以頭部外傷病人之臨床變數預測頭部電腦斷層掃瞄結果

Predicting Cranial Computed Tomography Results of Head Injury Patients Using Clinical Variables

中文摘要

頭部電腦斷層掃瞄是診斷頭部外傷的最重要工具,但對於何種情況下的頭部外傷病患,應安排頭部電腦斷層掃瞄,並無普遍性的原則;每個區域,甚至每個醫院,都可能因時因地採用寬鬆不一的標準。在臨床業務中也常會發生病患或家屬與醫療人員,因爲是否應該安排頭部電腦斷層掃瞄而發生爭執。

在避免醫療浪費的前提下健保局規定自民國八十九年七月一日起所有電腦斷層掃瞄與核磁共振掃瞄檢查,都需在檢查後二十四小時內利用網際網路向健保局提出報備。這項措施將使頭部外傷病患接受頭部電腦斷層掃瞄檢查的適應症引發更多的爭議。

針對各項檢驗或檢查訂定適應症是醫療執業中的慣例(1)。訂定完善的適應症標準,可以在不影響醫療品質的前提下減少不必要的檢驗或檢查。因此我們嘗試利用實際的病例,來訓練類神經元網路,以病人的臨床變數,來預測頭部電腦斷層掃瞄的結果。其中病人的臨床變數包含:性別、年齡、昏迷指數、血壓(收縮壓、舒張壓)、心跳速率、呼吸速率、瞳孔對光反應性(瞳孔狀態以兩個變數來表示即兩側孔是否等大及對光反應正常之瞳孔數目)、是否飲酒、是否伴隨其他傷害、與受傷機轉(車禍、暴力、跌落、其他)。電腦斷層掃瞄結果則分爲正常與異常,異常的結果又細分爲腦水腫、顱骨骨折、顱內出血(蜘蛛網膜下腔出血,硬腦膜上出血、硬腦膜下出血、腦出血、腦室出血)、中線偏移、腦幹周圍腦池消失與基底腦池消失。頭部電腦斷層掃瞄若出現中線偏移、腦幹周圍腦池壓迫或基底核腦池壓迫則特別標示爲具外科意義之血塊(surgically significant intracranial hematoma--SSIH)。所有的頭部電腦斷層掃描影像都利用掃瞄器數位化後加以儲存,並經一位神經外科醫師及一位放射科醫師判讀。

我們收集 150 例曾因頭部外傷接受頭部電腦斷層掃描檢查的病例,其中 100 例作爲訓練之用,50 例作爲驗證之用。以各種不同之輸入變數組合;頭部電腦斷層掃瞄結果是否正常及頭部電腦斷層掃瞄結果是否出現具外科意義之血塊爲輸出變數,共訓練出 9 組類神經網路。

所使用之類神經元演算軟體爲購自美國 Ward Systems Groups ,Inc 之 NeuroShell Classifier Realease 2.0。其運算法則爲機率類神經元網路。

我們的研究結果顯示經過適當訓練的類神經元網路在預測頭部電腦斷層掃描檢查結果爲正常或不正常其 Sensitivity 可達 81.48%,Specificity 可達 100%。預測頭部電腦斷層掃描檢查結果是否出現具外科意義之血塊其 Sensitivity 可達 92.11%,Specificity 可達 83.33%。

英文摘要

Cranial computed tomography is the most important tool for diagnosis of head trauma. However the indication to request cranial CT scans for head injury patients is controversial. More reliable prediction of the results of cranial CT in head injury patients would be helpful for clinicians to decide whether to request emergency cranial CT scans or not.

We developed neural network models to predict cranial computed tomography results in head injury patients using different combinations of clinical variables.

150 consecutive patients admitted to a regional trauma center with head injury were enrolled in the study. Clinical variables (Age, Sex, Glasgow coma scale, Systolic blood pressure, Diastolic blood pressure, Heart rate, Respiration rate, pupil response, cause of injury) and CT characteristics (Brain swelling, Skull fracture, Type of hematoma, midline shift, obliteration of ambient cistern or basal cistern) were recorded. If midline shift, obliteration of ambient cistern or basal cistern was found ,the CT was labeled with presence of surgically significant intracranial hematoma(SSIH). 100 cases were used to develop the models; and 50 cases were used to test the accuracy, sensitivity, and specificity of the models. Totally, nine sets of neural network models were developed.

The performance of our models to differentiate normal from abnormal cranial CT(Best performance : Sensitivity81.48%，Specificity100%) and detection of SSIH(Best performance : Sensitivity92.11%，Specificity83.33%) was ideal.