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Morphometric Analysis of Chronic Subdural Haematoma Membrane with Clinicoradiological Correlation

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ABSTRACT

Background: Chronic Subdural haematomas (CSDHs) occur at a rate of 1 to 2 per 100,000 per year. Head trauma is identified in less than 50% of cases. Of special interest are thickness of the membrane and the extent of eosinophilic infiltration in the chronic subdural haematoma membrane. **Methods:** 52 patients of symptomatic CSDHs belonging to all age groups were included in this study. Recurrent CSDH were excluded. Patients were operated at emergency operation theatre and the outer membrane of CSDHs excised. Specimens were stored in 10% formalin solution. Then paraffin embedding was done and prepared slides stained with Haematoxylin and Eosin stains. They were analyzed microscopically for eosinophilic infiltration. The thickness was measured by ocular micrometer. **Results:** 100% of cases in this study (52/52) showed the presence of eosinophils, with moderate to marked infiltration in 16 cases (30.76%). This study correlated CSDH membrane thickness and its eosinophilic infiltration with midline shift, recurrence and duration of the onset of symptoms. Out of 52 cases, there were 4 (7.7%) cases of recurrence. This study did not show any statistically significant correlation between thickness of the membrane, eosinophilic infiltration, duration and recurrence of the CSDH. **Conclusion:** This study depicted that there was no statistically significant correlation between thickness of the membrane and eosinophilic infiltration in CSDH membrane.

Keywords: Chronic Subdural haematomas, Eosinophilic infiltration, Membrane thickness.

INTRODUCTION

Chronic Subdural haematomas (SDHs) generally occur in the elderly, with the average age of occurrence at 63 years. Head trauma is identified in less than 50% of cases. Other risk factors are alcohol abuse, seizures, cerebrospinal fluid shunts and coagulopathies.[1] Eosinophilic leucocytes in the outer membrane of chronic subdural hematomas were demonstrated in 1956 by Christensen.[2] The significance of this phenomenon was discussed by Wrede in 1968 and Fujioka et al.[3,4] in 1983. While some reviews on these lesions make no mention of the presence and possible functions of these cells,[5,11-17] several others have found them to be a peculiarly regular feature.[4,6] Eosinophils play an important role in the growth of CSDHs.A range of pro-inflammatory cytokines have been shown to be significantly raised in CSDH compared with serum: IL-2R, IL-5, IL-6 and IL-17,[7,8] whilst others have been shown to have reduced levels: TNF-α, IL-1β, IL-2 and IL-4. However, the manner in which eosinophils accumulate within CSDH fluid remains undetermined. Eotaxin-3 is a chemoattractant of eosinophils. Eotaxin-3 is a chemokine with a specific role for attracting eosinophils and is important in contributing to the fibrosis contributing to CSDH membrane growth.[8] IL-5 induces the activation of eosinophils subsequent to degranulation of eosinophil-derived neurotoxin (EDN) into CSDH fluids. These factors may serve as novel therapeutic targets for managing CSDH. . One study has shown increase in eosinophilic infiltration with the increase in duration of symptoms.[9] Hence understanding their etiopathological nature is important. The brain constitutes an immunologically privileged site protected from immune surveillance except when the blood-brain barrier is breached.[10,14-17]

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AIMS AND OBJECTIVES

- To find out the association if any, between membrane thickness and eosinophilic infiltration.
- To correlate the thickness of the membrane and eosinophilic infiltration with midline shift and recurrence of Chronic Subdural Hematoma.

MATERIALS AND METHODS

Study Design:

52 symptomatic CSDH patients were studied from September 2016 to December 2017.It is a descriptive prospective study.

Inclusion and Exclusion criteria:

Symptomatic chronic subdural haematoma of any age or sex were included. Recurrent chronic subdural hematomas that had been operated for the initial hematomas during this study period were also included.

Chronic subdural hematoma associated with other intracranial hematomas, subdural hygroma, and subdural empyema was excluded.

Methods:

All patients included in the study were clinically and radiologically assessed with cerebral computed tomography scans. Patients were operated at emergency operation theatre by a burrhole craniostomy under local anesthesia with sedation or general anesthesia. Outer membranes of chronic subdural hematomas membrane were excised. Specimens were stored in 10% formalin solution. Then paraffin embedding was done and prepared slides stained with Haematoxylin and Eosin stains. They were analyzed microscopically for eosinophilic infiltration. The thickness was measured by ocular micrometer. Multiple readings were taken and average calculated by a single pathology consultant.

Thickness of the membrane was graded as follows:

- Grade I – 0.1 – 0.29mm
- Grade II – 0.3 – 0.49mm
- Grade III - >=0.5mm

The extent of eosinophilic infiltration was graded as below:

- Grade I – <1-1 per sq mm
- Grade II – 2-4 per sq mm
- Grade III – 5 – 10 per sq mm
- Grade IV - > 10 per sq mm

Duration:

The cases were classified as per the duration of the lesion (i.e. date of trauma and/or onset of clinical symptoms to date of surgery) into three groups:

- Group I: 1–30 days
- Group II: 31–90 days (1 month to 3 months)
- Group III: >90 days (>3 months).

RESULTS

52 patients of CSDHs of various age groups underwent operative intervention in 18 months of the study. The youngest patient was 22 year old and the oldest was 91 year old. We had 14 female and 38 male patients in this study with a male: female ratio of 2.7: 1. Number of recurrence in this study period was 4. Eosinophils were found in the membrane of all cases of CSDHs. The eosinophilic infiltrations were either diffusely distributed or in agglomerations within the membrane. The eosinophils were generally intact or sometimes disrupted and degranulated. The other cells in the inflammatory infiltrate consisted of neutrophils and plasma cells which were present in all cases.

Table 1: Distribution of patients according to thickness of the memberane (n=52)

Thickness of the memberane (mm)	Number of cases
I (0.1-0.29)	15 (28.8%)
II (0.30-0.49)	19 (36.5%)
III (>=0.5)	18 (34.6%)
Total	52

Table 2: Distribution of patients according to Thickness of the membrane with Eosinophilic infiltration (n = 52)

Thickness of membrane (mm)	Eosinophilic infiltration (sq.mm)			
	I (<1-1)	II (2-4)	III (5-10)	IV (>10)
I (0.1 – 0.29)	10 (19.2%)	2 (3.8%)	1 (1.9%)	2 (3.8%)
II (0.30 – 0.49)	5 (9.6%)	8 (15.3%)	3 (5.7%)	2 (3.8%)
III (>=0.5)	5 (9.6%)	7 (13.4%)	3 (5.7%)	4 (7.6%)
Total	20	17	7	8

P value > 0.05

Table 3: Distribution of patients according to Thickness of the membrane with Midline shift (n = 43*)

Thickness of the membrane (mm)	Midline shift (mm)	
	<10	<10
I (0.1 – 0.29)	3(6.9%)	10(23.2%)
II (0.30 – 0.49)	4(9.3%)	12(27.9%)
III (5 & >5)	4(9.3%)	10(23.2%)
Total	11	32

*9 Patients of bilateral chronic SDH were excluded. P value = 0.94 (>0.05)

Table 4: Distribution of patients according to Thickness of the membrane with Recurrence (n = 52)

Thickness of the membrane (mm)	Recurrence	
	Present	Absent
I (0.1 – 0.29)	1(1.9%)	14(26.9%)
II (0.30 – 0.49)	1(1.9%)	18(34.6%)
III (5 & >5)	2(3.8%)	16(30.7%)
Total	4	48

P value = 0.78 (>0.05)

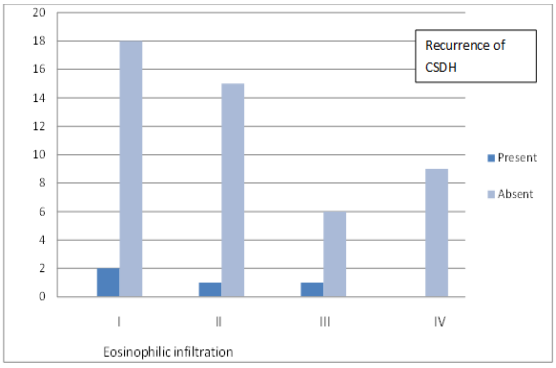

Figure 1: Distribution of patients according to eosinophilic infiltration with recurrence of CSDH. Recurrence (2 of 4) occurred in the grade I eosinophilic infiltration group. Chi square =0.24, P value =0.88 (> 0.05)

Figure 2: Distribution of patients according to eosinophilic infiltration with midline shift. Chi square =1.70, P value =0.636 (>0.05)

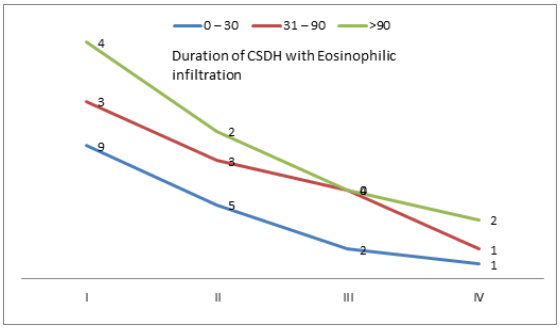

Figure 3: Distribution of patients according to eosinophilic infiltration with duration of CSDH.

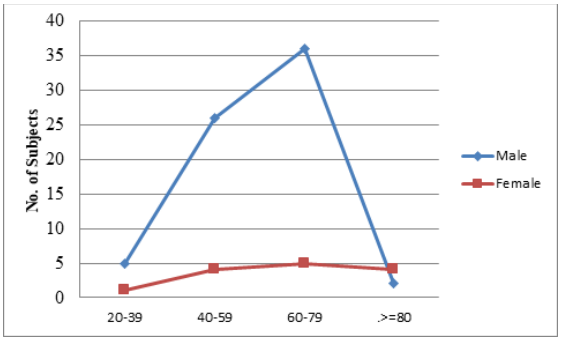

Figure 4: Age and sex distribution of patients.

[Table 1] show that most of the cases of our study group were almost equally distributed according to the thickness of the membrane.

[Table 2] depicts that there is no statistically significant correlation between thickness of the membrane and eosinophilic infiltration.

[Table 3] shows that there is no statistically significant correlation between thickness of the membrane and midline shift of the CSDH.

[Table 4] does not show any statistically significant correlation between thickness of the membrane and recurrence of the CSDH.

DISCUSSION

The finding of eosinophils at various stages of haematoma evolution, have aroused speculation on their role.[7,8] This assumes greater significance in view of the fact that eosinophils are neither resident in the nervous system nor do they form the usual cell type in fresh or resolving haematomas elsewhere in the body. The external membrane is considered more crucial in driving CSDH growth.

100% of cases in this study (52/52) showed the presence of eosinophils, with moderate to marked infiltration in 16 cases (30.76%). Our study depicts that there is no statistically significant correlation between thickness of the membrane and eosinophilic infiltration [Table 2]. The study also shows that there is no statistically significant correlation between thickness of the membrane and midline shift [Table 3] of the CSDH (p value = 0.94). This study does not show any statistically significant correlation between thickness of the membrane and recurrence [Table 4] of the CSDH (p value = 0.78, >0.05). However there is increase in chance of recurrence where thickness of the membrane is 5 or >5mm. Correlation of eosinophilic infiltration with recurrence of CSDHs [Figure 1], midline shift [Figure 2] and duration of hematoma [Figure 3] are also not statistically significant. There was no association of eosinophils with gender or age [Figure 4] of the patients in contrary to female preponderance shown in some studies.[9]

CONCLUSION

No specific clinical cause for tissue eosinophilia was identified in the cases reviewed. Recognition of eosinophilia as a pathological feature of organizing CSDH is important in order to avoid confusion with other diagnoses. Eosinophils appear at such unusual site probably due to chemotactic stimulus abetted by the mast cells as well as lymphocytes and haemosiderin pigments. The eosinophils may have an important role in the repair and healing process of these membranes.

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