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## Hangover headache: various manifestations and proposal for criteria. Vågå study of headache epidemiology

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**Abstract** Hangover headache has been focused upon in connection with the Vågå study of headache epidemiology, with 714 cases among 1122 dalesmen (64%). Most frequently the headache was global in location. It was more frequently located in the anterior (frontotemporal) than occipital area. A unilateral headache was present in only 3% of the dalesmen, many of whom were migraineurs. Headache seemed to be more intense in males than females. Headache usually seemed to be of a lower intensity than the pain of migraine, but higher than, or similar to, that of tension-type headache. The headache appeared late in the night/early morning hours, i.e., several hours after discontinuation of drinking. In most cases, headache stopped in the late

morning hours, or at high noon, but it could even last until somewhat late in the afternoon; it rarely, if ever, exceeded 12 hours duration. Red wine seemed mostly to provoke headache the same evening (with traits similar to those of the spontaneously occurring headache attacks). Criteria for hangover headache are proposed.

**Key words** Headache • Hangover headache • Migraine • Alcohol • Red wine

### Introduction

Hangover headache is a well-known and characteristic manifestation of alcohol consumption. It appears in the wake of a drinking bout, when the blood alcohol concentration is falling (IHS code 8.3.1 [1]). There are few detailed descriptions of the panorama of manifestations of hangover headache in headache literature. The complaints during attack mainly seem to pertain to two major symp-

tom categories: headache and gastro-intestinal (g-i) upset. The g-i discomfort in hangover headache in Vågå has been described elsewhere [2].

In the present communication, particular attention will be paid to localisation, duration and intensity of the headache. The connection between red wine and headache will also be touched upon. The symptomatology of hangover headache in the Vågå study will be compared with the description given by Raskin [3]. Finally, we will propose criteria for hangover headache.

## Material and methods

Details regarding the concept and structure of the Vågå study of headache epidemiology have been published elsewhere [4]. The parish of Vågå had 3907 inhabitants within its precincts just prior to the start of this study in 1995. All 18–65-year-old dalesmen were invited to participate in the study [4]. Questions concerning drinking sprees and hangover headache were asked in a face-to-face interview, but only from no. 501 onwards. The main reason for this delay was uncertainty as to whether a sensitive topic like alcohol intoxication could be incorporated into this study. As detailed elsewhere [5], the number of interviewed dalesmen was 1122; the number of females 523 and males 599. Mean age and gender ratio were of similar magnitude in the examined and the non-examined ones.

The criteria for hangover headache (IHS, code 8.3.1) in the present context were:

1. "Intoxication" by alcohol (IHS [1]).
2. Among the hangover symptoms, headache was an obligatory feature.
3. Headache onset >3 hours after discontinuation of drinking. Criterion (3) has been derived from the IHS rules for "alcohol-induced headache" (code 8.1.4, IHS [1]), the latter headache starting within 3 hours after drinking; hangover headache could then probably be assumed to start after 3 hours. The coding from IHS I [1] has been adhered to in this communication, as this was the available one at the time of study (1995–97). The generally accepted, rough requirement for alcohol intoxication, i.e., >5–6 standard units of alcohol, has been adhered to in this context (criterion 1).

This headache has undoubtedly had an almost indelible influence upon most dalesmen. Presumably, therefore, epidemiological data from a retrospective study can, generally and grossly, be relied upon as regards binge drinking. There were 714 dalesmen with a lifetime experience of hangover headache: 64% [5].

Intensity was assessed in absolute terms, according to IHS [1], or it was compared with that of migraine and tension-type headache (T-TH) in those with the appropriate combinations. The diagnoses of migraine and T-TH were established according to the IHS criteria [1]. Questions about localisation and duration of the headache were routinely asked.

The effect of red wine and chronic abuse (n=14) will be briefly dealt with. The headache originating in the wake of red wine consumption may frequently appear earlier than the headache after other alcoholic beverages. It may be of the "alco-

hol-induced headache" type (IHS code 8.1.4). The rules of this IHS code, i.e., onset within 3 hours, have, therefore, been adhered to [1]. Validation studies [5] have shown a high consistency between the results for hangover headache.

## Results

### Localisation of the headache

The headache was bilateral in the overwhelming majority of cases (Table 1). However, in 20 dalesmen (3%) there seemed to be a unilateral headache. All of these, except three, also suffered from migraine or other unilateral headache, such as cluster headache. Of the bilateral ones, more than half were global. The forehead was frequently involved, either solitarily (33%) or as a component of "global headache". The occipital area was also involved as a component of global headache. A more "pure", occipital, bilateral headache seemed to have been present in 2.6% of the cases (Table 1).

### Intensity of the complaints

With the prevailing drinking pattern, relatively more males than females seemed to suffer from hangover headache (IHS 8.3.1) (male/female ratio: 1.5 [5]). When assessing headache intensity in "absolute values" (IHS system: "mild"–"severe") (Table 2), males seemed to suffer more than females: in the higher intensity categories ("severe"/"moderate" categories combined), there was a clear male preponderance ( $p < 0.0005$ ;  $\chi^2 = 37.88$ ;  $df = 1$ ). Surprisingly, most responders rated the intensity as only "mild". Dalesmen claim that this is a self-inflicted headache, not worthy of much concern. Dissimulation – and conceivably remorse – may possibly explain the low rating.

A more correct picture of the intensity can possibly be obtained by a comparison with migraine and T-TH. The

**Table 1** Localisation of hangover headache

Localisation	n	Percentage	Females	Males	M/F ratio
Unilateral	20	3	12	8	0.67
Bilateral					
Global	328	50	129	199	1.54
Frontal	219	33	79	140	1.77
Temporal	76	12	28	48	1.71
Occipital	17	2	7	10	1.43
Total	660	100	255	405	1.59

**Table 2** Intensity of headache

Group	n	%	Females	Males	M/F ratio
Severe	9	3	0	9	–
Moderate	24	9	4	20	5.0
Mild	244	88	102	142	1.4

Based on IHS scaling [1]

**Table 3** Hangover headache intensity. Comparison with migraine and T-TH

Group	n	%	Females	Males	M/F ratio
(A) Hangover headache vs. migraine					
> migraine	65	25	28	37	1.32
= migraine	46	18	19	27	1.42
< migraine	145	57	78	67	0.86
(B) Hangover headache vs. T-TH					
≥ T-TH	98	88	34	64	1.88
< T-TH	14	12	5	9	–

Hangover headache at the level of T-TH, or exceeding it, in 88% of the cases; the corresponding figure vs. migraine: 43%. These figures are significantly different ( $p < 0.0005$ ). These figures concern only individuals with either migraine or T-TH

prevailing impression that hangover headache generally is rather severe, is only partially substantiated, even by this procedure. Hangover headache frequently seemed to be surpassed by or to be equal with migraine (in 75% of the cases, i.e., 191 (46+145) out of 256, Table 3). The vast majority (88%) of parishioners, who had experienced both hangover headache and T-TH, claimed that hangover headache equalled or overpowered T-TH (Table 3). These figures are statistically highly different (i.e., the figures for hangover headache vs. migraine ( $\geq$ migraine) (43%, 111 out of 256), and hangover headache vs. T-TH ( $\geq$ T-TH) (88%, 98 out of 112) ( $p < 0.0005$ )).

If confirmed, these relationships may even be of some value in the differential diagnosis of migraine/T-TH. One circumstance that favours this type of comparison is that hangover headache experience is rather frequent in the western world. There seemed, also with this method, to be a tendency, but a non-significant one, for hangover headache to be stronger among males than females: male/female ratio 1.32 for >migraine, vs. 0.86 for <migraine (Table 3A) ( $p = 0.18$ ).

#### Duration of hangover headache

Headache usually started in the late night/early morning hours, and it started several hours (>3 hours, by definition) after discontinuation of heavy drinking during the previous

evening and/or night. The hangover headache victim frequently woke up with a pounding headache, generally preferring the horizontal position. The maximum generally was reached in the morning hours, and then the headache gradually faded away. In 46% of the cases, it usually was largely gone in the late morning hours, and in the vast majority before noon, but in some it usually lasted until early afternoon, and in 3%, it usually lasted until somewhat late in the afternoon. The duration of hangover headache generally seemed to have been between 4 and 10 hours and only rarely >12 hours. The headache seemed to last longer in males than in females. As regards headache episodes lasting until afternoon, the following was found: M/F ratio 2.83, superseding by far the minor male preponderance in the entire series (M/F ratio: 1.14) ( $p < 0.0005$ ). The timing has been kept in rough terms, because it to a large extent depended upon the timing – and the quantitative aspects – of the alcohol consumption. Other symptoms might outlast the headache (see Discussion).

#### Red wine and headache

Sixty-two dalesmen had more than just minimal experience with red wine. Headache could apparently be provoked in 77% (Table 4), the provoked headache seemingly being of two types: either reproduction of the basic headache – or of a similar headache (IHS code 8.1.4 [1]) or

**Table 4** Red wine and headache. Number in parentheses are percentages

	Dalesmen, n
Red wine experience, total	62
No headache with red wine	14
Headache with red wine	48*
Precipitation of basic headache or similar headache (IHS 8.1.4)	34 (71)
Hangover headache type (IHS 8.3.1)	17 (35)**

\* In other words, headache with red wine in 77% of the wine drinkers

\*\*In three cases there seemed to be both types of headache (8.1.4 and 8.3.1 IHS [1]), for which reason the percentages do not add up to 100

hangover-type headache (IHS code: 8.3.1). The former response pattern seemed to outweigh the latter (Table 4). In three dalesmen, the two headaches types seemed to alternate, occasionally with evening headache and occasionally with headache only the next morning. In other words, 55% (34 out of 62) of those with red wine experience seemingly could be categorised under code 8.1.4.

Eleven of the 48 dalesmen with red wine headache had not experienced hangover headache with other alcoholic drinks. Seventeen of the 34 in the alcohol-induced headache group had unilateral headache (not shown in Table 4). This figure for unilaterality of headache in alcohol-induced headache should be compared with the 3% unilaterality in hangover headache (Table 1). These figures differ significantly ( $p < 0.0001$ , Fisher exact test). Three of the 17 dalesmen, with unilateral headache, i.e., 18%, also suffered from unilateral, migrainous headache.

Some had apparently tried rather heavy amounts of red wine without headache.

#### Chronic alcohol abuse and hangover headache

Five of 14 chronic abusers claimed to have had hangover headache in recent years, three to a severe degree. Five had

**Table 5** Alcohol response patterns

Source	Alcohol-induced headache (%) (IHS 8.1.4)	Hangover headache (%) (IHS 8.3.1)
Porto study [7]	0.3	–
Copenhagen study [8]	–	72
Peatfield et al. [9, 10]	29*	
Present study	(a) 3; (b) 55**	64
Kaivola et al. [6]	–	Invariably***

\*It is stated that foods (e.g., alcohol) precipitated headache [9, 10]

\*\* (a) Prevalence: a total of 34 out of 1122 (whole study group); (b) 55%=frequency among those with adequate exposure

\*\*\*Selected trial persons (n=30), see text

had no such headache, while four had had hangover headache previously; although this series is too scarce for conclusions to be drawn, there did not seem to be a uniform, stereotyped hangover picture in alcohol abuse. The variation in headache pattern may conceivably be linked to variation in consumption, even in chronic abusers.

## Discussion

Prevalence of alcohol-induced headache (IHS code 8.1.4) vs. hangover headache (IHS code 8.3.1)

There are, in principle, two reaction patterns after intake of considerable amounts of alcohol, as far as headache is concerned: (I) an early headache, i.e., prior to 3 hours (8.1.4 IHS); the headache in essence possibly being a reproduction of an inherent headache or a similar one; (II) a late headache, i.e., appearing upon falling blood alcohol concentrations (8.3.1 IHS).

Which of the two responses that will evolve to a certain extent depends upon the nature of the beverage. Hard liquor mostly gives rise to response pattern II [6], while red wine has a reputation of mostly leading to response pattern I. Vodka is said to be so “pure” as to only rarely give rise to headache. It should be emphasised that the two reaction patterns also may depend upon quantitative and temporal aspects of the drinking pattern – and not only upon the qualities of the beverage.

In Scandinavia, with a “Nordic” drinking pattern, the beverage much of the time consists of hard liquor [2] (Table 5), so there is obviously a high prevalence of hangover headache.

Daily – or close to daily – consumption of more than only minimal quantities, the beverage much of the time consisting of wine, a drinking pattern adhered to in southern Europe, may give rise to a different headache panorama. In e.g. Portugal, which has this pattern, there was a prevalence of headache due to alcohol of 0.3% [7] (Table 5).

There seems to be a considerable scatter as regards frequency of alcohol-induced headache in the literature (code: 8.1.4, IHS) [7, 9, 10, present study] (Table 5). In an English study, a relatively high percentage did “report precipitation of headache by alcoholic drinks” [10]. This was prior to the IHS criteria [1]. It is somewhat uncertain what “precipitation by alcoholic drinks” actually means. Anyhow, the figures in Table 5, the code 8.1.4 part, are heterogeneous. The figures from the English study [9, 10] and the present one are probably rather far from being directly comparable. The first ones concern the frequency of “dietary migraine” inclusive of alcohol ingestion, in a hospital setting, i.e., in “established migraineurs”. The present study concerns two situations, both entirely at variance with that in migraineurs. The one concerns headache in all those exposed to red wine, i.e., 55%; or: 34 of 62 (Tables 4 and 5). The other concerns the prevalence of red wine-induced headache, a figure that naturally will be a low one, due to the low exposure, i.e., 3%. So, although all three figures concern the early effect of alcohol, they cannot be directly compared. In the present study, where 55% of the wine-drinkers may have experienced alcohol-induced headache, the prevalence of such headache was low: 3% (Table 5). The figure, 3%, should actually be compared with the prevalence of 64% of hangover headache, IHS 8.3.1 (Table 5). This comparison is, however, not an entirely valid one due to the vast difference in alcohol exposure in the hard liquor and red wine parts of the study. Possibly, the 55% figure would give a more correct picture of prevalence in the society exposed to red wine than the 3%. It was remarkable that some dalesmen seemed to vacillate between response categories 8.1.4 and 8.3.1 [1]. It lies outside the scope of the present investigation to try to answer the question whether or not this headache with migraine-like traits in the solitary case really was “migrainous”.

#### Hangover vs. hangover headache

The delimitation of hangover vs. hangover headache seems to be a largely neglected field in neurological literature.

In the present study, hangover headache was focused on. This entails that there would be a headache component in every victim, but headache would not necessarily be present on every occasion in that particular victim. Besides the headache, the g-i symptoms were of particular interest, and symptoms characterising the headache, like intensity, photo- and phonophobia, nausea etc., were routinely asked about. The symptomatology of hangover headache, as, for example, presented in connection with the Vågå study [2], will – naturally – to some extent be characterised by the questions asked.

The reason for not including symptoms like anxiety, tachycardia, sweating, stomach pain [11–13] and blackouts in the present context, was that they supposedly neither derive directly from the headache, nor from the g-i phenomena. In one particular enumeration of symptoms, the “hangover” symptoms were arranged sequentially, according to importance [11]: headache; poor sense of overall well-being; diarrhoea; anorexia, tremulousness; fatigue; and nausea. And there was the following pronouncement of policy: When  $\geq 2$  of these features were present, “hangover” would be present. So, a combination of symptoms, not including headache and/or g-i symptoms could, in theory, fulfil the criteria for “hangover”. This would, accordingly, be a situation entirely at variance with that of hangover headache, as outlined in the present work. The reason why vomiting, photo- and phonophobia, and throbbing were not part of the “hangover” picture, probably was mainly that these symptoms were not part of the protocol [11].

The description of symptomatology largely depends upon how and to what extent the victims are “interrogated” concerning specific traits. “Hangover” and “hangover headache” are apparently two different sides of the same story. In retrospect, it is realised that symptoms characterising “hangover” and not only those characterising hangover headache should have been asked about in the Vågå study. In the present situation, we lack information on the interrelationship of the two manifestations of binge drinking.

#### The symptomatology of hangover headache

Rather detailed descriptions are those in Wolff’s book [14] and by Raskin [3]. The latter will be compared with our own results in Table 6.

During the hangover headache stage, there may seem to be two principal types of symptomatology: headache and g-i symptoms.

Headache is presumably the most frequently occurring symptom of hangover [11]. It begins several hours (3–5 hours) after heavy alcohol intake, in the late night or early morning hours, when the alcohol may be more or less metabolised. The maximum generally may appear in the early/late morning hours, possibly 4–6 hours after onset, the temporal pattern depending upon the timing of the drinking. It is frequently gone by noon, although occasionally it may last until late afternoon. Even though this type of headache may last 12 hours (or more), it will probably only rarely last >10 hours. However, although the headache has disappeared, complete soberness is not re-established [13, 15]; absolute fitness may not occur until 15–17 hours after drinking [15]. Similar findings as

**Table 6** Hangover headache: symptomatology

	Raskin [4]	Present study
Time of appearance	Several hours after alcohol ingestion ceased	>3 hours after alcohol ingestion
Localisation	“Generalised”, usually	Almost invariably bilateral: global or frontotemporal
Throbbing	+	+
Worsened by		
Postural change	+	+
Coughing	+	NM
Head movement	+	+
Duration	5–10 hours	4–10 (12) hours
Headache more frequent in males than females	–	+
Headache attacks longer-lasting in males than females	–	+
Intensity	NM	≤ migraine (75%) ≥ T-TH (88%)
Headache generally more intense in males than females	–	+
Nausea	+	+
Vomiting	NM	+
Diarrhoea	NM	Rare*
Photophobia	NM	+
Phonophobia	NM	+
Malaise	+	+
Pallor	+	NM
Hyperexcitability	+	NM

NM, not mentioned

\*Rarely observed in the present study (n=3); mentioned in [6]; in [11]: present in 36% of alcohol hangover cases, see text

regards the temporal aspects were obtained in a prospective study of 23 subjects, where ethanol, 1.5 g/kg body weight, was ingested in the course of 3 hours [13].

The headache was almost invariably bilateral and apparently more frequently localised anteriorly than posteriorly. A heavy, pulse-synchronous throbbing, probably also mainly anteriorly, seems to be one of the most regular and characteristic symptoms of hangover headache [2, 14]. The pounding may lead to inactivity, partly because postural changes, stooping [2] and head movements [14] exacerbate it. Photophobia and phonophobia, in other words: rather typical “migrainous” symptoms, can also occur [2]. Headache intensity frequently seems to be between the pain levels in migraine and T-TH (Table 6).

G-i symptoms and signs, and in particular nausea, occurred frequently; vomiting was present in approximately one fourth of the total series [2]. In some cases with nausea and even vomiting, not only could the headache appear

asynchronously, i.e., 6–8 hours later than the g-i symptoms; occasionally, headache might even not materialise at all, in those who usually experienced headache. Loose stools after heavy alcohol ingestion are occasionally present, according to our previous experience, but were only occasionally observed in this series. Diarrhoea has been described by others [6, 11], but this partly seems to concern hangover [11].

In the previously mentioned, recent review article concerning “hangover” and not “hangover headache”, headache was at the top of the list of symptoms, at 66% [11]. Remarkably, nausea was placed at the bottom of the list of seven symptoms (at 9%), while diarrhoea was in the third position – at 36%. It was, nevertheless, stated elsewhere in the same communication [11] (Table 2) that nausea is “common”.

Generally, Raskin’s description [3] and the present one correspond (Table 6), as regards the variables that have

**Table 7** Criteria for hangover headache: a proposal. Criteria 1–3 are obligatory; two, preferably all three, of the criteria 4–6 should be present

1. Alcohol intoxication (a drinking spree with >5–6 units of alcohol)
2. Headache
3. Headache onset >3 hours after cessation of drinking
4. Throbbing headache
5. Duration of the headache: 4–12 hours
6. Headache global

Other symptoms and signs, probably secondary to alcohol, but not to the headache, are supportive of the diagnosis

G-i symptoms (nausea, vomiting)

Tremor

Palpitation

been studied by both groups. It should, however, be emphasised that both accounts are descriptions of hangover headache characteristics and not criteria.

Finally, however, we venture to come up with tentative criteria for hangover headache (Table 7). The g-i symptoms and signs have been toned down somewhat in this context; but their presence would be highly supportive of the diagnosis.

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## References

1. – (1988) Classification and diagnostic criteria for headache disorders, cranial neuralgias, and facial pain. Headache Classification Committee of the International Headache Society. *Cephalalgia* 8[Suppl 7]:1–96
2. Sjaastad O, Bakketeig LS (2004) Hangover headache: accompanying symptoms. Vågå study of headache epidemiology. *J Headache Pain* 5:224–229
3. Raskin NH (1986) Ice cream, ice pick and chemical headaches. In: Vinken PJ, Bruyn GW, Klawans HL, Rose FC (eds) *Handbook in clinical neurology*, Vol 48. Elsevier, Amsterdam, pp 441–448
4. Sjaastad O, Båtnes J, Haugen S (1999) The Vågå study: an outline of the design. *Cephalalgia* 19[Suppl 25]:24–30
5. Sjaastad O, Bakketeig LS (2004) Hangover headache. Prevalence: Vågå study of headache epidemiology. *J Headache Pain* 5:181:187
6. Kaivola S, Parantainen J, Österman T, Timonen H (1983) Hangover headache and prostaglandins: prophylactic treatment with tolfenamic acid. *Cephalalgia* 3:31–36
7. Monteiro JM (1995) Cefaleias. Estudo epidemiológico e clínico de uma população urbana. Thesis. Porto
8. Rasmussen BK (1994) Epidemiology of headache. Thesis, Københavns Universitet, Copenhagen
9. Peatfield RC, Glover V, Littlewood JT, Sandler M, Rose FC (1984) The prevalence of diet-induced migraine. *Cephalalgia* 4:179–183
10. Peatfield RC, Glover V, Littlewood JT, Sandler M, Rose FC (1985) The prevalence and inheritance of dietary migraine. In: Rose FC (ed.) *Migraine*. Karger, Basel, pp 218–224
11. Wiese JG, Shlipak MG, Browner WS (2000) The alcohol hangover. *Ann Intern Med* 132:897–902
12. Harburg E, Davis D, Cummings KM, Gunn R (1981) Negative affect, alcohol consumption and hangover symptoms among normal drinkers in a small community. *J Stud Alcohol* 42:998–1012
13. Anylian GH, Dorn J, Swerdlow J (1978) The manifestations, aetiology and assessment of ethanol-induced hangover. *S Afr Med J* 54:193–198
14. Dalessio DJ (1972) *Wolff's headache and other head pain*, 3rd edn. Oxford University Press, New York
15. Yesavage JA, Leiser VO (1986) Hangover effects on aircraft pilots 14 hours after alcohol ingestion: a preliminary report. *Am J Psychiatr* 143:1546–1550