Hypomagnesemia, Hyponatremia And Hypercholesterolemia On Admission As Prognostic Predictors For Patients With Subarachnoid Haemorrhage

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Citation

Abstract

BACKGROUND: A subarachnoid hemorrhage may occur spontaneously, usually from a ruptured cerebral aneurysm, or it may result from a head injury. It is a medical emergency and can lead to death or severe disability even when recognized and treated at an early stage. Up to half of all cases of SAH are fatal and 10–15% die before reaching a hospital, and those who survive often have neurological or cognitive impairment. The early prediction of outcome after subarachnoid hemorrhage is important for allocation of time and effort to patients with a more favorable prognosis. Magnesium is the second most prevalent intracellular cation. It plays important roles in maintaining both normal cellular and body functions. So its deficiency can have dramatic effects. It appears to increase the risk of strokes. Hypomagnesemia after subarachnoid hemorrhage is considered as a strong predictor for delayed cerebral ischaemia. Sodium plays a vital role in maintaining the concentration and volume of the extracellular fluid and a major determinant of extracellular fluid osmolality. Hyponatremia after subarachnoid hemorrhage potentially worsens the underlying neurological condition and probably increases the risk of mortality and morbidity. Hypercholesterolemia is a recognized major risk factor for endothelial vasomotor dysfunction in cerebral arterioles because its effects on large arterial vessels (atherosclerosis) increase the likelihood that tissues will experience an ischemic episode. Altered microvascular function during hypercholesterolemia produces exaggerated tissue responses to ischemia. AIM OF THE WORK: The aim of the presented study was correlation between hypomagnesemia, hyponatremia and hypercholesterolemia on admission in patients with subarachnoid hemorrhage and patients' outcome in the form of both morbidity and mortality according to the Glasgow outcome scale. PATIENTS AND METHODS: The study was conducted on 60 patients with subarachnoid hemorrhage who were admitted to the Critical Care Medicine Department at Alexandria Main University Hospital during the year 2009. Our results revealed that, RESULTS: In the present study, the age of patients with SAH ranged from 3-65 years with a mean age of 39.75 ±16.027. The present study revealed that there were no statistical significant differences between the outcome and the age of patients. The present study revealed that there were no statistical significant differences between the outcome and sex of the patient, in this study 21 patients (35.0%) were females and 39 patients (65.0%) were males. In the present study, traumatic subarachnoid hemorrhage constituted the main category of SAH (88.3%), followed by spontaneous subarachnoid hemorrhage (11.7%). The present study revealed that there was no significant relation between outcome and subarachnoid hemorrhage type either traumatic or spontaneous. The present study revealed that there was a statistical significant relationship between outcome and serum magnesium level on admission, we notice that, normomagnesemia was associated with better outcome than hypomagnesemia. The present study revealed that there was a statistical significant relationship between outcome and serum sodium level on admission, we notice that normonatremia was associated with better outcome than hyponatremia. The present study revealed that there was a statistical significant relationship between outcome and serum cholesterol level on admission, we notice that, normal cholesterol level was associated with better outcome than hypercholesterolemia.

INTRODUCTION
Subarachnoid haemorrhage presents urgent state in neurology, with dramatic clinical picture and high mortality, with a sequence of vasospasm and cerebral infarction. The pathophysiology of SAH involves a primary event and commonly a subsequent cascade of insults. The secondary cascade substantially contributes to morbidity and mortality as a sequence of vasospasm and cerebral infarction.
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and associated with clinically apparent delayed ischaemic neurological deficits (DID) in one-third of patients.

Vasospasm following SAH is considered reversible vasculopathy and appear to be due to structural and biochemical alteration at the level of the vascular endothelium and smooth muscle cells; mostly triggered by blood in the subarachnoid space. Cerebral infarction is a consequence of SAH-induced hypovolaemia and impaired cerebral autoregulatory functions with subsequent reduction in cerebral blood flow and cerebral perfusion. (4)

Therapeutic strategies rather than surgical intervention were employed to explore new prevention and treatment options; Nimodipine; a calcium channel antagonist; is so far the only available therapy with proven benefit for reducing the impact of DID.

Multiple drugs are usually implemented with different mechanisms of actions, has been studied in SAH and promising, the most ones are magnesium sulphate and 3-hydroxy-3-methylglutaryl-coA reductase inhibitors (statins).

Magnesium (Mg), one of the essential trace elements, plays important roles in maintaining both normal cellular and body functions. (5,6) Evidence has suggested that The beneficial mechanisms of Magnesium are multidirectional, it can protect neurons from ischemic damage and can support neuronal survival through various mechanisms, including noncompetitive inhibition of the release of presynaptic excitatory neurotransmitters, blocking of N-methyl-D-aspartate receptors (NMDA) channels and voltage-gated calcium channels, potentiation of presynaptic adenosine, suppression of cortical spreading depression and anoxic depolarization, potential as an antioxidant. (7,8) Additionally, magnesium is known to causes vascular smooth muscle to relax, thereby potentially increasing cerebral blood flow. (9) Recently, it has been reported that Mg has the potential to attenuate apoptosis by inhibiting DNA fragmentation factor and p53 gene expression and by altering the balance of proapoptotic bax to antiapoptotic bcl-2. (10) A number of studies have suggested that the level of free magnesium in the brain is an important factor in the development of secondary traumatic and ischaemic brain injury. In different models of experimental injury, the intracellular concentration of free magnesium declines after injury and the extent of this decline is correlated with poor outcome. (22,23) In the clinical situation, various studies have shown low concentrations of serum magnesium after traumatic brain injury. (3,4) The administration of magnesium after traumatic brain injury is neuroprotective and attenuates neuromotor dysfunction and cell death in the injured cortex and hippocampus. (10)

Some current studies consistent with an emerging body of literature suggesting that statins may improve outcome in preclinical models of intracranial hemorrhage, (11,12) as well as other forms of acute brain injury, such as subarachnoid hemorrhage (SAH) (13) and stroke. (14) These studies have strong potential for clinical translation. For example, based on data demonstrating that simvastatin reduced vasospasm and improved functional outcomes in a mouse subarachnoid hemorrhage (SAH) model. (13)

The class of 3-hydroxy-3-methylglutaryl coenzyme A (HMG CoA) reductase inhibitors has pleiotropic effects that are independent of cholesterol metabolism. There are several potential mechanisms by which statins may have a palliative effect in the injured brain. In preclinical models of closed head injury, HMG CoA reductase inhibitors reduce glial activation and inflammatory responses (15) which contribute to cerebral edema and secondary neuronal injury. Statins may also reduce cerebral hypoperfusion via upregulation of endothelial nitric oxide synthase (eNOS) and stabilization of endothelial function. (13,16) This may be attributable to both upregulation of eNOS expression and improved stability of its activity by increasing availability of tetrahydrobiopterin, (17) a critical cofactor required for endothelial nitric oxide production. Statins may also reduce oxidative stress by inhibiting nicotinamide adenine dinucleotide phosphate (NADPH)-oxidase, a source of superoxide. (18) In addition to these acute effects, preclinical data suggest that long-term effects after injury may include enhanced neuronal plasticity, synaptogenesis, and angiogenesis. (19)

Hyponatremia occurred commonly (24%) in patients within 24 h after TBI&SAH. (20) Hyponatremia is associated with a variety of clinical signs or symptoms of neuronal dysfunction after many types of brain injury/fillness, including traumatic brain injury (TBI), SAH. (21,22) It may increase post-traumatic vasospasm (23,24) promote vasogenic and/or cytotoxic brain edema, or interfere with cell volume homeostasis. (22,25)

There is a need for further studies to determine a risk factors that influence outcome in this population of patients, yet screening patients at risk for vasospasm and DID following SAH; including hypomagnesemia, hyponatremia and hypercholesterolemia and...
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The aim of the present work was to study “the hypomagnesemia, hyponatremia and hypercholesterolemia as a prognostic predictors in patients with subarachnoid haemorrhage”.

**PATIENTS**

This study was conducted on 60 adult patients admitted to the critical care unit in Alexandria Main University Hospital during the year 2009.

**INCLUSION CRITERIA**

All patients included in this work should fulfill the following criteria:

Patients presented with traumatic SAH.

Patients presented with aneurysmal SAH, multiple aneurysms and other vascular abnormalities such as Arterio-Venous Malformations (AVM).

Patients presented with GCS≥12. (26)

4. Patients presented with HUNT-HESS Scale≥3. (27,28)

**EXCLUSION CRITERIA**

Patients presented with a major cardiac disease.

Patients presented with renal, hepatic or pulmonary disease.

Pregnant females.

**PATIENTS WAS CLASSIFIED INTO**

Group A: 30 patients suffering from SAH presented with hypomagnesemia, hyponatremia and hypercholesterolemia on admission.

Group B: 30 patients suffering from SAH presented with normal serum levels of magnesium, sodium and cholesterol will serve as controls.

**METHODS**

Informed consent will be taken from every patient included in this work or relatives as recommended by The Ethical Committee of Alexandria Faculty of Medicine.

This work will be conducted over two weeks during which the patients will be managed according to the conventional therapeutic strategies for SAH.

**PATIENT'S SELECTION**

To select patients admitted to the critical care unit with SAH, the followings will be done:

History of a new onset of neurological deficits, signs and symptoms of SAH such as:

(The classic symptom of subarachnoid hemorrhage is thunderclap headache “like being kicked in the head”, (29) Vomiting, seizures, (30) neck stiffness, other signs of meningism, confusion, decreased level of consciousness or coma may be present) either spontaneous or following head trauma.

Clinical examination and investigations to exclude a pre-existing cardiac, renal, hepatic or pulmonary disease such as ECG, renal function tests, liver function tests, chest x-ray and arterial blood gases.

CT-Brain compatible with the diagnosis of SAH.

Serum Mg, Na and Cholesterol levels on admission.

**PATIENT MONITORING**

Along the duration of this work, the followings will be monitored:

Neurological deficits, signs and symptoms of SAH.

GCS and HUNT-HESS SCALE

Haemodynamic monitoring such as (heart rate-mean arterial blood pressure-body temperature).

Monitoring of the respiratory rate and oxygenation.

Monitoring of the renal and hepatic functions.

Serum Mg level: will be measured daily.

Serum Na level: will be measured daily.

Serum Cholesterol level: will be measured weekly.

**GROUPING**

The selected patients will be classified into 2 groups; group A hypoMg, hypoNa and hypercholesterolemia on admission, and group B normal each on admission.
OUTCOME
To measure outcome in patients diagnosed with subarachnoid hemorrhage, assessment of the neurological outcome by accessing Glasgow Outcome Score. [Time Frame: 14 days].

STATISTICAL ANALYSIS
Statistics of the results were carried out according to the following formulae:

1. Arithmetic mean (X̄):
   
   Was calculated as follows:

   \[ X̄ = \frac{\sum x}{n} \]

   Where: \( x \) = arithmetic mean
   \( \sum x \) = Sum of observations
   \( n \) = number of observations

2. Standard deviation (SD):
   
   Was calculated as follows:

   \[ SD = \sqrt{\frac{\sum x^2 - (\sum x)^2}{n - 1}} \]

   Where: \( \sum x^2 \) = sum of squared observations.
   \( (\sum x)^2 \) = square of the sum of observations.
   \( n \) = number of observations.

3. “t” test:
   
   \[ t = \frac{X_1 - X_2}{\sqrt{S_p^2 \left( \frac{1}{n_1} + \frac{1}{n_2} \right)}} \]

   \[ S_p^2 = \frac{S_1^2 (n_1 - 1) + S_2^2 (n_2 - 1)}{n_1 + n_2 - 2} \]

   Where: \( S_p^2 \) = Pooled variance.
   \( S_1^2 \) = Variance of sample (1).
   \( S_2^2 \) = Variance of sample (2).
   \( n_1 \) = Size of sample (1).
   \( n_2 \) = Size of sample (2).
   \( X_1 \) = Mean of sample (1).
   \( X_2 \) = Mean of sample (2).

5. Chi-square (X²):

   For comparison between distribution of patients according to different items of study and use this formula for calculation:
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**RESULTS**

**AGE**

Relation between outcome and age was presented in table (2), it shows that, there were no statistical significant differences between the outcome and age, \( P=0.473 \).

**GENDER**

This work was carried on 60 patients in which 21 patients (35.0\%) were females and 39 patents (65.0\%) were males.

In this study 15 males (38.4\%) have been died, 9 (23\%) had become persistent vegetative, 9 (23\%) had severe disability outcome , 5 (12.8\%) had moderate disability outcome and one patient (2.5\%) recovered, while 9 females (42.8\%) have been died, 3 (14.2\%) had become persistent vegetative, 3 (14.2\%) had severe disability outcome, 4 (19\%) had moderate disability outcome and 2 patients (9.5\%) recovered.

\[ \chi^2 = \sum \frac{(O - E)^2}{E} \]

where \( E = \frac{\text{Total row x total column}}{\text{Grand total}} \)

\( S^2_1 = \text{Variance for group 1} \)

\( S^2_2 = \text{Variance for group 2} \)

\( p \) is significant if \( < 0.05 \)

6. Fisher test (F-test)
SAH CATEGORY

This study was carried out on 60 patients with SAH where 53 (88.3%) patients presented with traumatic SAH and 7 (11.7%) patients presented with spontaneous SAH.

Relation between outcome and SAH category was presented in table (6), it showed that, there were no statistical significant differences between out come and the type of SAH, (P=0.801).

GCS

The present study revealed that traumatic SAH was associated with less mortality rate than spontaneous SAH where patients with traumatic SAH had the following outcome, 21 patients (39.6%) have been died, 11 patients (20.7%) had become persistent vegetative, 11 patients (20.7%) had severe disability outcome, 7 patients (13.2%) had moderate disability outcome and 3 patients (5.7%) recovered. Whereas 3 (42.8%) patients suffered from spontaneous SAH have been died, one (14.2%) patient had become persistent vegetative, one (14.2%) patient had severe disability outcome, two (28.4%) patients had moderate disability outcome and no patient recovered.

H&H SCALE

The present work was carried on 60 patients suffered from SAH where 8 patients (13.3%) were presented with H&H scale ≤ 2 and 52 patients (86.7%) were presented with H&H scale ≤ 3.

SAH CATEGORY

Table (5): Distribution of the category of SAH

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tr.SAH</td>
<td>53</td>
<td>88.3</td>
</tr>
<tr>
<td>SP.SAH</td>
<td>7</td>
<td>11.7</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Relation between outcome and GCS on admission was presented in table (6), it shows that, there were no statistical significant differences between outcome and GCS on admission, (P=0.068).

H&H SCALE

Table(9): Distribution of the studied group regarding Hunt and Hess scale (H&H) on admission

<table>
<thead>
<tr>
<th>H&amp;H Scale</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 2</td>
<td>8</td>
<td>13.3</td>
</tr>
<tr>
<td>≤ 3</td>
<td>52</td>
<td>86.7</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The present work was carried on 60 patients suffered from SAH where 8 patients (13.3%) were presented with H&H scale ≤ 2 and 52 patients (86.7%) were presented with H&H scale ≤ 3.
Table (10) showed relation between outcome and H&H scale on admission, it illustrated that, there were no statistical significant differences between outcome and H&H scale, (P=0.118).

Figure 16
Table (10): Relation between outcome and Hunt and Hess scale (H&H) on admission

<table>
<thead>
<tr>
<th>H&amp;H scale</th>
<th>No</th>
<th>Persistent vegetative</th>
<th>Severe disability</th>
<th>Moderate disability</th>
<th>Good recovery</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 2</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>≤ 3</td>
<td>18</td>
<td>11</td>
<td>12</td>
<td>0</td>
<td>2</td>
<td>52</td>
</tr>
<tr>
<td>X²</td>
<td>7.355</td>
<td>34.6%</td>
<td>21.1%</td>
<td>23%</td>
<td>17.3%</td>
<td>3.8%</td>
</tr>
<tr>
<td>P</td>
<td>0.118</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Patients with H&H scale ≤ 2 on admission had mortality rate as 6 patients (75%), one patient (12.5%) had become persistent vegetative, one patient (12.5%) recovered and no patient had become with severe disability or moderate disability outcome; while patients with H&H scale ≤ 3 on admission had mortality rate as 18 patients (34.6%), 11 patients (21.1%) had become persistent vegetative, 12 patients (23%) had severe disability outcome, 9 patients (17.3%) had moderate disability outcome and two patients (3.8%) recovered.

MG
Table (11) showed relation between outcome and Serum magnesium level on admission, it demonstrated that, there was a statistical significant relationship between outcome and serum Mg level on admission, we notice that normal serum magnesium level was associated with better outcome than hypomagnesaemia, (P=0.050).

Figure 17
Table (11): relation between outcome and serum magnesium level on admission

<table>
<thead>
<tr>
<th>Mg category</th>
<th>No</th>
<th>Persistent vegetative</th>
<th>Severe disability</th>
<th>Moderate disability</th>
<th>Good recovery</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>7</td>
<td>6</td>
<td>8</td>
<td>6</td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td>Abnormal</td>
<td>17</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>9</td>
<td>30</td>
</tr>
<tr>
<td>X²</td>
<td>9.500</td>
<td>33.3%</td>
<td>20%</td>
<td>20%</td>
<td>10%</td>
<td>59%</td>
</tr>
<tr>
<td>P</td>
<td>0.001</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

The present work showed that mortality rate of Patients with serum magnesium <1.6 mg/dl on admission was 17 patients (56.7%), 6 patients (20%) had persistent vegetative outcome, 4 patients (13.3%) had severe disability outcome, 3 patients (10%) had moderate disability and no patient was recovered, where patients with S.Mg ≥1.6 mg/dl on admission had mortality rate as 7 patients were died (23.3%), 6 patients (20%) had a persistent vegetative outcome, 8 patients (26.7%) had severe disability outcome, 6 patients (20%) had moderate disability outcome and 3 patients (10%) had been recovered.

NA
Table (12) showed relation between outcome and serum sodium level on admission, it illustrated that, there was a statistical significant relationship between outcome and serum sodium level on admission, we notice that, Normonatremia was associated with better outcome than Hyponatremia, (P=0.001).

Figure 18
Table (12): relation between outcome and serum sodium level on admission

<table>
<thead>
<tr>
<th>Na category</th>
<th>No</th>
<th>Persistent vegetative</th>
<th>Severe disability</th>
<th>Moderate disability</th>
<th>Good recovery</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>4</td>
<td>7</td>
<td>9</td>
<td>7</td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td>Abnormal</td>
<td>20</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>X²</td>
<td>19.778</td>
<td>13.3%</td>
<td>23.3%</td>
<td>20%</td>
<td>23.3%</td>
<td>10%</td>
</tr>
<tr>
<td>P</td>
<td>0.001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The present work showed that mortality rate of patients with serum sodium <135 meq/l on admission was 20 patients (66.7%), while 5 patients (16.7%) had persistent vegetative outcome, 3 patients (10%) had severe disability outcome, 2 patients (6.7%) had moderate disability outcome and no patient had been recovered, whereas patients with S.Na ≥135 meq/l on admission had mortality rate as 4 patients (13.3%), while 7 patients (23.3%) had persistent vegetative outcome, 9 patients (30%) severe disability outcome, 7 patients (23.3%) had become moderate disability and 3 patients (10%) had recovered.

CHOLESTEROL
Table (13) showed relation between outcome and serum cholesterol level on admission, it demonstrated that, there was a statistical significant relationship between outcome and serum cholesterol level on admission, we notice that Normal serum cholesterol level was associated with better outcome than Hypercholesterolemia, (P=0.012).
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The present work showed that mortality rate of patients with serum cholesterol ≥ 200 mg/dl on admission was 15 patients (50%), while two patients (6.7%) had persistent vegetative outcome, 9 patients (30%) had severe disability outcome, 4 patients (13.3%) had moderate disability outcome and no one had been recovered, while in patients with serum cholesterol <200 mg/dl on admission there were 9 patients (30%) died, 10 patients (33.3%) with persistent vegetative outcome, 3 patients (10%) had severe disability outcome, 5 patients (16.7%) had moderate disability outcome and 3 patients (10%) had become recovered.

GOS
Table (14) shows the distribution of the Glasgow Outcome Score (GOS) in the studied patients with SAH which describes the patients’ outcome after 14 days. The outcome of (3 patients, 5%) was good recovery, the outcome of (9 patients, 15%) was moderate disability, the outcome of (12 patients, 20%) was severe disability, while (12 patients, 20%) became vegetative and (24 patients, 40%) has been died.

DISCUSSION
This study was conducted on 60 adult patients males and non pregnant females who were admitted to the critical care unit in Alexandria Main University Hospital during 2009 diagnosed as subarachnoid hemorrhage. All patients included in this work known to be of no cardiac, renal, hepatic or pulmonary disease and presented with GCS ≥12 and H&H scale ≥3. Informed consent has been taken from every patient included in this work or relatives as recommended by The Ethical Committee of Alexandria Faculty of Medicine and this work conducted over two weeks. Patients had been classified into two Groups, Group A: 30 patients presented with hypomagnesemia, hyponatremia and hypercholesterolemia on admission and Group B: 30 patients presented with normal serum levels of magnesium, sodium and cholesterol as controls.

The present work showed that there was significant relation between serum magnesium on admission and the patient’s outcome, where Patients with serum magnesium <1.6 meq/l on admission had a worse Galascow Outcome Score than patients with serum magnesium ≥1.6 meq/l on admission.
The present work showed that mortality rate of patients with serum magnesium < 1.6 meq/l on admission was 17 patients (56.7%), 6 patients (20%) had persistent vegetative outcome, 4 patients (13.3%) had severe disability outcome, 3 patients (10%) had moderate disability outcome and no patient (0%) was recovered, where patients with S.Mg ≥1.6 meq/l on admission had mortality rate as 7 patients were died (23.3%), 6 patients (20%) had a persistent vegetative outcome, 8 patients (26.7%) had severe disability outcome, 6 patients (20%) had moderate disability outcome and 3 patients (10%) had been recovered.

Van den Bergh WM, et al, 2003, assessed the relationship between hypomagnesemia and the severity of SAH and whether hypomagnesemia at admission or during the clinical course predicts delayed cerebral ischemia (DCI) and poor outcome, they found that hypomagnesemia at admission was associated with more cisternal and ventricular blood, a longer duration of unconsciousness, and a worse World Federation of Neurosurgical Societies score at admission. They also concluded that the crude risk for DCI with hypomagnesemia at admission was higher than after multivariate adjustment.

Reinhart RA, et al, 1985, Rubeiz GJ, et al, 1993 and Polderman KH, et al, 2000, found that hypomagnesemia can occur in several cardiovascular and neurological emergencies, including cerebral infarction, head trauma, migraine, seizures, and preeclampsia, and it is associated with increased risk of death.

The present work showed that there was significant relation between serum sodium on admission and the patient’s outcome, where Patients with serum sodium < 135 meq/l on admission had a worse Galascow Outcome Score than patients with serum sodium ≥135 meq/l on admission.

The present work showed that mortality rate of Patients with serum sodium < 135 meq/l on admission was 20 patients (66.7%), 5 patients (16.7%) had persistent vegetative outcome, 3 patients (10%) had severe disability outcome, 2 patients (6.7%) had moderate disability outcome and no patient (0%) had been recovered, where patients with serum sodium ≥135 meq/l on admission had mortality rate of 4 patients (13.3%), 7 patients (23.3%) had persistent vegetative outcome, 9 patients (30%) severe disability outcome, 7 patients (23.3%) had become moderate disabled and 3 patients (10%) had been recovered.

Widjicks, et al, 1985, in their study 60% of SAH patients with hyponatremia developed cerebrovascular spasm whereas it was 12% in patients with normal serum sodium levels.

Hasan D, et al, 1990, only 24% of SAH patients with hyponatremia developed CVS.

Qureshi et al, 2002, did not find any correlation between hyponatremia and risk of CVS in patients with SAH.

The present work showed that there was significant relation between serum cholesterol on admission and the patient’s outcome, where patients with serum cholesterol > 200 mg/dl on admission had a worse Galascow Outcome Score than patients with serum cholesterol < 200 mg/dl on admission.

The present work showed that mortality rate of patients with serum cholesterol > 200 mg/dl on admission was 15 patients (50%), 2 patients (6.7%) had persistent vegetative outcome, 9 patients (30%) had severe disability outcome, 4 patients (13.3%) had moderate disability and no one (0%) had been recovered, while in patients with serum cholesterol < 200 mg/dl on admission there were 9 patients (30%) died, 10 patients (33.3%) persistent vegetative outcome, 3 patients (10%) had severe disability outcome, 5 patients (16.7%) had moderate disability outcome and 3 patients (10%) had become recovered.


Yano K, et al, 1989 Adamson, et al, 1994, asserted that atherosclerosis which may be aggravated by increased cholesterol concentration contributes to the rupture of cerebral aneurysms.

Inagawa T et al, 2002 concluded that, hypertension, cigarette smoking, and hypercholesterolemia were significantly more common in patients with SAH and independently associated with an increased risk of SAH. Where an increased concentration of cholesterol is the second most notable risk factor associated with SAH where hypertension was the most important risk factor.

In the present study, the age of patients with SAH ranged from 3-65 years with a mean age of 39.75 ±16.027. Most of the patients (26 cases, 43.3%) were in the age group 20-39 years followed by those between 40-59 years (22 cases, 36.7%) followed by those >59 years (7 cases, 11.7%) and patients <19 years old (5 cases, 8.3%).

The present study revealed that there was no significant relation between the age of patients with SAH and patients' outcome, where higher mortality rate was reported in the age group 20-39 years old as it was 10 patients (38.4%) followed by those between 40-59 years old it was 9 patients (40.9%) followed by those older than 59 years old 4 patients (57%) and 19 years old and younger it was one patient (20%), whereas recovery according to GOS was reported in those older than 59 years old as the higher rate of recovery which is (14.2%) followed by the age group 40-59 years old (4.5%) then the age group 20-39 years old (3.8%) and those < 19 years old it was (0%) where no patient have been recovered.

The present study revealed that those in the age group 20-39 years old exhibit 10 patients (38.4%) died, 6 patients (23%) had become persistent vegetative, 6 (23%) patients had severe disability outcome, and 3 (11.5%) patients had moderate disability outcome and one patient (3.8%) was recovered, whereas those in the age group 40-59 years old exhibit 9 patients (40.9%) died, 2 (9%) patients had become persistent vegetative, 6 (27.2%) patients had severe disability outcome, and 4 (18%) patients had moderate disability outcome and one patients (4.5%) was recovered, whereas those in the age group >59 years old exhibit 4 patients (57%) died, one (14.2%) patients had become persistent vegetative, no patients had severe disability outcome, and one (14.2%) patients had moderate disability and one patients (14.2%) was recovered and those in the age group<19 years old exhibit one patient (20%) died, 3 (60%) patients had become persistent vegetative, no patients had severe disability outcome, and one (20%) patients had moderate disability outcome and no patients has been recovered.

Age as a risk factor for SAH was recorded by de Rooij NK et al (2007), who found that the risk continues to rise with age and is 60% higher in the very elderly (over 85 years old) than in those between 45 and 55 years old and by Feigin VL et al. (2005), who found that the group of people at risk for SAH is younger than the population usually affected by stroke, the risk still increases with age, young people are much less likely than middle aged people (risk ratio 0.1, or 10%) to suffer a subarachnoid hemorrhage.

The present study demonstrated that the mean age of the non survivors (40.93± 15.443 years old) was higher than the mean age of the survivors (37.00 ± 9.899 years old). The more advanced the age groups the higher the mortality rate due to the process of senility and decreased reserve function of most organs. Theses results were in concordance with those of the study of Thurman et al, who stated that the non survivors were significantly older than the survivors. Jacobs et al, had similar results with higher mean age of the non survivors than the survivors 52.0± 20.6 years and 49.7± 20.3 years respectively.

This study was carried out on 60 patients with SAH where 53 patients (88.3%) presented with traumatic SAH and 7 patients (11.7%) presented with spontaneous SAH.

The present work showed that there was no significant relation between type of SAH and the patient’s outcome.

The present study revealed that traumatic SAH was associated with less mortality rate than spontaneous SAH where patients with traumatic SAH had the following outcome, 21 patients (39.6%) have been died, 11 patients (20.7%) had become persistant vegetative, 11 patients (20.7%) had severe disability outcome, 7 patients (13.2%) had moderate disability outcome and 3 patients (5.7%) recovered, whereas 3 patients (42.8%) suffered from spontaneous SAH have been died, one patient (14.2%) had become persistant vegetative, one patient (14.2%) had severe disability outcome, two patients (28.4%) had moderate disability outcome and no patient was recovered.

This work was carried on 60 patients in which 21 patients (35.0%) were females and 39 patients (65.0%) were males.

The present work showed that there was no significant relation between sex and the patient’s outcome.

In this study 15 males (38.4%) have been died, 9 (23%) had become persistent vegetative, 9 (23%) had severe disability...
outcome, 5 (12.8%) had moderate disability outcome and 1 patient (2.5%) recovered, where 9 females (42.8%) have been died, 3 patients (14.2%) had become persistent vegetative, 3 patients (14.2%) had severe disability outcome, 4 patients (19%) had moderate disability outcome and 2 patients (9.5%) recovered.

In contrast to de Rooij NK et al 2007(59), who found that Risk of SAH is about 25% higher in women.

The present work was carried on 60 patients suffered from SAH where 8 patients (13.3%) were presented with Hunt &Hess Scale(H&H) ≤ 2 and 52 patients (86.7%) were presented with Hunt &Hess Scale ≤ 3, with no significant relationship between H&H scale on admission and the patients’ outcome as revealed by the GOS of patients after 14 days. However patients with H&H scale ≤ 2 on admission had a mortality rate 6 patients (75%), one patient (12.5%) had become persistent vegetative, one patient (12.5%) recovered and no patient had become with severe disability or moderate disability; patients with H&H scale ≤ 3 on admission had a mortality rate 18 patients (34.6%), 11 patients (21.1%) had become persistent vegetative, 12 patient (23%) had severe disability outcome, 9 patients (17.3%) had Moderate disability outcome and two patients (3.8%) recovered.

Nakagawa T, et al 2005, concluded that good and intermediate H&H scores (1, 2, and 3) on admission were associated with a favorable outcome, in their evaluation of the clinical factors to predict outcome in patients with a subarachnoid hemorrhage.

Although many methods of defining level of consciousness as indicator of brain damage exist, but the most widely used measure is The Glasgow Coma Scale (GCS) introduced by Teasdale and Jennett in 1974. (65) as it provides simple grading of the arousal and functional capacity of cerebral cortex in addition to predicting the outcome of the comatose patients. However, Jagger, (66) stated that the predictive power of the GCS is derived mainly from the motor score, which easily affected by several factors in the Intensive Care Unit (ICU) such as sedation and muscle relaxants.

The present study revealed that there was a no significant relation between the GCS on admission and patients’ outcome, where the patients presented with GCS <8 on admission were 18 (30%) patients who had a mortality rate 3 patients (16.7%), 5 patient (27.8%) had become persistent vegetative, 6 patient (33.3%) had severe disability outcome, 4 patients (22.2%) had moderate disability outcome and no patient (0%) was recovered, however, the patients presented with GCS 8-12 on admission were 42 (70%) patients who had a mortality rate 21 patients (50%), 7 patient (16.7%) had become persistent vegetative, 6 patient (14.2%) had severe disability outcome, 5 patients (12%) had moderate disability outcome and 3 patients (7.1%) were recovered.

Philip E, et al 2000, concluded that features that predict outcome in patients with subarachnoid hemorrhage (SAH) include densely packed intraventricular hemorrhage (IVH), hydrocephalus, and a Glasgow Coma Scale (GCS) score of less than 11 to 12 all predicting poor outcome.

This study was conducted on 60 patients presented with SAH, 38 patients were medically managed and 22 patients managed with surgical interventions. The all patients’ outcome after 14 days were assessed by GOS where the outcome of (3 patients, 5%) was good recovery, the outcome of (9 patients, 15%) was moderate disability. The outcome of (12 patients, 20%) was severe disability, while (12 patients, 20%) became vegetative and (24 patients, 40%) has been died.

References

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