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Incarcerated and eventrated abdominal wall hernia reconstruction with autologous double-layer dermal graft in the field of purulent peritonitis—A case report



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ABSTRACT

INTRODUCTION: Double-layer dermal grafts are used for the management of complicated abdominal wall hernias in obese, high risk patients. The method has not yet been used in case of emergency in septic/dirty environment.

CASE REPORT: A 76-year old female patient (BMI 36.7 kg/m²) was admitted with mechanical bowel obstruction and sepsis caused by a third time recurrent, incarcerated and eventrated abdominal wall hernia. During the emergency surgery perforation of the terminal ileum and the ascending colon was detected, along with a feculent peritonitis and extended abdominal wall necrosis. Extended right hemicolectomy and necrectomy of the abdominal wall were performed. The surgery resulted in an abdominal wall defect measuring 223 cm², for the management of which direct closure was not possible. Using a specific method, an autologous dermal graft was prepared from the redundant skin. The first dermal graft was placed under the abdominal wall with 5 cm overlap, and the second layer was placed onto the first layer with 3 cm overlap in a perforated fashion. The operating time was 250 min. No significant intra-abdominal pressure elevation was measured. No reoperation was performed. On the fifth postoperative day, the patient was mobilised. She was discharged in satisfactory general condition on the 18th postoperative day. There is no recurrent hernia 8 months after the surgery.

DISCUSSION: Abdominal wall reconstruction was possible in a necrotic, purulent environment by using a de-epithelised autologous double layer dermal graft, without synthetic or biological graft implantation. The advantage of the procedure was cost-effectivity, and the disadvantage was that only in an obese patient is the sufficient quantity of dermal graft available.

CONCLUSION: A homogeneous internal and perforated outer dermal graft was suitable for bridging the abdominal gap in the case of an obese, high risk patient. Autologous dermal grafts can be a safe and feasible alternative to biological meshes in emergency abdominal wall surgeries. Evaluation of a case series can be the next cornerstone of the method described above.

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1. Introduction

Closing the abdominal wall safely and in a tension-free manner is a major challenge in the case of large, incarcerated abdominal wall incisional hernias [1–3]. In a septic, dirty environment (CDCP IV) reconstruction of a large defect by direct sutures is impossible. In these cases, the use of the acellular dermal matrix (ADM) is an obvious option to close the large abdominal gap, however biological grafts are not generally available. One of the disadvantages of biological grafts is their app. 11–36% recurrence and 8–15% surgical site infection rate [4]. Implantation of synthetic grafts in a septic field is technically possible, however a significantly higher complication rate is to be expected [5]. The autologous single or

double-layer dermal grafts in the case of obese, high risk patients with recurrent, infected hernias can be successfully used in elective abdominal wall reconstructions [6,7]. We present a case report in which double-layer dermal grafts were applied for the reconstruction of a recurrent, eventrated and incarcerated abdominal wall hernia in a dirty operating environment performed in an academic institution. This case report has been written in full accordance with the SCARE criteria [8].

2. Case report

2.1. Patient's clinical data and surgical method

The medical history of the 76-year-old female patient includes hypertension treated for 30 years, type II diabetes mellitus treated for 24 years, coronary heart disease, myocardial infarction suffered 15 years earlier, senile dementia, open cholecystectomy performed

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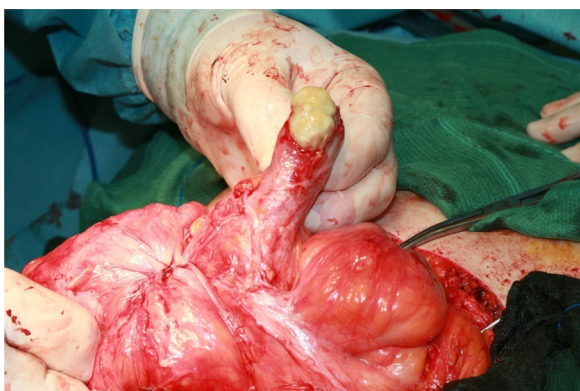


Fig. 1. Eventrated and incarcerated abdominal wall hernia. The perforated terminal ileum segment and the perforated hernia sac are visible in the left hand of the surgeon. The ascending and transverse colon as well as a remarkable segment of the terminal ileum were incarcerated and perforated into the hernia sac.



Fig. 2. Adequate preparation of the epidermal surface of dermal graft. The epidermis was removed by scalpel. The colour difference between the removed and not yet removed epidermal surface areas (light brown coloured area: removed epidermis, darker yellowish-brown coloured area: not removed epidermis) is clearly visible.

35 years earlier and abdominal wall hernia repairs (altogether on five occasions, three of them were performed due to incarceration). The patient had morbid obesity, the body mass index (BMI) was 37.8 kg/m². There was no regular alcohol consumption and smoking in her medical history. Five days prior to her admission a progressive abdominal pain set in. She was brought by ambulance in weak general condition and in status febrilis. After physical examination, the primary admission diagnosis was septic-toxic shock, and acute abdomen caused by recurrent, incarcerated and eventrated abdominal wall hernia. On admission, an eventrated hernia of the size of a handball and local defense musculaire were palpable in the right subcostal region. Following abdominal ultrasonography, laboratory tests, chest X-ray, native abdominal X-ray, securing central venous access, epidural cannulation and intravesical catheter insertion, an urgent right upper transverse laparotomy was carried out. The surgeon performing the procedure was an expert in different types of abdominal wall reconstructive surgeries. The operation was carried out under general anaesthesia and complete muscle relaxation. Local feculent peritonitis was found in the eventrated hernia sac along with considerable subcutaneous inflammatory oedema. The peritonitis was caused by the incarcerated and perforated ascending colon and terminal ileum (Fig. 1). During surgery extended right hemicolectomy and resection of app. 60 cm segment of the terminal ileum were performed with side-to-side ileo-transversostomy. After necrectomy, a 223 cm² abdominal gap (app. 14 × 16 cm) remained on the abdominal wall. Closing the defect by direct sutures was not possible. A biological graft was unavailable. Synthetic mesh implantation was not considered with respect to the CDCP IV environment. The wide, bay leaf shaped dermal-subcutaneous pannicule removed at the initiation of the surgery was used for the abdominal wall recon-

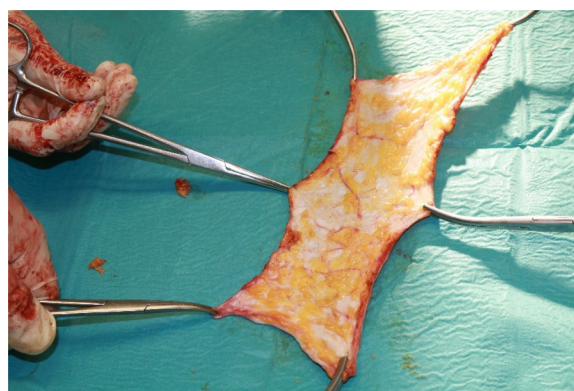


Fig. 3. Adequately removed subcutis. It is clearly visible that a small amount of fat tissue remained on the dermis. The abundant adipose derived stem cells (ADSC), located in the fat tissue. ADSC play an important part in the integration and remodelling of the grafts.

struction. First the epidermis (Fig. 2) then the subcutaneous adipose tissue was removed from the pannicule (Fig. 3). The defect was completed with the prepared dermal flaps. The first homogeneous dermal graft was cut to size and was inserted into the abdominal cavity with its epidermal surface facing out, and it extended over the edge of the defect by at least 5 cm. The dermal graft was fixed to the abdominal wall by interrupted, 2/0 non-absorbable stitches (Fig. 4). The external dermal graft was fixed with the original epidermal surface facing the abdominal cavity with at least 3 cm overlap using 2/0 non-absorbable stitches. The external dermal graft was perforated as it is seen in Fig. 5. The greater omentum was carefully spared. Direct abdominal sutures were not applied. The

Table 1

Changes of intraabdominal pressure and body temperature, as well as the results of the laboratory tests between the 1–17th p.op. days.

	Postoperative day					
	1	2	3	4	5	17
Intra-abdominal pressure (mmHg)	13	13	10	9	7	8
C reactive protein (mg/L)	316	252	275	268	208	95
Glucose (mmol/L)	22,6	16,5	14,3	8,5	8,1	7,9
Creatinine (μmol/L)	115	143	153	101	75	64
Creatine kinase (IU/L)	5124	2844	1340	2413	1520	176
GFR (mL/min/1,73m ²)	44	48	40	28	64	81
Na (mmol/L)	138	140	138	152	152	143
K (mmol/L)	4,8	4,3	4	4,6	4,3	4
Temperature (°C)	38,7	39,1	38,2	37,6	36,9	36,7
Hemoglobin (g/L)	85	84	92	98	105	112

Abbreviations: GFR: glomerule filtration rate, Na: sodium, K: potassium.

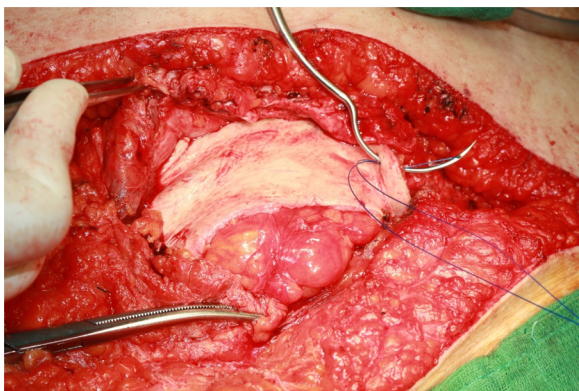


Fig. 4. The first dermal graft in appropriate position. At least 5 cm overlapping was necessary. The original epidermal surface looked outward. No direct sutures were put into the abdominal wall. The abdominal wall defect was completed by the dermal grafts. The size of the prepared abdominal gap was 223 cm².

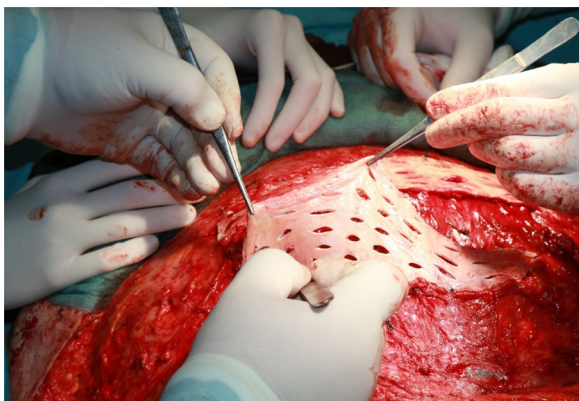


Fig. 5. The second dermal graft in appropriate position. The original surface of the prepared dermis faced the abdominal cavity. It was perforated as demonstrated. The perforation of the graft is important for its more intense integration.

surgery took 250 min out of which the preparation of the dermal grafts required 50 min. The estimated intraoperative blood loss was 740 mL [9]. The patient required intensive care (IC) in the first fourth postoperative days (p.op.d.). Empiric 4 × 1 g imipenem/cilastatin i.v. antibiotic therapy started at the operating table. For thrombosis prophylaxis 1 × 0.6 mL enoxaparine s.c. was started 6 h after the end of the operation. Imipenem/cilastatin was administered intravenously for another six days, amended as per the microbiological culture results (*Escherichia coli*, *Enterococcus fecalis*). The fever ceased on the fourth p.op.d. The bowel movement was restarted with 100 mL of Mannitol solution p.o. on the fifth p.op.d. In the first five p.op. d., due to moderate anaemia, altogether five units of compatible red blood cell transfusions were administered. The changes in the intra-abdominal pressure, body temperature and specific laboratory parameters over the p.op. period are presented in Table 1. A nasogastric tube was left in place for three days. Respiratory and kidney functions remained in normal range, O₂ saturation was 92–95%, daily urine production was more than 1600 mL each day during the IC. We started the patient's oral nourishment with 160/80 g carbohydrate/protein diet on the fifth p.op.d. She was mobilised on the fifth p.op. d. by a physiotherapist. An elastic abdominal belt with Velcro™ was put on from the start of the mobilisation both in standing and lying positions with short, 1–2 h intervals. The intra-abdominal, as well as the left and right side subcutaneous drains were removed on the sixth, seventh, and

tenth days, respectively. The skin sutures were removed on the fifteenth p.op.d. Real seroma or diffuse subcutaneous fluid accumulation was not detected. The patient was discharged in satisfactory general condition on the eighteenth p.op.d. For thrombosis prophylaxis, 1 × 0.6 mL enoxaparine s.c. was prescribed for further 21 days. The wound healed per primam intentionem (Clavien-Dindo grade I) [10]. The patient was instructed to wear the elastic bandage on a regular basis and avoid bloating food to prevent abdominal wall distention. Physical examinations in a standing and lying position, blood tests and abdominal wall ultrasonographies were performed in the first and third month. Moreover, an abdominal computed tomography was carried out in the sixth p.op. month. No hernia recurrency occurred and there was no subcutaneous fistula or seroma formation at the operating site.

3. Discussion

Different synthetic, biological grafts, and autologous tissues have important part in the reconstruction of the complicated and eventrated abdominal wall hernias [11–13]. The majority of surgeons are reluctant to implant synthetic grafts in a CDCP III–IV operating field [14]. In the case of incarcerated, giant abdominal wall hernias, the reconstructive surgery of the abdominal wall is a significant challenge for surgeons, because of the remarkable abdominal wall defect [15]. The use of an ADM can be the solution in these cases, however ADM is not generally at disposal [16]. Using an ADM goes with higher recurrency (app. 32%) and a considerable rate of surgical site complications (app. 19%) in the cases of infected, complicated and eventrated abdominal wall hernias. ADM is considered to be an expensive hernia sac by some authors [17,18]. To date, the double-layer autologous dermal graft has not been applied in emergency surgery, consequently this presentation is the first in a human. The use of the double-layer dermal graft for complicated and recurrent abdominal wall hernias is known in the literature as an elective surgical method. The rationale of the external graft perforation is its faster integration and remodelling. During the integration of the ADM neovascularisation and collagenous remodelling were proved even under suboptimal (infected, necrotic) conditions [19]. Presumably, the same process is likely to happen in the case of the autologous vital dermal grafts too. This abdominal wall reconstruction does not result in significant intra-abdominal pressure increase. In our opinion, the use of double-layer grafts, (an inner non-perforated and an outer perforated one) has two advantages over single-layered and homogenous grafts. On the one hand, double-layer dermal autografts have a better capacity to resist the intra-abdominal pressure. Furthermore, the reinforcement of the abdominal wall is more pronounced than in the case of single-layered grafts. The second advantage is the more intense integration and remodelling of the outer dermal graft perforated in the presented manner. The disadvantage of double-layer dermal grafts is that a dermal graft of adequate size can only be obtained in obese patients. If a dermal graft of adequate size cannot be collected, the intervention cannot be performed. For example, for the double-layer dermal graft reconstruction of an abdominal defect of 100 cm² size a dermal graft of app. 300 cm² is required. Prior to the application of this method, during the physical examination of the abdomen, the size of the redundant dermal-subcutaneous panniculus can be estimated and the method can only be considered if the available size is sufficient. The appropriate preparation of the grafts requires practice. It is not advisable to use this method in an acute, incarcerated case for the first time.

4. Conclusion

The primary message of the publication is that a large abdominal wall defect in dirty environment can be successfully reconstructed

with autologous double-layer dermal grafts. The autografts can integrate in a purulent, septic field too. Up to date, we have applied the method on one urgent occasion only, therefore the result of the intervention cannot be generalized. In the case of eventrated and incarcerated abdominal wall hernias, even in CDCP IV environment, the use of autologous dermal grafts can be considered in obese, high risk patients. The good result of the first case can be the basis for further study involved patients with incarcerated giant abdominal wall hernias causing a septic-toxic condition.

Consent

The corresponding author declares that the required detailed informed consent was signed by the patient prior the surgery. There is no any personal data, photograph or image that could identify the patient presented in this manuscript. The guarantor of the case report is the corresponding author of this article. Authors declare that there are no sources of founding.

Conflict of interest

The authors declare that there is no any conflict of interest.

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Ethical approval

Ethical approval of the authors institution was obtained before submission by the Ethical Committee of the Department of Surgery Ref. No. RKEB/IKEB 4599.

Author contribution

Gábor Martis. study concept and design, data analysis, wrote and edited the manuscript, performed the surgery of the patient presented.

Máté Rózsahegyi: collected the data, follow-up of the patient.

János Deák: 1. assistant surgeon of the surgery.

László Damjanovich: interpretation of the data.

Guarantor

Gábor Martis, corresp. author, first author.

Submission declaration

The work described has not been published previously. The manuscript is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere including electronically in the same form, in English or in any other language, without the written consent of the copyright-holder. There

is no plagiarism in this manuscript at all. The whole manuscript is the authors' own work. No other people contributed to this article except for the authors.

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