ROLE OF REPEAT HEAD COMPUTED TOMOGRAPHY IN THE MANAGEMENT OF MILD TRAUMATIC BRAIN INJURY PATIENTS WITH A POSITIVE INITIAL HEAD CT

By

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DEDICATION

To my dearest wife,

Haslina

And

My children,

Haiqal
Ammar
Affan
Alya

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My utmost appreciation to

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ABBREVIATION

CI	:	Confidence interval
cm	:	centimeter
CT	:	Computed Tomography
EDH	:	Extradural haemorrhage
g	:	gram
GCS	:	Glasgow Coma Score
Hb	:	Haemoglobin
ICP	:	Intracranial pressure
INR	:	International Normalised Ratio
LOC	:	Loss of consciousness
MTBI	:	Mild traumatic brain injury
MVA	:	Motor-vehicle accident
PT	:	Prothrombin time
PTA	:	Post-traumatic amnesia
PTT	:	Partial Thromboplastin Time
RTI	:	Road traffic injuries
SPSS	:	Statistical Package for Social Science
SDH	:	Subdural haemorrhage
SAH	:	Subarachnoid haemorrhage
TBI	:	Traumatic brain injury
USM	:	Universiti Sains Malaysia

ABSTRACT

Introduction

The advent of computed tomography (CT) has revolutionized the approach to mild traumatic brain injured (MTBI) patients. CT scan has now become standard practice in the initial management of MTBI patients. Those with a positive initial head CT not requiring surgical intervention will be warded for continuous neurological observation. As a routine, a repeat head CT is frequently ordered within 24 to 48 hours, even without any clinical neurological deterioration in patients condition. The logic of this practice is questionable as convincing evidence is lacking. Indiscriminate ordering of radiological tests puts a strain on the healthcare system, especially so in Malaysia since less than 30 government hospitals nationwide are equipped with CT scans. Therefore, the objective of this study is to evaluate the role of routine repeat head CT in providing useful information that leads to a neurosurgical intervention.

Methods

This is a prospective observational study of MTBI patients admitted to the Neurosurgical ward, Sultanah Aminah Hospital, Johor Bahru from 1st June 2008 to 30th September 2009. A total of 279 patients was included in the study after meeting the inclusion criteria. MTBI is defined as Glasgow Coma Scale (GCS) score of 13, 14 or 15, with at least one of the following; head trauma with loss of consciousness lasting < 30 minutes; Glasgow Coma Scale score of 13 or more; post-traumatic amnesia lasting < 24 hours; any mental alteration at time of injury; and/or any transient or persistent neurological signs.

A head CT is considered positive if there was a suspicion or clear evidence of an intracranial pathology. The result of the first head CT were obtained from the radiological

report from this hospital's radiologist, or when not available, from the attending neurosurgeon's interpretation as documented in the case notes. The patient's demographic data, initial neurological examination findings, and biochemical analyses were documented. Neurological status was also documented until discharge. The results of the repeat head CT scan were obtained from the radiological report from the hospital's radiologist or from the attending neurosurgeon's notes. These were categorized as improved, unchanged or worsened. Any other additional neuroradiologic imaging or neurosurgical interventions were noted until discharge.

Results

Patients were divided into two groups, one with an unchanged or improving repeat head CT (n = 217) while the other with a worsened repeat head CT (n = 62). 31 patients received urgent surgical intervention after the repeat head CT was done. In all cases, neurological deterioration preceded and prompted an urgent repeat head CT. When the 62 patients with the worsened repeat head CT were compared to the other 217 patients, they were found to have significant statistical correlation with older age ($\geq$ 65 years old) (p value < 0.001), lower GCS on admission (p value = 0.003), associated symptoms of headache (p value = 0.019), multiple lesion on initial head CT (p value = 0.001), haemoglobin levels on admission (p value = 0.009), longer hospital stay (p value < 0.001), higher mortality rate (p value = 0.001), higher risk to undergo surgical intervention (p value < 0.001) and higher risk for neurological deterioration (p value < 0.001). There was no significant difference on gender, ethnic groups, mechanism of injury, other associated symptoms on admission, types of intracranial injury on initial head CT, types of skull fracture sustained and International Normalized Ratio levels. On applying multiple logistic regression, three factors were found to independently predict a

worse repeat head CT. This includes age ≥ 65 years old, GCS of less than 15 (i.e. 13 or 14) and multiple lesions on initial head CT.

Conclusion

The role of a repeat head CT in MTBI patients with a positive initial head CT have been evaluated in this study. Without a clinical neurological deterioration, a repeat head CT did not change the surgical outcome of patients. Patients with a GCS of 13 - 15 can be easily observed and assessed in the neurosurgical ward, therefore it is unnecessary to order a repeat head CT in all MTBI patients. Due vigilance is warranted in those with risk factors for a worsening repeat head CT.

ABSTRAK

Pendahuluan

Ketibaan alat pengimbas Komputed Tomografi (CT scan) telah mengubah sepenuhnya cara berhadapan dengan pesakit yang mengalami kecederaan otak minima. Skan CT sekarang telah menjadi norma amalan perawatan pesakit kecederaan otak minima. Selepas skan CT diimbas kepada pesakit ini, mereka yang tidak memerlukan pembedahan segera akan dimasukkan ke wad untuk pemerhatian berterusan. Disini, lazimnya skan CT akan diulangi di dalam jangkamasa 24 ke 48 jam, meskipun tiada kemerosotan tahap neurologi pesakit. Amalan ini banyak dipersoalkan kerana kekurangan bukti secara penulisan. Arahan pengulangan ujian radiologi meletakkan beban yang besar kepada sistem kesihatan, terutama sekali di negara ini, dimana hanya kurang daripada 30 buah hospital kerajaan mempunyai kemudahan skan CT. Oleh itu, objektif kajian ini ialah untuk menilai peranan skan CT berulang bagi pesakit kecederaan otak minima dalam memberi maklumat yang mendorong kepada pembedahan.

Metodologi

Kajian ini dijalankan secara pemerhatian prospektif kepada pesakit yang mengalami kecederaan otak minima, yang telah dimasukkan ke Wad Neurosurgeri Hospial Sultanah Aminah, Johor Bahru dari 1hb Jun 2008 hingga 30hb September 2009. Sejumlah 279 pesakit telah memenuhi kriteria-kriteria kajian ini. Kecederaan otak minima didefinasikan sebagai Skala Koma Glasgow (GCS) antara 13, 14 tau 15, dengan sekurang-kurangnya satu dari yang berikut; kecederaan kepala mengakibatkan pengsan kurang dari 30 minit; GCS 13 atau lebih; hilang ingatan selepas trauma kurang dari 24 jam; sebarang gangguan mental semasa kecederaan berlaku; dan/atau sebarang tanda-tanda ketidakseimbangan neurologi.

Skan CT kepala dianggap positif jika terdapat sebarang tanda-tanda jelas atau keraguan terhadap patologi otak. Keputusan ini diambil dari laporan pakar radiologi atau interpretasi pakar neurosurgeri seperti tertera di nota kes. Data tentang demografi pesakit, pemeriksaan awal neurologi dan analisis biokimia akan dicatat, juga status neurologi pesakit dari semasa ke semasa sehingga discaj. Keputusan imbasan skan CT ulangan akan diambil dari pakar radiologi atau interpretasi pakar neurosurgeri. Ianya dikategorikan kepada semakin pulih, tiada perubahan atau mudarat. Keputusan lain berkenaan skan atau intervensi pembedahan neuro juga akan didokumenkan sehingga discaj.

Keputusan

Pesakit dibahagikan kepada dua kategori, pertama dengan keputusan imbasan ulangan skan CT yang semakin pulih atau tidak berubah (n = 217); kedua dengan keputusan mbasan ulangan skan CT mudarat (n = 62). Intervensi neurosurgeri segera telah diberi kepada 31 pesakit selepas ulangan imbasan skan CT. Semua kes didahului dengan; dan dipercepatkan oleh deteriorasi neurologi pesakit. Kedua-dua kumpulan ini telah dibandingkan, dan didapati bahawa kumpulan imbasan ulangan skan CT mudarat mempunyai korelasi statistik yang jelas dengan umur lanjut ($\geq$ 65 tahun) ($p < 0.001$), GCS rendah semasa kemasukan ke wad ($p = 0.003$), simptom sakit kepala ($p = 0.019$), lebih dari satu tanda-tanda pada skan CT kepala pertama ($p = 0.001$), tahap haemoglobin semasa kemasukan ke wad ($p = 0.009$), tempoh rawatan hospital lebih lama ($p < 0.001$), kadar kematian lebih tinggi ($p = 0.001$), berisiko lebih tinggi untuk intervensi pembedahan ($p < 0.001$) dan berisiko lebih tinggi untuk deteriorasi neurologi ($p < 0.001$). Tiada perbezaan ketara pada jantina, kaum, mekanisma kecederaan, simptom-simptom berkaitan yang lain, jenis kecederaan otak pada skan CT pertama, jenis keretakan tengkorak dan tahap Ratio Normal Antarabangsa (INR). Dengan aplikasi regressi ordinal, didapati 3 faktor dapat meramalkan, secara berasingan, skan CT

ulangan yang mudarat. Ini termasuk umur ≥ 65 tahun, GCS kurang dari 15 dan lebih dari satu tanda-tanda pada skan CT pertama.

Kesimpulan

Peranan skan CT kepala ulangan kepada pesakit kecederaan kepala minima dengan skan CT pertama positif, telah dinilai didalam kajian ini. Skan CT ulangan tidak akan memberi apa-apa perubahan, dari segi pembedahan, kepada pesakit, tanpa deteriorasi neurologi. Pesakit dengan GCS 13 - 15 boleh di awasi dengan senang di wad neurosurgeri, oleh itu ulangan skan CT tidak diperlu dilakukan kepada semua pesakit kecederaan kepala minima. Langkah berjaga-jaga perlu dilaksanakan kepada pesakit berisiko tinggi untuk mendapat skan CT ulangan mudarat.