



# Continuous postoperative negative pressure irrigation assisted mammoplasty in treating chronic refractory plasma cell mastitis

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**Background:** Chronic refractory plasma cell mastitis (CRPCM) is an aseptic inflammation of the breast with a chronic course of the disease, extended treatment cycle (months to years), with a high recurrence rate. The objective of this study was to evaluate the efficacy of continuous postoperative negative pressure irrigation assisted mammoplasty (CPNPIAM) in treating CRPCM.

**Methods:** Between 2016 and 2018, 36 CRPCM patients receiving CPNPIAM were enrolled in this study. CPNPIAM mainly involved complete lesion removal, immediate breast mammoplasty, and continuous postoperative negative pressure irrigation. The age of the patients, local symptoms, history of treatment, the duration of the disease before surgery, hospitalization period, related risk factors, the success rate, the recurrence rate and patients' overall satisfaction ratings were analyzed in the article.

**Results:** Patients were aged between 22 and 53 years (mean 34.64 years). All patients had a history of conservative treatment or simple drainage. Local symptoms included inflammatory mass (n=36, 100%), abscess (n=33, 92%), nipple discharge (n=7, 19%), inflammatory plaque (n=34, 94%), and sinus tract formation (n=19, 53%). The lesion sizes ranged from 3 to 10 cm (mean 5.13 cm) in diameter. The mean hospitalization period was 8.42 days. The success rate was 100% (36/36) and the recurrence rate was 0% (0/36) at a 3-month follow-up. The patients' overall satisfaction ratings were "very good" (n=22, 61%), "good" (n=12, 33%), and "moderate" (n=2, 6%) with no poor or unsatisfactory ratings.

**Conclusions:** CPNPIAM is an effective way of treating CRPCM, and showed a high success rate, a low recurrence rate, and high patient satisfaction.

**Keywords:** Chronic refractory plasma cell mastitis (CRPCM); surgery; mammoplasty; continuous postoperative negative pressure irrigation

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## 1 Introduction

2 Plasma cell mastitis (PCM) is a benign non-infectious  
 3 inflammatory breast disease characterized by dilation of  
 4 the mammary ducts and infiltration of plasma cells and  
 5 was first reported by Cheatle and Cutler in 1949 (1). PCM  
 6 normally occurs in young and middle-aged women who are  
 7 not lactating or pregnant. PCM is challenging to be treated,  
 8 and the recurrence rate is high (2,3). Some studies have  
 9 reported the incidence of PCM in benign breast disease  
 10 as 4.1–5.5%. However, other researchers have reported a  
 11 higher incidence rate of PCM in recent years (4,5). The  
 12 etiology of PCM is still unclear. Risk factors include the  
 13 following: a congenitally inverted nipple, breast dysplasia,  
 14 milk retention, trauma, surgical infections, autoimmune  
 15 diseases, endocrine hormone disorders, and smoking  
 16 (6,7). There are differences between the acute and chronic  
 17 phases of PCM. In the acute phase, PCM presents as acute  
 18 inflammation of breast with reddish skin that is swollen,  
 19 hot, and painful. PCM with a course of disease greater  
 20 than one month is defined as chronic plasma cell mastitis.  
 21 Repeated treatment failure or recurrence in patients with  
 22 chronic plasma cell mastitis is defined as chronic refractory  
 23 plasma cell mastitis (CRPCM). The clinical manifestations  
 24 of CRPCM mainly involve nipple retraction, nipple  
 25 discharge, inflammatory mass, abscess, and sinus tract  
 26 formation (3,5-8). Breast inflammatory mass mostly locates  
 27 in the areola area, often accompanied by nipple retraction  
 28 with or without nipple discharge. CRPCM can also present  
 29 ipsilateral axillary lymph node enlargement. Normally,  
 30 patients do not display a systemic inflammatory response,  
 31 and antibiotics are ineffective. Typical syndrome, ultrasound  
 32 and MRI examination and pathological examination by core  
 33 needle biopsy are necessary for the diagnosis of CRPCM.  
 34 Pathological examination of CRPCM is characterized by  
 35 dilation of the mammary ducts and infiltration of plasma  
 36 cells.

37 The current treatment of PCM is complex, with a high  
 38 recurrence rate (8,9). Chinese medicine, dexamethasone,  
 39 tamoxifen and anti-tuberculosis drugs have been  
 40 recommended for the treatment of plasma cell mastitis.  
 41 However, the effects were limited. Surgery remains to be  
 42 the most effective treatment. Traditional surgical procedure  
 43 for PCM mainly involves repeated simple drainage,  
 44 lumpectomy, quadrant resection, or mastectomy, which  
 45 is still subject to recurrence and breast deformity. Some  
 46 patients experience physical or psychological distress due  
 47 to the repeated treatment failure, long disease course,  
 48

recurrence, breast deformity or breast absence (4-10). 49  
 Therefore, it is critical to find an ideal treatment regimen 50  
 for CRPCM. This article reports on a novel surgical 51  
 technique CPNPIAM for treating CRPCM. The procedure 52  
 of CRPCM involves complete lesion removal, immediate 53  
 breast mammoplasty, and continuous postoperative negative 54  
 pressure irrigation. Satisfactory results were achieved, as 55  
 reported below. 56

We present the following article in accordance with the 57  
 STROBE reporting checklist (available at <http://dx.doi.org/10.21037/gs-20-795>). 58  
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 60

## 61 Methods

### 62 Patients

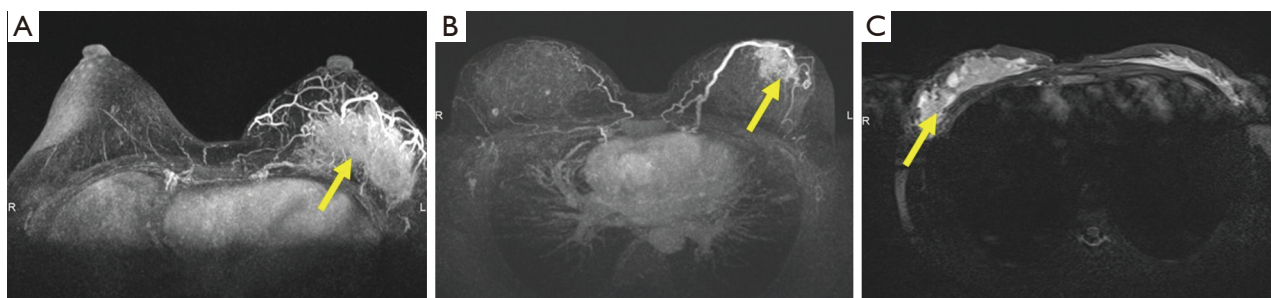
63 A total of 36 patients who received CPNPIAM in our 64  
 hospital between November 2016 and October 2018 were 65  
 retrospectively included in this study. All patients were 66  
 diagnosed as CRPCM according to typical syndromes, 67  
 disease course, ultrasound, MRI, and pathological 68  
 examination by cord needle biopsy before surgery. 69  
 Pathological examination was verified by two experienced 70  
 pathologists. The images of MRI before CPNPIAM are 71  
 shown in *Figure 1*. The study was approved by Shanghai 72  
 Ninth People's Hospital, Shanghai Jiao Tong University 73  
 School of Medicine institutional ethical committee 74  
 standards (institutional ethical committee number: 2016- 75  
 194-T138). All patients signed an informed consent form. 76  
 The study conformed to the provisions of the Declaration 77  
 of Helsinki (as revised in 2013). 78  
 79  
 80

### 81 Case selection criteria

82 The inclusion criteria were as follows: (I) female gender; 83  
 (II) with a course of illness longer than one month; and (III) 84  
 experienced unsuccessful conservative treatment or repeated 85  
 simple drainage, lumpectomy. Exclusion criteria were as 86  
 follows: (I) male gender; (II) with suspected breast cancer or 87  
 mastitis of other causes; and (III) with a course of illness less 88  
 than 3 months. 89  
 90

### 91 Surgical technique

92 Before the surgery, the excision area was drawn on the skin 93  
 with the patient in the standing position (*Figure 2A,B,C*). 94  
 Under general anesthesia, the patient was placed in a supine 95  
 position with both arms outstretched. If necessary, the 96



**Figure 1** Magnetic resonance imaging (MRI) of plasma cell mastitis (PCM) lesion before surgery. (A,B,C) MRI images of PCM lesion (arrow) before surgery in three patients with chronic refractory plasma cell mastitis.

97 operating table was adjusted in a position better to observe  
 98 the cosmetic appearance of the bilateral breasts. The skin  
 99 should be kept as much as possible, except the sinus area  
 100 or necrotic tissue. All inflammatory masses, abscesses,  
 101 sinus tract formations, and abnormal mammary ducts  
 102 were thoroughly resected. The surrounding breast tissue  
 103 should be carefully checked to ensure no lesions residue  
 104 (Figure 2D). The excised area was washed with hydrogen  
 105 peroxide (250 mL) and saline solution (1,000 mL). The  
 106 glandular flaps originating from the surrounding breast  
 107 tissue was separated and rotated to the excised area for  
 108 immediate breast mammoplasty (Figure 2E). The position  
 109 of nipple areola was adjusted by removing dermis around  
 110 areola. Locally advanced skin flap was designed to cover  
 111 the absence of skin, according to local defect situation. A  
 112 negative pressure suction equipment was arranged into  
 113 the surgical area for continuous postoperative negative  
 114 pressure irrigation with negative pressure 0.02 mmHg  
 115 (Figure 2F). The saline irrigation solution flowing from the  
 116 tube's entrance point drains the exudates and inflammatory  
 117 factors of the wound out via the tube's exit point, which is  
 118 connected to the vacuum drainage system. After 3–7 days  
 119 of continuous saline irrigation, the drainage tube was  
 120 removed before the patient was discharged from hospital.  
 121 The appearances of the breast on post-operative Day 7  
 122 (Figure 2G) and 6-month (Figure 2H) were recorded. The  
 123 equipment of continuous postoperative negative pressure  
 124 irrigation which includes saline irrigation, multiple-hole  
 125 drainage tube and vacuum system is shown in Figure 3.

### 127 *Clinical assessment*

128 Clinical assessment measures including age, history of  
 129 treatment, disease duration before surgery, local symptoms,  
 130 hospitalization time and related risk factors were assessed  
 131

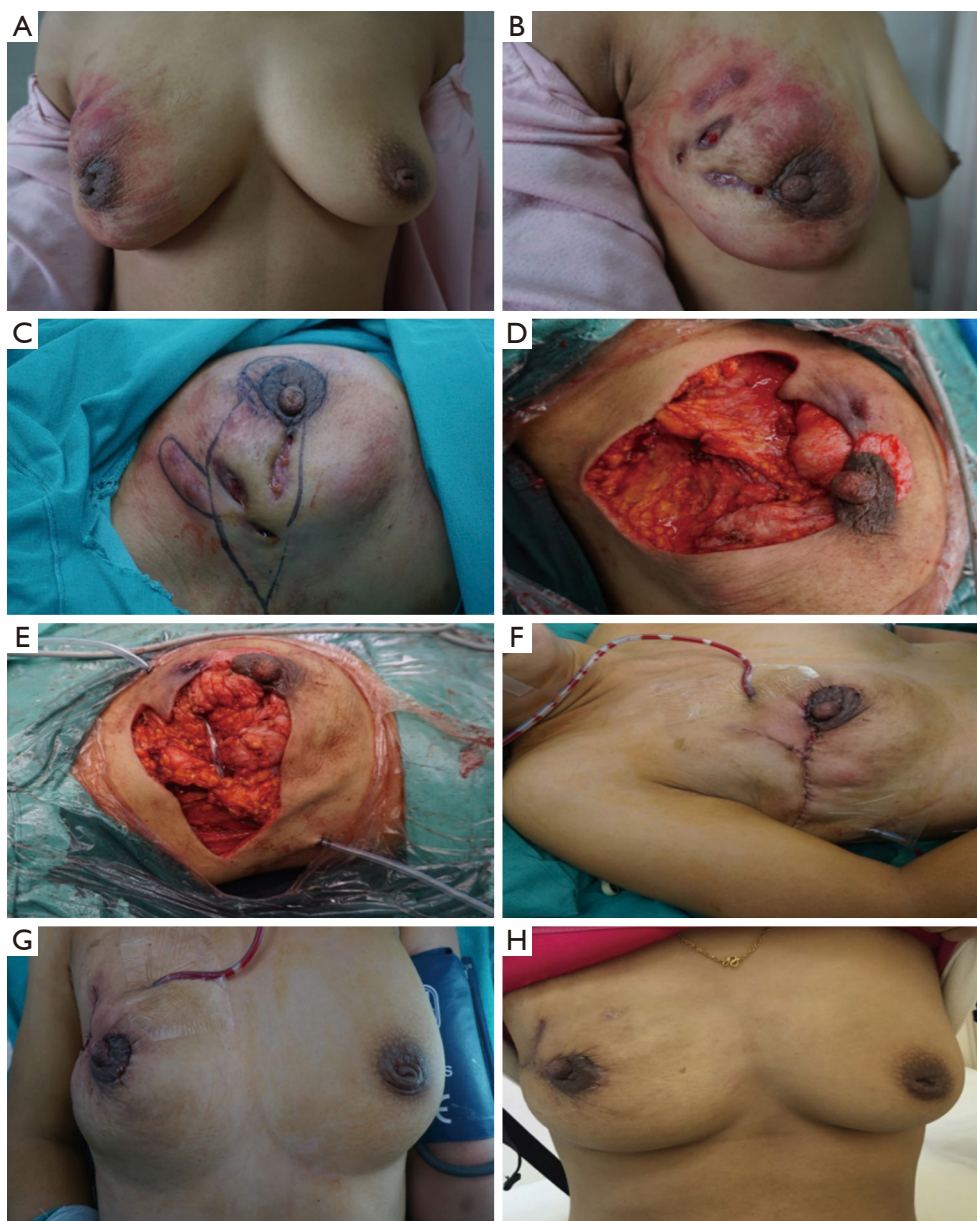
and documented after surgery. The success rate, recurrence  
 rate, and patient satisfaction ratings were assessed after a  
 3-month follow-up. Patients were asked by the investigator,  
 using Breast-Q tables, to evaluate their degree of satisfaction  
 (very good, good, moderate, poor, failed) regarding the  
 overall procedure, the shape, size, and symmetry of their  
 breasts, and the incidence of recurrence. Images comparing  
 the appearance and shape of the breasts before and after  
 surgery are shown in Figure 4.

### *Statistical analysis*

Continuous variables were presented as mean  $\pm$  standard  
 deviation. Categorical variables were presented as numbers  
 and percentages. All data were calculated with SPSS 22.0  
 (IBM Corp., Armonk, NY, USA).

### **Results**

All 36 patients were Chinese females, ranging in age from  
 22–53 years (mean 34.64 years). CRPCM was unilateral in  
 34 patients (94%) and bilateral in two patients (6%). Ten  
 patients were aged between 20–29 years (28%), 17 patients  
 were aged between 30–39 years (47%), six patients were  
 aged between 40–49 years (17%), and three patients were  
 aged between 50–59 years (8%). None of the patients was  
 over 60 years of age (Table 1). All patients had a history  
 of medicine treatment or repeated simple drainage, 18  
 cases had received antibiotics (50%), 33 cases had received  
 Chinese medicine (92%), and 20 cases had received prior  
 more than once time simple drainage (56%). The systemic  
 symptoms included 5 patients with low fever (14%), while  
 31 patients demonstrated no systemic symptoms (86%).  
 Major symptoms included inflammatory mass (n=36,  
 100%), abscess (n=33, 92%), nipple discharge (n=7, 19%),



**Figure 2** Continuous postoperative negative pressure irrigation assisted mammoplasty (CPNPIA) in treating chronic refractory plasma cell mastitis (CRPCM) in a 32-year-old patient. (A,B) Front and right side view of the patient's breast; (C) pre-operation, the dissection area was drawn on the skin; (D) all inflammatory masses, abscesses, sinus tract formations, and abnormal mammary ducts were completely removed; (E) a glandular flap originating from the surrounding breast tissue was separated and rotated to the excised area for immediate breast mammoplasty; (F) a negative pressure suction equipment was arranged into the surgical area for continuous postoperative negative pressure irrigation; (G) the appearance of the breast on Day 7 after surgery; (H) the appearance of the breast at 6-month follow-up.

167 inflammatory plaque (n=34, 94%), and sinus tract formation  
 168 (n=19, 53%) (Table 2). The lesion sizes ranged from 3 to  
 169 10 cm (mean 5.13 cm) in diameter. The mean duration of  
 170 the history of CRPCM before this surgery ranged from  
 171 1 to 13 months (mean 4.86 months). The mean duration

of hospitalization was 8.42 days. The possible related risk  
 172 factors for PCM included a congenital inverted nipple  
 173 (n=13, 36%), milk retention (n=7, 19%), trauma (n=7,  
 174 19%), and a history of breast surgery (n=6, 16%). No  
 175 family history of PCM, autoimmune disease or endocrine  
 176

177 hormone disorder was detected in these patients. None  
 178 had received hormone replacement therapy, and all were  
 179 non-smokers. Twenty patients displayed no related risk  
 180 factors (Table 3). The success rate after surgery was 100%  
 181 (36/36). Satisfaction ratings of breast shape after operation  
 182 were “very good” (n=23, 64%), “good” (n=12, 33%), and



**Figure 3** The equipment of continuous postoperative negative pressure irrigation includes saline irrigation, multiple-hole drainage tube and vacuum system.

“moderate” (n=1, 3%). Satisfaction ratings of breast size  
 were “very good” (n=24, 67%), “good” (n=11, 30%),  
 and “moderate” (n=1, 3%). Satisfaction ratings of breast  
 symmetry were “very good” (n=19, 53%), “good” (n=15,  
 41%), and “moderate” (n=2, 6%). None of the patients had  
 experienced a recurrence of symptoms at a 3-month follow-  
 up. The overall satisfaction in the procedure as rated by  
 CRPCM patients was “very good” (n=22, 61%), “good”  
 (n=12, 33%), and “moderate” (n=2, 6%), with no “poor” or  
 “failed” ratings recorded in any category (Table 4).

**Discussion**

PCM is defined as a variant of aseptic mastitis. It is  
 easily misdiagnosed and confused with other types  
 of breast mastitis, including sarcoidosis, necrobiotic  
 xanthogranulomatosis, fibrous mastitis, tuberculous  
 granulomas, fat necrosis, and breast cancer (11). The  
 etiology of PCM remains obscure. Ductal obstruction,  
 hyperprolactinemia, autoimmune disease, infection,  
 smoking and trauma are possible risk factors. In this study,  
 the causes of PCM were as follows: a congenital inverted



**Figure 4** Images comparing the appearance and shape of the breasts before and after surgery. 1–6 indicate different patients, A indicates before surgery, and B indicates after surgery.

**Table 1** Distribution of patients by age ranges

Age (years)	Numbers	Percentage (%)
20-29	10	28
30-39	17	47
40-49	6	17
50-59	3	8
60-69	0	0
Total	36	100

**Table 2** Symptoms of plasma cell mastitis (PCM)

Symptoms	Numbers	Percentage (%)
Inflammatory mass	36	100
Abscess	33	92
Nipple discharge	7	19
Inflammatory plaque	34	94
Sinus tract formation	19	53

**Table 3** Risk factor distribution

Risk factors	Numbers	Percentage (%)
Congenital inverted nipple	13	36
Milk retention	7	19
Trauma	7	19
History of breast surgery	6	16
Autoimmune diseases	0	0
Hormone replacement therapy	0	0
Family history	0	0
Endocrine hormone disorders	0	0
History of smoking	0	0
No related risk factor	20	56

**Table 4** Aesthetic outcome of plasma cell mastitis (PCM) comprehensive surgery

Variable	Very good	Good	Moderate	Poor	Failed
Shape	23 (64%)	12 (33%)	1 (3%)	0 (0%)	0 (0%)
Size	24 (67%)	11 (30%)	1 (3%)	0 (0%)	0 (0%)
Symmetry	19 (53%)	15 (41%)	2 (6%)	0 (0%)	0 (0%)
Recurrence	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Overall	22 (61%)	12 (33%)	2 (6%)	0 (0%)	0 (0%)

nipple, milk retention, trauma, and previous history of breast surgery. No patients had family history, autoimmune disease, endocrine hormone disorder, hormone replacement therapy, or smoking. The majority of the patients did not have any obvious trigger. Bani-Hani and Kessler showed that PCM normally occurred in young and middle-aged women who are not lactating or pregnant (2,3). In our study, 75% of patients were also under 39 years old, and no patients were over 60 years old. Also, no patient was pregnant. The major symptoms of CRPCM included inflammatory mass, abscess, nipple discharge, inflammatory plaque, and sinus tract formation. Most of them presented inflammatory mass and abscess. The longest duration of CRPCM before surgery was 13 months. All patients in our study had received previous unsatisfactory conservative treatment or surgical treatment, such as antibiotics treatment, Chinese medicine treatment, repeated simple drainage or incomplete lumpectomy. The unsatisfactory treatment outcome, delayed healing process, and a high recurrence rate imposed physical and psychological burdens on the patients.

Surgical excision is a major advance in treating PCM (12,13). Traditional surgery for PCM has typically included repeated simple drainage, lumpectomy, quadrant resection, or mastectomy (4,14). Simple drainage is usually applied in CRPCM with abscess formation. Surgical processes include the complete opening of the abscess cavity, scraping of the necrotic tissue, and drainage. After simple drainage, the treatment cycle of patient can be lengthy and is often accompanied by pain, scar hyperplasia, breast deformity, and a high symptom recurrence rate. Lumpectomy and quadrant excision are also the most common surgical options, which have a high possibility of leading to recurrence and breast deformity. In some extreme cases, mastectomy is required when inflammation has invaded most of the breast tissue, and there is little normal gland remaining (15,16). In our opinion, all inflammatory masses,

abscesses, sinus tract formations, and abnormal mammary ducts should be thoroughly resected in once operation. The surrounding breast tissue should be carefully checked to ensure no lesions residue. Any remaining lesions may easily induce a recurrence or failure treatment of CRPCM.

Complete lesion excision could certainly lead to breast deformity. In our opinion, the best way to solve this aesthetic problem is to perform an immediate mammoplasty. Hladik reported using Deep Inferior Epigastric Perforator (DIEP) for breast reconstruction in three mastitis cases (15). However, infection of the surgical site after excision is a commonly reported complication. In our experience, the time-consuming surgery is not suitable for CRPCM cases because the prolonged surgical duration may significantly increase the risk of infection and a subsequent adverse outcome (9). We used glandular flaps originating from the surrounding breast tissue for immediate breast mammoplasty. The position of nipple areola was adjusted by removing dermis around areola and locally advanced skin flap was designed to cover the absence of skin, if necessary. The use of topical negative pressure therapy was first reported by Argenta and Morykwas in 1997 and was designed to stimulate granulation tissue formation and remove bacterial secretion (17). It is now widely practiced in treating acute and chronic wounds and surgical site inflammations (18-20). This study applied continuous postoperative negative pressure irrigation equipment, a modified negative pressure therapy system. The major advantage of this system is its effectiveness in diluting the pus and sucking away the necrotic tissue. The use of negative pressure drainage was effective in achieving complete wound closure, maintaining a sterile environment and preventing from secondary infection, which stimulated granulation tissue formation and accelerated the wound healing process.

There have been no standardized or systematic guidelines for diagnosing and treating PCM (8,9). Treatment of CRPCM is complex due to the potential for surgical site infection, postoperative breast deformity, and a high recurrence rate. Therefore, the challenge for treating clinicians has been to find effective ways to shorten the disease course, decrease the recurrence rate, and reshape the breast. Traditional PCM surgical procedures involve repeated simple drainage, lumpectomy, quadrant resection or even mastectomy, and immediate breast mammoplasty was not recommended for infected breast. These surgical procedures may lead to scar hyperplasia, breast deformity or breast absence, and have a high recurrence rate. The

advantage of CPNPIAM is that it enables the surgeons to remove focuses and perform mammoplasty simultaneously, which shortened the course of disease and maintained the shape of breast in one-step. The short-term follow-up data has revealed satisfying results in the success and recurrence rates and cosmetic appearance.

We acknowledge that there are limitations to this study. Larger sample sizes and cohort studies are necessary to assess this new surgical technique and confirm its clinical value in further study. Patients who received our treatment in this study suffered some mild physical inconvenience related to the CNPI procedure. Therefore, it will be important to consider ways to modify the drainage system and potentially shorten the treatment time in any future studies.

## Conclusions

CPNPIAM provided a novel and effective way to treat patients with CRPCM and demonstrated a high success rate, a low recurrence rate, and a high satisfaction rating from patients. Larger sample sizes and multicenter randomized controlled studies are now necessary to verify the efficacy of this novel surgical technique in future research.

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## Footnote

*Reporting Checklist:* The authors have completed the STROBE reporting checklist. Available at <http://dx.doi.org/10.21037/gs-20-795>

*Data Sharing Statement:* Available at <http://dx.doi.org/10.21037/gs-20-795>

*Conflicts of Interest:* All authors have completed the ICMJE uniform disclosure form (available at <http://dx.doi.org/10.21037/gs-20-795>). The authors have no conflicts of interest to declare.

*Ethical Statement:* The authors are accountable for all

338 aspects of the work in ensuring that questions related  
 339 to the accuracy or integrity of any part of the work are  
 340 appropriately investigated and resolved. The study was  
 341 approved by Shanghai Ninth People's Hospital, Shanghai  
 342 Jiao Tong University School of Medicine institutional  
 343 ethical committee standards (institutional ethical committee  
 344 number: 2016-194-T138). All patients signed an informed  
 345 consent form. The study conformed to the provisions of the  
 346 Declaration of Helsinki (as revised in 2013).

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