

Case Report

Broken Mayfield Head Clamp

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The Mayfield head clamp is the most frequently used head clamp system in the field of neurosurgery. In many cases, surgery is performed with complete reliance on the safety of the MHC. However, we experienced an extremely rare case in which the MHC accidentally broke while installing this system for immobilization of the head and neck. This is a case report with a brief review of the literature. The patient was a 58-year-old female who was scheduled to undergo cervical laminoplasty under the diagnosis of degenerative spondylotic cervical stenosis. In an attempt to install an MHC, we fixed three pins in the scalp; however, the arm of the MHC system broke when force was applied from both directions. Fortunately, the patient remained in a stable position and did not sustain an injury to the head or neck. Fixation was performed using another MHC, and the surgery was performed successfully. The patient was discharged after surgery with no specific complications related to the MHC system. The authors experienced an extremely rare case of MHC breakage during application and report the importance of properly managing and maintaining the instruments in order to prevent fatal injury.

KEY WORDS : Mayfield head clamp · Breakage.

INTRODUCTION

The Mayfield head clamp (MHC, manufactured by Ohio Medical Instrument Co., Cincinnati, Ohio) is the most frequently used head clamp system in the field of neurosurgery. In many cases, surgery is performed with complete reliance on the safety of the MHC. However, we experienced an extremely rare case in which the MHC accidentally broke while installing this system for immobilization of the head and neck.

CASE REPORT

The patient was a 58-year-old female who was scheduled to undergo cervical laminoplasty under the diagnosis of degenerative spondylotic cervical stenosis. In an attempt to install an MHC system while the patient was under general anesthesia and lying in the supine position, we fixed three pins in the scalp; however, the arm of the MHC system broke when force was applied from both directions (Fig. 1).

Fortunately, the patient remained in a stable position and did not sustain an injury to the head or neck. Fixation was performed using another MHC, and the surgery was performed successfully. The patient was discharged after surgery with no specific complications related to the MHC system.

DISCUSSION

The MHC is one of the most effective head clamp systems used by neurosurgeons around the world to operate on cerebral, cervical and upper thoracic lesions. According to the Ohio Medical Instrument Co., the MHC base unit is of a marine grade and highly suited for use in a saline environment²⁾. The material specifications call for a shear strength of 27,000 psi and a modulus of elasticity of 10.3 million psi. In other words, it was designed to bend, not break. This material is used for product applications under sustained loads without the use of torque wrenches to control load forces.

During surgery, neurosurgeons rely completely on the safety of the MHC because without it, the patient's head would be hanging in the air. Since this apparatus can cause fatal injury if it breaks during neck or brain surgery, surgeons fix three MHC pins with accurate positioning and proper pressure. Moreover, surgeons repeatedly confirm the

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immobilization of the connection parts. It is very important to examine the apparatus thoroughly before each use to prevent unnecessary complication.

The MHC that broke was the oldest of three MHCs owned by the hospital. The authors had been using this MHC for the past 10 years. We estimate that this MHC had been used at least 1,000 times considering the number of surgeries performed during that period of time. Only the pins were subjected to sterilization, and the rest of the device was cleaned but not sterilized. The MHC was always stored in a designated place.

Considering that povidone-iodine solution was found in the cross section where the MHC had broken, we believe that micro-fractures had been forming on the inner side. The mechanism of fracture was probably fatigue fracture.

In a previous reports, Taira et al.³⁾ reported a similar case. They reported that a patient's head fell suddenly to the level of the surgeon's knee when operating on a cerebral aneurysm under a microscope. The arm joint of the MHC broke, and povidone-iodine solution was found in the broken section. Chovanes¹⁾ sent a letter to Taira et al. agreeing to carefully inspect the MHC before every operation. He found

two cracks in the threaded portion of the MHC. The three clinical cases of MHC breakage, including our case, are summarized in Table 1.

Surgeons and nurses must carefully handle all tools used during surgery in order to prevent any tool-related problems that could occur. Damaged tools that should not be used can lead to surgical failure. Safety is of utmost importance when using position fixation instruments. Thus, it is important to carefully follow the operating instructions provided by the manufacturer.

The first step in preventing fatal injury is to ensure that the instrument is applied in the correct position. Second, the instruments must be protected from impact and physical damage. Third, all cleaning and sterilization procedures should be performed in accordance with the operating instructions provided by the manufacturer. Fourth, the surgeon should examine the apparatus thoroughly before each use. Finally, the authors recommend choosing the option of having the instruments subjected to regularly scheduled maintenance by the manufacturer, when available. This could be arranged through a separate contract when purchasing the MHC. However, most buyers

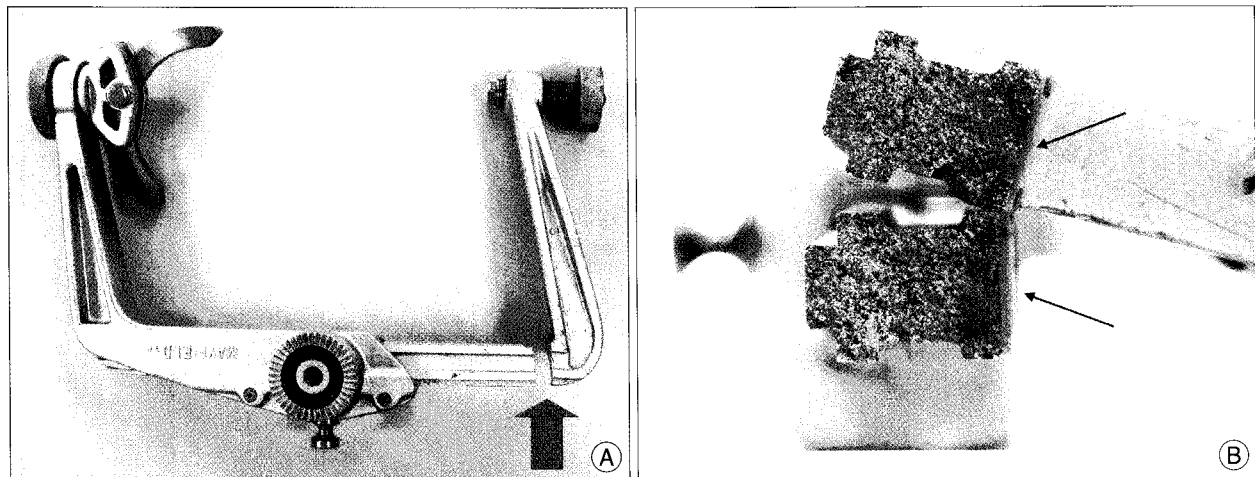


Fig. 1. Photographs showing broken Mayfield head clamp. A : A fracture occurred in two arms of the Mayfield head clamp, leaving it bent at an acute angle (green arrow). B : When the cross section of the place where the Mayfield head clamp broken was examined in detail, povidone-iodine solution was found in the inner side of the arm (red arrows).

Table 1. Literature review of cases of Mayfield head clamp breakage

Authors & year	Age/Sex	Procedure	Event time	Problem site	Usage period	Management	Result
Taira T & Tanikawa T ³⁾ (Japan), 1992	68/F	Aneurysm clipping	During operation	Arm joint broken	8 years (>1200 times)	Broken part replacement	Uneventful
Chovanes GI ¹⁾ (USA), 1992	N/A	Check	Preoperation check	Threaded portion two cracks	14 years	Unknown	Uneventful
Present case	58/F	Cervical laminoplasty	During preoperative preparation	Acute angle arm broken	10 years (>1000 times)	Other head clamp replacement	Uneventful

ignore this aspect in order to purchase the apparatus at lower cost. Likewise, the authors did not sign a separate contract for regular maintenance at the time of purchase in an effort to reduce costs.

Furthermore, the use of high-energy X-ray images for the detection of fatigue fractures in the MHC may be helpful. We will collect X-ray pictures of the MHCs, and report the results in future study.

CONCLUSION

The importance of safety when using position fixation

instruments, such as the MHC, cannot be overemphasized. The authors experienced an extremely rare case of MHC breakage during application and report the importance of properly managing and maintaining the instruments in order to prevent fatal injury.

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