

# Features indicative of cervical abnormality

## A factor to be reckoned with in clinical headache work and research?

Ottar Sjaastad<sup>a,b</sup>  
Torbjørn A. Fredriksen<sup>c</sup>  
Hans Petersen<sup>d</sup>  
Leiv Bakketeig<sup>e</sup>

Departments of <sup>a</sup>Neurology and <sup>c</sup>Neurosurgery  
St. Olavs Hospital, Trondheim, University of Trondheim  
Hospitals, Trondheim, (NTNU)

<sup>b</sup>Vågå Communal Health Centre, Vågåmo, Norway

<sup>d</sup>Department of Statistics, and <sup>e</sup>Institute of Public  
Health, Epidemiology, University of Southern Denmark,  
Odense, Denmark

Reprint requests to: Prof. Ottar Sjaastad,  
Gautes gate 12  
N-7030 Trondheim  
E-mail: berit.mjoen@medisin.ntnu.no

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### Summary

The current criteria for cervicogenic headache (CEH) contain an anamnestic and a physical examination part. The latter consists of: 1) range of motion in the cervical spine (1+); 2) mechanical precipitation of head pain (uppermost score: 1.5+). These two factors are included in "Features indicative of cervical abnormality", outlined in the present context, with a view to possibly facilitating CEH diagnosis. These "features" have a wider scope, containing not only the two original factors (1 and 2), but also three additional factors – their relative contribution to the totality also given in parentheses: 3) facet joint tenderness (0.5+); 4) neck muscle tenderness (0.5+); and 5) skin-roll test (1.0+). The sum of the solitary features is, accordingly, 4.5+. An extra 0.5+ can be added if there is extreme positivity of one of the factors, i.e., a maximum of 5.0+. This coarse system concerning cervical function has also been tested out in 1834 parishioners in the Vågå study of headache epidemiology (irrespective of headache diagnoses). The mean number of features increased with increasing intensity of head pain (by a factor of almost 3). In headache-free individuals (n.=246), the mean was 0.42+, against a mean in the whole series of 0.79+. Reproducibility tests demonstrated relatively high consistency.

*KEY WORDS: cervicogenic headache, headache, neck, range of motion, skin-roll test.*

### Introduction

The role of the neck in headache has been a matter of debate over decades. In neurological circles in the

1970s, it was more or less accepted that headache did not stem from the neck. The two major headache categories were at the time assumed to be migraine and tension headache (1).

In the wake of the description of the clinical manifestations of a headache originating in the neck – cervicogenic headache (CEH) (2) – CEH criteria were also set forth (3). These criteria to a large extent are clinical-anamnestic: unilaterality of the headache, radiation of pain to the ipsilateral shoulder/arm, etc. However, both the old and the revised set of criteria also contain a clinical examination part, composed of two components: range of motion in the neck (ROM) and mechanical precipitation of head pain, similar to the spontaneous one, from cervical/nuchal structures. However, the neck is a complex structure, and the two mentioned variables may not be the only pertinent ones. A broader, exploratory approach to clinically significant neck involvement in CEH may, therefore, be appropriate. Moreover, the current CEH criteria contain no recommendations for quantitative assessment.

In the present communication, a group of five separate factors pertaining to the neck have been assembled under the umbrella: "features indicative of cervical abnormality", or: the "cervical factor" ("CF"). An effort has been made to roughly quantify/semi-quantify these – admittedly rather inhomogeneous – features in a clinical context. It should be emphasized that we regard this as an entirely tentative approach.

An estimation of this factor in headache-free parishioners from the Vågå study of headache epidemiology and in that study's total unsorted series will be included. Blinded, intra-observer reproducibility of the method will be reported. Each of the factors, mechanical precipitation of attacks and ROM, will be scrutinized. The skin-roll test will be dealt with in detail elsewhere (4), in which context the value of this method – if any – in various headache syndromes will be explored.

### Scope

The principal aim of this communication is to present a battery of tests that are fast and easy to administer, and – with the exception of the skin-roll test – non-instrumental. The ultimate objective is, naturally, to provide a basis for rapid screening of cervical disorders, above all CEH.

The five separate features, or elements, are set forth in Table I (see over). Some type of quantification is desirable in this field. Most of these clinical parameters can, however, only be assessed in a semi-quantitative way. Since there are a total of five separate features (Table I), one initial, rough step as regards quantifying/semi-quantifying the abnormality would be to allot an equal

number, for example up to 1+, to each of the features. However, since one or more of these features could have greater significance than the others, placing all five on the same footing would *a priori* be an ill-conceived idea. A distinction between them should, accordingly, be made. Features I and II (Table I) can be quantified, using an algometer, and this has previously been done also in our setting (e.g., 5). The main reason for not applying an algometer routinely in the present context is that the test preferably should be a quick, overall assessment, carried out in a somewhat rough screening fashion.

The structures examined in connection with features I-III (Table I) may also be tender in healthy individuals. This part of the examination is, therefore, a delicate matter. For features I and II, we use pressure applied directly to the skin by the thumb, approximately 90° to the surface. If the applied force is not graded in some way, the danger of obtaining non-reproducible results is high. We have "standardized" the force used: step I, i.e., *mild* pressure, which equals 0.5-1 kg; step II, *moderate* pressure: 3-4 kg; step III, *hard* pressure: 6-8 kg; and step IV, *maximal* pressure: >10 kg. It is noteworthy that the palpation pressure used in identifying "tender points" in fibromyalgia is around 4 kg/cm<sup>2</sup> (6,7). And 1 cm<sup>2</sup> is not widely different from the surface area of the thumb used in our test. How can one be fairly certain about the extent of pressure applied in the various steps? One can train oneself, so to speak. By repeatedly – over years – pressing against weights/scales – and in the later stages, entirely blindly – we have been able

to convince ourselves that we can grade the pressure exerted in a reproducible way. Then, through long-lasting and thorough training on colleagues and test persons, and last, but not least, on oneself – one can learn to sense the extent of the pressure applied and the type of response that one can expect.

We have used "maximal force" *only scientifically* and in the following very special circumstances:

– To find out whether it is possible in headache-free individuals to cause a protracted fronto-temporal pain by external pressure applied to nuchal/cervical structures. In those tested (ourselves and colleagues; n.>25, some repeatedly), we have not been able to produce such pain radiation.

– To study the *immediate* effects of external pressure at the neck. Chronic paroxysmal hemicrania (CPH) patients with a capacity to precipitate attacks mechanically are almost ideal subjects for this. Does indomethacin afford *absolute* protection against attacks in CPH patients, i.e., during optimal medication and without spontaneous attacks. In those tested (n.=4; one of them many times (8)), indomethacin seemed to give partial to complete protection: a local discomfort could ensue, but no attack.

There is, of course, no gold standard for the assessment of the responses. The extreme response levels, as regards precipitation mechanisms are, for features I and II, and in principle also for III (Table I): no discomfort (upon moderate, or greater pressure) and a frank attack.

Also as regards feature IV (ROM, Table I), a rough semi-quantification can be carried out without instrumentation (see e.g. 9). We have purposely tried to avoid sophisticated instruments with a much higher exactitude – and power of resolution – as regards ROM assessment (10). The latter instruments, of course, have their strengths in certain scientific contexts, for example, where cervical movement patterns are the issue.

One element involving objective assessment is the skinfold thickness part of the skin-roll test (feature Va, Table I).

Anteriorly localized structures, like for example, the superficially located nerves, the temporal artery, and the temporo-mandibular joint should also be included routinely in the examination of headache patients, but are – naturally – not evident components of the "features indicative of *cervical abnormality*".

This examination technique was tested out during the Vågå study of headache epidemiology, in which 1834 parishioners were examined (941 females and 893 males). The test battery was also assessed in headache-free parishioners (n.=246). The design of the Vågå study has been described in detail elsewhere (11). The study protocol was approved by the Regional Ethics Committee and by the "State Data Inspectorate".

#### The various "features" and the background for selecting them

*Tenderness over nerves/tendons in the neck/occipital area (feature II, Table I)*

Feature II may be the most important one; it is probably one of the cornerstones of the diagnosis of CEH (3). It

Table I - "Features indicative of cervical abnormality".

I.	Tenderness, neck muscles
	a) Trapezius muscle, mainly upper part
	b) Neck muscles (splenius)
	c) Sternocleidomastoid muscle (upper/middle part)
II.	Tenderness over nerves/tendons in the neck/occiput *
	a) Greater occipital nerve (GON)
	b) Minor occipital nerve (MON)
	c) "Groove behind mastoid process"
	d) "Bony area", medial to mastoid process
	e) "Posterior neck tendons"
III.	Tenderness, facet joints
	a) Upper ones
	b) Middle ones
	c) Lower ones
IV.	Range of motion in the neck (ROM) *
	Rotation
V.	Skin-roll test **
	a) Skinfold thickness (in mm)
	b) Tenderness

\* Part of the diagnostic system for cervicogenic headache. \*\* In the shoulder area.

A comparison of symptomatic and non-symptomatic sides is always carried out.

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would, therefore, *a priori*, not be unreasonable for it to be promoted to a *primus inter pares* position, by, for example, allotting it a top value of 1.5+ (Tables II and III). Accordingly, one possible way of grading the responses as regards feature II would be as follows: responses A and B (Table II) could be 'lumped' into one group. The rationale for so doing is that some individuals feel a minor, local and transitory discomfort, or only an exacerbation of existing pain, upon just "mild"/"moderate" pressure in this area; it takes extensive experience to discriminate between what is "normal" and what is weakly pathological. Such a 'lumping together' will, therefore, in many cases hinder the already difficult decision-making process. This group is tentatively not allotted any points, since it would anyhow be problematic to ascribe pathological significance to such a marginal finding.

With the *radiation*, i.e., the spreading of pain into an area of the head that has not been palpated, a higher level of response seems to have been attained: the first level of response seems to be a transitory, occipital pain (response C), the next a brief pain into the forehead (D), whilst the final level of response would appear to be a prolonged frontal head pain, either an ex-

acerbation of existing pain – or even an "attack" (E) (Table II). In principle, a clear positivity of any of the sub-tests under feature II (Table I) suggests, but does not prove, that a certain precipitation mechanism may be operative. From experience, we know that if the precipitation test is maximally positive in one area, e.g., over the "groove behind the mastoid process" (feature II, c), precipitation tests also in other areas, specified under feature II, are likely to be positive to some extent. Simple addition of the responses obtained (under feature II, a-e) would, then, not be correct. Once, a maximum score has been obtained for one sub-test, the score should not then be increased further.

If one were always to apply for instance only moderate pressure (3-4 kg) or more, one would miss the extremely sensitive subjects. It seems logical, therefore, routinely to start with the lowermost external pressure. If there is a response, even mild, at 0.5-1 kg, one should only cautiously increase the force and await the response. "Mild pressure" in the "normal" situation rarely causes more than just a feeling of touch. To provoke an exacerbation/attack, we, therefore, routinely apply "moderate" or "hard" pressure. If a head pain of more than a couple of minutes' duration is generated by moderate pressure,

Table II - Scaling of precipitation response.

Pressure over greater occipital nerve (Feature II a, from Table I)	Points
A. No/mild ("normal") tenderness	} 0+
B. Somewhat increased tenderness, locally	
C. Pain radiating into back of the head	0.5+
D. Pain radiating into frontal parts of the head, briefly	1.0+
E. "Extra" pain, radiating to the frontal parts of the head, lasting > a couple of minutes	1.5+

The "extra" pain under E may be an exacerbation of already existing pain, or – rarely – a "new" pain (= attack) of varying duration.

Table III - Grading of the 5 "features indicative of cervical abnormality".

Features	Points	The uppermost level indicates
I. Tenderness, neck muscles	0-0.5+	Spreading of pain of more than minor intensity to the head, preferably anteriorly
II. Tenderness over nerves/tendons, neck/occiput	0-1.5+	Pain (sustained), radiating to the anterior part of the head
III. Tenderness, facet joint	0-0.5+	Pain radiation of more than minor intensity, to the anterior parts of the head
IV. Range of motion in the neck	0-1.0+	Rotation reduction 25°
V. Skin-roll test	0-1.0+	Asymmetry of tenderness and skinfold thickness (s>ns side)
Total	4.5+	

An extra 0.5+ may be added to make the total sum: 5.0+, when one of the above features (I-V) shows extreme positivity. Abbreviations: s=symptomatic side; ns=non-symptomatic side.

the response should probably be considered as pathological. The force used to precipitate a certain response should be noted. There is also the possibility of adding an extra 0.5+ in the event of an extraordinary response, for example: severe – and lasting – pain on “mild-moderate” stimuli. Occasionally, there may be a *slow* response after external pressure, the response appearing gradually over many minutes or even an hour or more after pressure application. Extensive experience is desirable for correct assessment of the responses.

An example of assessment of a case of CEH, with application of pressure over the occipital area, is detailed in Table IV.

The responses in sub-group I, and in principle also III (Table I), are graded in a similar way as shown in Table II for feature II a (from Table I). However, since 0.5+ is the uppermost grade for features I and III, 0.5+ indicates spreading of pain to the anterior part of the head (Table III). If the pain only spreads to the occiput, ear, etc., the response should be graded at a lower level: for example <0.5+.

*Tenderness of neck muscles; feature I, Table I*

*Muscle tenderness* has been set forth as a separate feature, distinct from “nerve/tendon tenderness” (feature II). Pressure over the sternocleidomastoid muscle is known to cause pain, spreading to the fronto-temporal and occipital areas (12). External pressure over the upper trapezius muscle may cause pain in the posterior auricular/occipital area, radiating to the anterior temporal area (12). These muscles may be examined as already described under “tenderness over nerves/tendons”. Or, they may be palpated with the three radial fingers. In our hands, these two methods of examination seem to give rather similar results as far as radiation of pain is concerned. Marked tenderness over the occipital nerves/tendons is frequently accompanied by tenderness over neck muscles. Maybe, however, the response from muscles is less important than that following pressure over the nerves and tendons, in *this* context. There is certainly no abundance of hard facts to substantiate this statement. CEH in general is, nevertheless, hardly a “primary” muscular disorder. Any muscular involvement in CEH is likely to be secondary to neurogenic involvement. It would, therefore, probably – at this preliminary stage – be wrong to allot equivalent points to features I and II: tentatively, a maximum of

0.5+ could indicate radiation of the pain anteriorly (see Table III), on applying “moderate” or greater than moderate pressure.

*Facet joint tenderness; feature III, Table I*

Here, the palpation technique differs from that described for the occipital area. Fingers II-IV are used and not the thumb. These are delicate, sensitive structures, almost invariably slightly/moderately tender, even to “mild” pressure. We, therefore, routinely apply only “mild” to somewhat less than “moderate”, external pressure. There may, even with this gentle pressure, be some radiation of the discomfort: from the lower joints towards the shoulder/arm and from the upper ones towards the head. With this type of pressure, we have only exceptionally been able to create a long-lasting head pain/pain exacerbation from these structures.

The inclusion of the facet joints is tentative. The diagnostic inferences, based on positivity of this type of palpation, are uncertain. Localized tenderness is hardly an indication of a significant level of pain generation in the cervical spine; at most, it is probably just a hint. In the present situation, it would probably be best to give less than average credit to facet joint palpation results: 0 might then mean no or very slight, i.e., “normal”, tenderness/discomfort, and 0.5+ a local pain, including radiation to the anterior parts of the head (Table III).

*The contribution of each of the three precipitation mechanisms to the totality in “no headache” cases*

In none of the parishioners with “no headache” in the Vågâ study (n.=246) could long-lasting pain/attacks be precipitated mechanically (features I-III, Table I) with the application of up to “hard” pressure.

As regards *neck tendon* tenderness, there was only one parishioner with a value >0, corresponding to approximately 0.4% of the cases. In none was a value of >0.5+ obtained. Thus, the *mean* contribution was: 0.002+. There were only three parishioners, i.e., 1.2% of the cases, with a pain radiating to the head upon *muscle* palpation, 0.5+ in each. The mean contribution was, accordingly, 0.006+. And there was only one parishioner with a *facet joint* sensitivity of 0.5+, corresponding to 0.4% of the cases. The mean value was 0.002+. The total sum of precipitation was, therefore, 0.01+ in the headache-free population (0.002; 0.006;

Table IV - Response to provocation mechanisms. Example: female, 53, right-sided cervicogenic headache; external pressure, groove behind mastoid process\*.

External pressure applied	Symptomatic side	Non-symptomatic side
0.5-1 kg	Weak local discomfort	–
3-4 kg	Local pain + radiation to frontal parts of the head	–
6-8 kg	Protracted, unilateral pain-“attack”***	Local discomfort + weak radiation to occipital area

\* Feature II c, Table I; \*\* similar to the usual attacks.

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and 0.002=0.01+). Considering the *totality* of provocation factors, only four parishioners in the “no headache”-group exhibited a value above zero, the highest single value being 1.0+, i.e.: 0.5+ and 0.5+. Thus, only 1.6% showed a value 0.5+ (Table V). Applying the present scaling, mechanical precipitation factors make practically no contribution to the totality of the CF in the headache-free population (Table V).

*The contribution of each of the precipitation mechanisms in 41 parishioners, followed over time*

Some randomly selected parishioners (n.=41) (11) were followed over a mean of 14.8 months (4-23 months), after which these tests were repeated. At examination I, a mean precipitation value of 0.15+ was found: a much higher value than in the headache-free group (Table V). In 34 cases, a 0-value was present, while seven out of the 41 (17%) showed positive findings at examination I, and in one a 1.5+ value was obtained (vs a maximum of 2.5+ in the entire series, Table V).

At examination II, there was a mean value of 0.085+. In 33 of the 34 cases, there was a continuation of a 0-value status. In four, there was an unaltered >0-value; in three, there was a reduction of 0.5+; and in one, a reduction of 1.0+. A total mean change (reduction) of 0.065+ had, therefore, taken place (Table V). Thus, in the clear majority of cases (>80%), the situation as regards precipitation of head pain seemed to remain stable over time.

*The skin-roll test; feature V, Table I*

The skin-roll test consists of two parts; i.e., assessment

of: 1) skinfold thickness and: 2) tenderness of the skin (13,14). In this context, we carried out the test only in the shoulder area (4).

The best way to carry out the test is with the aid of skin calipers (Servier®, Leiden, The Netherlands), the equipment used in the present context. A constant pressure is exerted onto the skin, at all widths of the jaw of the calipers. This uniformity of the stimulus would seem to be of major importance for the reproducibility of the test. In our view, a considerable pain should be provoked in order for the tenderness part of the test to be positive. The asymmetry of this test in CEH may be greater than the asymmetry in migraine (14). Tenderness may be of diagnostic importance in unilateral headaches, like CEH.

The measurement error exceeded 3 mm in only 1.1% of the cases (4). Differences greater than 3 mm between two measurements should, therefore, probably be considered clinically relevant. As regards *skinfold thickness*, the following observations were made in the “no headache”-group in the Vågâ study (four observations in each individual; both genders; age group: 18-65 years; n.=246): The average was: 14.3±5.7 mm (4). The *upper normal value* can thus be estimated as: mean + 2.5 S.D. = ca. 28 mm; or: mean + 2 S.D. = ca. 25 mm (Table V). We prefer an upper limit of 25 mm (4). An *asymmetry* >3 mm and a *change along the time axis* (within approximately 1 year) of >5 mm seems abnormal (4). A change >5 mm over time was observed in only 6% of the cases (4) (Table V). Positivity of skinfold thickness may involve any one of these three variables. We are inclined to believe that it might be appropriate to have two levels of positivity: 0.5+ for clearly abnormal values of either skinfold thickness or tenderness, and

Table V - Parameters used in the evaluation.

	Cervical abnormalities (0-5.0+) <sup>a</sup>	Skin-roll test (mm)	ROM; deficit, rotation (degrees)	Precipitation, pain/attack (maximal value: 2.5+)
Mean, general population <sup>b</sup> (n.=1834)	0.79+	15.1±6.0	?	0.15+
Mean, headache-free individuals (n.=246)	0.42+	14.3±5.7 <sup>c</sup>	6.2° (range 0-75°)	Mean value: 0.01+ <sup>d</sup> 0.5 (1.6% of cases)
Definite abnormality	>2.5+: 2.3% (>2.0+: 6.0%)	Approximately 25	10° (in 3.3% of <50-year-old subjects)	0.5+ (>0.5?)
Changes over time, mean <sup>e</sup>	0.17+	>5 mm: (in 6%) <sup>f</sup> >6 mm: (in 1.3%) <sup>f</sup>	5.2°	0.065+
Maximum change observed	1.0+: 8% >1.0+=none	9	20°	1.0+
Asymmetry, abnormal	not relevant	>3	10°	0.5+?

<sup>a</sup> “Features indicative of cervical abnormality”.

<sup>b</sup> Values based on 1834 parishioners in the Vågâ study (slight variation in numbers from one variable to another).

<sup>c</sup> The values are somewhat less for males than for females (see 4).

<sup>d</sup> Sum of all three precipitation mechanisms: tendons, muscles, and facet joints.

<sup>e</sup> In 39 parishioners, Vågâ study, followed for a mean of 14.8 months (range 4-23 months).

<sup>f</sup> Per cent of the observations.

1.0+ when both features are abnormal (Tables I and III). *Range of motion in the neck (ROM); feature IV, Table I*

ROM is one of the cornerstones in the assessment of cervical function. To simplify the test, we have opted for neck rotation in this context.

Sophisticated equipment can be used for ROM measurements (10). Such equipment is expensive and requires experience and expertise, both for the execution of the test and for the interpretation of the results; it can solve complicated problems (e.g., "motion patterns") and is of clear scientific value.

In population studies, such as the Vågå study – in which >1800 individuals were examined and where the time available for each individual was limited (60-75 min) – it goes without saying that the time allotted to each sub-test is critical. One technique for ROM assessment – a potentiometric technique – takes ca. 10 min per individual, according to Dvorak et al. (15), whereas with our approach it takes <1 min to assess ROM in the sitting position. The advantage of the present technique from this viewpoint is obvious.

In the present context, rotation on the right and left sides was measured separately. The "imaginary zero-point" corresponded to an angle at which the chin should point directly towards the shoulder (at 90° rotation), a position presumably obtainable in the normal situation. "Hyper-rotation" (>90°) was not studied in this context. *Reduction in ROM* was then assessed visually, in steps of 5°; or 5-10°, when the latter was deemed more correct. The movement was conducted in a "passive" way, the external pressure exerted being a mild one. The immediate intra-observer repeatability seemed to be satisfactory for a rough screening technique: up to 5-10° difference. The training of the observer, which should include comparison with inclinometric and Cybex results, is decisive for the exactness and reproducibility of this test.

Visual assessment of ROM has been regarded as an inferior test in various reviews (e.g., 16): "too unreliable for clinical practice" – and estimation errors, ranging up to 45° (sic!) have been recorded (16). Errors of this order of magnitude seem quite unbelievable as regards rotation; in our experience, they will usually not exceed 5-10°, and will rarely – if ever be >10°. Moreover, the said communication (16) contains sort of a *contradictio in adjecto*: "– it is not possible to state that any technology is more or less valid than another. In fact, visual estimation, known to be of low reliability and questionable validity has provided estimates that approximate the overall mean values for all technologies". However, it goes without saying that if precision of 0.1° is the aim, as in the study of Dvorak et al. (15), then visual assessment has no chance. In *clinical* situations, one will only rarely (probably *never*) need such precision; in many contexts, precision of 5° or 10° will do. Asymmetry may in the present context probably be as important an item as absolute precision.

In the Vågå study of headache epidemiology, there were 246 headache-free individuals (stage 0 on a 0-6+ headache scale (17)). It is emphasized that although these individuals were headache-free, they could, of course, still have *neck-ache* and *neck symptoms* (as in the case of many tractor drivers (18)). A reduction in rotation of >10° was observed in 22% of these cases. However, rotation reduction was most frequent in those

above 60 years of age. A reduction in rotation of 10° was observed rather rarely below 50 years, i.e., in 3.3%. Of those <60 years old, 3.2% had a rotation reduction of >15°. A mean reduction of 6.2° was found (Table V) in headache-free parishioners. This corresponds entirely to what has been found for rotation in other materials (16).

To test the solidity of this very parameter, 41 parishioners were re-examined absolutely blindly after a mean of 14.8 months (range 4-23 months): 82 pairs for comparison. Changes occurred – in both directions (increase/decrease; but mostly increase) – but were generally minor, the average change being 5.2°. In four out of the 82 observations, i.e., 5% of the cases, there was a difference between examinations I and II of 20°; in 16: 10° (20%). In other words, in 66 or 80% of the observations, there was a difference between examinations I and II of <10°. The consistency between results from examinations I and II was satisfactory: 0.81; 95% CI: 0.70-0.88. In this comparison, a difference of <10° has been allowed, since the exactness of the method appears to be from 5° to 5-10°. We have no good explanation for the observed 20° change, whether it is due to a change over time or to methodological shortcomings. We are not in a position to exclude the last-mentioned possibility. The other CF sub-tests did not indicate any particular abnormality in these cases. When taking into consideration that the study was undertaken absolutely blindly, that the average interval between examinations was 14.8 months, and that only an unaided visual assessment was used, this probably attests to the relative stability of ROM in most individuals. It should be considered that the chance of obtaining identical values at the two different examinations would be much greater were the original examination to have shown an entirely normal result. However, even with the clearly abnormal values, e.g., 45/45° recorded at examination I, the corresponding results at examination II were as close as one might expect: 40/40°.

It is felt that a total of 1+ may be given for positivity of the ROM test (Table III). We have not placed any emphasis on a 5-<10° rotation reduction. A 0.5+-value is proposed to represent a rotation reduction 10°- 20°; and 1+: 25°. Admittedly, these demands may altogether be too strict.

#### *Features indicative of cervical abnormality: total sum*

If the maximal points allotted to each of the features are summed up, the total is 4.5+ (Table III). In this way, there is an opening for adding another 0.5+, to make an *absolute maximum* of 5.0+. A further 0.5+ can be added if the response to one particular feature is disproportionate.

#### **Consistency tests**

Intra-observer consistency tests for the "features" as such were carried out in two ways:

##### *a) Re-check of records*

One hundred records from the Vågå study were re-checked blindly by O.S. Occasionally, the situation had been characterized by two numbers during the original examination, e.g., 2.5+-3.0+. The reason for this could,

for instance, be that it was difficult to decide whether the pain was spreading into the back of the head or was a mainly localized one on provocation tests (feature II, Table I). On re-check, a discrepancy of 0.5+ between the results at first and second examination was, therefore considered satisfactory. In no case, did the difference exceed 0.5+. If one accepts a margin of error of 0.5+, 100% concurrence was thus obtained. Complete concurrence was obtained in 88%; 95% CI: 80-94%.

*b) Re-check of parishioners*

Forty-one parishioners in the Vågâ study were re-examined blindly after a mean of 14.8 months (range 4-23 months (13)). The rules for a) also apply to b). Naturally, there might have occurred events of medical significance in the meantime (up to 23 months). Two parishioners were excluded from the comparison for such reasons. They both exhibited a deviation of 1.5+ from examination I to examination II: one parishioner, a male, with a 16-month interval between examinations had in the intervening period developed a fairly typical CEH; the "features" had changed from 1.0+ to 2.5+ (addition of m. trapezius tenderness; tenderness on skin-roll test, and tenderness over the GON). A female parishioner had during a 20-month interval developed neck-shoulder-arm pain – but no headache – after a local neck trauma (addition of m. trapezius tenderness; facet joint tenderness, and skin-roll test tenderness). It is our considered opinion that the demonstrated differences were *not* due to methodological shortcomings: there was in all probability a deterioration in the physical status of the parishioners, and this was reflected by this, admittedly somewhat crude, technique. There were accordingly 39 parishioners left for comparison.

In three cases, there was an improvement of 1.0+. Two of them had in the period prior to examination II (11 and 15 months, respectively) retired from their work as car mechanics (work that, in Vågâ, is not infrequently associated with neck complaints). The last one also had retired from his work as a civil servant at the time of examination II (interval of 23 months). These three were naturally not excluded from the comparison.

Allowing for a 0.5+ deviation (see a), re-check of records revealed a consistency of 92%; observed proportion with confidence intervals: 0.92; 95% CI: 0.79-0.98. Absolute congruence was found in 29 out of 39, i.e., in 74% of the parishioners; observed proportion with confidence intervals: 0.74; 95% CI: 0.58-0.87.

It should be re-emphasized that this scaling is a crude one. The steps in, for instance, the ROM assessment may be viewed as being disproportionately unrefined. Had the scale been more nuanced with smaller intervals, then it would have been somewhat more difficult to obtain congruency in test-retest situations. Analogous reasoning also applies to the other tests (features I-III, Table I). The present, relatively high consistency figures should also be viewed in this light.

**Distribution of parishioners according to number of "features"**

The distribution of features in the whole – unassorted – Vågâ series, is presented in a nomogram (Fig. 1). The mean number of features was 0.79+. More than half of

the parishioners (57%) had 0.5+ features. It is highly unusual to have a high number of features (4-4.5+ features (n.=4) and 5.0+ features (n.=1); in other words: 0.27% had 4.0+ features). The solitary parishioner with 5.0+ features had sustained a direct trauma to the neck/back of the head. Forty-two, or 2.3% of the parishioners, had >2.5+ features and 111 or 6.0% had >2+. We consider that >2.5+ features indicate clear abnormality.

When followed over time (in the present study, on average 14.8 months; n.=41), a change of >1.0+ would be most unlikely to occur, in the absence of development of a "new" disorder in this area (see Table V<sup>e</sup>). In the Vågâ series, no subject fell into in this category. A change of 0.5+ occurred in 18% of the cases, and of 1.0+ in 8% of the cases.

The headache-free ones had a mean score of 0.42+. The value of 0.42+ should be compared to the mean contribution of the provocation factors *per se* in the same group: 0.01+ (Table V).

With increasing pain intensity, the features generally in-

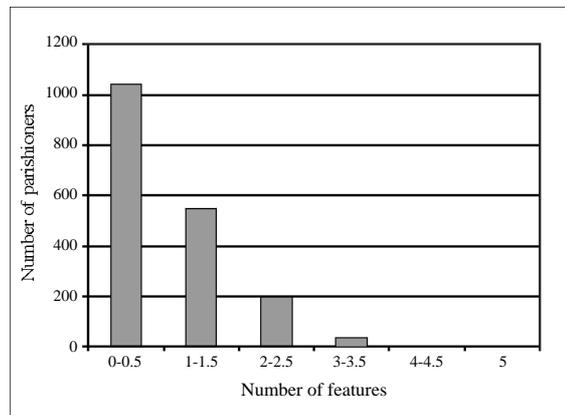


Figure 1 - "Features indicative of cervical abnormality". Number of parishioners in the various groups. Total n. of parishioners: 1834, with a mean number of features of 0.794+.

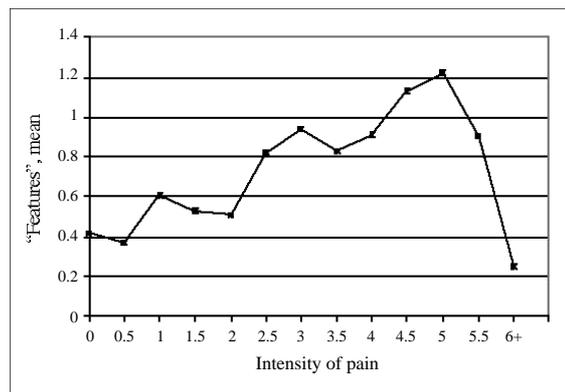


Figure 2 - Relationship between intensity of pain and "features": "features indicative of cervical abnormality". Unselected material, Vågâ study.

Intensity "1" corresponds to minimal unpleasantness, but no pain; "2" to "heaviness/discomfort"; "3" to "mild" headache; "4" to "moderate" headache; "5" to "severe" headache, and "6" to "excruciatingly intense" headache (21). "3" to "5" correspond to the IHS stages, carrying the same designations.

creased (Fig. 2): from severity 0 to 5.0+, the features increased almost by a factor of 3. This tendency seemed to end abruptly at 5.0+ ("severe headache"); there were 68 parishioners in this sub-group. There was a clear drop at 6.0+ ("excruciatingly intense headache"). Only cluster headache patients (19) were in the latter category. It is striking that cluster headache patients do not seem to exhibit "CF" features in spite of claims that nuchal factors might be of importance in the pathogenesis of cluster headache (20).

## Discussion

### *Physical findings in headache diagnosis*

Most headache patients come for consultation in-between attacks, when almost without exception there are no diagnostic signs present. The prevailing notion of negative findings in headache patients during consultation has highly influenced headache practice. Although among the pioneer headache physicians, some type of neurological examination ("short-version", "quick-version") was frequently carried out, neck structures were not included. When we in our group in the early 1970s started carrying out a thorough, clinical examination of the neck, head, and face in headache patients, this was so unusual that it raised the eyebrows of foreign colleagues: what was the purpose? It was time-consuming and was not going to be rewarding! The long-term perspective was, nevertheless, with accumulating experience, to develop a functioning and reliable – and swift – screening system for headaches related to neck disorders. Although two clinical parameters are integral parts of the current CEH diagnostic criteria, no quantitative/semi-quantitative aspects have been involved, as in the present communication (3,6). Thus, the IHS criteria for "cervical headache" (21) do not include any *clinical* tests for neck function.

The neck may be of importance in various headaches and not only in the typical CEH case; thus, in CPH with a capacity to precipitate attacks mechanically (8), neck-tongue syndrome (22), and neck sprain (23), and also in tractor drivers (18), who might react with headache (and not only with neck-ache). In the latter group, the "features" were widely different (mean 1.63+) from those in an age- and sex-matched control material, i.e., mean 0.45+ ( $p < 0.0001$ ) (18).

### *CEH criteria and "features indicative of cervical abnormality"*

In the present context, the repertoire of potentially useful sub-tests as regards CEH diagnosis (3) has been extended. An advantage of the palpation technique over the algometer technique is the ease with which it can be carried out. The palpation technique reproducibility tests have shown a relatively good consistency (features I-III, Table I). Probably, a palpation method functions only when rough, unsophisticated results are aimed at.

A comparison can be made with clinical testing of muscle power. In clinical settings, one can, using dynamometers, obtain rather exact expressions of muscular power, as regards certain muscle groups, e.g., hand grip. But when it comes to other areas – shoulders, an-

kles, etc., each clinician generally has to train himself to obtain reliable, reproducible estimates of the power, as for example carefully described by De Myer (24). This is probably the only method that functions for the routine neurological practice. The situation seems to be analogous as regards pain provocation in the head/neck.

For CEH proper, Suijlekom and co-workers recently validated the CEH criteria (25) and found that they generally function. As for the *anamnestic* part of the diagnosis, they found Kappa-values up to 0.76 for inter-observer agreement. For the *physical* part of the examination, their K-values naturally varied, and partly were considerably lower, the reason for this probably being that the various investigators' techniques had not been "tuned"/"harmonized" prior to the study: the values ranged from 0.59 for what was termed "pain provocation retroflexion" to 0.16 for "low zygapophyseal pressure pain". Also in headache in general (migraine, tension-type headache and CEH), the K-values were low for the zygapophyseal joints (upper ones): 0.14. Differences in the design between their studies and the present one can probably to a large extent explain the discrepancy, as regards the physical part of the examination. The present reliability investigation is based on an *intra-observer* study; the cited ones (25) were inter-observer studies. Moreover, in-depth training in this very special field would seem to be essential for obtaining a comfortable consistency of the results.

In the present study, the mean rotation capacity in headache-free individuals was of the same order of magnitude as in other healthy groups examined using more elaborate techniques (15,26). Besides, our study, like others (15,26), shows the same clear tendency towards rotation reduction with age.

In our group, we have demonstrated, using Cybex equipment, that as regards rotation, there is a significant difference ( $p < 0.001$ ) between the average values in controls, migraine, and tension-type headache on the one hand and CEH on the other (27). There is, however, far from a one-to-one relationship between clear ROM reduction and presence of CEH. There may be a marked stiffness of the neck, accompanied by mild/moderate neck symptoms, but no headache. On the other hand, occasional cases of clear-cut CEH show only a minor reduction of ROM.

Interestingly, in a recent study (28), the highest agreement between the results of the two physiotherapists who blindly examined 47 subjects, with passive, general and inter-segmental movements in the cervical spine, concerned neck rotation.

Results relating to "features indicative of cervical abnormality" ("cervicogenic factor") have been mentioned in previous studies (18,29). The Vågå study represents the first large-scale exploration of the diagnostic impact of the "CF" and its limitations. In this communication, we have concentrated on the findings in the population at large. Later, we will report on their virtue – if any – in CEH for example, such as when CEH may seem to co-exist with migraine (3,29,30).

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