

Original Article

Adhesion sutures for seroma reduction in cranial reconstructions with polymethyl methacrylate prosthesis in patients undergoing decompressive craniectomy: A clinical trial

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Abstract

Background: Cranial reconstruction with polymethyl methacrylate (PMMA) prosthesis is used for calvarial defects secondary to decompressive craniectomies. Seroma is one of the most frequent complications of this procedure and can lead to the dehiscence, extrusion, infection, and loss of the prosthesis. The objective of the study is to analyze the effectiveness of the tacking sutures between the prosthesis and the scalp flap in reducing the seroma.

Methods: This is a prospective study with 63 patients submitted to cranioplasty between 2014 and 2017 for defects resulting from decompressive craniectomies. All patients were followed up postoperatively for at least 3 months and the diagnosis of seroma was made clinically. In the first 22 patients, the conventional technique was applied and, in the following 41, the technique with tacking sutures was used. The incidence of seroma was collected for both groups.

Results: The overall incidence of seroma was 65.1%. Compared to the conventional technique, the use of tacking sutures was associated with a statistically significant reduction in the incidence of seroma from 90.9% to 51.2% ($P = 0.002$).

Conclusion: The use of the tacking sutures in cranioplasties with PMMA prosthesis reduced the incidence of seroma postoperatively.

Key Words: Cranial reconstruction, cranioplasty, decompressive craniectomy, polymethyl methacrylate, seroma

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INTRODUCTION

Decompressive craniectomy is indicated for the treatment of severe and refractory intracranial hypertension related to conditions such as head trauma and ischemic stroke.^[1,5,12-15,18] Calvarial reconstruction, performed as soon as the patient is clinically stable, has been shown to improve psychological status, social performance, and neurocognitive function, while protecting the brain from further physical damage.^[2,10,15-17]

Cranioplasty is associated with possible complications occurring in 19.7%–36.5% of cases.^[9,11,19] Despite being under-reported in the neurosurgical literature, seroma is one of the most frequent complications found in our patient population. It is a collection of exudative features that usually appear below the flap in large-detachment surgeries.^[3,7] Its importance has been shown in plastic surgery literature, potentially leading to infection, dehiscence, and loss of prosthesis.^[3,7,20,21] The presence of seroma in cranioplasties often raises questions about the need for implant fenestration, aspiration and/or drainage, and the final surgical outcome, in addition to being uncomfortable for the patient.

Our initial analysis of patients undergoing cranioplasty in our institution showed a high incidence of seroma, for which a change in technique was adopted. The tacking suture of Baroudi^[3] is a widely accepted surgical strategy in abdominal plastic surgery (and other flaps) for seroma reduction. Moreover, it can prevent the use of drains in these procedures.^[3]

This study aims to demonstrate the effectiveness of the tacking sutures applied to cranial reconstructions with polymethyl methacrylate (PMMA) prosthesis in reducing the incidence of seroma.

METHODS

This study was approved by the Hospital of Restauração (HR) IRB-CAAE under the number 128551/2017. This was a retrospective review of all patients who underwent cranioplasty with PMMA after decompressive craniectomy as a consequence of severe head trauma, stroke, or neoplasia at the Plastic Surgery and Neurosurgery Services of the Hospital of Restauração (HR) in Recife, Brazil between 2014 and 2017. The study included 63 patients who were followed up for at least 3 months postoperatively.

Patients were evaluated for functional improvement, aesthetics, and complications. After initial data analysis of 22 patients, a very high incidence of seroma was noted. Therefore, the surgical team adopted a new intervention.

The customized PMMA prosthesis was prepared intraoperatively with the aid of three-dimensional (3D)

models, and then placed in solution with antibiotic and saline until it reached room temperature. Exposure was obtained through a secondary incision from previous craniectomy, without resection of the scar, to avoid tension during the closure. The defect was exposed with elevation of the scalp flap just superficial to the dura. The prosthesis was then fitted into the defect and secured using titanium plates and screws (Bioplate®, 1.6-hole 2-plate system).

In the first 22 patients, the prosthesis was simply fixated and the closure was made in scalp layers. In the remaining 41 patients, before prosthesis fixation, fenestration was done with 8 pairs of holes and 3-0 Mononylon® sutures were threaded through them. All prostheses were routinely given 8 retention sutures or tacking sutures mainly in the temporal region [Figure 1]. After prosthesis fixation, the scalp flap, including galea and subcutaneous tissue, was progressively sutured down to the implant. In the temporal region, the temporal muscle was also included [Figure 2].

A Blake® silicone tubular continuous suction drain was positioned and the surgical wound was closed in scalp layers. Postoperatively, the patient was referred to the Advanced Neurosurgery Support Unit (USAN) where a computed tomography (CT) scan was performed within the first 12 hours. The drain was removed when the output was lower than 50 ml per 12 hours, and hospital discharge usually occurred within 48 hours.

The sample size was determined by the number of patients operated during the study period. The volume of the seroma was not calculated using imaging methods. The diagnosis was made by physical examination and all collection was punctured and emptied. Postoperative consultations were mandatorily carried out at 7, 14, 21, and 30 days and at the 3rd, 6th, and 12th month. The lowest emptied volume of one patient was 4 ml and the

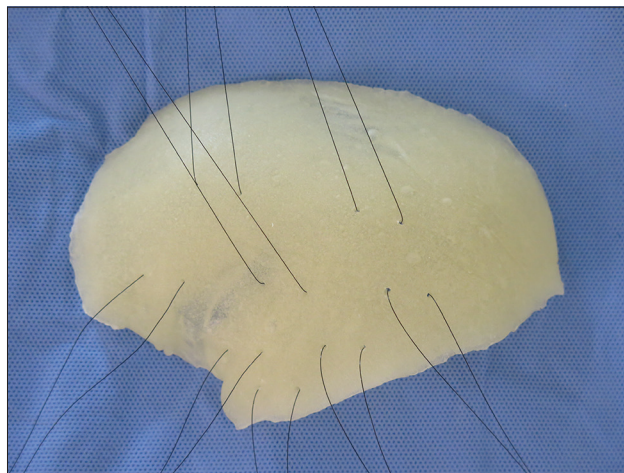


Figure 1: Fenestration and 3-0 Mononylon® sutures through the prosthesis mainly in the temporal region

largest was 70 ml. Every time a patient was diagnosed with seroma, the patient was evaluated twice a week until resolution of the seroma with emptying and compressive dressing. All seromas were addressed with aspiration and drainage. Seroma was drained using a 40 × 12 needle and a 10 ml syringe only by the scar (less likely site of vascular injury). Chi-square test was used to calculate the proportions. *P* value of <0.05 was considered statistically significant.

RESULTS

Sixty-three consecutive cranioplasties were performed in patients with an average age of 33 years (range, 13–58 years), including 55 males and 8 females. The average time between decompressive craniectomy and cranial reconstruction was 21 months, ranging from 2 to 84 months. The average area of the defect was 147 cm². The average postoperative follow-up of the patients was 21 months (range, 6–33 months). There was significant statistical difference in age and gender between both groups (*P* value = 0.535 and 0.702, respectively) [Table 1].

The overall incidence of seroma was 65.1%. However, there was a statistically significant decrease in the incidence from 90.9% to 51.2% (*P* = 0.002) after adopting the use of tacking sutures between the prosthesis and scalp flap. All patients who developed seroma underwent aspiration and/or drainage. Contained seroma is a predisposing factor of infection. There was one case of extradural hematoma after seroma aspiration on postoperative day 10 requiring immediate evacuation.

Seromas usually develop between the 1st and 2nd week of surgeries, whereas extradural hematomas usually develop within the first 48 hours while the patient is still hospitalized. In the aspirated contents, it is also possible to differentiate the characteristics of the liquid



Figure 2: Scalp flap and temporal muscle sutured down to the implant after prosthesis fixation

between seroma and hematoma. The resolution of the seroma in the postoperative period was assessed clinically (inspection and palpation) [Table 2].

DISCUSSION

As part of a larger study on the use of customized PMMA prosthesis for calvarial reconstruction, we initially found a prohibitive incidence of seroma. Therefore, we intervened with the application of the Baroudi's tacking sutures^[3] between the scalp flap and the implant.

The large tissue detachment, residual dead space, and the presence of alloplastic material are contributory factors for seroma formation. Seroma, if not drained, may evolve to wound dehiscence, implant extrusion, infection, and, finally, loss of reconstruction. On the other hand, serial seroma aspirations carry the risk of introducing infection and vascular injury.

Our seroma rate was higher than that reported in the literature. Williams *et al.* (*N* = 151) reported an incidence of 14.5% with titanium prosthesis^[22] whereas Broughton *et al.* (*N* = 83)^[4] showed a lower rate of complications (collection or superficial infection) of 10.3%. Sobani *et al.*^[19] (*N* = 93) revealed an incidence of 3.1% of subgaleal collection. There are not many studies in the literature reporting seroma incidence in cranioplasties.^[6]

The use of tacking sutures between the scalp flap and the prosthesis is a reproducible technique that does not add considerably to the surgical time. In plastic surgery operations, it is an already well-defined strategy for the reduction of seroma.^[3,8] In cranioplasties, we

Table 1: Patient's characteristics

Rated factor	Type of technique		<i>P</i>
	Technique 1 (<i>n</i> =22)	Technique 2 (<i>n</i> =41)	
Age			
Average	32.7 ± 10.7	34.4 ± 10.4	0.535 ^a
Sex, <i>n</i> (%)			
Female	2 (9.1)	6 (14.6)	0.702 ^b
Male	20 (90.9)	35 (85.4)	

^a*P*-value of the Chi-square test for independence, ^b*P*-value of Fisher's exact test

Table 2: Incidence of seroma in patients submitted to cranial reconstruction with customized polymethyl methacrylate prosthesis (*n*=63)

Complication	Value, <i>n</i> (%)	<i>P</i>
Seroma	41 (65.1)	-
Seroma: Technique 1 (22 cases)	20 (90.9)	0.002 ^a
Seroma: Technique 2 (41 cases)	21 (51.2)	

^a*P*-value of the Chi-square test for comparison of the proportion (if *P*<0.05, the prevalence differs significantly)

emphasize the importance of concentrating the sutures in the temporal region where seroma is more commonly found. In addition to decreasing the seroma, the sutures might decrease the tension at the closure of the surgical wound. The number of adhesion points, eight pairs, was a random choice of our surgical team.

CONCLUSION

The creation of tacking sutures between the scalp flap and the prosthesis, a simple and reproducible technique, statistically reduced the incidence of seromas in cranial reconstructions with PMMA prosthesis through 3D impression molds.

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Conflicts of interest

There are no conflicts of interest.

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