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Usefulness of silicone elastomer sheet as another option of adhesion preventive material during craniectomies

Choon-Hyun Lee, Do-Sang Cho, Sung-Chul Jin *, Sung-Hak Kim, Dong-Been Park

Department of Neurosurgery, College of Medicine, Ewha Womans University, 70, Jongno-6-ga, Jongno-gu, Seoul 110-783, Republic of Korea

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Abstract

Objective: We describe the use of a silicone elastomer sheet (SILASTIC®) to prevent peridural fibrosis in patients who underwent a craniectomy and a subsequent cranioplasty.

Materials and methods: We performed a decompressive craniectomy and a subsequent cranioplasty with an autologous bone flap in 50 patients (mean age, 40 years) between 1996 and 2005 at our institution. Most of the craniectomies were performed as an emergency procedure for relief of brain swelling. The standard decompressive craniectomy technique that we performed included bone removal and a duroplasty in 26 of the 50 patients, however, a SILASTIC® sheet was added to the standard decompressive craniectomy in the remaining patients in an attempt to prevent dural adhesions. The development of adhesion formation between the tissue layers was evaluated during the cranioplasty in terms of operative time and the amount of blood loss.

Results: During the cranioplasty, we observed that the SILASTIC® sheet succeeded in creating a controlled dissection plane, which facilitated access to the epidural space, shortened the operative time by approximately 24.8% and diminished the intraoperative blood loss by 37.9% as compared with the group of patients who underwent the standard cranioplasty. These differences were statistically significant ($p < 0.05$).

Conclusions: The use of a SILASTIC® sheet to prevent peridural scarring and to facilitate cranioplasty in patients who have previously undergone a craniectomy is a good technique, regardless of the procedural indication.

Keywords: Silicone elastomer sheet; Craniectomy; Cranioplasty; Adhesions

1. Introduction

The standard craniectomy is associated with dural adhesions when a subsequent cranioplasty is performed. More operative time, greater blood loss and dural injury are common accompaniments of the standard craniectomy. To prevent these complications, various techniques have been developed. For instance, the use of a polytetrafluoroethylene dural substitute to prevent adhesion formation during cranioplasties after a craniectomy for brain swelling was first described by Kawaguchi et al. [10] who used this procedure in 10 patients suffering from aneurysmal sub-arachnoid hemorrhage and obtained excellent results.

We describe here in the use of a silicone elastomer sheet (SILASTIC® Sheeting, Medical Products Division, Dow Corning Corporation, Midland, MI, USA), a material to prevent peridural scarring during craniectomies of various causes. During reoperation for a cranioplasty, there was an absence of adhesion formation in all patients in whom we applied a SILASTIC® sheet. Thus, we suggest this additional procedure for the prevention of dural adhesions.

2. Materials and methods

Fifty patients (37 males and 13 females, 7–71 years of age; mean age, 40 years) underwent a decompressive craniectomy and subsequent cranioplasty from 1996 to 2005 in our department. Most of the procedures were performed on an

* Corresponding author. Tel.: +82 10 6392 5277; fax: +82 2 744 2489.
E-mail address: kusmal@hanmail.net (S.-C. Jin).

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Table 1
Gender, age, initial diagnosis, time interval between craniectomy and cranioplasty, cranioplasty operation time, blood loss of 26 patients underwent standard craniectomy and cranioplasty without the use of the SILASTIC® sheet (Group 2)

No.	Gender	Diagnosis	Age	Time between craniectomy and cranioplasty (month)	Operation time (minute)	Blood loss (ml)
1	Male	Intracerebral hemorrhage	32	3	200	350
2	Male	Depressed skull fracture	41	6	140	220
3	Male	Acute subdural hematoma	55	4	215	450
4	Male	Acute subdural hematoma	20	5	150	1220
5	Female	Depressed skull fracture	50	3	180	250
6	Male	Acute subdural hematoma	49	8	225	500
7	Female	Intracerebral hemorrhage	28	8	120	250
8	Male	Depressed skull fracture	54	6	85	200
9	Male	Depressed skull fracture	7	8	100	100
10	Male	Epidural hemorrhage	23	6	180	350
11	Male	Acute subdural hematoma	30	7	125	550
12	Male	Intracerebral hemorrhage	18	9	130	600
13	Female	Acute subdural hematoma	47	3	270	450
14	Male	Acute subdural hematoma	55	1	80	180
15	Female	Aneurysmal rupture	49	2	155	120
16	Male	Acute subdural hematoma	56	4	160	450
17	Male	Acute subdural hematoma	31	4	160	500
18	Female	Epidural hemorrhage	55	11	305	1300
19	Male	Intracerebral hemorrhage	55	4	155	490
20	Female	Epidural hemorrhage	6	8	130	30
21	Male	Depressed skull fracture	30	3	170	300
22	Male	Intracerebral hemorrhage	27	1	230	800
23	Male	Acute subdural hematoma	38	2	210	750
24	Male	Acute subdural hematoma	46	3	120	400
25	Male	Intracerebral hemorrhage	71	2	280	650
26	Male	Cerebral infarction	47	4	220	300
Mean values				4.8	172.5	452.3

emergency basis to relieve cerebral edema in patients with elevated ICP levels.

The initial diagnosis was acute subdural hematoma in 20 patients, intracerebral hematoma in 11 patients, depressed skull fracture in 7 patients, ruptured aneurysm in 6 patients, epidural hematoma in 4 patients, MCA infarction in 1 patient and cerebral edema secondary to an oligodendroglioma in 1 patient. In 26 of the above patients, we performed a craniectomy and duroplasty with an organic dural substitute (Table 1). In the other 24 patients, however, the dura was patched with the organic dural substitute and a SILASTIC® sheet was placed between the dura and the temporal muscle. The size of the SILASTIC® sheet fully covered the bone margin created by the craniectomy. Two or three sutures were placed between the SILASTIC® sheet and the galea to fix the SILASTIC® sheet in place. We thus used a SILASTIC® sheet as an adhesion preventive material (Table 2).

Cranioplasty with an autologous bone flap was performed in all cases and the operating time for the two groups of patients was calculated together with the intraoperative blood loss. The operating time was recorded from the time at which the patient underwent induction with general anesthesia to the time the patient was weaned from general anesthesia. The results were statistically evaluated with a correlation test and a *t*-test (SPSS, version 10.0; SPSS, Inc., Chicago, IL, USA).

3. Operative techniques

3.1. Craniectomy and cranioplasty

The standard decompressive craniectomy technique that we perform includes bone removal and a duroplasty. In 24 of the 50 patients, however, to protect the patient from adhesion formation, a SILASTIC® sheet was added to the standard procedure. The duroplasty involves opening of the dura in a cruciate fashion and suturing the free dural edges with an organic dural substitute. After the duroplasty was performed, the SILASTIC® sheet was placed between the dural flap and the galea in order to prevent the formation of adhesions. For fixation of the SILASTIC® sheet, several sutures were used to anchor the free edge of the SILASTIC® sheet to the galea flap. The subcutaneous tissue and skin were then closed in a serial fashion.

4. Results

In our series, the cranioplasty was performed 1–11 months after the craniectomy (mean, 3.96 months). After opening the skin flap in the 24 patients in whom we used a silicone sheet (Group 1), no adhesions were found between the galea and the underlying silicone sheet. Furthermore, the dissection