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Dataset for reporting of the invasive carcinoma of the breast: recommendations from the International Collaboration on Cancer Reporting (ICCR)

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Dataset for reporting of the invasive carcinoma of the breast: recommendations from the International Collaboration on Cancer Reporting (ICCR)

Background and Objectives: Current national or regional guidelines for the pathology reporting on invasive breast cancer differ in certain aspects, resulting in divergent reporting practice and a lack of comparability of data. Here we report on a new international dataset for the pathology reporting of resection specimens with invasive cancer of the breast. The dataset was produced under the auspices of the International Collaboration on Cancer Reporting (ICCR), a global alliance of major (inter-)national pathology and cancer organizations.

Methods and Results: The established ICCR process for dataset development was followed. An international expert panel consisting of breast pathologists, a surgeon, and an oncologist prepared a draft set of core and noncore data items based on a critical review and discussion of current evidence. Commentary was provided for each data item to explain the rationale for selecting it as a core or noncore element, its clinical relevance, and to highlight potential areas of disagreement or lack of evidence, in which case a consensus position was formulated. Following international public consultation, the document was finalized and ratified, and the dataset, which includes a synoptic reporting guide, was published on the ICCR website.

Conclusions: This first international dataset for invasive cancer of the breast is intended to promote

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high-quality, standardized pathology reporting. Its widespread adoption will improve consistency of reporting, facilitate multidisciplinary communication, and enhance comparability of data, all of which will help to improve the management of invasive breast cancer patients.

Keywords: dataset, guidelines, ICCR, international, invasive carcinoma of the breast, pathology, protocol, structured report, synoptic report

Introduction

Pathology reporting on cancer resection specimens provides information that is essential to the management of the individual patient, used for clinical trials and tissue-based research, and recorded in cancer registries. Given this central role of pathology data in cancer care at an individual and population level, standardized and structured pathology reporting is essential to ensure that relevant information is complete, unambiguous, and delivered in a user-friendly format. Several organizations worldwide have independently developed datasets for pathology reporting on invasive cancer of the breast.[1–3] While these are broadly similar, differences in content, structure, and terminology may affect comparability of data between countries. Moreover, existing datasets are mainly limited to the content of the pathology report but lack guidance regarding practical aspects of the examination process that are essential for the provision of accurate data. These concerns pertain especially to the reporting on some breast cancer specimens, which can be perceived as challenging, due to the complexity of the surgical specimens and the divergence of recommendations issued by national and international organizations.

The International Collaboration on Cancer Reporting (ICCR) coordinates the production of evidence-based international pathology reporting datasets that have a consistent style and contain all the parameters needed to guide patient management. The ICCR is a collaboration of multiple pathology organizations and has alliances with international cancer organizations, including the International Agency for Research on Cancer, Union for International Cancer Control (UICC), and American Joint Committee on Cancer (AJCC). The ICCR datasets are freely available from the ICCR website (http://www.iccr-cancer.org).

Here we report on the development of the dataset for the pathology reporting of resection specimens with invasive cancer of the breast, discuss the rationale for the inclusion of data items, and propose a consensus position in areas of controversy and where there is limited evidence to assist pathologists in their diagnostic practice.

Methods

In accordance with the ICCR procedure for the development of cancer datasets, the Dataset Steering Committee (DSC) appointed a Series Champion (P.H.T.) and a Chair (I.O.E.). The responsibility of the former was to coordinate the development of a series of datasets for invasive breast cancer, ductal carcinoma *in situ*, surgically removed lymph nodes, and postneoadjuvant therapy treated breast cancer and ensure harmonization across datasets, while the Chair oversaw the development of the dataset for invasive breast cancer. Together, they identified 10 other expert breast pathologists who, together with the Chair, two clinicians, and Project Manager (F.W.), formed the Dataset Authoring Committee (DAC). The expert panel included pathologists from Australia (S.L.), Brazil (H.G.), Canada (E.S.), China (W.Y.), Europe (J.K., C.Q., A.S.), Japan (T.M.), Singapore (P.H.T), the United Kingdom (UK) (I.O.E.), and United States of America (USA) (K.H.A., S.S), and as well as a breast surgeon (M.S., UK) and oncologist (C.D., USA).

In line with other ICCR datasets, the invasive breast cancer dataset included a number of elements, categorized as core or noncore, with a reporting guide accompanied by commentary for each element. Core elements were determined based on whether they were considered essential for clinical management, staging, or prognosis and with evidentiary support at Level III-2 or above (based on prognostic factors in the National Health and Medical Research Council levels of evidence[4]). In the absence of such evidence, an element was considered to be core if there was unanimous agreement by the DAC. Noncore elements were elements categorized as lacking level III-2 evidence but were unanimously considered clinically important and part of good practice, albeit not yet sufficiently validated or regularly used in patient management.

The initial working draft of the dataset was developed by the Project Manager based on a review of all published, relevant pathology datasets and guidelines. Following editing by the Chair, the draft was circulated to the DAC and discussed in a series of teleconferences. Based on these discussions, the Chair edited the dataset and recirculated to the DAC for further review via email communications until consensus was reached. The dataset was posted on the ICCR website for open international consultation for a period of 8 weeks. The dataset was reviewed in response to feedback received, approved by the DAC, and ratified by the DSC.

Results

SCOPE

This dataset was developed for the reporting of resection specimens from patients with invasive carcinoma of the breast, with or without ductal carcinoma *in situ* (DCIS). DCIS without invasive carcinoma and microinvasive carcinoma (≤1 mm) are dealt with in a separate International Collaboration on Cancer Reporting (ICCR) dataset.[5] Ipsilateral multifocal disease should be dealt with in a single report. For bilateral invasive breast tumours, a separate dataset should be completed for each side. Surgically removed lymph nodes are dealt with in a separate ICCR dataset that may be used, as appropriate, in conjunction with this dataset.[6] Invasive breast cancer for the post-neoadjuvant setting is also dealt with in a separate ICCR dataset.[7] Phyllodes tumours and needle biopsies are not covered in this dataset.

CORE ELEMENTS

Core elements are those which are essential for the clinical management, staging, or prognosis of the cancer. These elements will either have evidentiary support at Level III-2 or above (based on prognostic factors in the National Health and Medical Research Council levels of evidence[4]). In rare circumstances, where level III-2 evidence is not available, an element may be made a core element where there is unanimous agreement in the expert committee.

The summation of all core elements is considered to be the minimum reporting standard for a specific cancer.

A summary of the core elements is outlined in Table 1 and each is described in further detail below:

Table 1. Core and noncore elements for the pathology reporting of invasive carcinoma of the breast

Core	Noncore
Clinical information	Specimen dimensions
Operative procedure	Specimen weight
Specimen laterality	Specimen details
Tumour site	
Tumour focality	Tumour focality • Number of foci • Size of individual foci
Tumour dimensions	Tumour dimensions • Additional dimensions of largest invasive focus • Maximum dimension of whole tumour field (invasive + DCIS)/total extent of disease
Histological tumour type	
Histological tumour grade	Histological tumour grade • Tubule score 1, 2, 3 • Nuclear pleomorphism 1, 2, 3 • Mitotic count per mm^2 OR • Mitotic count per 10 HPF (field diameter ____ mm) • Score 1, 2, 3 • Total score
Carcinoma *in situ*	Carcinoma *in situ* DCIS • Negative for extensive intraductal component (EIC) • Positive for EIC
Classification of carcinoma *in situ*	Classification of carcinoma *in situ* Histological architectural pattern • Cribriform • Micropapillary • Papillary • Solid • Other (e.g. clinging/flat), specify
Tumour extension	
Margin status	Margin status Invasive carcinoma • Specify extent • Distance of invasive carcinoma to other margins (< or > may be used) DCIS • Specify extent • Distance of invasive carcinoma to other margins (< or > may be used)

Table 1. (*Continued*)

Core	Noncore
Lymphovascular invasion in primary breast carcinoma	Lymphovascular invasion in primary breast carcinoma • Specify extent • Lymphovascular invasion identified elsewhere, specify
	Coexistent pathology
	Microcalcifications
Oestrogen receptor (ER)	Oestrogen receptor (ER) • Antibody clone, specify
Progesterone receptor (PR)	Progesterone receptor (PR) • Antibody clone, specify
HER2	HER2 • Antibody clone, specify By immunohistochemistry • Percentage of cells with uniform, intense, complete membrane staining By *in situ* hybridization • Number of observers • Aneusomy • Heterogeneous signals
Pathological staging	Ancillary studies

Clinical information

Provision of accurate clinical information and detail are considered important to provide context to the specimen, nature of the abnormality, its method of detection, and patient medical history. Examples of key information include past history of breast disease or cancer, prior treatment such as neoadjuvant therapy, and inherited genetic mutations such as *BRCA1* or *BRCA2*.

Operative procedure

The nature of the operation or procedure(s) performed is important to ensure appropriate pathological examination protocols are followed, and accurate clinical correlation and postoperative management discussion. The nature, extent, focality of the abnormality, and patient choice can influence the type of operation. Multiple procedures may be performed and sent as separate specimens that require cross-correlation. The forms of surgical procedure used to manage breast disease are considerable, and more specific detail of the specimen can be provided.

Partial mastectomy, lumpectomy, and quadrantectomy/segmental excision are considered synonymous with wide local excision.

Specimen laterality

Specification of the side and site in the breast is important for clinical correlation and accuracy of the patient medical record.

For bilateral invasive breast tumours, a separate dataset should be completed for each side.

Tumour site

A measure of distance from the nipple is required (core). Clock face delineation of location is a more commonly used determination of site than quadrant alone, but either is acceptable. Specification of the side and site in the breast is important for clinical correlation, postoperative management discussion, and accuracy of the patient medical record, especially when there are multiple lesions for correlation with radiology/prior biopsies.

Tumour focality

Some features relating to tumour focality are core, while others are noncore features (Table 1). The presence of a single tumour focus is the most common clinical situation, but breast cancer can present with multiple tumour foci as a consequence of a number of scenarios, including:

- Extensive DCIS with multiple associated foci of invasive carcinoma.
- A large dominant primary tumour focus with surrounding smaller satellite foci.
- In-breast metastatic deposits due to lymphovascular invasion (LVI).
- Multiple synchronous independent primary tumours, which may be of different type, grade, and receptor status (historically this form of multifocality has been classified as multicentricity).

Identification of the presence of multiple tumour foci requires further clarification through measurement of the main focus, the overall extent of disease (DCIS and invasive foci), and their type, grade, and receptor status to determine which of the above forms of multifocality is present. Ipsilateral multifocal disease, even if of different types, should be dealt with in a single report.

It can be difficult, if not impossible, on rare occasions to determine whether two adjacent foci represent satellite foci or one lesion mimicking this process due to the plane of sectioning. A practical approach is required; the presence of intervening normal tissue and increasing distance between foci are features that indicate that these are more likely to be multiple foci than a localized process. A distance of 5 mm or greater is used to define a separate focus.

Tumour dimensions

Most features relating to tumour dimensions are core, although there are some noncore features (Table 1). The size of the tumour or of the largest/dominant invasive tumour focus is a key variable required for breast cancer staging, and requires accurate assessment to the nearest mm. Histological tumour size is deemed the gold standard but should be correlated with the gross macroscopic size measurement and, where possible, with the imaging size.

On rare occasions, the tumour size is obtained from a previous core needle biopsy specimen, as the tumour in the core may be larger than the tumour in the excision specimen or the entire invasive tumour has been removed by the needle sampling procedure.

In the context of extensive surrounding DCIS and/or florid or pleomorphic lobular carcinoma *in situ* (LCIS), the total extent of the entire disease process including all invasive tumour foci and associated DCIS should be provided as the whole tumour size (Figure 1). This information is useful for clinical and radiological correlation and to assist in the determination of completeness of disease excision.

In the context of multiple invasive tumours without associated extensive DCIS, the total extent of disease can be used to indicate the total size of area involved by invasive carcinoma (Figure 2). However, for more complex tumours, such as synchronous primary carcinomas in separate quadrants, a pragmatic description of each tumour and its accompanying features will be necessary.

Where microscopic size measurement is not possible or deemed inaccurate, for example, prior needle biopsy partial removal or piecemeal resection of the tumour at single or multiple operations (Figure 3), the gross macroscopic, magnetic resonance imaging (MRI), ultrasound, mammographic, and clinical tumour size, listed here in priority sequential order, should be used.

Histological tumour type

To ensure consensus and consistency of reporting, it is recommended to use the most recent edition of the World Health Organization (WHO) Classification of Breast Tumours, 5th edition, 2019, nomenclature and definitions for diagnosis, and classification of invasive tumour type (Table 2).[8] The ICCR dataset includes 5th edition Corrigenda, September 2020.[9]

Determination of histologic type is based on routine histologic examination; special stains or immunohistochemistry (IHC) such as E-cadherin are not required for determining histologic type. Special type carcinomas should consist of at least 90% pure pattern. Therefore, classification as a pure special type cannot be determined with certainty on a limited core biopsy sample and will usually require findings in the resection.

Some invasive breast carcinomas and invasive breast carcinoma of no special type (IBC-NST) can contain a mixture of both no special type and a special subtype. If the special subtype makes up 10–90% of the cancer, the term "mixed IBC-NST and special subtype carcinoma" may be used. For this type of mixed IBC-NST and special subtype, it is recommended to report both elements present, as well as the overall percentage of the special subtype. For example, "mixed IBC-NST and invasive lobular carcinoma (30% lobular)". Cancers with <10% special subtype should be classified as IBC-NST, while cancers with >90% specialized subtype should be classified as the special subtype.

Note that the 2019 WHO classification now considers carcinoma with medullary pattern, invasive carcinoma with neuroendocrine differentiation, carcinomas with pleomorphic and choriocarcinomatous patterns, tumours with melanocytic features, oncocytic, lipid-rich, glycogen-rich, clear cell, and sebaceous carcinomas as special morphological patterns of IBC-NST.[8] These tumours are considered morphological patterns of IBC-NST regardless of the extent of differentiation/pattern, and the 90% rule for special subtype is not applied to tumours showing any of these patterns.

Where no residual invasive carcinoma is present, for example, if the invasive tumour has been removed entirely by a previous operation or biopsy sampling, the tumour characteristics identifiable in the prior diagnostic specimen should be used to fill out the synoptic report, with an explanatory note.

Histological tumour grade

Most features relating to histological tumour grade are core, although there are some noncore features (Table 1). Histological grading provides powerful prognostic information and within each stage grouping there is a relationship between histologic grade and outcome.

All invasive breast carcinomas should be graded. The Nottingham combined histologic grade (Elston-Ellis modification of Scarff-Bloom-Richardson grading system) is the recommended method.[10] It requires some commitment and strict adherence to the accepted protocol. The method involves the assessment of three components of tumour morphology: tubule/acinus/gland formation, nuclear atypia/pleomorphism, and frequency of mitoses. Each is scored from 1 to 3.

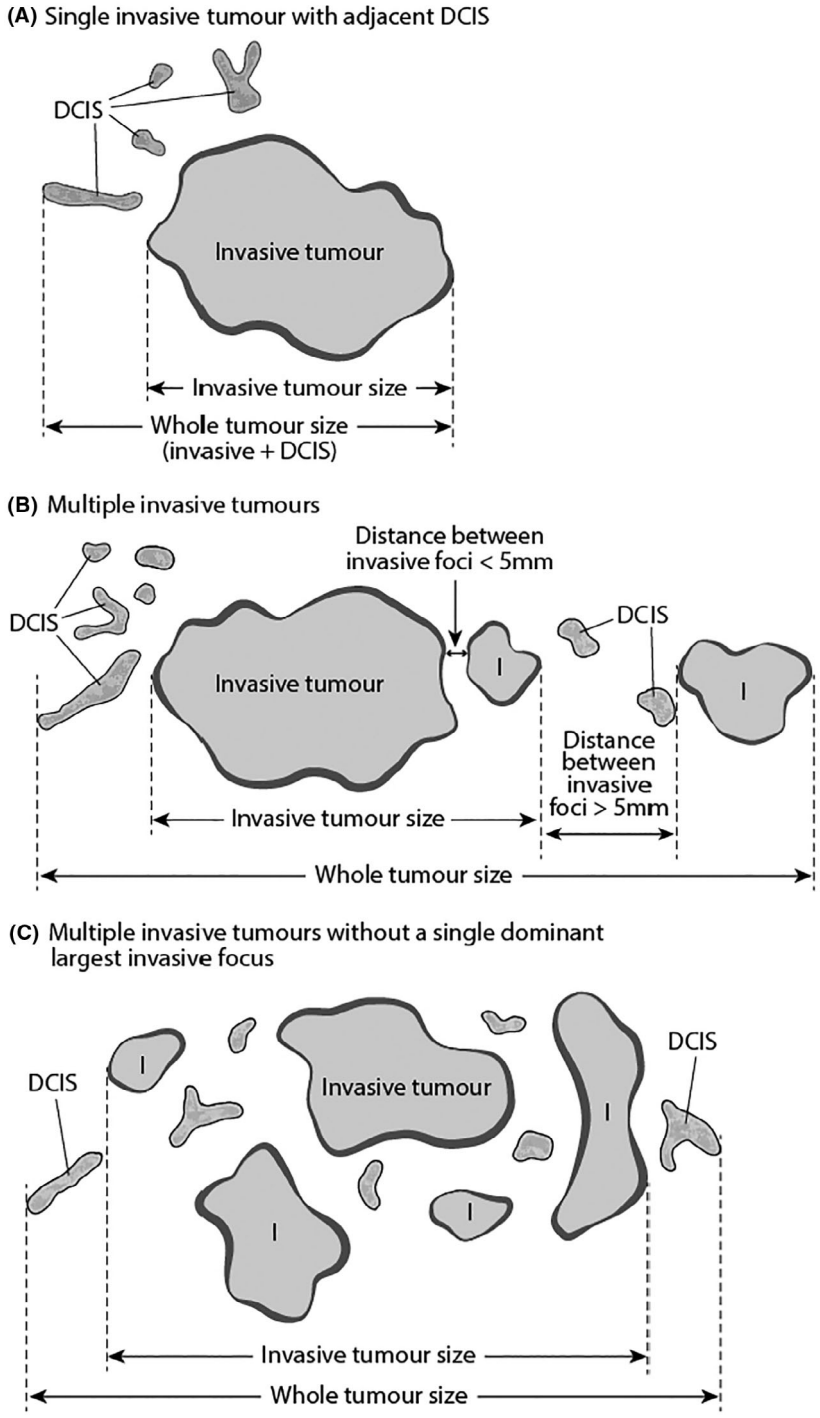

Figure 1. Invasive carcinoma with DCIS. © 2022 International Collaboration on Cancer Reporting Limited (ICCR).

Adding the scores gives the overall histological grade, as shown below. The use of terms such as well differentiated or poorly differentiated in the absence of a numerical grade is inappropriate.

Overall grade
- Grade 1 = Scores of 3–5
- Grade 2 = Scores of 6 or 7
- Grade 3 = Scores of 8 or 9.

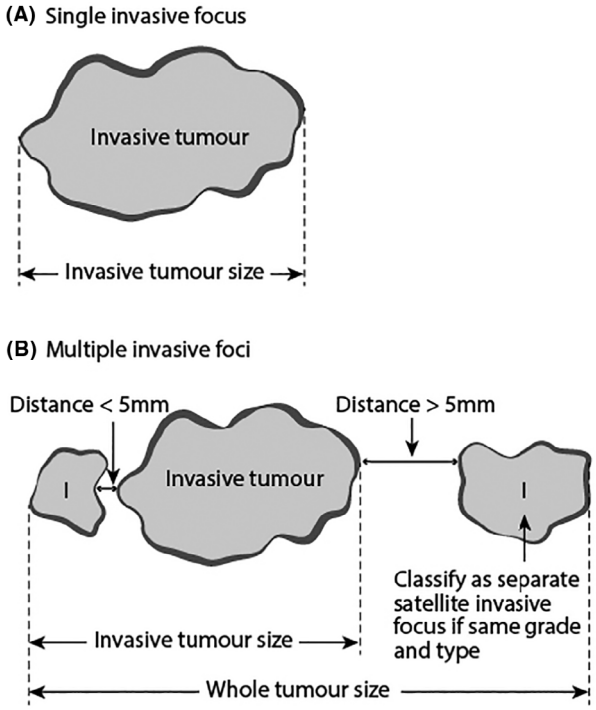

Figure 2. Invasive carcinoma without DCIS. © 2022 International Collaboration on Cancer Reporting Limited (ICCR).

Published ratios for grades 1, 2, and 3 are approximately 2:3:5 in symptomatic breast cancer, with about half of all symptomatic cancers assigned as grade 3. Screen-detected cancer series are likely to include a smaller proportion of high-grade cases. Poor fixation impairs accurate assessment of mitotic frequency, reducing their visibility, which can result in a change in grade ratios typically with a larger proportion of grade 2 cases and a lower proportion of grade 3 cases. If audit of grade distribution in symptomatic cancers shows substantially fewer grade 3 cases, or a majority of grade 2 cases, fixation and grading protocols should be reviewed.

Some degree of variation in appearance from one part of a tumour to another undoubtedly occurs; this is particularly true of tumours of mixed type. Assessment of tubular differentiation is made on the overall appearances of the tumour, and so account is taken of any variation. Nuclear appearances are evaluated at the periphery and/or least-differentiated area of the tumour to obviate differences between the growing edge and the less active centre. The mitotic score is determined by the number of mitotic figures found in representative 10 consecutive high-power fields (HPF) in the most mitotically active part of the tumour. Representative field selection is based on fields having appropriate tumour cellularity based on assessment of the overall cellularity of the tumour identified at low-magnification scanning. Fields with low or no tumour cells should not be counted. A random meander approach counting only representative fields is recommended. Only clearly identifiable mitotic figures should be counted; hyperchromatic, karyorrhectic, or apoptotic nuclei are excluded. Because of variations in field size, the HPF size must be determined for each microscope and the appropriate point score determined accordingly, which can also be designated as mitoses/mm^2 (see separate section below).

Assessment of grade on needle core biopsies. Histological grade can be assessed on core biopsies using the approach described above. This is of particular value if the patient has preoperative systemic treatment (refer to the ICCR Invasive breast cancer for the postneoadjuvant setting dataset[7]) or if grade in the surgical specimen is not assessable. There is about 70% agreement on grade between core biopsy and subsequent surgical specimen. Usually, the histological grade in the surgical specimen is used in preference to the core grade. However, if assessment of grade in the surgical specimen is compromised, for example, by poor fixation or preoperative systemic treatment, it is reasonable to use the mitotic count score in the core biopsy. Another alternative is to use the mitotic count score in nodal metastases if interpretation of grade is difficult in the primary carcinoma.

Assignment of glandular (acinar)/tubular differentiation score. All parts of the tumour are scanned, and the proportion occupied by tumour islands showing clear acinar or gland formation or defined tubular structures with a luminal space is assessed semiquantitatively. This assessment is generally carried out during the initial low-power scan of the tumour sections. A tumour in which more than 75% of its area is composed of such structures would score 1 point for gland/tubule formation. A tumour with between 75% and 10% of glandular/tumour area would score 2 points. A tumour with less than 10% gland/tubule formation would score 3 points. These rules apply to tumours with simple gland/tubule formation such as invasive tubular carcinoma, and those exhibiting complex gland formations such as invasive cribriform carcinoma.

In the assessment of gland/tubule formation, only structures in which there are clearly defined central lumens, surrounded by polarized tumour cells, should be counted. This does, however, include larger islands of tumour with central gland formation, as may be

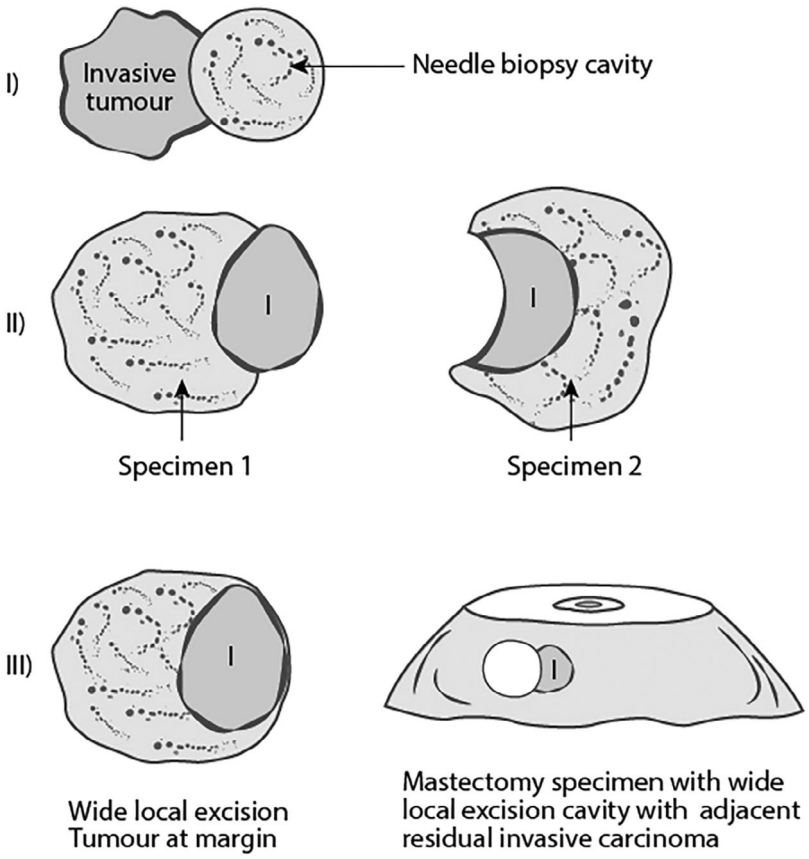

Figure 3. Piecemeal tumour resection by: (I) prior partial removal by diagnostic needle biopsy sampling; (II) same invasive tumour in two or more portions of tissue; (III) tumour resected at multiple operations. Recommendation: Do not add together the maximum tumour dimensions from each separate sample, which is likely to lead to an overestimate of true invasive tumour size. Default to imaging size, or if not available, then clinical size. © 2022 International Collaboration on Cancer Reporting Limited (ICCR).

seen in mucinous carcinoma or invasive micropapillary tumours. Thus, mucinous, micropapillary, and pure papillary tumours without, or with <10%, secondary luminal spaces, are classified as having no tubular or glandular formation and assigned a score of 3. Papillary structures are also not regarded as glandular/tubular structures. Artefactual 'false' spaces can occur as a consequence of suboptimal fixation and tissue freezing. Such spaces should be excluded from assessment.

Intracytoplasmic lumen formation (intracytoplasmic vacuoles with true luminal microvillar surface, PAS+) does not count as gland formation whatever the size of the intracytoplasmic vacuoles.

Assignment of nuclear pleomorphism score. Individual pathologists differ markedly in their approach to nuclear grading, and breast specialists appear to allocate higher grades than nonspecialists. Few cancers possess the very bland nuclei warranting an atypia/pleomorphism score of 1, and obvious atypia/pleomorphism should attract a score of 3. The minimum proportion of tumour nuclei which should show marked nuclear atypia/ pleomorphism before a score of 3 is allocated has not been defined, but the finding of an occasional enlarged or bizarre nucleus should not be used to give a score of 3 rather than a score of 2.

Assignment of mitotic frequency score. Accurate mitosis counting requires high-quality fixation, obtained when fresh specimens are sliced into promptly after surgery and fixed immediately in neutral buffered formalin. This can be achieved without compromising the evaluation of resection margins. Poor-quality fixation can result in underscoring of mitotic frequency; optimal fixation is therefore essential.

A minimum of 10 HPFs should be counted at the periphery of the tumour, where it has been demonstrated that mitotic activity is greatest on a

Table 2. Detailed invasive tumour classification based on 2019 World Health Organization classification of breast tumours subsections[8]

Descriptor	ICD-O* codes*
Invasive type for pure or mixed (include all types present if >10%)	
Main categories	
No special type	
Invasive breast carcinoma of no special type (see 'a' below)	8500/3
Special types	
Invasive lobular carcinoma (see 'b' below)	8520/3
Tubular carcinoma	8211/3
Invasive cribriform carcinoma	8201/3
Mucinous carcinoma	8480/3
Invasive micropapillary carcinoma	8507/3
Carcinoma with apocrine differentiation	8401/3
Metaplastic carcinoma (see 'c' below)	8575/3
WHO 2019 classification additional sub categories (use 'Other, specify') box	
a. NST special patterns	
None	8500/3
Present	
Medullary	
Neuroendocrine differentiation	
Pleomorphic	
Choriocarcinomatous	
Melanocytic features	
Oncocytic	8290/3
Lipid-rich	8314/3
Glycogen-rich	8315/3
Clear cell	
Sebaceous carcinomas	8410/3
b. Lobular subtype	
Classical	8520/3
Pleomorphic	
Solid	
Alveolar	
Tubulolobular	
Mixed subtypes	
c. Metaplastic carcinoma	
Low-grade adenosquamous carcinoma	8575/3
Fibromatosis-like metaplastic carcinoma	
Squamous cell carcinoma	
Spindle cell carcinoma/myoepithelial carcinoma	
Metaplastic carcinoma with mesenchymal differentiation (chondroid, osseous, other types of mesenchymal differentiation)	
Mixed metaplastic carcinoma	
d. Salivary gland-type and other rare tumours	
Mucinous cystadenocarcinoma	8470/3
Acinic cell carcinoma	8550/3
Adenoid cystic carcinoma	8200/3
Secretory carcinoma	8502/3
Mucoepidermoid carcinoma	8430/3
Polymorphous adenocarcinoma	8525/3
Tall cell carcinoma with reversed polarity	8509/3
e. Invasive papillary carcinomas	
Solid papillary carcinoma – invasive	8509/3
Invasive papillary carcinoma	8503/3
f. Neuroendocrine neoplasms	
Neuroendocrine tumour	8240/3
Neuroendocrine carcinoma	8246/3
g. Epithelial-myoepithelial tumours	
Malignant adenomyoepithelioma	8562/3

*These morphology codes are from the International Classification of Diseases for Oncology, third Edition, second revision (ICD-O-3.2). Behaviour is coded /0 for benign tumours; /1 for unspecified, borderline, or uncertain behaviour; /2 for carcinoma *in situ* and grade III intraepithelial neoplasia; /3 for malignant tumours, primary site; and /6 for malignant tumours, metastatic site. Incorporates all relevant changes from the 5th edition Corrigenda, September 2020.[9]

lower-power search. If there is variation in the number of mitoses in different areas of the tumour, the least differentiated area (i.e. with the highest mitotic count) should be assessed. If the mitotic frequency score falls very close to a score cutpoint, one or more further groups of 10 HPFs should be assessed to establish the correct (highest) score. It is recommended that identification of the most mitotically active or least-differentiated part of the tumour forms part of the low-magnification preliminary assessment of the histological section. If there is no evidence of heterogeneity, mitotic scoring can be carried out at a part of the tumour periphery chosen at random. Fields chosen for scoring are selected during a random meander along the peripheral margin of the selected tumour area. Only fields with a representative tumour burden should be used. The low-power scan of the tumour can be used to provide an assessment of the typical tumour-to-stromal ratio. Only definite mitotic figures (in any phase of the growth cycle) should be counted. Hyperchromatic nuclei and/or apoptotic nuclei should not be scored.

The mitosis score depends on the number of mitoses per 10 HPFs. The size of HPFs of modern microscopes is very variable, so it is necessary to standardize the mitotic count using Table 3. Field diameter is a function of the objective lens and the eyepiece, so if either of these is changed this exercise should be repeated. The field diameter of the microscope should be measured using the stage graticule, a Vernier scale, or one of the simplified methods detailed below. The scoring category should be assigned from the corresponding line of Table 3. Mitotic counts can also be expressed per mm^2, which may be amenable to digital microscopy assessment.[8]

Modern microscopes have an HPF area that would equate to assessment of an area of ~2 mm^2. Using Table 3 it is possible to calibrate a score for 1 mm^2, and to calibrate a digital virtual microscope viewer.

Based on the current grading methodology the cutpoints for number of mitoses identified in a tumour area of 2 mm^2 is:

- Mitotic score 1: ≤7
- Mitotic score 2: 8–14
- Mitotic score 3: ≥15.

Methods for calculation of field diameter:

1. The field diameter can be calculated simply by dividing the field number by objective magnification; for example, if the eyepieces give field number 22 when using a ×40 objective lens, the field diameter (in mm) is 22/40 = 0.55 mm.
2. Use a clear ruler to measure the diameter of a low-power field. This number can be used to

Table 3. Score categories according to field diameter, area, and mitotic count

Scoring categories of mitotic counts				
		Number of mitoses per 10 fields corresponding to		
Field diameter (mm)	Area (mm^2)	Score 1	Score 2	Score 3
0.40	0.125	≤4	5–9	≥10
0.41	0.132	≤4	5–9	≥10
0.42	0.139	≤5	6–10	≥11
0.43	0.145	≤5	6–10	≥11
0.44	0.152	≤5	6–11	≥12
0.45	0.159	≤5	6–11	≥12
0.46	0.166	≤6	7–12	≥13
0.47	0.173	≤6	7–12	≥13
0.48	0.181	≤6	7–13	≥14
0.49	0.189	≤6	7–13	≥14
0.50	0.196	≤7	8–14	≥15
0.51	0.204	≤7	8–14	≥15
0.52	0.212	≤7	8–15	≥16
0.53	0.221	≤8	9–16	≥17
0.54	0.229	≤8	9–16	≥17
0.55	0.238	≤8	9–17	≥18
0.56	0.246	≤8	9–17	≥18
0.57	0.255	≤9	10–18	≥19
0.58	0.264	≤9	10–19	≥20
0.59	0.273	≤9	10–19	≥20
0.60	0.283	≤10	11–20	≥21
0.61	0.292	≤10	11–21	≥22
0.62	0.302	≤11	12–22	≥23
0.63	0.312	≤11	12–22	≥23
0.64	0.322	≤11	12–23	≥24
0.65	0.332	≤12	13–24	≥25
0.66	0.342	≤12	13–24	≥25
0.67	0.353	≤12	13–25	≥26
0.68	0.363	≤13	14–26	≥27
0.69	0.374	≤13	14–27	≥28

Reproduced with permission from The Royal College of Pathologists (2016). *Pathology reporting of breast disease in surgical excision specimens incorporating the dataset for histological reporting of breast cancer*. The Royal College of Pathologists and National Coordinating Committee for Breast Pathology.[3]

calculate a constant based on the following formula: Eyepiece magnification × objective magnification × microscopic field diameter = a constant.

When the value of the constant is known, the diameter of an HPF can be calculated for other objectives by using the following formula: Unknown field diameter = constant/(eyepiece magnification × objective magnification).

Half of the field diameter is the radius of the field (r), which can then be used to calculate the area of the HPF: $3.1415 \times r^2$ = area of microscopic field.

3. Use of a calibrated microscope slide.

Carcinoma in situ

Most features relating to carcinoma *in situ* and classification of carcinoma *in situ* are core, although there are some noncore features (Table 1).

The presence of coexisting DCIS (and/or florid or pleomorphic LCIS) is commonplace with invasive carcinomas of the breast and forms part of the overall disease process, which requires complete surgical excision to reduce the risk of local recurrence.

Classification of DCIS and accompanying *in situ* lesions with respect to histological nuclear grade (core), the presence or absence of necrosis (core), and architectural pattern (noncore) is dealt with in the ICCR DCIS, variants of LCIS, and low-grade lesions dataset.[5] Nuclear grade of DCIS is largely determined by size and pleomorphism, although other morphologic features (see Table 4) are also of help.

Pleomorphic and florid LCIS have overlapping features with DCIS and may be treated similarly, but at present there is insufficient evidence to establish definitive recommendations for treatment. The current understanding of the natural history of pleomorphic LCIS and florid LCIS is limited, and the optimal treatment is unknown with regard to pursuing negative margins and consideration of additional adjuvant therapies. Nevertheless, although pleomorphic and florid LCIS are not currently included in the AJCC pTis classification, with classic LCIS being considered a 'benign' lesion,[11] they remain as a category in the UICC TNM 8th edition,[12] and there is emerging evidence suggesting that these forms of LCIS might be better treated as DCIS,[8,13] in particular the practice of excision to negative margins.

Tumour extension

Tumour extension to involve overlying skin or underlying skeletal muscle is a variable which influences TNM staging and should be recorded when present. It is recognized that in the context of primary operable breast cancer these phenomena are rare. The majority of cancer resection cases will be confined to the breast with no skin, nipple, or underlying skeletal muscle involvement and in this context disease extent classification is deemed noncore.

The finding of invasive carcinoma that directly invades into the dermis or epidermis without skin ulceration does not change the pT stage.

Satellite skin nodules must be separate from the primary tumour and macroscopically identified to assign a category as pT4b. Skin nodules identified only on microscopic examination and in the absence of epidermal ulceration or skin oedema (clinical peau d'orange) do not qualify as pT4b. Such tumours should be categorized based on tumour size.

The finding of tumour extension into the nipple does not change the pT classification of invasive carcinomas.

Table 4. Nuclear grade of ductal carcinoma *in situ*

Feature	Grade I (low)	Grade II (intermediate)	Grade III (high)
Pleomorphism	Monotonous (monomorphic)	Intermediate	Markedly pleomorphic
Size	1.5 to 2 × the size of a normal RBC or a normal duct epithelial cell nucleus	Intermediate	>2.5 × the size of a normal red blood cell or a normal duct epithelial cell nucleus
Chromatin	Usually diffuse, finely dispersed chromatin	Intermediate	Usually vesicular with irregular chromatin distribution
Nucleoli	Only occasional	Intermediate	Prominent, often multiple
Mitoses	Only occasional	Intermediate	May be frequent
Orientation	Polarized toward luminal spaces	Intermediate	Usually not polarized toward the luminal space

Reproduced with permission from College of American Pathologists (2021). *Protocol for the Examination of Resection Specimens From Patients With Ductal Carcinoma In Situ (DCIS) of the Breast*. College of American Pathologists.[1] RBC, red blood cell.

Invasion into the pectoralis muscle is not considered chest wall invasion, and cancers are not classified as pT4a unless there is invasion deeper than this muscle.

Margin status

Some features relating to margin status are core, although there are some noncore features (Table 1). There is an assumption that all breast tissue will be resected in patients undergoing a complete mastectomy and that pathological examination of margins is of limited value. However, there is evidence that margin involvement can increase the risk of local recurrence after mastectomy and modification of the comprehensive margin analysis and reporting recommendations for wide local excision and other similar specimens are adopted for reporting of mastectomy specimens to include a statement of the distance to the closest margin(s) or site(s) of margin involvement.

Assessment of adequacy of excision requires close correlation between the surgical excision procedure and pathological examination. In particular, it is essential that the pathologist is made aware of the depth of tissue excised and whether the surgeon has excised all the tissue from the subcutis to the pectoral fascia. Similarly, it has been recognized that involvement of a margin, particularly the posterior margin in a mastectomy specimen, should also be described, as this could result in a recommendation for further surgery or radiotherapy.

There remains some controversy regarding the minimum width of uninvolved tissue that defines 'complete' excision, although narrower margins are now more widely accepted as adequate than previously. For this reason, it is recommended that the pathologist reports the measurement to the inked margins of DCIS and invasive carcinoma rather than quoting 'complete' excision or 'not at ink' in histology reports.

Some centres find it helpful to report the approximate extent of margin involvement. The following system is recommended—this is considered a noncore feature:

- Unifocal: one focal area of carcinoma at the margin, <5 mm.
- Multifocal: two or more foci of carcinoma at the margin.
- Extensive: carcinoma present at the margin over a broad front (≥5 mm).

Lymphovascular invasion in primary breast carcinoma

Most features relating to LVI in primary breast carcinoma are core, although there are some noncore features (Table 1). The presence of LVI is an adverse feature providing independent prognostic information about both local recurrence and survival. It is therefore important to record whether or not it is present. Reporting the LVI status for stage IIA and IIB patients who have an axillary lymph node dissection may influence the use of adjuvant radiotherapy.

As it is difficult to distinguish between lymphatic and venous channels, findings should be categorized as LVI rather than define a specific channel. This is supported by evidence identifying that most tumour emboli are present in lymphatic channels.[14]

The presence of unequivocal tumour in lymphovascular spaces should be recorded. 'Indeterminate' may be used where it is equivocal or uncertain. If there is doubt about the presence of tumour in lymphovascular spaces, but it is considered to be very likely, it should be recorded as 'indeterminate'.

Useful criteria for recognition of LVI include:

- Groups of tumour cells in spaces around the main tumour mass; ensure that any spaces are lined by a rim of endothelial cells and are not fat spaces.
- The presence of adjacent channels that may be of varying sizes.
- The presence within the space of lymphocytes, erythrocytes, and/or thrombus. Note that true blood vascular involvement in the breast is rare.
- Shrinkage artefact results in nests of cells having the shape of the space in which they lie; and endothelial cells will not be seen.

The best method for assessing LVI is the use of good quality, optimally fixed and processed haematoxylin-eosin (H&E) stained sections. Immunostaining for endothelial and/or lymphoendothelial markers does not generally contribute further but could be considered for difficult critical cases. Shrinkage artefact may also involve DCIS, where the myoepithelial layer may mimic endothelial cells, and it should be recognized that both lymphatic endothelial cells and myoepithelial cells stain positively with the lymphendothelial marker podoplanin/D2-40 antibody.

One of the major problems in trying to determine whether or not tumour cells are in a vessel is shrinkage artefact, so care should be taken, wherever possible, to ensure that there is optimal tissue fixation and processing.

Only LVI identified in breast tissue associated with the primary breast carcinoma should be recorded. LVI identified elsewhere, for example, in axillary tissue, may be described but not recorded formally as LVI-positive. Perineural invasion should not be recorded as LVI. Documenting the presence of dermal

LVI is valuable because of its strong association with the clinical findings of inflammatory breast carcinoma.

There is no agreed definition of extensive LVI and no substantive evidence base. Subcategorisation of LVI as extensive or nonextensive is therefore subjective and considered optional/noncore.

Oestrogen receptor (ER)

All features relating to oestrogen receptor (ER) are core, with the exception of antibody clone specification (Table 1). Use of hormone receptor scoring systems such as Allred, Quickscore, and H score are optional (see methodology details below).

Hormone receptor status is determined primarily to identify patients who may benefit from endocrine therapy. About 75 to 80% of invasive breast cancers are positive for ER and progesterone receptor (PR), including almost all well-differentiated (grade 1) cancers and most moderately differentiated (grade 2) cancers, and studies have shown a substantial survival benefit from endocrine therapy among patients with ER-positive tumours. Receptor status is only a weak prognostic factor. Currently, ER status is used to select patients suitable for endocrine therapy. PR status has been shown to provide information on the degree of response to endocrine therapy in patients for ER-positive tumours.

Hormone receptor status. True ER-negative, PR-positive carcinomas are extremely rare, but patients with such tumours are also considered eligible for endocrine therapy.

The finding of an ER-negative, PR-positive tumour can indicate a false-negative ER assessment or a false-positive PR assessment and audit or repeat staining is recommended.

Hormone receptor status is most often determined in formalin-fixed, paraffin-embedded tissue sections by IHC. Only nuclear staining is considered positive. Single-gene expression assays are not recommended for routine use.

The American Society of Clinical Oncology (ASCO) and College of American Pathologists (CAP), The Royal College of Pathologists UK (RCPath), and The Royal College of Pathologists of Australasia (RCPA) have issued recommendations for reporting the results of IHC assays for ER and PR.[15–17] Studies using both IHC and the ligand binding assay suggest that patients with higher hormone receptor levels have a higher probability of response to endocrine therapy, but expression as low as 1% positive staining has been associated with a clinical response. As a result, the guidelines recommend classifying all cases with at least 1% positive cells as receptor-positive. For patients with low ER expression (1–10% positive cells), the decision on endocrine therapy should be based on an analysis of its risks and potential benefits.[18]

Definition of a negative result. All current guidelines recommend that carcinomas with <1% positive cells be considered negative for ER and PR.[2,3,19] In the Allred system (see Table 4), the survival of patients whose carcinomas had a score of 2 (corresponding to <1% weakly positive cells) was similar to that of patients whose carcinomas were completely negative for ER.[20] Therefore, a score of 2 was considered to be a negative result. Using the Allred or Quickscore system[21] carcinomas with <1% positive cells and intensity scores of 2 or 3 would have a total score of 3 or 4 and historically were considered positive. These are rare carcinomas, and their response to endocrine therapy has not been specifically studied. Thus, use of the Allred/Quickscore assessment methods can, in a small proportion of cases, conflict with the 1% cutpoint for positivity/negativity recommended above. It is recommended that all cases showing ≥1% of tumour cells positive should be classified as receptor positive regardless of their Allred/Quickscore. Reports should include the overall percentage of positive cells and the average intensity, regardless of whether additional scoring systems, such as Allred or H score, are also reported. All cases showing <1% of tumour cells positive should be classified as receptor negative, regardless of their Allred score.

It has become increasingly recognized that there are limited data on response to endocrine therapy in carcinomas with low-level ER expression, defined as 1–10% positive cells, although the available information currently supports possible benefit. Furthermore, recent studies of ER gene expression have shown profiles more similar to ER-negative cancers. It is recommended that these tumours remain classified as positive and considered eligible for endocrine treatment, but be designated low ER-positive.[18] The following reporting comment is recommended in ER low-positive cases, to aid in communicating the challenges and more limited data on cancers with this result: "The cancer in this sample has a low level (1–10%) of ER expression by IHC. There are limited data on the overall benefit of endocrine therapies for patients with low level (1–10%) ER expression but they currently suggest possible benefit, so patients are considered eligible for endocrine treatment. There are

data that suggest invasive cancers with these results are heterogeneous in both behaviour and biology and often have gene expression profiles more similar to ER negative cancers."

When a tumour is negative but no internal control cells are present, the pathologist must exercise judgement as to whether the assay can be interpreted as a true-negative. If there is doubt, then a recommendation to repeat on another block or specimen that contains internal controls should be made.

'Cannot be determined' is used when any issue prevents reliable interpretation of the result. This can include suboptimal specimen handling, presence of artefacts (crush or edge artefacts) making interpretation difficult, or if the analytical testing procedure failed.

Quantification of ER and PR. There is a wide range of receptor levels in cancers, as shown by the biochemical ligand binding assay and as observed with IHC. Patients whose carcinomas have higher levels have improved survival when treated with endocrine therapy. Quantification systems may use only the proportion of positive cells or may include the intensity of immunoreactivity:

- Number of positive cells: The number of positive cells can be reported as a percentage or within discrete categories.
- Intensity: Refers to the degree of nuclear positivity (i.e. pale to dark). The intensity can be affected by the amount of protein present, as well as the antibody used, the antigen retrieval system, and the detection system. In most cancers, there is heterogeneous immunoreactivity with pale to darkly positive cells present.

Two methods of quantifying ER by using both intensity and percentage of positive cells are the Allred score (Table 5) and the H score (Table 6). The two systems classify carcinomas into similar, but not identical, groups. If high-affinity antibodies are used with sensitive detection systems, most carcinomas will fall into clearly positive (score 7 or 8) or clearly negative (score 0) categories by the Allred score. A small group of carcinomas (<1% of total) show intermediate levels of immunoreactivity.

Quality assurance. There are many preanalytic, analytic, and postanalytic variables that can affect test results, and the assays must be validated to ensure their accuracy. External quality assurance proficiency testing surveys for ER and PR are invaluable tools to help ensure that assays perform as expected, and they are available from established immunocytochemistry external quality assurance (EQA) scheme providers (CAP, United Kingdom NEQAS, NordiQC, CPQA, CBQA, etc).

Table 5. Allred score* for oestrogen and progesterone receptor evaluation

Proportion score	Positive cells, %	Intensity	Intensity score
0	0	None	0
1	<1	Weak	1
2	1 to 10	Intermediate	2
3	11 to 33	Strong	3
4	34 to 66		
5	≥67		

Reproduced with permission from College of American Pathologists (2021). *Template for Reporting Results of Biomarker Testing of Specimens From Patients With Carcinoma of the Breast*. College of American Pathologists.[22]

*The Allred score combines the percentage of positive cells and the intensity of the reaction product in most of the carcinoma.[20] The two scores are added together for a final score with eight positive values. Scores of 0 and 2 are considered negative. Scores of 3 to 8 are considered positive.

Table 6. *H* score* for oestrogen and progesterone receptor evaluation

Calculation of *H* score		
Cell signal	Percentage of cells	Value multiplied
Cells with no signal		% × 0 = 0
Cells with weak signal		% × 1 =
Cells with moderate signal		% × 2 =
Cells with strong signal		% × 3 =
Total score =		

Reproduced with permission from College of American Pathologists (2021). *Template for Reporting Results of Biomarker Testing of Specimens From Patients With Carcinoma of the Breast*. College of American Pathologists.[23]

*The *H* score is determined by multiplying the percentage of cells demonstrating each intensity (scored from 0 to 3) and adding the results.[24] There are 300 possible values. In this system, <1% positive cells is considered to be a negative result.

Progesterone receptor (PR)

All features relating to PR are core, with the exception of antibody clone specification (Table 1). The value of PR in the selection of endocrine therapy in both the adjuvant and metastatic settings has not been

demonstrated and at present ER status is used to predict the benefit of endocrine therapy. Within the group of cancers that are ER-positive, PR expression levels (the percentage of stained cells) are considered a prognostic marker: cases with lower PR expression levels are associated with worse outcomes, but patients still receive benefit from endocrine therapy.

When a tumour is negative but no internal control cells are present, the pathologist must exercise judgement as to whether the assay can be interpreted as a true negative. If there is doubt, then a recommendation to repeat on another block or specimen that contains internal controls should be made.

'Cannot be determined' is used when any issue prevents reliable interpretation of the result. This can include suboptimal specimen handling, presence of artefacts (crush or edge artefacts) making interpretation difficult, or if the analytical testing procedure failed.

HER2

Most features relating to HER2 are core, although there are some noncore features (Table 1).

A subset of breast carcinomas (~15–20%) overexpress human epidermal growth factor receptor 2 (HER2; HUGO nomenclature *ERBB2*). Protein overexpression is usually due to gene amplification. Assays for gene copy number, mRNA quantity, and protein generally give similar results; gene amplification correlates with protein overexpression in about 95% of cases. In a small subset of carcinomas (probably <5%), protein overexpression may occur by different mechanisms.

Overexpression is both a prognostic and predictive factor.

HER2 status is primarily evaluated to determine patient eligibility for anti-HER2 therapy. It may also identify patients who have a greater benefit from anthracycline-based adjuvant therapy.

HER2 status can be determined in formalin-fixed, paraffin-embedded tissue by assessing protein overexpression on the membrane of tumour cells using IHC or by assessing the number of HER2 gene copies using *in situ* hybridization (ISH). When both IHC and ISH are performed on the same tumour, the results should be correlated. The most likely reason for a discrepancy is a false result of one of the assays, but in a small number of cases there may be protein overexpression without amplification, amplification without protein overexpression (especially in low-level amplification), or marked intratumoural heterogeneity.

There are many preanalytic, analytic, and postanalytic variables that can affect test results, and the assays must be validated to ensure their accuracy. External quality assurance proficiency testing is essential to ensure accurate performance of testing. EQA HER2 surveys are available from established EQA scheme providers.

It is recommended that testing and scoring be carried out according to recommendations made by professional bodies including ASCO, CAP, RCPath, and RCPA.[3,25,26]

The majority of laboratories worldwide use first-line IHC testing with reflex ISH gene assessment for borderline 2+ cases only.

Differences in recommendations for positive versus negative classification of some ISH results have emerged recently relating to HER2 gene/chromosome 17/ratio and HER2 gene copy number findings. As the ASCO/CAP[25] recommendations on reporting results of HER2 testing by ISH are not universally adopted, it is recommended that laboratories follow the recommendations pertinent to their geographic location.

Pathological staging

The Tumour Node Metastasis (TNM) system of the UICC is recommended.[12]

Pathologic classification. Additional descriptors can be used:

The suffix 'm' indicates the presence of multiple primary tumours in a single site and is recorded in parentheses, e.g. pT(m) NM.

The 'r' prefix indicates a recurrent tumour when staging is carried out after a documented disease-free interval.

Pathological T (pT): Histological assessment of the primary tumour (pT) generally is based on the largest invasive tumour focus. See TUMOUR DIMENSIONS for methodology details.

NONCORE ELEMENTS

The ICCR adopts a policy that key information other than that which is essential for clinical management, staging, or prognosis of the cancer such as macroscopic observations and interpretation, which are fundamental to the histological diagnosis and conclusion, e.g. macroscopic tumour details, may be included as either core or noncore elements by consensus of the Dataset Authoring Committee. Noncore elements are those that are unanimously agreed should be included in the dataset but are not supported by level III-2 evidence. These elements may be clinically important and recommended as good

practice but are not yet validated or regularly used in patient management. A summary of the noncore elements is outlined in Table 1 and each is described below:

Specimen dimensions
It is usual for specimens to be measured in three dimensions with documentation.

Specimen weight
It is usual for specimens to be weighed with documentation.

Specimen details
It is usual for specimen type or nature to be documented.

Tumour focality
Some features relating to tumour focality are noncore (Table 1). These include number and sizes of individual foci for multifocal tumours.

Tumour dimensions
Most features relating to tumour dimensions are core, while some are noncore (Table 1).

Histological tumour grade
Most features relating to histological tumour grade are core, although there are some noncore features (Table 1).

Carcinoma in situ
It is recognized that the term "Extensive Intraductal Component" (EIC) has different definitions in different countries and centres. Most refer to either a substantial volume of DCIS within the invasive carcinoma and/or substantial DCIS quantity beyond the limits of the invasive cancer. No preferred definition is provided, as there is a limited evidence base for each of these proffered definitions, with no international consensus. For this reason, subcategorisation as EIC is deemed noncore and its use is optional.

Classification of carcinoma in situ
Classification of DCIS and accompanying *in situ* lesions with respect to architectural pattern is noncore and is dealt with in the ICCR DCIS, variants of LCIS and low-grade lesions dataset.[5]

Margin status
Some fatures relating to margin status are noncore (Table 1).

Lymphovascular invasion in primary breast carcinoma
Some features relating to LVI are noncore (Table 1). These include extent and LVI identified elsewhere.

Coexistent pathology
In some situations, inclusion of coexisting conditions can be considered beneficial if this supports clinicopathological correlation or patient management. Examples include microcalcification detected mammographically and extension into or involvement of a benign lesion such as a sclerosing lesion, papillary lesion, or fibroepithelial lesion. An exhaustive description of all coexisting conditions is not required.

Microcalcifications
DCIS found in biopsies performed for microcalcifications will almost always be at the site of the microcalcifications or in close proximity.[27,28] Some of these lesions may also include an invasive component.

The pathologist must be satisfied that the specimen has been sampled in such a way that the lesion responsible for the microcalcifications has been examined microscopically. The presence of the targeted microcalcifications in the specimen can be confirmed by specimen radiography. The relationship of the radiologic microcalcifications to the DCIS should be indicated.

Oestrogen receptor (ER)
Antibody clone specification is the only noncore feature of this element (Table 1).

Progesterone receptor (PR)
Antibody clone specification is the only noncore feature of this element (Table 1).

HER2
Most features relating to HER2 are core, although there are some noncore features (Table 1).

Ancillary studies
The results of any additional ancillary studies, such as multigene test results, when performed are recommended to be included or added subsequently to the pathology report, to ensure a record of all assays performed on the case in a single comprehensive report.

Ki-67 is a nuclear protein found in all phases of the cell cycle and is a marker of cell proliferation. The percentage of Ki-67 positive tumour cells determined by IHC has been used to stratify patients into good and poor prognostic groups, but there is a lack of consensus on scoring, definition of low versus high expression, an

appropriate cutpoint for positivity, or which part of the tumour should be scored (e.g. leading edge, hot spots, overall average). There is also a paucity of data on the effects of preanalytic variables (e.g. ischaemic time, length of fixation, antigen retrieval) on Ki-67 staining. For these reasons, routine testing of breast cancers for Ki-67 expression is not currently recommended or deemed required by organizations such as the ASCO, National Comprehensive Cancer Network (NCCN), and RCPath. However, it is recognized that Ki-67 testing is routine in some countries. International collaborative efforts aim to develop standardized validated staining and scoring methodology, which may lead to more widespread adoption.[29–31]

Other tests may become relevant in classification of some forms of breast cancer and the results of these assays, when performed, should be included in the report. For example, tumour-infiltrating lymphocyte (TIL) assessment is gaining importance as a prognostic and predictive marker. High numbers of TILs are associated with better outcome and better response to neoadjuvant therapy in triple-negative (ER, PR, and HER2 negative) and HER2-positive breast carcinomas. It is recommended to follow the international consensus scoring recommendations for quantifying TILs.[32]

Discussion

It is well established that structured pathology reporting ensures that data are complete and leads to better multidisciplinary communication, greater clinician satisfaction, and easier data extraction by cancer registries.[33] Currently, several national datasets and reporting checklists exist for invasive breast cancer. However, they show some differences and lack guidance on key aspects of pathology examination that may reduce international comparability of data. Here we describe the development of the first internationally agreed dataset for the reporting of resection specimens with invasive cancer of the breast. To promote widespread uptake with the aim of improving the quality of invasive breast cancer reporting globally, the dataset and structured reporting template are freely available at the ICCR website.

The process of developing the dataset revealed divergent practice related to a number of core data elements, the cause of which is essentially a lack of evidence. Particularly, the use of neoadjuvant chemo(radio)therapy as part of the standard treatment for breast cancer has resulted in areas of uncertainty, especially those related to the evaluation of tumour size, margin status, and treatment effect. For this reason, it was agreed to deal with postneoadjuvant therapy invasive breast cancer specimens in a separate standalone document. This illustrates the need for research that focuses on concrete diagnostic challenges, as well as the importance of regular review of the dataset to align routine pathology reporting with ongoing developments in breast cancer care. Last, but not least, worldwide standardized reporting will allow the establishment of benchmarking metrics that define good practice. While this is an essential part of the quality assessment in diagnostic pathology more generally, it is currently inadequate for the reporting of invasive breast cancer.

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Author contributions

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Conflict of interest

None.

Data availability statement

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

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