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RESEARCH ARTICLE

PRIMARY SPONTANEOUS INTRACEREBRAL HAEMORRHAGE IN A TEACHING HOSPITAL IN JOHANNESBURG, SOUTH AFRICA: RADIOGRAPHIC PROFILE, MANAGEMENT AND OUTCOME

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ABSTRACT

Aim: To determine the radiological presentation, management and outcomes of patients with primary spontaneous intracerebral haemorrhage (PSICH) referred for neurosurgical management in Charlotte Maxeke Johannesburg Academic Hospital (CMJAH). ***Patients and Methods:*** This was a 6-month prospective study of 45 patients referred to the CMJAH Neurosurgical Unit with a Computed Tomography (CT) scan confirmed diagnosis of spontaneous intracerebral haemorrhage. Patients who met the inclusion criteria were then assessed for relevant data such as demographic, clinical and radiological data. Management offered and outcome were then assessed. ***Results:*** There were 13 (28.89%) female patients and 32 (71.11%) male patients. The mean age was 52 ± 11.44 yrs. Supratentorial bleeds accounted for 35 (77.78%) patients while 10 (22.22%) patients suffered infratentorial bleeds. The anatomical location of the haemorrhages was: putamen 23 (51.11%), cortical 6 (13.33%), Pontine 5 (11.11%), thalamus 6 (13.33%), cerebellum 5 (11.11%). Craniotomy was performed in 3 (6.67%) patients and 4 (8.89%) patients had EVD inserted. There was poor outcome in 35(77.78%) patients with 22 (48.89%) dead, 1 (2.22%) vegetative and 12 (26.67%) severely disabled. ***Conclusion:*** Our study has shown that PSICH presents a common clinical problem in our environment. It has a predilection for the putaminal area and carries a significant morbidity and mortality.

INTRODUCTION

Spontaneous intracerebral haemorrhage (SICH) affects more than a million people annually worldwide. It accounts for 10% – 25% of all strokes. SICH incidence ranges from 10 per 100 000 to 30 per 100 000. In terms of outcome, SICH causes a higher level of morbidity and mortality as compared to ischaemic stroke (Amenta, 2017; Qureshi, 2001; Dastur, 2017). SICH mortality varies between 20 – 50%. Some studies report mortality rate of up to 70% ((Atadzhanov, 2012; Damasceno *et al*., 2010; Deresse, 2015). The highest number of SICH cases and mortality is in Sub-Saharan Africa and Asia (Krishnamurthi *et al*., 2014). Radiological investigations are the mainstay of diagnosis of SICH. Various radiological modalities such as CT, MRI and DSA can be used to ultimately make the diagnosis of SICH. CT and MRI help to locate the anatomical location of the bleed. The most frequent locations are the basal ganglia, thalamus, lobar, pons and cerebellum (Amenta, 2017; Dastur, 2017; Hsieh, 2008). CT and MRI can also help to assess complications of the bleed such as mass effect, midline shift and features of raised ICP. Angiography either by CT or DSA can help in excluding other secondary causes of the ICH and thus establishing the diagnosis of SICH. Management of SICH is primarily medical unless there is a sequalae that would benefit from surgical intervention such as massive haemorrhage, haemorrhage with intraventricular extension, and hydrocephalus. Two major studies have looked at the role of surgery in SICH, the STICH I (Surgical Trial in Intracerebral Haemorrhage) (2005) and STICH II (Surgical Trial in Lobar Intracerebral Haemorrhage) (Amenta, 2017; Qureshi, 2001; Dastur, 2017; Hsieh, 2008). In the STICH I, there was no difference between medical and surgical treatment but subset analysis showed there might be a benefit in operating patients with superficial lobar haematoma (Mendelow *et al*., 2005; Mendelow *et al*., 2013). STICH II looked at this subset of patients who had superficial lobar haematomas. There was no difference in the two treatment arms (Mendelow *et al*., 2005). Two meta-analyses of randomized controlled trials comparing craniotomy to medical treatment showed a modest benefit with surgery (Mendelow *et al*., 2013). Very few studies have been conducted in Sub Saharan Africa looking at SICH. Due to this we decided to conduct a prospective hospital-based study looking at all aspects of SICH in our patient population.

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PATIENTS AND METHODS

We conducted a prospective descriptive study over a period of 6 month. The study was approved by the University of the Witwatersrand Human Research Ethics committee. The study was conducted at CMJAH, a tertiary level academic hospital in Johannesburg. It serves the northern part of Johannesburg. Our study included all patients who were referred to the neurosurgical unit at CMJAH with a CT scan confirmed diagnosis of ICH. Secondary causes of ICH were excluded by; CTA, MRI or in certain instances DSA. The cases were referred from emergency units of CMJAH or surrounding hospital, medical and neurology wards. All consecutive patients during the study period were added. Exclusion criteria included; history of trauma, secondary causes of ICH identified on other imaging modalities and bleeding dyscrasias. Hematoma volume was calculated using the A*B*C/2 method (Broderick *et al*., 1993). A structured questionnaire was used to capture clinical and radiological details of the participants in the study. Radiological and clinical data were captured and analysed. The data was analysed, with a statistician, by the use of computer aided statistical analysis of the variables. The data was entered into an Excel spreadsheet and then exported to the Stata (Version 15) Statistical Software. Categorical variables such as gender were described as frequency, percentages or charts. While nominally distributed continuous variables such as age were reported as mean ± standard deviation but non-nominally distributed variables were presented as median (interquartile range). Outcomes were measured at 30 days using Glasgow Outcome Score (GOS). Good outcome was defined as GOS of 4 and 5 while poor outcome was defined as GOS of 1 to 3.

RESULTS

Location: Thirty-five (77.78%) patients suffered supratentorial bleeds while 10 (22.22%) patients suffered infratentorial bleeds (see Table 1). The anatomical location of the bleeds was: putamen 23 (51.11%), cortical 6 (13.33%), Pontine 5 (11.11%), thalamus 6 (13.33%), cerebellum 5 (11.11%).

Table 1 Anatomical location of haemorrhage

Variable	Location	Frequency	Percent (%)
Compartment	Supratentorial	35	77.78
	Infratentorial	10	22.22
Specific location	Putamen	23	51.11
	Thalamus	6	13.33
	Cortical	6	13.33
	Cerebellum	5	11.11
	Pontine	5	11.11

Other Scan Characteristics: Thirty-seven (82.22%) patients (see Table 2) had bleeds less than 30ml while 8 (17.78%) had bleeds more than 30ml. The mean size was 26.51ml ± 24.35ml. The range was 2ml – 100ml. The median was 20ml. Mass effect was present in 28 cases (62.22%). Intraventricular haemorrhage was present in 25 cases (55.56%). Hydrocephalus was present in 17 cases (37.78%).

Table 2. CT Scan findings

Variable	Characteristics	Frequency	Percent **(%)**
Size of ICH			
	<30ml	37	82.22
	>30ml	8	17.78
Intraventricular Haemorrhage			
	Yes	25	55.56
	No	20	44.44
Mass Effect			
	Yes	28	62.22
	No	17	37.78
Hydrocephalus			
	No	28	62.22
	Yes	17	37.78

Management Decisions: The neurosurgical management decisions for the 45 patients is as shown in Table 3. Thirty-nine (86.67%) patients were managed conservatively, while 3 (6.67%) patients underwent craniotomy and 4 (8.89%) patients had EVD inserted. One patient had an EVD inserted and then underwent a formal craniotomy.

Table 3. Management decisions

Variable	Characteristics	Frequency	Percent **(%)**
Craniotomy			
	No	42	93.33
	Yes	3	6.67
EVD			
	No	41	91.11
	Yes	4	8.89
Best Medical Therapy			
	Yes	39	86.67
	No	6	13.33

Outcomes: Twenty-two (48.89%) patients (see Table 4) died, while other outcomes were 1 (2.22%) patient for persistent vegetative state, 12 (26.67%) patients for severe disability, 6 (13.33%) patients for moderate disability and 4 (8.89%) had good recovery. In terms of good or poor outcomes 35 (77.78%) patients had poor outcomes while 10 (22.22%) had good outcomes.

Table 4. Outcomes based on Glasgow Outcome Score

Variable	Characteristics	Frequency	Percent **(%)**
GOS			
	Dead	22	48.89
	Vegetative	1	2.22
	Severe disability	12	26.67
	Moderate disability	6	13.33
	Good recovery	4	8.89
Outcome			
	Poor outcome	35	77.78
	Good outcome	10	22.22

A cross tabulation of GOS and ICH Score is as shown in table 5. Out of the 11 patients with an ICH Score of 0, a total of 4 patients had poor outcome including 1 death, while a total of 7 patients had good outcome (4 moderate disability, 3 good recovery). From the cohort of 12 patients with ICH Score of 1, 9 patients had poor outcome including 4 deaths, while 3 patients had good outcome. All 8 patients with ICH Score of 3 had poor outcome (5 dead, 3 severe disability), and all 6 patients with ICH Score of 3 also had poor outcome (4 dead, 1 vegetative, 1 severe disability). The 8 patients with ICH Score of 4 all demised. No patients had ICH Score of 5 or 6.

Table 5. Cross Tabulation of GOS and ICH Score

GOS	ICH Score					
	0	**1**	**2**	**3**	**4**	**Total**
Dead	1	4	5	4	8	22
Vegetative	0	0	0	1	0	1
Severe disability	3	5	3	1	0	12
Moderate disability	4	2	0	0	0	6
Good recovery	3	1	0	0	0	4
Total	11	12	8	6	8	45

DISCUSSION

Location: Haematoma location was supratentorial in 77.78% of the cases and infratentorial in the remainder 22.22%. This compares with the study by Soto *et al* who reported supratentorial location of haemorrhages in 81.5% of the time with infratentorial accounting for 18.5% (Soto, 2014).

Also, Adeleye *et al* reported supratentorial location in 90.5% of the cases (Adeleye, 2015). The commonest location in our study was putamen (51.11%) followed by thalamus and cortical each with 13.33% and lastly cerebellum and pontine both with 11.11% each. These findings are comparable to other studies. Adeleye *et al* reported basal ganglia location as commonest site followed by lobar location (Adeleye, 2015). In Soto *et al*'s study, basal ganglia was the most frequent site followed by lobar, thalamus, cerebellum and pons (Soto, 2014). An Ethiopian study by Deresse and Shaweno reported basal ganglia location as the most common site accounting for 38% of the bleeds, followed by thalamic (29.6%), lobar (18.3%), pons (5.6%), midbrain (4.2%), cerebellum (2.8%), IVH (1.4%) (Deresse, 2015). The Texas community study by Zahuranec *et al* indicated that deep cerebral location was the most common location (55%) followed by lobar, brainstem, cerebellum and multifocal (Zahuranec *et al*., 2006). Erkabu reported that basal ganglia was the most common location (50.4%) followed by multiple location (25%), lobar (20.3%) and brainstem (1.6%) (Getachew Erkabu, 2018). Sia *et al* reported basal ganglia/thalamus as most common location. This was followed by lobar, brainstem and cerebellum (Sia, 2007). However, in contrast to our findings, Nkusi *et al* reported lobar location as the most common location (38.2%), followed by basal ganglia (29.1%), thalamic (27.2%) and pontine (5.4%) (Nkusi *et al*., 2017).

Other Scan Characteristics: The other characteristics from the CT scan findings were also consistent with other studies reported. Our findings showed that 82.22% of patients had haematoma volume less than 30ml. 55.56% had IVH. Mass effect was documented in 62.22%. Hydrocephalus was present in 37.78%. Adeleye *et al* reported mass effect in 78.3% of the cases and IVH in 65.1% of the cases, the median volume of the bleed was 28ml (Adeleye, 2015). Our median volume was 20ml. These results from Nigerian study are very similar to ours. Soto *et al* reported IVH in 52.6% of the cases (Soto, 2019). Nkusi *et al*, in Rwanda reported IVH rate of 46% (Nkusi *et al*., 2017). These rates of IVH are also consistent with our findings.

Management decisions: Management options for ICH include craniotomy, minimal invasive techniques, external ventricular drains and conservative management. There are no standardised guidelines for the surgical management of ICH and most units have their own independent decision-making process. We passively analysed our decision-making process. We found that 6.67% of patients underwent craniotomy and 8.89% had EVD inserted while 86.67% were managed by utilizing best medical therapy. It is very difficult to critique any of the decisions as all units make decisions based on their own local patient profile. Due to this there is wide variability in terms of management decision-making across most of the studies. Adeleye *et al* in Ibadan, Nigeria reported that 36.5% of the patients had operative management. This was mostly craniotomies and few EVD placements (Adeleye, 2015). A Chilean study reported 3.1% craniotomy rate and 2.1% EVD rate (Soto *et al*., 2014). A Swedish study looking at all neurosurgical centres in Sweden showed that 5% of patients with ICH underwent surgical intervention. There was a similar incidence of surgical intervention across all the neurosurgical centres in Sweden (Fahlström *et al*., 2019). This makes our findings consistent with this nationwide Swedish study.

Outcomes: ICH carries a high level of morbidity and mortality especially when compared to ischaemic stroke. Mortality ranges from 20-30% in high income countries to 70% in low-income countries (Amenta, 2017). Most of the studies report on mortality as an outcome. In our study we have included GOS category 1-3 and reported it as poor outcome. Based on this we have established that 77.78% had poor outcomes. The overall mortality rate was 48.89% while 2.2% were in a vegetative state and 26.67% were severely disabled. Our mortality rate compares with Hemphill *et al*, in the USA and also Sia *et al*, done in Malaysia. Hemphill and Sia reported mortality rates of 45% and 43.9% respectively (Sia, 2007; Hemphill, 2001). A study done in Hong Kong reported a mortality rate of 22% (Cheung, 2003). This is significantly lower than our findings. This is probably related to the high-income status of Hong Kong. A study conducted in India reported a 35.5% bad outcome (Goswami, 2016). The Zambian study reported a 71.6% poor outcome with 53.4% dead while 2.3% were in vegetative state and 15.9% had severe disability (Atadzhanov, 2012). The Mozambican study reported a 28-day mortality rate of 72% (Damasceno *et al*., 2010). The Ethiopian study reported 67.9% poor outcome with 23.5% dead and 44.4% severely disabled (Deresse, 2015). A Senegalese study reported a 56% mortality (Sagui, 2005). A Rwandan study showed a mortality rate of 55.6% at 1 year follow up with in-hospital mortality reported as 19.4% (Nkusi *et al*., 2017). The Swedish multicentre study reported a mortality rate of 10 – 28% (Fahlström *et al*., 2019). Cross tabulation of GOS and ICH Score in our study showed that our patients were demising with even lower scores for ICH Score. In Hemphill study there was no mortality for ICH Score of 0. Our study had a 9.09% mortality for ICH Score of 0. We had a mortality rate of 33%, 62.5%, 66%, and 100% for ICH Score of 1 – 4 respectively. We did not have participants with higher scores. Hemphill had a mortality rate of 13%, 26%, 72%, 97% and 100% for ICH Score of 1 – 6 with both 5 and 6 having 100% mortality (Hemphill, 2001). These findings can be attributed perhaps to the difference in our demographics as our patients are younger. Another possibility is poor emergency response to the initial ICH which converts potentially salvageable patients into patients that cannot be saved. This shows that the ICH Score in our setting would not be an adequate predictor of outcome especially at its lower end.

CONCLUSION

The most common site of haematoma location was putamen. The overwhelming majority of our study participants were managed medically. A small number underwent surgical intervention with either craniotomy or EVD. These interventions had no impact on eventual outcome. The outcome of the study participants was dominated by poor outcome. Almost half of the patients died with a further 20% being severely disabled. This confirms the high rate of mortality of ICH especially in a developing world setting such as ours. Although most developed world studies quote lower poor outcome figures, studies from developing world and especially Sub-Saharan Africa report similar results as ours.

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