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Tailoring the Extent of Therapeutic Lateral Neck Dissection in Papillary Thyroid Carcinoma With Lateral Cervical Lymph Node Metastases: A Systematic Review

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Abstract

The optimal extent of therapeutic lateral neck dissection (LND) in patients with papillary thyroid carcinoma (PTC) and lateral cervical lymph node metastases remains debated, particularly regarding the inclusion of levels IIb, Va, and Vb. This systematic review synthesized evidence on level-specific metastatic involvement, oncological outcomes, and morbidity associated with different extents of therapeutic LND. PubMed/MEDLINE, Scopus, Web of Science, the Cochrane Library, and Google Scholar were searched from database inception to August 2026.

Studies evaluating therapeutic LND in patients with documented lateral cervical lymph node metastases were eligible. Eleven observational studies published between 2008 and 2025 were included. Metastatic involvement was most frequently reported in levels III and IV, with reported rates ranging from 65.5% to 84.3% and 50.0% to 83.1%, respectively.

Reported involvement of level IIb ranged from 7.9% to 16.7%, whereas level Vb involvement varied from 3.7% to 40.0%. Several studies identified associations between level V metastasis and multilevel lateral nodal involvement, particularly simultaneous disease in levels II, III, and IV. Comparative studies reported inconsistent oncological outcomes: some found similar regional control following selective and comprehensive dissection, whereas others reported higher recurrence rates after selective dissection. Selected studies also reported lower postoperative shoulder morbidity with less extensive dissection.

Overall, metastatic involvement was generally concentrated in levels III and IV, while reported level IIb involvement was lower and findings for level V were heterogeneous. These patterns may inform individualized surgical planning but do not independently establish the safety of omitting specific nodal levels. The available observational evidence does not demonstrate the equivalence of selective and comprehensive LND or establish validated criteria for level-sparing surgery. Prospective, standardized comparative studies with adequate follow-up are needed to determine whether tailored dissection can reduce morbidity without compromising regional control.

Categories: Otolaryngology, General Surgery, Oncology

Keywords: cervical lymph node metastasis, lateral neck dissection, level iib, level vb, papillary thyroid carcinoma, selective neck dissection

Introduction And Background

Papillary thyroid carcinoma (PTC) is the most common differentiated thyroid malignancy and generally has a favorable prognosis, with reported 10-year survival exceeding 91%. Nevertheless, cervical lymph-node metastases are frequent, occurring in approximately 30% to 80% of patients, and are associated with increased locoregional recurrence and the need for additional treatment [1,2]. Lymphatic spread commonly follows an anatomic pattern, with metastases initially involving the central compartment and subsequently extending to the ipsilateral lateral neck. Lateral cervical lymph-node metastasis (LLNM), classified as N1b disease, is reported in approximately 6.5% to 27.5% of patients and generally represents a more extensive pattern of nodal involvement than central disease [3,4]. Multilevel lateral nodal involvement is common, while skip metastases occur less frequently, supporting the importance of understanding level-specific patterns when planning therapeutic surgery [5-7].

Therapeutic lateral neck dissection (LND) is established for clinically evident lateral nodal disease, but the optimal anatomical extent remains controversial. Historically, approaches have ranged from removal of

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individually involved nodes to comprehensive modified radical neck dissection (MRND). Although comprehensive surgery may facilitate removal of occult disease, more extensive dissection can increase postoperative morbidity, particularly shoulder dysfunction, nerve injury, chyle leakage, and other functional complications [1,8]. Consequently, selective lymph-node dissection has increasingly been considered to achieve regional disease control while limiting unnecessary removal of uninvolved structures [9]. The key clinical challenge is to determine whether dissection can be tailored to the distribution and burden of disease without compromising regional control, rather than assuming that either the most extensive or the least extensive procedure is appropriate for every patient.

The principal controversy concerns whether selected sublevels can be safely omitted in patients with lateral nodal metastases. Levels III and IV are consistently among the most frequently involved regions, whereas involvement of IIb, Va, and Vb is more variable [2,6,9]. Level IIb metastasis appears to occur predominantly in the presence of IIa disease, whereas Va involvement has been reported infrequently, raising the possibility of selective omission in appropriately selected patients [7,10]. Conversely, other studies have reported clinically relevant occult disease in level V and have argued that omission of selected levels may risk residual nodal disease [8,11]. Studies have also identified disease burden, tumor size, multilevel nodal involvement, and other clinicopathological characteristics as potential factors associated with additional lateral-level metastases [12–14]. However, the reported frequency of metastasis and the apparent safety of omitting a particular level must be interpreted in the context of differences in patient selection, preoperative imaging, pathological assessment, surgical definitions, and follow-up across studies. In particular, a low prevalence of pathological involvement alone does not establish that omission is oncologically safe, and evidence from selected patients cannot necessarily be generalized to all patients with N1b disease. Although PTC can rarely arise within a thyroglossal duct cyst, this distinct presentation may pose additional diagnostic and therapeutic challenges [15,16]. The present review, however, focuses on patients with PTC and LLNMs undergoing or being evaluated for therapeutic LND, rather than on the primary site of origin or the management of thyroglossal duct cyst carcinoma.

Thus, the extent of therapeutic LND in N1b PTC requires balancing oncological clearance against procedure-related morbidity. Despite multiple studies evaluating level-specific metastatic patterns and selective approaches, substantial variation remains regarding the necessity of routinely dissecting IIb, Va, and Vb [9,14,17]. Moreover, the available evidence includes both studies describing the pathological distribution of metastases and studies directly evaluating recurrence, regional control, or postoperative morbidity; these evidence types address related but distinct questions and should not be interpreted interchangeably. A systematic synthesis of the available evidence is therefore needed to distinguish the evidence supporting level-specific omission from evidence describing metastatic prevalence alone, clarify patterns of nodal involvement, identify factors associated with additional-level metastasis, and evaluate the oncological and functional outcomes associated with tailoring the extent of therapeutic LND. Accordingly, this systematic review aimed to synthesize evidence on the distribution and predictors of LLNMs in PTC, with particular emphasis on levels IIb, Va, and Vb, and to evaluate the oncological outcomes and postoperative morbidity associated with selective, superselective, tailored, and comprehensive therapeutic LND.

Review

Methods

Study Design

This study was conducted as a systematic review in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement [18]. Because the included literature comprised heterogeneous observational studies with different surgical strategies, anatomical definitions, comparators, and outcome measures, the review was designed to provide a structured narrative synthesis rather than a quantitative meta-analysis. The synthesis and reporting of findings were additionally informed by the Synthesis Without Meta-analysis (SWiM) reporting guideline [19].

The review question was structured using a modified Population, Intervention, Comparator, and Outcomes (PICO) framework to accommodate both comparative and non-comparative evidence [20]. The population comprised patients with PTC and clinically, radiologically, cytologically, or pathologically documented LLNMs for whom therapeutic LND was undertaken or evaluated. The intervention of interest was tailoring of therapeutic LND, including selective, superselective, or compartment-oriented dissection and intentional omission or sparing of selected anatomical sublevels, particularly level IIb, level Va, and level Vb. Comparators, when available, included more comprehensive LND and alternative selective dissection strategies. The outcomes of interest included the distribution of metastatic lymph nodes by cervical level, rates of occult or pathological metastasis in individual levels, regional recurrence and regional control, predictors of level-specific metastasis, and postoperative complications associated with different extents of dissection.

Search Strategy

A systematic literature search was conducted from the inception of each database to 29 August 2026 to

identify studies evaluating the distribution of LLNMs and the oncological and functional outcomes associated with different extents of therapeutic LND in PTC. The search strategy combined controlled vocabulary, where available, and free-text terms relating to PTC, thyroid malignancy, cervical lymph-node metastases, LND, selective or superselective neck dissection, and variations in the anatomical extent of lymph-node dissection.

To improve sensitivity and reduce the risk of missing relevant studies, the revised search did not require specific anatomical sublevels, such as IIb, Va, or Vb, to be mentioned in the title, abstract, or indexed record. Instead, studies were retrieved using broader combinations of thyroid cancer, cervical lymph-node involvement, and neck-dissection terms, allowing potentially eligible studies of tailored or selective surgical approaches to be identified even when individual sublevels were not explicitly named. Level-specific terminology was considered in supplementary searches and during study selection.

The search was performed in PubMed/MEDLINE, Scopus, Web of Science Core Collection, and the Cochrane Library. Google Scholar was searched as a supplementary source, and the reference lists of relevant studies and reviews were examined to identify additional eligible publications. The Google Scholar search was limited to the first 60 results, consistent with the prespecified supplementary-search approach. Search syntax was adapted to the indexing system and requirements of each database. No publication-year restriction was applied. The complete database-specific search strategies are presented in Table 1.

Database	Search strategy
PubMed/MEDLINE	("papillary thyroid carcinoma"[tiab] OR "papillary thyroid cancer"[tiab]) AND ("lateral neck dissection"[tiab] OR "lateral cervical lymph node dissection"[tiab] OR "selective neck dissection"[tiab] OR "superselective neck dissection"[tiab] OR "modified radical neck dissection"[tiab]) AND ("lymph node metastases"[tiab] OR "lymph node metastasis"[tiab] OR "lateral lymph node"[tiab] OR N1b[tiab] OR "level IIb"[tiab] OR "level Va"[tiab] OR "level Vb"[tiab])
Scopus	TITLE-ABS-KEY("papillary thyroid carcinoma" OR "papillary thyroid cancer") AND TITLE-ABS-KEY("lateral neck dissection" OR "lateral cervical lymph node dissection" OR "selective neck dissection" OR "superselective neck dissection" OR "modified radical neck dissection") AND TITLE-ABS-KEY("lymph node metastases" OR "lymph node metastasis" OR "lateral lymph node" OR N1b OR "level IIb" OR "level Va" OR "level Vb")
Web of Science Core Collection	TS=("papillary thyroid carcinoma" OR "papillary thyroid cancer") AND TS=("lateral neck dissection" OR "lateral cervical lymph node dissection" OR "selective neck dissection" OR "superselective neck dissection" OR "modified radical neck dissection") AND TS=("lymph node metastases" OR "lymph node metastasis" OR "lateral lymph node" OR N1b OR "level IIb" OR "level Va" OR "level Vb")
Cochrane Library	("papillary thyroid carcinoma" OR "papillary thyroid cancer") AND ("lateral neck dissection" OR "lateral cervical lymph node dissection" OR "selective neck dissection" OR "superselective neck dissection" OR "modified radical neck dissection") AND ("lymph node metastases" OR "lymph node metastasis" OR "lateral lymph node" OR N1b OR "level IIb" OR "level Va" OR "level Vb")
Google Scholar	("papillary thyroid carcinoma" ("lateral neck dissection" OR "selective neck dissection" OR "superselective neck dissection" OR "modified radical neck dissection"))

TABLE 1: Database-specific search strategies

Information Sources

Electronic searches were conducted in PubMed/MEDLINE, Scopus, Web of Science Core Collection, and the Cochrane Library to provide broad coverage of the biomedical, surgical, and multidisciplinary literature relevant to PTC and therapeutic LND. In addition, Google Scholar was searched as a supplementary source to identify potentially relevant studies that may not have been retrieved through the major bibliographic databases. To maintain a focused and reproducible approach, the first 60 Google Scholar results (corresponding to the first six result pages) retrieved using the predefined search terms were screened for eligibility. Google Scholar results were screened from the top of the ranked results because the search engine orders retrieved records according to their relevance to the search query and other ranking signals. Reference lists of all included studies and relevant systematic or narrative reviews were also manually screened to identify additional potentially eligible studies not captured by the electronic database searches.

Eligibility Criteria

Eligibility was determined according to predefined inclusion and exclusion criteria developed in accordance with the review question. Studies were eligible if they included patients with PTC and LLNMs who underwent, or were evaluated for, therapeutic LND and reported information relevant to surgical extent,

anatomical distribution of nodal metastases, oncological outcomes, or postoperative morbidity. Eligible studies were not required to evaluate levels IIb, Va, or Vb specifically, provided that their findings contributed to understanding the extent or tailoring of therapeutic LND. This broader criterion was intended to capture comparative studies, level-specific distribution studies, and studies investigating selective or superselective surgical strategies.

Comparative and non-comparative observational studies were considered eligible, including prospective and retrospective cohorts and case series, provided that sufficient information was available to assess their relevance to the review question. Studies involving mixed thyroid cancer populations were eligible only when PTC-specific findings were separately reported or could be extracted. Studies limited to prophylactic LND in clinically node-negative patients were excluded unless an independently analyzable cohort with lateral nodal metastases was available. Reviews, meta-analyses, editorials, letters, guidelines, conference abstracts, and other non-original publications were excluded. The complete inclusion and exclusion criteria are presented in Table 2.

Criterion	Inclusion criteria	Exclusion criteria
Population	Patients with PTC and lateral cervical lymph-node metastases, including therapeutic N1b disease	Clinically node-negative or prophylactic populations without a separately analyzable cohort with lateral nodal metastases
Intervention/surgical context	Therapeutic selective, superselective, comprehensive, modified radical, or tailored lateral neck dissection	Central neck dissection alone without relevant lateral neck evaluation
Surgical extent	Studies reporting the extent, anatomical levels, tailoring, or omission of lateral neck dissection; studies of levels IIb, Va, or Vb were particularly relevant but not mandatory	Studies focused exclusively on robotic, endoscopic, or other technical approaches without relevant information on dissection extent or outcomes
Outcomes	Level-specific or occult metastasis, multilevel or skip-metastatic patterns, recurrence, regional control, predictors of additional-level involvement, or postoperative morbidity	Studies providing insufficient information relevant to the review question
Study design	Original prospective or retrospective observational studies, including comparative studies and relevant case series	Reviews, meta-analyses, editorials, letters, guidelines, conference abstracts, and other non-original publications
Mixed populations	Mixed thyroid cancer populations with separately reported or extractable PTC-specific data	Mixed populations without separable PTC data
Recurrent disease	Initial therapeutic dissection cohorts, including studies reporting relevant recurrence outcomes after initial dissection	Recurrent-only cohorts without independently interpretable evidence relevant to the initial therapeutic dissection question

TABLE 2: Inclusion and exclusion criteria for study eligibility

N1b, lateral cervical lymph-node metastasis; PTC, papillary thyroid carcinoma

Study Selection and Screening

All records retrieved from the database and supplementary searches were collated, and duplicates were removed before screening. Six reviewers participated in the study-selection process. Records were assessed against the predefined eligibility criteria at the title and abstract stages, followed by full-text assessment of potentially eligible studies. Studies were considered eligible if they evaluated the extent or tailoring of therapeutic LND in patients with PTC and LLNMs, including selective or comprehensive dissection, intentional omission or preservation of selected levels, level-specific metastatic patterns, predictors of additional-level involvement, or relevant oncological and postoperative outcomes. Reasons for exclusion at the full-text stage were documented, and the study-selection process was summarized using the PRISMA 2020 flow diagram.

Data Extraction

Data were extracted using a standardized data-extraction form by six reviewers. Extracted information included study characteristics, publication year, country or setting, study design, patient and neck-dissection sample sizes, eligibility criteria, follow-up duration, indications for LND, and the anatomical extent of surgery. Outcomes of interest included level-specific metastatic rates, occult metastases, multilevel and skip-metastatic patterns, recurrence and regional control, predictors of additional-level

involvement, and postoperative complications and functional outcomes. For comparative studies, reported effect estimates, 95% confidence intervals, and statistical comparisons were recorded when available.

Where reported, denominators were retained as defined in the original studies, including patient-level, neck-level, specimen-level, or dissection-level denominators. Missing or unreported information was not assumed to indicate the absence of an outcome.

Definition and Classification of Surgical Extent

Surgical extent was classified according to the anatomical levels and operative definitions reported by the original studies. Comprehensive LND generally encompassed levels II-V, with the inclusion of specific sublevels recorded when available. Selective dissection involved removal of selected lateral neck levels according to clinical, radiological, intraoperative, or institutional criteria. Superselective or tailored dissection referred to a deliberately limited procedure based on the anticipated distribution of disease, including intentional omission or preservation of levels IIb, Va, and/or Vb.

Because the definitions of selective and comprehensive dissection, as well as the subdivision of level V, varied between studies, procedures were not reclassified solely on the basis of their labels. The anatomical levels actually removed or omitted were recorded whenever these details were available. Studies reporting only an overall surgical category without sufficient anatomical detail were interpreted according to the authors' original definitions, and this limitation was considered during synthesis.

Primary and Secondary Outcomes

The primary outcome was evidence relevant to the optimal tailoring of therapeutic LND, with particular emphasis on the oncological implications of omitting or preserving selected lateral neck sublevels in patients with PTC and LLNMs. Secondary outcomes included level-specific rates of lymph-node metastasis, the frequency of occult metastasis in clinically or radiologically negative levels, multilevel and skip-metastatic patterns, regional recurrence and regional recurrence-free survival, recurrence according to the extent of initial LND, predictors of involvement of levels IIb, Va, and Vb, postoperative morbidity and functional complications, and the relationships between preoperative imaging, pathological findings, and the extent of dissection [21].

Risk of Bias Assessment

Risk of bias was assessed independently according to study design using validated methodological appraisal tools. Comparative non-randomized studies were assessed using the Risk Of Bias In Non-randomized Studies of Interventions (ROBINS-I) tool [22]. The seven ROBINS-I domains were evaluated: bias due to confounding, selection of participants into the study, classification of interventions, deviations from intended interventions, missing data, measurement of outcomes, and selection of the reported result. Each domain was judged as having low, moderate, serious, or critical risk of bias, with an overall judgment assigned according to the ROBINS-I framework.

Non-comparative studies were assessed using a checklist appropriate to their actual design, rather than automatically applying a cohort checklist to all descriptive studies. The Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Cohort Studies [23] was used where the study design and longitudinal structure were appropriate. Where a study was better characterized as an analytical cross-sectional study or case series, the corresponding design-specific appraisal tool should be used instead. Domains that were not applicable to a study were distinguished from domains for which information was insufficient to make a judgment. Not-applicable responses were not interpreted as evidence of low risk of bias. Domain-level assessments were presented transparently, and overall judgments were made only where supported by the relevant tool's guidance. No numerical quality score was calculated.

Risk-of-bias assessments were performed independently by two reviewers, with disagreements resolved through discussion and consensus. The findings are presented by study and appraisal domain, with the limitations of individual studies considered when interpreting the evidence.

Data Synthesis

Because of substantial heterogeneity in study designs, patient populations, dissection strategies, anatomical definitions, follow-up, and outcomes, meta-analysis was not considered appropriate. A structured narrative synthesis was therefore performed. Studies were grouped into five evidence domains: (i) level-specific metastatic patterns; (ii) selective omission or preservation of IIb, Va, and Vb; (iii) comparative oncological outcomes of selective versus comprehensive dissection; (iv) predictors of additional-level metastasis; and (v) postoperative morbidity and functional outcomes. Findings were summarized according to the reported anatomical levels, recurrence and regional control, predictors, and complications. Particular attention was given to the type of evidence supporting level omission, including pathological distribution, prospective

omission strategies, comparative studies, and recurrence outcomes. Differences between studies were interpreted in relation to patient selection, disease burden, imaging, surgical strategy, follow-up, and study limitations.

Results

Study Selection

The database and supplementary searches identified 1,022 records, including 239 from PubMed/MEDLINE, 407 from Scopus, 270 from Web of Science Core Collection, 46 from the Cochrane Library, and 60 from Google Scholar. After removal of 142 duplicate records, 880 records underwent title and abstract screening. Of these, 856 were excluded because of an ineligible PTC population ($n = 374$), failure to assess LND extent or tailoring ($n = 176$), irrelevant outcomes ($n = 151$), prophylactic or clinically node-negative populations, central-only dissection, or recurrent-only disease ($n = 99$), or non-original publications ($n = 56$). The remaining 24 reports were sought for full-text assessment, and all were retrieved. Following full-text review, 13 reports were excluded because they provided insufficient information on LND extent ($n = 5$), involved ineligible or mixed thyroid cancer populations without separable PTC data ($n = 6$), examined recurrent disease without an independently interpretable cohort undergoing initial therapeutic dissection ($n = 1$), or focused on a technical surgical approach rather than dissection extent ($n = 1$). Ultimately, 11 studies were included in the qualitative synthesis [6,8-11,14,17,24-27]. The study selection process is presented in the PRISMA 2020 flow diagram (Figure 1).

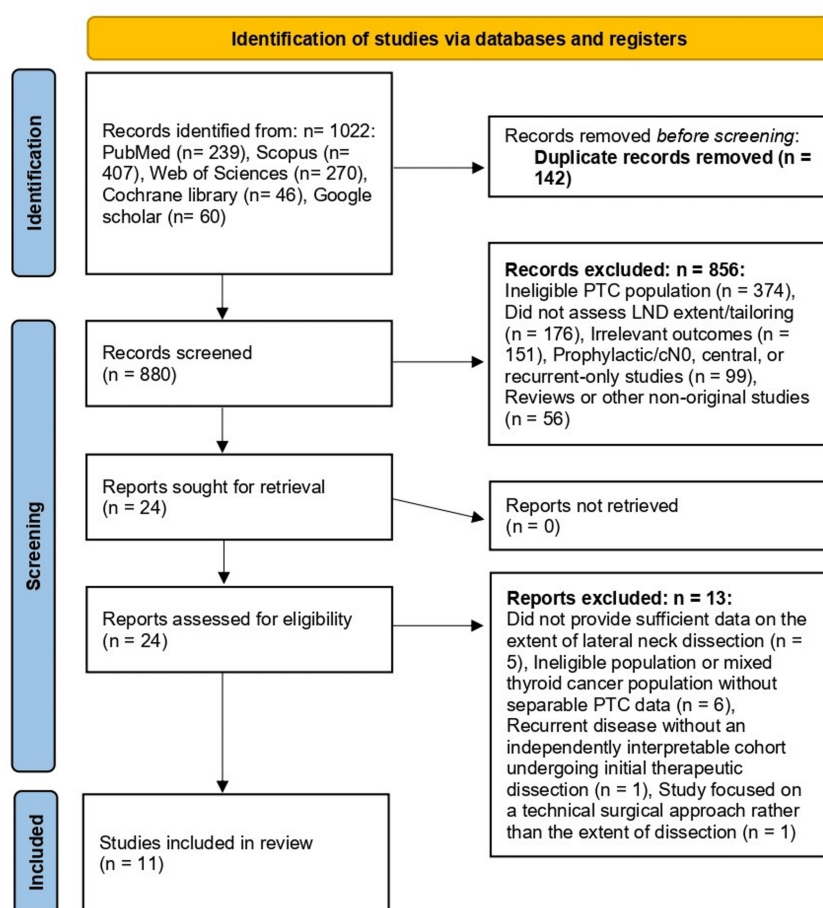


FIGURE 1: PRISMA 2020 flow diagram of the study selection process for the systematic review

Characteristics of Included Studies

The 11 included studies were published between 2008 and 2025 [6,8-11,14,15,22-25] and comprised prospective and retrospective observational cohorts. The studies were conducted in South Korea, the United States, China, Canada, and Türkiye. Sample sizes ranged from 47 to 646 patients, with several studies reporting outcomes according to the number of LNDs. The surgical strategies included comprehensive II-V dissection, selective II-IV dissection, selective dissection involving IIa, IIb, III, IV, and Vb, and strategies

involving selective omission or assessment of specific sublevels. Follow-up duration ranged from pathological assessment without longitudinal follow-up to a median or mean follow-up of more than six years. Detailed characteristics of the included studies are summarized in Table 3.

Study	Country	Design	Study period	Patients/neck dissections	Population	Lateral neck dissection strategy	Follow-up/outcome assessment
Roh et al. (2008) [6]	South Korea	Prospective observational cohort	2003-2006	52/57	Previously untreated PTC with lateral cervical nodal metastases	Therapeutic comprehensive central and lateral neck dissection; levels IIa, IIb, Va/Vai and Vb assessed separately	Pathological distribution of cervical nodal metastases
Farrag et al. (2009) [10]	USA	Retrospective chart review	Feb 2002-Dec 2007	53/60	PTC with FNA-confirmed lateral nodal metastasis in ≥ 1 lateral level	Therapeutic lateral neck dissection; II, III, IV and V were assessed according to extent performed; IIa/IIb and Va/Vb analyzed separately	Pathological distribution and factors associated with IIb/Va involvement
Lim et al. (2010) [11]	South Korea	Retrospective cohort	Mar 2005-Mar 2008	70/70	PTC with clinically positive lateral nodes and no clinically positive level V	Therapeutic dissection of levels II-V; level V clinically negative before surgery	Occult level V metastasis and predictors of V involvement
Yu et al. (2012) [27]	China	Prospective observational study	Oct 2006-Oct 2008	47/47	Low-risk PTC (<45 years, T1/T2/M0) with positive levels II-IV and clinically negative level V	Selective II-IV dissection with intentional omission of level V	Mean 48.2 months (36-60); nodal recurrence
Merdad et al. (2013) [9]	Canada	Retrospective chart review	2004-2011	185/248	Biopsy-proven PTC with lateral neck metastasis; no previous lateral neck dissection	Selective dissection of IIa, IIb, III, IV and Vb; Va omitted unless clinically, radiologically or intraoperatively suspicious	Pathological distribution of lateral nodal metastases
Javid et al. (2016) [8]	USA	Retrospective single-institution cohort	Jun 2006-Dec 2014	191/241	PTC with FNA-proven lateral nodal metastases	202 initial dissections; 195 formal MRND II-V and 7 less-extensive dissections	Median 14.3 months (range 0.1-107); persistence/recurrence and complications
Kim et al. (2017) [17]	South Korea	Retrospective cohort with propensity-score matching	Jan 1997-Jun 2015	646/646	N1b PTC undergoing unilateral therapeutic dissection	MRND II-V versus selective II-IV dissection; propensity-matched comparison	Recurrence and surgery-related morbidity; matched comparison of 263 patients per group
Xu et al. (2017) [25]	Canada	Retrospective cohort	2000-2012	178/204	PTC with lateral neck metastases	Selective versus comprehensive dissection, with comprehensive dissection including Vb	Mean follow-up 6.3 years; regional recurrence and recurrence patterns
Strajina et al. (2019) [24]	USA	Retrospective cohort	2000-2015	409/467	PTC undergoing first-time lateral neck dissection	Comprehensive IIa-Vb versus less-extensive selective dissection	Median follow-up 64 months; lateral neck recurrence and complications
Song et al. (2022) [26]	China	Prospective observational cohort	Jun 2018-Aug 2021	156/178	Previously untreated N1b PTC	IIa, IIb, III, IV and Vb dissection; preoperative FNA used to identify candidates for IIb sparing	Median 25 months (4-42); IIb metastasis, recurrence and complications
Matlim Ozel et al. (2025) [14]	Türkiye	Retrospective cohort	Jun 2020-Jul 2024	63/78	PTC with lateral neck metastases undergoing standardized lateral neck dissection	II-III-IV-Vb dissection; IIb added selectively for suspicious/conglomerated IIa disease	Predictors of level II/Vb metastasis and postoperative morbidity

TABLE 3: Characteristics of studies included in the systematic review

FNA, fine-needle aspiration; LND, lateral neck dissection; MRND, modified radical neck dissection; N1b, lateral cervical lymph-node metastasis; PTC, papillary thyroid carcinoma

The distribution of LLNMs varied across studies. Levels III and IV were consistently among the most frequently involved regions, whereas reported involvement of levels IIb and V varied across cohorts and depended on the anatomical sublevels assessed. Level IIb metastasis ranged from 7.9% to 16.7% in studies reporting separate IIb data, while reported level Vb involvement ranged from 3.7% to 40.0%. Va involvement was absent in the Farrag et al. [10] cohort, whereas Roh et al. [6] reported involvement of the inferior portion of level V (Vai) in 13.0% of evaluable dissections.

Multilevel disease was common in studies reporting this outcome, and skip metastases were also documented. However, these percentages were derived from studies with different populations, anatomical definitions, and denominators and should not be interpreted as directly comparable pooled estimates. The study-specific findings and their implications for tailoring dissection extent are presented in Table 4.

Study	Level II, n (%)	Level IIb, n (%)	Level III, n (%)	Level IV, n (%)	Level Va/Vai, n (%)	Level Vb, n (%)	Multilevel disease	Skip metastasis	Main implication for tailoring the extent of dissection
Roh et al. (2008) [6]	41/57 (72.2)	9/54 (16.7)	39/54 (72.2)	41/54 (75.9)	Vai: 7/54 (13.0); Vas: 0	2/54 (3.7)	46/57 (80.7)	5/52 (9.6)	IIb metastasis occurred in the setting of IIa disease; V involvement occurred with multilevel disease
Farrag et al. (2009) [10]	33/59 (56.0)	5/59 (8.5)	38/58 (65.5)	29/58 (50.0)	0/40 (0)	16/40 (40.0)*	NR	NR	IIb may be omitted when IIa is negative; Va showed no metastatic involvement; Vb considered relevant
Lim et al. (2010) [11]	34/70 (49.0)	NR	52/70 (74.0)	48/70 (69.0)	NR	11/70 (16.0) occult V disease	NR	NR	No isolated V metastasis; all V-positive patients had IV-positive disease
Yu et al. (2012) [27]	17/47 (36.1)	NR	36/47 (76.6)	34/47 (72.3)	NR	V intentionally omitted	30/47 (63.8)	NR	Selected low-risk patients with clinically negative V underwent II-IV dissection without routine V clearance
Merdad et al. (2013) [9]	122/248 (49.3)	Not separately assessable	189/247† (76.6)	152/247† (61.6)	Va not routinely dissected	72/247† (29.2)	73%	9%	Routine II-IV + Vb favored; Va and possibly IIb may be omitted when no evidence of disease
Javid et al. (2016) [8]	137/199‡ (68.8)	NR	132/201‡ (65.7)	105/202 (52.0)	NR	33/195‡ (16.9)	NR	NR	Authors argued that omission of II and V could miss substantial occult disease
Kim et al. (2017) [17]	348/644‡ (54.0)	NR	483/643‡ (75.1)	495/641‡ (77.2)	NR	90/646 (13.9)	74.5%	14.1%	Level V disease was relatively uncommon; simultaneous II+III+IV involvement predicted V metastasis
Xu et al. (2017) [25]	NR	NR	NR	NR	NR	Vb included according to surgical strategy	NR	NR	Recurrence rather than pathological prevalence was used to evaluate whether Vb clearance was necessary
Strajina et al. (2019) [24]	NR	NR	NR	NR	NR	Included in comprehensive group	NR	NR	Clinical recurrence data used to compare comprehensive and selective approaches
Song et al. (2022) [26]	76/178 (42.7)	17/178 (9.6)	150/178 (84.3)	148/178 (83.1)	NR	10/178 (5.6)	139/178 (78.1)	NR	IIb involvement was strongly associated with positive FNA at level II; negative FNA identified a very-low-risk IIb group
Matlim Ozel et al. (2025) [14]	46/78 (58.9)	6/76§ (7.9)	61/78 (78.2)	60/78 (76.9)	NR	9/78 (11.5)	NR	9.5%	IIb and Vb involvement were associated with ETE and larger metastatic nodes; selective omission may be considered in selected patients

TABLE 4: Distribution of lateral cervical lymph-node metastases and evidence relevant to selective omission

* Farrag et al. [10] reported positive level V in 16/40 dissections; none involved Va, indicating that the positive V specimens were attributable to Vb.

† Merdad et al. [9] reported level-specific denominators according to evaluable dissections; percentages are reproduced as reported.

‡ Javid et al. [8] and Kim et al. [17] reported level-specific positivity using the available/evaluable dissection denominators rather than always the total cohort denominator.

§ Matlim Ozel et al. [14] reported IIb metastases in six evaluable dissections; the denominator differs from the total number of comprehensive dissections.

ETE, extrathyroidal extension; FNA, fine-needle aspiration; NR, not reported; PTC, papillary thyroid carcinoma

Oncological Outcomes, Recurrence, and Morbidity

The comparative evidence was limited and heterogeneous. Kim et al. [17] reported a lower frequency of shoulder syndrome after selective II-IV dissection than after modified radical dissection of levels II-V. Xu et al. [25] reported similar five-year regional control following selective and comprehensive dissection, whereas Strajina et al. [24] observed higher recurrence in the selective-dissection group. In the prospective cohort reported by Yu et al. [27], one patient developed an ipsilateral level V recurrence after intentional

omission of level V. These findings require cautious interpretation because of differences in patient selection, dissection definitions, follow-up, and study design.

Postoperative morbidity included shoulder dysfunction, nerve injury, chyle leakage, wound infection, and hypoparathyroidism. The reported frequencies varied across studies, and direct comparisons were limited by inconsistent outcome definitions and ascertainment. Detailed oncological outcomes, recurrence patterns, complications, and factors associated with additional-level disease are summarized in Table 5.

Study	Comparison/strategy	Main oncological outcome	Recurrence/regional control	Complications/morbidity	Factors supporting tailoring
Roh et al. (2008) [6]	Comprehensive dissection; level-specific pathological assessment	Distribution study; no direct comparison of surgical extents	Not designed to assess comparative recurrence	Not reported as a comparative endpoint	IIb disease occurred with IIa involvement; level V involvement associated with multilevel disease
Farrag et al. (2009) [10]	Therapeutic LND with selective consideration of IIb and Va	No comparative oncological outcome	Not assessed as primary endpoint	No significant permanent shoulder dysfunction reported	All 5 IIb-positive specimens had IIa involvement; 5/33 IIa-positive cases (15%) had IIb disease; Va 0%
Lim et al. (2010) [11]	Full II-V dissection despite clinically negative V	Occult V metastasis in 11/70 (16%)	No recurrence comparison	Not reported as principal study outcome	No isolated V metastasis; all V-positive patients had IV-positive disease; simultaneous II+III+IV involvement strongly associated with V disease (multivariable OR 9.8, 95% CI 1.8-53.0)
Yu et al. (2012) [27]	II-IV dissection with V omitted	Feasibility of selective II-IV approach in low-risk patients	2/47 (4.3%) nodal recurrences; 1/47 (2.1%) in ipsilateral V; mean follow-up 48.2 months	Not quantified	The single V recurrence occurred in a patient with simultaneous II, III, and IV disease
Javid et al. (2016) [8]	Mostly formal MRND II-V	202 initial dissections; 195 MRND and 7 less extensive	Ipsilateral persistence/recurrence in 22/202 (10.9%); recurrence sites: II 45.5%, III 36.4%, IV 31.8%, V 13.6%	Temporary nerve injury 6/202 (3.0%) initially and 4/39 (10.3%) after reoperation; no permanent nerve injury	Findings used to argue against routinely omitting II or V
Kim et al. (2017) [17]	MRND II-V vs SND II-IV, propensity-matched	Level V metastasis 13.9%; occult level V metastasis 8.6%	26/646 (4.0%) lateral neck recurrences overall; 2/26 recurrences involved V (7.7%)	Shoulder syndrome 9.1% vs 2.7%, p=0.002; operation time 221.4 vs 175.0 min, p<0.001; hospital stay 6.0 vs 5.4 d, p=0.021	Simultaneous II+III+IV metastasis independently predicted V metastasis (adjusted OR 3.079, p=0.003)
Xu et al. (2017) [25]	Selective vs comprehensive, comprehensive including Vb	Extent of dissection was not an independent predictor of regional failure	5-year regional control 91% selective vs 92% comprehensive, p=0.89; subgroup without radiographic V disease 94% vs 92%, p=0.63; Vb recurrence 2% vs 3%, p=1.00	Not a principal comparative endpoint	Imaging-defined extent of disease was used to select the dissection extent
Strajina et al. (2019) [24]	Comprehensive IIa-Vb vs selective	102 comprehensive vs 143 selective dissections with known extent	Recurrence 12% vs 22%, p=0.04; 5-year recurrence-free survival p=0.09	Complications 11% vs 5%, p=0.08; shoulder dysfunction/marginal mandibular complications 2% vs 0%, p=0.09	Older age associated with recurrence; fewer nodes removed in recurrence group (19 vs 23, p=0.02)
Song et al.	FNA-guided potential	IIb metastasis	Median follow-up 25 months; 2 ipsilateral lateral recurrences, 2 contralateral cervical	Shoulder syndrome 5.8%, all temporary;	Positive level-II FNA: 30.0% IIb metastasis vs 1.6% with negative FNA, p<0.001; largest suspected

Table with 6 columns: Study/Intervention, Population, Results, Recurrence, Morbidity, and Factors associated with extensive disease. Rows include (2022) [26], Matlim, and Ozel et al. (2025) [14].

TABLE 5: Oncological outcomes, recurrence, morbidity, and factors associated with more extensive disease

ETE, extrathyroidal extension; FNA, fine-needle aspiration; LND, lateral neck dissection; MRND, modified radical neck dissection; RLN, recurrent laryngeal nerve; SND, selective neck dissection

Risk of Bias

Four comparative non-randomized studies were assessed using the Risk Of Bias In Non-randomized Studies of Interventions (ROBINS-I) tool. Overall risk of bias was judged serious for Javid et al. [8], Xu et al. [25], and Strajina et al. [24], and moderate for Kim et al [17]. The principal concerns related to confounding and participant selection. In Javid et al. [8], the marked imbalance between the formal MRND II-V group and the less-extensive dissection group (195 versus 7 initial dissections) limited the strength of comparative inferences. Xu et al. [25] had concerns regarding treatment selection and incomplete follow-up, whereas Strajina et al. [24] had concerns related to confounding, missing surveillance data, and variation in the extent of dissection. Kim et al. [17] used propensity-score matching, yielding 263 patients in each matched group; however, the retrospective, non-randomized design left potential for residual confounding. Domain-level ROBINS-I judgments are presented in Figure 2.

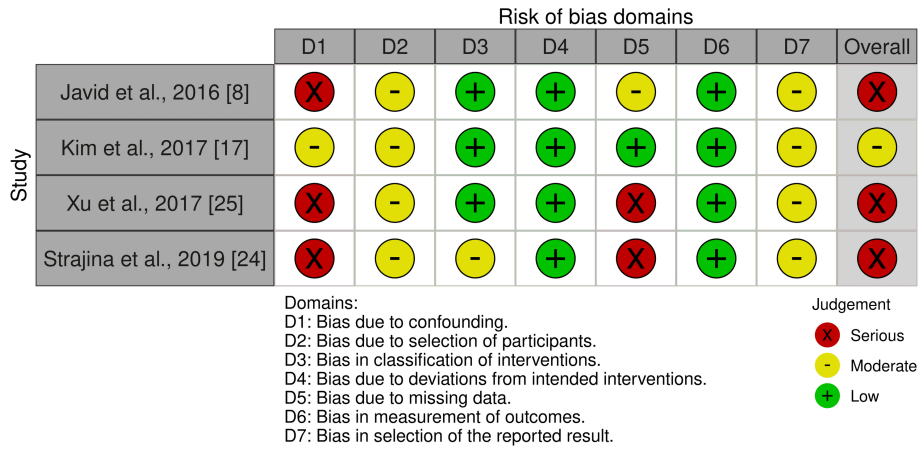


FIGURE 2: Risk of bias assessment of comparative non-randomized studies using the ROBINS-I tool

Overall risk of bias was judged as serious for Javid et al. [8], Xu et al. [25], and Strajina et al. [24], and moderate for Kim et al. [17]. Judgments were based on study design, treatment allocation, baseline imbalance, completeness of follow-up, outcome ascertainment, and reporting practices.

The non-comparative studies were appraised using design-appropriate Joanna Briggs Institute (JBI) critical appraisal checklists. The JBI prevalence-study checklist was used to assess studies reporting level-specific pathological metastasis frequencies, including Roh et al. [6], Farrag et al. [10], Merdad et al. [9], Lim et al. [11], Song et al. [26], and Matlim Ozel et al. [14]. The assessments were interpreted at the individual-item level, considering limitations in sampling, sample-size adequacy, reporting, and the precision of prevalence estimates. Yu et al. [27] was assessed using the JBI cohort-study checklist for its follow-up outcomes after selective LND. Because this study included a single cohort without a concurrent comparison group,

comparison-specific items were considered not applicable. The item-level assessments are presented in Table 6 and in the Appendix. No overall numerical quality score or universal quality category was assigned to the JBI appraisals.

JBI critical appraisal item	Roh et al. (2008) [6]	Farrag et al. (2009) [10]	Merdad et al. (2013) [9]	Lim et al. (2010) [11]	Song et al. (2022) [26]	Ozel et al. (2025) [14]
1. Was the sample frame appropriate to address the target population?	Y	Y	Y	Y	Y	Y
2. Were study participants sampled appropriately?	Y	Y	U	Y	Y	Y
3. Was the sample size adequate?	N	N	U	N	U	N
4. Were the study subjects and setting described in detail?	Y	Y	Y	Y	Y	Y
5. Was the data analysis conducted with sufficient coverage of the identified sample?	U	U	U	Y	Y	Y
6. Were valid methods used to identify the condition?	Y	Y	Y	Y	Y	Y
7. Was the condition measured in a standard, reliable way for all participants?	Y	Y	Y	Y	Y	Y
8. Was appropriate statistical analysis used?	Y	Y	Y	Y	Y	Y
9. Was the response rate adequate, and if not, was the low response rate managed appropriately?	U	U	U	U	U	U

TABLE 6: Risk-of-bias assessment of non-comparative cohort studies using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Cohort Studies

JBI, Joanna Briggs Institute; Y, Yes; N, No; U, Unclear; NA, Not applicable. Appraisal was performed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Studies Reporting Prevalence Data. Each item was rated as Yes (Y), No (N), Unclear (U), or Not applicable (NA), according to the information reported in the original study. "Unclear" indicates insufficient information to make a definitive judgment, whereas "Not applicable" indicates that an item was not relevant to the study design. The assessments were interpreted at the individual-item level; no numerical summary score or overall quality category was assigned. Sample-size adequacy was considered in relation to the study objectives and the precision of the reported prevalence estimates. Pathological confirmation of lymph-node metastasis was considered when assessing the validity and consistency of condition measurement. These ratings reflect the information available in the published reports and should be interpreted in the context of each study's design and methodological limitations.

Evidence Map

The included studies provided evidence across cervical lymph-node levels IIa, IIb, III, IV, Va, and Vb, with variation in the extent of reported level-specific assessment. Levels III and IV were reported across multiple cohorts, while IIb, Va, and Vb were specifically evaluated in studies addressing selective dissection, occult metastasis, or level-specific metastatic distribution. The included evidence also reported clinical, radiological, and pathological factors associated with additional-level involvement, including the distribution and burden of metastatic lymph nodes, multilevel disease, preoperative FNA findings, extrathyroidal extension, and metastatic node size.

The evidence map summarizes these findings according to the anatomical level, reported metastatic involvement, factors associated with additional-level disease, and the surgical strategies evaluated across the included studies. It also displays the reported recurrence findings and the studies contributing evidence to selective or tailored approaches to LND (Figure 3). The figure provides a visual summary of the distribution and type of evidence identified in the review.

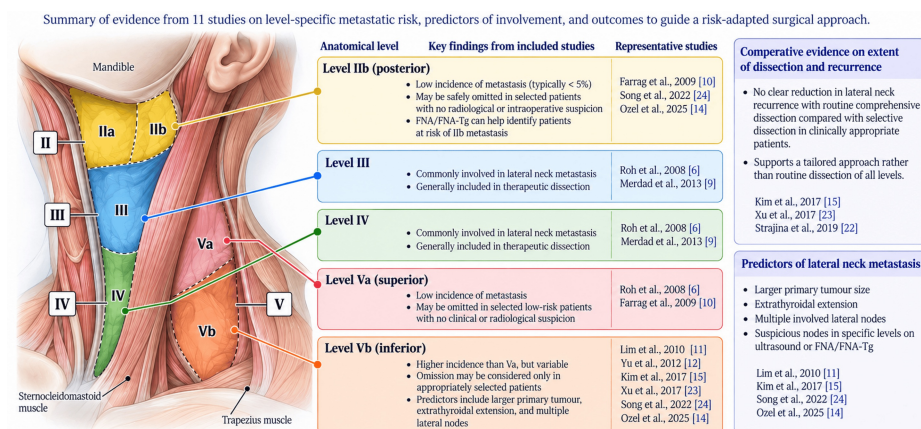


FIGURE 3: Evidence map of anatomical levels and clinical factors informing tailored therapeutic lateral neck dissection in papillary thyroid carcinoma

The anatomical classification of cervical lymph node levels and sublevels IIa, IIb, III, IV, Va, and Vb is based on the standardized neck-dissection classification proposed by Robbins et al. [21]. The evidence summaries were derived from the studies included in the present systematic review and illustrate level-specific metastatic involvement, reported predictors of additional-level disease, recurrence outcomes, and surgical strategies.

The figure was created by the authors using BioRender (BioRender, Toronto, Ontario, Canada) and Canva (Canva Pty Ltd, Sydney, Australia). The figure is intended as a visual synthesis of the available evidence and does not represent a clinical guideline or prescriptive surgical algorithm.

Discussion

This systematic review evaluated the evidence regarding tailoring the extent of therapeutic LND in patients with PTC and clinically evident lateral cervical lymph node metastases. Across 11 observational studies [6,8-11,14,17,24-27], metastatic involvement was generally concentrated in levels III and IV, while reported involvement of level IIb was less frequent. Findings for level V were more variable. These patterns identify potential opportunities for individualized surgical planning but do not, in isolation, establish the oncological safety of omitting any nodal level. The evidence must be interpreted in light of differences in patient selection, disease burden, dissection extent, pathological assessment, and follow-up across studies [6,9,28,29].

The predominance of metastases in levels III and IV supports their central role in therapeutic LND. Reported involvement of level III ranged from 65.5% to 84.3%, whereas level IV involvement ranged from 50.0% to 83.1%. These estimates are broadly consistent with the established distribution of lateral nodal disease in PTC and support the inclusion of these levels in therapeutic compartment-oriented surgery [2,6,9,30]. However, the percentages should not be interpreted as directly comparable estimates of the relative risk of metastasis across levels because the included studies differed in their populations, surgical approaches, denominators, and pathological assessment. The 2025 American Thyroid Association guideline describes therapeutic lateral LND as typically encompassing levels IIa, III, IV, and Vb. Accordingly, the present findings support the importance of adequate clearance of involved lateral compartments rather than routine reduction of the dissection extent solely on the basis of average level-specific prevalence.

Level IIb may be a candidate for selective preservation in appropriately selected patients, but the evidence remains insufficient to establish a universal omission strategy. Reported IIb involvement ranged from 7.9% to 16.7% in the included studies [10,14,26]. Importantly, IIb metastasis was closely associated with IIa disease, with earlier studies reporting concomitant involvement of these sublevels in most IIb-positive cases [7,10]. In addition, positive level-II FNA, extrathyroidal extension, and greater metastatic nodal burden were associated with a higher likelihood of IIb involvement [14,26]. These findings suggest that preoperative imaging, targeted sampling when indicated, and the distribution of known nodal disease may inform decisions about IIb. Nevertheless, the available evidence does not establish a validated clinical rule for safely omitting IIb, and the presence of disease in adjacent sublevels or other adverse features should prompt careful consideration of the likelihood of occult involvement. Furthermore, a low prevalence of IIb metastasis should not be equated with a low risk of recurrence after IIb is omitted, because pathological prevalence studies and studies evaluating recurrence after selective dissection address different outcomes.

The evidence concerning level V was more heterogeneous. Lim et al. [11] found occult level V metastases in patients with lateral nodal disease, while Kim et al. [17] identified V involvement in 13.9% of patients and found that simultaneous involvement of levels II, III, and IV was associated with level V metastasis. Merdad

et al. [9] also reported substantial Vb involvement, although estimates varied across studies. The finding that level V disease was associated with involvement of other lateral levels, particularly in patients with multilevel disease, suggests that the distribution and burden of nodal metastases may help inform the extent of surgery. However, evidence concerning occult metastasis should be distinguished from evidence that omission of level V does or does not increase subsequent recurrence. Yu et al. [27] reported two nodal recurrences following selective level II-IV dissection in a selected low-risk cohort, including one ipsilateral level V recurrence. This observation demonstrates that out-of-field recurrence can occur but, given the small number of events and the absence of a concurrent comparison group, cannot quantify the excess risk attributable to omitting level V. The evidence therefore provides a rationale for evaluating selective preservation of Va in carefully assessed patients, but it does not support routinely omitting Vb when its inclusion is indicated by the clinical distribution of disease.

Comparative evidence provides important context for interpreting whether a less extensive dissection compromises oncological control. Xu et al. [25] reported similar five-year regional control between selective and comprehensive dissections, whereas Strajina et al. [24] observed a higher recurrence rate after selective dissection. McNamara et al. [31] likewise reported comparable overall lateral neck recurrence-free outcomes in selected patients undergoing selective dissection, although ipsilateral recurrence-free status favored comprehensive dissection. These apparently differing findings likely reflect differences in patient selection, disease burden, operative definitions, and follow-up rather than establishing equivalence between surgical strategies. Javid et al. [8] further demonstrated persistent or recurrent ipsilateral disease after therapeutic dissection, emphasizing that residual or occult nodal disease remains clinically relevant even after apparently adequate surgery.

Several studies identified clinical and pathological characteristics that may help refine surgical selection. Song et al. [26] found that positive FNA of level II was associated with IIb metastasis, while Matlim Ozel et al. [14] identified extrathyroidal extension and larger metastatic nodes as predictors of II and Vb involvement. Kim et al. [17] found simultaneous II, III, and IV disease to be associated with V metastasis. Broader evidence also indicates that tumor characteristics and nodal distribution can help predict lateral nodal involvement, while contralateral spread may be associated with greater ipsilateral nodal burden and adverse primary tumor characteristics [32,33]. The reticular lymphatic model proposed by Cai et al. [34] further emphasizes that cervical nodal spread may involve interconnected rather than strictly linear pathways, supporting individualized assessment of metastatic patterns rather than reliance on a single presumed sequence.

The potential benefit of tailoring must also be considered against morbidity. Kim et al. [17] reported a lower rate of shoulder syndrome after selective level II-IV dissection than after modified radical level II-V dissection. Other included studies also described complications such as shoulder dysfunction, chyle leak, and nerve-related morbidity. These findings provide a rationale for investigating whether limiting dissection in selected patients can reduce treatment-related harm. However, the magnitude of any benefit remains uncertain because the studies differed in their operative approaches, complication definitions, and ascertainment methods. Moreover, the association between lower lymph node yield and subsequent lateral neck recurrence reported by Heaton et al. [35] cautions against reducing the extent of surgery without an oncological rationale. The objective of tailoring should therefore be to avoid unnecessary dissection while maintaining adequate control of clinically relevant disease, rather than simply minimizing the number of removed nodes.

Limitation

This review has several limitations. First, the evidence base was limited to 11 observational studies, with substantial heterogeneity in sample size, study design, definitions of selective and comprehensive LND, follow-up duration, and patient selection. This heterogeneity limited direct comparisons across studies and precluded firm conclusions regarding the optimal extent of dissection. Second, most studies were retrospective and therefore susceptible to selection bias, confounding by indication, and incomplete clinical or pathological data. These limitations were particularly relevant to comparative studies, in which differences in baseline disease burden and surgical selection may have influenced recurrence and regional control outcomes. Third, the definitions and assessment of levels IIb, Va, and Vb were not entirely uniform, potentially contributing to variability in reported metastasis rates. Furthermore, pathological prevalence and recurrence following omission of a nodal level represent distinct outcomes and should not be interpreted interchangeably. Several studies reported limited recurrence events or relatively short follow-up, restricting the precision of estimates of long-term oncological outcomes. Finally, the predominance of Asian study populations may limit generalizability to other populations and healthcare settings. These limitations should be considered when interpreting the potential role of tailored therapeutic LND.

Conclusions

This systematic review found that metastatic involvement in PTC with lateral cervical lymph node metastases was generally concentrated in levels III and IV, whereas reported involvement of level IIb was lower and findings for level V were more variable. These patterns may inform individualized surgical planning, but lower pathological prevalence alone does not establish that omission of a nodal level is

oncologically safe. Levels IIb and Va may be considered for selective preservation in appropriately assessed patients, whereas decisions regarding Vb should account for the distribution and burden of lateral nodal disease. Clinical and pathological features, including multilevel nodal involvement, metastatic node size, extrathyroidal extension, and level-specific fine-needle aspiration findings, may help inform these decisions; however, the available evidence does not establish validated criteria for selecting patients for level-sparing surgery. Comparative studies have reported inconsistent regional control outcomes, and the current evidence does not demonstrate the equivalence of selective and comprehensive dissection. Accordingly, surgical planning should prioritize adequate compartmental clearance of clinically relevant disease while avoiding unnecessary morbidity. Prospective, standardized comparative studies with clearly defined dissection levels, reproducible patient-selection criteria, and sufficiently long follow-up are needed to establish when, and in which patients, a less extensive therapeutic LND can be performed without compromising oncological outcomes.

Appendices
Appendix

JBI cohort-study checklist item	Yu et al. (2012) [27]	Rationale
1. Were the two groups similar and recruited from the same population?	NA	The study included a single cohort of 47 selected patients; no comparison group was reported.
2. Were exposures measured similarly to assign participants to exposed and unexposed groups?	NA	Participants were not divided into exposed and unexposed groups.
3. Was the exposure measured in a valid and reliable way?	Y	The surgical approach was explicitly described as selective lateral neck dissection of levels II–IV, with level V omitted.
4. Were confounding factors identified?	N	The study described a selected low-risk population but did not comprehensively identify potential confounders affecting recurrence outcomes.
5. Were strategies to deal with confounding factors stated?	N	No formal adjustment strategy for confounding was reported.
6. Were participants free of the outcome at the start of the study?	Y	The study evaluated recurrence following initial therapeutic surgery; patients with previous thyroid or neck surgery for non-thyroid head and neck cancers were excluded.
7. Were outcomes measured in a valid and reliable way?	Y	Follow-up included clinical assessment and ultrasonography to identify suspected recurrent nodal disease.
8. Was the follow-up time reported and sufficient to be long enough for outcomes to occur?	Y	Mean follow-up was 48.2 months (range, 36-60 months), allowing assessment of regional recurrence, although longer follow-up would be valuable.
9. Was follow-up complete, and were reasons for loss to follow-up described?	U	The report did not clearly document completeness of follow-up for every enrolled participant or provide a detailed account of losses to follow-up.
10. Were strategies to address incomplete follow-up stated?	U	Specific methods for handling incomplete follow-up were not clearly reported.
11. Was appropriate statistical analysis used?	U	Recurrence was reported descriptively, but the small number of events and absence of a concurrent comparison group limit the assessment of comparative effectiveness.

TABLE 7: JBI critical appraisal of the cohort study evaluating selective lateral neck dissection

JBI, Joanna Briggs Institute; Y, Yes; N, No; U, Unclear; NA, Not applicable

Additional Information
Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Disclosures

Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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