

potential for collaborative regional strategies to improve both the detection of and, more importantly, the prevention of HO-MRSA.

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When an Infection Prompts Removal of an Unnecessary Device

In recent decades, there has been a worldwide increase in the number of implanted devices, including neurosurgical shunts. Device-related infection represents a worrisome complication, and the prevention of such infections is primarily based on the use of aseptic measures during device insertion, proper management of the device itself, and perioperative antibiotic prophylaxis when needed. Over the long term, however, the

best preventive approach remains the removal of the device when it is no longer necessary.

Cerebrospinal fluid (CSF) shunts significantly improve the quality of life for patients with hydrocephalus, and the insertion rate has dramatically increased over the past 20 years.¹ In the United States, 40,000 neurosurgical ventricular shunts are inserted annually.² The rate of shunt-associated infections ranges from 1% to 18%, and such infections are associated with high morbidity and mortality.³ Assessment of the optimal functioning of a CSF shunt is subject to variation, and once a CSF shunt is inserted, it almost always remains for the life of the patient. However, CSF shunt independence (ie, a shunt that is no longer necessary), although uncommon, is not exceptional.⁴ We describe two cases in which a CSF shunt infection prompted the recognition of shunt independence and led to the removal of the shunt.

A 67-year-old woman with chronic kidney disease presented with an 8-month history of intermittent fever, neutrophilia (white blood cell [WBC] count, 16,000 cells/mm³), elevated C-reactive protein (CRP) level, and elevated erythrocyte sedimentation rate (ESR). Three years earlier, she had had a road traffic accident complicated by an intracerebral hemorrhage and subsequent hydrocephalus that was treated with insertion of a ventriculoatrial shunt. Methicillin-resistant *Staphylococcus epidermidis* was isolated from 3 consecutive blood cultures. A transesophageal echocardiogram revealed vegetations 4 and 8 cm in diameter that were adherent to the shunt and located on the tricuspid valve, respectively (Figure 1). Treatment with intravenous daptomycin (6 mg/kg/day) was commenced. After 3 days, defervescence was observed, and the patient's WBC count and inflammatory markers decreased. On day 10 after presentation, the patient experienced tachypnea and fever. Computed tomography (CT) of the chest revealed septic emboli. Daptomycin therapy was continued, and on day 15, blood cultures showed no growth and chest radiograph findings were unremarkable. The shunt was externalized, and 10 mL was drained over a 24-hour period without radiological signs of hydrocephalus, which suggested shunt independence and led to the definitive device removal.

A 21-year-old man was admitted to the hospital with a 30-day history of intermittent fever and headache. Two years earlier, he had had a road traffic accident that resulted in the development of posthemorrhagic hydrocephalus that required placement of a ventriculoperitoneal shunt. At admission to the hospital, physical examination findings were normal. Investigations showed that the patient's WBC count was 11,300 cells/mm³, his ESR and CRP level were elevated, and CT of the brain revealed hydrocephalus. The remaining laboratory test results were normal. On day 3 of hospitalization, the patient complained of abdominal pain. An abdominal ultrasound revealed the presence of ascites with peritoneal thickening, and fluid from paracentesis had a WBC count of 3,000 cells/mm³ (60% neutrophils). *Candida albicans* was isolated from the fluid sample. The ventriculoperitoneal shunt

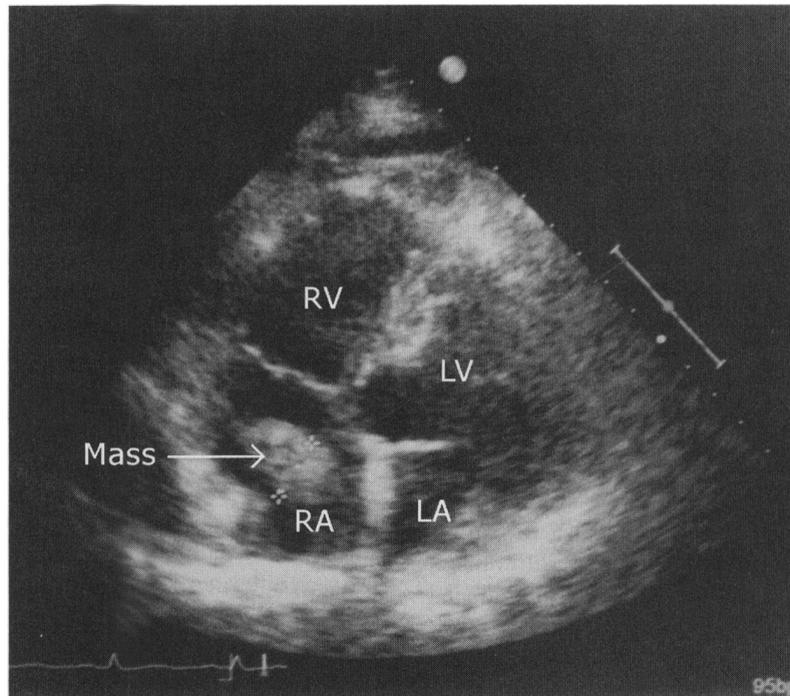


FIGURE 1. Transesophageal echocardiogram revealing a large vegetation (Mass) adherent to the distal portion of the shunt and sticking in the right atrium (RA). LA, left atrium; LV, left atrium; RV, right ventricle.

drainage was externalized, and cultures from the aspirated CSF shunt fluid and the shunt tip each grew *C. albicans*. Shortly after commencing fluconazole therapy, the patient became afebrile, and his pain resolved. On day 13 of hospitalization, CT of the brain revealed a marked reduction in hydrocephalus. Additional CSF samples from the external shunt drainage were sterile. CSF drainage from the externalized shunt was 5–10 mL over a 24-hour period, which allowed shunt independence to be considered, and the device was definitively removed. Two days later, abdominal ultrasound findings indicated neither ascites nor peritoneal thickening. On day 20, the patient was discharged home and maintained therapy with oral fluconazole for a total duration of 90 days. After 2 years of outpatient follow-up, the patient remains asymptomatic.

In conclusion, CSF shunts may be the cause of contiguous (eg, endocarditis and peritonitis) and metastatic (eg, pneumonia) infections, and the long-term necessity for such shunts should be carefully and regularly evaluated to avoid giving credence to the aphorism “once a shunt, always a shunt.” There is a need for clear guidelines on the long-term management of CSF shunts.

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Factors Associated with Not Removing Urinary Catheter after Reminder

To the Editor—Reminder systems (eg, a stop order or reminder) to minimize unnecessary urinary catheter use have been associated with a reduction in catheter-associated urinary tract infection (CAUTI).¹ However, little information has been reported for factors associated with prolonged urinary catheter use after implementation of a systematic reminder to remove urinary catheters. We established a urinary catheter team to remind physicians to remove unnecessary catheters in the medicine wards and intensive care units (ICUs) at Thammasat University Hospital, Pratumthani, Thailand. From March 16 to April 15, 2012, the team pursued two identified goals: to remind physicians to remove unnecessary catheters and to evaluate factors associated with not removing urinary catheters after the reminder. All patients in all medicine wards ($n = 6$) and ICUs ($n = 4$) were prospectively evaluated for appropriateness of urinary catheterization; criteria for inappropriate urinary catheterization were as previously defined.² After the reminder, patients were prospectively followed on days 2 and 7 for catheter removal, development of CAUTI, and indications for not removing an unnecessary urinary catheter. In this hospital, interns, resi-

dents, and staff were responsible for orders to insert and remove catheters. Criteria for diagnosis of CAUTI were derived from guidelines endorsed by the Infectious Diseases Society of America.³ Factors associated with not removing urinary catheters were computed using multivariable analysis.

During the 1-month study period, 39 patients had urinary catheter placement, 22 (56%) of whom received inappropriate urinary catheterization (Table 1). A systematic face-to-face reminder to remove the urinary catheter was made to the ordering physician in all 22 cases. The majority of reminders (12 [55%]) were made to interns. Thirteen (59%) urinary catheters were removed within 48 hours, and 9 (41%) were not removed during the study period. Inappropriate indications associated with retained urinary catheters were urinary incontinence without skin breakdown (5 [56%]), staff forgetting to remove the urinary catheter (2 [22%]), and retained use after monitoring of urine output (2 [22%]). No patient had recatheterization after catheter removal. There was a significant trend of not removing the catheter if the reminder was made to physicians with more years of training (Table 1). One patient with retained catheter use (11%) developed a CAUTI within 1 week of the reminder. In multivariable analysis, a reminder to physicians who were not directly involved in patient care (resident 2 or 3) was associated with retained catheter use (adjusted odds ratio, 12.5; 95% confidence interval, 1.4–65.4; $P = .04$).

In this 1-month study, we found that the initial prevalence of inappropriate urinary catheter use was high and that a systematic reminder to remove urinary catheters was asso-

TABLE 1. Characteristics of Participants

Variable	Proportion (%) of participants
Type of unit	
Medicine units	4/22 (18)
Intensive care units	18/22 (82)
Staff	
Intern	12/22 (55)
Resident 2	6/22 (27)
Resident 3	4/22 (18)
Catheter removal after reminder	13/22 (59)
Indications of unnecessary urinary catheterization	
Urinary incontinence without skin breakdown	5/9 (56)
Staff forgot to remove urinary catheter	2/9 (22)
No longer needed to monitor urine output	2/9 (22)
Other ^a	0/9 (0)
Type of physicians associated with retention of urinary catheter ^b	
Intern	3/12 (20)
Resident 2	2/6 (33)
Resident 3	4/4 (100)

^a “Other” indications include convenience of care, staff are too busy, amphotericin B bladder irrigation, unclear indication, and neurogenic bladder for which intermittent catheterization is possible.

^b $P = .04$ (χ^2 for trend).