Neurosurgical management of spontaneous intracerebral haematoma in a resource-limited setting: profile and challenges

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Abstract

Background: Spontaneous inracerebral haematoma (SICH) is the most devastating type of stroke and challenges of its care in resource-limited settings may worsen its gloomy outlook. There is a need to provide neurosurgical data for SICH in resource-limited settings. This study provides information about SICH in such a setting.
Method: We conducted a retrospective review of patients who had neurosurgery for SICH at the UNIOSUN Teaching Hospital, Osogbo, Nigeria over an eleven year period (October 2011 to June 2022). Demographics, clinical presentations, operative procedures and outcomes/challenges of care were reviewed. Descriptive and inferential data analyses were performed.
Results: Sixteen patients had neurosurgical procedures for SICH but only 15 had complete data. Males were 13/15(86.7%) and most (66.7%) had admission GCS ≤8. The mean age was 58.8years (range: 34-80). Most of the patients were elderly (53.3%). Systemic hypertension was the cause in 14(93.3%). There was right-sided and lobar predominance (60.0% and 46.7% respectively) and most (80.0%) had intraventricular extension. The commonest procedure was external ventricular drainage (86.7%) with or without craniotomy (20.0%) / burr hole (13.3%) for haematoma evacuation. Twelve (80.0%) of the patients died. Predictors of poor outcome were low admission GCS, brainstem dysfunction, aspiration/chest infection, seizures and long ictus-to-operation time. Identified challenges of care included delay in presentation, delay in getting CT, difficulty with blood pressure control, lack of hospital facilities and tortuous referral pathway.
Conclusion : The high mortality of SICH and its gloomy outlook may be improved upon by tackling the various identified challenges surrounding its care .

Prise en charge neurochirurgicale de l'hématome intracérébral spontané dans un contexte à ressources limitées : profil et défis

Résumé
Contexte de l'étude *:* L'hématome inracérébral spontané (SICH) est le type des accidents vasculaires cérébraux et les difficultés liées à leur prise en charge dans des contextes aux ressources limitées pourraient aggraver ses sombres perspectives. Il est nécessaire de fournir des données neurochirurgicales pour le SICH dans les contextes à ressources limitées. Cette étude fournit des informations sur le SICH dans un tel contexte.
Méthode de l'étude : Nous avons mené une revue rétrospective de patients ayant subi une neurochirurgie pour SICH à l'hôpital universitaire UNIOSUN, Osogbo, Nigéria sur une période de onze ans (octobre 2011 à juin 2022). Les données démographiques, les présentations cliniques, les procédures opératoires et les résultats/défis des soins ont été examinés. Des analyses de données descriptives et inférentielles ont été effectuées.
Résultat de l'étude: Seize (16) patients ont subi des interventions neurochirurgicales pour SICH, mais seulement 15 disposaient de données complètes. Les hommes étaient 13/15 (86,7 %) et la plupart (66,7 %) avaient un GCS≤8 à l'admission. L'âge moyen était de 58,8 ans (extrêmes : 34-80). La plupart des patients étaient des personnes âgées (53,3 %). L'hypertension systémique était en cause chez 14 d'entre eux (93,3 %). Il y avait une prédominance du côté droit et lobaire (60,0 % et 46,7 % respectivement) et la plupart (80,0 %) avaient une extension intraventriculaire. L'intervention la plus courante était le drainage ventriculaire externe (86,7 %) avec ou sans craniotomie (20,0 %) / trou de fraise (13,3 %) pour l'évacuation des hématomes. Douze (80,0 %) des patients sont décédés. Les prédicteurs de mauvais résultats étaient un faible GCS à l'admission, un dysfonctionnement du tronc cérébral, une aspiration/infection pulmonaire, des convulsions et un long temps d'intervention avant l'opération. Les défis identifiés en matière de soins comprenaient un retard dans la présentation, un retard dans l'obtention d'un scanner, des difficultés de contrôle de la tension artérielle, le manque d'installations hospitalières et un parcours de référence tortueux.
Conclusion: La mortalité élevée du SICH et ses sombres perspectives peuvent être améliorées en s'attaquant aux différents défis identifiés entourant sa prise en charge.

INTRODUCTION

Cerebrovascular disease (CVD) or stroke is a devastating disease that affects mostly adults. It is the second leading cause of death worldwide (1). It is broadly classified into ischaemic or haemorrhagic strokes, the former being commoner, accounting for 70-80% of all strokes (2). Haemorrhagic strokes, though less common, are more devastating and contribute a much larger portion of the morbidity and mortality of strokes (3). The spontaneous bleeding in haemorrhagic strokes may be into the brain parenchymal itself (cerebrum, brainstem or cerebellum) known as Spontaneous Intracerebral Haematoma (SICH), or into the subarachnoid space containing cerebrospinal fluid, known as subarachnoid haemorrhage (SAH) (4).

Although SICH is mostly managed non-operatively, early surgical intervention in qualified candidates help to preserve the nervous system, reduce intracranial pressure and gives favourable survival outcomes (5-8). Surgical options include craniotomy for clot evacuation, minimally invasive procedures (endoscopy and burr hole for clot evacuation) and diversion of cerebrovascular fluid via an external ventricular drainage (3).

The stroke burden is much higher in low and middle income countries (LMIC) and these developing countries also have a much worse morbidity and mortality rates (9-13). The gloomy outlook of stroke and its management in the developing countries are due largely to delay in presentation, inadequacy of appropriate workforce and poor access to critical care (10,14-16). As might be expected, these determinants and the consequent outcomes of strokes are worse the more the resource-limitations. There is paucity of data on neurosurgery for SICH in resource-limited settings. As the most devastating type of stroke, challenges of SICH care in resource-limited settings may worsen its gloomy outlook. This study provides information about SICH in such a setting.

METHOD

Study Design and Setting

We performed a retrospective review of patients who had neurosurgical care for SICH at the UniOsun Teaching Hospital, Osogbo, Nigeria from October 2011 to June 2022. The hospital is government-owned and run and receives patients mainly from Osun State and parts of the neighbouring Oyo, Ondo, Ekiti and Kwara States of Nigeria. The hospital has an attending neurosurgeon (lead author) and two neurologists. Sometimes these personnel were not available, either individually or together as a result of relocation or official leave. At such periods, the care of stroke patients is handled by other internal medicine specialists (who also handle the initial care in most of the patients before transferring them to the neurology unit) and those needing surgery were referred to other centres. The hospital had a CT scan but it worked for only about half of the study period. During its down periods, patients for CT scans were sent to any of the two private centres in the town or when those were faulty/before their installations, to other cities or states which are in the range of 60-100 kilometers away. There is no dedicated stroke unit. Patients admitted via the emergency unit are managed initially on the medical wards and then moved to the intensive care unit (ICU) if necessary. Some are admitted to the ICU directly from the emergency unit. The ICU is a four-bedded unit with 2-3 ventilators that work on and off and depended largely on unreliable energy supply from the national grid.

General Management

Stroke patients had volume support with isotonic saline, parenteral anti-hypertensives for blood pressure optimization, and 30-degree head up positioning to optimize cerebral blood supply. Control of cerebral oedema was done with mannitol. Anticonvulsants were administered in those with seizures. Patients with GCS$\leq$ 8 and those with respiratory difficulties from aspiration pneumonitis and/or chest infection were placed on mechanical ventilation. Mechanical prophylaxis for deep venous thrombosis was done using thrombo-embolic (TED) stockings and limb physiotherapy.

Surgical Procedures: Surgeries for SICH were performed as indicated. Large haematomas with severe pressure effects and associated raised intracranial pressure (ICP) were managed by craniotomy with clot evacuation under general anaesthesia or burr hole (BH) craniostomy under either local or general anaesthesia (LA or GA). These were done in the operating room (OR). SICH with intraventricular haemorhage and/or obstructive hydrocephalus was managed with external ventricular drainage (EVD) alone or in combination with intra-parenchymal clot evacuation. EVDs were performed under LA by the bedside on the wards, ICU or the OR via standard frontal access.

Data Collection

We kept a prospective database of neurosurgical patients. This and the neurosurgery operation register were used to identify the surgically treated cases of SICH. Their case files were then retrieved from the hospital's records unit for additional details. We retrieved data on demographics, clinical presentations, radiological and laboratory investigations, operative procedures and outcomes. Information on the challenges of care was also retrieved. Patients' stratification was done using the admission Glasgow Coma Score (GCS) while the outcome at discharge or death was assessed with the Glascow Outcome Score (GOS). GOS of 4 and 5 were considered favourable.

Data Analysis

We performed simple descriptive and inferential analysis using SPSS version 26 (IBM Corp. 2019). A p-value of <0.05 was considered statistically significant.

RESULTS

Demographics

Sixteen patients had neurosurgery for SICH but complete data were available for only 15 of them. Of these, males were 13/15(86.7%) and females 2/13(13.3%) with male to female ratio of 6.5:1. The mean age was 58.8years (Range: 34-80). Most of the patients were elderly 53.3%. (Table 1)

Aetiology

Systemic hypertension was the identified cause in 14(93.3%) of the cases. Of these, 2 (14.3%) were previously undiagnosed, and 8(57.1%) had poor drug compliance. The cause was unknown in 1(6.7%) of the cases. One of the patients had a repeat stroke eight years after an earlier (first) stroke. One patient (each) had concomitant diabetes mellitus and chronic kidney disease.

Admission Characteristics

The mean admission GCS was 8 (range 3-15). Most of the patients (10, 66.7%) presented with a GCS of $\leq$8. There was a preceding history of headache in 11(73.3%) while 5(33.3%) had associated seizures. The duration of ictus to presentation ranged from 30minutes to 15 days. The range of blood pressure (BP) was 80-220/52-150mmHg and elevated BP was recorded in 13(86.7%) cases. The observed lateralizing signs were: hemiparesis (6, 40.0%), quadriparesis (5, 33.3%), facioparesis (5, 33.3%) and anisocoria (2, 13.3%). The pupils were mostly sluggish or unreactive to light (13, 86.7%). Ten (66.7%) cases presented with brainstem dysfunction and 6(40.0%) had aspiration pneumonitis. (Table 2)

Radiological Investigations and Findings

Computerized Tomographic (CT) scans were done in 14 patients while 1 patient had Magnetic Resonance Imaging (MRI). The average ictus to neuro-imaging time was 84.5Hrs (Range: 4 -360Hrs). The ICH was located on the right in 9(60.0%) and was considered huge/extensive in 10(66.7). It was located in the frontal, parietal and occipital lobes in 1(6.7%), 5(33.3%) and 1(6.7%) respectively. Other locations were the basal ganglia (1, 6.7%), thalamus (6, 40.0%) and cerebellum (1, 6.7%). Intraventricular extension/heamorrhage (IVH) was found in 12(80.0%) of the patients. Other imaging findings were brain swelling (8, 53.3%) and subdural extension of the ICH (1, 6.7%) (Table 3). Examples of neuroimaging findings are shown in figure 1.

Surgical Procedures: The average CT to operation time was 31hours (Range: 4-96hours). The procedures performed were:

i. External ventricular drainage (EVD): 7(46.7%)
ii. Craniotomy + EVD: 3 (20.0%)
iii. Burr Hole clot evacuation: 2(13.3%)
iv. Burr Hole clot evacuation + EVD: 2(13.3%)
v. Craniotomy + clot evacuation: 1(6.7%)

Outcomes

The mortality rate was 80.0% (12/15). One patient had severe disability (GOS 3) and 2(13.3%) had moderate disability (GOS 4) at discharge. (Figure 2) Various factors were analysed for association with clinical outcomes and presented in Table 4. Absent or sluggish pupillary reaction to light and the presence of brainstem dysfunction were found to be significant in predicting mortality (p-values of 0.002 and 0.024 respectively).

Challenges of Care

The challenges faced in the care of the patients are classified into social/family, referral pathways, hospital administration and clinical (Table 5).

Follow up

Only one of the three discharged patients attended the outpatient clinic. The duration of follow up was 18 months. He had seizures and residual deficits (aphasia, facioparesis and

hemiparesis) which improved progressively.

DISCUSSION

This study showed that SICH needing neurosurgical intervention is commoner in males with systemic hypertension being the predominant aetiology. The poor admission parameters, delays in getting CT scans, tortuous referral pathways, financial and family/social constraints as well as limited resources in the hospital contributed to the high mortality rate in a primarily devastating disease.

In this series from a resource-limited setting, the brunt of SICH is borne largely by those in the 6th and 7th decades of life. The generally poor clinical states of the patients evidenced by poor admission GCS and the presence of brainstem dysfunction, high average ictus to CT scans time and subsequent high CT to operation time occasioned by lack of funds, delay in consenting for surgery and logistic problems in the hospital called attention to the myriads of challenges faced in the management of SICH in settings such as ours.

Despite the fact that stroke, like other non-communicable diseases, is a leading cause of death and disability in the sub-Saharan Africa (SSA) (17,18), the healthcare programmes in this region are largely focused on infections with largely inadequate stroke-treatment programmes (17,19). These and several other factors are contributory to the reported high case-fatality ratio of stroke and especially SICH in the SSA (20-23). Specifically, Tobi et al reported a mortality rate of 78% in stroke patients admitted to the ICU which is similar to the 80% in our current series of critical stroke patients (23).

The anatomical distribution of SICH is this study is largely similar to that reported by Adeleye et al from a neighbouring centre (13). However, in terms of laterality, right side predominated in contrast to their report (60% versus 48%) with no bilateral lesion.

The reported predictors of stroke mortality in SSA include low admission GCS, severity of stroke, lung infection, presence of hypertension at admission, previous stroke and older age (24-31). Heamorrhagic stroke on its own has been reported to be a significant cause of death despite the fact that ischaemic stroke is commoner (32). Also, ventricular involvement, which was present in a majority of our cohort (80%) has been noted to be a strong predictor of mortality as high as 83% (33).

In this study, GCS 3-8, presence of seizures, poor or no pupillary reaction to light, presence of brainstem dysfunction at admission, aspiration pneumonitis/chest infection, large haematoma size, severe effacement of the basal cisterns and long ictus to operation time were determinants of mortality in operatively managed SICH. However, only brainstem dysfunction and poor or no pupillary reaction to light were of statistical significance.

To our knowledge, this is the first study to identify the social, administrative and clinical challenges militating against optimal operative care of SICH in resource-limited settings. Nonetheless, a major limitation of this study is the low number of operated cases which may be the reason most of the possible determinants of case fatality did not demonstrate statistical significance.

While the philosophical tenet "*time is brain*" is generally accepted in stroke care (34), time to surgery is particularly important to optimize outcomes of SICH (8,33). Of importance is the proposal by Ojo and Onyia (35) to move to early surgical intervention in intracranial haematomas as the resources and personnel needed for proper conservative management are inadequate in LMIC. The establishment of a dedicated stroke unit in addition to the strengthening of the healthcare systems to confront the multitude of challenges identified in this study may help to improve the gloomy outlook of SICH. In earlier publications, we have called attention to the need to improve healthcare researches and strengthen the healthcare systems in developing countries, especially SSA in order to reduce the burden of diseases facing the nations (36, 37).

CONCLUSION

The high mortality of SICH and its gloomy outlook in resource-limited settings may be improved upon by tackling the various challenges surrounding its care. This may be achieved through the establishment of a stroke unit and strengthening of the health care systems.

Conflict of interest: None

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Table 1: Demographics

	Number (n)	Percentage (%)
Sex Distribution		
Male	13	86.7
Female	2	13.3
Age Distribution (Years)		
30-40	3	20.0
41-50	0	0.0
51-60	4	26.7
61-70	6	40.0
70-80	2	13.3

Table 2: Admission Characteristics

	Number (n)	Percentage (%)
Admission GCS		
3-8	10	66.7
9-12	2	13.3
13-15	3	20.0
Preceeding headache	11	73.3
Seizures	5	33.3
Ictus to Presentation		
≤4Hrs	6	40.0
>4Hrs – 8Hrs	2	13.3
>8Hrs – 24Hrs	1	6.7
>24Hrs – 72Hrs	2	13.3
>3 days -7 days	2	13.3
>7days – 14days	2	13.3
Systolic Blood Pressure (mmHg)		
≤140	3	20.0
141-160	1	6.7
161 – 200	5	33.3
>200	6	40.0
Diastolic Blood Pressure (mmHg)		
≤90	4	26.6
91-120	7	46.7
>120	4	26.6
Lateralizing Signs		
Hemiparesis	6	40.0
Quadriparesis	5	33.3
Facioparesis	5	33.3
Anisocoria	2	13.3
Pupillary Reaction		
None	5	33.3
Sluggish	8	53.3
Brisk	2	13.3
Brainstem Dysfunction	10	66.7
Aspiration Pneumonitis	6	40.0
Chest Infection	6	40.0

Table 3: Imaging Findings

	Number (n)	Percentage (%)
Ictus to CT/MRI Time (Hrs)		
≤4	1	6.7
>4-8	2	13.3
>8-24	5	33.3
>24-72	3	20.0
>72-168	1	6.7
>168	3	20.0
SICH Side		
Right	9	60.0
Left	6	40.0
Bilateral	0	0.0
SICH Size		
Small	1	6.7
Moderate	4	26.6
Huge	10	66.7
SICH Location		
Lobar	7	46.7
Frontal	(1)	(14.3)
Parietal	(5)	(71.4)
Occipital	(1)	(14.3)
Basal Ganglia	1	6.7
Thalamus	6	40.0
Cerebellum	1	6.7
IVH	12	80.0
1 lateral	(1)	(8.3)
2 lateral	(2)	(16.6)
1 lateral & 3rd	(1)	(8.3)
All	(8)	(66.8)
Massive	(3)	(24.9)
Obstructive Hydrocephalus	2	13.3
Midline Shift	6	40.0
Ventricular effacement	8	53.3
Brain Swelling	8	53.3
Subdural extension of ICH	1	6.7

Table 4: Analyses for significant associations

	GOS 1	GOS2	GOS3	GOS4	GOS5	P-Value
GCS						
GCS 3-8	9	0	1	0	0	0.494
GCS 9-12	2	0	0	1	0	
GCS 13-15	1	0	0	1	0	
Seizures						
Yes	4	0	1	0	0	0.223
No	8	0	0	2	0	
Pupillary Reaction						
None	4	0	1	0	0	0.002*
Sluggish	8	0	0	0	0	
Brisk	0	0	0	2	0	
Brainstem Dysfunction						
Yes	10	0	0	0	0	0.024*
No	2	0	1	2	0	
Aspiration Pneumonitis/Chest Infection						
Yes	8	0	1	0	0	0.229
No	4	0	0	2	0	
Haematoma Location						
Thalamus	6	0	0	0	0	0.638
Basal Ganglia	1	0	0	0	0	
Lobar	4	0	1	2	0	
Cerebellum	1	0	0	0	0	
Haematoma Size						
Small	1	0	0	0	0	0.432
Moderate	3	0	1	0	0	
Huge	8	0	0	2	0	
Effacement of Basal Cisterns						
Mild	2	0	0	0	0	0.260
Moderate	3	0	0	2	0	
Severe	7	0	1	0	0	
Ictus to Operation Time						
<24Hrs	2	0	0	0	0	0.363
>24Hrs-72Hrs	4	0	1	1	0	
>72Hrs	6	0	0	1	0	

*Statistically significant

Table 4: Analyses for significant associations

	GOS 1	GOS2	GOS3	GOS4	GOS5	P-Value
GCS						
GCS 3-8	9	0	1	0	0	0.494
GCS 9-12	2	0	0	1	0	
GCS 13-15	1	0	0	1	0	
Seizures						
Yes	4	0	1	0	0	0.223
No	8	0	0	2	0	
Pupillary Reaction						
None	4	0	1	0	0	0.002*
Sluggish	8	0	0	0	0	
Brisk	0	0	0	2	0	
Brainstem Dysfunction						
Yes	10	0	0	0	0	0.024*
No	2	0	1	2	0	
Aspiration Pneumonitis/Chest Infection						
Yes	8	0	1	0	0	0.229
No	4	0	0	2	0	
Haematoma Location						
Thalamus	6	0	0	0	0	0.638
Basal Ganglia	1	0	0	0	0	
Lobar	4	0	1	2	0	
Cerebellum	1	0	0	0	0	
Haematoma Size						
Small	1	0	0	0	0	0.432
Moderate	3	0	1	0	0	
Huge	8	0	0	2	0	
Effacement of Basal Cisterns						
Mild	2	0	0	0	0	0.260
Moderate	3	0	0	2	0	
Severe	7	0	1	0	0	
Ictus to Operation Time						
<24Hrs	2	0	0	0	0	0.363
>24Hrs-72Hrs	4	0	1	1	0	
>72Hrs	6	0	0	1	0	

*Statistically significant

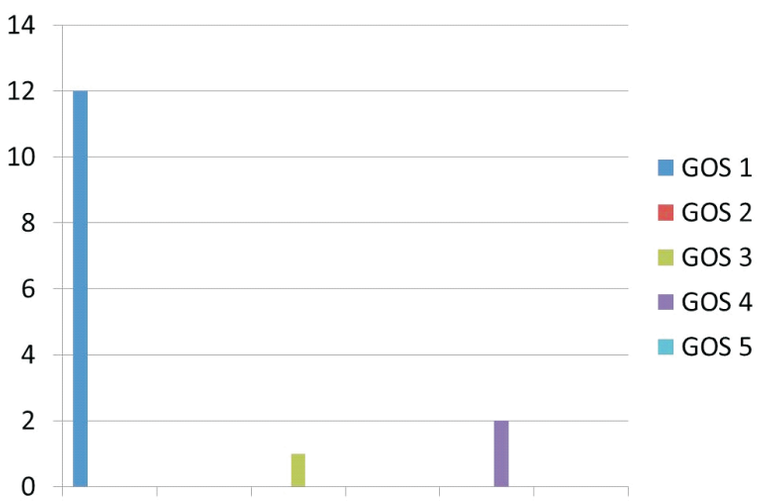

Figure 1: Clinical Outcomes

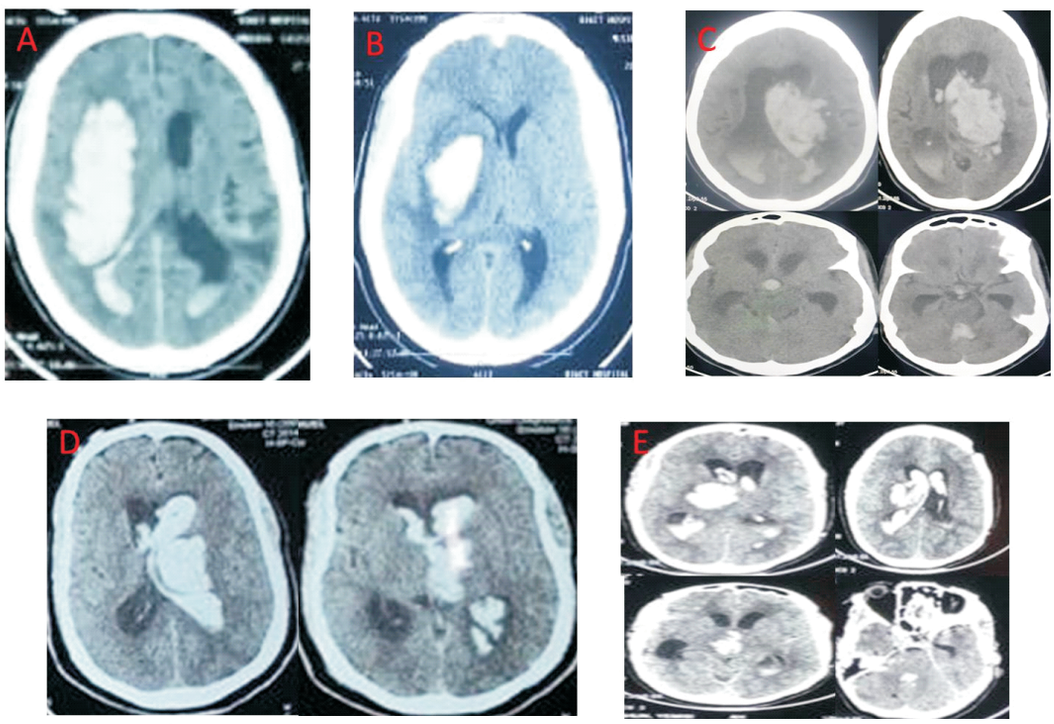

Figure 2: Examples of CT findings and appearances {A. 65yoM-Right-sided lobar haematoma with bilateral IVH; B.41yo M- Deep right-sided lobar haematoma with pressure effects; C. 50yoF – Left thalamic haematoma with IVH (all ventricles) and obstructive hydrocephalus; D. 50yoM – Left thalamic haematoma with bilateral IVH; E. 48yoF – Right basal ganglia haematoma with IVH (all ventricles)}

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