An Innovation of "Stereotactic Frame Clothing"

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Background: *Many stereotactic brain surgeries have been performed in our center. There was difficulty in operative field preparation and patients with surgical wound infection were found. We therefore invented stereotactic frame clothing to solve these problems.*
Objective: *The invention aims to prevent contamination and infection during stereotactic surgery, and to improve convenience in operative field preparation.*
Material and Method: *The authors invented stereotactic frame clothing from a large piece of surgical cloth. The invention was used and evaluated with questionnaire by surgeons and surgical nurses.*
Results: *This invention was used in 20 patients undergoing stereotactic surgery and was evaluated by ten surgeons and ten nurses. No contamination and infection was found. The device was helpful in improvement of convenience in operative field preparation. Statistical analysis showed very good satisfactory level in all aspects of evaluation.*
Conclusion: *Stereotactic frame clothing is easy to use, convenient, safe, and helpful in prevention of intraoperative contamination. It can be used in hospitals with available stereotactic frame.*

Keywords: *Innovation, Stereotactic surgery, Stereotactic frame, Clothing*

J Med Assoc Thai 2017; 100 (Suppl. 4): S54-S58
Full text. e-Journal: *http://www.jmatonline.com*

In neurosurgical practice, stereotactic surgery has been performed for several decades. This type of neurosurgical procedure is useful in many aspects, such as biopsy of deeply-seated tumor in the brain[1,2], deep brain stimulation (DBS) for movement disorders[3,4] and pain[5-7], and psychosurgery[8-10]. Stereotactic system makes surgery less invasive, reduces brain damage and can shorten operative time. Stereotactic frame system is essential equipment for precise target localization in the brain.

In our institute, there have been many stereotactic surgeries. The most common type of stereotactic frame used in our hospital is Leksell Stereotactic System. One of major concerns is contamination during draping of operative field. The stereotactic frame has to be covered with sterilized cloth during the procedure. In the past, we found that two patients had infected surgical wound.

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We therefore invented stereotactic frame clothing for Leksell Stereotactic System to prevent contamination and infection during the procedure, and to improve convenience in operative field preparation.

This invention aims to prevent intraoperative contamination which may occur while draping of stereotactic frame. It can reduce a length of timing for cover of the frame by using less surgical linen.

Material and Method

Materials and equipments include a rectangular-shaped surgical cloth 120x250 cm in size, scissors, ruler, thread, sewing pin and sewing machine. Stereotactic frame clothing is created as the following steps.

1) Make a template to create a 4-inch-diameter central hole (CH) on the cloth (Fig. 1A).

2) Make a 3-inch-long lateral slit (LS) on each side of the CH (Fig. 1B).

3) A 9-inch-long median slit (MS) on the template (Fig. 1C) and the cloth (Fig. 1D).

After application of stereotactic frame to patient's head (Fig. 2A), stereotactic frame clothing is prepared correctly (Fig. 2B). The clothing was used for

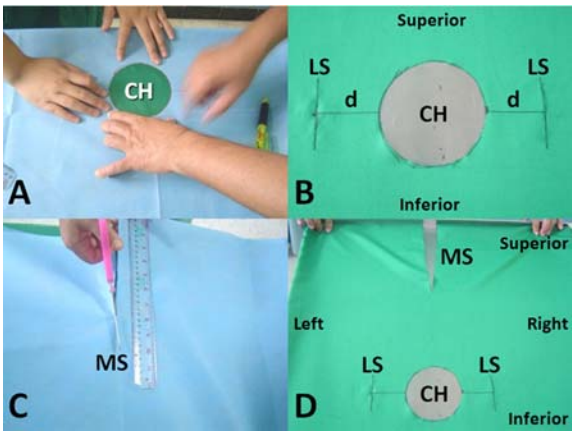

Fig. 1 Creation of stereotactic frame clothing: (A) a 4-inch-diameter central hole (CH) is made on a cloth; (B) a 3-inch-long lateral slit (LS) is made on each side of the CH in an appropriate distance (d); (C) a 9-inch-long median slit (MS) is made on the template; (D) MS is made on the cloth at the superior border.

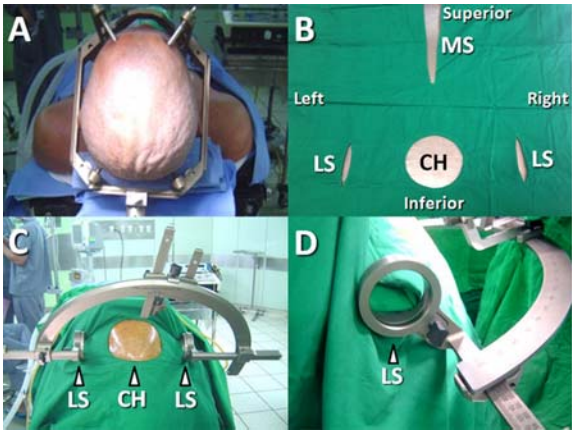

Fig. 2 Use of stereotactic frame clothing: (A) stereotactic frame is applied to patient's head; (B) preparation of stereotactic frame in correct orientation; (C) coverage of operative field, central hole (CH) is on the scalp and a ring of stereotactic frame is passed through a lateral slit (LS); (D) the ring is passed through the LS.

covering operative field. The CH is on the scalp (Fig. 2C) and rings of stereotactic frame are passed through both LS (Fig. 2C, 2D). The MS was used to expose patient's face in awake stereotactic surgery.

Results

The invented stereotactic frame clothing was used at Division of Neurosurgery, Department of Surgery, Faculty of Medicine Siriraj Hospital between June to December 2011. Assessment of this invention focused on patient safety and convenience in use. Our results showed that the device was helpful in prevention of intraoperative contamination that may occur while stereotactic frame was being installed. Additionally, it was proved to be time-saving method. We studied incidence of contamination in use of stereotactic frame clothing for covering operative field in 20 patients who underwent stereotactic brain surgery. Outcome was evaluated in three phases, including at 1 month, 3 months and 6 months. Neither contamination nor infection was found. Satisfaction with the invention by users was higher than 80% (Table 1).

The data in terms of satisfaction were collected from 10 surgeons and 10 nurses who used stereotactic frame clothing in stereotactic brain surgeries. After using the device, the users answered a questionnaire. Satisfaction was evaluated in several aspects. Score in the questionnaire was divided into 4 levels: very good (4), good (3), fair (2), and improvement needed (1) (Table 2). Regarding average score in an individual aspect, satisfaction level is divided into 4 levels: very good (3.5 to 4.0), good (2.5 to 3.49), fair (1.5 to 2.49), and improvement needed ($\geq$1.49).

In analysis of the data obtained from the questionnaire, satisfaction level in all aspects was in the range of very good level (Table 3).

Discussion

Stereotactic surgery is a distinctive method in localization of a target in the brain. It is used in biopsy of deep lesions in the brain[1,2], movement disorder surgery[3,4], pain surgery[5-7] and psychosurgery[8-10]. Good effectiveness and shortened operative time are ideal requirements for this kind of surgery. In utilizing the aforementioned target localizing instrument, stereotactic frame, a set of sterilized devices is needed. During this process, however, preparation of sterile cloths poses some difficulty and problems to surgical staff. Furthermore, there has not been any proper cloth for covering the area where stereotactic operation will be carried out, resulting in possibility of intraoperative contamination and infection after the surgery.

Owing to the above reasons, we invented stereotactic frame clothing to assist the surgeons in reduction of problem in preparation of operative field, and prevention of contamination and infection that may occur during stereotactic procedure. Statistics analysis showed very good satisfaction level in all aspects. This indicated that stereotactic frame clothing was safe,

Table 1. Outcome measurement

Indicator (KPI)	Target	Results		
		The first evaluation (1 month)	The second evaluation (3 month)	The third evaluation (6 month)
Incidence of contamination and infection during the procedure	0	0	0	0
Satisfaction with the device by surgeons and nurses	80%	90%	95%	95%

Table 2. Questionnaire for evaluation of satisfaction level

Satisfaction criteria	Very good	Good	Fair	Improvement needed
1) Prevent contamination				
2) Easy to use and convenience				
3) Proper size				
4) The device is useful				
5) The device can be applied at other hospitals				

Table 3. Satisfaction level evaluated by users

Satisfaction criteria	Mean ± SD	Satisfaction level
1) Prevent contamination	3.6±0.6	Very good
2) Easy to use and convenience	3.7±0.5	Very good
3) Proper size	3.6±0.6	Very good
4) The device is useful	3.7±0.5	Very good
5) The device can be applied at other hospitals	3.6±0.6	Very good

useful and convenient in use. Making this device is easy and it can be reproducible to use in other hospitals. Nevertheless, this invention was created to use only for Leksell System and could not be applied to other types of stereotactic frame. Other patterns of clothing can be made suitably for other types of stereotactic frame.

Conclusion

The satisfaction level towards stereotactic frame clothing evaluated by the surgeons and surgical nurses was in the very good level. This reveals that the new device is easy to use, convenient, safe effective, and can prevent contamination during operative field preparation. This device can be applied in a neurosurgical unit of hospitals where stereotactic frame is available.

What is already known on this topic?

Stereotactic surgery is a unique operative method in neurosurgery. Stereotactic frame is required in this kind of surgery. Preparation of operative field is relatively sophisticated and is risky to have contamination and infection.

What this study adds?

The authors invented stereotactic frame clothing for intraoperative coverage of stereotactic frame. Regarding evaluation of many users, this invention is safe, easy to use, convenient, and can

prevent intraoperative contamination. It can be reproducible and used in other hospitals with stereotactic frame.

Potential conflicts of interest

None.

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นวัตกรรมผ้าคลุมโครงโลหะยึดศีรษะสำหรับผ่าตัดสมอง

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ภูมิหลัง: มีการผ่าตัดโดยอาศัยการกำหนดพิกัดในสมองหลายรายในโรงพยาบาลของผู้นิพนธ์ยังคงมีความยากในการเตรียมบริเวณผ่าตัดและพบว่ามีการติดเชื้อของแผลผ่าตัดในผู้ป่วยที่ได้รับการผ่าตัดวิธีดังกล่าว ดังนั้นผู้นิพนธ์จึงได้ประดิษฐ์นวัตกรรมผ้าคลุมโครงโลหะยึดศีรษะสำหรับผ่าตัดสมองเพื่อแก้ปัญหาดังกล่าว

วัตถุประสงค์: เพื่อป้องกันการปนเปื้อนและป้องกันการติดเชื้อขณะผ่าตัดโดยอาศัยการกำหนดพิกัดในสมอง และเพื่อเพิ่มความสะดวกในการเตรียมบริเวณผ่าตัด

วัสดุและวิธีการ: ผู้นิพนธ์ประดิษฐ์นวัตกรรมผ้าคลุมโครงโลหะยึดศีรษะสำหรับผ่าตัดสมองจากผ้าคลุมผ่าตัดผืนใหญ่ มีการใช้นวัตกรรมนี้ในการผ่าตัดและได้รับการประเมินความพึงพอใจโดยศัลยแพทย์และพยาบาลผ่าตัดโดยใช้แบบสอบถาม

ผลการศึกษา: มีการใช้นวัตกรรมนี้ในผู้ป่วย 20 รายซึ่งได้รับการผ่าตัดโดยอาศัยการกำหนดพิกัดในสมองและประเมินโดยศัลยแพทย์ 10 คน และพยาบาลผ่าตัด 10 คน ไม่พบการปนเปื้อนและการติดเชื้อในผู้ป่วยทุกราย นวัตกรรมนี้ช่วยเพิ่มความสะดวกในการเตรียมบริเวณผ่าตัด จากการวิเคราะห์ทางสถิติพบว่าระดับความพึงพอใจ ของผู้ใช้งานอยู่ในระดับดีมากในทุกด้านของการประเมิน

สรุป: นวัตกรรมผ้าคลุมโครงโลหะยึดศีรษะสำหรับผ่าตัดสมองสามารถใช้งานได้ง่าย เพิ่มความสะดวกในการผ่าตัดมีความปลอดภัยช่วยป้องกันการปนเปื้อนขณะผ่าตัด สามารถใช้นวัตกรรมนี้ได้ในโรงพยาบาลต่างๆ ซึ่งมีโครงโลหะยึดศีรษะสำหรับผ่าตัดสมอง