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Microsurgical Approach to Hypertensive Deep Nuclear Bleed: Preliminary Experience and Short Term Outcome

Dr. Karuna Tamrakar Karki
College of Medical Sciences
Bharatpur, Nepal
ORCID iD: https://orcid.org/0000-0003-2655-5226

Dr. Binod Bhattarai
College of Medical Sciences
Bharatpur, Nepal

Dr. Sunil Munakomi
College of Medical Sciences
Bharatpur, Nepal

Dr. Pramod K Chaudhary
College of Medical Sciences
Bharatpur, Nepa

Address for correspondence:
Dr. Karuna Tamrakar Karki
College of Medical Sciences
Bharatpur, Nepal
E-mail: tamrakarkaruna@gmail.com
Contact number: +977 9843405124

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Efficacy of surgical evacuation of hypertensive deep nuclear bleed with or without decompressive craniectomy remains controversial. Our paper mainly focuses on short-term preliminary experience on the evacuation of hypertensive deep nuclear bleed via transsylvian approach in reducing secondary brain injury for better neurological outcome.

In between August 2012 to October 2013, 25 surgically managed patients with hypertensive deep nuclear bleed were reviewed retrospectively. Among them, 13 cases underwent transsylvian evacuation of hematoma.

84.6% were males. Age ranged between 38 to 68 years with a mean age of 50.23 with standard deviation of 8.29 years. The size of hematoma measured in computed tomography scan ranged from 48 to 156 ml (mean 69 ml with standard deviation 38.28 ml). Nine hypertensive patients were taking medication on an irregular basis. The remaining had never taken antihypertensive agents before the ictus. 7/15 was the lowest Glasgow Coma Scale score and 13/15 was the highest score on arrival to the emergency room. Eight cases showed near-total evacuation of hematoma on repeated scan was taken after 24 hours of surgery. One patient underwent transsylvian evacuation in 2nd postoperative day after recollection following the transfrontal evacuation of right putaminal bleed. Two patients died on 3rd and 4th post-operative day respectively (GOS=1). GOS score during discharge was 3 in three cases and five cases obtained score 4. Three cases obtained GOS 5. In a 3-month clinical follow-up, one case scored modified Rankin Scale 1, three cases scored 2, four cases obtained score 3, two others scored

modified Rankin Scale grade 4 and one case had modified Rankin Scale 6.

Transsylvian transinsular microsurgical technique safely depicts the anatomical orientation in sylvian fissure preserving the overlying eloquent cortex in frontal and temporal lobes. This aided us to achieve better surgical and neurological outcome in patients with hypertensive deep nuclear hemorrhage irrespective to the size of hematoma.

Key words*:* Hypertensive deep nuclear bleed, Transsylvian approach

Irreversible brain damage occurs due to hemorrhage and edema to surrounding brain tissue. This is primary because of ischemia and hypoxia[4]. Secondary brain injuries which occur following initial bleed are usually associated with significant neurological deterioration. A hematoma can produce toxic effects on surrounding brain tissue causing edema degeneration micro-hemorrhages, necrosis and subsequently acts as the other main cause of raised ICP in hypertensive deep nuclear bleed[2,4]. There is still conflict on choosing treatment modalities for basal ganglion bleed. Although reduction in the size of the clot considerably improves brain edema and additional neuronal damage, effectiveness of surgical evacuation of hypertensive deep nuclear bleed remains controversial[14]. Decompressive craniectomy is usually mandatory to overcome the secondary brain damage and chances of rising in intracranial pressure[11]. However, early transsylvian trans-insular approach has proven to be feasible[14,16,17]. The purpose of our study was to elucidate the feasibility of transsylvian evacuation of hypertensive deep nuclear bleed for the reduction of secondary brain damage and for better neurological outcome.

Methods and Materials

In between August 2012 to October 2013, 25 surgically managed patients with hypertensive deep nuclear bleed were reviewed retrospectively. Among them, 13 cases underwent transsylvian trans-insular evacuation of hematoma. Patients with low GCS of 3/15 with fix and dilated pupils, coagulopathy, those taking anticoagulation drugs and suspected cases of vascular malformation and tumor bleed were excluded from the study. Informed consent was signed by the relatives before the procedure. We retrospectively collected clinical, radiographic and surgical data of each patient. All patients underwent initial computed tomography (CT) scans before admission. Clinical data including; age, sex, presenting symptoms, medical co-morbidities, bleeding pattern in an initial CT scan, details of surgical technique, the course of hospital stay, clinical outcome during discharge and follow-up clinical status was serially recorded. Clinical outcome during discharge, at one-month follow-up and 3 months follow-up was categorized according to Glasgow Outcome Score (GOS) and modified Rankin Scale (mRS) respectively.

Surgical intervention

Supine position, ipsilateral shoulder raised and patient head was rotated 30^{o} away from the side of hematoma. Head was then extended 20 degrees to align in the plane of proximal sylvian fissure vertically allowing frontal and temporal lobes to fall naturally to either side once the fissure is microscopically dissected and separated off. Classical pterional skin incision was made. Fronto-temporal craniotomy was performed after raising myocutenous flap. Dural was opened in T shaped fashion. Cortical arachnoid dissection was started with an insulin needle under microscope (Figure 1A). Sylvian dissection proceeded from distal to proximal direction mobilizing the sylvian veins and its tributaries. This separated the frontal and temporal cortex around the sylvian fissure.

Microsurgical dissection followed M3 (opercular) and M2 (insular) branches of MCA down into the fissure. Separation of the distal length of fissure followed by distal dissection opened up the sylvian cistern. Insula was adequately exposed between frontal and temporal opercula anteriorly and posteriorly. This helped to minimize in excess of brain retraction. Dissection was continued parallel to opercular cleft and was directed to the opercular segments of MCA to reach the long gyri of the insula (Figure 1B). Use of gentle suction and warm water irrigation, hematoma was evacuated. Homeostasis was accomplished coagulating offending vessels with bipolar cautery and surgicel was laid

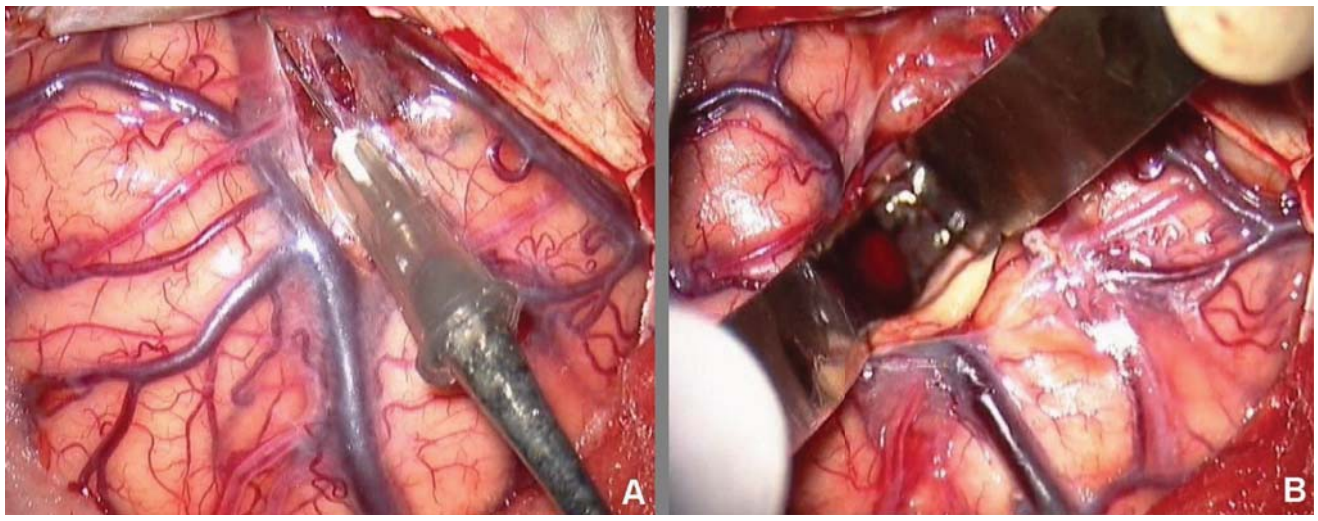

Figure 1A: Microscopic picture of cortical arachnoid dissection being carried out on sylvian fissure with an insulin needle

Figure 1B: Dissection being continued parallel to opercular cleft to reach the long gyri of the insula

down over the wall of hematoma cavity. Dura was closed watertight and bone flap was replaced. Wound was closed with subgaleal drain.

Results

Clinical results

84.6% were males. Age ranged between 38 to 68 years with mean age of 50.23 with SD 8.29 years. The size of the hematoma was initially measured by a x b x $c/_2$ method in computed tomography scan. It was ranged between 48 to 156 ml (mean 69 ml with SD 38.28 ml). 9 hypertensive patients were taking medication in irregular basis. Remaining had never started antihypertensive agents before the ictus. 7/15 was a lowest GCS score with maximum 13/15 on arrival to emergency room. 8 cases showed near-total evacuation of hematoma on repeated scan that was taken after 24 hours of craniotomy (Figure 2).

One patient underwent trans-sylvian evacuation in 2nd post-operative day after recollection following the trans-frontal evacuation of right putaminal bleed. 2 patients died on 3rd and 4th postoperative day respectively (GOS=1). GOS score during discharge was 3 in 3 cases and 5 obtained GOS=4 and 3 other had GOS =5.

Radiological results

1-month follow-up results

In 1-month clinical follow-up, 3 cases attained modified Rankin Scale 2, other 4 patients scored mRS grade 3. 3 graded as 4 and 1 had mRS 5.

3-month follow-up results

In 3-month clinical follow-up, 3 cases attained modified Rankin Scale 2, 4 other presented with mRS grade. 2 cases scored mRS 4 and 1 had mRS =6 (death).

Discussion

According to the different literatures putaminal bleed is the most common of all other hypertensive deep nuclear bleed which largely ties with our study.[10] Although some researchers stated that thalamic bleed is the commonest among all types of hypertensive deep nuclear bleed. Hypertension, hyperglycemia, smoking, alcoholism and coagulopathy increase the risk of ICH.[1,2,4] In our study majority of the patients (70.6%) had unmanageable hypertension. Some left medications and started on herbs. Few of them were taking antihypertensive irregularly. Although

Different surgical methods have been in practice for evacuation of ICH. [9] Those methods can be broadly categorized into minimally invasive and non minimally invasive. Among the minimally invasive approaches, sterotactic and endoscopic aspiration is on rise.[5,8,9] However due to additional cost burden and step learning curve, these kind of sophisticated approaches can still lag behind in developing countries. Most of the neurosurgeons preferred for conventional craniotomy for basal ganglia bleed with features of herniation syndromes.[11] Additional economical burden of cranioplasty may require to overcome from trephine syndrome. However chances of rebleed, over decompression, subgaleal hygroma, infarction may complicate and earlier rehabilitation may not be possible. Transcortical approach though is very

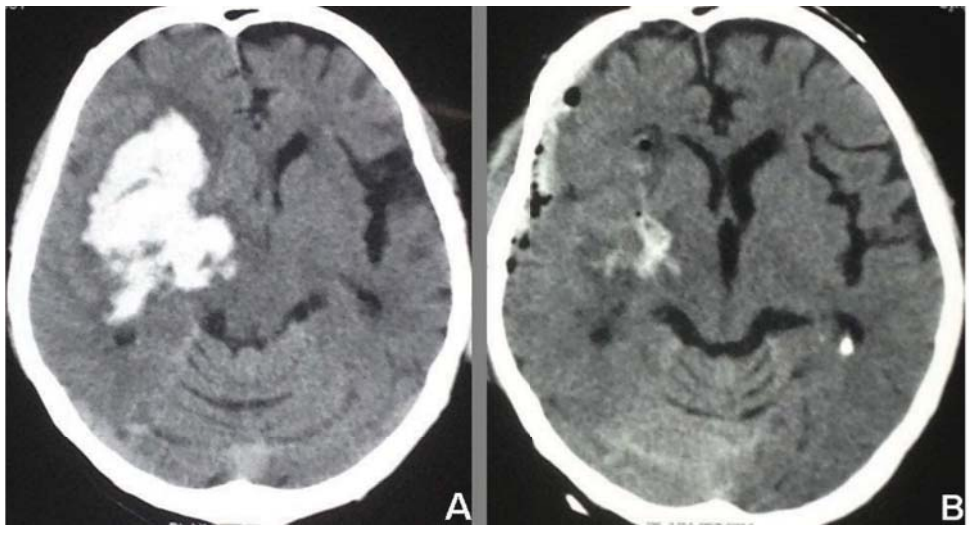

Figure 2 A: 58 year-old hypertensive gentleman with right basal ganglia bleed with mass effect and midline shift, B: Post operative CT (after 24 hours) showing near-total evacuation of hematoma

simple and easy to perform, however eloquent area like speech center is always at risk when superior temporal gyrus and middle temporal gyrus are incised.[7,8,13] large hematomas may not be cleared from the transcortical route. Excessive manipulation of brain tissue may lead to second brain damage and edema around it.[7,8] Retraction induced iatrogenic trauma and subsequent edema and vasospasm may occur. Vein of Labbe is at high risk to get damaged while clearing out the deep lying inferiorly located hematoma. Eventually venous infarction may land up with poor outcome.[7,8,9] Appropriate control of torn vessel may be unlikely and chances of re collection is higher. However large putamen, claustrum, external capsule hematoma extending towards cortical surface carries better surgical and functional outcome when transcortical approach is preferred via thinnest cortical surface.[11,14] Transsylvian transinsular (TSTI) approach has been prefered by most of the neurosurgeons as a safe technique for removal of hypertensive ICH.[13,14,15,16,17] Advantages of TSTI over transcortical approach are; small craniotomy, shortest route to reach hematoma cavity, preservation of cortical veins, less brain damage, early and clear control of torn vessel under the microscope, can avoid most of the complications related to decompressive craniectomy. The transsylvian approach is important for exposing the lesions in the insula and basal ganglia including globus pallidus, internal capsule, putamen, external capsule, and claustrum. Though this approach has been stated as time consuming however it is an ideal approach for managing deep nuclear hematoma where sylvian dissection helps to release CSF and gives the better operative window to prevent unnecessary traction on the brain thus decreasing the operative morbidity and mortality compare to transcortical approach.[10] Although this approach has been proven to be safe to evacuate deep nuclear bleed but good microsurgical skill is acquired for meticulous sylvian dissection to prevent unintentional injury to sylvian veins and distal branches of middle cerebral artery. In deep nuclear hemorrhage, the major culprit is usually the perforators from the middle cerebral artery i.e lenticulostriate artery rupture which can be well exposed or visualized through transsylvian approach. Bleeding from it can be prevented by direct coagulation thus reducing the chance of re-hemorrhage. [16,17]

Sometimes middle cerebral vein or its tributaries might need a sacrifice to access the operculum and compromising venous flow may result into venous infarction. In our series, we had two cases in which middle cerebral veins were sacrificed, but did not show features of venous infarction in postoperative CT scans.

Putaminal bleed is the common clinical entity among all other hypertensive intracranial hemorrhage encountered in neurosurgical clinics. The neurological outcome remained the main question after surgical evacuation of the basal ganglia bleed. Functional recovery is the main concern then only salvaging the life. Though surgical intervention has still remained controversial and no clear evidence indicates the improved functional outcome or mortality rates.[12] However improved clinical outcome has been noticed in many clinical studies that have helped in lowering of raised ICP significantly by reducing the volume of ICH. [3, 5,6,7,8]

Conclusions

Trans-sylvian trans-insular microsurgical technique safely depicts the anatomical orientation in sylvian fissure preserving the overlying eloquent cortex in frontal and

temporal lobes. This aided us to achieve better surgical and neurological outcome in patients with hypertensive deep nuclear hemorrhage irrespective to the size of hematoma.

Conflict of interest

None of the authors have any conflict of interest to disclose regarding this study.

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