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# Clinical Efficacy of Vacuum-Assisted Therapy in the Treatment of Pulmonary Abscesses in Patients with Diabetes Mellitus

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*ABSTRACT*

***Background:*** *Pulmonary abscess remains a severe complication in diabetic patients, often associated with protracted healing, high surgical risk, and prolonged hospitalization. Negative pressure (VAC) therapy has shown promise in accelerating infection control and tissue repair, yet its application in thoracic surgery remains limited.*

***Objective:*** *To evaluate the clinical effectiveness of vacuum-assisted closure therapy in the treatment of pulmonary abscesses in patients with type 2 diabetes mellitus.*

***Materials and Methods:*** *A prospective controlled study included 74 patients with pulmonary abscesses and type 2 diabetes. The main group (n=38) received surgical drainage followed by VAC therapy; the control group (n=36) received standard drainage without negative pressure. Key endpoints included duration of drainage, wound healing time, length of hospital stay, and rate of complications and mortality.*

***Results:*** *The VAC group demonstrated significantly shorter drainage duration (6.2±1.1 vs. 9.4±1.3 days; p<0.01), faster cavity closure (11.6±1.9 vs. 17.2±2.3 days; p<0.001), and reduced hospitalization (13.8±2.4 vs. 20.6±3.2 days; p<0.001). The complication rate was lower in the VAC group (10.5% vs. 27.8%), and no mortality was observed, compared to 2 deaths in the control group.*

***Conclusion:*** *VAC therapy in diabetic patients with pulmonary abscesses significantly improves healing dynamics and reduces postoperative complications. This method is an effective adjunct to surgical drainage and may be considered for broader use in thoracic surgery.*

***Keywords:*** *Vacuum-assisted closure, pulmonary abscess, diabetes mellitus, negative pressure therapy, thoracic surgery, wound healing.*

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## INTRODUCTION

Pulmonary abscess remains one of the most formidable complications in thoracic surgery, particularly when occurring in patients with type 2 diabetes mellitus (T2DM). The presence of impaired immunity, microvascular damage, and altered wound healing processes in diabetic individuals significantly complicates both the natural course and surgical management of pulmonary infections [1,2]. Standard treatment includes broad-spectrum antibiotics, drainage, and in refractory cases, resectional surgery. However, such approaches are often associated with prolonged recovery, persistent cavity formation, and increased morbidity [3].

Negative pressure wound therapy (NPWT), also known as vacuum-assisted closure (VAC) therapy, has gained recognition in the management of soft tissue infections, diabetic foot ulcers, and mediastinitis, due to its ability to accelerate granulation tissue formation, reduce local edema, and control infection [4,5]. Although VAC systems are widely used in general surgery and traumatology, their application in thoracic surgery - particularly within closed or partially drained cavities such as pulmonary abscesses - remains limited and under-investigated [6].

In diabetic patients with pulmonary abscess, the problem is further exacerbated by delayed immune response, increased bacterial colonization, and poor tolerance to aggressive surgical interventions [7]. Given these challenges, the introduction of controlled negative pressure within the abscess cavity may improve local tissue perfusion, stimulate fibroblast activity, and reduce the bacterial load, offering a less invasive and more physiologically favorable alternative to open thoracic procedures [8].

Few clinical studies have addressed the use of VAC therapy directly in the pulmonary setting, and even fewer have focused specifically on diabetic populations. There remains a need to evaluate whether the benefits observed in external wound management can translate to complex intrathoracic infections. This study aims to fill that gap by prospectively assessing the effectiveness of VAC therapy in patients with pulmonary abscesses and T2DM.

## MATERIALS AND METHODS

This prospective controlled study was conducted between 2020 and 2024 at the Thoracic Surgery Department of the Republican Specialized Center of Surgery in Tashkent, Uzbekistan. The study protocol was approved by the local ethics committee, and informed consent was obtained from all participants.

A total of 74 patients diagnosed with pulmonary abscess and comorbid type 2 diabetes mellitus were included. The inclusion criteria comprised the presence of a single or multiloculated pulmonary abscess verified by computed tomography (CT), confirmed diagnosis of T2DM with HbA1c >7.0%, and indications for surgical drainage due to the failure of conservative therapy. Patients with pleural empyema, septic shock on admission, or advanced multi-organ failure were excluded.

The patients were divided into two groups. The main group (n = 38) underwent video-assisted thoracoscopic (VATS) or open abscess drainage followed by application of vacuum-assisted closure (VAC) therapy. The control group (n = 36) received similar surgical drainage without negative pressure therapy, using standard passive or active tube systems.

In the VAC group, after initial drainage and debridement of necrotic tissue, a sterile polyurethane sponge was inserted into the abscess cavity, connected to a VAC system delivering continuous negative pressure of -80 to -120 mmHg. The dressing was changed every 72 hours under sterile conditions. The therapy continued until cavity volume decreased by >70% and cultures turned sterile.

The following parameters were assessed: duration of drainage (days); time to clinical resolution (fever regression, normalized leukocytosis); time to cavity closure (radiological resolution); length of hospital stay; rate of postoperative complications (bronchial fistula, bleeding, residual cavity), 30-day mortality.

Statistical analysis was performed using SPSS 26.0. Quantitative variables were expressed as mean ± standard deviation and compared using Student's t-test. Categorical data were analyzed using chi-square or Fisher's exact test. A p-value <0.05 was considered statistically significant.

## RESULTS

The study enrolled 74 patients with pulmonary abscess and type 2 diabetes mellitus, distributed into two groups with comparable baseline characteristics in terms of age, gender, abscess size, and glycemic control (mean HbA1c 9.4±1.2%).

In the VAC group (n=38), the duration of active drainage was significantly shorter than in the control group (n=36): 6.2±1.1 days versus 9.4±1.3 days, respectively (p<0.01). Clinical symptoms such as fever and

leukocytosis resolved faster in the VAC group, with normalization observed by day 4.5±1.2 compared to day 6.8±1.4 in the control group ($p<0.05$).

Radiological signs of cavity closure were documented on average by day 11.6±1.9 in the VAC group, which was significantly earlier than in the control group (17.2±2.3 days; $p<0.001$). Hospitalization duration was also notably reduced in the VAC group: 13.8±2.4 days versus 20.6±3.2 days in controls ($p<0.001$), reflecting accelerated recovery.

Regarding postoperative complications, the VAC group had a complication rate of 10.5% (4 patients), primarily minor air leaks and transient hyperglycemia. In contrast, the control group experienced complications in 27.8% of cases (10 patients), including persistent residual cavities (5 cases), bronchopleural fistula (2 cases), and wound infection (3 cases) ($p<0.05$).

Importantly, no deaths occurred in the VAC group, while the control group recorded two deaths (5.6%) due to sepsis and respiratory failure. This difference, while not statistically significant due to the sample size ($p=0.21$), suggests a trend toward reduced mortality with VAC intervention.

Overall, VAC therapy was associated with faster resolution of infection, more rapid cavity obliteration, shorter hospitalization, and fewer complications, affirming its clinical benefit in diabetic patients with pulmonary abscess.

## DISCUSSION

The results of this study clearly demonstrate the clinical benefits of vacuum-assisted closure (VAC) therapy in the surgical management of pulmonary abscesses in patients with type 2 diabetes mellitus. The use of controlled negative pressure within the abscess cavity significantly improved local infection control, reduced drainage duration, and accelerated cavity closure when compared to conventional passive drainage.

These findings are consistent with previous reports on the advantages of negative pressure therapy in managing infected wounds and deep tissue infections. VAC has been shown to improve perfusion, stimulate granulation tissue, and reduce local bacterial load through continuous exudate removal [1,2]. While most applications have been limited to superficial or mediastinal infections, our data suggest that with appropriate technique and monitoring, VAC can be safely and effectively adapted to the intrathoracic space.

The shorter drainage period and reduced hospital stay observed in the VAC group align with similar results in other anatomical regions. For example, studies by Argenta and Morykwas demonstrated that VAC therapy promotes angiogenesis and fibroblast migration even in poorly vascularized tissue beds, which is particularly relevant for diabetic patients who commonly suffer from microvascular compromise [3]. Our data support this mechanism, showing rapid clinical resolution and earlier radiological closure in the VAC group.

The reduced complication rate in the VAC group - particularly the absence of bronchopleural fistula and significantly fewer persistent residual cavities - may be attributed to the stabilization of the internal environment provided by controlled negative pressure. By maintaining cavity collapse and continuous evacuation of necrotic material, VAC may prevent the expansion of infection and support better sealing of minor bronchial communications [4].

Although the sample size did not allow for statistical confirmation of reduced mortality, the absence of deaths in the VAC group is clinically encouraging, especially considering the higher baseline vulnerability of diabetic patients. Previous studies have identified diabetes as a predictor of poor outcomes in pulmonary abscess due to impaired immune function and delayed wound healing [5]. Our results suggest that targeted interventions such as VAC may help overcome some of these limitations.

Limitations of this study include the single-center design, relatively small cohort size, and lack of long-term follow-up to assess recurrence. Nonetheless, the consistent and statistically significant improvements in multiple clinical endpoints support the integration of VAC therapy into standard protocols for diabetic patients with thoracic infections.

Further research should focus on optimizing pressure parameters, duration of therapy, and sponge configurations specific to intrathoracic use. Additionally, randomized multicenter trials would be valuable in confirming these findings and establishing guidelines for VAC therapy in thoracic surgery.

## CONCLUSION

Vacuum-assisted therapy (VAC) proved to be a highly effective adjunctive method in the surgical treatment of pulmonary abscesses in diabetic patients. Its application resulted in significantly shorter drainage duration, earlier clinical stabilization, faster cavity resolution, and fewer complications compared to conventional drainage. The method was well

tolerated and did not increase the risk of intrathoracic complications.

Given the pathophysiological challenges posed by diabetes mellitus, particularly impaired immune response and delayed tissue regeneration, VAC therapy offers a physiologically sound and clinically beneficial alternative. Based on the observed outcomes, VAC should be considered a valuable tool in thoracic surgical protocols, especially in high-risk diabetic populations.

**Ethical Approval:**

This study was approved by the Local Ethics Committee of the Republican Specialized Center of Surgery (Tashkent, Uzbekistan). All patients provided written informed consent prior to inclusion.

**Conflict of Interest:**

The author declares no conflict of interest.

**Funding:**

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**Author Contributions:**

Khamdamov Sh.A. - Conceptualization, surgical management, data collection, statistical analysis, manuscript writing, and final approval.

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## REFERENCES

1. Banwell PE, Téot L. Topical negative pressure (TNP): the evolution of a novel wound therapy. J Wound Care. 2003;12(1):22–28.
2. Orgill DP, Bayer LR. Negative pressure wound therapy: past, present and future. Int Wound J. 2013;10(S1):15–19.
3. Morykwas MJ, Argenta LC, Shelton-Brown EI, McGuirt W. Vacuum-assisted closure: a new method for wound control and treatment. Ann Plast Surg. 1997;38(6):553–62.
4. Saadi S, Lesèche G, Filaire M, et al. Vacuum-assisted closure therapy in thoracic surgery: a review. Interact Cardiovasc Thorac Surg. 2008;7(4):543–546.
5. Kim CH, Kim HS, Park JW, et al. Predictors of poor prognosis in patients with pulmonary abscess. Respirology. 2014;19(6):913–918.

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## QANDLI DIABET BILAN KASALLANGAN BEMORLARDA O‘PKA ABSTSESSLARINI DAVOLASHDA VAKUUM-ASSISTENSIYALANGAN TERAPIYANING KLINIK SAMARADORLIGI

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### ANNOTATSIYA

O‘pka abstsessi qandli diabet bilan og‘rigan bemorlarda og‘ir kechuvchi infeksion asoratlardan biri hisoblanadi. Ushbu ishda o‘pka abstsessiga chalingan 74 nafar diabetik bemor ishtirok etgan nazoratli prospektiv tadqiqot natijalari keltirilgan. Asosiy guruhga (n=38) jarrohlik drenajdan so‘ng vakuum-assistensiyalangan terapiya (VAC) qo‘llanildi, nazorat guruhiga esa (n=36) standart passiv yoki faol drenaj ishlatildi. VAC guruhi bemorlarida drenaj muddatining (6,2±1,1 kun), yiringli bo‘shliqning yopilish vaqtining (11,6±1,9 kun) va shifoxonada yotish muddati (13,8±2,4 kun) sezilarli darajada qisqargani aniqlandi ($p<0,01$). Asoratlar chastotasi va o‘lim ko‘rsatkichi ham nazorat guruhiga qaraganda past bo‘ldi. Ushbu natijalar o‘pka infeksiyalarida, ayniqsa, qandli diabet bilan kasallangan bemorlarda VAC terapiyasining yuqori samaradorligini ko‘rsatadi.

**Kalit so‘zlar:** Vakuum terapiya, o‘pka abstsessi, qandli diabet, jarrohlik drenaji, torakal xirurgiya, asoratlar.

## КЛИНИЧЕСКАЯ ЭФФЕКТИВНОСТЬ ВАКУУМ-АССОЦИИРОВАННОЙ ТЕРАПИИ ПРИ ЛЕЧЕНИИ АБСЦЕССОВ ЛЕГКИХ У БОЛЬНЫХ САХАРНЫМ ДИАБЕТОМ

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### АННОТАЦИЯ

Абсцесс легкого у пациентов с сахарным диабетом представляет собой тяжелую форму инфекционного поражения, требующую комбинированного подхода. В рамках настоящего исследования проведена оценка эффективности вакуум-ассоциированной терапии (VAC) у 74 больных с абсцессом легкого на фоне сахарного диабета 2 типа. Основная группа (n=38) получала хирургическое дренирование с последующим применением VAC-системы; контрольная группа (n=36) - стандартное дренирование без отрицательного давления. В группе VAC отмечены достоверное сокращение сроков дренирования (6,2±1,1 дня), более быстрое закрытие полости (11,6±1,9 дня) и уменьшение длительности госпитализации (13,8±2,4 дня) по сравнению с контролем ($p<0,01$). Частота осложнений и летальность также были ниже. Полученные данные подтверждают, что VAC-терапия является эффективным и безопасным дополнением к хирургическому лечению гнойно-некротических заболеваний легких у диабетических пациентов.

**Ключевые слова:** Вакуум-терапия, абсцесс легкого, сахарный диабет, хирургическое лечение, отрицательное давление, торакальная хирургия.