International Surgery Journal
Potdar NV et al. Int Surg J. 2017 Jul;4(7):2164-2169
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: http://dx.doi.org/10.18203/2349-2902.isj20172539

Original Research Article

Role of outer membrane histopathology and comparison of clinico-radiological aspects of chronic subdural hematoma in different age groups: a retrospective study

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Received: 12 May 2017
Accepted: 23 May 2017

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ABSTRACT

Background: The incidence of chronic subdural hematoma (CSDH) has been found to increasing in younger patients. This study was aimed to evaluate the role of outer membrane histopathology and comparison with the clinic-radiological aspects of chronic subdural hematoma in different age groups.
Methods: Cases of CSDH admitted to the Neurosurgery department during January 2014 and December 2016 were included in the study. They were analyzed clinically, radiologically like site, size, thickness in computed tomography, the attenuation value and midline shift. Histopathological features were also recorded. Cases of acute and chronic sub dural hematoma which were managed conservatively irrespective of age and sex were excluded from the study.
Results: Total 196 patients were included with median age of 66 yrs. The most common histopathological type of membrane was the scar inflammatory membrane (Type IV) in 43% of cases followed by hemorrhagic inflammatory membrane (Type III) in 31% of cases while the scar inflammatory type of membrane (Type II) was in 26% of cases. Young age group patient having less thickness of hematoma (<2cm) and having hyper density on CT scan. Old age group had more thickness(3.2cm) and mixed density with multiple layering.
Conclusions: Young age group patient having less thickness of hematoma and hyper density compared to old age group. Recurrence and bilateral disease were more common in old age group associated with brain atrophy. Histopathological study completes the spectrum of CSDH in terms of severity of disease and overall prognosis of patient.

Keywords: Brain atrophy, Chronic subdural hematoma, Histopathology, Inflammation

INTRODUCTION

Chronic subdural hematoma (CSDH) affects mainly elderly patients. Since the population continues to age, it has become a common neurosurgical disease seen by both general and specialized health-care practitioners. Because the proportion of people aged 65 years and older is expected to double worldwide between 2000 and 2030 a large rise in incidence is expected. Despite the benign nature of CSDH re-accumulation of hematoma is still a matter of concern, and disease progression can be fatal without timely surgical intervention. Nevertheless, the early diagnosis and proper treatment result in complete recovery in most cases.[1-6]

Although most clinicians focus on elderly in majority of studies, CSDH in young population is not rare in neurosurgical practice. Recent reports indicated the incidence of CSDH is not only in elderly but has also been increasing in younger patients. Whether the younger population differs from the elderly in clinical manifestation or significance has not been clarified so

far.[4,5] Therefore, in the present study, we retrospectively analysed symptomatic presentation, neurological grading, imaging findings, histopathology of outer membrane of the CSDH and surgical outcomes in patients with CSDH, and identify the differences in clinical details between different age groups.

METHODS

Design of this study was an institutional retrospective descriptive study among patients admitted under Neurosurgical department in the duration of January 2014 to November 2016. A total 196 patients were admitted and the burr hole evacuation of CSDH as surgical procedure were performed including recurrent cases during study period and patients enrolled in the study. Cases of acute subdural haematoma and cases of chronic sub dural hematoma which were managed conservatively irrespective of age and sex were excluded from the study. The study was approved by the institutional ethical committee.

Medical records and radiological finding were reviewed retrospectively. Demographic factor, head trauma history, underlying morbidity, taking of anti-platelets and other etiological factor comparison were made among each groups and histopathology of outer membrane of CSDH study. Patients divided into four groups, group 1 having age less than 45 consider as young age, group 2 having age between 46-60 consider as middle age, group 3 group having age 61-75 consider as older age and lastly group 4 having age more than 75 consider as elderly.

Statistical analysis

The data was analyzed using SPSS software (v16, IBM, NY, USA). Qualitative variables were compared using Chi-square test. Statistical significance was set at $P<0.05$.

RESULTS

Total 196 patients were admitted with CSDH and underwent burr hole and evacuation of CSDH. The youngest age of presentation was 1½ year with haematological disorder and oldest age of presentation was 92 years. Median age of presentation of CSDH in this study was around 66 years. Over all, there was male predominance, males 139 (70%), females were 57 (30%) (Table 1).

Table 1: Symptoms of CSDH.

Symptoms	Number of patient	Percentage
Headache	123	63
Vomiting	49	25
Limb weakness	107	54
Vertigo	17	8.7
Blurring of vision	2	1
Gait disturbance	113	57
Slurring of speech	16	8.2
Altered sensorium	54	28
Urinary and fecal incontinence	25	13
Bilateral disease	2	4.1
Recurrence	11	5
Tension pneumocephalus	2	1.1
Death	1	0.5
Wound infection	2	1.1

The clinical presentation of CSDH in overall patient were studied, in which we found that headache was the most common symptom of presentation (63%) followed by gait disturbances (57%), limb weakness, memory disturbances and speech impairment.

Table 2: Comparison of clinical presentation.

Total patient	<45	46-60	61-75	>75	P Value
	18 (9%)	53 (27%)	74 (38%)	50 (26%)	
Headache	13 (72%)	35 (66%)	43 (58%)	32 (64%)	0.648
Gait disturbances	11 (61%	31 (58%)	37 (50%)	34 (68%)	0.254
Limbs weakness	5 (27.5%)	27 (50.5%)	42 (57%)	33 (66%	0.041
Memory disturbances	4 (22%)	11 (21%)	18 (24%)	14 (28%)	0.855
Speech disturbances	2 (11%)	4 (7%)	11 (15%)	14 (28%)	0.035
Altered sensorium	6 (33%)	19 (36%)	20 (27%)	22 (44%)	0.274

The comparison among the 4 age groups were done, showing maximum no of patient were found in the age group 61-75 years 74 (38%) and male predominance of disease was found. Head ache was the most common presentation in all groups. Gait disturbances, limb weakness altered consciousness were found mostly in elderly and older group of patients. Memory disturbances was found more in elderly age group, speech impairment more in elderly age group and altered consciousness also common in elderly age group. In young age patients, we found that headache was the most common presenting complaint (Table 1 and 2).

pISSN 2349-3305 | eISSN 2349-2902

Table 3: Comparison between etiological factors.

	<45 (A)	46-60 (B)	61-75 (C)	>75 (D)	P1 value A vs B vs C vs D	P2 value A+B vs C+D
Total	18 (9%)	53 (27%)	74 (38%)	50 (26%)		
Female	6 (33%)	14 (26%)	14 (18%)	23 (46%)	0.039	0.805
Trauma	11 (61%)	34 (64%)	48 (64%)	42 (84%)	0.072	0.0042
Brain atrophy	0 (0%)	3 (5%)	66 (29%)	47 (94%)	0.001	0.0001
Bilateral disease	2 (11%)	2 (15%)	10 (13%)	15 (30%)	0.079	0.287
Drugs	7	24 (45%)	40 (54%)	29 (58%)	0.093	0.101
Recurrence	0	2 (3%)	6 (12%)	3 (6%)	0.5	0.196

Comparison of CT scan finding according to the age groups

Bilateral disease was found most commonly in elder age group and older age group patients. Brain atrophy also found to be more on elderly and older age group patients. Thickness of CSDH was more in elderly group of patients. Younger age group patient presented with more of isodensity on CT scan. Older age group patients presented more of mixed density with multiple layering on CT scan (Table 4).

Table 4: Comparison of the radiological findings.

Total patient	<45	46-60	61-75	>75	P value
Bilateral	2 (11%)	8 (15%)	10 (13%)	15 (30%)	0.079
Brain atrophy	0	3 (5%)	66 (89%)	47 (94%)	0.0001
Maximum thickness	1.6±0.3	2.8±1.1	3.1±0.5	3.2±1.6	
Density on CT	4-9-5	17-12-21	19-17-38	7-11-32	
Hypo	4 (22%)	17 (32%)	19 (25%)	7 (14%)	
Iso	9 (50%)	12 (23%)	17 (23%)	11 (22%)	
Mix	5 (28%)	21 (55%)	38 (52%)	32 (64%)	

Table 5: Comparison of the histopathological report of the outer membrane.

Age	<45	46-60	61-75	>75	Total
Type 1 membrane	0	0	0	0	0
Type 2 membrane	9 (4.5%)	20 (10%)	14 (7%)	5 (2.5)	48 (26%)
Type 3 membrane	7 (3.5%)	7 (3.5)	25 (12.5)	13 (6.5)	62 (31%)
Type 4 membrane	2 (1%)	16 (8%)	35 (17.5)	32 (16%)	85 (43%)

Comparison between the etiological factors in all age groups

There was male predominance of disease. Association of head trauma in each group is the main etiological factor with statically significance also. CSDH is associated with brain atrophy in elderly and older age group patient which was statically significant also.

When antiplatelet and anticoagulant therapy was the etiological factor, incidence was increased in younger population but our study did not reveal the statistically significant association. Bilateral disease was more in elder and older age group patients. Recurrence of disease was more in the older age group patients (Table 4).

Comparison between the outer membrane of CSDH in all age groups

There was no Type 1 membrane found in present study. The type 4 membrane was found in 85(43%) cases. Type 3 membrane was found in 62 (31%) cases and type 2 membrane was found in 48(24%) cases. Patients having age more than 60 having type 4 membrane in more prevalence as compared to the other type of membrane. Younger patient having type 2 membrane in more prevalence (Table 5).

Outcome of the CSDH in our study showed that patients were showing improvement in the symptoms. We found recurrence of disease more in elderly age group patient

(5%) having more fibrous membrane which required re exploration and second burr hole evacuation. Only one patient required decompressive craniectomy. The wound infection rate was 0.5%, we found that the tension pneumocephalus was found in only one patient for that we did reexploation and saline wash was given. Only one 83-year-old patient died in our study during the hospital stay after surgery (Table 1).

DISCUSSION

CSDH is nowadays considered to be a benign entity. CSDH is principally a disease of the elderly in whom physiological brain atrophy, frequent head trauma and several coagulopathic diseases are present. Miranda et al found that the overall mortality rates at 6months and 1 year were 26.3% and 32%, respectively, and concluded that CSDH in the elderly may not be a benign disease. Hence, the impact of age on the clinical manifestation and prognosis of CSDH should receive attention. As expected, the younger patients have fewer medical illnesses, such as hypertension, diabetes mellitus, stroke, or the requirement for antiplatelet therapy. By contrast, among patients with a prior head injury, the younger adults are often involved in violent motor vehicle accidents rather than trivial fall accidents. Despite these differences in predisposition in our series, the neurological state at admission, including the GCS score and Mark walder grade, did not differ between the four age groups. Current trends including liberal use of anti-platelets and anticoagulants, as well as longer life span due to well controlled medical diseases such as liver cirrhosis, hematologic malignancy and alcoholism yield higher prevalence of CSDH, especially in young patients.[6-8]

CSDH starts as a flat blood clot between the dura and the arachnoid membrane. Initially, it is not attached to the dura. Fibroblasts, growing from the dura into the clot, organize it. In 5-6 days, fibroblast growth causes the blood clot to be loosely attached to the dura. In 10-20 days, a loose fibrous membrane is formed between the dura and the clot (outer membrane). Fibrous tissue then grows around the edges of the hematoma and along its inner surface (inner membrane), encapsulating it completely. Maturation of connective tissue results, after several weeks or months, in the formation of a sac with a fibrous wall (chronic SDH). Blood in this sac is absorbed to a variable degree, and the cavity contains clear or hemorrhagic fluid and a loose, vascular connective tissue. Rupture of delicate vessels may cause repeated bleeding in the sac. Fluid may also leak into the cavity from immature capillaries. If a large amount of cerebrospinal fluid enters the subdural space during the traumatic event, it washes off the blood, and no clotting or organization takes place. The histological appearance of the sac is helpful in estimating the duration of the SDH.

Hence, our study highlights several clinical and radiological differences and histopathology of outer membrane between the younger and older population of CSDH. We had divided our patient into 4 groups according to the age basis and comparative study was done on the basis of clinical finding and radiological findings and histopathologically.

In this study, the young group of patients presented with headache as the most common presenting symptom as compared to other groups, other symptoms like gait disturbances, limb weakness, speech impairment has less incidence in young group of patients. As compared to young group patients, older patients also presented with headache as the main symptoms but older patients have more incidences of gait disturbances and limb weakness and altered sensorium (Table 2). This is due to the brain weight decrease as age progressed and space between the brain parenchyma and skull increase from 6% to 11% of total intracranial space. The late detection can lead to more severe neurological deficit in older age patient.[10] Elderly patient with dementia show slow progressive neurological disease seldom visit to hospital early in course of the disease because of the indefinite symptoms progression. Elderly patients can endure a larger volume of hematoma collecting in the subdural space before experiencing clinical symptoms. Young adult has less intra cranial capacity to allow hematoma expansion and deep cerebral distortion without increase in intracranial pressure, that's why young adult most commonly presented with headache as the presenting symptoms.[9-11]

Fogelholm et al observed that younger patients had more evidence of increased intracranial pressure, and older patients had more evidence of mental deterioration and pyramidal tract lesions. The same presentations were documented in other studies. In our investigation, hemiparesis occurred in 38% of younger CSDH patients and 60% of older patients. Tanaka et al suggest that CSDH may induce neurological dysfunction primarily through mechanical distortion of the central brain regions, such as the thalamus, with the influence on the remote regions attributable to trans neural depression. Unlike the aged, who have a decreasing brain volume, Therefore, the observation that young patients had more neurological deficits and a shorter interval from trauma to operation is a logical result of the physiological differences that occur in the brain.[9-12]

Comparison of CT finding between the different age groups

Young patients group has less thickness of CSDH, is dense in nature and less evidence of brain atrophy, less evidence of bilateral disease presentation. This indicate that high density area from low density area strongly suggest that recent major haemorrhage has occurred into a well-developed hematoma. Imaging characteristics indicate that repeated intra hematoma haemorrhage is unusual in young patient with CSDH and young age group patients have less evidence of brain atrophy. Elderly patient has more thickness of hematoma, more

evidence of bilateral disease and mixed in density with multilayering. Repeated bleeding into the hematoma cavity may induce new inflammatory process with accompanying neomembrane formation of septa which is responsible for compartmentization of hematoma cavity. As with the layering of the hematoma, young adult has lower frequency of rebleeding and shorter interval to diagnosis, the multiplicity of hematoma cavities is not common.[13-16]

Comparison of disease and etiological factors with different age group

In our study, CSDH has male predominance in each age group which is comparable with other studies also. Recent history of minor trauma to head as the main etiological factor in each age group which is statically significant also and this comparable to the other studies.[6] Brain atrophy is another etiological factor we found in this study which is statically significant also. Brain atrophy in young age group is less common as compared to older age group patient; this is also comparable with other studies. Bilateral disease also common in elderly and older age disease due to more evidence of brain atrophy which is also statistically significant.[12,13,15]

Comparison between the outer membrane of CSDH in all age groups

In our study, we found more number of type 4 membrane which was more common in the old age patient. There was multiple layering of the membrane more common in this age because of the recurrent hematoma formation and fibrosis and scarring of the membrane found, also old patient also having brain atrophy so here hematoma may get organised without causing much clinical symptoms initially. Younger patient having more prevalence of the type 2 membrane, this inflammatory in nature which causing more irritation of the brain so headache other pressure effect of the hematoma was more common in this age group.[17,18]

Histopathological typing of outer membrane in chronic subdural hematoma is recommended for following reasons.

- Membrane study acts as a rough guide to estimate the time since injury
- A retrospective analysis of the patient's clinical condition can be made if membrane report is known (Specially with Type II and III membranes)
- Membrane study helps in correlating the clinical and radiological parameters of a case of chronic subdural hematoma
- Role of membrane in hematoma evaluation can be roughly assessed.

CONCLUSION

CSDH is the disease of male predominance in all age group. In young age group patient, headache is the most common presenting symptom, as compare to the older age group having headache associated with cerebral hemispheric sign. Young age group patient having less thickness of hematoma (<2cm) and having isodensity on CT scan, old age group having more thickness(3.5cm) and mixed density with multiple layering. Recurrence and bilateral disease were more common in old age group. Trauma to head is most common etiological factor in each age group. Brain atrophy is etiological factor associated with old age group. Histopathological study of the membrane widens/completes the spectrum of CSDH in terms of severity of disease and overall prognosis of patient.

ACKNOWLEDGMENTS

Authors would like to thank valuable help of Dr. Ajith TA, Professor, Department of Biochemistry, Amala Institute of Medical Sciences, Thrissur, Kerala, India, during the preparation of this manuscript.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

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Cite this article as: Potdar NV, Kumar SS, Kaplinghat B. Role of outer membrane histopathology and comparison of clinico-radiological aspects of chronic subdural hematoma in different age groups: a retrospective study. Int Surg J 2017;4:2164-9.