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A Decade of Management of Subdural Haematoma in Children Aged 2 to 24 Months Hospitalized at the Paediatric Neurosurgery Department of La Timone Children's Hospital

J Fondop[1,2], CE Bekolo[1], F Atemkeng[1], Djam AC[1]

[1]Faculty of Medicine and Pharmaceutical Sciences, University of Dschang, Dschang, Cameroon
[2]Timone Children's Hospital, Marseille, France

ABSTRACT

Objective: Subdural haematomas constitute a major cause of morbidity and mortality in children under 2 years old. We aimed to describe the clinical presentation, therapeutic options, and sequelae of subdural haematomas.

Method: A chart review of 138 records of patients aged 2 to 24 months hospitalised for treatment of a subdural haematoma (SDH) in the PaediatricNeurosurgery Department of the Timone Children's Hospital between 1996 and 2006. We included 107 cases with complete medical records. Data collected included sociodemographics, the circumstances of occurrence, personal history, the clinical presentation, fundoscopic and imaging findings, the therapeutic modalities, and patient outcomes. Descriptive statistics were used to present the proportion of distinctive characteristics.

Results: Of the 107 children included, 83 (78%) were boys, their average age was 6 months and 99 (93%)were less than 1 year old. About 12% of patients had a history of epilepsy. Suspected child abuse was reported in 31% and was confirmed in 17% of patients. Acute SDH was reported in 21% and chronic SDH in 79% of patients. Impaired consciousness (78%) and convulsions (49%) were the main symptoms reported. The main clinical signs were a bulging fontanel (69%) and an increased head circumference (64%). The commonest fundoscopic finding was a retinal haemorrhage in 48% of patients. The main treatment options included a conservatory treatment (7%), transfontanellar puncture (36%), external subdural diversion (42%), subdural-peritoneal diversion(73%), trephine (8%) and flap (7%) craniotomy. Recurrences were recorded in 6% of patients. Epilepsy (4%) was the main sequelae. Only a single death (1%) was recorded at the end of the study.

Conclusion: Childhood SDH is a condition often linked to abuse in children aged 2 to 24 months in this setting. Subdural peritoneal diversion is the main therapeutic method used in this retrospective study. Despite advances in therapeutic techniques, SDH leaves children with sequelae notably epilepsy.

KEYWORDS: *subdural haematoma, therapeutic methods- sequelae*

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INTRODUCTION

Brain lesions are the main causes of morbidity and mortality in children under 2 years old due to the vulnerable characteristics of the brain in this age group (2). The infantile skull is voluminous and supported by weak cervical muscles. The brain is bathed in a large space of cerebrospinal fluid, it is attached to the cranial vault by bridge veins which go from the cortex to the superior longitudinal sinus.

Sudden rotational movements generate forces that can lead to ruptures of these bridging veins causing subdural haematomas. These haematomas can be acute but are most often chronic. The majority of these haematomas are bilateral, communication between the two hemispheres has been proven (2.9). Fractures are rarely associated with these haematomas (2, 18,21).

In the majority of cases, these lesions coincide with abuse, trauma, and coagulopathy. The aetiology remains unknown in less than 23% of cases (3, 9, 16,19,). Maltreatment syndrome includes shaken child syndrome and battered child syndrome. It is characterised by the clinical discovery of subdural and intraocular bleeding associated with fractures of the extremities of the upper limbs. There are no obvious external signs of head trauma. They are frequently difficult to detect (8, 13, 18,19). The clinical presentation is often nonspecific with signs and symptoms such as irritability, excessive crying, vomiting, drowsiness, seizures, psychomotor retardation, macrocephaly, bulging fontanelle, (12, 13,18). Subdural haematomas associated with abuse are most often bilateral (12). CT scan and Magnetic Resonance Imaging (MRI) make it possible to make the diagnosis (8). In children with open fontanelles, the diagnosis is made by transfontanellar ultrasound.

The therapeutic approach is nowadays very varied and less invasive. Recent literature advocates minimally invasive treatment strategies including observation, transfontanellar puncture, external subdural shunt, subdural-peritoneal shunt, small craniotomy with endoscopic flushing, trephine craniotomy, or large flap of craniotomy and membranectomy (9.11). Each of these procedures has its advantages and disadvantages, so there is no standardized consensus (9).

The prognosis of non-accidental trauma such as child abuse is very severe. Sequelae are found in 20% of children. These sequelae are neurological: stability disorders, spastic quadriplegia and motor dysfunctions, cognitive deficits. The mortality rate ranges from 20 to 31% (3.11).

Our work focuses on the management of subdural haematomas in children aged 2 to 24 months hospitalized in the paediatric neurosurgery department of La Timone for a period of 10 years The aim of our work is to describe the clinical signs, therapeutic options, and sequelae of subdural haematomas.

Materials and method

Our study identified 138 children aged 2 months to 24 months hospitalised for treatment of a subdural haematoma (SDH) in the paediatric neurosurgery department of the Timone Children's Hospital, from May 1996 to September 2006, i.e., over a period of 10 years. We included 107 children with a complete file were retained in our study. Excluded from this study are children with incomplete records and infants under 2 months of age because distinguishing between SDH of obstetrical origin and SDH of other causes seems difficult at this age.

Data collected included patient identity, age, sex, circumstances of occurrence, personal history, clinical signs, fundus examination, imaging, modalities therapies, patient outcomes and sequelae.

Children with no notion of head trauma, but skin and bone lesions of different ages, a CT scan showing hyperdense subarachnoid lesions, lesions of petechial or haemorrhagic papilledema on fundus examination, or a history of mistreatment by parents or relatives were considered to be abused. Otherwise, trauma was consideredin children presenting a history of a fall, a road accident, or any impact on the cranial vault.

The clinical and laboratory workup involved an examination of the fontanel, measurement of the head circumference, laboratory investigations including a complete blood count, the coagulation profile, measurement of transaminases.

All the children underwent a fundus examination for papilla oedema, petechiae and retinal haemorrhage at the Ophthalmology Department of Timone Hospital.

In all cases, the diagnosis of subdural haematoma was done by CT or MRI scans. We identified acute SDH ashyperdense images while chronic SDH were characterised by hypodense or isodense images in the subdural space (8).

Conservatory treatment was chosen when the haematoma was tolerated; transfontanellar puncture was recommended for moderate haematomas. Surgical treatment (trephine, craniotomy, external subdural diversion, subdural-peritoneal diversion) was reserved for severe SDH. None of the children received endoscopic treatment. Subdural-peritoneal diversion was performed only when there were no signs of meningitis. These different therapeutic methods were sometimes combined.

Results

Of the 138 patient records were reviewed, 107 patients (24 girls (22%) and 83 boys (78%)) were included in our study. Their ages ranged from 2 to 24 months with an average age of 6 months, 93% of children were under 1 year old.

Background

Approximately 72% of patients had no significant history. A history of epilepsy (12%), prematurity (6%), a mother with mental disorder (3%), neonatal seizure (2%), dystocia (2%), trauma (2%), and infections (2%).

Aetiology

The aetiology of SDH was identified in71% of patients, among whom: suspicion of abuse (31%), established abuse (17%), road accidents (11%), falls from height (7%), head trauma (2%), complications from lumbar puncture (1%). No aetiology was found in 29% of cases.

Clinical Presentation

The major symptoms included: impaired consciousness (78%), seizures (49%), vomiting (41%), drowsiness (40%), irritability (23%), loss of consciousness (21%), hypotonia (14%), coma (13%); weight loss (3%), and other symptoms (6%).

The main clinical signs included: bulging fontanel (69%), increased head circumference (64%), stature hypotonia (14%), skin lesions (10%), bruises of different ages (4%), other skin lesions (4%), cephalo-haematomas (2%), hemiplegia (2%) and anaemia (1%).

Fundus examination showed papillary lesions (18%) and retinal haemorrhages (48%) but was normal in 44% of the patients.

Imaging assessment

Standard X-ray of the skull was done in 16 children (15%) and showed a disjunction of the sutures (9% of patients) and fractures (4%). It was normal in 2% of the children.

In 6% of patients, we observed fractures of the humerus (3%), of the femur (4%), of the tibial and fibula(1%), of the ribs(1%). One patient (1%) presented with multiple fractures of rib, femur, and tibia.

The brain scan revealed acute SDH in 22 children (21%) and chronic SDH in 85 children (79%). Approximately 11% of SDH were located on the right, 10% on the left and 79% were bilateral (Table I).

Table I. Types and Location of subdural haematomas

Types of SDH	Location of SDH				
	Left	Right	Bilateral	TOTAL	Percent (%)
Acute	5	5	12	22	19.6
Chronic	6	7	72	85	73.8
Recurrent chronic	1	0	0	1	0.9
Total	11	12	84	107	100
Percent (%)	10	11	79	100	

Management

Therapeutic options

The various treatment options included: Conservatory (7%), transfontanellar puncture (36%), external subdural diversion (42%), subdural-peritoneal diversion in 73%. , craniotomy by trephine (8%) or by flap in 7% of cases (TableII).

Table II. Different treatment techniques used

Treatment method	Number	Percent (%)
Conservatory	8	7%
Transfontanellar puncture	39	36%
Trephine	8	8%
Craniotomy	8	7%
External subdural diversion (ESDD)	45	42%
Subdural-peritoneal diversion (SDPD)	78	73%

A single therapeutic technique was sufficient to treat SDHin 43% of patients: conservatory (1%), transfontanellar puncture (6%), trephine (1%), craniotomy (4%), ESDD (5%) and SDPD (26%) (Table III).

Table III. Distribution of the 46 patients treated by a single technique

Technique used	Number	Percent (%)
SDPD only	28	26
Transfontanellar puncture only	7	6
ESDD only	5	5
Craniotomy only	4	4
Observation only	1	1
Trephine only	1	1
Total	46	43

In 41% of patients, we used a combination of two surgical techniques to achieve healing and complete evacuation of SDH: 17% of patients by association of ESDD and SDPD, 11% by association transfontanellar puncture and SDPD, 3% by transfontanellar puncture and ESDD, 3% by observation and SDPD, 2% by transfontanellar puncture and trephine, the other dual techniquesin 1% of children(Table IV).

Table IV. Distribution of 41 patients treated by dual techniques

Two therapeutic methods	Number	Percent (%)
ESDD + SDPD	18	17
Transfontanellar puncture + SDPD	12	11
Transfontanellar puncture + ESDD	3	3
0observation+SDPD	3	3
Transfontanellar puncture + trephine	2	2
Observation + Transfontanellar puncture	1	1
Trephine+ ESDD	1	1
Trephine+SDPD	1	1
Craniotomy+ESDD	1	1
Craniotomy+SDPD	1	1
Craniotomy+Cardiac bypass	1	1
Total	44	41

In 15% of patients, we used three successive therapeutic techniques to completely drain the SDH:10% by the combination of puncture, ESDD and SDPD, 2% by the association of Trephine, ESDD and SDPD (Table V).

Table V. Distribution of patients treated by triple combination techniques

Triple combination therapy	Number	Percent (%)
Conservatory +Transfontanellar puncture+ESDD	1	1
Conservatory +ESDD+SDPD	1	1
Transfontanellar puncture+ESDD+SDPD	10	10
Transfontanellar puncture + trephine + ESDD	1	1
Trephine+ESDD+SDPD	2	2
Total	15	15

Finally, in 2% of the children had recourse to four successive therapeutic techniques for the complete evacuation of SDH including 1% of children successively underwent puncture, craniotomy flap, ESDD and SDPD, and1% by successively underwent conservatory, puncture, ESDD and SDPD. (Table 6)

Assessment of delays between therapeutic modalities

The chronological but not systematic order of management of our patients was as follows: Conservatory, transfontanellar puncture, trephine, craniotomy flap, ESDD and SDPD. The treatment plan was based on clinical and radiological findings.

The duration of the conservatory approach when it was chosen as the main option varied from 1 to 6 days with an average of 4 days before discharge or before proceeding to another treatment method. Two patients were discharged after 6 days of observation without further treatment.

Among the 36% of patients who underwent transfontanellar puncture, 4% benefited from another therapeutic method on the same day, 23% in the first week, 7% in the second week and 2% in the third week. About 1% of patients benefited from a transfontanellar puncture after craniotomy, the average duration between the puncture and the exit or the choice of another therapeutic modality is approximately 6 days(Table VI).

Table VI. Mean duration between treatment options

Intervals between techniques	Mean duration (days)
Conservatory to discharge or to another procedure	4
Transfontanellar puncture to discharge or to other therapeutic technique	6
Trephine craniotomy to discharge or to other therapeutic technique	7
ESDD to discharge or to SDPD	11
SDPD to removal of	128

For the 6% of children who underwent trephine craniotomy, 1% were cured after 3 days, three benefited from a ESDD after respectively 3, 12 and 19 days, while two benefited from a SDPD after 6 and 7 days, respectively. The average duration of follow-up before discharge or the choice of another therapeutic decision was 7 days (Table VI).

Among those (7%) who underwent a craniotomy flap, six were discharged after one week of monitoring on average, while one underwent a ESDD after 10 days and another a SDPD after 8 days.

Finally, among the 42% who benefited from ESDD, 14% were monitored for one week, 17% for 8 to 14 days, 9% for 15 to 21 days and 2% for 22 to 28 days. The average duration of follow up after an ESDD before discharge or before proceeding to another therapeutic option was 11 days, 11 children (10%) were successfully treated after an ESDD (Table VI).

The average duration between the ESDD and the SDPD is 11 days. In 9% of cases, ESDD was replaced by SDPD during the first week, 11% during the 2nd week, 7% during the 3rd week and 3% during the 4th week. This duration is long because of infections. The transition from a ESDD to a SDPD is done in a context a febrile and not infectious.

Among the 73% of patients treated with SDPD, the drain was removed in 27% during the 1st trimester, 28% during the 2nd trimester, 10% after the 3rd trimester. The duration of the drain was not specified in 8% of cases. The average duration of a SDPD is 4 months 8 days before stent removal (Table VI).

Length of hospital stay

The duration of hospitalisation varied from 1 to 83 days with an average of 14 days. 21% of children were hospitalized for one week, 39% for 2 weeks, 21% for 3 weeks. Hospitalisation lasted 2 months in nearly 7% of children.

Table VII. Duration of hospitalisation

Duration of hospitalisation (days)	Number	Percent (%)
0 -7	22	21
8-14	39	36
15-21	21	20
22-28	9	8
29-35	4	4
36-42	1	1
43-49	3	3
50-56	1	1
57-64	4	4
65+	3	3
Total	107	100

Complications and sequelae

Around 23% of patients had complications, 2% had a recurrence of contra lateral SDH, 4% recurrence of ipsilateral SDH, 3% hydrocephalus, 4% epilepsy, 3% infectious episodes. Ataxic disorders, school difficulties, motor deficit, psychomotor disorders each accounted for 1% of complications. The pericallosal aneurysm has been described as a sequel (1% of cases) although the pathophysiology is not very well elucidated. (Table VIII)

TABLE VII. Complication and sequelae of SDH

SDH complications and sequalae	Number	Percent (%)
Contralateral recurrence treated with DPSP	2	2
Ipsilateral recurrence treated with DPSP	4	4
Hydrocephalus	3	3
Pericallosal aneurysm	1	1
Infection	2	2
Fever	3	3
Ataxia	1	1
Difficulty of school integration at 4 years old	1	1
Motor deficit	1	1
Total	25	23

Outcomes of children with SDH

One (1%) child victim of a head trauma died, 3% were reoperated before leaving for recurrence, 96% were cured without recurrence.

DISCUSSION

Several authors have performed retrospective studies of subdural haematomas in children less than 2 years of age (2, 11, 13.15). These studies, including infants from 0 to 2 months, did not consider aetiologies of obstetrical origin. The 107 patients in our study are made up of 22% girls and 78% boys, i.e., a sex ratio of around 1:3. This sex ratio is comparable to the 79% of boys described by Dimitra et al. (2) in children aged 0 to 2 years in Australia. This male predominance was also reported by Marie Bourgoie et al. who find 72% of boys in their studies of shaken children with epilepsy (14). Similar findings were reported by Golden et al. (3) on brain damage in children aged 7 days to 5 months. King et al. reported 56% of boys in their study (7). Gender differences in normal brain structure (size and asymmetry) and function may contribute to the pathogenesis of SDH. Male brain is larger than female brains in all settings, especially most prominent in frontal and occipital lobe, bilaterally.

The average age of our patients is 6 months 1 week. This average is not far from that described by some authors who found an average ageranging from 4.6 months to 6 months(2, 11, 13). Our study excluded patients from 0 to 2 months due to the impact of obstetric SDH. The main presenting features included impaired consciousness in 78% of cases followed by convulsions (49%), vomiting (41%), drowsiness (40%) and epilepsy (7%). SDH is of non-accidental in 52% to 73% across the literature (2.14). Seizures were observed in 91% of acute SDH in a study by Joon-Khim et al. (8). The low frequency of epilepsy as observed in our study can be explained by the probable existence of epileptic seizures labelled as impaired consciousness by family members.

Abuse remains the leading aetiology of SDH in several studies, with a prevalence ranging from 25% to 81% of case (1.2). Only the Stéphane et al. observed abuse in only 12.7% of patients. It is the 3rd cause of brain damage after trauma and falls. In our study, abuse was suspected in 33% of patients. It was established at admission in 17% of the children. No aetiology was found in 29% of cases seemingly higher than what has been described in the literature where unknown aetiologies varied from 1.4% to 23% (1, 9.15).

Among the 28% patients with a known history, epilepsy was reported in 12% of them, prematurity in 6%. Epilepsy can be a clinical manifestation of an SDH, it can also be one of the aetiologies, the child presenting with this condition can rupture the pontine vessels during a crisis. As for prematurity, it cannot explain the occurrence of subdural haematoma after 2 months.

The clinical examination was marked by signs of intracranial hypertension: bulging fontanel (68%), increase in the cranial circumference (64%). This frequency was higher than that from the study by Joon-Khim et al. who reported 38% of children with a bulging anterior fontanelle (8).

Funduscopic examination revealed 18% papilledema and 48% retinal haemorrhage which is an ocular sequela of intracranial hypertension and child abuse syndrome. The mechanism of occurrence of retinal haemorrhage is not well known, however there is a strong correlation between the phenomenon of acceleration and deceleration in the mechanism of occurrence of brain damage. Retinal haemorrhages result from increase in the pressure transmitted to the central retinal veins by the intrathoracic pressure or by the intracranial pressure during the trauma. The trauma can result from direct impact on vitreous humour resulting to the movement of the latter that impinges on the retina. Retinal haemorrhage is usually bilateral, rarely it will be unilateral. It can persist for several days or even years.5, 10,17,). The

presence of a retinal haemorrhage is not a sufficient argument to claim child abuse. Although observed in 40 to 85% of cases of abuse (5, 8, 10,17), the presence of retinal haemorrhage requires a full examination to rule out other differential diagnoses (5). Its absence does not rule out a child abuse either. In our study, 3% of children abused at presentation had a normal fundus.

The standard X-ray is one of the diagnostic tools for child abuse syndrome. In 1946 the first descriptions by Caffey associated radiological features of long bone fractures with SDH. Carty et al., in a retrospective study of radiological results from 467 children with non-accidental lesions, 25% had cranial fractures associated with other fractures, 67% had multiple fractures and long bone ends without cranial fractures, 8% have at least one cranial fracture (4).In our study, the standard cranial X-ray revealed 9% of patients had a disjunction of their cranial sutures related to hydrocephalus, a humeral fracture in an abused child, the other extra cranial fractures were related to a road traffic accident.

The CT scan is the most important imaging tool for the diagnosis of SDH (3, 9,11). It revealed acute SDH in 21% of patients and chronic SDH in 79%, with the predominance of bilateral SDH (79%). This predominance of chronic SDH and bilateral SDH was observed by Dimitra. et al as well (12).

MRI contributed to incidental diagnosis in 1% of patients during the assessment of epilepsy. Transfontanellar ultrasound was used for monitoring SDH but not for diagnostic purposes.

Several therapeutic modalities are recommended for the treatment of SDH in infants, the principle adopted in our practice was to start with a conservative treatment depending on the clinical condition and the size of the SDH on the scan, then to progress towards surgical treatment. In 1925 Putnam and Cushing began the treatment of chronic SDH by puncture and drainage, craniotomy being indicated for removal of clots. In 1939 In graham and Mast son recommended the treatment of these patients by bilateral drainages considering failures associated with craniotomy and membranectomy for which patients remain in care for a long time. Until 1982, invasive treatment was recommended.

In the study by KORIN et al., non-invasive methods were recommended (9.14). In this study, conservatory treatment led to successful outcomes in 1%of patients, transfontanellar puncture in 6%, trephine (1%); craniotomy (4%) and ESDD in 6%.

Around 43%of children were cured after treatment with a single therapeutic modality, 54% underwent at least two therapeutic modalities before healing. The decision to move to another treatment option and the interval between two modalities was based on the clinical and the imaging features of the size of the haematoma. No treatment approach has been standardised in the literature. This explains the difficulty of standardising treatment of SDH.

The average duration of monitoring ranged from 6 days under a conservatory and transfontanellar approaches through 7 days after the trephine craniotomy or the wide flap craniotomy, and 11 days following an ESDD and up to 128 days following a SDPD. In patients who had benefited from several treatment modalities, the average duration of the intervals between two therapeutic modalities was 7 days. Joon-Klim et al. reported that 13 out of 21 children with small SDH received conservative treatment, while the average follow up period after a SDPD as reported by MC Korinth et al (9) was 10 months.

The average length of hospitalization was 14 days in our survey after which Sequelae were observed in 23% of our patients. Paula et al., saw 50% of surviving children with cognitive disorders and other neurological deficits. King et al., in a multicentre study described 364 children aged 7 days to 5 years old of whom 62% of patients were surviving without sequelae(6.12).

In our study, we saw a 1% mortality. Other authors reported 15% to 38% of deaths (3, 7,12), However, the latter included infants from 0 to 2 months. Not only their figures were influenced by mortality due to perinatal sequelae but also this age groupare more vulnerable because their brainsize to subarachnoid space volume exposes them more to SDH when shaken.

Conclusion

Subdural haematoma in children aged 2 to 24 months is a neurosurgical condition most often associated with abuse. It concerns more boys more than girls. It is usually bilateral and chronic in nature with association to extra cerebral lesions. Management includes several therapeutic methods: observation, transfontanellar puncture, external subdural diversion, subdural-peritoneal diversion, trephine, or flap craniotomy. The latter two methods being more invasive and less successful. Despite the progress in the management of subdural haematoma in children, sequelae are still significant.

References

[1] Dean Biron, Doug Shelton. *Perpetrator accounts in infant abuse head trauma brought about by a shaking*, Child Abuse and neglect 29

(2005) 1347-1358

[2] DIMITRA Tzioumi, R KIM Oates. *Subdural haematomas in children under 2years Accidental or inflicted, a 10-years experience.,* Child and abuse and neglect, Vol. 22, No. 11, p. 1105-1112, 1998

[3] Golden N., Mallawan S. MD. *Clinical analysis of non-accidental head injury in infants,* Journal of Clinical Neuroscience (2005)12(3), 235-239

[4] Helen Carty, Agnes Stone. Non-accidental injury: a retrospective analysis of a large cohort European Radiology (2002)12: 2919-2925

[5] Henry E Aryan, MD, Faris R Ghoshen MD, Rahul Jandial MD, Micheal Levy, MD, PHD. *Retinal hemorrhage and pediatric brain injury / etiology and review of the literature*, Journal of clinical neuroscience (2005), -624-631

[6] Ingra Talvik, Mairimännamaa, PiretJüri, KajaLeito, HaidePôder, MalleHâmarrik, PilleKool, Tina Talvik. Outcome of infants with inflicted traumatic brain injury (shaken baby syndrome) in Estonia) Actapaediatrica 96 PP. 1164-1168

[7] James King W., Morag MacKay, Angela Sirnick and The Canadian Shaken Baby Study Group. *Shaken baby syndrome in Canada: clinical characteristics and outcomes of hospital cases*, CMAJ • January 21, 2003; 168 (2)

[8] Joon-KhimLoh, MD, Chih-Lung Lin, MD, Aij-Lie Kwan, MD, Ph. D., and Shen-Long Howing, MD, Ph. D. *Acute subdural haematoma in infancy,* Surg. Neurol. 2002: 218-24

[9] Kourinth MC, . Lippitz, L B. Mayfrank and. Gilsbach J. M. *Subdural-Atrial and subdural-peritoneal shunting in infants with chronic subdural fluid collections.* Journal of Pediatric Surgery, Vol. 35, no 9 (September)2000: pp 1339-1343

[10] Mary E. *Cases Abusive head injuries in infants and young children*, Legal Medicine 9 2007)83-87

[11] Miguel Gelabert-Gonzales, Miguel Iglesias-Pais, Alfredo Garela-Allut, Ramon Martinez-Rumbo. *Chronic subdural haematoma: surgical treatment and outcome in 1000 clinical cases* Neurology and neurosurgery 107 (2005) 223-22

[12] PAULA Gerber, Karthyn Coffman. *No accident head trauma in infants*, Childs verv system (2007) 23: 4999 – 507

[13] Ronald H. USCINSKI. *Shaken Baby Syndrome: An Odyssey* Neurol. Med Chir(tokyo)46. 57-61. 2006

[14] Shilito J. Matson DD. *Craniotomy for excision of subdural membranes*, An Atlas of Pediatric Neurosurgical Operations. Philadelphia, PA, Saunders, 1982, pp 119-138

[15] Stephen Lazoritz and Sandra Baldwin, Narendra KINI. *The whiplash shaken infant syndrome: Has Coffey's syndrome changed or Have we changed his syndrome.* Child abuse and neglect, vol. 21 no. 10, pp 1009-1014, 1997

[16] Trench coats V. Curcoy Al. Navaro R. Pou J. *Subdural haematomas and physical abuse in the first two years of life*, Pediatrneurosurg 2007; 43(5); 352-7

[17] ValrieBiousse, MD, Daniel Y. Suh, MD, Nancy J. Newman, MD, Patricia C. Davis, MD, Timothy Mastone, MD, and Scott R. Lambert, MD. *Diffusion-weighted Magnetic Resonance Imaging in shaken baby syndrome*, American journal of ophthalmology (February 2002)vol, 133, No. 2