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Original Article

Histopathological spectrum of thyroid lesions in thyroidectomy specimens: A hospital-based cross-sectional observational study.

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Abstract

Background

Thyroid lesions include a wide range of non-neoplastic, benign neoplastic and malignant conditions. Histopathological examination of thyroidectomy specimens remains essential for final diagnosis, classification and subsequent clinical management.

Objectives

To evaluate the histopathological spectrum of thyroid lesions in thyroidectomy specimens and describe their distribution according to age, sex, clinical presentation and type of thyroidectomy specimen.

Methods

This hospital-based cross-sectional study included consecutive thyroidectomy specimens meeting predefined eligibility criteria. The minimum sample size, calculated using a single-proportion formula with 95% confidence, 50% expected prevalence, and 10% absolute precision, was rounded to 100. Demographic, clinical, surgical, and histopathological data were recorded. Specimens underwent routine processing and haematoxylin–eosin staining. Lesions were categorised histologically. Data were summarised using descriptive statistics.

Results

A total of 100 consecutive thyroidectomy specimens were assessed for eligibility. All 100 met the eligibility criteria; no specimen was excluded, and all were included in the final analysis. The age of patients ranged from 18 to 72 years, with a mean age of 41.8 ± 13.6 years. Females constituted 82% of cases, giving a female-to-male ratio of 4.5:1. Anterior neck swelling was present in all patients, followed by compressive symptoms in 22%. Non-neoplastic lesions accounted for 66% of cases, benign neoplastic lesions for 21% and malignant lesions for 13%. Colloid goitre was the most frequent diagnosis (32%), followed by multinodular goitre (18%) and follicular adenoma (14%). Papillary thyroid carcinoma was the most common malignant lesion.

Conclusion

Benign thyroid lesions predominated in thyroidectomy specimens, with a clear female preponderance. Histopathology confirmed colloid goitre as the leading diagnosis and papillary thyroid carcinoma as the most frequent malignancy.

Recommendations

Routine histopathological evaluation should be strengthened for all thyroidectomy specimens to improve diagnostic accuracy, detect occult malignancy and guide postoperative follow-up.

Keywords: *Thyroidectomy, thyroid lesions, histopathology, colloid goitre, follicular adenoma, papillary thyroid carcinoma, cross-sectional observational study*
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Introduction

The thyroid gland is one of the most frequently evaluated endocrine organs in surgical pathology practice because it is affected by developmental, inflammatory, hyperplastic and neoplastic disorders. Thyroid lesions commonly present as diffuse enlargement, multinodular swelling or solitary nodules, and their biological behaviour ranges from clinically innocuous colloid-rich lesions to aggressive malignant neoplasms. Although clinical examination, thyroid function testing, ultrasonography and fine needle aspiration cytology provide useful preoperative guidance, the final categorization of many thyroid lesions depends on histopathological examination of the resected specimen [1-4].

The clinical importance of thyroid enlargement lies in distinguishing common benign disorders from lesions with malignant potential. Benign conditions such as colloid goitre, multinodular goitre, thyroiditis and follicular adenoma form the bulk of thyroidectomy specimens in most institutional series. However, thyroid carcinoma is regularly encountered as a primary indication for surgery or as an incidental histological finding in goitrous glands. Papillary thyroid carcinoma is consistently reported as the most frequent malignant thyroid tumour, while follicular carcinoma, medullary carcinoma and other uncommon malignancies occur less often [5-10].

The distribution of thyroid lesions is influenced by age, sex, iodine status, geographic background, referral patterns, diagnostic access and surgical selection. Most histopathological series show a strong female preponderance and clustering of cases in the third to fifth decades of life. This pattern reflects the higher frequency of thyroid enlargement and autoimmune thyroid disease in women, along with greater clinical detection of nodular thyroid disease. Studies from South Asia, Africa and the Middle East have shown that non-neoplastic lesions outnumber neoplastic lesions, while papillary carcinoma remains the dominant malignant subtype [6-12].

Histopathological evaluation has value beyond diagnostic labelling. It confirms tumour type, identifies capsular and vascular invasion in follicular-patterned lesions, detects incidental microcarcinoma, recognizes autoimmune thyroiditis, and provides essential information for postoperative surveillance. Contemporary thyroid tumour classification also emphasizes careful separation of benign, borderline and malignant follicular cell-derived lesions because this distinction affects risk stratification and treatment planning [2,13,14]. In routine hospital settings, therefore, a local audit of thyroidectomy specimens provides practical insight into the burden and pattern of thyroid disease in the served population.

The present study was undertaken with the objective of evaluating the histopathological spectrum of thyroid lesions in thyroidectomy specimens at Konaseema Institute of Medical Sciences and Research Foundation, Amalapuram, Andhra Pradesh, India. The study also aimed to describe the distribution of thyroid lesions according to age, sex, clinical presentation, type of thyroidectomy specimen and broad histopathological category.

Materials and Methods

Study design and setting

This was a hospital-based cross-sectional observational study conducted in the Department of Pathology, Konaseema Institute of Medical Sciences and Research Foundation, Amalapuram, Andhra Pradesh, India. Thyroidectomy specimens received for routine histopathological examination from October 2025 to March 2026 were evaluated at a single time point after surgical excision.

Study population and sampling technique

The study population comprised patients who underwent thyroidectomy for clinically or radiologically diagnosed thyroid swelling, nodular thyroid disease, toxic goitre, suspected neoplasm or confirmed malignancy. Consecutive sampling was used. Each hemithyroidectomy, total thyroidectomy or subtotal thyroidectomy specimen received through routine surgical pathology services was accompanied by a requisition form and linked clinical record before eligibility assessment.

Sample size determination

The minimum sample size was estimated using the formula $n = Z^2p(1-p)/d^2$. At a 95% confidence level ($Z = 1.96$), an expected proportion of 50% was selected because no precise local estimate was available, and an absolute precision of 10% was assumed. The calculated minimum sample size was 96.04 specimens. This was rounded upward, and 100 consecutive eligible specimens were included in the final analysis.

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Inclusion and exclusion criteria

All adequately fixed thyroidectomy specimens received during the study period, with complete identification and essential demographic and clinical information, were eligible. Specimens showing gross autolysis or inadequate fixation, specimens with incomplete identification or missing essential clinical information, and repeat specimens from the same patient were excluded.

Bias and its minimization

Selection bias was reduced by consecutive inclusion of every eligible thyroidectomy specimen received during the fixed study period. Information bias was minimised through use of a structured data collection sheet and cross-verification of requisition forms with available case records. Diagnostic and observer bias were limited by uniform grossing and processing protocols, application of predefined histomorphological criteria, systematic slide review, and joint reassessment of doubtful or discordant areas by another pathologist before final categorisation. Duplicate specimens and records with insufficient information were excluded according to predefined criteria.

Specimen handling and histopathological processing

Each specimen was received in 10% neutral buffered formalin and examined grossly for laterality, size, external surface, nodularity, cystic change, haemorrhage, fibrosis, calcification and suspicious solid areas. Representative sections were taken from nodules, capsule, adjacent thyroid tissue and grossly abnormal areas. Tissue processing was performed by routine paraffin embedding. Sections of approximately 3-5 microns were stained with haematoxylin and eosin and examined under light microscopy.

Diagnostic categorization

Final diagnoses were rendered by histomorphological assessment and grouped into non-neoplastic lesions, benign neoplastic lesions and malignant lesions. Diagnostic terminology was harmonized with accepted thyroid histopathology principles and contemporary thyroid tumour classification [4,13]. Papillary thyroid carcinoma, follicular carcinoma and medullary carcinoma were recorded separately. Follicular-patterned lesions were assessed for encapsulation, capsular invasion, vascular invasion and nuclear features, wherever applicable.

Data collection

Age, sex, presenting clinical features, type of thyroidectomy specimen and histopathological diagnosis were entered into a structured data sheet. Clinical details were obtained from requisition forms and case records. The study did not include immunohistochemistry or molecular testing because the objective was to document routine histopathological spectrum in thyroidectomy specimens.

Statistical analysis

Data were entered into Microsoft Excel and checked for completeness. Categorical variables were summarized as frequencies and percentages. Age was summarized as range and mean with standard deviation. The study was descriptive in nature; therefore, no inferential comparison was planned. Patient identity was not disclosed in the analysis, tables or manuscript.

Informed consent, ethical considerations and quality control

The study was conducted after approval from the Institutional Ethics Committee of Konaseema Institute of Medical Sciences and Research Foundation. Written informed consent was obtained from all participants before inclusion for the use of anonymised clinical information and surgically resected tissue for research purposes. Patient confidentiality was maintained, and no personal identifiers were entered into the analysis sheet. Slides were reviewed systematically, doubtful areas were reassessed before final categorisation, and grossing adequacy, block selection and clinicopathological correlation were checked to maintain diagnostic consistency.

Results

Participant flow

During the six-month study period, 100 consecutive thyroidectomy specimens were received through routine surgical pathology services and assessed for eligibility. All 100 specimens were adequately fixed, correctly identified and accompanied by essential clinical information; therefore, all were confirmed eligible. No specimen met the predefined exclusion criteria, and none was excluded. All 100 specimens were included in the final histopathological analysis (Figure 1). The age of the patients ranged from 18 to 72 years, with a mean age of 41.8 ± 13.6 years. The largest age group was 31–45 years,

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and females predominated, with a female-to-male ratio of 4.5:1 (Table 1).

Figure 1. Participant flow diagram

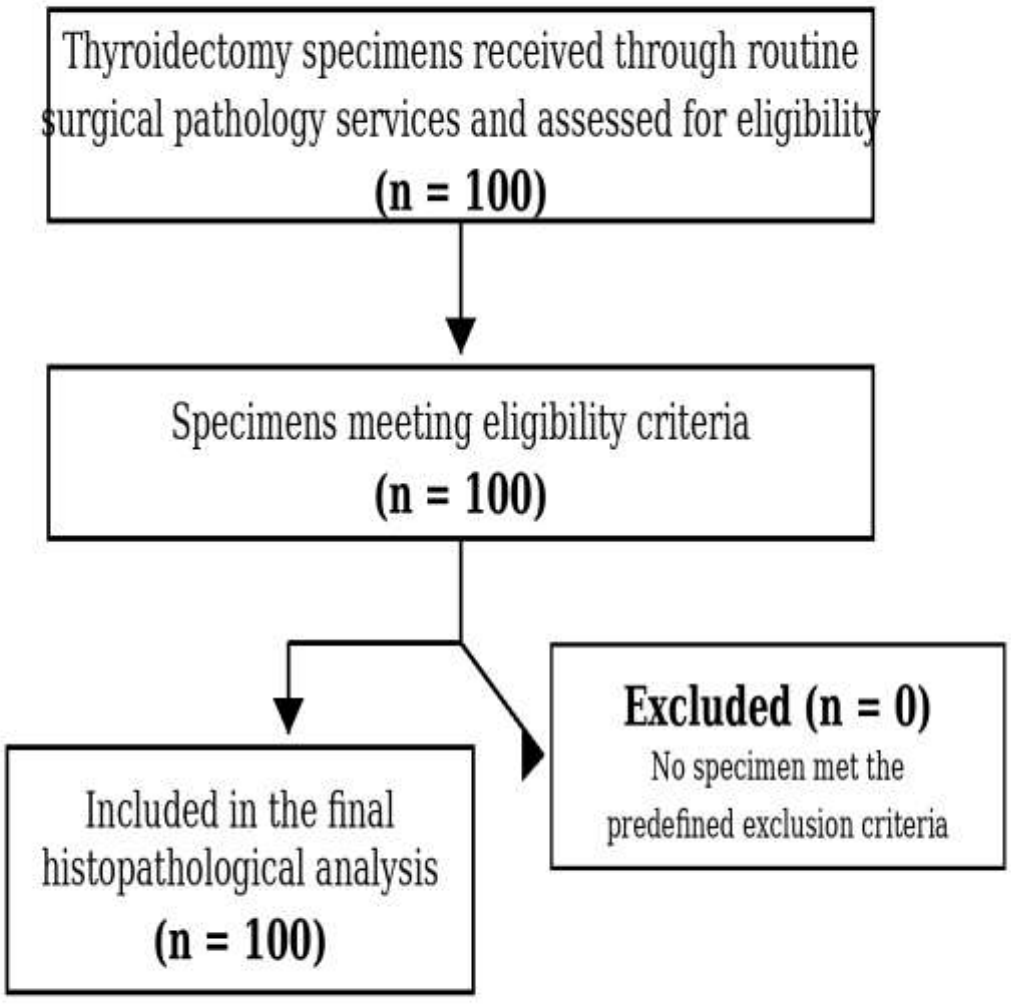

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Table 1: *Demographic Characteristics of Patients With Thyroid Lesions*

Variable	n	%
Age group		
18-30 years	19	19.0
31-45 years	42	42.0
46-60 years	27	27.0
>60 years	12	12.0
Sex		
Male	18	18.0
Female	82	82.0
Total	100	100.0

Note. N = 100. Percentages are based on the final analysed sample.

Anterior neck swelling was the most common clinical presentation and was observed in all patients. Compressive symptoms were reported in 22% of patients. Symptoms suggestive of hypothyroidism and hyperthyroidism were noted in 10% and 8% of patients, respectively. Cervical lymphadenopathy was clinically documented in 3% of cases. Total thyroidectomy was the most frequently received specimen, followed by hemithyroidectomy and subtotal thyroidectomy (Table 2).

Table 2: *Clinical Presentation and Type of Thyroidectomy Specimen*

Variable	n	%
Clinical presentation		
Anterior neck swelling	100	100.0
Compressive symptoms	22	22.0
Symptoms of hypothyroidism	10	10.0
Symptoms of hyperthyroidism	8	8.0
Cervical lymphadenopathy	3	3.0
Type of specimen		
Hemithyroidectomy	38	38.0
Total thyroidectomy	52	52.0
Subtotal thyroidectomy	10	10.0

Note. N = 100. Clinical presentations were not mutually exclusive; therefore, percentages may exceed 100% when summed.

On histopathological examination, non-neoplastic lesions were the most common category, accounting for 66% of cases. Benign neoplastic lesions were seen in 21% of cases, while malignant lesions constituted 13% of the total thyroidectomy specimens (Table 3).

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Table 3: *Broad Histopathological Classification of Thyroid Lesions*

Histopathological category	n	%
Non-neoplastic lesions	66	66.0
Benign neoplastic lesions	21	21.0
Malignant lesions	13	13.0
Total	100	100.0

Note. N = 100.

Colloid goitre was the most common individual histopathological diagnosis, followed by multinodular goitre and follicular adenoma. Among inflammatory and functional lesions, Hashimoto thyroiditis, Graves' disease and subacute thyroiditis were identified. Among malignant lesions, papillary thyroid carcinoma was the most frequent malignancy, followed by follicular carcinoma and medullary carcinoma (Table 4). Overall, benign thyroid lesions were much more frequent than malignant lesions.

Table 4: *Histopathological Spectrum of Thyroid Lesions*

Histopathological diagnosis	n	%
Non-neoplastic lesions		
Colloid goitre	32	32.0
Multinodular goitre	18	18.0
Hashimoto thyroiditis	10	10.0
Graves' disease	4	4.0
Subacute thyroiditis	2	2.0
Benign neoplastic lesions		
Follicular adenoma	14	14.0
Hurthle cell adenoma	5	5.0
Other benign adenomatous lesions	2	2.0
Malignant lesions		
Papillary thyroid carcinoma	10	10.0
Follicular carcinoma	2	2.0
Medullary carcinoma	1	1.0
Total	100	100.0

Note. N = 100. Percentages represent the proportion of all thyroidectomy specimens.

Discussion

The present study evaluated 100 thyroidectomy specimens and demonstrated that benign thyroid lesions formed the major component of surgically treated thyroid disease. Non-neoplastic lesions accounted for 66% of cases, benign neoplastic lesions for 21%, and malignant lesions for 13%. This distribution is consistent with many histopathological series in which goitrous and hyperplastic lesions outnumber neoplastic lesions in

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thyroidectomy specimens [5-8,10,11]. The predominance of benign lesions reinforces the continued clinical burden of nodular thyroid enlargement in hospital practice.

A clear female preponderance was observed in the present study, with females constituting 82% of cases and a female-to-male ratio of 4.5:1. Similar female dominance has been reported by Santosh et al., Ghartimagar et al., Tsegaye and Ergete, and Raheem et al., although the exact ratios vary across regions [5-7,9]. The greater frequency among women is biologically plausible because thyroid enlargement, autoimmune thyroiditis and nodular disease occur more often in females. The highest number of cases in the present study was seen in the 31-45 years age group, which also aligns with previous observations that thyroid disorders requiring surgery commonly cluster in young and middle-aged adults [6,9,12].

Colloid goitre was the most frequent diagnosis in this series, followed by multinodular goitre. This finding corresponds with reports from Nepal, Nigeria and Saudi Arabia, where colloid goitre or nodular goitre formed the leading histopathological pattern [6,8-11]. The high frequency of goitrous lesions emphasizes that long-standing follicular hyperplasia and colloid accumulation continue to contribute substantially to thyroidectomy workload. Hashimoto thyroiditis was present in 10% of cases, reflecting the recognized role of autoimmune thyroid disease within the spectrum of surgically excised thyroid lesions.

Follicular adenoma was the most common benign neoplasm, accounting for 14% of all specimens. This observation is compatible with previous studies in which follicular adenoma represented the leading benign thyroid tumour [6,10,11]. In follicular-patterned thyroid lesions, histopathology is indispensable because capsular and vascular invasion cannot be reliably assessed on cytology alone. Careful sampling of the capsule and surrounding thyroid tissue is therefore essential for distinguishing follicular adenoma from follicular carcinoma [4,13].

Malignant lesions constituted 13% of cases. Papillary thyroid carcinoma was the most common malignancy, representing 10% of all specimens and the majority of malignant lesions. This result is in agreement with regional studies that identify papillary carcinoma as the dominant thyroid malignancy [5,10,12-14]. Follicular carcinoma and medullary carcinoma were less frequent. The detection of malignant lesions in a background dominated by benign disease supports the need for systematic grossing, adequate sampling and careful microscopic examination of all thyroidectomy specimens.

The findings of this hospital-based study are generalizable to similar tertiary care and teaching hospital settings in coastal Andhra Pradesh where thyroidectomy specimens are processed through routine histopathology services. Because the study used consecutive surgical specimens and standard microscopic evaluation, the observed pattern reflects real-world surgical pathology workload and routine diagnostic decision-making. Extrapolation to the community prevalence of thyroid disease should be done cautiously because non-operated thyroid lesions were not included.

Conclusion

In this hospital-based cross-sectional observational study of 100 thyroidectomy specimens, benign thyroid lesions were more common than malignant lesions. Non-neoplastic lesions formed the largest category, with colloid goitre as the single most frequent diagnosis, followed by multinodular goitre. Follicular adenoma was the commonest benign neoplasm. Malignant lesions constituted 13% of cases, and papillary thyroid carcinoma was the leading malignancy. The study also showed a marked female preponderance and highest case frequency in the 31–45 years age group. These findings highlight the continuing diagnostic value of histopathological examination in confirming thyroid disease, identifying unsuspected malignancy and guiding appropriate postoperative clinical management. Regular institutional audits can further support early recognition of changing disease trends.

Limitations

This study was limited by its single-centre design and relatively small sample size. Only surgically treated thyroid lesions were included, so the findings do not represent all thyroid diseases in the community. Clinical, radiological, cytological and biochemical correlations were not analysed in depth. Immunohistochemistry and molecular testing were not performed. The short study period also restricts assessment of temporal diagnostic trends.

Recommendations

Every thyroidectomy specimen should undergo meticulous gross examination, adequate sampling and structured microscopic reporting. Greater emphasis should be placed on careful evaluation of follicular-patterned lesions, incidental papillary microcarcinoma and associated thyroiditis. Future studies should include larger multicentre cohorts with clinicoradiological, cytological and biochemical correlation. Linking histopathological findings with ultrasound risk

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stratification, Bethesda cytology categories, postoperative follow-up and recurrence data will improve the clinical value of thyroid pathology audits. Periodic institutional review of thyroidectomy specimens is recommended to monitor changing patterns of benign and malignant thyroid disease. A standard departmental checklist for thyroid grossing and reporting should be adopted for consistency.

Acknowledgement

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Abbreviations

FNAC: Fine needle aspiration cytology;

H&E: Haematoxylin and eosin;

PTC: Papillary thyroid carcinoma;

SD: Standard deviation;

WHO: World Health Organization.

Source of funding

The study had no funding.

Conflict of interest

The authors declare no conflict of interest.

Author Contributions

Dr. Narendra Kumar Chandrashekar contributed to the conception and design of the study, supervision of pathological evaluation, data interpretation, manuscript drafting, and critical revision of the manuscript.

Dr. Thiragati Venu Gopala Krishna contributed to data collection, laboratory/pathological assessment, literature review, data organization, and preparation of the initial manuscript draft.

Dr. Kandanala Mallika contributed to histopathological/cytopathological evaluation, analysis of findings, interpretation of results, manuscript review, and intellectual refinement of the article.

Dr. Anand Acharya contributed to overall academic supervision, research methodology guidance, critical review of the manuscript, and final approval of the version to be submitted.

All authors read and approved the final manuscript. All authors agree to be accountable for the accuracy and integrity of the work.

Data availability

Data available on request

Author Biographies

Dr. Narendra Kumar Chandrashekar is an Associate Professor in the Department of Pathology, Konaseema Institute of Medical Sciences and Research Foundation, Amalapuram, Andhra Pradesh, India. He is actively involved in undergraduate and postgraduate teaching, diagnostic histopathology, cytopathology, and academic research. His areas of professional interest include surgical pathology, clinicopathological correlation, and pathology-based observational research.

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His academic interests include histopathology, cytology, hematology, and evidence-based laboratory medicine.

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Dr. Anand Acharya, currently serves as Dean and Professor, Department of Pharmacology, at the Konaseema Institute of

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Medical Sciences & Research Foundation (KIMS&RF), Amalapuram, Andhra Pradesh, India. A distinguished academician, researcher, and medical education leader, he has been pivotal in transforming KIMS&RF from its formative phase into a premier medical institution with over 200 undergraduate and 100 postgraduate seats.

With more than 18 years of teaching and administrative experience, Dr. Acharya has held several leadership positions, including Vice Principal, Principal, Chief Warden, Member Secretary of Institutional Ethics and Animal Ethics Committees, and is an approved PhD Guide under Dr. NTR University of Health Sciences, Vijayawada. His visionary leadership has significantly enhanced the institution's academic quality, clinical exposure, research infrastructure, and postgraduate training standards.

He has completed prestigious national faculty development programs such as the Revised Basic Course Workshop (rBCW), Advanced Course in Medical Education (ACME), and National Teacher Training Course (NTTC, JIPMER, Puducherry). He also serves as Coordinator for Pharmacovigilance and Materiovigilance Programs under IPC–PvPI and MoHFW, Government of India, contributing actively to national drug safety and regulatory initiatives.

A prolific academician, Dr. Acharya has authored and co-authored more than 100 scientific publications in reputed national and international indexed journals. His wide-ranging research covers toxicology, pharmacovigilance, antimicrobial resistance, endocrinology, neuropharmacology, and clinical pharmacology. His recent studies include long-term analyses of pyrethroid, paraquat, and chlorpyrifos poisoning, investigations into antimicrobial resistance trends, and predictive models for treatment outcomes in dermatological and toxicological emergencies.

Dr. Acharya's professional interests include clinical pharmacology, toxicovigilance, rational drug use, pharmacovigilance systems, and innovations in medical education technologies. He continues to mentor numerous postgraduate and undergraduate researchers while playing an integral role in curriculum reform, ethics governance, and institutional academic advancement.

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