uncommon for osteoarthritic changes such as in young males without heavy occupational activities. In addition, our data indicate that mechanical factors may play a role in the formation of finger nodules.

#### ACKNOWLEDGEMENTS

We thank E. Hächler, MD, for examining patients and all colleagues of the Departments of Internal Medicine (Prof. P. W. Straub, Prof. H. Studer, Prof. T. Hess) and Cardiovascular Surgery (Prof. U. Althaus), Inselspital Berne for allowing us access to their patients.

#### REFERENCES

1. Resnick D, Shaul SR, Robins JM. Diffuse idiopathic skeletal hyperostosis DISH: Forestier's disease with extraspinal manifestations. *Radiology* 1975;115:513-24.
2. Resnick D, Shapiro RF, Wiesner KB, Niwayama G, Utsinger PD, Shaul SR. Diffuse idiopathic skeletal hyperostosis (DISH) (ankylosing hyperostosis of Forestier and Rotes-Querol). *Semin Arthritis Rheum* 1978;7:153-87.
3. Utsinger PD, Resnick D, Shapiro RF. Diffuse skeletal abnormalities in Forestier's disease. *Arch Intern Med* 1976;136:763-8.
4. Utsinger PD. Diffuse idiopathic skeletal hyperostosis. *Clin Rheum Dis* 1985;11:325-51.

TABLE V  
MULTIPLE LOGISTIC REGRESSION ANALYSES

Independent variable	Dependent variable	Parameter estimate beta	$\chi^2$	Probability of $\chi^2 P$
DIP joint nodules	DISH	—	2.40	0.122
	Sex	—	2.59	0.108
	Age	-0.030	4.94	0.026
	History of work	-0.712	6.50	0.011
PIP joint nodules	Sex	—	0.06	0.803
	History of work	-0.587	3.87	0.049
	Age	-0.034	5.49	0.019
	DISH	-0.673	6.09	0.014
DIP or PIP joint nodules	Sex	—	0.56	0.455
	Age	-0.031	5.67	0.017
	DISH	-0.611	6.17	0.013
	History of work	-0.744	8.06	0.005

DIP, distal interphalangeal joint; PIP, proximal interphalangeal joint.

5. Arlet J, Mazières B. La maladie hyperostotique. *Rev Med Interne* 1985;**6**:553-64.
6. Littlejohn GO, Urowitz MB, Symthe HA, Keystone EC. Radiographic features of the hand in diffuse idiopathic skeletal hyperostosis (DISH). *Radiology* 1981;**140**:623-9.
7. Fischer E. Exo- und endomarginale Reaktionen an der Hand bei der diffusen idiopathischen Skeletthyperostose, ihre Quantifizierung und Altersabhängigkeit. *Fortschr Röntgenstr* 1985;**142**:447-54.
8. Henrard JC, Bennett PH. Etude épidémiologique de l'hyperostose vertébrale. Enquête dans une population adulte d'indiens d'amérique. *Rev Rhum* 1973;**40**:581-91.
9. Harris J, Carter AR, Glick WN, Storey GO. Ankylosing hyperostosis. Clinical and radiological features. *Ann Rheum Dis* 1974;**33**:210-15.
10. Schlapbach P, Beyeler Ch, Gerber NJ *et al.* Diffuse idiopathic skeletal hyperostosis (DISH) of the spine: a cause of back pain? *Br J Rheumatol* 1989;**28**:299-303.
11. Kirkwood BR. *Essentials of medical statistics*. Oxford: Blackwell Scientific Publications, 1988.
12. Schlesselman JJ. *Case-control studies*. Oxford: Oxford University Press, 1982.
13. Stecher RM. Heberden's nodes: the incidence of hypertrophic arthritis of the fingers. *N Engl J Med* 1940;**222**:300-8.
14. Stecher RM. Heberden Oration. Heberden's nodes. A clinical description of osteoarthritis of the finger joints. *Ann Rheum Dis* 1955;**14**:1-10.
15. Kellgren JH, Lawrence JS. Osteoarthrosis and disk degeneration in an urban population. *Ann Rheum Dis* 1958; **17**: 388-97.
16. Kellgren JH, Lawrence JS, Bier F. Genetic factors in generalized osteoarthrosis. *Ann Rheum Dis* 1963;**22**:237-55.
17. Lawrence JS, Brenner JM, Bier F. Osteoarthrosis. Prevalence in the population and relationship between symptoms and X-ray changes. *Ann Rheum Dis* 1966;**25**:1-24.
18. Radin EL, Parker HG, Paul IL. Pattern of degenerative arthritis. Preferential involvement of the distal finger joints. *Lancet* 1971;**i**:377-9.
19. Radin EL, Paul IL, Rose RM. Role of mechanical factors in the pathogenesis of primary osteoarthritis. *Lancet* 1972;**i**:519-22.
20. Frey A, Müller W. Heberden-Arthrosen bei Judo-Sportlern. *Schweiz Med Wschr* 1984;**114**:40-8.
21. Lawrence JS. Rheumatism in cotton operatives. *Br J Ind Med* 1961;**18**:270-6.