Review

Prophylactic and Therapeutic Usage of Drains in Gynecologic Oncology Procedures: A Comprehensive Review

Chrysoula Margioula-Siarkou , Aristarchos Almperis , Emmanouela Aliki Almperi , Georgia Margioula-Siarkou , Stefanos Flindris , Konstantinos Dinas , Stamatios Petousis *

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Prophylactic and Therapeutic Usage of Drains in Gynecologic Oncology Procedures: A Comprehensive Review

Chrysoula Margioula-Siarkou [1], Aristarchos Almperis [1], Emmanouela-Aliki Almperi [1], Georgia Margioula-Siarkou [1], Stefanos Flindris [1], Konstantinos Dinas [1] and Stamatios Petousis [1]*

[1] 2nd Department of Obstetrics and Gynaecology, Aristotle University of Thessaloniki, Greece
* Correspondence: petousisstamatios@gmail.com; Tel.: +306934050763, Konstantinoupoleos 49, 54624, Thessaloniki, Greece.

Simple Summary: This review examines the use of drains post-operatively in gynecologic oncology, emphasizing on their efficacy and necessity. Although drains are widely accepted to reduce hematomas and infections rates, their routinely use remains a subject of debate. Evidence suggests that drains do not consistently enhance outcomes in surgeries like radical hysterectomy with pelvic lymphadenectomy and may even increase complications. Negative pressure wound therapy shows promising results in reducing surgical site infections for ovarian cancer surgery, the existing data remain limited. Guidelines generally suggest against routine use, advocating for early removal to enhance fast recovery and minimize complication risk. Further research is needed to clarify their role in specific high-risk situations.

Abstract: Background/Objectives: The use of post-operative drains in gynaecologic oncology procedures is controversial with evidence both supporting and questioning their efficacy. Proponents argue that such drains help detect complications early, reduce abscess formation, and also alleviate post-operative pain. On the other hand, drains are associated with increased risks of incisional hernia, infection, prolonged hospitalization, and postoperative pain. **Methods**: We conducted a research in the PubMed database and supplemented it with a manual search to retrieve additional papers eligible for inclusion. **Results**: Their use is not always found to improve outcomes, notably in surgeries such as a radical hysterectomy with pelvic lymphadenectomy, where they may actually enhance lymphocyst formation and other complications. In cytoreductive surgery for ovarian cancer, negative pressure wound therapy showed some potential benefits, but evidence remained inconclusive due to limited studies. The international guidelines presented in this review, suggest avoiding the routine use of drains and promote early removal when their use is necessary. **Conclusions**: This review aims to present an update on the current knowledge regarding the role of drainage in gynaecologic oncology and while further good-quality research is required, particularly in high-risk surgical procedures, numerous prospective trials have extensively addressed the topic, trying to provide clear suggestions.

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1. Introduction

The use of post-operative drainage has been a topic of debate for several years [1]. While the trend has increasingly shifted towards avoiding routine drainage, opinions on its necessity remain divided. Proponents argue that drainage aids in the early detection of complications and prevents abscess formation by preventing the accumulation of blood and infected fluids [2]. It is also suggested that drainage might reduce post-operative pain by evacuating trapped gas, although this claim is contested. The frequency of drainage application varies among surgeons, with junior surgeons more likely to use drainage compared to their senior counterparts. Despite the perceived benefits, drainage is not without its drawbacks. Complications associated with drainage include an increased risk of incisional hernias, infections, prolonged operation times, extended hospital stays, and post-operative

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pain [3]. Drainage can also cause intraoperative intestinal injury, post-operative fever, pain at the drainage site, and issues such as blockage, dislodging, and kinking of the drain [4]. Consequently, it is recommended that drains be removed as soon as possible after surgery.

Regarding current status of drainage usage, 2018 guidelines for the prevention of surgical site infections (SSIs), the World Health Organization (WHO) endorsed the utilization of negative pressure wound therapy (NPWT) for adult patients with closed surgical incisions in situations deemed high-risk [5]. The use of drains following radical hysterectomy and pelvic lymph node dissection remains controversial. Some systematic reviews suggest that drains reduce lymphocyst formation after pelvic lymphadenectomy, while others highlight the benefits of early mobilization associated with the absence of drains, including reduced rates of post-operative ileus and shorter hospital stays [6].

Main objective of this comprehensive review is to effectively summarize and present current knowledge and up-to-date evidence about the role of prophylactic drainage in female women undergoing oncological, or other types of gynecological surgical procedures in terms of indications, postoperative surgical infections, morbidity recovery, post-operative complications, and patients' outcomes.

2. Materials and Methods

The present review presents a summary of the current literature, summarizing evidence regarding the post-operative usage drainage in various gynecologic oncology procedures. PubMed and Scopus databases with the key phrases/key words, 'Drainage AND cytoreduction', 'Drainage AND hysterectomy', 'Drainage AND lymphadenectomy', 'Drainage AND debulking', Drainage AND gynecologic oncology' . Prospective randomized clinical trials (RCTs), prospective observational studies and meta-analyses written in the English language were set in the center of interest for interpretation of their results. Retrospective studies, in the absence of higher-level evidence, were also considered for the purpose of the present review. All studies identified from the search strategy were imported in a reference management software (Zotero 6.0.30) for elimination of duplicate data and further assessment. All identified studies were screened by two of the authors based on their full-text manuscript, while articles irrelevant to the objective of the present study were excluded. The eligibility of retrieved articles was independently determined by 2 reviewers (C.M-S., A.A.) Main outcomes set in the center of interest were wound infection rate and the wound complications rate, incidence of vault hematomas in cases of hysterectomy, febrile morbidity rates, length of hospital stay, readmission, incidence of pelvic cellulitis and lymphocyst formation percentages in cases of lymphadenectomy.

3. Drainage of Subcutaneous after Cytoreduction for Ovarian Cancer

The topic of intraoperative placement of subcutaneous wound drains has been extensively covered as a method to reduce wound complications. This technique is advantageous for the removal of fluid accumulated in subcutaneous tissue and helps in reducing dead space. Regarding non-obstetric patients, the role of negative pressure wound drain showed conflicting results in various gynecologic surgeries [8-10] However, the inconsistent results may be attributed to the heterogeneity of the population and that of the procedures. Extensive cytoreductive surgery, despite its lengthy duration, is crucial for reducing intraperitoneal residual tumors in advanced or recurrent ovarian cancer. In gynecologic cancers requiring additional treatments—like adjuvant chemotherapy after cytoreductive surgery for ovarian cancer or radiotherapy and/or chemotherapy following radical hysterectomy for cervical cancer—wound complications have crucial impact on disease progression by delaying the scheduled treatment.

Regarding cytoreduction surgery for ovarian cancer, an inadequate number of published studies is available, and the few data are derived from retrospective cohorts, providing low-quality evidence. A retrospective cohort study by Kim et al. encompassed patients who underwent cytoreductive surgery for epithelial ovarian cancer. Wound infection rate and the wound complications rate between groups using and not using subcutaneous wound drains were compared and a reduction rate of up to 80% and up to 65%, respectively, was observed. [11] Another more recent retrospective

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cohort, examining 312 patients undergoing surgery with a midline incision for ovarian cancer, suggested a roughly 60% lower wound complication risk and a lower rate of seroma formation (6.1% vs 16.0%; p=0.015) by using subcutaneous negative pressure drains compared to standard dressing. [12] Although both studies identified placement of wound drain as an independent prognostic factor for uncomplicated wound outcomes, no statistically significant difference between the two arms, regarding progression-free and overall survival was observed. One of the limitations of the above-mentioned studies, which was the selection of only ovarian cancer, was addressed in another retrospective cohort study where the benefit of subcutaneous negative pressure drain without subcutaneous suture on wound patients who underwent abdominal surgery was studied. The laparotomy indication included both malignant and benign gynecological conditions. However, from the subgroup analysis of malignant disease patients, statistically higher rate of clear healing was achieved in the arm with the drainage (95.6% vs. 82.8% (p = 0.032)) [13].

Thereafter, as there are only two retrospective studies [11,12] with concordant outcomes, a clear suggestion for the beneficial role of negative pressure wound therapy only in cytoreduction surgery for ovarian cancer can be derived. However, the lack of randomized trials or prospective studies leaves enough space for debate and further study performance.

4. Drainage following Vaginal or Laparoscopic Hysterectomy

Hysterectomy remains until today the most common non-obstetric procedure among female patients, and although major guidelines suggest that the optimal way to be performed is the minimal invasive approach the surveillance suggests otherwise [14,15]. Although there is a rising rate of laparoscopically, and robotically-assisted hysterectomies, the vast majority are performed abdominally [16]. All hysterectomies, regardless of the surgical approach, require the vault to be opened. Therefore, inserting a drain vaginally helps avoid the morbidity associated with using an abdominal drain. reduce postoperative morbidity related to the development of hematomas.

Vaginal route of hysterectomy is associated with higher incidence of vault hematomas than abdominal hysterectomies. In literature, hematoma rates can vary widely, reported as high as 59%. However, in clinical practice, the incidence may be as low as 10% due to differing circumstances and study methodologies [17]. Vault hematomas are significant due to postoperative morbidity, including infection, pelvic pain, and prolonged hospital stays. Many mainly small RCTs have led Krishnaswamy et al. [18] in conducting a systematic review and meta-analysis of ten studies involving 1778 women, 811 with a vaginal drain and 967 without a drain, to clarify the role of vaginal drainage. The use of a vaginal drain after hysterectomy may significantly reduce the incidence of vault haematoma (OR 0.22, 95% CI 0.08 - 0.57) and febrile morbidity (OR 0.54, 95% CI 0.40 to 0.73), but a statistically significant reduction regarding the use of antibiotics, or the length of hospital stay was not observed. The types of drains used in the studies analyzed included a large-bore Foley catheter, Robinson's drain, T-tube suction drain, and a Jackson Pratt closed suction drain, while the type of hysterectomy included all approaches. However, another randomized prospective study comparing an arm with drainage in the peritoneal cavity and cul-de-sac after vaginal hysterectomy with no drainage arm was retrieved. In terms of postoperative, infectious morbidity and complications, in the 324 patients undergoing laparoscopic-assisted hysterectomy, no statistical significant difference was observed [19].

All of the above-mentioned studies export their data from patients undergoing either laparoscopically, assisted vaginal, hysterectomy, abdominal or vaginal hysterectomy. Regarding laparoscopic hysterectomy, a retrospective cohort study by Oh et al. was retrieved from the literature, comparing 504 patients undergoing laparoscopic hysterectomy and pelvic drain either through the abdomen or the vaginal vault in terms of postoperative fever, readmission, and reoperation [20]. The results between the two groups were comparable and therefore, vaginal vault placement of a closed pelvic gravity drain may represent a promising new approach for reducing infectious complications associated with pelvic hematomas. The efficacy of this minimally invasive technique warrants further investigation through larger-scale clinical trials since no other study has compared the adequacy between vaginal or abdominal drains in laparoscopic hysterectomy.

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Unfortunately, there are no published data available, referring to the role of drainage in cases of hysterectomy combined with sentinel lymph node biopsy for malignant conditions, to determine the rates of postoperative complications, infectious morbidity, or the necessity in early identification of blood loss or prevention of lymphocyst formation. In clinical practice, taking into consideration accumulated clinical experience, drainage usage offers no further advantage, since the vast majority of the patients experience no severe post-operative complications after laparoscopic hysterectomy, have quick mobilization and short duration of stay, being discharged within 24 to 48 hours after the surgery.

In conclusion, a meta-analysis and a RCT were the only studies to approach the topic of vaginal or peritoneal drain after any type of hysterectomy by searching the databases. Thereafter, since only low-quality evident is provided, no definite conclusions can be deduced. However, it is indicated that vaginal drain has some merit regarding hematoma and infectious morbidity, but on the other hand, vaginal and peritoneal drain may not be necessary to prevent postoperative morbidity. To further explore this potential, prospective comparative clinical trials are warranted.

5. Drainage following Radical Hysterectomy and Lymphadenectomy or Lymphadenectomy for various Gynecological Malignancies (pelvic and/or para-aortic)

Over the past 30 years, starting from the pre-antibiotic period, the effectiveness of drainage in radical hysterectomy followed by pelvic lymphadenectomy, lied in the prevention of postoperative febrile morbidity and formation of lymphocysts or fistulas. However, the utilization of antibiotics and the surgical tendency to leave the retroperitoneum open and thus, enabling the reabsorption of the lymph fluid from the abdominal cavity, made the drainage quite debatable [21]. Jensen et al., in a retrospective series of 67 patients undergoing radical hysterectomy and bilateral pelvic lymphadenectomy (RHPL) for early-stage cervical cancer with drainage found no significant improvement in terms of febrile morbidity rates, incidence of pelvic cellulitis and compared to the group without drain. In fact, on some occasions, drainage contributed to postoperative complications, such as local infection or cellulitis at the exit site of the drain, prolonging the antibiotic therapy [21]. Consistent with these data were the results of 2 prospective randomized [22,23] and 1 prospective non-randomized study [24] monitoring a similar population of cervical cancer patients undergoing RHPL with homogenous epidemiological, clinical, and surgical characteristics, focusing on postoperative morbidity, complications and lymphocyst formation. Evaluation of possible lymphocysts was performed clinically, with CT scan or the use of transabdominal / vaginally sonography. No statistically important difference favoring drainage usage in reductions of infection, fistula or lymphocyst formation rates was observed in any of the above studies. In fact, lymphcysts were observed only in patients with closed-suction drainage, possible due to the presence of the foreign body, as Jensen et al. first noticed.

The most updated review of the Cochrane, consisting of four studies, including 2 of the above [22,23] set in the center of focus patients who underwent systematic pelvic or pelvic and aortic lymphadenectomy for various gynecologic malignancies regardless of the surgical approach [6]. It was concluded that the overall rates of lymphocyst formation including all methods of pelvic peritoneum management were comparable, while in the sub-group analysis, when the peritoneum was left open, a trend for higher incidence in the drained group was observed. Thereafter, the advantage of the drain in the prevention of pelvic infection or lympocyst formation was not proved. Similar results came from a prospective non-randomized study of 143 oncological female patients, not included in the above review, by Bafna et al. [25]. Morice et al. set in the center of attention the role of drain in the lympocyst formation after complete para-aortic lymphadenectomy up to the level of the left renal vein for ovarian or cervical carcinoma, conducting the only randomized trial [26]. Drainage was significantly associated with a lower rate of cyst formation, but higher rate of post-operative complications and longer hospital stay.

Overall, high-quality data coming mostly from prospective studies, clearly suggest that the practice of drains generally does not improve the risk of postoperative morbidity in women undergoing RHPL. lymphocyst formation is a common complication after pelvic or para-aortic

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lymph node dissection, potentially causing lower limb edema, deep vein thrombosis, secondary infection, pain or ureteral obstruction [27]. Taking into consideration the open retroperitoneal space and the usage of prophylactic antibiotics, drainage could be kept for high-risk occasions, especially in the presence of intraoperative retroperitoneal bleeding, oozing or ureteral injury. To conclude, their routine use could as well be omitted offering no further benefit, otherwise could potentially lead to postoperative complications, especially in oncological patients with a history of previous chemo- or radiotherapy. Summary of the above-mentioned results are displayed in Table 1.

Table 1. Drainage following radical hysterectomy and lymphadenectomy or lymphadenectomy for various gynecological malignancies.

	Type of study	Patients	Type of operation	Febrile morbidity rates (drain vs no drain)	Mean length of hospital stay in days (drain vs no drain)	Lymphocysts formation (drain vs no drain)	Postoperative complications (drain vs no drain)
Jensen et al. [21]	Retrospective cohort	Early-stage cervical cancer	RHPL[1]	32,8% vs 29,1% **(NS[2])**	7,6 ± 2,4 vs 7,0 ± 1,3 **(NS[2])**	-	-
Srisomboon et al. [22]	Prospective randomized	Early-stage cervical cancer	RHPL[1]	5,8% vs 0% **(NS[2])**	9.4 ± 1.6 vs 9.2 ± 1.4 **(NS[2])**	**NS[2], p=0,2**	-
Franchi et al. [23]	Prospective randomized	Early-stage cervical cancer	RHPL[1]	-	-	5.9% vs 0.9% **(NS[2], p=0,06)**	0,53% vs 0,66% **(NS[2])**
Patsner et al. [24]	Prospective non-randomized study	Early-stage cervical cancer	RHPL[1]	10% vs 3,3% **(NS[2])**	5,5 vs 4,5 **(NS[2])**	11,6% vs 0% **(NS[2])**	
Charoenkwan et al. [6]	Systematic review	Various gynecologic malignancies	Systematic pelvic or pelvic and aortic [3]LND	-	-	**NS[2]**	-
Bafna et al. [25]	Prospective non-randomized	Various gynecologic malignancies	Pelvic ± aortocaval [3]LND	-	10 vs 10 **(NS[2])**	7,2% vs 2,7% **(NS[2], p>0,05)**	-
Morice et al. [26]	Randomized trial	Ovarian or cervical carcinoma	Complete para-aortic [3]LND up to the level of the left renal vein	-	11 vs 9 **(P<.03)**	5% vs 24% **(P<0,05)**	36% vs 13% **(P<0,02)**

[1] RHPL: radical hysterectomy and bilateral pelvic lymphadenectomy, [2]NS: no statistically different, [3]LND: lymphadenectomy.

6. Drainage following Complex Debulking with Colectomy and Peritonectomy

Another issue of debate and controversy is the potential value of drainage in monitoring potential anastomotic leakage after a modified posterior pelvic exenteration (MPPE). Most patients with advanced primary ovarian cancer are treated with cytoreductive surgery and platinum-based chemotherapy. Achieving a macroscopic complete resection during surgery significantly improves survival rates [28]. Due to the rectosigmoid proximity to female pelvic organs and its frequent involvement in ovarian cancer, rectosigmoid resection is commonly performed. En bloc resection of pelvic tumors, including the uterus and rectosigmoid (known as modified posterior pelvic exenteration) is a valuable part of cytoreductive surgery. Despite advances in techniques, anastomotic leakage remains a serious complication, with an incidence ranging from 0.8% to 10% in

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these procedures [29,30.]. To reduce this risk, surgeons have explored various preventative measures, including the use of a transanal drainage tube (TDT) in rectal cancer surgeries to prevent leakage after a low anterior resection. As it is indicated, from a recent retrospective review, concerning patients who had undergone an MPPE for primary ovarian, tubal, or peritoneal cancer, TDT placement seems to be an effective and safe way to decrease the rate of anastomotic leakage and the need for a diverting stoma. However, some patients will inevitably require a diverting stoma in addition to TDT placement.[31].

Several randomized prospective studies in western countries have found prophylactic abdominal drainage tubes to be unnecessary [32,33]. A Japanese retrospective study involving 260 patients who underwent colectomy and suprapromontory anastomosis showed that, when comparing 124 patients with prophylactic drainage tubes and 136 without, no statistically significant difference in postoperative complications or abscess formation was found. However, there was a higher incidence of abscess formation and statistically significant higher rate of re-operation in the drained group. The study concluded that prophylactic drainage tubes are unnecessary even in cases involving extensive resection and regional lymphadenectomy and no crucial benefit can be proven.[34]

7. Guidelines

The international guidelines approaching the issue of perioperative management regarding the placement of drains, in an effort to minimize the rate of postoperative complications and shorten the recovery time, have currently set clear suggestions. According to ACOG COMMITTEE OPINION number 750 [35] and the ERAS protocol (Enhanced recovery after surgery) surgical drains and vaginal packs should be avoided or taken out as early as possible post-surgery. Relatively, the habitual use of nasogastric, abdominal, and vaginal drains limits mobility, elevates morbidity, and extends hospital stays, with minimal evidence of their benefit. Avoiding regular use of tubes is strongly recommended to increase mobility and shorten hospital stay, since its use is poorly associated with lower rate of anastomotic leaks but frequently with pulmonary complications. Furthermore, the European Society of Gynecological Oncology, mainly focuses on the prevention and management of postoperative complications, such as intra-abdominal and collections and abscesses [36]. Diaphragmatic surgery does not justify routinely chest tube placement, unless there are high-risk characteristics or pre-operative pleural effusion. (grade B). In cases of clinically significant post-operative collections or abscesses, imaged-guided percutaneous drainage is recommended (grade B), with in cases of ascites and lymphadenectomy is proposed just an option to consider (grade C). In conclusion, 2 major international guidelines, suggest that the prudent implementation of surgical drains and tubes only where is needed and the early removal is the appropriate approach, since the benefit of its routinely used cannot be justified by the existing published data. A summary of the guidelines regarding usage of tubes peri- and post-operatively can be found in Table 2.

Table 2. Summary of guidelines regarding usage of tubes peri- and post-operatively.

Tubes	Upper abdominal complications	Diaphragmatic surgery	Pleural effusion	Post-op collections or abscess	Diet	Urinary Catheter
ESGO guidelines [36]	Could be considered in large-volume ascites and extensive peritoneal and/or lymph node resections (III, C)	Not routinely indicated (III, B)	Could be considered in cases of high-volume pre-operative pleura effusion, frailty, hypoalbuminemia, and large diaphragmatic resection (III, B)	Preferable management: Image-guided percutaneous drainage (III, B)	-	-

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ACOG committee opinion and ERAS protocol [35]	Avoidance of drains and vaginal packs	-No nasogastric tube -Regular diet and gum chewing 4 hours post-operatively	Removal within 24 hours

8. Conclusions and Future Directions

The present article discusses the efficacy and necessity of using drains in post-operative care, particularly in gynecologic oncology surgeries. It is suggested that negative pressure wound therapy may reduce surgical site infection rates patients undergoing cytoreductive surgery for ovarian cancer. It is highlighted that while vaginal drains may help with hematoma and infectious morbidity, the overall benefit of vaginal and peritoneal drains in preventing post-operative morbidity is questionable. Specifically, drains do not appear to improve post-operative outcomes in women undergoing radical hysterectomy with pelvic lymphadenectomy, but still could be reserved for high-risk situations, such as intraoperative bleeding or injury. However, their routine use may not be necessary and could lead to complications, particularly in cancer patients with a history of chemotherapy or radiotherapy. Conflicting evidence exists regarding drains' effectiveness in preventing anastomotic leakage, with high rates of re-operation and abscess formation noted. Furthermore, early catheter removal is indicated to facilitate faster recovery and reduce urinary tract complications. Although there is still great need for further investigation, the topic has been covered mostly by many prospective trials and the international guidelines have published clear suggestions to guide the physicians in clinical practice.

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