TOXICOLOGICAL AND PSYCHOPATHOLOGICAL PROFILES OF ALCOHOLICS BASED ON LINEAR AND NON LINEAR CLUSTERING

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Introduction. Distribution of drug addicts in discrete subgroups, characterized by a high level of similarity, in terms of both risk factors and natural history of dependence, has been the target of a great deal of research. Such distribution may indeed facilitate the choice among different therapeutic options, eventually improving prognostic outcomes. In previous studies we showed that artificial neural networks (ANN) are useful instruments to solve both prediction and classification problems in the field of drug addiction [1, 2]. In particular, we disclosed implicit natural classes in a consecutive series of hospitalized intravenous drug users by adopting a Self-Organizing Map (SOM) [3], an unsupervised ANN. The possibility that alcoholics also are distributed in different subgroups according to their toxicological and psychopathological profiles has been evaluated in the present study using both a non linear computation and a linear hierarchical cluster analysis (HCA).

Methods. We recruited 184 alcoholics admitted to the emergency room of the Policlinico Umberto I of Rome for medical or surgical problems related to the alcohol consumption. On the average these subjects have drunk more than 6 alcohol units per day in the last 2 years. They were examined for abstinence symptoms, levels of alcohol dependence, craving for alcohol, familiarity for psychiatric illness or drug dependence, the presence of hepatitis, consumption of other drugs of abuse, and the psychopatological status. The final database included 184 vectors, each one with 19 input dimensions. Database was firstly submitted to the HCA that used the mean relation between groups as clustering algorithm, whereas distances between clusters were measured by the Hamann dissimilarity index. HCA provided a stable solution for 32 theoretical clusters. SOM adopted in the present study consisted of a 6x6 matrix of processing elements (PEs). In this type of ANN a layer of input PEs is directly connected with the output PEs that are organized in a two-dimensional matrix. The output layer maps inputs using a competitive algorithm that, according to a learning coefficient, reinforces the winner PE having the shortest euclidean distance between the input vector and the vector representing the output contribution to the input. Each winner PE is surrounded by a neighborhood consisting of PEs with contribution vectors progressively less proximal to the input pattern. At the end of the training each PE will include inputs with marked similarities. Such similarities are represented by spatial proximity, so that the more proximal PEs are, the more similar they are. In the present study the starting value of learning coefficient was 1.0 and it decreased monotonically from 0.001 steps to 0.5. The input vectors were reiterated for 500 epochs. This number of reiterations allowed the gaussian neighborhood function to pass from 1 to 0 according to 0.002 steps. Finally, only the winner PE was reinforced for 10 further reiterations. The U-Matrix method [4] was adopted to determine the mutual distances between PEs contribution and to disclose areas of similarity in the SOM matrix. We also selected and described PEs that were not included by U-Matrix in areas of similarity but codified more than 9 input vectors. ANOVA analysis was performed on emerged groups.

Dunnett test was adopted for post-hoc analysis comparing emerged groups and the overall population.

Results. HCA produced 4 main groups of 9 or more subjects each one. The total number of subjects included in these groups were 112 (60.9%). Subjects of group 1 were vigilant with a toxicological profile similar to that of the overall population; group 2 included abstinent subjects, with high craving for alcohol, tremors and insomnia, and an accelerated psychomotricity. A slowing of psychomotor activity, including the ideoverbal flux, characterized groups 3 and 4, the latter also showing torpor and a restricted consciousness field. SOM computation disclosed 7 groups with 9 or more subjects. The total number of subjects included in these groups was 147 (79.9%). Groups A and F only differed from the overall population for a high incidence of hepatitis. Subjects of group F also were all vigilant. Subjects with abstinence symptoms were distributed to groups B, C and D, and shared high scores at the CAGE and craving tests. Subjects of group D differed from the others for higher levels of psychomotor activity and for positive urinalysis for benzodiazepines. Group C consisted of women with an elevated incidence of toxicological and psychiatric familiarity. The last two groups E and G included subjects with different levels of acute intoxication.

Discussion. Both HCA and SOM disclosed clinically relevant clusters in a series of alcoholics and suggest that our subjects belonged to three macro-groups: alcoholics without any apparent symptom of intoxication or of alcohol withdrawal; subjects experiencing a moderate alcohol abstinence syndrome, and subjects intoxicated. The most relevant difference between the two methods was that HCA detected few but clear-cut groups, showing a high capacity to summarize the principal macro-groups present in our population of alcoholics, while SOM revealed different but more shadowed profiles for each macro-groups. In addition, SOM seemed to discriminate mainly on the base of toxicological rather than psychopathological dimensions. This is consistent with our previous observations (unpublished results) showing that psychopathological variables did not increase the capacity of SOM to discriminate different types of drug addicts.

References:

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