Journal of Bangladesh College of Physicians and Surgeons
Vol. 34, No. 2, April 2016

Spontaneous Intracerebral Haematoma-II:Post-Operative Changes and Outcome of Burrhole Aspiration after Urokinase Mediated Clot Lysis

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Summary:

Background: Treatments of intracerebral hematoma (ICH) are controversial and surgical interventions in spontaneous ICH are required and more accepted. Although advantage of neurosurgical intervention conservative treatment of ICH has not been established, recent reports have suggested favourable effects of blood clot removal after liquefaction by means of urokinase. Objectives: To study the intervention by and out come in without or with complications of Burrhole aspiration treatment after urokinase mediated clot lysis; Study Design : Prospective interventional study. Place and Duration of Study: Departments of Neurosurgery and Radiology & Imaging ,Dhaka Medical College Hospital, Dhaka, Bangladesh from July 2010 to December 2010; Materials &Methods: A total of 30 Bangladeshi patients with spontaneous ICH (Age range: 40-75yrs,Mean age ±SD:59.1±11.52 years, Gender : 22 males, 8 females) full filling the criteria for spontaneous ICH were included in the study. The desired information relevant to the objectives were obtained and recorded carefully using a structured questionnaire; The Patients were treated with Burrhole aspiration after urokinase mediated lysis , evaluated for out come , complications and death and statistically analyzed ; Results: The results on delays of intervention ,types of intervention, doses of urokinase, post-operative changes in haematoma volume, outcome with Glasgow outcome scale(GOS) and GOS at follow–up, complications and death were presented with statistical analyses and significance .The outcome and death were compared with various variables such as hypertension (p <0.05), diabetes mellitus (p< 0.05) primary GOS (P<0.05),site of hematoma (p<0.05),volume of haematoma (p<0.05),ventricular extension of hematoma (p<0.05) and delay from ictus to intervention (p<0.05). Conclusion : It was observed that early treatment (within 24 hours of occurance) by using minimally invasive technique and clot removal by urokinase mediated lysis can improve the consequences especially those with haematoma volume < 40 ml, lobar haematoma and without ventricular extension. Bad prognostic factors were increase of blood pressure, diabetes mellitus, GOS level <8, haematoma in the basal ganglia , ventricular extension of the haematoma volume> 40 ml and delay in intervention. However, the present was conducted with 30 patients only and therefore, studies with larger number of patients are required to draw more meticulous and more definitive conclusions.

Key words: Intracerebral Haematoma, Burrhole Aspiration, Clot Lysis.

(J Bangladesh Coll Phys Surg 2016; 34: 64-75)

Introduction:

Literature on spontaneous intracerebral hematoma (ICH) have been reviewed in our preceeding article where age, gender distribution, precipitating factors, clinical presentations, neurological observations and CT scan findings in our patients with spontaneous ICH were documented. Although treatments of ICH are controversial, surgical interventions in spontaneous ICH are required and more accepted[1]. Haematomas about 3 cm diameter and those causing hydrocephalus generally require surgical evacuation. The detailed account of back ground scientific literature was not repeated here, as it has been stated in our preceding article.[2-21] The procedure of intervention by, and outcome of, Burrhole Aspiration after urokinase mediated clot lysis constitute the contents of the present article, i.e. Part- II of our study.

Materials and Methods:

Place & period of study, subjects of study, inclusion & exclusion criteria and data collection procedures were

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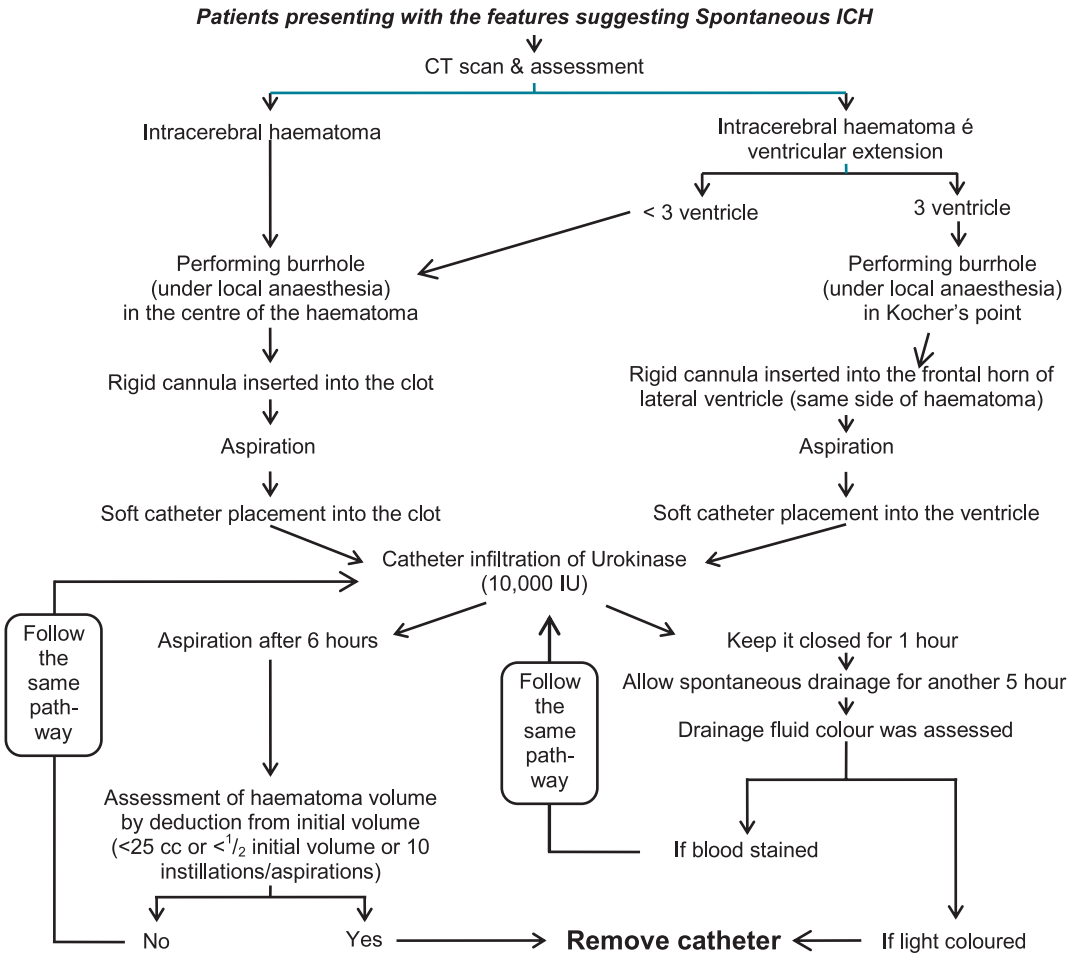
Received: 19 March, 2014 **Accepted:** 10 February, 2016



stated and explained in our preceding article[1]. ICH Diameter was measured from maximum diameter of axial section of CT scan; ICH Volume of haematoma was measured by modified ellipsoid formula by ð/6 ABC which practically amounts to ½ ABC as described [22.] The procedure of catheter placement was determined by the site of hematoma. Status of the patient during 3rd post operative day (POD), at discharge and follow up (30th POD) were recorded. Outcome was measured according to the modified Glasgow outcome scale (GOS) as suggested [23.] Favorable: GOS 3-5 Unfavourable: GOS 1 and 2. The flow chart of the patients presenting with features of spontaneous ICH has been stated below :

Statistical Analysis

Data were analyzed with descriptive statistics, Chi-squared () test and bi-variate analysis using computer aided statistical software SPSS win-17.The p value d" 0.05 was used as the level of significance.

Results:

Interventions

The results on delays of intervention, types of intervention and doses of urokeinase are presented in Table-1, Table-2, and Table-3 respectively. The post - operative changes in haematoma volume and GOS and GOS at follow up are presented in Table-4,Figure-1 & Table 5 respectively. The post- operative outcome(over all) complications, time of death and haemorrhage and death are stated in Figure-2 ,Table 6, Table-7 and Table-8 respectively.

The results on comparison of variables and outcome such as hypertension & outcome, diabetes mellitus (DM) & death, GOS & outcome, site of haematoma and outcome, haematoma volume and outcome, ventricular extension and outcome and finally delay, site of haematoma and outcome are reported in Table 9a & 9b, Table-10, Table-

11a & 11b, Table-12a & 12b, Table 13a & 13b, Table 14a & 14b, and Table-15a & 15b respectively.

Delay: Table -1 shows that, on an average the delay from ictus to intervention was 41:43 hours with a range from 7.00 to 72.00 hours.

Table -I

Distribution of the patients by their delay from occurrence to intervention

Time(Hours)	Frequemncy	Percent
≤24:00	14	46.7
24:00 – 48:00	3	10.0
48:00 – 72:00	13	43.3
Total	30	100.0

Mean ± SD, 41.34 ± 20.09 Hours, Mode 48:00 Hours, Range 7:00 to 72:00 Hours

Type of intervention:_Table- 2 illustrate that catheter was inserted in the Ventricle in 2 (6.6%) patients, in the centre of haematoma in 23 (76.7%) patients and in both in 5 (16.7%) patients..

Table-II

Distribution of the patients by the types of intervention

Intervention	Frequency	Percent
Catheter in the centre of haematoma	23	76.7
Catheter in the Ventricle	2	6.7
Catheter in Both	5	16.7
Total	30	100.0

Dose: Table- 3 shows that, on an average the patients received 5.7 doses (instillation and aspiration) of urokinase with a range from 2 to 10 times; Most of them (14,46.7%) received 4 to 6 doses.

Table-III

Distribution of the patients by the doses of urokinase

Dose	Frequency	Percent
≤3	6	20.0
4 -6	14	46.7
> 7	10	33.3
Total	30	100.0

Mean ± SD: 5.70 ± 2.38, Mode :4 ,Range: 2 to 10 times

Post-operative changes

Change in haematoma :Table- 4 shows that, average haematoma volume on 3rd POD was 7.67 ml. Only in a single patient, the volume in ventricle had increased.

Table-IV

Distribution of the patients by their changes in haematoma volume

Volume of haematoma	Ventricular extension Yes	No	Total
d" 5 ml	6	4	10
5 -10 ml	4	5	9
> 10 ml		2	2
More blood in ventricle		1	1
Total	10	12	22

Mean ± SD: 7.67 ± 4.531, Mode: 10, Range :2 to 20 m

Change in GOS: Figure-1 explains that, more than one-fourth of the patients (8, 26.67%) died before 3rd POD (the first day for post-operative assessment of changes achieved through intervention). In a single (3.33%) patient GOS decreased. Out of the remaining 21 cases, GOS increased 1 to 5 points.

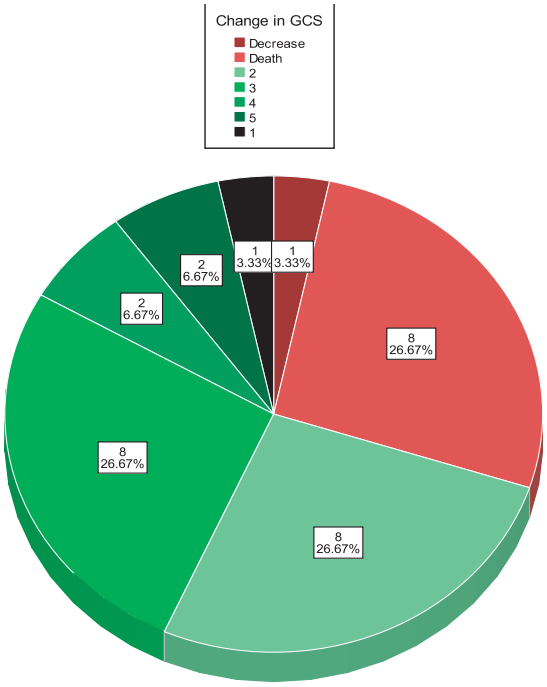


Fig.-1: *Distribution of the cases by the change in GOS on 3rd POD.*

GOS at follow up :Table 5 shows that, among the live patients, the GOS level had increased, i.e. on admission the level ranged from 6 to 11 and on 30th POD the lowest level was 10.GCS and also, the average of GCS had increased from 8.00 (On admission) to 13 (On 30th POD). There is positive correlation between the changes of GCS level among the alive cases.

Outcome, Complications & Death

Outcome of intervention overall : Figure-2 explains that near about three-fourth (22, 73.33%)] of the patients had unfavourable outcome; 14 (46.67%) 'Death' and 8 (26.67%) 'Severe disability'. The remaining 8 had favourable outcome; 5 (16.67%) 'Moderate disability' and 3 (10.0%) 'Good recovery'.

Complications: Table - 6 illustrates that Iatrogenic pneumocephalous was the most (5, 16.7%) occurring complication;. 15 (50%) of the interventions were uncomplicated.

Time and cause of death: Table -7 shows that respiratory distress' was the cause of most (7, 23.33%) deaths.

Haemorrhage and death :Table- 8 shows that involvement of different areas of the cerebral hemisphere had strong association in outcome, when only death was considered; i.e. only 14.3% patients with cortical haematoma died, on the contrary 85.7% patients with ICH in the basal ganglia with ventricular extension (3 or more ventricles) died.

Table-V

Distribution of alive cases by the GOS at follow - ups

GOS Follow up	6 - 8	9 - 12	13 - 15	Total	Mean ± SD
On 3rd POD	3	14	5	22	10.95 ± 2.535
At discharge	1	9	7	17	12.18 ± 1.879
On 30th POD		4	12	16	13.44 ± 1.548

Correlation [GOS (on admission and on 3rd POD)], R = 0.724	R = 0.740	p = 0.001
Correlation [GOS (on admission and at discharge)],R = 0.846	R = 0.846	p = 0.000
Correlation [GOS (on admission and on 30th POD)],R = 0.787	R = 0.641	p = 0.002

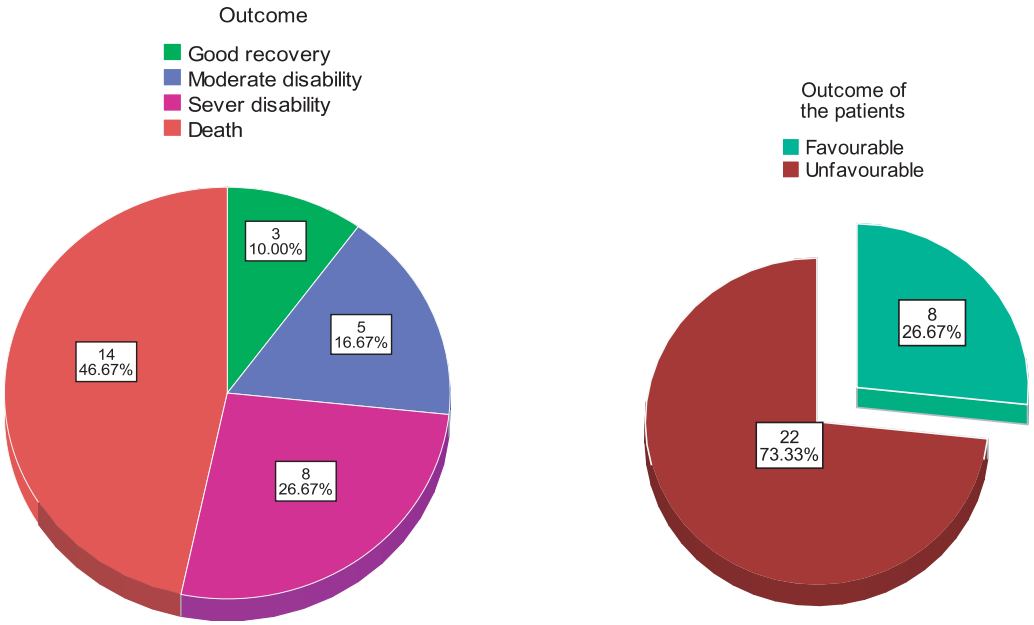


Fig.-2: *Distribution of the patients by their outcome (according to GOS).*

Table-VI

Distribution of the cases by their postoperative complications

Complications		Frequency	Percent
No complication		15	50.0
Complications	Pneumocephalous	5	16.7
	Accidental catheter withdrawal	2	6.7
	Aspiration pneumonia	2	6.7
	Chest pain	2	6.7
	Others (Meningitis, Re-stroke, Re-bleeding, Psychosis)	4	13.3
Total		30	100.0

Table-VII

Distribution of the cases by their time and cause of death

Cause of death	Time of death			Total
	Before 3rd POD	Before discharge	Before 30th POD	
Respiratory distress then death	7			7
Sudden chest pain, then death		3		3
Meningitis		1		1
Aspiration pneumonia	1			1
Re-bleeding		1		1
2nd stroke			1	1
Total	8	5	1	14

Table-VIII

Distribution of the cases by their ICH and of death

Area of ICH	Number (n)	Death	Percentage (%)	Fraction of death
Cerebral cortex	7	1	14.3	7.15
Basal ganglia without ventricular extension	6	3	50.0	21.43
Basal ganglia ventricular extension (<3 ventricle)	10	4	40.0	28.57
Basal ganglia ventricular extension (e"3 ventricle)	7	6	85.7	42.85
Total	30	14	46.7	100

Variables and Outcome

Hypertension and outcome: Table -9a shows , an inverse relation of blood pressure with outcome ,i.e. with the increase of BP (both systolic and diastolic) GOS decreases'. Table-9b shows that atthough all the deaths were among those with high blood pressure, the difference in death in respect of hypertension was not statistically significant($x^2 = 22.969$, $p > 0.05$).

GOS and Outcome: Table 11a shows that outcome achieved depended on initial GOS (on admission). The incidence of death was higher in patients with lower GOS level group. All of the patients with 'good recovery' had a GOS of 9 to 12 and patients with 'moderate disability' had initial GOS more than 6. Table -11b shows the incidence of death among patient with primary GOS; it was significantly higher in patients with lower GOS on admission ($X^2=3.519$, $p < 0.05$).

Table- IX a

Distribution of the cases by hypertension and outcome

		Outcome					Total
		Death	Persistent vegetative state	Severe disability	Moderate disability	Good recovery	
Hyper-tension	Mild hypertension			6	5	3	14
	Moderate hypertension	6		1			7
	Severe hypertension	8		1			9
	Total	14		8	5	3	30

Table-IX b

Distribution of the cases by hypertension and death

hypertension	Outcome		Total
	Dead	Alive	
Mild	0	14	14
Moderate to severe	14	2	16
Total	14	16	30

$\chi^2 = 22.969$, df= $p<0.05$

DM and death; Table-10 shows that all the 7 (23.33%) DM patients suffering from spontaneous ICH died.

Table -X

Distribution of the patients by DM and death

DM	Death		Total
	Yes	No	
Yes	7	0	7
No	0	0	0
Total	7	0	7

Table -XI a

Distribution of the patients by their primary GOS and outcome

GOS	Outcome					Total
	Death	Persistent vegetative state	Sever disability	Moderate disability	Good recovery	
6 to 8	11		4	1		16
9 to 12	3		4	4	3	14
Total	14		8	5	3	30

Table- XI b

Distribution of the patients by their primary GCS and death

	Outcome		Total	
	Dead	Alive		
GCS	6	6	2	8
	> 6	8	14	22
Total	14	16	30	

$\chi^2 = 3.519$ df=1 p=0.05

Site of haematoma and outcome :Table-12a shows that outcome of haematoma in the basal ganglia was not good, as out of 23 (76.67%) haematoma 13 (43.33%) died. All 3 'good recovery' had cortical haematoma. Table- 12b shows that the death rate was higher in patients with haematoma in the basal ganglia which was statistically significant(p = 0.05).

Hematoma volume and outcome: Table-13a indicates that outcome of large haematoma was not good; death rate was high among patients with larger haematoma. All 3 'good recovery' was with smaller haematoma. Table- 13b shows that, the difference between death and haematoma volume was statistically significant ($\chi^2 = 0.117$, $p<0.05$).

Ventricular extension and outcome :Table-14a shows that the ratio of death was higher among patients with ventricular extension of the haematoma as 10 (33.33%) died out of 18 (60.0%) patients were with ventricular extension. All the patients with 'good recovery' did not have any ventricular extension of the haematoma.

Table14b shows that the difference in death among patients with ventricular extension of haematoma was statistically significant ($p < 0.05$)

Delay, site haematoma and outcome: Table 15a explains that the cortical haematoma showed time dependant outcome, 'the earlier the intervention the better the recovery. The single death in patient suffering from ICH in the cortex, had a 72 hours delay from incidence to start of intervention. Table -15b shows that there was statistically significant difference in death and interval between ictus and intervention ($p < 0.05$); Better results were shown with early intervention

Table- XII a

Distribution of the cases by their site of haematoma and outcome

Location of haematoma	Outcome					Total
	Death	Persistent vegetative state	Sever disability	Moderate disability	Good recovery	
Basal ganglia	13		7	3		23
Cortical haematoma	1		1	2	3	
Total	14		8	5	3	30

Table -XII b

Distribution of the cases by the location of haematoma and death

		Outcome		Total
		Dead	Alive	
Location	Basal ganglia	13	10	23
	Cortex	1	6	7
Total		14	16	30

$\chi^2 = 3.846$, df = 1 p= 0.05

Table-XIII a

Distribution of the patients by their volume of the haematoma and outcome

		Outcome				Total
	Death	Persistent vegetative state	Sever disability	Moderate disability	Good recovery	
Volume of haematoma	≤20 ml		2	2	1	5
	21 – 40 ml		5	3	2	1 11
	41 – 60 ml		6	3	2	1 12
	> 60 ml		1		1	2
Total	14		8	5	3	30

Table-XIII b

Distribution of the cases by the volume of haematoma and death

		Outcome		Total
		Dead	Alive	
Size of haematoma	≤40 ml	7	9	16
	> 40 ml	7	7	14
	Total	14	16	30

$\chi^2 = 0.117$ df= 1, p<0.05

Table-XIV a

Distribution of the cases by their ventricular extension of haematoma and outcome

		Outcome				Total
	Death	Persistent vegetative state	Sever disability	Moderate disability	Good recovery	
Ventricular extension	No	4	1	4	3	12
	Yes	10	7	1		18
Total		14	8	5	3	30

Table-XIV b

Distribution of the cases by their ventricular extension of haematoma and death

		Outcome		Total
		Dead	Alive	
Ventricular extension	No	4	8	12
	Yes	10	8	18
Total		14	16	30

$\chi^2 = 1.429$, df= 1, p= <0.05

Table -XV a

Distribution of the patients by their outcome with site of haematoma and delay from ictus to intervention

Site of haematoma		Basal ganglia						Cortical						Total
Outcome		Death	Persistent vegetative state	Severe disability	Moderate disability	Good recovery		Death	Persistent vegetative state	Severe disability	Moderate disability	Good recovery		
Delay from ictus to intervention	≤ 24 hrs	6		4	3							1		14
	24 to 48 hrs	1									1	1		3
	> 48 hrs	6		3				1		1	1	1		13
Total		13		7	3	0		1		1	2	3		30

Table -XV b

Distribution of the cases by their delay and death

		Outcome		Total
		Dead	Alive	
Delay	≤ 24 hrs	6	8	14
	> 24 hrs	8	8	16
Total	14	16	30	

$\chi^2 = 0.153$, df= 1, $p<0.05$

Discussion:

The age – gender information, precipitating factors , clinical presentations , neurological observation and CT scan findings in spontaneous ICH were presented and discussed in our previous article (Part-I)[1]. In the present article (Part -II), the surgical intervention by, and outcome of, Burrhole aspiration after urokeniase mediated clot lysis were presented and discussed as part –II of our study findings.

On an average, the delay from ictus to intervention was 41:43 hours with a range from 7:00 to 72:00 hours. Among our patients, 47(49%) were operated within 24 hours, 21 (22%) between 24 to 48 hours, 14 (15%) between 48 to 72 hours and 13 (14%) between 3 to 7 days. Only 01 patient was operated beyond 7 days after ictus[24]. Our27 (67.50%) patient's presented within 2 days and 13(32.50%) patients attended after 2 days.)[19,25.]

Catheter in the Ventricle was inserted in 2 (6.6%) patients. Catheter was placed in the centre of the haematoma in 23 (76.7%) patients and the remaining 5 (16.7%)] were benefited by both centre of haematoma and ventricle procedures. On an average, the patients received about 6 doses (instillation & aspiration) of urokinase with a range from 2 to 10 times. Most of them [14 (46.7%)] received 4 to 6 doses. Out of total 40 patients with ICH, in 25(62.5%) patients Burrhole aspiration of haematoma was done, in 8(20.00%) patients external ventricular drainage, in 5(12.50%) patients craniectomy and decompression, in 2 patients (5.0%) cranicctomy and evacuation of haematoma was done [19,26] Out of total 29 patients with ICH, in 8(27.56%) patients external ventricular drainage, in 7(24.13%) patient's craniectomy and decompression, in 14(48.27%) patient's craniotomy and evacuation of haematoma was done[27] .Out of total 30 patients with ICH, in 13 (43.3%) patients craniotomy and evacuation of haematoma was done, in 13 (43.3%) patients Burrhole aspiration of haematoma was done, in 3 (10%) patients craniectomy and evacuation of

haematoma was done, in 1 (3.3%) patient external ventricular drainage (EVD) was done [28,29].

Average haematoma volume on 3rd POD was 7.67 ml. Only in 1(one) patient, the volume in ventricle had increased. a mean ICH volume of 65.4 ml (SD 28.1 ml) on day 1, 47.5 ml (SD 30 ml) on day 3, and 44.4 ml (SD 30.7 ml) on day7[30].The average haematoma volume after operation was 7.60 ml. With each dose of urokinase the average haematoma volume decrease varied in individuals from as less as 2.0 ml to 15.0 ml. . In a single (3.33%) patient GOS decreased. Out of the remaining 21 cases, GOS increased 1 to 5 points. In most cases [9 (30.0%)], the increase was by 3 points, followed by 2 points in 7 (23.33%) cases and 4 in 3 (10.0%) cases. Motor strength of all the live patients gradually increased except only a single case who eventually died.

More than one-fourth of the patients [8 (26.67%)] died before 3rd POD (the first day for post-operative assessment of changes achieved through intervention). In a single (3.33%) patient GOS decreased. Out of the remaining 21 cases, GOS increased 1 to 5 points. Again, among the live patients the GOS level had increased, i.e. on admission the level ranged from 6 to 11 and on 30th POD the lowest level was 10. GOS and also, the average of GOS, had increased from 8.00 (On admission) to 13.44 (On 30th POD). There is positive correlation between the changes of GOS level among the alive cases. {Correlation [GOS (on admission and on 3rd POD)] = 0.724; R = 0.740 (p = 0.001); Correlation [GOS (on admission and at discharge)] = 0.846; R = 0.846 (p = 0.000) and Correlation [GOS (on admission and on 30th POD)] = 0.787; R = 0.641 (p = 0.002)}.

About three-fourth [22 (73.33%)] of the patients had unfavourable outcome; 14 (46.67%) 'Death' [among them 1 (7.14%) patient from lobar haematoma, 3 (21.42%) patients from basal ganglia without ventricular extension, 4 (28.57%) patients from basal ganglia with less than three ventricular extension and remaining 6 (42.82) patients from basal ganglia with more than three ventricular extension and 8 (26.67%) 'Sever disability' ['(one from lobar(12.5%), six from basal ganglia with less than three ventricle extension (75.0%) and one from basal ganglia with more than three ventricle extension(12.5%)]. The remaining 8 had favourable outcome; 5 (16.67%) 'Moderate disability' [two from lobar (40.0%) and 3 (60.0%) basal ganglia without ventricular extension] and 3 (10.0%) 'Good recovery'(all from lobar haematoma). In basal ganglia mortality is 25%, severe disability was 50% and moderate disability was 25%[31]. In lobar haematoma mortality was 41.2%, severe disability was 35.5% and moderate disability was 23.5%. In Basal ganglia with ventricular extension, mortality was 100% and lobar haematoma with ventricular extension mortality was 71.4 %.

Of the interventions 50% (15) were uncomplicated. Iatrogenic pneumocephalous was the most [5 (16.7%)] occurring complications, 2 (6.7%) individuals each had 'accidental catheter withdrawal', aspiration pneumonia and chest pain. Other complications like, meningitis, re-stroke, re-bleeding, psychosis accounted for a single (3.3%) case. Near about half [14 (46.67%)] of the patients died. Out of the deaths, most [8 (26.67%)] occurred before 3rd POD (1st date for assessment of outcome). 'Respiratory distress' was cause of 7(50.0%) deaths. Myocardial infraction was responsible for 3 (21.48%) deaths. Re-bleeding, meningitis, aspiration pneumonia and re-stroke were the cause of remaining 4 (28.52%) deaths. Jin et al reported that nine patients (16.9%) died before hospital discharge (one from cardiac problems and eight from respiratory failure).[18]

Involvement of different areas of the cerebral hemisphere had strong association in outcome when only death was considered, i.e. only 14.3% patients with cortical haematoma died. On the contrary, 85.7% patients with ICH in the basal ganglia with ventricular extension (3 or more ventricles) died. An inverse relation of blood pressure with outcome, ie 'with the increase of BP (both systolic and diastolic) GOS decreased. Although all the deaths were among those with 'moderate to high blood pressure', the difference in death in respect of hypertension was not statistically significant ($p > 0.05$). All the 7 (23.33%) diabetic patients suffering from spontaneous ICH died. Outcome achieved depended on initial GCS (on admission). The ratio of death was higher in patients with lower GOS level group. All of the patients with good recovery had a GOS of 9 to 12 and patients with 'moderate disability' had initial GOS more than 6. Death rate was higher in patients with lower GOS on admission; the difference was statistically significant ($p < 0.05$). Outcome of haematoma in the basal ganglia was not good, as out of 23 (76.67%) haematoma 13 (43.33%) died. All 3 good recovery had cortical haematoma. Although the death rate was higher

in patients with haematoma in the basal ganglia, the difference was not statistically significant; ($p > 0.05$). Outcome of large haematoma volume was not good; death rate was high among patients with larger haematoma (>40 ml). All 3 good recovery was with small volume of haematoma (<40 ml). The difference was statistically significant between death and haematoma volume.($p < 0.05$). The ratio of death was higher among patients with ventricular extension of the haematoma as 10 (33.33%) died out of 18 (60.0%) patients with ventricular extension. On the contrary, only 4 (13.33%) died among the 12 (40.0%) cases without ventricular extension. The death rate was 1.67 times higher in patients with ventricular extension. All the patients with good recovery did not have any ventricular extension of the haematoma. The difference in death among patients with ventricular extension of haematoma was statistically significant; $p < 0.05$. The cortical haematoma showed time dependant outcome, 'the earlier the intervention the better was the recovery'. The single death in patient suffering from ICH in the cortex had a 72 hours delay from incidence to start of intervention. There was statistically significant difference in death and interval between ictus and intervention indicating better results with early intervention ($p<0.05$). Outcome of study by Jin et al, was - at discharge, 25 patients (47%) had achieved good recovery (17patients GOS 3, 6 patients GOS 4 and 2 patients GOS 5), and 19 patients (35.8%) remained vegetative (GOS 2)[18,32,33]. At 6 months follow up, 29 patients (55%) had achieved good recovery (17 patients GOS 3, 8 patient GOS 4, and 4 patients GOS 5) and 15 patient ,(28.3%) remained vegetative (GOS 2).

However the current study was conducted among 30 patients only, not a large study to draw a definitne conclusion. Study of Spontaneous ICH in the perspective of the objective of the study was rare, causing difficulty to compare the findings to other research findings. Patients came from all corners of the country after referral from local primary and secondary hospitals, even from some tertiary hospitals. So, the delay in occurrence to intervention took its toll as death of the patients or severe disability. Patients had their last follow up on 30th POD, very short duration to overcome neurological deficits. If the duration were longer, the condition of the live patients would have been better ideally. It meant that larger study including more patients with longer postoperative follow-up and minimal delay between the occurrence of ICH and intervention should be done to draw more definitive conclusion.

In Conclusion, early treatment (within 24 hours of occurrence) by using minimally invasive technique and clot removal by urokinase mediated clot lysis can improve the consequences especially those with haematoma volume <40 ml, lobar haematoma and without ventricular extension. Bad prognostic factors were increase of BP (both systolic and diastolic), diabetes mellitus, GOS level <8, haematoma in the basal ganglia, ventricular extension of the haematoma volume >40 ml and delay in intervention.

Acknowledgements:
The authors would like to thank and gratefully acknowledge Dr. K. A. Jhuma for valuable suggestions and help during preparation of the manuscript.

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