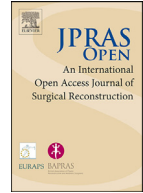


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# Incision planning in complex abdominal wall reconstruction

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## ABSTRACT

**Background:** Complex abdominal wall reconstruction (CAWR) has evolved dramatically over the last 10 years and has become a speciality in its own right. Usually surgery is carried out by a General Surgeon, sometimes alone and sometimes in combination with a Plastic Surgeon. Patients frequently have multiple incisions over the abdomen, soft tissue excess and skin redundancy and planning the incisions to allow for a comprehensive abdominal wall reconstruction can be a challenge.

In order to help simplify incision planning we examined our personal series of 150 cases to formulate a classification system for the incision and provide a simple algorithm.

**Methods:** Over an 8 year period from 2007 to 2015, 150 patients underwent complex abdominal wall reconstruction, patient demographics, outcome and complications were recorded. Preoperative photographs of the planned incisions were reviewed by the senior author and classified into 4 groups.

**Results:** All patients fell into one of four groups. Type 1, using existing incisions (28%). Type 2, using an abdominoplasty approach (26%). Type 3, a fleur-de-lys approach (43%). Type 4, a free style group where the incisions are so complex that the above three categories are not suitable (3%).

**Conclusion:** Soft tissue management in CAWR can be challenging with the primary objective to achieve uncomplicated primary wound healing while optimising the aesthetic outcome. We present

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a simple classification system and associated algorithm, which can help surgical planning and identify cases that may benefit from a joint procedure with a Plastic Surgeon.

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## Introduction

Ventral hernias have an estimated occurrence rate of 15% following laparotomies<sup>1</sup>. In the presence of soft tissue excess and multiple scars these complex ventral hernias require CAWR. The management of these complex abdominal wall defects is usually carried out by a General surgeon sometimes alone and sometimes in combination with a Plastic Surgeon and achieving uncomplicated primary wound healing with a good aesthetic outcome can be challenging. Over the last 10 years complex abdominal wall reconstruction has become a speciality in its own right and has focused on achieving a mesh supported primary fascial closure of the abdominal wall. Much effort has been put into the development and selection of appropriate meshes and in finding a variety of techniques to allow for a successful repair with low recurrence rates. Repairing these defects and reinforcing them with either a biological or synthetic mesh has been shown to reduce morbidity and recurrence rates<sup>2</sup>. Patients frequently have multiple incisions over the abdomen, soft tissue excess and skin redundancy and therefore planning the skin incisions to provide access for a CAWR can be challenging. The primary objective in the soft tissue management is to maintain well vascularised flaps to allow for uncomplicated primary wound healing to support the hernia repair while maintaining an optimal aesthetic outcome.

Difficulty in planning the incision has led us to review our personal series of 150 cases and to develop a classification system to help streamline the decision making process.

## Patients and methods

All cases of CAWR over an 8 year period from 2007 to 2015 were examined. All cases were carried out by the same team comprising a General surgeon and a Plastic surgeon (senior author) who have adopted a two consultant approach. Patient demographics, outcome and complications were recorded.

Preoperative photographs of the markings were reviewed by the senior author and categorised into 4 types.

## Results

Over the 8 year period 150 patients were identified. The average BMI was 33 with a 68% female to 32% male ratio, biological meshes were used in 67% of cases and synthetic meshes in 33%. Using the Ventral Hernia Working Group's (VHWG) grading scale, 10% of cases were grade 1, 33% grade 2, 45% grade 3 and 12% grade 4 (Figure 1). 33.3% were recurrent hernias, 18.4% had diabetes, 30.7% had a current diagnosis of malignancy, 15.8% were smokers, 5.3% had stomas, 7.0% had COPD and 12.3% had ischaemic heart disease.

The complication rate was 28.9%. Surgical site occurrences 15.8%, Respiratory complications 7%, Cardiac complications 2.63%, Hernia recurrence 3.5% (at a mean follow-up of 35 months).

We achieved primary wound healing in 93% of cases.

Analysis of the preoperative photographs of the markings has allowed all the cases to be classified within 4 distinct groups (Figure 2) 28% classified as Type 1, 26% as Type 2, 43% as Type 3 and 3% as Type 4.

We will show 2 cases per group emphasising the incision planning and final result.

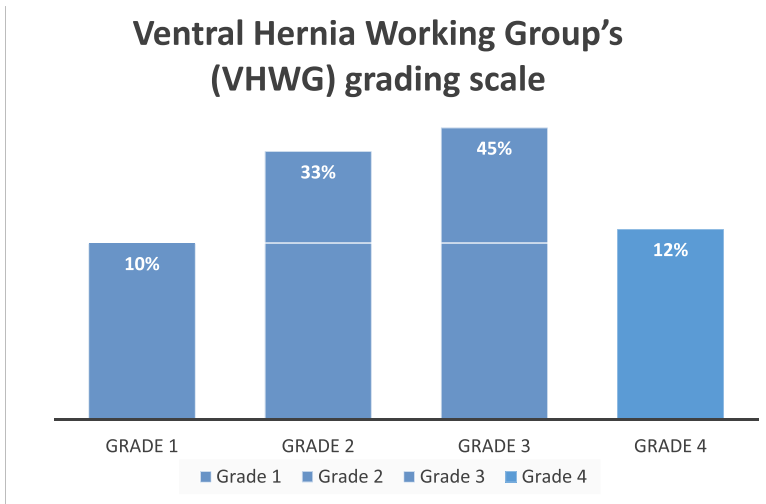


Figure 1. Cases classified into the Ventral Hernia Working Group's (VHWG) grading scale.

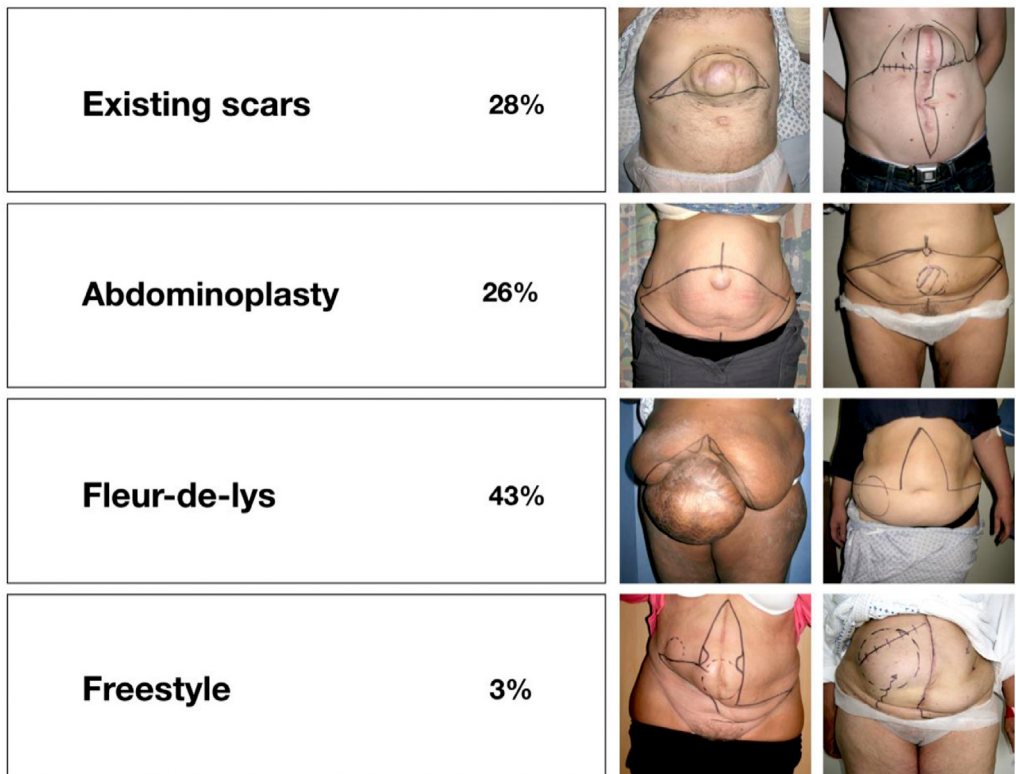
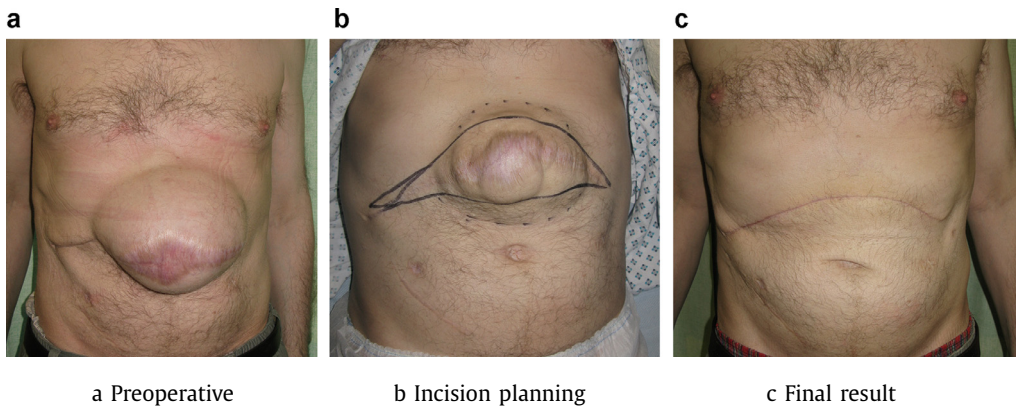


Figure 2. Classification of preoperative photographs of the markings into 4 distinct groups.

**Type 1: Using existing incisions** - usually in a slim patient with little skin excess and incisions placed close to or over the hernia.

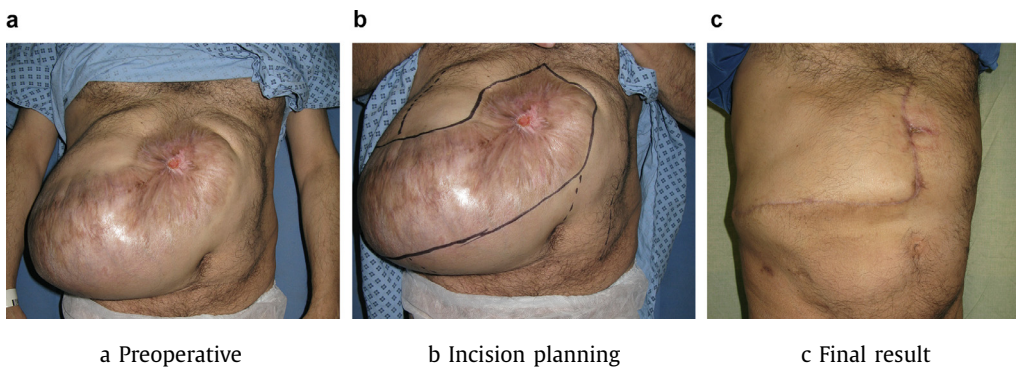
*Case 1*

54 year old male who developed a hernia following excision of a cholangiocarcinoma via a roof top incision. The incision was planned using his existing scar and the hernia was repaired using strattice to achieve fascial closure.



*Case 2*

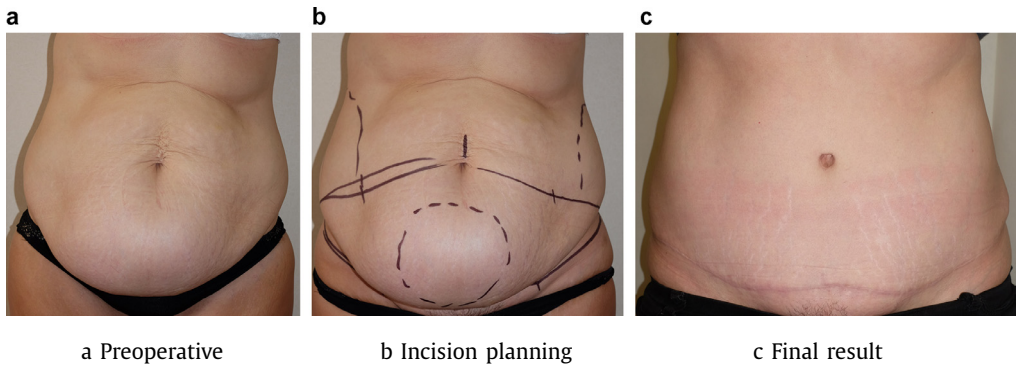
55 year old male who developed a complex hernia following a liver transplant via an L shaped incision. This was repaired through the original scar using strattice achieving fascial closure with an acceptable cosmetic outcome.



**Type 2: Using an abdominoplasty approach** - if lower abdominal panus present, post-partum skin laxity, or a midline scar below the umbilicus.

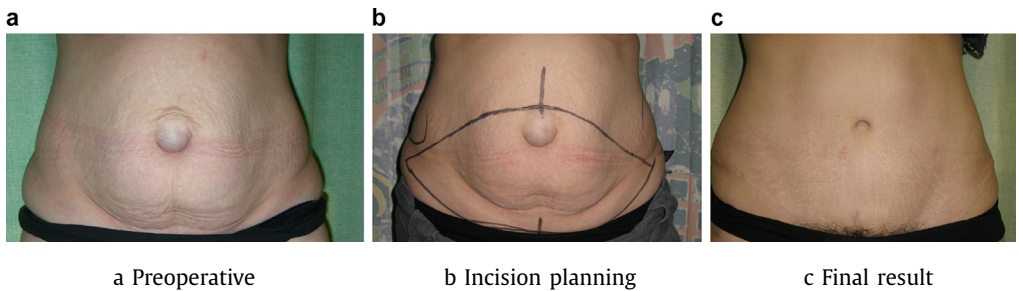
**Case 3**

44 year old female who developed an incisional hernia post hysterectomy. The hernia was repaired using a synthetic mesh via an abdominoplasty approach with removal of the excess lower abdominal tissue leaving a low well hidden scar.



**Case 4**

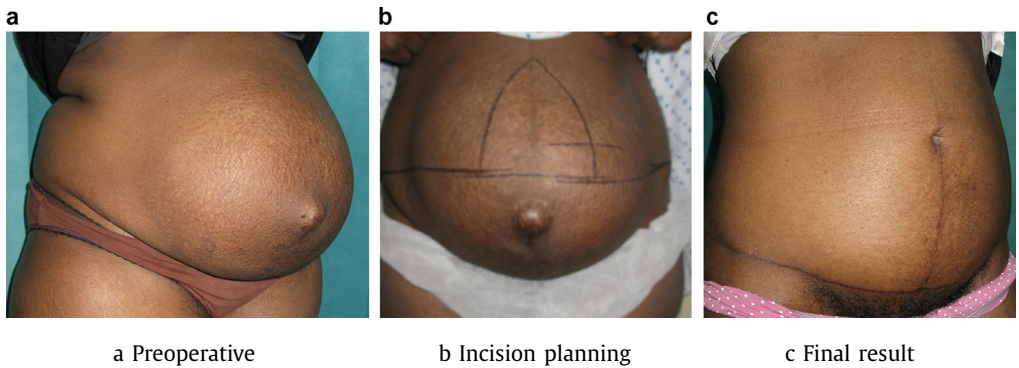
38 year old female who developed a large umbilical hernia following a laparoscopic procedure. She underwent repair of this via a abdominoplasty approach using a synthetic mesh. At the time of the primary hernia repair the umbilicus was removed. She then underwent a delayed umbilical reconstruction 3 month later.



**Type 3: A fleur-de-lys approach** - marked skin laxity in 2 dimensions, especially if already a midline scar above the umbilicus, usually used with a perforator sparing technique.

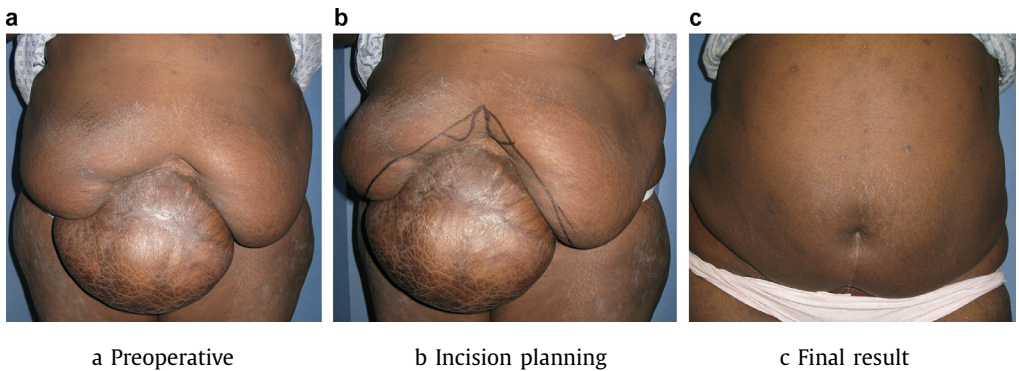
*Case 5*

This 42 year old woman developed a dramatic midline dehiscence following 3 children. Due to the excess tissue a fleur-de-lys approach was used and the hernia was repaired using a synthetic mesh achieving midline fascial closure.



*Case 6*

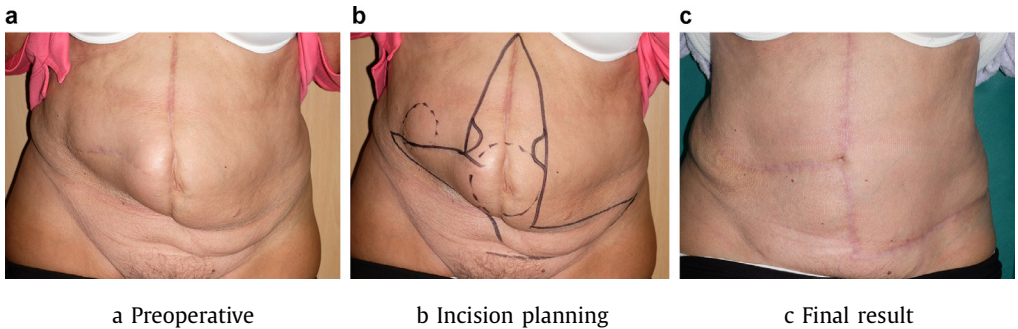
55 year old woman underwent a laparotomy for bowel obstruction. This was complicated by infection and she was left with a laparostomy that required a split skin graft. The hernia was repaired with strattice via a fleur-de-lys approach achieving a midline fascial closure with reconstruction of a neoumbilicus.



**Type 4: Free style approach** - too many old scars to safely use 1,2,3. Often with skin excess, creative incisions and perforator sparing techniques required.

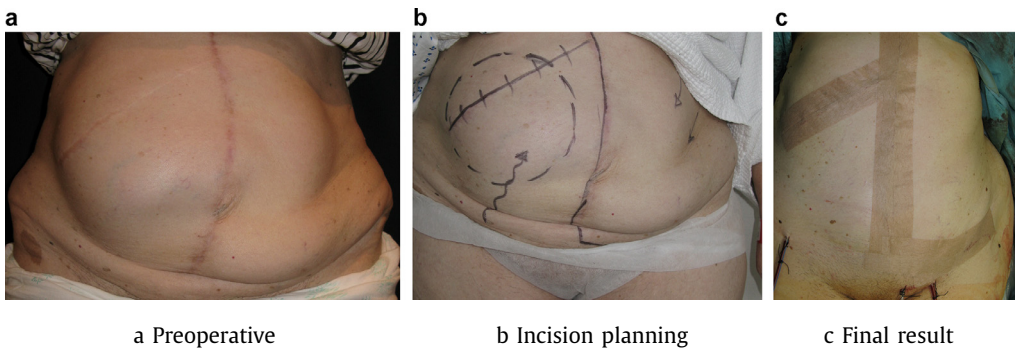
Case 7

66 year old woman who previously underwent a nephrectomy and bowel resection, developed a stomal hernia that had previously been repaired and had developed a further recurrence. Due to the multiple incisions and previous hernia repair a freestyle approach was adopted. The hernia was repaired using synthetic mesh achieving a midline fascial closure.



Case 8

65 year old woman who underwent an emergency laparotomy for bowel obstruction, she had a previous kochers incision following cholecystectomy surgery. She underwent a delayed synthetic mesh repair of her hernia using a freestyle approach to achieve fascial closure.



**Discussion**

Patients undergoing CAWR often have raised BMI with skin and soft tissue redundancy. Once the tissues have been elevated to allow for mesh repair of the hernia there is often redundant skin and soft tissue that is poorly vascularised and requires excision<sup>3,4</sup>.

The advent of perforator sparing techniques has helped focus our approach on skin flap vascularity but there is still often skin excess that requires excision. Experience with bariatric patients has shown that removal of excessive skin and subcutaneous fat leads to a better quality of life<sup>5</sup> and we would expect CAWR cases to benefit in the same way.

Abdominal wall reconstruction has become a speciality in its own right. Much work has taken place in the development of biological/synthetic meshes and in the techniques of CAWR<sup>6</sup>. The objectives in soft tissue management in CAWR is to achieve primary wound healing to support the under-

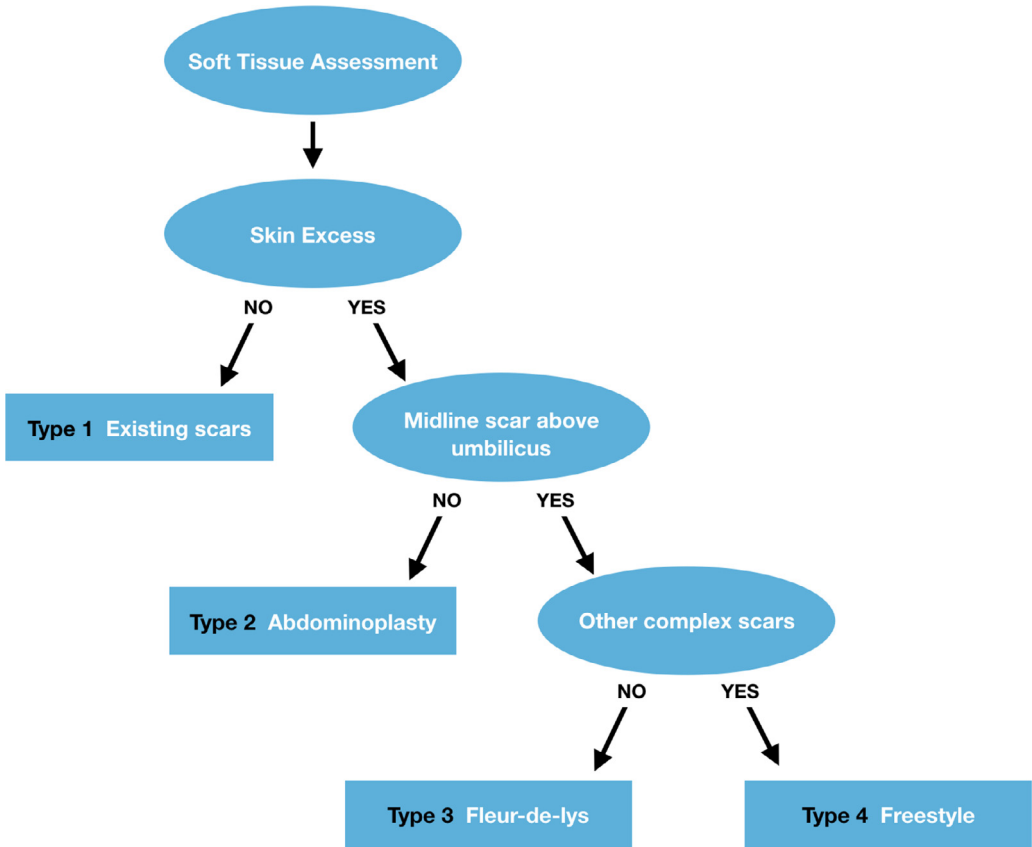


Figure 3. Treatment algorithm.

lying hernia repair. Our classification system is designed to help in the preoperative planning to make this possible.

Having worked with this classification for a number of years we have incorporated it into a simple algorithm that can be used in the clinical setting to help plan surgery (Figure 3).

In our unit all CAWR cases are treated jointly by a General and Plastic surgeon. We acknowledge this may not be possible in every unit and selecting the cases that would benefit from Plastic Surgery input can be a challenge. We hope this classification system and algorithm can help select the more complex cases for joint surgical treatment. Patients in Group 1 require little soft tissue management and in most case can be safely managed without Plastic Surgical input.

Groups 2, 3 and 4 however have an excess of skin, soft tissue and/or multiple scars and involvement of a Plastic surgeon is beneficial. The role of the plastic surgeon is to plan the optimal incision/approach and soft tissue resection to allow for well vascularised flaps and achieve tension free closure with an optimal aesthetic outcome.

### Conclusion

Soft tissue management in CAWR can be challenging with the primary objective to achieve uncomplicated primary wound healing while optimising the aesthetic outcome. This simple classification



system and associated algorithm will help surgical planning and identify cases that may benefit from a joint procedure with a Plastic Surgeon.

### **Funding**

None.

### **Conflicts of Interest**

None declared.

### **Ethical approval**

Not required.

### **Supplementary material**

Supplementary material associated with this article can be found, in the online version, at doi:[10.1016/j.jpra.2020.11.012](https://doi.org/10.1016/j.jpra.2020.11.012).

### **References**

1. Goodenough CJ, Ko TC, Kao LS, et al. Development and validation of a risk stratification score for ventral incisional hernia after abdominal surgery: hernia expectation rates in intra-abdominal surgery (the HERNIA Project). *J Am Coll Surg*. 2015;220:405–413.
2. Breuing K, Butler CE, FerzocoS Franz M, et al. Incisional ventral hernias: review of the literature and recommendations regarding the grading and technique of repair. *Surgery*. 2010;148:544–558.
3. Patel KM, Bhanot P, Franklin B, Albino F, Nahabedian MY. Use of intraoperative indocyanine-angiography to minimize wound healing complications in abdominal wall reconstruction. *J Plast Surg hand Surg*. 2003;47:476–480.
4. Van der Beek ES, Te Riele W, Specken TF, Boerma D, Ramshorst B. The impact of reconstructive procedures following bariatric surgery on patient well-being and quality of life. *Obes Surg*. 2010;20:36–413.
5. Skipworth JR<sup>1</sup>, Vyas S, Uppal L, Floyd D, Shankar A. Improved outcomes in the management of high-risk incisional hernias utilizing biological mesh and soft-tissue reconstruction: a single center experience. *World J Surg*. 2014;38(May(5)):1026–1034.
6. Wang HD, Singh DP. The use of indocyanine green angiography to prevent wound complications in ventral hernia repair with open components separation technique. *Hernia*. 2013;17:397–402.