

Analysis of Postoperative Hospital Infection Characteristics and Influencing Factors in Esophageal Cancer

Jing Lv¹, Jing Wei^{2,*}

¹Department of Thoracic Surgery, People's Hospital of Deyang City, Deyang, Sichuan, China

²Second People's Hospital of Deyang City, Deyang, Sichuan, China

*Corresponding author

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Abstract: To gain a deep understanding of the characteristics of postoperative hospital infections in patients with esophageal cancer and provide comprehensive prevention and treatment measures. A comprehensive prospective and retrospective survey was conducted, including 412 cases of esophageal cancer patients for observation and analysis. We found that the incidence of hospital infections among these patients reached 16.99%. In terms of infection sites, surgical incisions, respiratory tract, and pleural cavity were the most common. Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, and fungi were the most common pathogens causing infections. In order to effectively prevent and treat postoperative hospital infections in patients with esophageal cancer, a series of comprehensive measures need to be taken. Firstly, preoperative preparation is crucial, including thorough disinfection and purification of the surgical environment to ensure the cleanliness of the surgical incision. Secondly, it is important to focus on improving patients' immune function by providing appropriate nutritional support and using immunomodulators. In addition, reducing invasive procedures, careful selection of antibiotic use, and rational use of antifungal drugs are also key steps. Lastly, special attention should be given to elderly patients and patients with prolonged hospital stays, closely monitoring changes in their condition and implementing timely treatment measures. By implementing these comprehensive prevention and treatment measures, the incidence of postoperative hospital infections in patients with esophageal cancer can be effectively reduced, improving the quality of patient recovery and minimizing the occurrence of related complications [1].

Esophageal cancer is a common malignant tumor that primarily affects middle-aged and elderly populations. Surgical intervention is the preferred treatment method for esophageal cancer, but it involves significant trauma and invasive procedures, resulting in longer hospital stays for patients. Additionally, treatments such as radiotherapy and chemotherapy can weaken patients' immune defenses, further increasing their risk of hospital-acquired infections. To gain deeper insights into this issue, this study conducted an investigation and analysis of 412 patients who underwent surgical treatment for esophageal cancer in our hospital over the past four years, with a particular

focus on 70 patients who developed hospital-acquired infections.

The survey results revealed a significantly high incidence of hospital-acquired infections among these 70 patients. The most common infection sites were surgical incisions, respiratory tracts, and the thoracic cavity. It was also observed that *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and fungi were the primary pathogens causing these infections ^[2].

1. Data and Methods

1.1 General Information

To gain in-depth understanding of patients with esophageal cancer who underwent surgical treatment in our hospital from February 2019 to February 2023, we collected data from a total of 412 cases. Among them, 70 patients developed hospital-acquired infections, including 42 males and 28 females. The age of the patients ranged from 36 to 78 years, with an average age of 56 years. The length of hospital stay for these patients varied from 13 to 180 days.

Through the investigation and analysis of these patients, we can gain more detailed insights into the characteristics and related information of postoperative hospital-acquired infections in patients with esophageal cancer. This data can help us formulate more effective prevention and treatment measures to reduce the incidence of hospital-acquired infections and improve the treatment outcomes and recovery conditions of patients with esophageal cancer.

1.2 Pathogen Examination

In accordance with the requirements of the "National Clinical Laboratory Testing Procedures" for clinical bacterial specimen collection, we strictly followed the procedures to collect specimens from the hospital-acquired infection patients in this study to ensure the accuracy and reliability of the results. Regarding pathogen examination, we collected samples such as wound secretions, respiratory tract sputum, fresh urine, and blood, and conducted detailed testing.

To determine the pathogenic bacteria, specific methods were employed. Firstly, we consecutively submitted the same sample for testing more than two times, ensuring consistency of the results. Only when the results of two consecutive tests were the same, we confirmed the identified pathogen as the causative agent.

Through this rigorous process of specimen collection and pathogen examination, we were able to accurately determine the causative agents of hospital-acquired infections in patients and provide essential evidence for formulating effective treatment plans. Such meticulous procedures contribute to ensuring diagnostic accuracy, providing more precise and individualized treatment measures for patients, and improving treatment outcomes and recovery quality^[3].

1.3 Diagnostic Criteria

We strictly followed the "Diagnostic Criteria for Hospital-Acquired Infections (Trial Implementation)" issued by the Medical Administration Department of the National Health Commission in 2001 to diagnose hospital-acquired infections. These criteria provided clear guidance to ensure the diagnosis and judgment of hospital-acquired infections were uniform and standardized. According to these criteria, the diagnosis of hospital-acquired infections was carried out rigorously. The criteria define hospital-acquired infections, specify infection sites, infection symptoms, and relevant laboratory indicators. We followed these guidelines for the diagnostic process^[4].

By adhering to the "Diagnostic Criteria for Hospital-Acquired Infections (Trial Implementation)"

issued by the Medical Administration Department of the National Health Commission in 2001, we ensured that the diagnosis of hospital-acquired infections was scientific and reliable. This helps in promptly identifying and managing hospital-acquired infections, implementing appropriate treatment measures, safeguarding patient safety, and reducing the risk of infection transmission.

1.4 Research Method

A retrospective survey method was used to collect and organize patient medical records. A standardized survey form was completed, which included general patient information, surgical timing, type of surgical incision, length of hospital stay, invasive procedures, and antibiotic usage. The collected data will be subjected to statistical analysis.

In this study, we retrospectively examined patient medical records. We collected information on patients' demographics, such as age, gender, and medical history, as well as surgical-related information, including surgical timing, type of surgical incision, and length of hospital stay. We also recorded the specifics of invasive procedures undergone by patients and the usage of antibiotics during their hospitalization.

2. Results

2.1 Incidence of Hospital-Acquired Infections

A total of 412 postoperative patients with esophageal cancer were included in the study, and it was found that 70 patients developed hospital-acquired infections, resulting in a staggering incidence rate of 16.99%. The research results revealed that hospital-acquired infections are not uncommon in postoperative patients with esophageal cancer, with a significant proportion of patients being affected by such infections. The postoperative recovery phase is a critical period prone to infections, necessitating proactive preventive measures to reduce the occurrence of hospital-acquired infections.

2.2 Distribution of Infection Sites

Among the 70 cases of hospital-acquired infections in postoperative patients with esophageal cancer, there were notable differences in the incidence rates of infections at different sites. Surgical site infections were the most common, accounting for a staggering 41.35%. Respiratory tract infections were the second most common, accounting for 34.14%. Pleural cavity infections also occurred in a portion of patients, accounting for 9.75%. These findings highlight the characteristics of hospital-acquired infections in postoperative patients with esophageal cancer. Surgical site, being directly exposed to the external environment, is susceptible to bacterial and pathogen invasion, hence resulting in a higher incidence rate of infections. The occurrence of respiratory tract infections may be associated with compromised immune defenses and challenges in maintaining airway cleanliness in postoperative patients. Pleural cavity infections may be related to thoracic manipulations during the surgical procedure.

2.3 Distribution of Major Pathogens in Hospital-Acquired Infections

During the pathogen examination of the aforementioned hospital-acquired infection patients, a total of 54 strains of pathogens were detected, with 2 cases showing mixed infections, indicating the simultaneous presence of multiple pathogens. Among all the detected pathogens, *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and fungi were the most common, ranking as the

top four. This research result reveals the characteristics of pathogen spectrum in hospital-acquired infection patients. *Escherichia coli* is commonly found in the gastrointestinal tract and its presence may be associated with contamination during the surgical procedure or other factors. *Pseudomonas aeruginosa* is a common pathogen in hospital-acquired infections, and its infection may be related to factors such as antibiotic use and invasive procedures. *Staphylococcus aureus* is commonly found on the skin and mucous membranes, and it can cause infection through surgical incisions and other pathways. Fungal infections are also common in postoperative patients and may be related to factors such as compromised immune function and prolonged antibiotic use.

2.4 Relationship between Hospital-Acquired Infections and Length of Hospital Stay

Among the 70 cases of hospital-acquired infection patients in this group, the majority were aged ≥ 60 , accounting for 44 cases; 18 cases were aged 40 to 59; and 8 cases were aged < 40 . In terms of hospital stay, 24 patients had a duration of 2 to 3 weeks, while 46 patients had a stay exceeding 3 weeks. These data indicate a positive correlation between hospital-acquired infections and patient age and length of hospital stay. Patients aged ≥ 60 are more prone to hospital-acquired infections, which may be attributed to weaker immune function and lower resistance in elderly patients, making them more susceptible to pathogen invasion. Furthermore, prolonged hospital stay increases the risk of hospital-acquired infections, possibly due to prolonged exposure to the hospital environment, leading to greater contact with pathogens.

3. Discussion

Hospital-acquired infections in patients after esophageal cancer surgery are common and serious complications. According to the data from this study, the incidence rate of hospital-acquired infections was 16.99%. The most common infection sites were surgical incisions, respiratory tract, and pleural cavity.

There are several main factors contributing to the occurrence of hospital-acquired infections in postoperative esophageal cancer patients. Firstly, esophageal cancer surgery is typically a thoracotomy procedure that involves endotracheal intubation under general anesthesia, as well as nasogastric tube insertion for drainage of oropharyngeal secretions and gastrointestinal reflux. These procedures increase the risk of aspiration, leading to the occurrence of aspiration-related infections. Secondly, thoracic surgery may stimulate visceral organs, causing reflex inhibition of the diaphragm and reducing respiratory volumes in postoperative patients, leading to atelectasis in the lower lungs. Furthermore, diaphragmatic dysfunction results in a shift from abdominal to thoracic breathing, reducing dynamic movement in the lower lungs and impairing coughing and sputum clearance, which can lead to retention of airway secretions and an increased risk of pulmonary infections. Lastly, esophageal cancer predominantly affects middle-aged and elderly populations, whose immune function tends to decline. Additionally, postoperative radiotherapy, chemotherapy, and invasive procedures further weaken the body's immune defenses^[5].

According to our research findings, the composition of pathogens causing hospital-acquired infections exhibited the following characteristics: *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and fungi were the most common pathogens. *Escherichia coli*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus* are commonly found in the hospital environment, exhibiting strong resistance to physical and chemical factors and low growth requirements, making them the primary pathogens causing hospital-acquired infections. It is noteworthy that we observed an increasing trend in fungal infections in our hospital, which may be related to the compromised immune function of patients and inappropriate use of antibiotics.

Overall, our study highlights the significance of implementing preventive measures to reduce the

occurrence of hospital-acquired infections in postoperative esophageal cancer patients. These measures should focus on minimizing aspiration risk, optimizing respiratory management, enhancing immune function, and implementing appropriate antibiotic and antifungal drug usage. By addressing these factors, the incidence of hospital-acquired infections can be reduced, contributing to improved treatment outcomes and better patient recovery.

In terms of prevention and treatment measures for hospital-acquired infections in postoperative esophageal cancer patients, the following recommendations are suggested:

Firstly, Hospitals should prioritize providing comprehensive psychological care for patients, ensuring they receive adequate preoperative preparation to facilitate their psychological adaptation to the hospital environment and upcoming procedures. Secondly, Hospitals should emphasize the importance of nutritional support therapy, especially during the postoperative fasting period. Promptly providing enteral nutrition support can significantly enhance patients' immune resistance and promote a faster recovery process. Additionally, Hospitals should adopt a conservative approach when considering invasive procedures, minimizing them whenever possible. Adhering strictly to aseptic techniques is vital to reduce the risk of injuries and prevent complications. Moreover, Hospitals should focus on enhancing respiratory management for patients. Regularly ventilating the rooms, performing timely air disinfection, and assisting patients with effective coughing and sputum clearance can significantly reduce the chances of respiratory-related complications. Furthermore, special attention should be given to elderly patients and those with extended hospital stays. Close monitoring and timely preventive measures are essential to prevent the occurrence of hospital-acquired infections in these vulnerable populations. For patients on long-term antibiotic use, strict precautions should be taken to prevent dysbiosis and fungal infections.

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