建立以腦波爲基礎的阿茲海默病評估模式

Clinical EEG-based assessment model for Alzheimer's disease

中文摘要

背景

典型阿茲海默病的腦波爲慢波增加、快波減少的變化，由於這些現象爲非特異性變化，
所以一般認爲對於阿茲海默病的診斷助益有限。長期臨床觀察發現，此一變化似乎隨疾病進
展而愈加明顯，推測腦波指標可能反映疾病的嚴重程度，成爲追蹤此疾病的有利工具。然而
過去腦波與阿茲海默病的研究多專注於輔助鑑別診斷，對腦波指標和疾病嚴重程度的關係描
述不多，也缺乏一致的指標，致使臨床運用無法普及。本研究歸納過去文獻提出的腦波指標
進一步探討腦波指標和疾病嚴重程度的相關性，以及其臨床應用的價值。期望建立能夠廣泛
運用的腦波評估模式，加強醫療團隊對於阿茲海默病的追蹤及治療。

方法

本研究收集三個專科醫療機構、59 位阿茲海默病患的數位腦波資料，利用頻譜分析計
算並呈現 spectral profile、power ratio、interhemispheric alpha coherence 和 intrahemispheric alpha coherence 等指標。依據病患疾病嚴重程度分爲四組（非常輕微、輕度、中度、重度），分析各群組腦波指標特徵，及群組間腦波指標的差異。進一步討論腦波指標的臨床運用價值與其可能代表的神經生理意義。

結果

研究結果發現，spectral profile 能顯示不同程度阿茲海默病患的腦波差異，但其缺乏量化資訊，仍不易用於比較或追蹤病患；四組病患的平均 power ratio 分別爲：非常輕微 0.72、輕度 1.17、中度 1.86、重度 3.00，疾病程度越嚴重、power ratio 越高；interhemispheric alpha coherence 隨疾病程度嚴重呈現廣泛性下降現象，其中以 P3-P4 alpha coherence 和疾病嚴重度相關性最好。四組病患的平均 P3-P4 alpha coherence 分別爲：非常輕微 0.474、輕度 0.415、中度 0.347、重度 0.271，疾病程度越嚴重、coherence 越低；intrahemispheric alpha coherence 則未能有效鑑別不同嚴重程度的病患腦波。利用 ROC curve 訂定 cutoff value，正確區別四組病患的比率分別爲 power ratio 62.7% 及 P3-P4 alpha coherence 52.5%。

結論

腦波爲一客觀的檢查工具，適合用於顯示阿茲海默病的疾病嚴重程度。我們建議在腦波
指標的選擇上，使用　power ratio 和 P3-P4 alpha coherence 來進行評估。雖然運用在疾病分組的正確性尚不足以取代評估量表，但可作爲另一項客觀的參考依據。本研究提供可以廣泛利用的腦波評估模式來追蹤阿茲海默病患，對於單一病患病程變化的反應、藥物治療效果的反應、與其他評估方式間的相關性，則有待進一步深入研究。

英文摘要

Background

Typical EEG findings of Alzheimer's disease are increase of slow waves and decrease of fast waves. These changes are not specific for this disease, so it is commonly regarded EEG as of limited value for disease diagnosis. Long-term clinical observation suggests that the degree of these EEG changes seemed to be associated with the severity of the disease, and EEG study may serve as a potential tool to help clinical follow-up of these patients. However, most past studies of EEG and Alzheimer's disease focused on the issue of differentiation of Alzheimer's disease and other dementia syndromes. Description of the correlation of EEG parameters and the clinical course of Alzheimer's disease are rare and there's no unique recommended EEG parameter, so its clinical application is limited. We conducted this study to find sensitive and useful EEG parameters and provide a applicable model for the clinical assessment of Alzheimer's disease.

Method

This retrospective study included three medical institutes and fifty-nine patients of Alzheimer's disease. Based on spectral analysis, we calculated and presented spectral profile、power ratio、interhemispheric alpha coherence and intrahemispheric alpha coherence of individual EEG. We grouped the patients as very mild、mild、moderate、and severe groups according to the information of CDR or GDS and analyzed the correlation of these EEG parameters and different groups.

Results

Spectral profile provides valuable information of EEG about the dominant frequency and the power of different frequencies. We found characteristic profile of each group, however, it's a semi-quantitive method and is not suitable for

further comparison. Mean power ratio of each group is 0.72 in very mild group、1.17 in mild group、1.86 in moderate group and 3.00 in severe group, respectively. Higher value suggest more severe disease. Interhemispheric alpha coherence showed diffuse decrease as the advance of disease. Among the electrode pairs, P3-P4 showed better correlation with the disease severity. Mean alpha coherence in each group is 0.474 in very mild group、0.415 in mild group、 0.347 in moderate group and 0.271 in severe group, respectively. Lower value of P3-P4 alpha coherence suggest more severe disease. As for interhemispheric alpha coherence, we cannot find apparent correlation with disease severity. According to ROC curve, cutoff value among groups were suggested. Correct classification was 62.7% and 52.5% by power ratio and P3-P4 alpha coherence respectively.

Conclusion

EEG is a objective diagnostic tool, suitable of providing information of severity of Alzheimer's disease. Among various parameters, we recommended power ratio and P3-P4 alpha coherence as the tools to assess Alzheimer's disease. Although not sensitive enough to compare with clinical assessment scales, such as CDR or GDS, it can be a objective tool to supplement current assessment method. Our study provide a practical model that can be widely applied among institutes to follow up these patients. Further studies are necessary to assess the value of interval change of individual patient 、drug response and correlation with other diagnostic tools.