We describe a drain that is implanted at operation for a chronic subdural hematoma. The drain provides access to the subdural space and can therefore be used for percutaneous aspiration of reaccumulation of subdural effusions.

Although a variety of treatment modalities for chronic subdural hematomas have been advocated [1, 2, 3, 11, 12, 14, 17, 19, 20, 21, 22, 24, 26, 27], it is an accepted practice to treat these lesions by simple evacuation through burr holes as first recommended by Gardner [8], and by Fleming and Jones [6]. The rate of postoperative recurrences after simple burr-hole evacuation may range between 8 and 20% [15, 23]. Although mortality is usually lower after burr-hole drainage, it has been reported to vary from 6 to 25% [5, 15]. If the first effort at surgical treatment of chronic subdural hematoma fails, repeated surgical procedures have been recommended. Most reported postoperative morbidities and mortalities occur in patients who require these additional surgical procedures [23]. Of Svien and Gelety's patients who died (7.2%), all had required reoperation [23].

Several groups of patients appear to be particularly vulnerable to development of subdural hematomas and to postoperative recurrences. These include chronic alcoholics; the elderly; patients on anticoagulants, hemodialysis, or with coagulopathies; infants and children with subdural effusions; and patients with cerebrospinal fluid shunts [3, 4, 7, 9, 10, 13, 16, 25]. Postoperative recurrences tend to occur shortly after the operation rather than later [23].

We have developed a simple implantable device* that provides direct and safe access to the subdural space. This mushroom-shaped instrument, which is made of silicone rubber, is placed in the burr hole at the time of the initial operation. The device has a low-profile dome that rests on the surface of the skull, and the stem fits into the burr hole and reaches the subdural space (Figs. 1, 2). The device is hollow, and the dome of the device, or reservoir, communicates with the subdural space through a hollow lumen in the stem. The dome can be punctured repeatedly with a needle, thereby allowing repeated aspirations of fluid from the subdural space.

The device was used in 25 selected patients, the distribution of which is shown in the Table. In 3 of the patients, the drain was placed at the time a recurrent subdural effusion was evacuated, while in the remaining 22 patients the drain was installed during the initial surgical intervention. Five of our patients had reaccumulated subdural effusions within the postoperative period as evidenced by evolving neurological deficit or recurrent headache and confirmed by computed tomography (CT) scan. The subdural effusions were drained by percutaneously needling the dome of the drain and gently aspirating the fluid with the patient in the recumbent position and the head tilted to the side of the drain. This procedure was curative in 4 of the patients as confirmed by repeat CT scan. However, 1 patient with hydrocephalus, who had a shunt, developed evidence of acute and chronic effusion and, despite repeated aspiration, continued to accumulate subdural blood and required a large craniotomy and stripping of membranes which was curative. We followed 8 patients for more than two years, 19 patients for more than one year, and 6 patients for less than one year. Within six weeks of their operations, 22 patients made a complete recovery, 3 patients had an incomplete recovery, and no patient deteriorated. There was no infection or other device-related complication in this series. A representative case report follows.

Case Report
A 46-year-old right-handed man on chronic dialysis because of renal failure secondary to polycystic kidney disease was admitted to The New York Hospital with a history of headaches for three weeks followed by sudden obtundation and loss of consciousness during dialysis on the day of admission. On neurological examination the patient was comatose, decerebrate, and responsive only to painful stimuli. The pupils were nonreactive, with a poor doll's eyes sign, a left Babinski reflex was present. His spontaneous respiration ceased during the examination, requiring

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endotracheal intubation and assisted respiration. A CT scan revealed a massive left subdural hematoma. The patient was taken to the operating room while mannitol and dexamethasone were started. A large subdural hematoma was drained through conventional burr holes. The patient's condition improved and he resumed spontaneous respirations. A residual left superior quadrant homonymous defect in the visual field and a left hemiparesis were noted, but the patient progressively improved over the following days. A Tenckhoff peritoneal catheter was placed to avoid hemodialysis and the use of heparin and to permit the patient to be dialyzed peritoneally. On the ninth postoperative day the patient became obtunded and a dense left hemiparesis was noted. At the bedside the subdural drain that had been installed at the previous operation was punctured and 60 ml of port-wine fluid was removed from the hematoma. Immediately thereafter the patient woke up and neurological improvement was noted. Repeated aspirations of the drain in the next two days were performed and 20 ml of fluid was removed daily; the patient continued to improve. A neurological examination prior to his discharge still revealed a homonymous hemianopia and a mild hemiparesis. A CT scan was normal and no residual hematoma or shift of the brain was noted. The patient had a normal neurological examination on a visit four weeks after his discharge.

Comment
We believe the device described to be invaluable in cases of subdural hematoma at high risk of recurrence. It allows repeated aspiration at the bedside as soon as there is evidence...
of recurrent accumulation of fluid or evolving neurological
deficit, thus avoiding further surgical intervention.

Some advantages of this device are obvious. It is simple
to place, and it is unobtrusive. It may be used for post-
operative drainage [2, 5], intermittent suction [18], and for
monitoring decompression rate [24]. It may be implanted
bilaterally. Since it is a foreign body, its use should be
avoided in septic patients or where the risk of infection is
high.

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