Letter to Editor

Post-Traumatic Hydrocephalus

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Dear Editor,

We read the recent article: "An Observation Study of Blood Glucose Levels during Admission and 24 Hours Post-Operation in a Sample of Patients with Traumatic Injury in a Hospital in Kuala Lumpur" published in the *Malaysian Journal of Medical Sciences*, Volume 18, Issue 4, 2011. We note the higher incidence of severe head injury in the publication (1). Therefore, we would like to add further comments on post-traumatic hydrocephalus.

We recently did a retrospective cohort study where in the respondents involved patients who were diagnosed and treated for post-traumatic hydrocephalus in Hospital Sultanah Aminah for the 4 years period 2008–2011. We initially looked into the differences between the duration of intensive care unit (ICU) stay, and development of hydrocephalus. We predicted that the initial head injury classification based on Marshal's computed tomography (CT) classification was the one causing longer stay in ICU. Based on previous studies done by different authors (2–6), we identified four main factors associated with post-traumatic hydrocephalus, which are intraventricular haemorrhage, subarachnoid haemorrhage, base of skull fracture, and interhemispheric subdural hygroma. We then predicted that it is safe to put shunt in patients with post-traumatic hydrocephalus without causing complications.

In our study, 15.9% of patients who developed post-traumatic hydrocephalus had stayed in ICU more than three weeks. Univariate analysis showed there is an association between duration of stay and development of hydrocephalus ($P < 0.001$). Of post-traumatic hydrocephalus patients in our study, 50% had severe brain injury. However, out of 22 cases diagnosed as post-traumatic hydrocephalus in our study, two patients had mild head injury. The first patient sustained base of skull fracture complicated by subdural empyema. The second patient, allegedly assaulted with machete, sustained multiple compound wounds that extended to brain parenchyma. This patient was complicated by meningitis and developed hydrocephalus. It indicates that the complification of infection in head-injured patients could increase the morbidity.

The cause of trauma of 77.3% of patients in our study was alleged motor vehicle accident. Of the remaining causes, 13.6% were falls from height and 4.5% for each: industrial accidents and assault. Nearly, 63.3% of post traumatic hydrocephalus patients in our study underwent decompressive craniectomy. Fifteen patients (68.2%) had an onset of hydrocephalus of more than 21 days in our study. There were five patients (22.7%) who had an onset within 8–20 days. Only two patients developed hydrocephalus in less than seven days.

Areal Kaen et al. found that the presence of interhemispheric subdural hygroma was a predictive radiological sign of hydrocephalus development within the first six months of decompressive craniectomy in patients with severe head injury. A subset of 14 (31.8%) of patients who had interhemispheric subdural hygroma on repeated scan developed post-traumatic hydrocephalus; 17 (38.6%) of patients who had traumatic subarachnoid haemorrhage developed post-traumatic hydrocephalus, 18 (40.9%) of patients who developed post-traumatic hydrocephalus had intraventricular haemorrhage on initial CT brain, and 20 (45.5%) of patients developed post-traumatic hydrocephalus in our study had base of skull fracture. However, multivariate analysis showed subarachnoid haemorrhage, intraventricular hemorhhage, base of skull fracture, and subdural hygroma are not associated with post-traumatic hydrocephalus ($P > 0.05$).

Aetiology of hydrocephalus appears to play a major role in influencing the complication rate (8). In our study, eight patients had complications out of 14 cases who had internal shunts, i.e. ventriculoperitoneal shunts. However, there is no association between internal shunt insertion, and complications ($P > 0.110$) in post-traumatic hydrocephalus patients in our study. We concluded that, a traumatic head injury patient who stayed longer than 21 days in ICU should be monitored

closely for symptoms and signs, of hydrocephalus ($P < 0.05$).There are no significant complications when shunt procedure is performed ($P > 0.05$).

There were some limitations of this study. The main limitation was the small sample size. It was found that only 44 patients were enrolled into this study due to incomplete data, missing case notes, or exclusion criteria. Since the data were mainly dependent on the case notes, some of the valuable data was not available. Incomplete documentation by the attending doctor, who reviewed the patients during admission and follow-up may have led to inaccurate interpretation by researcher. Secondly, we did not look into patients who present with chronic symptoms of post-traumatic hydrocephalus, particularly patients who were diagnosed with normal pressure hydrocephalus.

We recommend that the patients with head injury and evacuated mass, with CT brain showing traumatic subarachnoid haemorrhage, intraventricular haemorrhage, and base of skull fracture or interhemispheric subdural hygroma stay in ICU more than seven days and have a repeat CT brain within three weeks to six months after the injury. Additionally, the study suggests the necessity for further research a multi-centre study in Major Neurosurgery Centre in Malaysia with a larger sample over a longer period.

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Teleconsultation in Neurosurgery: Comparing the Multimodal Approach in Image Transfer in Kuala Lumpur Hospital

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Dear Editor,

I read with interest the article titled "An Observation Study of Blood Glucose Levels during Admission and 24 Hours Post-Operation in a Sample of Patients with Traumatic Injury in a Hospital in Kuala Lumpur" published in the *Malaysian Journal of Medical Sciences,* Volume 18, Issue 4, 2011 by Rahmat Haron et al., (1). We would like to highlight the teleconsultation aspect of brain injuries in Hospital Kuala Lumpur the largest referral center in Malaysia.

Wong et al., conducted a randomized controlled trial have concluded that telephone consultation equipped with teleradiological images or video consultation achieved a higher diagnostic accuracy as compared with a conventional telephone conversation (2). Another series led has demonstrated that teleradiology

was able to reduce the unnecessary transfer by 21% (3).

We recently completed a non-randomized, prospective observational study in Hospital Kuala Lumpur, whereby consultations from various peripheral hospitals were made with a tertiary neurosurgical center. The scan images were sent either using a telephone equipped with Multimedia Messaging (MMS) capabilities, or by any commercially available email system, or by using a web interface (Telehealth, TH). The system chosen by the peripheral hospital will depend on the availability of that particular system in their hospital. Equipped with clinical history alone, Walters KA has voiced the inadequacy of the history which is fraught with multiple problems during a transfer of a head injured, or suspected intracranial haemorrhage (4).

In our series, a total of 372 consecutive referrals from various institutions were enrolled after fulfilling a stringent criterias from December 2009 until July 2010. A smartphone equipped with third generation (3G) internet connection (BlackBerry Bold 9700, RIM, Ontario Canada), a computer networking stations with PACSPLUS viewer 2.0 (WorldCare Malaysia Pte Ltd), and any personnal computer can be used to retrieve all the scan images by the officer on duty, who will subsequently discuss the above cases with the neurosurgeon on call for definitive decision making. Whenever a situation arise, whereby an original films needed to be sent to us, this will reflect a failure of that particular image transfer system in replacing the original films.

The patients were categorized into three categories, mild (44.6%), moderate (22%) and severe (33.4%) head injury. Males comprises of 255 (68.5%) while 117 (31.5%) were females. Our youngest patient was four years old and the oldest was 89 years old. Majority of the patients were within 13-24 years old (23.9%), and most of them suffered from road traffic accidents. Telehealth consultation comprises of 23.9%, email recorded a 37.6% while MMS yielded a 38.5% of consultation respectively.

Using a chi-square test, the three modes of image transfer systems were compared head to head; (P = 0.424, TH vs email), (P = 0.324, email vs MMS), (P = 0.169, TH vs MMS). The results clearly indicates that there is no difference among the modalities being compared.

Similarly we used chi-square test in order to see the difference in Glasgow Outcome Scale (GOS) of patients upon discharge or referral to the rehabilitation center among those managed by the neurosurgeons, and those managed in periphery. GOS were further dichotomised into favourable and unfavourable group. $P < 0.001$ demonstrates that the outcome of those patients managed in tertiarry neurosurgical center was better as compared with those patients managed at the peripheral centers. The outcome might be interpreted as biased as our result may be influenced by poor neurological condition upon admission to the peripheral centers, thus rendering these group of patients from being transferred to a tertiarry center.

In our study, we managed to reduce the unnecessary transfer to 66%. The diagnostic accuracy improves from 87.8%, 90.7%, and 96.5% whenever the scan images were reviewed by the medical officers, clinicians, and the radiologists respectively. In our experience, we believe that MMS is very handy as well as portable while TH is a very comprehensive system as close as looking into the original films despite its bulky appearance, while the email system appears to be lying in between those two systems.

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