Rapid On-Site Evaluation (ROSE) in Diagnostic Interventional Pulmonology

Volume 3: Neoplastic Diseases

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ISBN 978-981-15-3909-1 ISBN 978-981-15-3910-7 (eBook)
https://doi.org/10.1007/978-981-15-3910-7

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd.
The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

Contents

1 Cellular Characteristics of ROSE in Pulmonary Solid Malignancies

Jing Feng

ROSE is often the "cytologic version" of histopathology, that is, the manifestation of the cell shedding of corresponding tissue content, so the interpreter should have a deep understanding of the histopathology of corresponding diseases.

1. As sinister "foreign cells," the solid malignant cells have the following characteristics:

This book is part of the 4-volume collection "Rapid On-Site Evaluation (ROSE) in Diagnostic Interventional Pulmonology". The following contents are important information for ROSE and have been published in chapters in "Rapid On-Site Evaluation (ROSE) in Diagnostic Interventional Pulmonology" Volume 1–2
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Volume 1: Print ISBN 978-981-13-3455-9; Online ISBN 978-981-13-3456-6
Volume 2: Print ISBN 978-981-15-0938-4; Online ISBN 978-981-15-0939-1

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(a) Increasing diameters of cells and their components.

(1) The volume of malignant cells often increases significantly or varies in size. The diameters of the larger malignant cells are often more than two times bigger than those of the smaller malignant cells. (2) The nucleus is large and the nucleus/cytoplasm ratio (N/C) is increased (because the nucleus components proliferate faster than those of the cytoplasm). It is generally considered that N/C < 1/3 is relatively normal, and >1/2 is suggestive of malignancy. (3) Nucleolus is often large or varies in size; nucleolar major axis (n)/ nuclear major axis (N) (n/N) > 0.25 indicates malignancy, and multiple nucleoli may be present.

(b) Malignant cells and their components become pyramidwise.

(1) The malignant cells are generally angled, polygonal, and have various irregular shapes. (2) The nucleus is angled, oddly shaped, irregularly round, kidney-shaped, bud-shaped, nodular, and have various irregular shapes, and even prominent from the cytoplasm. (3) The nucleolus forms angles, odd shapes, and irregular edges.

(c) Malignant cells and their components are always hyperchromatic.

(1) The overall cell and its plasma are unevenly hyperchromatic. (2) The nuclear chromatin is unevenly clumped and

J. Feng et al. (eds.), *Rapid On-Site Evaluation (ROSE) in Diagnostic Interventional Pulmonology*,
https://doi.org/10.1007/978-981-15-3910-7_1

hyperchromatic. (3) Nucleolus is unevenly hyperchromatic.

(d) Malignant cell components increase.

(1) It may be dual or even multinuclear. (2) It may be multinucleolar, 3 to 4 and above. (3) Polyploidy and aneuploidy may be present.

(e) The nuclear membrane (karyotheca) is thick and the cytoplasmic membrane (cytomembrane) is relatively thin.

(1) The nuclear membrane is thickened, or the nuclear outline is poor, degenerate, or naked. (2) The cytomembrane is relatively thin, the outer edge is unclear, and the shape is irregular.

(f) Overcrowding of malignant cells and their components.

(1) Malignant cells are crowded with each other and tend to overlap each other with unclear boundaries. Multiple nuclei crowd mutually. (2) The nucleoli are multiplied, arranged in a disorderly manner, and crowded with each other. (3) Chromatin is concentrated peripherally.

(g) Malignant cells and their components are disordered arranged.

(1) Malignant cells can be arranged into papillary, glandular, mulberry-like shapes, and even form three-dimensional structures, or malignant cells phagocytize each other, so-called "self-phagocytosis." (2) Nuclei are malformed, disorderly arranged, and vary in size. (3) Nucleoli are disorderly arranged, and may crowd and fuse with each other. (4) Nuclei may have pathological karyokinesis. (5) The chromosomes are arranged disorderly, depolarized, and can be fragmented.

(h) Analysis of cytological background.

(1) Erythrocytes, inflammatory cells, and lots of necrotic cellular fragments and debris may be seen in background and become so-called "tumoral positive background." (2) If accompanied with infection, neutrophil infiltration may be present.

2. ROSE cytological classification for pulmonary solid malignancies:

Usually, it will meet some of the cellular characteristics of ROSE of common solid malignancies, which are described previously.

(a) High differentiated squamous cell carcinoma:

(1) The malignant cells are irregularly shaped, aspheric, polygonal, deformed, fusiform, and sharply edged. (2) The cytoplasm is keratinized and appears "homogeneous plaster-like." The staining is red-color dominant, and the cytoplasm of some cells becomes scanty or even naked. (3) The nuclear chromatin is hyperchromatic, and nuclei are malformed, disorderly arranged, angled, oddly shaped, and vary in size. (4) The "tumoral positive background" is obvious.

(b) Low differentiated squamous cell carcinoma:

(1) The malignant cells proliferate actively and the keratinization is not obvious. (2) The overall shape is relatively regular, or quasi-circular, and the malignant cells can be distributed in clusters. (3) The nuclei are large and malformed. The chromatin is coarsely reticular, unevenly distributed, and the nucleoli are obviously presented. (4) Cytoplasm is scanty and basophilic with unclear edges.

(c) High differentiated adenocarcinoma:

(1) The malignant cells are relatively large, quasi-circular, and distributed in piles and clusters. (2) The nuclei are large, and the cytoplasm is abundant, vacuolated, showing "hypersecretory" or even "signet-ring like". (3) They are arranged as glandular, papillary, and mulberry-like. (4) There are also small round nuclei with more cytoplasm. (5) Chromatin is coarsely granular. (6) The nucleolus is large and clear, and it may be multiple.

(d) Low differentiated adenocarcinoma:

(1) The malignant cells are small, scattered or clustered, structurally detached, and the boundaries of cells are unclear. (2) The nucleus may be located against the edge and the edge may bulge. (3) There are also nuclear giants, which are round

and irregular. (4) Chromatin is unevenly concentrated. Cytoplasm may be scanty and basophilic, and may have clear vacuoles.

(e) Adenosquamous carcinoma

(1) Features of squamous cell carcinoma such as keratinization. (2) Features of adenocarcinoma such as abundant cytoplasm, three-dimensional glandular structure. (3) May coexist to form ROSE features of adenosquamous carcinoma.

(f) Undifferentiated carcinoma

- Small cell undifferentiated carcinoma:

  The malignant cells are relatively small. There is little or no cytoplasm (high nucleoplasm ratio). Nucleoli are unclear or absent. Nuclear chromatin is granular, unevenly distributed like grimace. Malignant cells can be arranged in a queue ("spine-like"), like mosaics (gomphoses), or clustered. Necrosis is common, and nuclear filaments are formed from necrotic malignant cells.
- Large cell undifferentiated carcinoma (large cell carcinoma and large cell neuroendocrine carcinoma):

  The sizes of malignant cells, nuclei, nucleoli are larger, and cytoplasm is scanty. Malignant cells can be arranged like mosaics (gomphoses), or clustered. Nuclear chromatin is abundant and granular, and pathological karyokinesis is common. Necrosis is common.
- Spindle cell carcinoma:

  Malignant cells are spindle-shaped, with larger oval or fusiform nuclei. Nuclear chromatin is clumped, unevenly distributed. Nucleoli are clear and may be multiple.

3. ROSE cytologic features of other types of malignancies that may affect the lung:

Usually, it will meet some of the cellular characteristics of ROSE of common solid malignancies, which are described previously.

(a) Atypical carcinoid

(1) The malignant cells are larger, and the necrosis and pathological karyokinesis is common. (2) The nuclei are round or oval, with characteristic fine granular chromatin ("salt and pepper" pattern) with less cytoplasm.

(b) Adenoid cystic carcinoma

The malignant cells are arranged to form a spherical structure, and translucent mucin matrix ball is often visible within the malignant cell clusters.

(c) Lymphoma

- Mucosal-associated lymphoid tissue type extranodal marginal B-cell lymphoma (MALT type)

  MALT lymphoma is mainly composed of small lymphoid malignant cells. Plasmocytes are often scattered in the malignant lymphocytes.
- Diffuse large B-cell lymphoma

  The malignant lymphoma cells are larger, about two to four times the size of the adjacent normal lymphocytes.
- Hodgkin's lymphoma

  Heteromorphosis is obvious, and the nuclei are significantly larger than those of the normal lymphocytes. Reed-Sternberg cells (RS cells, also known as mirror cells) may be seen.

(d) Pulmonary metastases of renal clear cell carcinoma

Malignant cells are larger, and the cytoplasm is abundant and transparent.

(e) Pulmonary metastases of gastrointestinal adenocarcinoma

The cytologic ROSE features of the primary gastrointestinal adenocarcinoma are presented.

(f) Connective tissue proliferative mesothelioma

Heteromorphosis is obvious, and some malignant cells are fusiform.

(g) Mucinous adenocarcinoma

Mucin is seen within the malignant cell, and the nucleus is often pushed against to one side of the cell, showing a

"crescent" shape. The well-differentiated mucinous epithelial cells are cubic or columnar. Mucus is often obvious in the background.

(h) Sarcomatoid carcinoma

Heteromorphosis is obvious, and some malignant cells are fusiform or giant cell-like. Cytoplasm is abundant and hyperchromatic.

(i) Epithelioid mesothelioma

The malignant cells are relatively small, with circular or quasi-circular nuclei.

(j) Sarcoma

The malignant cells are relatively large and some of these cells are spindle-shaped.

(k) Mucoepidermoid carcinoma

The malignant cells are relatively large, and the cytoplasm is abundant, vacuolated, and pale.

(l) Pulmonary metastases from extrapulmonary primary tumors

The cytologic ROSE features of the extrapulmonary primary tumors are presented.

Usual-Type Adenocarcinoma

2

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Because this type is common, it is not provided in the form of cases and directly provided with ROSE pictures and legends.

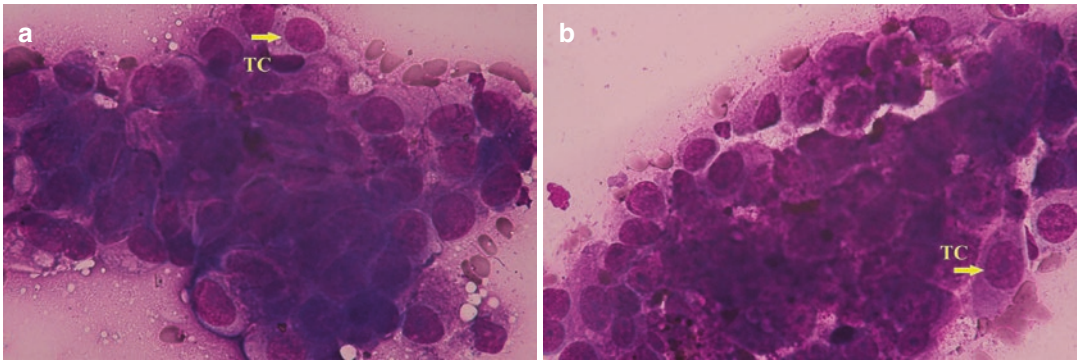

Fig. 2.1 (**a**–**n1**) Annotated at the figure (yellow arrow)

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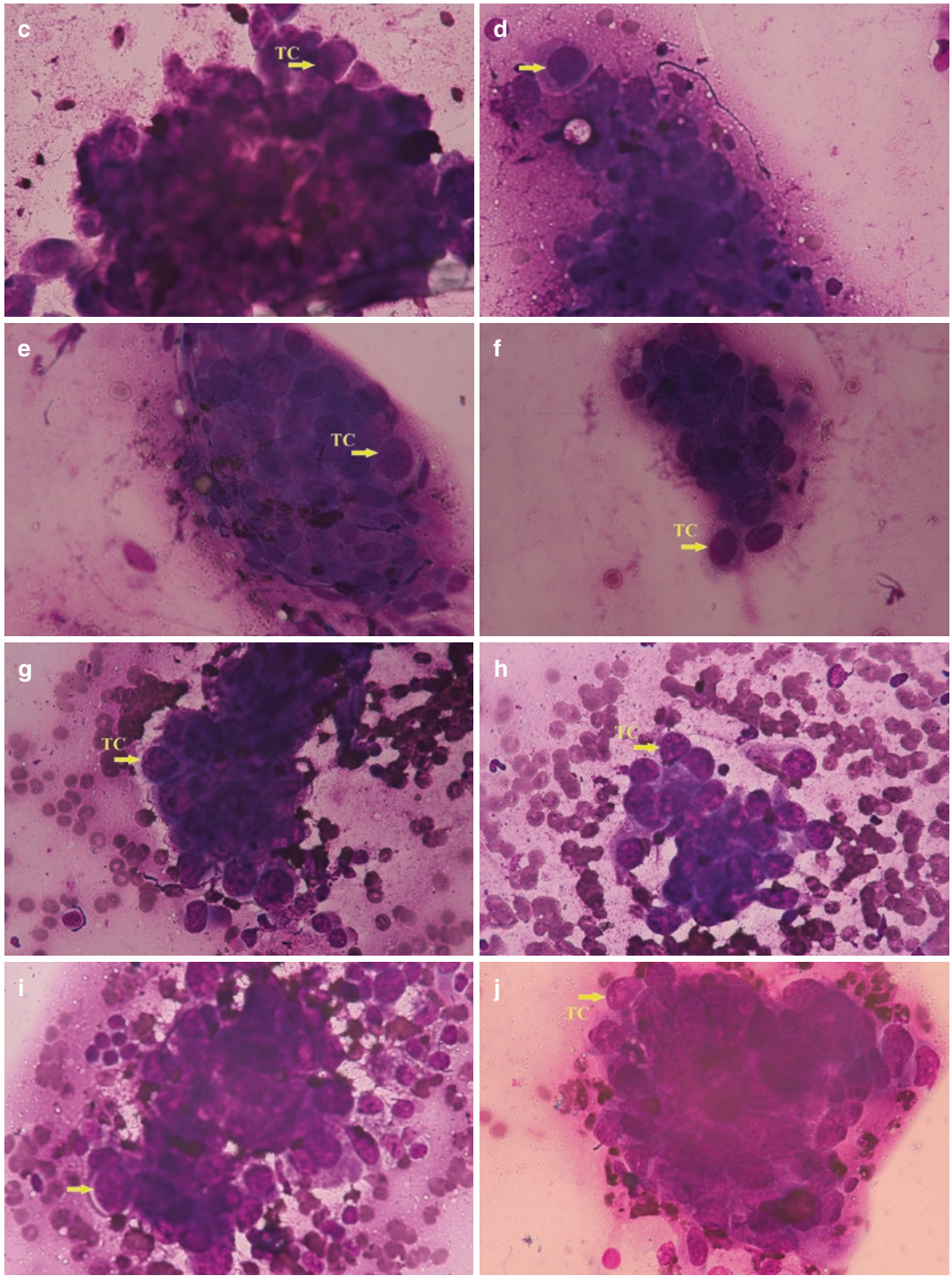
J. Feng et al. (eds.), *Rapid On-Site Evaluation (ROSE) in Diagnostic Interventional Pulmonology*,
https://doi.org/10.1007/978-981-15-3910-7_2



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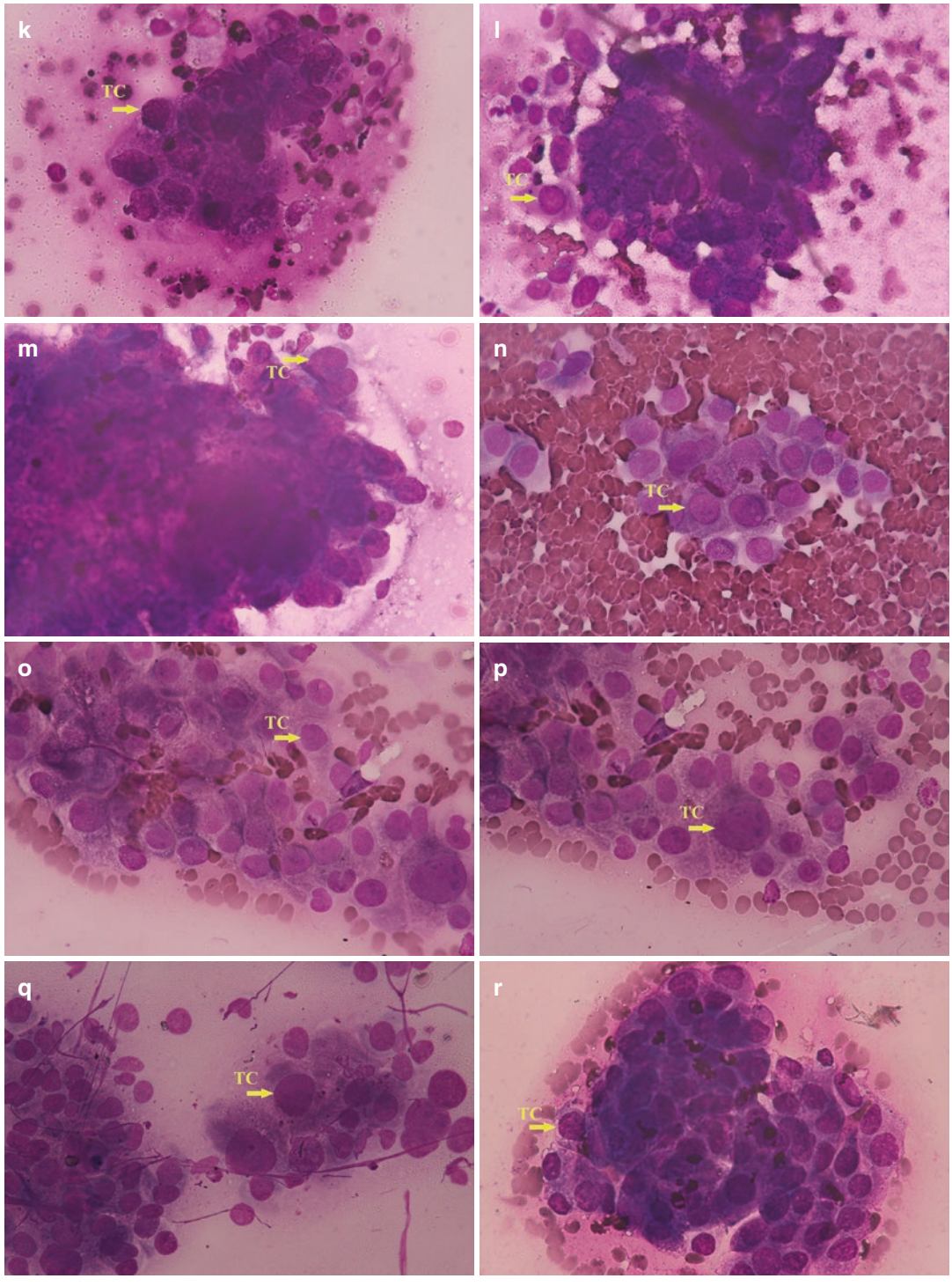

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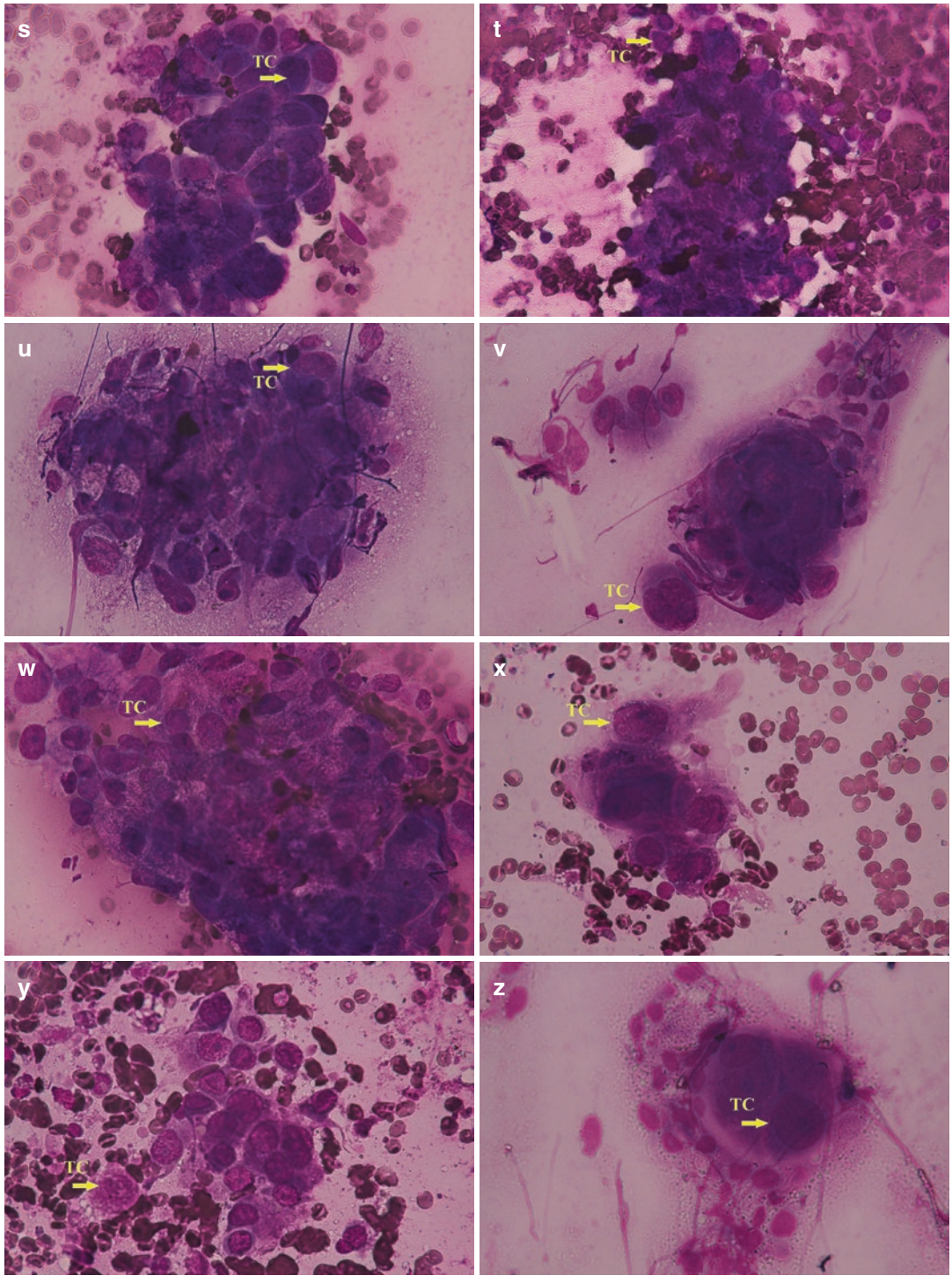

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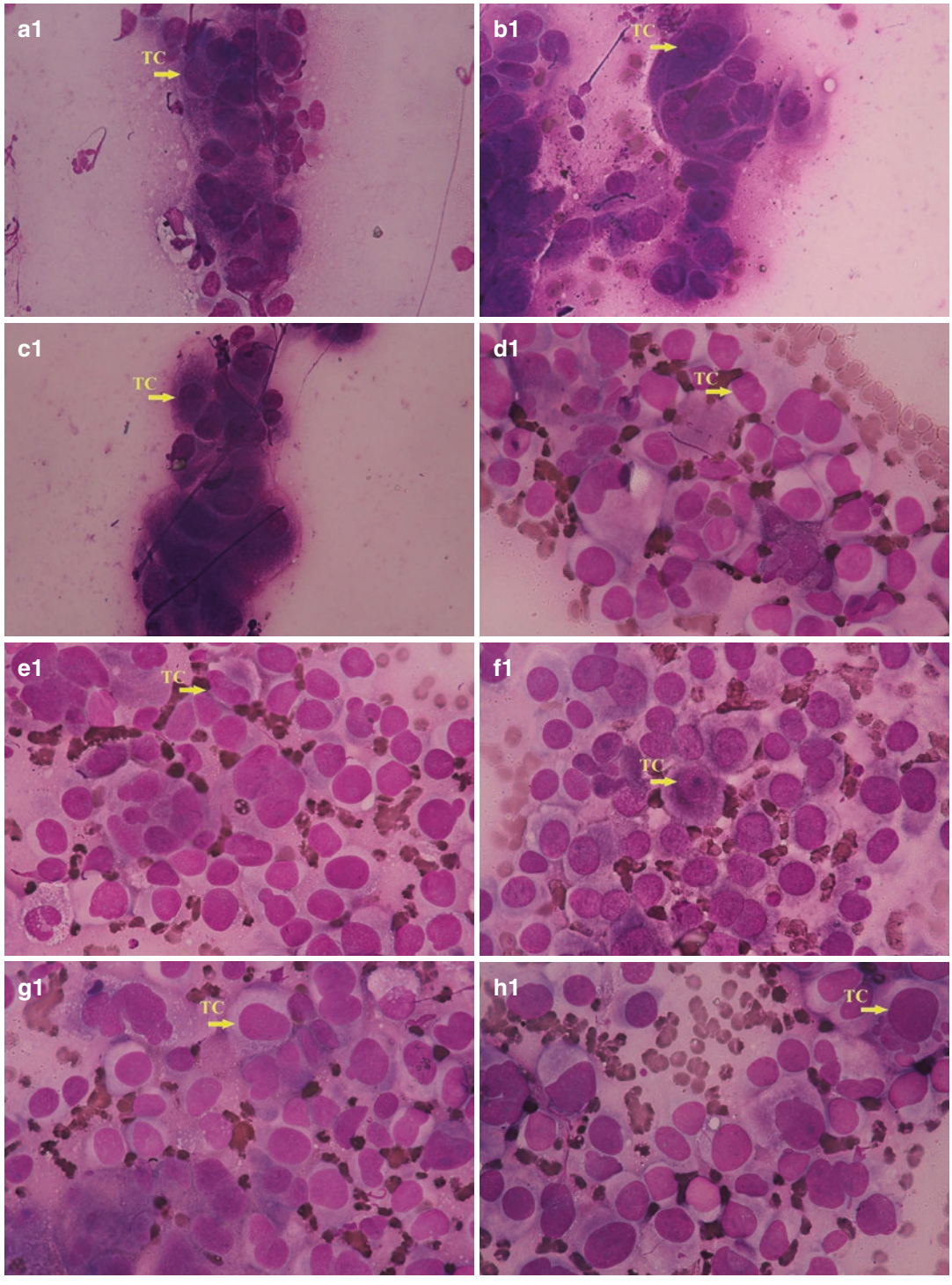

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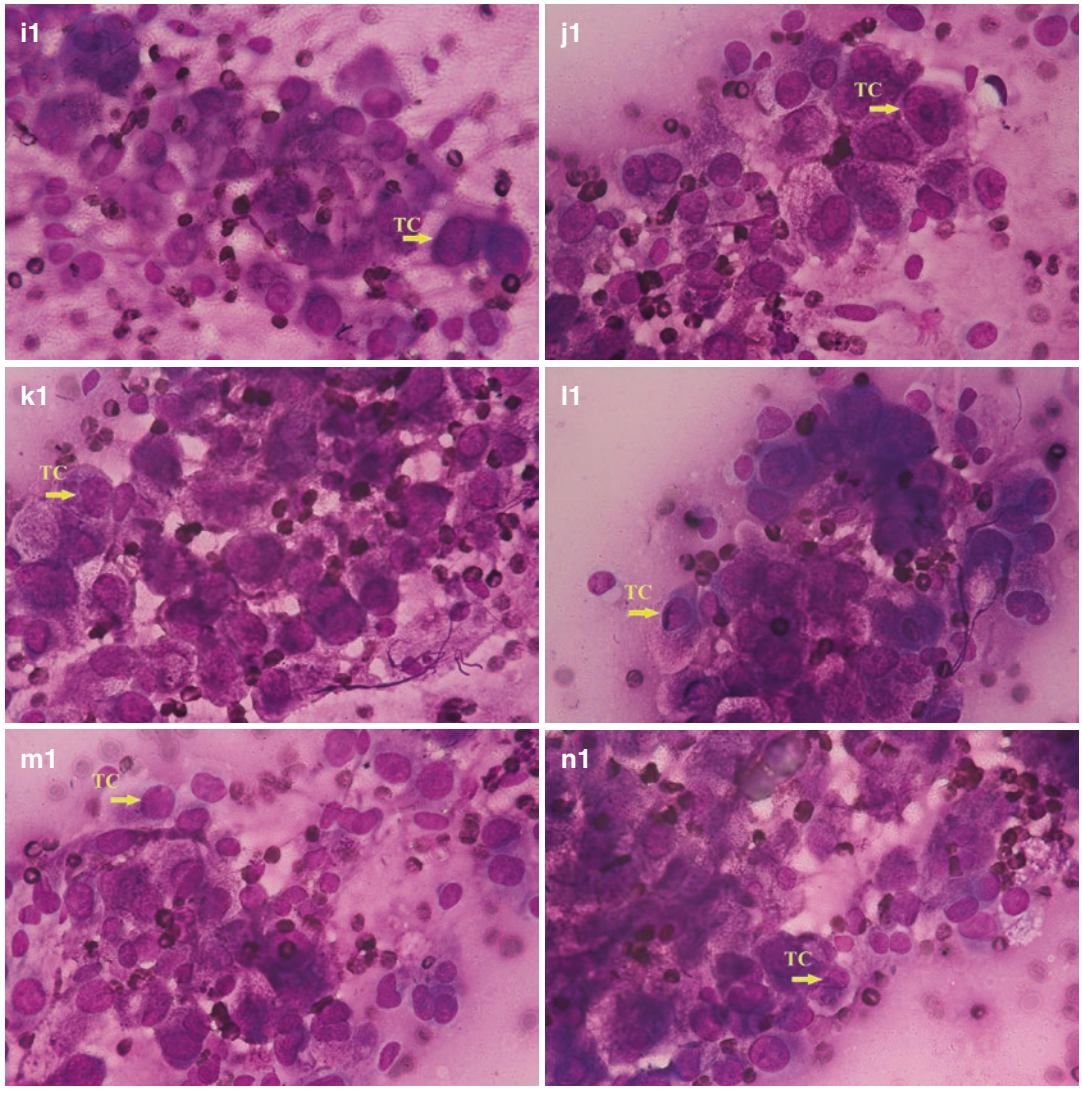

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3 Usual-Type Squamous-Cell Carcinoma

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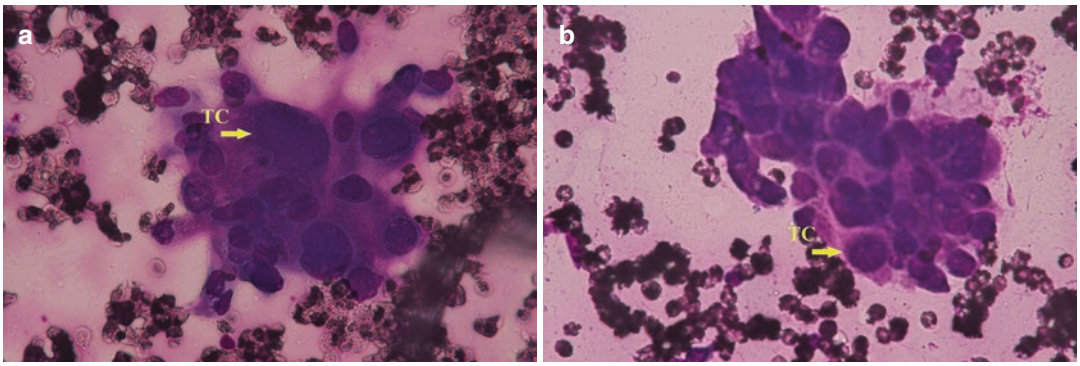

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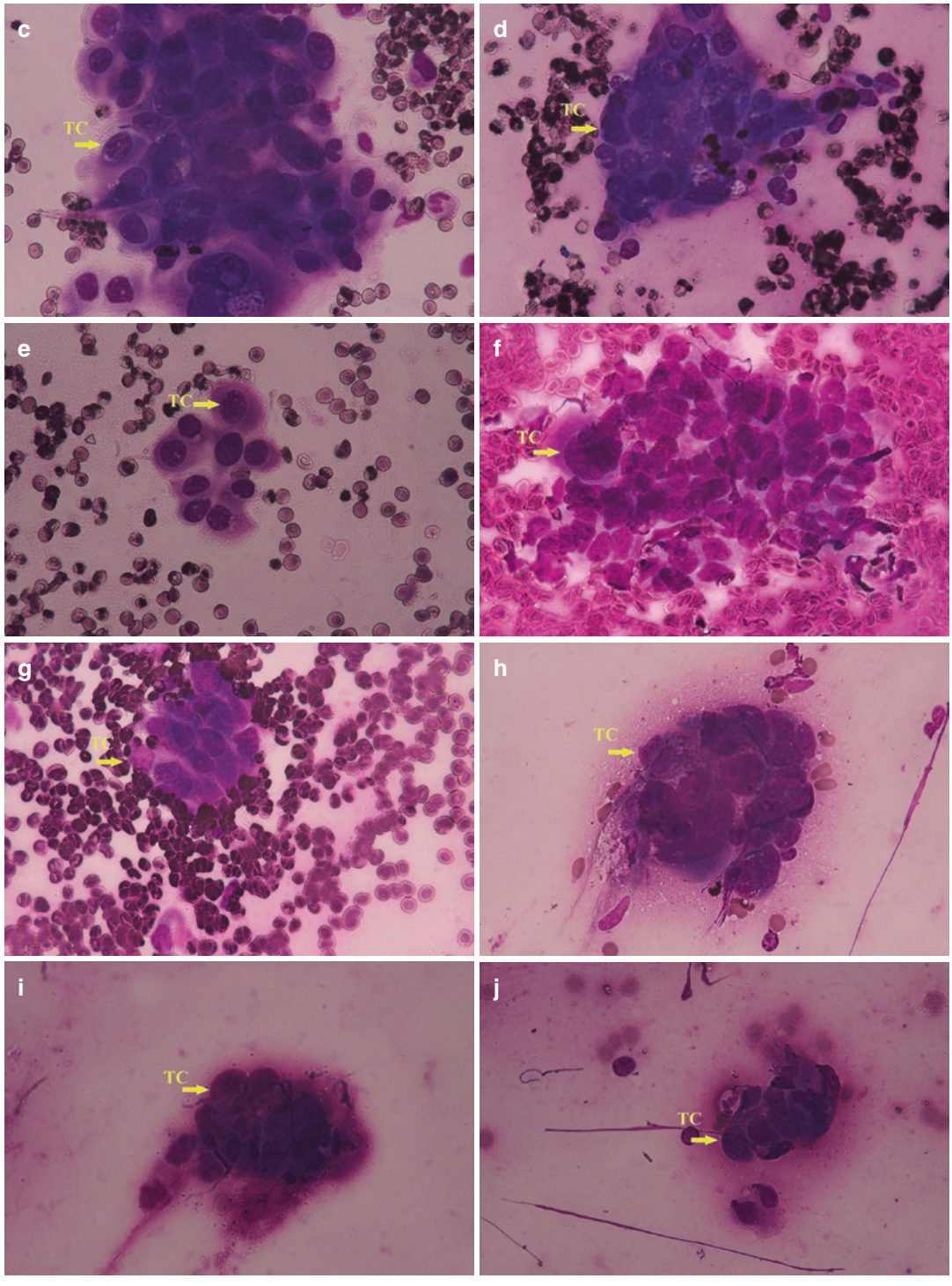
https://doi.org/10.1007/978-981-15-3910-7_3



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