
Original Article

Intracerebral hemorrhage: epidemiology and surgical options from a tertiary care hospital in Eastern Nepal

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Abstract

Background

Intracerebral hemorrhage accounts for 10 to 20% of strokes. Based on the precise site and size of the hematoma, ICH can manifest a range of clinical and radiological deficits. The role of surgical removal of hematoma has by far been controversial, and despite large clinical trials, the efficacy of surgery remains controversial. In this paper, we described our experience of ICH and its epidemiology along with the outcomes of patients undergoing surgical removal of hematoma secondary to ICH.

Patient and Methods

A retrospective observational study was conducted from April to September 2018 in a tertiary care center in Nepal. 102 patients undergoing surgery using trans-cortical, trans-sylvian or endoscopic approaches were included, and their outcomes were assessed using a 5-point GOS at a 6-weeks follow-up.

Results

A total of 102 patients were included in the study. Out of these, 54 were males (mean age: 54.7), and 48 females (mean age: 56.13). Smoking was common in 42.2% of patients and alcohol intake (15.7%). The site of hematoma was 55.9% basal ganglia bleed and 44.1% hemorrhages of the frontal, occipital, parietal and temporal lobes collectively. Surgical outcomes at a 6-weeks follow up included a mortality of 11.8% (n = 12), 27.5% (n = 28) with moderate disability, and 60.8% (n = 62) with good recovery.

Conclusion

The etiology of ICH is attributed to a spectrum of modifiable and non-modifiable risk factors. Treatment strategies should focus on prevention of progression to secondary brain damage. Surgical intervention, if performed during the ideal time-window provides a good outcome in patients with ICH. Further studies are needed to evaluate the efficacy and best treatment strategy.

Keywords: *Intracerebral Hemorrhage; Hematoma, Hemicraniectomy*

Introduction

Intracerebral hemorrhage accounts for approximately 10 % to 20 % of all strokes [1] and presents a wide variation in its epidemiology based on a spectrum of risk factors that contribute to the development of this manifestation. Spontaneous rupture

of small penetrating vessels inside the brain parenchyma lead to accumulation of blood manifesting with a range of clinical and radiological symptoms depending upon the size and site of hemorrhage. Typically, ICH can be divided into basal ganglia and lobar hemorrhage (including frontal, parietal,

temporal and occipital). Preventive strategies are based on the risk factors and other confounders. With the improvement of blood pressure control, the incidence of hypertensive ICH has decreased in developed countries. However, in developing countries, the burden of ICH remains the same [2,3]. Variations in regional incidence of ICH is attributed to age, sex, season and geographical location. The treatment of intracerebral hemorrhage remains anecdotal and inconsistent [4,5]. There is no convincing evidence of benefit from any medical treatment, and the role of surgery remains controversial despite clinical trial, which deemed inconclusive. This paper aims to identify the choice of surgical approach and efficacy of prompt surgical management in cases of spontaneous ICH.

Patients and Methods

A retrospective observational study was conducted between April to September 2018. All patients undergoing surgery for intracerebral hemorrhage were included in the study. Patient data was retrieved using hospital records and patient follow-up was obtained using a 5-point Glasgow Outcome Scale (GOS) at 6 weeks post-operatively. Data was entered and analysed using SPSS software and relevant conclusions were drawn.

Results

A total of 102 patients were included in the study. Out of these, 54 were male with a mean age of 54.7 years, and 48 were females, with mean age of 56.13 years. Smoking was common in 42.2% of patients, followed by alcohol intake (15.7%). Hypertension, diabetes and cardiovascular diseases were common comorbidities in almost all patients, with hypertension being the most prevalent followed by diabetes. Use of anticoagulant

drugs was also found in a small patient population [Figure 1]. Site of hemorrhage was divided into lobar and basal ganglia hemorrhages. In our set up, the distribution of hemorrhagic sites was equal with 55.9% basal ganglia bleed and the remaining 44.1% comprised hemorrhages of the frontal, occipital, parietal and temporal lobes collectively. Among all cases of lobar hemorrhages (n=45), majority were operated using trans-cortical approach (n=39, 86.67%) and remaining were operated using trans-sylvian approach (n=6, 13.33%). Similarly, basal ganglia hemorrhages (n=57) were operated using trans-cortical (n=30, 52.63%), trans-sylvian (n=15, 26.32%) and endoscopic approaches (n=12, 21.05%) [Table 1]. Surgical outcomes at a 6-weeks follow up included a mortality of 11.8% (n=12), followed by 27.5% (n=28) with a moderate disability, and 60.8% (n=62) with a good recovery. The outcomes were significantly correlated with age, with mortality occurring in patients aged 55 and above ($p=0.001$), whereas no statistically significant association was found between other confounders including smoking, comorbidities, site of hemorrhage and surgical approach [Figure 2].

Table 1: Site of hematoma and surgical approaches

Site * Surgery Crosstabulation

Count

		Surgery			Total
		Trans-cortical	Trans-Sylvian	Endoscopic Evacuation	
Site	Lobar	39	6	0	45
	Basal Ganglia	30	15	12	57
Total		69	21	12	102

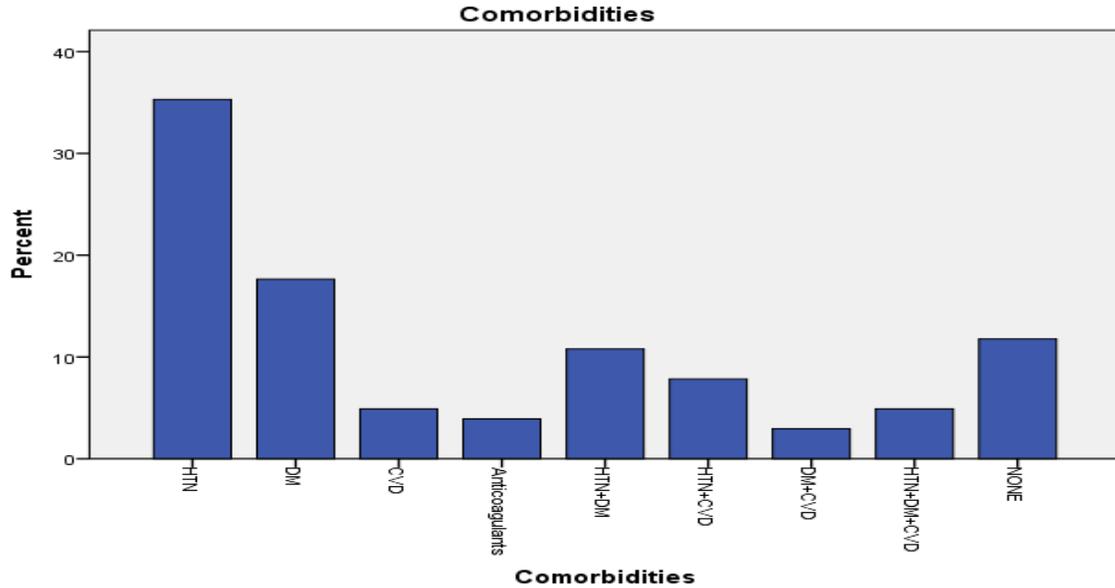


Figure 1: Frequency distribution of comorbidities in patient population

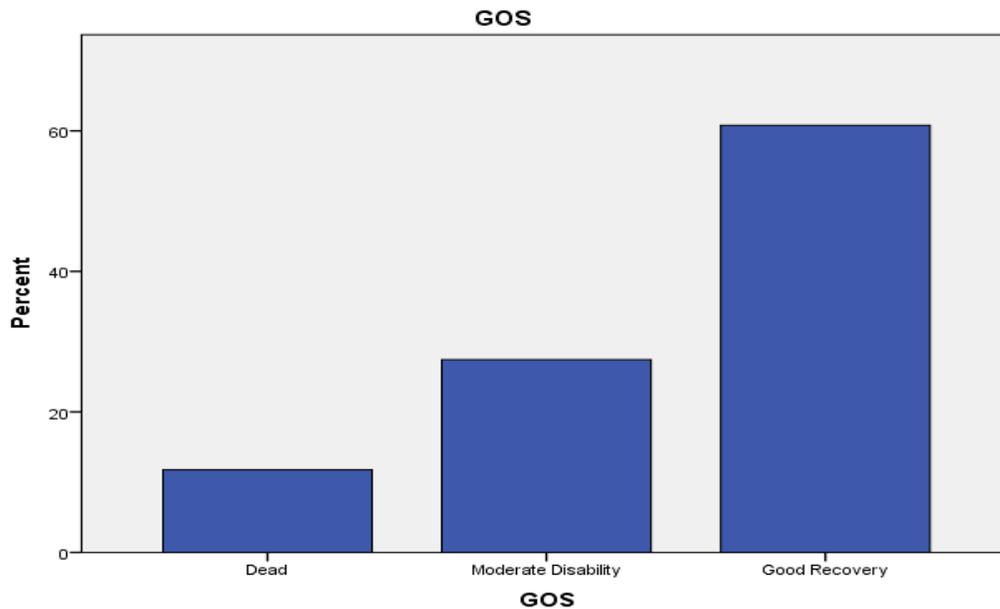


Figure 2: Surgical Outcomes at 6-weeks follow-up

Discussion

Intracranial hemorrhage refers to the pathological accumulation of blood within the cranial vault and may occur within brain parenchyma or the surrounding meningeal spaces. Hemorrhage within the meninges or the associated potential

spaces, including epidural hematoma, subdural hematoma, and subarachnoid hemorrhage. Intracerebral hemorrhage (ICH) is usually caused by rupture of small penetrating arteries secondary to hypertensive changes or other vascular abnormalities [6] and an extension of

parenchymal bleeding into the ventricles results in intraventricular hemorrhage [IVH]). ICH accounts for approximately 10-20% of all strokes [7] 8-15% in western countries like USA, UK and Australia [8], and 18-24% in Japan [9] and Korea [10]. The incidence of ICH is substantially variable across countries and ethnicities. The incidence rates of primary ICH in low- and middle-income countries were twice the rates in high-income countries (22 vs. 10 per 100,000 person-years) in 2000-2008 [11]. In a systematic review of 36 population-based epidemiological studies, the incidence rate of ICH per 100,000 person-years was 51 [12] in Asians, 24.2 in Whites, 22.9 in Blacks, and 19.6 in Hispanics [13].

The incidence of ICH has not changed over the last 30 years, probably due to changes in the risk factor profiles of ICH patients. It appears that ICH is more common in men, and Asian populations are more frequently effected than other populations. In addition to the known risk factors of hypertension and increasing age, alcohol consumption, the presence of the apolipoprotein $\epsilon 2$ or $\epsilon 4$ allele, extremes of body mass index, diabetes, and ophthalmic conditions have been suggested to be associated with ICH. Factors associated with a reduced risk of ICH include hypercholesterolaemia and a diet high in fruits and vegetables [14].

The neurological deficits caused by ICH can be attributed to localisation and volume of the hematoma and may develop within minutes to hours as seen in ischemic insults. These symptoms can range from severe headaches, sometimes in combination with vomiting; to alteration in level of consciousness. Symptoms of lobar ICH are associated with the affected cerebral lobe, so homonymic hemianopsia, paresis of arm or leg, or aphasia are observed. Small ICH of basal ganglia could occur without any symptoms, but larger ICH in this region leads to sensorimotoric

contralateral hemiparesis, sometimes in combination with aphasic disorders or homonymous hemianopsia, when the hematoma extends posteriorly and involves optic radiation. In ICH of Pons severe neurological deficits are observed like coma, disorders of pupillomotoric, abnormal flexions or extensions of extremities. Cerebellar ICH typically causes nausea, vomiting, and dizziness. Hydrocephalus may occur, if circulation pathways of CSF are obstructed, leading to an alteration in level of consciousness. Larger cerebellar haemorrhages could lead to brain stem compression. In these cases an alteration in level of consciousness, tetraparesis or paresis of cranial nerves could be observed. Hematomas located exclusively intraventricularly usually cause headaches only, although a secondary hydrocephalus can lead to unconsciousness.

There is no clear indication till date for surgical removal of ICH in the majority of patients. There are two reasons for this: (i) the mechanism of neurological damage is poorly understood; and (ii) the prospective randomized controlled clinical trials comparing surgical and medical treatment of ICH have been small and inconclusive [15]. Surgical removal of clot is considered life-saving by most neurosurgeons in patients who deteriorate with an initially good level of consciousness, however the efficacy can only be determined at the outcomes of the surgical removal of clot in patients who are stable or even improving. Functional impairment in ICH is based on the pathological oedema around an ICH which determines the degree of neuronal damage. Hence, measures need to be taken to salvage as much of the brain as possible. Clear surgical indication for initial clot removal are still under study. Current practice favours surgical intervention in the following situations: (i) superficial haemorrhage; (ii) clot volume between 20-

80 ml; (iii) worsening neurological status; (iv) relatively young patients; (v) haemorrhage causing midline shift/raised ICP; and (vi) cerebellar haematomas > 3 cm or causing hydrocephalus

Once a surgical intervention is warranted, the choice of surgery is dependant upon the site and size of hematoma. Open Craniotomy using smallest possible incision and Evacuation of the Hematoma is primarily done in a way, that the hematoma can be reached on the shortest path as possible avoiding further injury to eloquent brain-areas. Hemicraniectomy is useful for treating mass effect which is the main contributing pathology to death from ICH; therefore, it is possible that this may be an option for younger patients with rapidly declining conscious state and imminent herniation. One further advantage of this approach is that hemicraniectomy could potentially be performed by general surgeons, allowing for stabilization and then transfer of patients from geographically isolated regions. The use of an operation microscope aids for adequate hemostasis and satisfactory hematoma removal. Endoscopic Evacuation of the Hematoma Endoscopic guided evacuation of the hematoma allows the surgery to be performed through a single burr hole. While evacuating the hematoma the direction of the endoscope is changed to inspect all directions of the hematoma cavity for bleeding vessels, which could be coagulated. This is thought to provide better neurological outcome compared to an open craniotomy however, further randomized trials are still missing [16,17]. Different meta-analyses have provided different interpretations on the value of surgery for ICH [18]. The largest modern trial, the Surgical Trial in Intracerebral Haemorrhage (STICH), was negative, but did show a trend towards improved outcome with surgery, particularly in the subgroup of superficial ICH within 1 cm of

the cortex [19]. There was also a trend towards improvement with surgery in lobar ICH patients with deteriorating conscious state. The subgroup of patients with intraventricular hemorrhage (IVH) had a particularly poor outcome.

The STICH II study is re-examining the role of surgery specifically in the patients with superficial ICH [20]. There is also interest in minimally invasive surgical techniques, some in combination with thrombolytic agents, in order to enhance aspiration of the clot [21].

Timing of surgical interventions also seems to be an important issue depending upon the status of the leaking vessel, as well as brain edema and mass effect. Should surgery be required, to prevent death from the increasing mass effect and herniation, then this should be performed before the cascade of secondary changes from herniation (e.g., secondary infarcts from pressure effects on vessels) is at risk of occurring, providing the ideal time window between approximately 24 and 48 hours.

Apart from conventional surgical procedures, ventriculostomy is indicated for patients with severe intraventricular haemorrhage, hydrocephalus or elevated ICP [22]. Cisternal drainage of CSF in the setting of brain trauma instantly reduces the ICP and furthermore prevents secondary damage that otherwise is almost inevitable in standard decompression hemicraniectomies.

Conclusion

Intra cerebral hemorrhage accounts for the highest rates of strokes worldwide. The etiology is attributed to a spectrum of modifiable and non-modifiable risk factors and symptoms arise from the site and size of the hematoma formed. Treatment strategies should be targeted at preventing deterioration of neurological status and secondary brain damage. Surgical intervention, if performed during the ideal

time-window provides a good outcome in patients with ICH. Further studies are needed to evaluate the efficacy and best treatment strategy.

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