ORIGINAL RESEARCH PAPER

Neurology

KEY WORDS: Intracranial Haemorrhage, Children, Coagulation Disorders

# NONTRAUMATIC INTRACRANIAL HAEMORRHAGE IN CHILDREN

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ABSTRACT

**Objectives:** To determine the clinical profile, aetiology and prognosis of spontaneous intracranial haemorrhage in children beyond neonatal age group.
**Design:** Descriptive study.
**Setting:** Tertiary care teaching hospital.
**Method:** Children with spontaneous intracranial haemorrhage beyond neonatal age group were studied regarding age, sex, symptoms and signs, site of haemorrhage, aetiology and prognosis.
**Results:** There were 70 children with intracranial haemorrhage. Males (70%) predominated the study. Altered sensorium (77%) was the commonest symptom followed by seizures, focal deficits and symptoms of increased intracranial pressure. Parenchymal bleed (81%) was the commonest. Coagulation disorders (66%) were the most common cause of intracranial bleed followed by vascular malformations and other causes. The mortality rate was 23% and 37% had sequelae.

## INTRODUCTION:

Stroke in children is relatively uncommon and under reported due to lack of recognition and delay in diagnosis. Haemorrhagic stroke is particularly important as it accounts for half of all childhood strokes compared with less than 20% of adult strokes and often associated with high rates of mortality and morbidity.[1,2]. The incidence of intracranial haemorrhage among children is reported to be 0.8/100,000 person-years[3] resulting in mortality up to 33% and major deficits up to 40%, including seizures, cognitive and motor impairments [3-5] ,The frequent causes of spontaneous intracranial haemorrhage in children reported in various studies include vascular malformations, hematological causes and other entities such as tumours, drug abuse which differ from adults in whom hypertension is the commonest cause. Considering the paucity of data in our country, this study was conducted to determine the clinical profile, aetiology and prognosis of children with spontaneous intracranial haemorrhage.

## SUBJECTS AND METHODS:

The study group comprised of all children beyond neonatal age group with a diagnosis of intracranial haemorrhage proved by Computed Tomography or Magnetic Resonance Imaging from July 2011 to June 2017. Those with a history of trauma were excluded from the study.

The data was analyzed for age and sex distribution, clinical symptoms and signs, prior history of bleeding, family history of bleeding disorders, type and extent of haemorrhage in neuroimaging, possible cause and outcome. Relevant investigations such as complete haemogram, peripheral smear, coagulation profile, sepsis screening, liver function tests were done. Magnetic resonance angiography was done whenever it was required.

## RESULTS:

During the study period, we came across 70 children with spontaneous intracranial haemorrrhage. Their mean age was 3.72 years (range 0.12 – 12 years). There were 49 (70%) males and 21 (30%) females. Of the 70 children with intracranial haemorrhage, 26 (37%) were under one year of age, 19 (27%) were between one and five years and 25(36%) belonged to more than five years age group.

Altered sensorium 54 (77%) and seizures 52 (74%) were the common symptoms followed by vomiting 43 (61%), headache 26 (37%), lethargy 29 (41%), refusal of feeds 27 (39%) and fever 24 (34%). Focal deficits were noticed in 36 (51%) patients, bulging anterior fontanel in 27 (39%), pallor in 20 (29%), shock in 14 (20%), retinal haemorrhages in 12 (17%) and meningeal signs in 12 (17%). Most of the infants with intracranial haemorrrhage presented with nonspecific symptoms such as fever, lethargy, refusal of feeds and bulging anterior fontanel.

There were 5 children with a prior history of haemophilia, of which one had recurrent episodes of intracranial bleed (3episodes). Prior history of bleeding such as umbilical cord bleeding, haematomas following intramuscular injections was noticed in 16 (23%) children and 18 (26%) had evidence of bleeding from other sites viz. skin and mucosal bleeds, haematomas etc. during their admission.

The site of haemorrhage was parenchymal in 57 (81%) patients followed by subarachnoid haemorrhage (SAH) in 17 (24%), subdural haemorrhage (SDH) in 10 (14%), intraventricular haemorrhage (IVH) in 6 (9%) and extradural haemorrrhage (EDH) in one child. Of the intra parenchymal haemorrhages, 56 (97%) were in supratentorial and two in infratentorial location. Of the supratentorial bleeds, 6 were primarily involving basal ganglia, 2 intra ventricular, 2 cerebellar white matter and 46 lobar haemorrhages. Often there were combinations such as extension into subarachnoid, intra ventricular extensions in case of parenchymal haemorrhages and subarachnoid haemorrhages extending into the parenchyma and ventricles.

Coagulation disorders (66%) were found to be the most common cause of nontraumatic intracranial haemorrhage in children in our cohort followed by vascular anomalies in 11 (16%), acute lymphatic leukemia in 4, tumour with bleed in 3, hypertension in 2 and bacterial endocarditis in one.(Table I). Hemophilia(37%) topped the list among the coagulation disorders followed by secondary clotting factor deficiency in liver diseases such as neonatal cholestatic syndrome(22%), sepsis with DIVC in 7, factor XIII deficiency in 2, congenital hypofibrinogenemia in 2, aplastic anemia in 4, thrombocytopenic purpura in 2, and late hemorrhagic disease of newborn in 2. In two children with bleeding disorders, intra cranial haemorrhage was the presenting symptom which led to diagnosis. Aneurysm in right middle cerebral artery with bleed in the insula was diagnosed a child who underwent clipping of the

aneurysm. Of the two children with hypertension, one turned out to be mid aortic syndrome and the other chronic renal disease. The cause could not be found out in 3 patients. The type and extent of haemorrhage in various causes of intracranial haemorrhage is depicted in table II.

Children were managed with fresh frozen plasma, anticonvulsants and antiodema measures initially. Specific management was given appropriately according to the aetiology. 16 (23%) children died, and among the remaining, 26 (37%) had sequelae. Two children developed hydrocephalus following intra ventricular and subarachnoid haemorrhage requiring ventriculo-peritoneal shunt and the rest had residual neurological deficits in the form of hemiparesis, quadriparesis, microcephaly and seizure disorder.

**Table 1:** Aetiology of nontraumatic Intracranial hemorrhage in children

| Etiology | age < 1year | 1-5 years | >5 years | Total no. |
|---|---|---|---|---|
| 1. Coagulation disorders 46(66%) | | | | |
| Hemophilia | 2 | 8 | 7 | 11 |
| Neonatal cholestasis | 10 | | | 10 |
| Sepsis with DIVC | 6 | 1 | | 7 |
| Aplastic anemia | | 2 | 2 | 4 |
| Factor XIII deficiency | 1 | 1 | | 2 |
| Hypofibrinogenemia | 1 | 1 | | 2 |
| Thrombocytopenic purpura | | 1 | 1 | 2 |
| Late Hemorrhagic disease | 2 | | | 2 |
| 2. Vascular anomalies11(16%) | | | | |
| Arteriovenus malformation | | 1 | 9 | 10 |
| Aneurysm | | | 1 | 1 |
| 3. Acute Leukemia | | 2 | 2 | 4 |
| 4. Tumor with bleed | | 1 | 2 | 3 |
| 5. Hypertension | | | 2 | 2 |
| 6. Bacterial endocarditis | | 1 | | 1 |
| 7. Not identified | 1 | 2 | | 3 |

**Table 2:**Type and extent of haemorrhage & aetiology

| Etiology | Parenchymal | SDH | SAH | IVH | EDH |
|---|---|---|---|---|---|
| 1. Coagulation disorders(46) | | | | | |
| Hemophilia(17) | 11 | 3 | 2 | 1 | |
| Neonatal cholestasis(10) | 7 | 1 | 1 | 1 | |
| Sepsis with DIVC(7) | 6 | | 1 | | |
| Aplastic anemia(4) | 3 (BG -1) | | 1 | | |
| Factor XIII deficiency(2) | 2 (BG -1) | | | | |
| Hypofibrinogenemia(2 | | | 1 | | 1 |
| Thrombocytopenic purpura(2) | 2 | | | | |
| Late hemorrhagic disease(2) | 1 | 1 | | | |
| 2. Vascular malformations(11) | | | | | |
| Arteriovenus malformation(10) | 10 (BG-4) | | | | |
| Aneurysm(1) | 1 | | | | |
| 3. Tumour (3) | 3 (cerebellum -2) | | | | |
| 4. Acute leukemia(4) | 4 | | | | |
| 5. Hypertension(2) | 2 | | | | |
| 6.Infective endocarditis(1) | 1 | | | | |
| 7.Idiopathic(3) | 3 | | | | |

## DISCUSSION:

The mean age of our patients was 3.72 years with a range of 2 months to 12 years which is in variance with other studies which have reported 7 years as the mean age and a sex ratio of 1.3:1[3,6,9]. The was due to the frequent occurrence of intracranial bleed in infants with neonatal cholestatic syndromes and sporadic occurrence of late haemorrhagic disease of newborn in infants of 2-3 months age group. As quoted in the literature males predominated in our study but with a sex ratio of 2.3:1. This could be due to the fact that the commonest coagulopathy noted in this cohort was hemophilia which has an X linked inheritance.

We noticed that in our patients altered level of consciousness (77%) and seizures (74%) were the common symptoms followed by vomiting (61%), focal deficits (51%) and headache (37%). Lin et al in their study of 42 children with intracranial haemorrhage observed headache in 67%, altered level of sensorium in 52%, vomiting in 50%[10]. Most of the infants with intracranial bleed presented with nonspecific symptoms like fever, refusal of feeds, lethargy and bulging anterior fontanel and some of them were clinically diagnosed as probable bacterial meningitis before neuroimaging. A similar difficulty was also experienced by the other authors[6]. However presence of pallor, skin and subcutaneous bleeds, retinal bleeds would give a clue to the diagnosis.

81% of our patients had parenchymal bleed followed by haemorrhage in other sites which is in accordance with other studies[10,11]. The main location of hemorrhage was supratentorial (97%) as reported by others.[3,6,9]. The most common site of supratentorial hemorrhage was found to be lobar in our series (82%), in concordance with Abbas et al. who found lobar bleed in76.5% in their cases.

Many of the reported articles cite that vascular anomalies including arterio vascular malformations, cavernous angiomas, aneurysms as the common cause of non traumatic intra cranial haemorrhage in children [2,5,6,12]. Al Jarallah et al in their series of 68 children with intracranial haemorrrhage reported arteriovenous malformations in 42.6%, bleeding diathesis in 32.4%, tumours in 13.2% and not known in 10.3%). Warren et al have reported bleeding diathesis in 5%, vascular malformations in 28% tumour in 15% and heart disease in 16% in their cohort of 85 children. However we observed that disorders of coagulation (65.7%) were the common causes of spontaneous intracranial haemorrhage in children followed by vascular anomalies (15.7%). Abbas et al have also reported a similar trend in their study. Chung et al have reported in their cohort of 14 children with age ranging from 7 months to 11 years hematological abnormalities as the common cause of intracranial bleed in 64%.The cause could not be identified in 3(4.3%) children even after extensive workup. Kumar et al have quoted a similar percentage[8]. Two of them had haemorrhage in the basal ganglia and one in the frontal lobe . we presume that these children might be having cryptic or small arteriovenous malformation which were not picked up by magnetic resonance angiography, and may be identified by conventional angiography.

On analysing the risk factors and the location of haemorrhage, we found that children with coagulopathies developed haemorrhage anywhere inside the cranium including parenchymal, subdural, sub arachnoid and extra dural spaces. Hence the site of hemorrhage may not be able to give a clue to the etiological diagnosis in children.

The mortality rate was 23% in our study and 37% had sequelae which is in accordance with other studies.[6,13,15]

## CONCLUSION:

Coagulation disorders were the most common cause of spontaneous intracranial hemorrhage in children in our cohort in contrast to western literature. The clinical presentation mimics intracranial infection in infants and hence a high index of suspicion is necessary. Parenchymal bleed was the commonest site of haemorrhage and the site of bleed did not give a clue to the aetiology. Aetiological risk factors could be identified in the majority. Spontaneous intracranial hemorrhage in children continues to be a disabling disease with significant mortality and morbidity.

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