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Survival Outcome Of Central Compartment Clearance In High-Risk Papillary Carcinoma Thyroid- A Study In Combined Military Hospital, Dhaka

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Abstract

Background*: High-risk papillary thyroid carcinoma (PTC) poses significant challenges due to its aggressive nature, requiring comprehensive surgical strategies such as central compartment clearance (CCC) to enhance patient outcomes. This study aimed to evaluate the surgical and long-term outcomes associated with CCC in a cohort from the Combined Military Hospital, Dhaka.*

Methods*: This retrospective analysis included 100 patients diagnosed with high-risk PTC who underwent CCC from 2015 to 2022. Patient demographics, clinical presentations, operative details, postoperative complications, and long-term outcomes, including recurrence rates and five-year survival, were collected and analyzed. Statistical analysis was performed with a significance threshold set at $p<0.05$.*

Results*: The cohort had a predominance of females (70%) and a majority age range of 40-49 years (45%). Most tumors (47%) measured between 2.1 to 3.0 cm, with lymph node metastasis (53%), extrathyroidal extension(15%) and few distant metastasis (3%) in skull, lung and shoulder joint. The most common clinical presentation was a palpable thyroid nodule (75%). Intraoperative complications occurred in only 5% of cases. Postoperative transient hypocalcemia was noted in 15% of patients, while permanent hypocalcemia and recurrent laryngeal nerve injury were rare (5% and 2%, respectively). Nodal recurrence in neck was observed in 9% of patients, with a 96% overall five-year survival rate.*

Conclusion*: CCC demonstrates a strong efficacy profile in managing high-risk PTC, with low recurrence rates and high survival outcomes. The relatively low incidence of severe complications supports its safety. These findings reinforce the role of CCC as an effective strategy for surgical management in high-risk PTC.*

Keywords: *Papillary Thyroid Carcinoma, Central Compartment Clearance, High-Risk PTC, Surgical Outcomes, Recurrence, Survival Analysis, Postoperative Complications.*

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I. Introduction

Papillary thyroid carcinoma (PTC) is the most common type of thyroid malignancy, accounting for a significant proportion of thyroid cancer cases globally. The incidence of PTC has shown a marked increase over recent decades, attributed in part to improved diagnostic practices and heightened awareness among healthcare professionals. For instance, studies in Spain highlighted an increase in PTC cases, signifying a broader global trend of rising thyroid cancer diagnoses that span both developed and developing nations (1). The prognosis for PTC is generally favorable due to its typically indolent nature and responsiveness to treatment. However, high-risk variants, characterized by larger tumor sizes (>4 cm), extrathyroidal extension, lymph node metastases, and

aggressive histological subtypes, present considerable clinical challenges due to higher recurrence rates and reduced survival outcomes (2–4). The clinical landscape in regions such as Bangladesh also reflects these complexities, underscoring the importance of understanding high-risk PTC within local contexts. Central compartment clearance (CCC), involving the removal of lymph nodes and soft tissues in the central neck region, is a pivotal surgical intervention for high-risk PTC cases. This procedure aims to address nodal metastases, which are common in advanced PTC and significantly impact survival and recurrence rates (5). The debate surrounding the routine use of CCC has persisted due to its potential for postoperative complications, including recurrent laryngeal nerve injury and hypoparathyroidism (6). For instance, studies have noted that permanent hypocalcemia and transient vocal cord paralysis are notable risks, particularly in cases involving extensive nodal bulk and matted nodes (7). Despite these risks, comprehensive bilateral central compartment dissections have demonstrated efficacy in controlling disease and improving outcomes, as seen in long-term follow-up studies where a disease-specific survival rate of up to 98% was observed (8). The clinical decision to perform CCC, therefore, must balance these surgical risks against its potential benefits, emphasizing the need for individualized patient assessments. High-risk PTC classification is defined by specific tumor characteristics, including extrathyroidal extension and multifocality, which significantly alter the clinical approach. Tumor size has been shown to play a pivotal role in risk stratification and surgical decision-making, with studies demonstrating a higher likelihood of recurrence in tumors exceeding 4 cm (2,9). Extrathyroidal extension and aggressive histological subtypes, such as diffuse sclerosing and tall-cell variants, further compound the risks associated with high-risk PTC and demand comprehensive management strategies (3). The presence of lymph node metastasis in the central compartment is an established predictor of recurrence, impacting not only immediate surgical outcomes but also long-term disease-free survival. Research has highlighted that patients with central compartment nodal involvement often require more intensive postoperative monitoring and adjuvant treatment, such as radioiodine therapy, to reduce recurrence risk (10). Despite the established importance of CCC, current literature presents mixed findings regarding its routine implementation. A pivotal randomized controlled study reported that while CCC reduced the need for additional radioiodine treatments, it increased the prevalence of permanent hypoparathyroidism (11). Another observational study noted that comprehensive CCC could control persistent or recurrent PTC effectively, with a central compartment control rate exceeding 90% (8). This evidence points to a clear benefit in selected patient groups, particularly those with high-risk features such as macroscopic extrathyroidal extension and significant nodal involvement. However, these findings also underscore the variability in outcomes, with some studies indicating minimal differences in long-term survival between patients undergoing total thyroidectomy with or without prophylactic CCC (12). The regional context further adds complexity to this debate. In developing countries, including Bangladesh, resource limitations and differing patient demographics may influence treatment outcomes. Research conducted in local medical institutions has shown that the frequency of central compartment metastasis in advanced PTC cases can exceed 60%, underlining the high burden of nodal disease (5). This reinforces the importance of comprehensive studies to determine the optimal extent of CCC and tailor surgical interventions to regional needs and capacities. In conclusion, while existing literature underscores the potential survival benefits of CCC, it also highlights significant risks and a lack of consensus, particularly regarding its use in routine practice. The need for more region-specific data is crucial, as most current evidence is derived from studies in high-resource settings. By examining the survival outcomes associated with CCC in high-risk PTC patients within the context of a military hospital in Bangladesh, this study aims to contribute valuable insights to the ongoing discourse on optimizing surgical approaches and improving patient care in similar settings.

II. Methods

The study was conducted as a retrospective analysis of patients diagnosed with high-risk papillary thyroid carcinoma (PTC) who underwent central compartment clearance (CCC) at the Combined Military Hospital, Dhaka, from January 2015 to December 2022. Medical records were meticulously reviewed to identify eligible patients. Inclusion criteria encompassed those with a confirmed diagnosis of high-risk PTC defined by the presence of one or more of the following characteristics: tumor size greater than 4 cm, extrathyroidal extension, lymph node metastases, or aggressive histological subtypes as per the American Thyroid Association (ATA) guidelines for high-risk patients. Patients presenting with incomplete medical records, other concurrent thyroid malignancies, or those who had received neoadjuvant therapy were excluded from the study. Demographic data, including age, gender, and clinical presentation at diagnosis, were collected. Detailed surgical records were examined to document operative procedures, the extent of CCC performed, operative time, and intraoperative complications such as injury to the recurrent laryngeal nerve. Post-operative data were collected on patient recovery, including hospital stay length and post-surgical complications, specifically transient and permanent hypocalcemia and recurrent laryngeal nerve palsy. Clinical outcomes, including recurrence rates, re-intervention needs, and disease-free survival, were assessed through periodic

follow-up visits, which included physical examinations, serum thyroglobulin testing, and imaging studies such as neck ultrasound and CT scans. Data on overall survival were captured through hospital records and patient follow-ups. Statistical analyses were conducted using specialized software to compare surgical and clinical outcomes, with survival rates calculated using Kaplan-Meier curves. Multivariable Cox regression models were used to identify factors associated with recurrence and overall survival. The threshold for statistical significance was set at $p<0.05$. The outcomes of CCC in high-risk PTC patients were assessed in terms of both short-term surgical results and long-term oncologic effectiveness, providing insights into the impact of this surgical approach within the context of a tertiary-care military hospital in Bangladesh.

III. Results

Table 1: Basic Characteristics of the Sample (n=100)

Characteristics	Frequency (n)	Percentage (%)
Age (years)		
20 - 29	05	5.0
30 - 39	15	15.0
40 - 49	45	45.0
50 - 59	20	20.0
60 - 69	10	10.0
Gender		
Male	30	30.0
Female	70	70.0
Tumor Size (cm)		
1.1 - 2.0	17	17.0
2.1 - 3.0	47	47.0
3.1 - 4.0	23	23.0
>4	13	13.0
Extrathyroidal Extension		
Present	15	15.0
Absent	85	85.0
Lymph Node Involvement		
Present	53	53.0
Absent	47	47.0
Distant Metastasis		
Present	3	3.0
Absent	97	97.0

The study sample comprised 100 patients diagnosed with high-risk papillary thyroid carcinoma. The age distribution showed that the majority of patients were between 40 and 49 years old (35.0%). The youngest and oldest age groups, 20–29 years and 60–69 years, each accounted for 5.0% % 10% of the sample respectively. The cohort had a higher proportion of females (70.0%) compared to males (30.0%). Regarding tumor size, most patients (47.0%) had tumors measuring between 2.1 and 3.0 cm, followed by 23.0% with tumor sizes between 1.1 to 2.0 cm and 13.0% had tumors size more than 4.0 cm. Fifteen percent of the patients exhibited extrathyroidal extension. Half of the patients (53%) had lymph node involvement mostly in central compartment. Only 3% cases distant metastasis was present in skull, lung and shoulder joint.

Table 2: Clinical Presentation of Patients (n=100)

Clinical Presentation	Frequency (n)	Percentage (%)
Thyroid Nodule	75	75.0
Cervical Lymphadenopathy	53	53.0
Neck Discomfort	10	10.0
Asymptomatic	10	10.0

In the clinical presentation of the study cohort, the majority of patients (75.0%) presented with a thyroid nodule as the primary symptom. A good number of patients (53.0%) exhibited cervical lymphadenopathy. Neck discomfort was reported by 10.0% of the patients, while another 10.0% were asymptomatic at the time of diagnosis, showing no noticeable signs or symptoms prior to evaluation.

Table 3: Surgical Outcomes (n=100)

Intraoperative Complications	Frequency (n)	Percentage (%)
Present	5	5.0
Absent	95	95.0

The surgical outcomes for the study's 100 patients showed that intraoperative complications were less, occurring in only 5.0% of the cases, while the vast majority (95.0%) of surgeries proceeded without any reported complications.

Table 4: Postoperative Complications (n=100)

Postoperative Complication	Frequency (n)	Percentage (%)
Transient Hypocalcemia	15	15.0
Permanent Hypocalcemia	5	5.0
Transient Recurrent Laryngeal Nerve Injury	10	10.0
Permanent Recurrent Laryngeal Nerve Injury	2	2.0
No Complications	68	68.0

Postoperative complications among the 100 patients revealed that the majority (68.0%) experienced no complications following surgery. Transient hypocalcemia was the most common complication, occurring in 15.0% of patients, while permanent hypocalcemia was noted in 5.0% of cases. Transient recurrent laryngeal nerve injury was present in 10.0% of the patients, whereas permanent nerve injury was observed in only 2.0%. These findings indicate that while postoperative complications did occur, most were temporary, and the overall incidence of severe, lasting complications was low.

Table 5: Long-Term Outcomes (n=100)

Long-Term Outcome	Frequency (n)	Percentage (%)
Nodal recurrence in Neck	9	9.0
Need for revision surgery	7	7.0
Overall Survival		
Survived (5 years)	96	96.0
Died (5 years)	4	4.0

The long-term outcomes for the study group indicated positive results, with the majority of patients achieving favorable prognoses. Nodal recurrence of disease in the neck was observed in 9.0% of patients, while 7.0% required a revision surgery. The five-year overall survival rate was high at 96.0%, with only 4.0% of patients succumbing to the disease within this period.

IV. Discussion

The present study aimed to evaluate the survival outcomes and postoperative complications of central compartment clearance (CCC) in patients with high-risk papillary thyroid carcinoma (PTC) treated at the Combined Military Hospital, Dhaka. The demographic profile of our sample, which consisted predominantly of middle-aged patients with a female majority (70%), aligns with findings from similar research conducted in regional and global contexts. For instance, Parajuli et al. reported a higher prevalence of PTC among females, with a mean age approximating 40 years, underscoring the gender predisposition and age distribution consistent with PTC epidemiology (13). The tumor size distribution in our cohort, where most tumors ranged from 2.1 to 3.0 cm, also mirrors observations made by Lee et al., who noted similar size characteristics in multifocal PTC cases (14). The clinical presentation of patients primarily included palpable thyroid nodules (75%), with fewer instances of cervical lymphadenopathy and asymptomatic cases. These results are in line with Kumar et al., who found thyroid nodules as the most frequent presentation in PTC (15). The high incidence of palpable cervical lymphadenopathy in our cohort (53%) is noteworthy, especially compared to studies where lymph node metastasis was a more prominent feature (16). The intraoperative complication rate in our study was low (5%), resonating with findings by Dobrinja et al., who documented similar safety outcomes in prophylactic central neck dissection (17, 18). Postoperative complications were generally minimal, with transient hypocalcemia affecting 15% of patients and permanent hypocalcemia reported in 5%. These findings are consistent with Elhelbawy et al., who noted hypocalcemia as a common temporary complication following CCC (19). Similarly, transient recurrent laryngeal nerve (RLN) injury was seen in 10% of cases, while permanent RLN damage occurred in only 2%. This aligns with Misiołek et al., who observed comparable rates of RLN palsy post-thyroidectomy (20). Our results emphasize that while temporary complications are relatively common, permanent sequelae are less frequent, corroborating data from other surgical analyses that advocate for thorough procedural planning to minimize these risks (21). Long-term outcomes revealed a nodal recurrence in neck rate of 9%, with a need for completion thyroidectomy in only 7% of patients. These results point to the efficacy of CCC in managing high-risk PTC, as observed in studies such as Huang et al., who reported a 10-year recurrence-free survival rate of over 80% in similar surgical contexts (22). Moreover, the high five-year survival rate (96%) in our study parallels findings from Baerbock et al., where survival outcomes after complete resections were consistently favorable (23). The relatively low mortality rate of 4% in our cohort also reinforces

the benefits of comprehensive surgical approaches, echoing data from Mujammami et al., which highlighted that meticulous surgical management combined with postoperative monitoring could sustain high long-term survival rates (24). The implications of our findings underscore the potential for CCC to yield excellent survival outcomes while maintaining a manageable risk profile for complications. Our data support a more aggressive initial surgical approach in high-risk cases to minimize recurrence and maximize survival. Additionally, Glockzin et al.'s research on the timing and impact of completion thyroidectomy corroborates that prompt intervention in indicated cases can mitigate progression risks without substantially increasing morbidity (25). While our study contributes valuable data to the literature, especially regarding high-risk PTC management in a developing country context, it is crucial to recognize the limitations posed by single-center analysis and retrospective data collection. Future multi-center, prospective studies would enhance generalizability and provide deeper insights into optimizing surgical protocols for varied healthcare settings. In conclusion, our findings affirm that CCC is an effective surgical strategy for high-risk PTC, associated with low recurrence rates and a favorable survival outlook. The comparative analyses with existing literature underscore that while transient postoperative complications are relatively common, permanent adverse outcomes remain low, solidifying CCC as a viable option in managing advanced PTC cases.

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

V. Conclusion

In conclusion, this study highlights the efficacy and safety of central compartment clearance (CCC) in managing high-risk papillary thyroid carcinoma (PTC). The findings indicate that CCC, when performed as part of comprehensive surgical management, yields low recurrence rates and high long-term survival outcomes. While transient postoperative complications, such as hypocalcemia and recurrent laryngeal nerve injury, were observed, permanent adverse outcomes were rare, reinforcing the procedure's favorable risk profile. Comparisons with existing literature support these outcomes, demonstrating that CCC is an effective surgical approach for reducing recurrence and enhancing survival in high-risk patients. Future research involving multi-center and prospective studies would be beneficial to further validate these findings and refine treatment protocols for varied clinical settings.

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