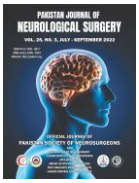

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Original Article

Relationship between Postoperative Pneumocephalus and Recurrence Following Chronic Subdural Hematoma Evacuation

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ABSTRACT

Objective: Postoperative pneumocephalus has been reported as one of the possible causes of increased recurrence following burrhole evacuation of chronic subdural hematoma (ChSDH). The present study was designed to assess the relationship between postoperative pneumocephalus and recurrence following ChSDH evacuation.

Materials and Methods: The clinical data of sixty-eight patients that had been operated on for ChSDH evacuation with burrhole drainage were retrospectively analyzed. The area of the pneumocephalus was measured in the slice where the size of the pneumocephalus was the biggest. The patients were then divided into the recurrent and the non-recurrent groups and compared for their association with the postoperative pneumocephalus. Patients with a pneumocephalus size of> 4 cm^2 were also compared with those in whom the pneumocephalus was≤ 4 cm^2 for recurrence.

Results: Fourteen (20.6%) patients had a recurrence following burrhole evacuation of ChSDH. The mean size of the pneumocephalus in the recurrent group was 7.88 ± 5.12 cm^2 and in the non-recurrent group was 6.56 ± 5.56 cm^2. The size of the pneumocephalus wasn't statistically different (p = 0.42) between the recurrent and the non-recurrent groups. We also compared patients with a pneumocephalus size of > 4 cm^2 with those in whom the pneumocephalus was ≤ 4 cm^2 and again found that the relationship with recurrence was not significant (p = 0.556).

Conclusion: We conclude that postoperative pneumocephalus is not associated with recurrence following burrhole evacuation of ChSDH.

Keywords: Postoperative pneumocephalus, burrhole evacuation, recurrence, chronic subdural hematoma.

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INTRODUCTION

ChSDH is one of the most common pathologies operated in the neurosurgical department.[1-3]

Burrhole evacuation of ChSDH is the most common surgical procedure employed for evacuation of a ChSDH.[1-6] The recurrence rate is high and ranges from 2.3 – 33%.[1,2,4,7,8,9] Recurrence after chronic subdural evacuation worsens the clinical outcome and leads to increased mortality.[3,8,10,11] It has been a continuous endeavor of the neurosurgical community to identify risk factors that lead to increased recurrence.[11] Numerous studies have been carried out to identify risk factors associated with increased postoperative recurrence of ChSDH.[2,4,5,7] These studies have led to the identification of multiple radiological factors such as hematoma density, its width, and the preoperative midline shift that could lead to increased recurrence.[5, 8] One such factor that could lead to increased recurrence is the presence of postoperative pneumocephalus following ChSDH evacuation.[12] Pneumocephalus is a common occurrence after ChSDH evacuation.[2,3,10,13] Some authors have identified a relationship between the presence of postoperative pneumocephalus and ChSDH recurrence. They reported that postoperative pneumocephalus after ChSDH evacuation was associated with increased recurrence.[1,2,4,7] Others have differed and concluded that postoperative pneumocephalus does not lead to increased recurrence.[13] We aimed to study the postoperative CT brain of the patients operated on for ChSDH evacuation and try to ascertain if a relationship exists between postoperative pneumocephalus and ChSDH recurrence.

MATERIALS AND METHODS

A retrospective analysis of the medical data of the patients that had been operated on for ChSDH evacuation in the neurosurgical center of Lahore General Hospital from June 2013 to May 2014 was carried out. As the data was collected and analyzed retrospectively so approval from an ethical board was not required.

Inclusion Criteria

All the adult patients that had been operated on with a single or double burrhole for ChSDH evacuation and with or without postoperative subdural drainage in which a preoperative CT, as well as a postoperative CT, obtained within seventy-two hours were available were included in the study.

Exclusion Criteria

Patients developing postoperative complications such as a subdural empyema, acute subdural hematoma, or an ICH (intracerebral hematoma) were excluded from the study. Patients that had undergone a craniotomy for ChSDH evacuation were also excluded from the study.

Patient Management Protocol

A CT brain had been obtained in all the patients within three days postoperatively. The area of the pneumocephalus was measured in the slice where the size of the pneumocephalus was the biggest. The patients were then divided into the recurrent and the non-recurrent groups and compared for their association with the postoperative pneumocephalus. All the patients had been followed for more than two months postoperatively.

Statistical Analysis

We compared the pneumocephalus size in the recurrent and the non-recurrent groups using an independent t-test. Patients with a pneumocephalus size of > 4 cm^2 were also compared with those in whom the pneumocephalus was ≤ 4 cm^2 for assessing the association with recurrence using a Chi-square test. The results were to be considered significant if the p-value was < 0.05.

RESULTS

Gender Distribution

Our study consisted of sixty-eight patients. Fifty-six were males and twelve for females.

Age Distribution

In the recurrent group, the mean age was 62.5 years. In the non-recurrent group of patients, the mean age was 64.3 years.

Table 1: Relationship between the size of postoperative pneumocephalus and recurrence.

	Recurrent (n = 14)	Non-recurrent (n = 54)	p-value
Size of the pneumocephalus Mean ± SD (cm^2)	7.88 ± 5.12	6.56 ± 5.56	0.42

Table 2: Comparison of patients with a pneumocephalus > 4 cm^2 and those with ≤ 4 cm^2 for association with recurrence

Size of the Pneumocephalus	Recurrent (n = 14)	Non-recurrent (n = 54)	p-value
> 4 cm^2	9 (64.3%)	30 (55.6%)	0.556
≤ 4 cm^2	5 (35.7%)	24 (44.4%)	

Postoperative Pneumocephalus Size and Association with Recurrence

Fourteen (20.6%) patients had a recurrence following burrhole evacuation of ChSDH. The mean size of the pneumocephalus in the recurrent group was 7.88 ± 5.12 cm^2. The mean size of the pneumocephalus in the non-recurrent group was 6.56 ± 5.56 cm^2. The size of the pneumocephalus wasn't statistically different (p = 0.42) between these groups as shown in table 1.

In the recurrent group in 9 (64.3%) patients the size of the pneumocephalus was > 4 cm^2 and in 5 (35.7%) patients the size of the pneumocephalus was ≤ 4 cm.[2] In the non-recurrent group in 30 (55.6%) patients the pneumocephalus was> 4 cm^2, and in 24 (44.4%) patients the size was ≤ 4 cm^2. This difference turned out to be non-significant (p=0.556) as depicted in Table 2.

DISCUSSION

Numerous studies have been carried out to identify risk factors that increase the recurrence rate following ChSDHevacuation.[2,4,5,7,14] The radiological factors that have been studied for their association with increased recurrence include the preoperative midline shift, the width of the hematoma, and the pattern/density of the hematoma and its laterality.[5,7,14,15,16,17,18] Pneumocephalus is a common finding after ChSDH evacuation and many authors have studied its relationship with ChSDH recurrence. The purported mechanism for increased recurrence is that pneumocephalus leads to the widening of the subdural space which creates a low-pressure area into which there may then be an accumulation of venous blood. Also, the adherent neomembranes may get separated and the veins may get disrupted which leads to hematoma formation.[2] You et al,[19] in their study found that postoperative pneumocephalus led to an increased recurrence rate of 32.6% compared to 17.7% in patients without pneumocephalus and also worsened the clinical outcome. Ito et al,[4] in their study also reported that postoperative pneumocephalus after burrhole drainage significantly increased recurrence. Ohba et al,[7] also concluded that a massive postoperative pneumocephalus tended to be associated with ChSDH recurrence. Multiple other authors reached a similar conclusion.[1,2,3,7,17,20] Stanisic et al[15] in their study on 121 chronic subdural hematoma cases found that although a large pneumocephalus led to increased recurrence the association was not statistically significant. Huang

et al,[13] however, reached a different conclusion. They found that ChSDH recurrence was not associated with postoperative pneumocephalus and that the recurrence rate wasn't different between patients with and without pneumocephalus.

In our study, the recurrence rate was 20.6% which fell between the 2.3 – 33% ranges quoted in the literature. We found that the size of the postoperative pneumocephalus did not differ significantly (p = 0.42) between the recurrent and the non-recurrent groups. Ito et al,[4] in their study had stated that they considered the size of the pneumocephalus to be significant when it was > 4 cm^2 in 1 axial CT slice. We also compared patients with a pneumocephalus size of > 4 cm^2 with those in whom the pneumocephalus was ≤ 4 cm^2 and again found that the relationship with recurrence was not significant (p = 0.556). Our findings are thus similar to the findings reported by Huang et al,[13] who had concluded that ChSDH recurrence was not associated with postoperative pneumocephalus and that the recurrence rate wasn't different between patients with and without pneumocephalus. We thus conclude that postoperative pneumocephalus is not associated with recurrence following burrhole evacuation of ChSDH.

LIMITATIONS

We gathered our data from a single neurosurgery department. Furthermore, the data had been studied retrospectively and the sample size was also small. A prospective study wherein the patient population is larger and with data acquired from multiple neurosurgery departments is required to establish the relationship that exists between postoperative pneumocephalus and ChSDH recurrence.

CONCLUSION

We conclude that postoperative pneumocephalus is not associated with recurrence following burrhole evacuation of chronic subdural hematoma.

RECOMMENDATIONS

Postoperative pneumocephalus following ChSDH evacuation should not raise suspicion for increased recurrence as it was found not to be associated with recurrence, and its presence does not require any specific treatment.

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Additional Information

Disclosures: Authors report no conflict of interest.
Ethical Review Board Approval: As the data was collected and analyzed retrospectively so approval from an ethical board was not required
Human Subjects: Consent was obtained by all patients/participants in this study.
Conflicts of Interest:
In compliance with the ICMJE uniform disclosure form, all authors declare the following:
Financial Relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.
Other Relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

AUTHORS CONTRIBUTIONS

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Imran Altaf	1. Study design, paper writing, referencing, and methodology.
3.	Imran Altaf & M. Rizwan Sarwar	3. Data collection, analysis, interpretations, and calculations.