

Characteristics and Efficiency of Inpatient Consultations in Oral and Maxillofacial Surgery: A Retrospective Study from a Tertiary Comprehensive Hospital

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Research Article

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Abstract

Objective To characterize inpatient consultation practices in the Department of Oral and Maxillofacial Surgery of a tertiary comprehensive hospital and to evaluate consultation efficiency in the context of multidisciplinary perioperative care.

Methods A retrospective review was conducted of inpatient consultations requested between April and December 2024. Data were extracted from the electronic medical record system, including consultation indications, involved specialties, response times, and completion status. Continuous variables were summarized using means, medians, and interquartile ranges (IQRs), while categorical variables were presented as frequencies and percentages.

Results Among 3,661 hospitalized patients, 51.7% had one or more systemic diseases. During the study period, 1,873 class III–IV procedures, 103 free flap reconstructions, 336 oncologic cases, and 675 trauma cases with comorbidities were managed, reflecting a substantial burden of complex perioperative care. A total of 822 consultations were requested, corresponding to a consultation rate of 22.5%, and involved more than 20 clinical specialties. Cardiology, otolaryngology, endocrinology, respiratory medicine, and neurology were the most frequently consulted departments. Approximately 60% of consultations were completed within 8 hours. Delayed consultations (> 24 h) accounted for 8.3% (68/822), while 9.1% (75/822) remained incomplete at discharge. Among consultations completed within 24 hours (n = 679), the mean response time was 7.36 hours (median, 5.42 hours; IQR, 1.82–10.15 hours). Potentially avoidable or inappropriate consultations accounted for 2.6% (21/822).

Conclusions The consultation burden in oral and maxillofacial surgery largely reflects the need for multidisciplinary perioperative management of patients with complex systemic conditions and high-risk surgical procedures. Although most consultations were completed in a timely manner, delayed and incomplete consultations remained common. Improving pre-consultation assessment, promoting early multidisciplinary involvement in high-risk patients, and enhancing communication between specialties may further improve consultation efficiency and perioperative care quality.

1 Introduction

Oral and maxillofacial surgeons in tertiary comprehensive hospitals are increasingly encountering patients with systemic diseases, particularly among those undergoing treatment for head and neck malignancies, microvascular free flap reconstruction, and complex maxillofacial trauma^[1,2]. The management of these patients extends beyond surgical treatment alone and often requires comprehensive perioperative assessment and optimization of coexisting medical conditions^[3]. As a result, multidisciplinary collaboration has become an integral component of contemporary oral and maxillofacial surgical care^[4].

Inpatient consultation serves as an important mechanism for obtaining specialist input and coordinating multidisciplinary management. Through consultation, oral and maxillofacial surgeons can obtain

recommendations regarding cardiovascular, endocrine, respiratory, neurological, and other medical conditions that may influence perioperative risk and treatment planning^[5]. Effective consultation supports perioperative optimization, facilitates clinical decision-making, and contributes to patient safety.

Despite its importance, consultation practice in oral and maxillofacial surgery has received relatively limited attention in the literature. Previous studies have primarily focused on surgical techniques, oncologic outcomes, and postoperative complications, whereas the characteristics and efficiency of inpatient consultation remain poorly described. A better understanding of consultation patterns may help identify opportunities to improve multidisciplinary collaboration and perioperative care.

Therefore, this study retrospectively reviewed inpatient consultations in the Department of Oral and Maxillofacial Surgery at a tertiary comprehensive hospital. We aimed to characterize consultation demand, specialty distribution, response times, and completion status, and to explore factors affecting consultation efficiency in routine clinical practice.

2 Materials and Methods

2.1 Study Population and Data Collection

This retrospective study reviewed all inpatient consultation requests generated in the Department of Oral and Maxillofacial Surgery at the Second Affiliated Hospital, Zhejiang University School of Medicine, between April and December 2024.

Patient-related data were extracted from the electronic medical record (EMR) system, including age, length of hospital stay, systemic diseases, diagnoses, surgical procedures. Consultation-related data included consultation volume, consultation indications, involved specialties, response times, completion status, and consultation-related delays.

Consultations requested for perioperative assessment, management of systemic diseases, postoperative complications, or multidisciplinary treatment planning were included. Informal consultations without documented records in the EMR system were excluded.

2.2 Definitions and Statistical Analysis

Consultation response time was defined as the interval between submission of a consultation request and documentation of the consultant's recommendation in the EMR system.

Consultations completed more than 24 hours after submission were classified as delayed consultations. Consultations without documented recommendations before patient discharge were classified as incomplete consultations.

Consultation records were further reviewed to identify potentially avoidable consultations. These included consultations requested for physiological findings not requiring specialist intervention and consultations directed to inappropriate specialties that did not provide clinically relevant recommendations.

Data were entered into Microsoft Excel and analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized using means, medians, ranges, and interquartile ranges (IQRs), whereas categorical variables were presented as frequencies and percentages. Differences in consultation response times among specialties were compared using one-way analysis of variance (ANOVA). A two-sided P value < 0.05 was considered statistically significant.

3 Results

3.1 Patient Characteristics

Between April and December 2024, a total of 3,661 inpatients were admitted to the Department of Oral and Maxillofacial Surgery, excluding day-surgery cases. Patient ages ranged from 6 to 89 years. Among them, 1,892 patients (51.68%) had documented systemic diseases. The cohort included 336 patients with head and neck malignancies, 675 trauma patients with comorbidities, 103 microvascular free flap reconstructions, and 1,873 class III–IV surgical procedures. The mean length of hospital stay was 6.46 days.

3.2 Consultation Distribution

A total of 822 inpatient consultation requests were identified, corresponding to a consultation rate of 22.5%, and involving more than 20 clinical specialties. Otolaryngology (18.73%) and cardiology (17.27%) were the most frequently consulted specialties, followed by endocrinology (8.88%), radiation oncology (6.20%), and respiratory medicine (5.72%). Together, these five specialties accounted for 56.80% of all consultations. The distribution of consultations by specialty is shown in Table 1.

Table 1
Distribution of inpatient consultations by specialty

Specialty	No. of consultations	Percentage (%)
Otolaryngology	154	18.73
Cardiology	142	17.27
Endocrinology	73	8.88
Radiation Oncology	51	6.20
Respiratory Medicine	47	5.72
Dermatology	31	3.77
Neurology	31	3.77
Orthopedics	27	3.28
Gastroenterology	27	3.28
Neurosurgery	26	3.16
Clinical Nutrition	25	3.04
Other specialties	188	22.87
Total	822	100.00

3.2 Consultation Response Time and Completion Status

Approximately 60% of consultations were completed within 8 hours and 23% within 8–16 hours. Overall, 679 consultations (82.60%) were completed within 24 hours, whereas 68 consultations (8.27%) were completed after 24 hours and 75 consultations (9.12%) remained incomplete at patient discharge.

Incomplete consultations occurred most frequently in otolaryngology (n = 25), radiation oncology (n = 15), and medical oncology (n = 9) (Table 2).

Delayed consultations (> 24 h) were most commonly observed in radiation oncology (n = 14), otolaryngology (n = 13), and cardiology (n = 10) (Table 2).

Among the most frequently consulted specialties, completion within 24 hours exceeded 90% in cardiology, endocrinology, respiratory medicine, whereas lower rates were observed in otolaryngology (75.32%) and radiation oncology (43.14%) (Table 2).

Table 2
Consultation Completion Status Among the Five Most Frequently Consulted Specialties

Specialty	Total Consultations (n)	Completed Within 24h, n (%)	Delayed (> 24 h), n (%)	Incomplete at Discharge, n (%)
Otolaryngology	154	116 (75.32)	13 (8.44)	25 (16.23)
Cardiology	142	130 (91.55)	10 (7.04)	2 (1.41)
Endocrinology	73	69 (94.52)	3 (4.11)	1 (1.37)
Radiation Oncology	51	22 (43.14)	14 (27.45)	15 (29.41)
Respiratory Medicine	47	44 (93.62)	2 (4.26)	1 (2.13)

Among consultations completed within 24 hours (n = 679), the mean response time was 7.36 hours, with a median of 5.42 hours (IQR, 1.82–10.15 hours). Across the most frequently consulted specialties, mean response times ranged from approximately 6 to 10 hours, with no statistically significant differences observed between specialties (P > 0.05).

3.3 Consultation Indications

Analysis of consultations completed within 24 hours showed that requests were predominantly directed to internal medical specialties, particularly cardiology, endocrinology, respiratory medicine, and neurology (Table 3). The most common reasons for consultation included cardiovascular assessment and blood pressure management, glycemic control, management of pulmonary complications, and perioperative medication guidance for patients with cerebrovascular disease.

Among cardiology consultations, arrhythmias (n = 53), hypertension (n = 38), and coronary artery disease (n = 25) were the most common indications. Endocrinology consultations mainly involved poor glycemic control (n = 42) and thyroid dysfunction (n = 10). Respiratory medicine consultations were primarily related to pulmonary complications, particularly postoperative pulmonary infection (n = 15) and pulmonary embolism (n = 3). Neurology consultations were mainly requested for perioperative antithrombotic management in patients with previous cerebral infarction (n = 15).

Among otolaryngology consultations, tracheostomy and tracheostomy-related care (n = 38) and nasopharyngeal examination (n = 21) were the leading indications.

Table 3
Common Consultation Indications in the Five Most Frequently Consulted Specialties

Specialty	Major consultation indications
Cardiology	Arrhythmia (53), hypertension (38), coronary artery disease (25)
Otolaryngology	Tracheostomy and tube management (38), nasopharyngeal examination (21), nasal bone fracture (11)
Endocrinology	Poor glycemic control (42), thyroid dysfunction (10), medication adjustment (6)
Respiratory medicine	Postoperative pulmonary infection (15), pneumonia (7), pulmonary embolism (3)
Neurology	Perioperative antithrombotic management after cerebral infarction (15), headache or dizziness (6)

3.4 Potentially Avoidable or Inappropriate Consultations

Twenty-one consultations (2.55%) were identified as potentially avoidable or inappropriate. These consultations included requests with limited clinical relevance as well as consultations involving inappropriate specialty selection (Table 4). Cardiology (6/130) and neurology (4/30) were the specialties most frequently involved.

Table 4
Categories of Potentially Avoidable or Inappropriate Consultations

Category	Representative examples	Cases, n
Inappropriate specialty selection	Pulmonary embolism referred to cardiology; renal insufficiency referred to cardiology; deep venous thrombosis referred to cardiology	9
Limited clinical relevance	Asymptomatic carotid plaque; prophylactic aspirin discontinuation; exclusion of intracranial metastasis	6
Physiological or benign abnormalities	Physiological sinus arrhythmia, sinus tachycardia/bradycardia, asymptomatic premature atrial or ventricular beats	6
Total		21

3.5 Consultation Volume

The 822 consultation requests involved 368 patients, corresponding to an average of 2.23 consultations per patient. Most patients required only one or two consultations during hospitalization (273/368, 74.18%). Seventy patients (19.02%) required three to five consultations, whereas 25 patients (6.79%) underwent six or more consultations, including five patients (1.36%) who required ten or more consultations during a single admission (Table 5).

Review of these high-utilization patients showed that repeated consultations were commonly associated with advanced head and neck malignancies, free flap reconstruction, tracheostomy, multiple systemic diseases, and postoperative complications.

Table 5
Distribution of Consultation Volume per Patient

Number of consultations per patient	Patients, n	Percentage (%)
1–2	273	74.18
3–5	70	19.02
6–9	20	5.43
≥ 10	5	1.36
Total	368	100.00

The characteristics of patients requiring frequent consultations are summarized in Table 6. These patients were predominantly characterized by head and neck malignancies (72.00%), multiple systemic diseases (80.00%), tracheostomy (68.00%), free flap reconstruction (48.00%), and postoperative complications (60.00%). MDT discussion was required in 20.00% of cases. The median length of hospital stay was 19.5 days (range, 8–37 days), indicating substantial clinical complexity and the need for repeated multidisciplinary assessment and management.

Table 6
Characteristics of patients requiring frequent consultations (≥ 6 consultations)

Characteristic	n (%) or Median (Range)
Total patients	25
Age, median (range), years	61 (19–81)
Head and neck malignancy, n (%)	18 (72.00)
Multiple systemic diseases ^a , n (%)	20 (80.00)
MDT discussion, n (%)	5 (20.00)
Tracheostomy, n (%)	17 (68.00)
Free flap reconstruction, n (%)	12 (48.00)
Postoperative complications ^b , n (%)	15 (60.00)
Length of stay, median (range), days	19.5 (8–37)
Emergency surgery, n (%)	4 (16.00)

^a: Multiple systemic diseases were defined as the presence of one or more documented cardiovascular, endocrine, respiratory, neurological, renal, or other systemic disorders requiring perioperative assessment or management.

^b: Postoperative complications included pulmonary complications, thromboembolic events, delirium, catheter-related complications, gastrointestinal complications, chyle leak, hepatic dysfunction, infectious complications, and other adverse events occurring during hospitalization.

4. Discussion

4.1 Consultation demand reflects the complexity of inpatient oral and maxillofacial surgery in a tertiary hospital

- In the present study, 51.68% of inpatients had systemic diseases, and a considerable proportion underwent high-complexity procedures, including 1,873 class III–IV operations, 336 oncologic surgeries, 103 free flap reconstructions, and 675 trauma cases with concomitant diseases. These findings indicate that oral and maxillofacial surgery in tertiary comprehensive hospitals is increasingly characterized by patients with complex medical backgrounds. Accordingly, perioperative management extends beyond local disease treatment and requires comprehensive assessment and management of systemic conditions and postoperative complications. Previous studies have shown that perioperative complications in major oral and head and neck surgery are closely associated with pre-existing diseases and overall physical status^[1,6,7].
- Consistent with these clinical characteristics, 822 consultations were requested during the study period, corresponding to a consultation rate of 22.5%. This finding suggests that multidisciplinary consultation has become an important component of perioperative management in hospitalized oral and maxillofacial surgery patients rather than an occasional requirement, particularly among patients undergoing free flap reconstruction^[8].
- Consultation demand was not evenly distributed among patients. A total of 822 consultations involved 368 patients, with an average of 2.23 consultations per patient. Among them, 58 patients underwent four or more consultations during a single hospitalization, including five patients who underwent ten or more consultations. Review of these patients showed that repeated consultations were commonly associated with advanced head and neck malignancies, free flap reconstruction, tracheostomy, multiple systemic diseases, and postoperative complications. These patients also tended to have longer hospital stays than the overall cohort.
- These findings suggest that consultation demand in oral and maxillofacial surgery is mainly concentrated in a relatively small number of patients with complex conditions. Therefore, consultation-related skills, including pre-consultation assessment, identification of key clinical problems, appropriate specialty selection, and effective communication with other disciplines,

should be regarded as an important part of oral and maxillofacial surgical training rather than an additional administrative task.

4.2 Specialty distribution reflects the characteristic consultation profile of oral and maxillofacial surgery

- The distribution of consultation requests was not uniform across specialties. Although more than 20 departments were involved, consultations were mainly concentrated in a limited number of specialties. Otolaryngology, cardiology, endocrinology, respiratory medicine, and neurology accounted for most high-frequency consultations. This pattern is consistent with previous reports in major head and neck surgery, where cardiovascular, metabolic, and respiratory conditions are important determinants of perioperative outcomes^[1,9].
- Among internal medicine specialties, cardiology consultations were mainly requested for arrhythmias, hypertension, and coronary artery disease, whereas endocrinology consultations were mostly related to perioperative glycemic control. Respiratory medicine consultations frequently involved pulmonary infection and pulmonary embolism, and neurology consultations mainly focused on perioperative management of antithrombotic therapy in patients with previous cerebrovascular events. These findings suggest that the scope of oral and maxillofacial surgery has expanded beyond local surgical treatment, and that perioperative management increasingly requires familiarity with common cardiovascular, metabolic, respiratory, and neurological conditions.

A notable finding of the present study was that otolaryngology was the most frequently consulted specialty, and radiation oncology ranked fourth among all consultation departments. This distribution differs from that reported in many other surgical specialties and reflects the unique characteristics of oral and maxillofacial surgery in tertiary comprehensive hospitals. Because of the close anatomical relationship between the oral and maxillofacial region and the upper aerodigestive tract, as well as the high proportion of head and neck malignancies and complex reconstructive procedures, consultations with otolaryngologists were frequently required for airway management, tracheostomy care, and evaluation of lesions involving adjacent structures. In addition, the relatively high consultation volume for radiation oncology reflects the substantial number of patients with head and neck malignancies and highlights the importance of multidisciplinary treatment. Therefore, consultation patterns in oral and maxillofacial surgery are influenced not only by perioperative medical optimization but also by the specific requirements of head and neck oncology and airway management.

4.3 Interpretation of consultation performance requires consideration of specialty characteristics and patient complexity

In the present study, 25 patients required six or more consultations during a single admission. These patients were predominantly characterized by head and neck malignancies, multiple systemic diseases,

tracheostomy, free flap reconstruction, and postoperative complications. Frequent consultations were mainly observed in three patient groups: head and neck malignancies, severe maxillofacial infections, and major maxillofacial trauma. These findings suggest that repeated consultations are more likely to reflect evolving clinical needs and multidisciplinary decision-making rather than inefficiencies in the consultation process.

Although most consultations were completed within 24 hours, delayed or incomplete consultations were still observed. However, these findings should be interpreted in the context of specialty characteristics and patient complexity rather than being regarded solely as indicators of poor responsiveness.

Despite having one of the highest consultation volumes, cardiology demonstrated relatively short response times and a high completion rate. Interestingly, several cardiology consultations remained unanswered. Review of these cases suggested that some requests were triggered by physiological findings, such as sinus arrhythmia in children and asymptomatic premature beats, whereas others involved conditions that might have been more appropriately managed by other specialties. In addition, some consultation requests were submitted after additional investigations had been completed, reflecting a heavy reliance on specialist interpretation of test results. Although repeated consultations were not specifically analyzed in the present study, these findings suggest that limited familiarity with the interpretation of common cardiovascular findings and uncertainty regarding perioperative management may contribute to increased consultation demand. Strengthening the ability of oral and maxillofacial surgeons to recognize physiological changes and interpret common investigations may help optimize the use of cardiology consultation resources.

Otolaryngology had the highest consultation volume but a relatively lower completion rate. Most consultations to otolaryngology were related to airway management, tracheostomy care, and evaluation of lesions involving adjacent anatomical structures, reflecting the close anatomical relationship and considerable overlap in disease spectrum between oral and maxillofacial surgery and otolaryngology. But some consultation requests involved pre-existing conditions unrelated to the current hospitalization, such as tinnitus or chronic sinusitis. In these situations, patients were usually advised to attend the otolaryngology outpatient clinic after completion of oral and maxillofacial surgery, and formal inpatient consultation was considered unnecessary. Therefore, incomplete consultations in otolaryngology should not be simply attributed to delayed responses.

Radiation oncology demonstrated a relatively low completion rate. Review of these cases showed that consultation requests were frequently initiated after the final pathological report became available, often on the day of discharge, when tumor staging and grading had been confirmed and postoperative radiotherapy needed to be considered. However, by the time radiation oncologists reviewed these requests, some patients had already left the hospital, resulting in the absence of a formal inpatient consultation note.

Although patients were routinely advised to attend the radiation oncology outpatient clinic after discharge, treatment-related information was sometimes conveyed during subsequent follow-up visits

rather than during the index hospitalization. Consequently, the completeness and continuity of treatment planning partly relied on outpatient communication, which may represent a potential source of fragmentation in multidisciplinary cancer care.

These findings also highlight the limitations of the traditional sequential consultation model. The value of earlier multidisciplinary involvement has been increasingly recognized in head and neck oncology, where MDT-based management has been associated with improved treatment coordination and more comprehensive care planning^[10]. In response to this issue, multidisciplinary team (MDT) discussions have been increasingly incorporated into our practice since 2025. By establishing treatment strategies before surgery and integrating postoperative radiotherapy planning into the overall management pathway, MDT-based care reduces dependence on delayed inpatient consultations and helps ensure greater continuity and completeness of treatment planning^[11].

4.4 Strategies for improving consultation practice

4.4.1 The potential value of pre-consultation assessment

A small proportion of consultations in the present study appeared to be related to physiological findings, uncertainty regarding the interpretation of routine examinations, or inappropriate specialty selection. Although specialist consultation remains necessary in many situations, these findings suggest that there may be opportunities to further optimize consultation requests. Adequate clinical assessment before consultation and clear identification of the clinical question may facilitate more targeted communication between specialties.

These findings may also reflect the challenges encountered by oral and maxillofacial surgeons when managing common medical conditions during the perioperative period. As the patient population becomes increasingly complex and the proportion of patients with systemic diseases continues to rise, oral and maxillofacial surgeons are increasingly required to participate in the assessment and management of common cardiovascular, endocrine, respiratory, and neurological disorders. Therefore, greater emphasis on perioperative medical management, interpretation of common clinical investigations, and consultation decision-making may be warranted during undergraduate education, postgraduate training, and residency programs^[12].

The findings of the present study may also have implications for surgical training. Because consultation requests were concentrated in several common perioperative scenarios, training programs may benefit from a staged approach. During the early stages of training, emphasis may be placed on structured history taking, physical examination, and recognition of common perioperative risks. More advanced training may focus on the management of frequently encountered conditions, such as antithrombotic therapy^[11,13], glycemic control, cardiovascular risk assessment, and postoperative pulmonary complications. Participation in MDT discussions and management of medically complex patients may provide additional opportunities for senior trainees to develop multidisciplinary decision-making skills.

4.4.2 Standardizing consultation requests

Clear communication is essential for efficient consultation. Incomplete clinical information or poorly defined consultation objectives may result in repeated communication and prolong the consultation process. A structured consultation format may help consulting physicians rapidly understand the clinical situation and provide targeted recommendations^[14]. Essential information should include the planned procedure, anesthesia method, relevant medical history, current medications, important laboratory or imaging findings, and the specific clinical question to be addressed. Such an approach may be particularly valuable for frequently consulted specialties, including cardiology, endocrinology, respiratory medicine, neurology, and otolaryngology.

4.4.3 Promoting earlier multidisciplinary involvement

The present study showed that consultation demand was concentrated among patients with advanced malignancies, multiple systemic diseases, free flap reconstruction, tracheostomy, and postoperative complications. These patients often required input from several specialties during a single admission. Under such circumstances, repeated sequential consultations may prolong the decision-making process and increase the risk of fragmentation of the treatment pathway.

Earlier communication between specialties and timely multidisciplinary team (MDT) discussions may help establish a more comprehensive treatment plan at an earlier stage and improve coordination among specialties. This may be particularly important for patients with head and neck malignancies and other medically complex conditions.

The findings related to radiation oncology consultations further illustrate the potential value of early multidisciplinary involvement. In some cases, consultation requests were initiated after the final pathological report became available, often shortly before discharge. As a result, treatment-related recommendations were sometimes deferred to subsequent outpatient visits. Although this practice remains clinically feasible, it may affect the completeness of treatment planning during hospitalization. Since 2025, MDT discussions have been increasingly incorporated into the management of head and neck malignancies in our institution. By facilitating earlier treatment planning and coordination between specialties, this approach may help reduce reliance on delayed inpatient consultations and improve the completeness of perioperative management^[5].

4.5 Limitations

Several limitations should be acknowledged. First, this was a single-center retrospective study conducted in a tertiary comprehensive hospital. Consultation patterns may be influenced by local case mix, institutional organization, and specialty availability, which may limit the generalizability of the findings to other settings.

Second, the present study focused primarily on consultation patterns, response times, and completion status. Although patients requiring frequent consultations were further characterized, the underlying

factors associated with repeated consultations and their potential impact on clinical outcomes warrant further investigation in future studies.

5. Conclusions

This study provides an overview of inpatient consultation practice in an oral and maxillofacial surgery department within a tertiary comprehensive hospital. In the context of a high prevalence of systemic diseases and a substantial proportion of complex surgical procedures, consultation has become an important component of perioperative management rather than a supplementary clinical activity.

Consultation requests were concentrated in a limited number of specialties, particularly cardiology, otolaryngology, endocrinology, respiratory medicine, and neurology, reflecting the multidisciplinary nature of contemporary oral and maxillofacial surgery. Although most consultations were completed within 24 hours, delayed and incomplete consultations were still encountered. These findings suggest that consultation performance is influenced not only by efficiency, but also by specialty-specific characteristics and patient complexity.

The present study identifies several opportunities for future quality improvement, including strengthening pre-consultation assessment, standardizing consultation requests, and promoting earlier multidisciplinary involvement for medically complex patients. Whether these measures can improve consultation efficiency, perioperative decision-making, and patient outcomes requires further prospective evaluation.

Declarations

Ethics approval and consent to participate

This study was approved by the Ethics Committee of the Second Affiliated Hospital, Zhejiang University School of Medicine (Approval No. 2026 – 0765). The study was conducted in accordance with the principles of the Declaration of Helsinki. Given the retrospective nature of the study and the use of de-identified data, the requirement for written informed consent was waived by the Ethics Committee.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

Authors' contributionsZhuoying Cai conceived the study, analyzed the data, and drafted the manuscript. Yihang Sun and Qin Yan collected and organized the data. Kaide Li contributed to manuscript revision and language editing. Yanming Liu critically reviewed the study design, interpretation of the findings, and overall manuscript logic. All authors reviewed and approved the final manuscript.

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Availability of data and materials

The datasets generated and analyzed during the current study are not publicly available because they contain information derived from hospital medical records but are available from the corresponding author on reasonable request and with permission from the Second Affiliated Hospital, Zhejiang University School of Medicine.

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