

# Surgical Management of the Giant Pannus: Indications, Strategies, and Outcomes

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Received: 11 September 2017 / Accepted: 18 November 2017 / Published online: 21 December 2017  
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**Abstract** The obesity pandemic continues to produce an inexorable increase in the number of patients requiring surgical treatment of obesity and obesity-related complications. Along with this growing number of patients, there is a concomitant increase in the complexity of management. One particular example is the treatment of patients with an exceptionally large and morbid pannus. In this report, we detail the management of seven patients suffering from a giant pannus. Medical and surgical variables were assessed. A quality of life questionnaire was administered pre- and postoperatively. All seven patients suffered some obesity-related medical morbidity and six of seven (86%) had local complications of the giant pannus. Each patient underwent giant panniculectomy [resection weight > 13.6 kg (30 lb)]. The mean resection weight was 20.0 kg. Four of seven (57%) patients experienced postoperative complications, with two (29%) requiring re-operation and blood transfusion. Six patients were available for long-term follow-up; 100% of participants indicated an increased quality of life while five (83%) reported additional postoperative weight loss, increase in exercise frequency and walking ability, and improved ability to work. Our results indicate that giant panniculectomy is a challenging and risky procedure, but careful patient selection

and intraoperative scrutiny can ameliorate these risks and afford patients a dramatically improved quality of life.

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**Keywords** Panniculectomy · Giant · Obesity · Quality of life

## Introduction

Morbid obesity continues to be a pandemic, especially in the USA. A subset of morbidly obese patients presents with a giant, hanging pannus either prior to or following bariatric surgery. The pannus on these patients can often become edematous, ulcerated, or infected, ultimately becoming medically disabling. The size of the pannus can also diminish the patient's ability to walk, exercise, work, or perform normal daily activities of living (e.g., hygiene). A giant pannus may result in the inability to undergo bariatric surgery or it can thwart a patient's weight loss efforts and progress.

Surgery in the morbidly obese patient is not without risk. For safety concerns, we will often defer panniculectomy in these patients and will refer them for bariatric surgery consultation if they have not had surgery. A previous review of our database demonstrated that patients undergoing panniculectomy with a body mass index (BMI) > 35 were at an increased risk for complications compared to those with a BMI < 35. In carefully selected patients with a giant pannus that is severely debilitating, we will offer surgical correction by means of a panniculectomy.

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We evaluated whether the risks associated with giant panniculectomy were outweighed by benefits of resection in terms of improvement in quality of life and daily activities of living. This paper also describes our current management of these high-risk patients to optimize patient safety.

## Methods

All patients in our practice were enrolled into a prospective clinical database; this study was subsequently approved by the Institutional Review Board of the University of Pittsburgh. A review of this database from 2015 to present demonstrated seven patients that were categorized as suffering from a “giant pannus” based on a combination of body habitus (preoperative BMI > 35 kg/m<sup>2</sup>) and size of pannus resected [resection weight > 13.6 kg (30 lb)]. Weight loss and medical histories were assessed and recorded at the time of initial consultation. A standard questionnaire assessing activities of daily living was distributed before and after surgery. Maximum weight was defined as the highest weight a patient reached prior to weight loss, preoperative weight was measured at the preoperative consultation, while postoperative weight was recorded at their last follow-up appointment.

Sequential compression devices (SCDs) were placed before induction in all cases. Patients received postoperative low molecular weight heparin (LMWH) beginning 6 h postoperatively and continued through discharge. As a matter of protocol, we recommend that patients undergo placement of a retrievable inferior vena cava (IVC) filter before giant panniculectomy to minimize the risk of pulmonary embolism. This is performed in conjunction with the vascular surgery service on the day of surgery with placement immediately following anesthesia induction prior to the excision of the giant pannus.

After the patients had fully recovered from surgery, patients were asked to complete a survey to assess whether panniculectomy improved their quality of life. These questions assessed their mobility, ability to exercise, perform daily hygiene, and work both before and after panniculectomy. Patient questionnaire responses were analyzed on a five-point scale. The Wilcoxon rank sum test was used to assess significant changes in scoring before and after surgery. All statistical tests were two-sided and significance was set to the level of  $P < 0.05$ . Statistical analysis was performed using Stata/SE version 10.0 (StataCorp Inc., College Station, TX, USA).

## Surgical Technique

An elliptical panniculectomy excision is marked out with the superior aspect extending from the borders of the anterior superior iliac spines bilaterally. The inferior aspect is drawn after the pannus itself is held on tract. Thus, it is somewhat variable but should be gently V-shaped and attention should be paid to connecting this line to the superior line in such an angular fashion as to avoid redundant lateral tissue upon closure. After incision, a crane hoist with Steinman pins through the pannus is used to assist with retraction. For the largest resection, this approach is also heavily relied upon for venous drainage of the large tissue mass. Extensive use of hemostatic clips and suture ligation is absolutely necessary to control bleeding secondary to the vascular hypertrophy innate to the physiology of the giant pannus; electrocautery is appropriate only for punctate bleeding. Elevation proceeds along the plane of the rectus fascia and meticulous attention is paid to avoid undermining beyond the resection margins. We advocate for sacrifice of the umbilicus. Hemostasis is very carefully achieved and verified before closure. Repair of any fascial intrusions with monofilament suture is next, followed by multilayered closure with absorbable, interrupted sutures. Placement of numerous closed suction drains should be performed at this point. Skin approximation can be achieved with running, absorbable monofilament sutures or stainless steel staples. All patients are kept on continuous cardiac and pulse oximetric monitoring postoperatively. We also routinely check a complete blood count after surgery.

## Results

Seven patients undergoing giant panniculectomy were included in the study. Table 1 summarizes their demographic characteristics. Five patients (71%) had previously undergone laparoscopic gastric bypass while the remaining two had no history of bariatric surgery. All seven patients had multiple comorbidities, in particular arthritis (6); hypertension (3); hypothyroidism (3); diabetes (2); prior history of deep venous thrombosis (1) and atrial fibrillation (1). Six (86%) had areas of active skin breakdown on the pannus at the time of surgery. None of the patients were current smokers.

IVC filters were placed in four patients (57%) and removed by three months postoperatively. Six patients (86%) also underwent hernia repair, the only procedure performed concomitantly with panniculectomy. The mean operative time was 280 min (range 125–390), while the median estimated blood loss (EBL) was 250 cc (range

**Table 1** Patient demographics

Age (years)	
Mean (range), yr	51.4 (43–65)
Gender	
Female	5/7 (71%)
Max Weight	
Mean (range), lb	632.9 (400–780)
Preop Weight	
Mean (range), lb	343.1 (224–446)
Postop Weight	
Mean (range), lb	282.3 (180–370)
Max BMI	
Mean (range)	90.4 (64.0–128.7)
Preop BMI	
Mean (range)	54.3 (38.4–66.2)
Postop BMI	
Mean (range)	45.8 (30.9–65.5)

150–600). The average weight of the resected pannus was 20.0 kg (range 15.2–36.3).

Four patients (57%) experienced postoperative complications. Two patients (29%) developed expanding abdominal hematomas requiring return to the operating room for drainage. Both of these patients required blood transfusions. One patient developed postoperative pneumonia and wound cellulitis while in the hospital. The patient was initially treated with intravenous antibiotics followed by oral antibiotics, leading to complete resolution. A fourth patient was unable to be weaned from the ventilator at the end of the case and required prolonged intubation. The average hospital stay was 4.9 days (range 2–8). One patient passed away from causes unrelated to their surgery.

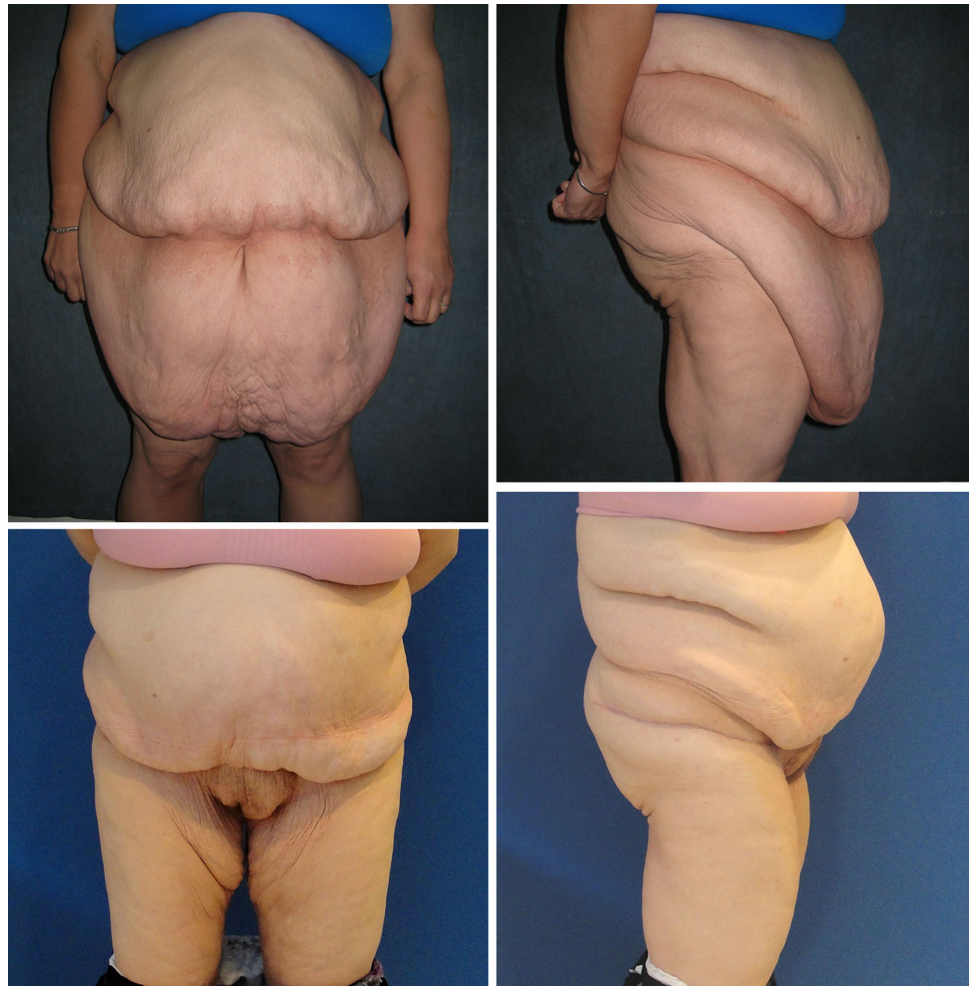
Of the six patients with long-term follow-up, five (83%) lost additional weight after their panniculectomy, averaging 26.8 kg (Figs. 1, 2, 3). The sixth patient had not undergone bariatric surgery and gained 25.0 kg following

**Fig. 1** A 45-year-old female patient who presented after a weight loss of 186 lb (top: preoperative AP and lateral photos, bottom: postoperative AP and lateral photographs)





**Fig. 2** A 43-year-old patient seeking panniculectomy after losing over 200 lb (top: preoperative AP and lateral, bottom: postoperative AP and lateral)



panniculectomy. Table 2 shows questionnaire responses before and after panniculectomy. All six patients stated that their ability to walk was substantially improved after surgery. Four patients had decreased requirement of a walker to assist them with ambulation. Quality of life issues, including personal hygiene and ability to fit into clothes, were significantly improved after surgery. Before surgery, four of six patients (66%) said they “never” exercised while the other two patients exercised “once a month or less” and “more than once a week”, respectively. After surgery, while one participant still “never” exercised, the remaining five (83%) were able to exercise “more than once a week” ( $P < 0.05$ ). Five out of six patients said that panniculectomy improved their ability to work.

## Discussion

Although giant panniculectomy continues to be an operation with significant risk for complications, we demonstrated in this small subset of patients that this procedure

improved global quality of life at long-term follow-up. Patients specifically demonstrated improvements in hygiene, physical activity, and the ability to fit into clothing.

Despite stringent preoperative screening, four of seven patients had complications with two requiring re-exploration for hematoma. Safety continues to be paramount in both our preoperative and intraoperative management of these patients. At our institution, several intraoperative steps are performed to minimize fluid shifts and blood loss. There have been many descriptions regarding the use of a suspension system to elevate the pannus and the use of tumescent solution along incision lines [1–3]. To minimize blood loss, we inject a freshly prepared epinephrine solution at a concentration of 1:100,000 along all incision lines. We also suspend the pannus using Steinman pins suspended from a Hoyer lift, which allows for the progressive elevation of the pannus during the procedure. This not only allows the surgeon to work expeditiously, but it also minimizes fluid shifts by allowing egress of blood and lymphatic fluid from the pannus as it is elevated prior to final

**Fig. 3** A 71-year-old female presenting with a sizable pannus interfering with ambulation (top: preoperative AP and lateral, bottom: postoperative AP and lateral)



**Table 2** Patient responses before and after giant panniculectomy

	Never	Occasionally	Half the time	Most of the time	Always
<i>I can walk without using an assisting device</i>					
Before Surgery	67%	16%	–	16%	–
*After Surgery	33%	33%	–	–	33%
<i>I can perform regular hygiene under my pannus without assistance</i>					
Before Surgery	67%	–	–	16%	16%
*After Surgery	–	–	–	–	100%
<i>I suffer from lower back pain:</i>					
Before Surgery	50%	–	–	16%	33%
After Surgery	50%	–	33%	–	16%
<i>I have difficulty walking up a flight of stairs</i>					
Before Surgery	–	–	–	–	100%
*After Surgery	33%	16%	–	16%	33%
<i>I have difficulty fitting into clothing</i>					
Before Surgery	16%	–	–	16%	66%
*After Surgery	66%	16%	16%	–	–

\*Significantly improved after surgery ( $P < 0.05$  by Wilcoxon rank sum test)

resection. We also use auto-clip ligation on all visible vessels along with suture ligation of the inferior epigastric vessels to minimize bleeding.

Venous thromboembolism (VTE) continues to be a significant concern in obese patients. Natural history trials demonstrate a DVT incidence of 1.2–1.6% and a PE incidence of 0.8–3.2% [4]. The American College of Chest Physicians (ACCP) recommendation for VTE prophylaxis for bariatric surgery patients includes pneumatic compression devices in combination with chemoprophylaxis; however, the optimal timing to initiate chemoprophylaxis has not been clearly defined [5]. The American Association of Clinical Endocrinologists, the Obesity Society, and the American Society for Metabolic and Bariatric Surgery (AACE/TOS/ASMBS) have made the recommendations that patients should receive either unfractionated heparin (UF) or LMWH prior to surgery and repeated 8–12 h postoperatively until the patient is ambulatory [6].

Unlike many of our bariatric surgery colleagues that give preoperative chemoprophylaxis, many plastic surgeons (including ourselves) do not give preoperative anticoagulation for the real concern of postoperative hematoma. Although there is minimal undermining performed with little potential dead space, these patients can often lose multiple units of blood prior to any clinical sign of bleeding. Our current VTE protocol includes SCD placement prior to the induction of anesthesia and the initiation of standing 30 mg subcutaneous doses of enoxaparin 6 h postoperatively until the time of discharge. Review of our database of over 500 post-bariatric body contouring patients has demonstrated that this protocol

does not increase the risk of hematoma compared to controls that received only SCDs as the only form of VTE prophylaxis. In this small study, we observed two cases of serious hematoma. Given the extent of the panniculectomy performed, we see this as an unavoidable risk despite our meticulous precautions to prevent this complication. The benefits of anticoagulation are readily apparent, however, as none of the patients suffered a DVT or PE, the latter of which is far more devastating than an unexpected re-operation to correct a hematoma.

The final element of our blood clot prevention strategy involves IVC filters. The use of IVC filters remains an area in which there is no clear consensus. The literature demonstrates that IVC filters can be safely placed and later removed in patients undergoing bariatric surgery [7–9]. However, there were no standard criteria amongst these papers. Currently, the ACCP does not recommend the use of IVC filters for prophylaxis. The AACE/TOS/ASMBS does recommend the use of IVC filters in high-risk patients [6]. This is an area that requires randomized, prospective studies. However, given the low incidence of VTE, demonstration that IVC filters make a statistically significant difference would require a large sample size. We encourage all patients to receive an IVC filter before giant panniculectomy; for those patients with notable risk factors (preoperative BMI  $> 55 \text{ kg/m}^2$ , a history of VTE, hereditary thrombophilia, or preoperative immobility), we virtually require their placement.

Perhaps most importantly, this study demonstrates that patients suffering from the ill effects of a giant pannus are capable of achieving significant improvements in their



health following giant panniculectomy. Prior research has demonstrated that patients generally enjoy increased quality of life and health after aesthetically motivated surgery [10, 11]. More specifically, patients consistently report significant improvements after resection of a smaller pannus, often less than six kilograms [12–15]. Similar data for patients undergoing the more physiologically demanding resection of a giant pannus are limited to one report by Reichenberger and colleagues, who reported mainly on surgical technique and healing [16]. Our report is the first to specifically address patient-centered outcomes such as quality of life and health. All seven patients in our series were able to consistently perform aspects of basic personal hygiene postoperatively, for example, whereas two-thirds of them were entirely unable to do so before giant panniculectomy. Similarly, there were very impressive improvements in ambulatory metrics such as unassisted walking and climbing a flight of stairs. These data demonstrate that giant panniculectomy, despite certain inherent risks, can have crucial, positive effects on overall health and well-being in these patients, beyond the immediate benefits of panniculectomy itself.

Although our postoperative quality of life data are extremely encouraging, the small sample size of this study prohibited us from demonstrating a truly statistically significant improvement. Because this procedure is uncommon, a multicenter study would be necessary to achieve the appropriate sample sizes necessary to conclusively demonstrate the benefits of giant panniculectomy.

## Conclusion

Giant panniculectomy continues to be a high-risk procedure. Careful patient selection and efforts to minimize blood loss and intraoperative fluid shifts will help to optimize outcomes in this population. In our small series, we demonstrate that patients undergoing giant panniculectomy had an improvement in their ability to perform physical activity and daily activities of living. Despite the inherent risks of this procedure in these patients, we advocate for giant panniculectomy in the appropriate clinical context.

**Acknowledgements** None of the authors has a financial interest in any of the products, devices, or drugs mentioned in this manuscript.

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