INTRODUCTION

In most intracranial surgery cases, a drain catheter is inserted to prevent the collection of the wound hematoma or seroma. Post-operative intracranial hematoma is a serious problem in the area of neurosurgery. Ideally, post-operative hematoma can be prevented by meticulous hemostasis during the procedure, but this is not always the case. The use of a post-operative drain device in wounds before the closure of which hemostasis was difficult to achieve can reduce the incidence of post-operative hematoma.2,10 A drainage catheter also sustains negative pressure on the wound and eliminates dead spaces that will help promote wound healing. It is also inserted to drain the hematoma or cerebrospinal fluid.

The drain catheter, itself does not cause complications. However, accidental traumatic removal of the drains bears very limited risk of subsequent intracranial hemorrhage. The other complications occur after removal and incomplete suture of the skin, such as cerebrospinal fluid leakage, air collection in the subdural space and ventricular space. To prevent these complications, neurosurgeons perform a suture on the catheter removal site.

In this study, an additional horizontal mattress suture was performed, which can be used to anchor the catheter and fasten the catheter removal site.

MATERIALS

An additional mattress suture has been performed in nearly all patients who had undergone intracranial surgery with placement of a catheter since September 2011 to June 2012. Of these periods, poor initial mentality and severe trauma patients were excluded for the patients can not feel pain. Routine elective surgery, some alert mentality trauma and subarachnoid patients were good candidate.

TECHNICAL METHOD

The first applied suture was the anchoring suture. The distal end of the catheter exited the skin at least 2 cm from the original incision. The exact tunneling distance was not controlled from patient to patient (Fig. 1A). The exiting distal catheter was anchored to the skin at its point of exit on the skin, with a 2-0 Mer-silk suture (Fig. 1B, C).

An additional mattress suture was performed for the skin su-
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The second stitch was sutured along the catheter approximately 0.5 cm away from the proximal side to the distal side, perpendicular to the first suture and horizontal to the drainage catheter (Fig. 2A). The stitch was again sutured 0.5 cm away from the other side, but now from the distal side to the proximal side (Fig. 2B). The second suture was completed with two sutures that were vertical to the drainage catheter and horizontal to the first suture (Fig. 2C). The remaining silk was wrapped around the drainage catheter outside the skin and fixed using mosquito forceps. Finally, a clean dressing was applied to the incision site and the catheter exit site. The patient was not administered additional antibiotics except routine post-operative doses. The stitch with the drainage catheter was dressed everyday from the second post-operative day and was maintained for 2-14 days.

When the drainage catheter had to be removed, the second stitch, which was wrapped around the drainage catheter, was untied, the first anchoring suture on the skin was cut (Fig. 3A, B). Then the assistant drew the drainage catheter that was connected to the first stitch. At the same time, the operator tied the second suture (Fig. 3D, E). Then, the drainage tube was removed and simultaneously, the suture was done. The second mattress suture was removed one week after the drainage catheter was removed.

RESULTS

Additional mattress suture has been performed in nearly all patients who had undergone intracranial surgery with place-
ment of a catheter since September 2011 to June 2012 (Table 1). The suture’s maintenance period was 2-15 days, 2-5 days for the epidural and subgaleal catheter; 2-7 days for the subdural catheter in the chronic subdural hemorrhage with burr hole drainage; 3-7 days for the intracerebral catheter in the hypertensive intracerebral hemorrhage with stereotactic and craniotomy hematoma evacuation; 7-15 days for the extraventricular drainage in the subarachnoid hemorrhage. Complications such as infection and skin necrosis were not reported after the additional sutures during that period. The patient felt pain when his skin was drawn while the mattress suture was being tied. The stitch itself did not induce pain.

**DISCUSSION**

Post-operative intracranial hematoma is a serious problem in the area of neurosurgery. It can be prevented by meticulous hemostasis during the procedure, but this is not always the case. The development of hemostasis methods such as bone waxing, bipolar electrocautery, the use of surgical glue and hemostatic materials, and dural tenting sutures have reduced hemorrhagic complications after intracranial operations. Still, post-operative epidural hemorrhagic complications have been reported in about 0.26-2.3% of cases\(^1\)\(^-\)\(^3\). To reduce these complications, drainage catheters have been used in many neurological surgeries. The catheter is commonly placed in the subgaleal, epidural or subdural spaces to prevent the collection of post-operative hematoma or seroma.

In the case of intracerebral hemorrhage (ICH), the aim of operative treatment should be the removal of as much of the clot as possible, with minimal disruption of the surrounding brain tissue, to reduce the intracranial pressure (ICP) and to preserve the cerebrospinal fluid (CSF) flow. The drainage catheter is inserted in the intracranial hematoma not only to drain the remaining blood but also to administer the fibrinolysis agent\(^4\). The drainage catheter is inserted in the subdural space to drain the chronic subdural hemorrhage and the post-operative air\(^5\)\(^-\)\(^8\).

The placement of an extraventricular drainage (EVD) for various conditions, such as traumatic brain injury (TBI), subarachnoid hemorrhage (SAH) and acute hydrocephalus, has been increasing in the last decade\(^9\).

The drain catheter itself does not cause complications. It is known to have a relatively high risk of infection. The longer it is used, the greater is the risk of infection. There has been little research on subgaleal and epidural drainage that cites the infection rate, but the infection rate of EVD catheters has been cited in literature as ranging from 0% to 45%\(^10\) and to have increased with the duration of the EVD maintenance and the number of EVD manipulations. This issue remains controversial.

Many complications such as subsequent intracranial hemorrhage occurs accidental traumatic removal of the drains. It can be prevented using meticulous drain remove. Other complications occur after removal and incomplete suture of the skin, such as cerebrospinal fluid leakage. The air collection in the subdural space and ventricular space is occurred by the pressure difference between in the cranial space and external cranial catheter’s hydrostatic gravity. That pressure difference is caused by movement of cerebrospinal fluid generated by patient’s position change\(^11\). To prevent these complications, neurosurgeons perform suture on the catheter removal site. Many thoracic surgeons insert a chest tube and fix it with an anchoring suture and an additional mattress suture to close the skin. An additional mattress suture prevents pneumothorax, which may occur during chest tube removal. In this study, an additional mattress suture was performed in a case of brain surgery. The authors believe that an additional horizontal mattress suture has the following advantages in anchoring the drainage catheter. 1) It maintains negative pressure in the catheter insertion site during the catheter removal, compresses the catheter tunnel site and attaches the external wounds strongly. 2) It reduces the patient’s pain and does not require an additional suture during the catheter removal and the suture of an external scalp wound.

**CONCLUSION**

If there is need for suture for the catheter removal site, intra-operative additional mattress suture to anchor the drain catheter is recommended.

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References