



## Application of a subcutaneous negative pressure drain without subcutaneous suture: impact on wound healing in gynecologic surgery



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### ABSTRACT

**Objective:** To evaluate the surgical outcome of a subcutaneous negative pressure drain without subcutaneous suture on wound healing in women undergoing abdominal gynecologic surgery.

**Study design:** The medical records of total 322 patients who underwent abdominal surgery, including cytoreductive surgery for ovarian cancer, between March 2010 and January 2013 were reviewed retrospectively. Patients were divided into two groups by the presence of subcutaneous negative pressure drains without subcutaneous suture, or suture without drainage.

**Results:** Patient's characteristics in the two groups were not statistically different. Among all patients, the 71 patients who had a subcutaneous wound drain achieved a higher rate of clear healing (97.2% vs. 88.8%;  $p = 0.033$ ): 100% vs. 98.0% (not significant) in 126 benign and 95.6% vs. 82.8% ( $p = 0.032$ ) in 196 malignant disease patients. In a multivariate analysis, wound drain placement was an independent prognostic factor affecting the surgical wound outcome; the disruption (OR, 0.100; 95% CI, 0.021–0.485;  $p = 0.004$ ) rate was significantly lower with subcutaneous negative pressure drain. Placement of a subcutaneous negative pressure drain without subcutaneous suture resulted in clinical benefit, such as shorter admission duration (median, 8 vs. 11 days;  $p = 0.021$ ).

**Conclusions:** Application of subcutaneous negative pressure drain is one of the effective and easy ways for clearer wound healing after major gynecologic surgery for malignant disease.

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## 1. Introduction

Wound complications are troublesome to not only patients and physicians, but also to hospitals and insurers. Wound complications clearly impact negatively the patients' quality of life, and furthermore are associated with an increase of hospital stay and a significant socioeconomic burden [1–3]. In gynecologic malignancies requiring adjuvant treatment, such as chemotherapy after

cytoreductive surgery in ovarian cancer or radiotherapy and/or chemotherapy after radical hysterectomy in cervical cancer, wound complications could be related to a delayed treatment schedule, ultimately impacting the disease course.

In an attempt to reduce wound complications, previous studies have elucidated pre-operative and intra-operative risk factors and others have validated several interventions which may reduce wound complications at the time of the operation. Alongside skin preparation methods or subcutaneous closure techniques, intra-operative placement of subcutaneous drainage is one of the most investigated interventions.

A subcutaneous wound drain has its merit in the reduction of subcutaneous tissue dead space by preventing accumulation of fluid and enabling its egress. This has led to several studies on the subcutaneous wound drain, carried out mainly on obese patients who have thick subcutaneous tissues [4–8]. The results of placement of a subcutaneous wound drain at cesarean delivery were controversial [6–9]. Similarly, the benefit of a prophylactic

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subcutaneous drain in gynecologic surgery is not consistent, and is mainly in obese women [4,5,10]. These conflicting results mainly come from differences in study populations, inclusion and exclusion criteria, disease types, definitions of wound complications and standardization of methods. Especially, the type and size of the drainage tube and duration of its application were all different between the studies. Moreover, the type of drain was not specified in several studies.

Therefore, the aim of this study is to evaluate the effectiveness and impact of a surgical wound drain on wound healing in women who underwent gynecologic operations, including cytoreductive surgery.

## 2. Materials and methods

### 2.1. Study population

This study was conducted with the approval by the Institutional Review Board of National Cancer Center (NCCNCS-13-697) and Yangsan Pusan National University Hospital (05-2013-019). Medical records were reviewed retrospectively.

A total of 322 patients who underwent abdominal surgery for gynecologic indications between March 2010 and January 2013 were included. Gynecologic indications included malignant disease, such as ovarian cancer, cervical cancer and endometrial cancer, and also included common benign disease, such as myoma uteri and endometriosis. Patients with severe renal or cardiac dysfunction, uncontrolled diabetes mellitus, autoimmune disease, immune deficiency disease, and previous radiotherapy on the pelvis were excluded from this analysis. We also excluded pregnant patients and long-term steroid users.

Two surgeons (Lim MC and Song YJ) performed all surgical procedures with a shared approach to all surgical procedures, including wound care. Bowel preparation was achieved by oral administration of magnesium carbonate solution and/or enema in benign gynecologic disease, and by 4 L of polyethylene glycol and electrolyte solution, Colyte, orally in malignancy. Before surgery, pubic hair was removed with thyoglycolate 80% cream. Povidone-iodine was used for abdominal skin preparation. All patients also received prophylactic antibiotics intravenously at the induction of anesthesia; 1st generation cephalosporin (cefazolin or cefazedone) in benign disease and 2nd generation cephalosporin (cefotetan) in malignancy. If bowel surgery was performed and there was a significant leakage of bowel contents during surgical procedures, intravenous metronidazole 500 mg was added, postoperatively.

The skin and underlying fat tissues were incised vertically. The incision was usually from the symphysis pubis to around the umbilicus and extended to just below the sternum if an upper

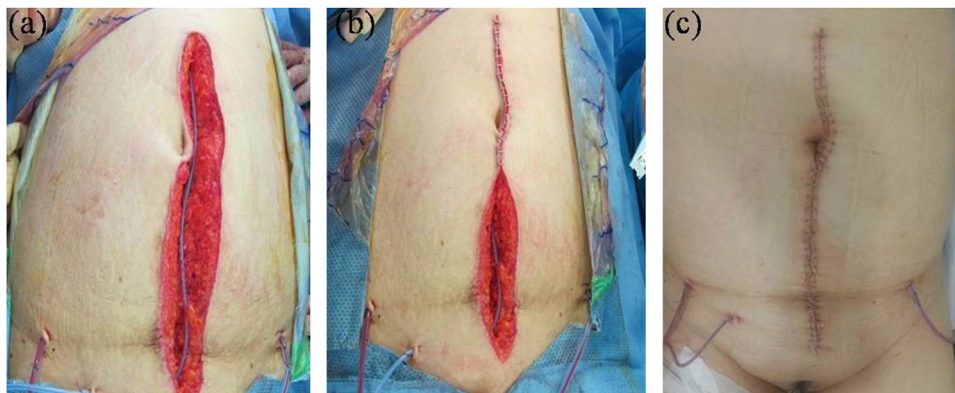
abdominal surgical procedure was required in a case of advanced ovarian cancer. After completing the surgical procedure, the rectus abdominis fascia was sutured. The subcutaneous tissue in the surgical incision was irrigated with saline solution. All bleeding points in the surgical wound were controlled by electrocautery. A wound drain was placed within the subcutaneous tissue and staples were applied to skin for approximation (Fig. 1). The wound was protected with a sterile dressing for first 48 h, and examined every other day during admission.

### 2.2. Data collection

Data including patient demographics, pre-operative and intra-operative risk factors (including diabetes mellitus, hypertension, pulmonary disease, current use of tobacco, history of abdominal surgery, wound types, operative time, estimated amount of blood loss, and performance of adhesiolysis), and outcomes (length of stay, result of wound, wound complications, and reoperation cases) were collected. Body weight and height were used to calculate the body mass index (BMI). According to the criteria suggested by the World Health Organization for the Asian population, overweight and obesity were defined as  $23 \leq \text{BMI} < 27.5 \text{ kg/m}^2$  and  $\text{BMI} \geq 27.5 \text{ kg/m}^2$ , respectively [11].

We grouped patients by the placement of the subcutaneous wound drain. In Group 1, all patients had subcutaneous Jackson-Pratt drains composed of perforated silicone round tubes with a 1.6 mm inner diameter and a 3.2 mm outer diameter, which were inserted intra-operatively and connected to a 100 cc silicone bulb reservoir to apply negative pressure continuously as the closed suction drain system. BAROVAC SS100M (Sewoon Medical, Cheonan-si, Chungcheongnam-do, Republic of Korea) was used in 34 patients at the National Cancer Center. EZ-VAC ESS100M (eGMedisys, Goyang-si, Gyeonggi-do, Republic of Korea) was used in 37 patients at Pusan National University Yangsan Hospital. In this group, subcutaneous fat was not sutured, and staples were used for skin closure. The drain was usually removed at the time of removal of stitches from the surgical wound if the daily drain amount was less than 1 mL over 24 h. If the surgical wound extended to the sternum in a case of ovarian cancer, a second drain was inserted into the upper abdominal wound. Each drain was connected to a separate suction reservoir. In Group 2, on the other hand, all patients were without any subcutaneous wound drain, and the subcutaneous fat was approximated with interrupted 2-0 or 3-0 Vicryl suture and the skin was closed with the same staples.

Wound complications are defined as follows. Clear healing was defined as surgical wound healed without any problems such as disruption or infection. Disruption was defined as surgical wound with visible breakdown. Wound infection was defined as a wound



**Fig. 1.** A Jackson-Pratt drain was placed in subcutaneous layer, intra-operatively (a). Subcutaneous fat was not sutured, and staples were used for skin closure (b). Negative pressure was applied continuously to achieve closed suction drain system. Wound of postoperative day 3 with subcutaneous negative pressure wound drain (c).

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