

Stereotaxis

Stereotactic biopsy complicated by pneumocephalus and acute pulmonary edema

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Abstract

Background: The aim of this study was to describe pneumocephalus as a rare complication of stereotactic biopsy and as a possible cause of acute neurogenic pulmonary edema.

Case Description: A case of frameless stereotactic biopsy complicated by pneumocephalus presenting with acute lung injury 48 hours after the procedure. A frameless stereotactic procedure was performed in the standard fashion. Immediate postoperative CT showed no intracranial air except for a gas inclusion at the biopsy site within the lesion. The skin staple placed at the end of surgery on the skin incision was removed 36 hours later. A CT scan performed 48 hours postoperatively showed new pneumocephalus. The patient exhibited acute respiratory distress but no new neurologic symptoms. There was no detectable systemic cause for the pulmonary edema. The patient received supportive respiratory treatment and fully recovered.

Conclusion: Pneumocephalus is apparently a rare complication of stereotactic brain biopsy and one that may result from early removal of the skin staple or suture. The occurrence of acute neurogenic pulmonary edema may be attributed to the pneumocephalus.

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Keywords:

Neurogenic pulmonary edema; Pneumocephalus; Stereotactic biopsy

1. Introduction

Stereotactic brain biopsies are carried out routinely in neurosurgery. The main indications for performing them are when patients at high surgical risk need tissue diagnosis of brain lesions, when lesions are situated in eloquent areas associated with high surgical morbidity, and for patients harboring multiple lesions not diagnosed by other means. Stereotactic biopsies are associated with a low rate of morbidity and mortality. The main complication, hemorrhage, occurs in about 2% to 8% of cases [9,12,13,34], and most cases remain asymptomatic and require no specific treatment. The permanent morbidity rate is about 1% to 4%, and mortality is 0% to 1% [9,12,13,34], both related to hemorrhage or perioperative mortality from systemic causes. We present a rare complication of massive pneumocephalus and acute lung injury that appeared 48 hours after a

frameless stereotactic biopsy and discuss the possible pathophysiology of this unusual complication.

2. Case report

A 79-year-old right-dominant male presented with new-onset right hemiparesis. The patient had undergone an aortic valve replacement (to a biologic valve) 2 years previously. He also suffered from hypertension and paroxysmal atrial fibrillation and was being treated with aspirin. On physical examination, the patient had a Karnofsky performance score of 60 and right hemiparesis of 4/5. Brain CT (Fig. 1A) demonstrated a deep-seated left parietal lesion with minor mass effect.

The patient underwent a frameless stereotactic biopsy. Under local anesthesia (lidocaine 200 mg and bupivacaine 100 mg), and with the head fixed in a Mayfield head holder (Mayfield head holder, OMI, Cincinnati, Ohio), a needle fixator was placed against the left parietal area. The entry point and trajectory were planned preoperatively with a navigation system (BrainLab, Heimstetten, Germany).

Abbreviations: CSF, cerebrospinal fluid; CT, computed tomography; DBS, deep brain stimulation; WHO, World Health Organization.

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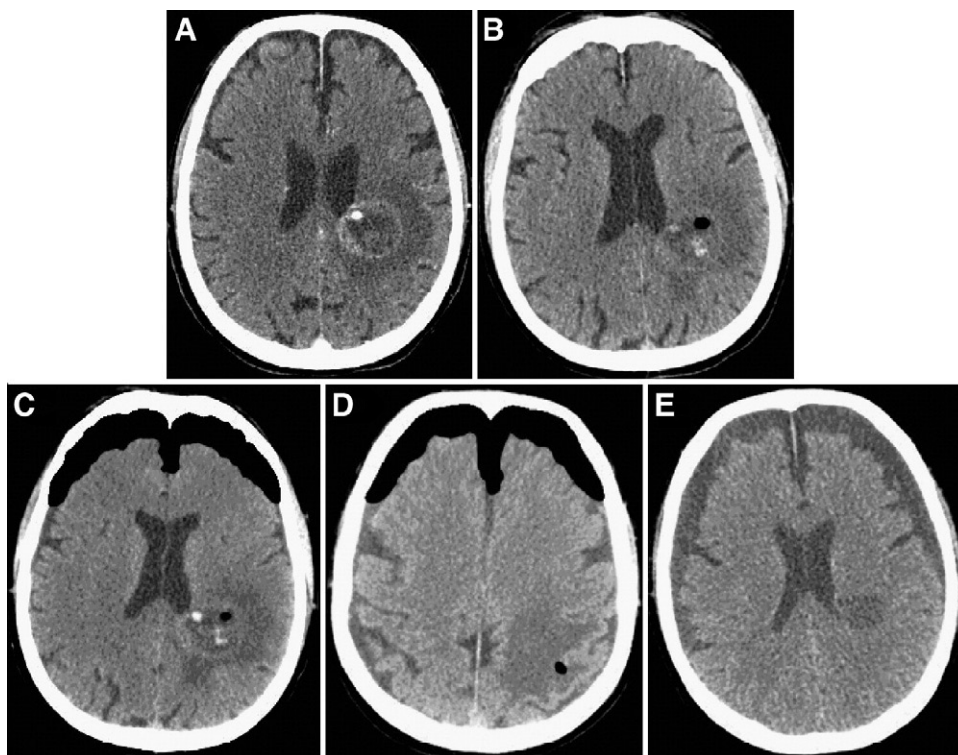


Fig. 1. A: Preoperative CT showing a deep-seated left parietal lesion. B: Immediate postbiopsy CT showing an air bubble and a small hemorrhage within the lesion. C: CT performed 48 hours post biopsy showing pneumocephalus and (D) a new air bubble in the needle's tract. E: CT performed 6 days post biopsy showing filling of the subdural cavity with fluid and resolution of the pneumocephalus.

Under local anesthesia, a 3.2-mm twist drill hole was used to penetrate the scalp and the cranium. The dura was coagulated with monopolar cautery, and the biopsy needle (Sedan 2.5 mm, Elekta, Sussex, UK) was introduced according to the planned trajectory. Two tissue specimens were obtained. After confirmation of pathologic tissue by frozen section, 2 additional biopsies were performed, and the needle was withdrawn. A staple was placed on the skin incision. The patient had an uneventful recovery from the procedure. Immediate postoperative CT revealed a negligible bleed and gas within the lesion (Fig. 1B). The patient was discharged 36 hours after surgery, and the skin staple was mistakenly removed shortly before discharge (the routine protocol is to remove the staples 7–10 days after surgery). Eight hours later, the patient returned to the emergency department, presenting with respiratory distress and hypoxemia. There were no new neurologic findings. The small biopsy wound was open, and no CSF leak was evident, and the patient and his family denied the presence of any leak previous to readmission. The chest x-ray showed bilateral alveolar infiltrates with a $\text{PaO}_2/\text{FIO}_2$ ratio of 200 in arterial blood gases. There were no electrocardiographic changes, and cardiac enzymes were within normal range. A brain CT scan demonstrated pneumocephalus (Fig. 1C); there was no skull fracture, and some air was detected in the tract of the biopsy needle (Fig. 1D). The surgical wound was closed again with a staple and covered with Vaseline gauze (Vernon-Carus Limited, Lancashire, UK). The patient was

admitted to the general intensive care unit, where he was maintained in a ventilated state. He was diagnosed as suffering from severe acute lung injury and underwent a systemic workup, which revealed normal blood, urine, and CSF cultures. An echocardiogram showed no cardiac cause for the pulmonary edema. He was treated empirically with antibiotics and diuretics and slowly recovered to his baseline status. Follow-up CT scans performed 4 days after admission showed resolution of the pneumocephalus (Fig. 1E). The final pathologic diagnosis was an anaplastic astrocytoma (WHO III).

3. Discussion

Stereotactic brain biopsies are routinely performed as diagnostic procedures in patients at high surgical risk and in those with lesions situated in eloquent or deep anatomical sites that have a high morbidity rate. The diagnostic yield of stereotactic biopsies has been previously noted to be about 90% to 98% [12–14,34].

Stereotactic biopsy-related complications include bleeding that occurs in up to 8%, whereas the permanent morbidity rate is 1% to 4%, and the mortality rate is 0% to 1% [9,12–14,34]. Morbidity risk increases in brainstem or pineal region biopsies and a low ($<150,000/\text{mm}^3$) platelet count [9]. Other factors, such as patient's age and sex, number of biopsies obtained, history of hypertension, periventricular biopsy targets, and aspirin use until 5 days

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