BONE MARROW SPECIMEN (ASPIRATE AND TREPHINE BIOPSY) STRUCTURED REPORTING PROTOCOL

(1st Edition 2014)

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Contents

Scope

This protocol contains standards and guidelines for the preparation of structured reports for bone marrow (aspirate and trephine biopsy) specimens. The protocol does not provide comprehensive information about bone marrow collection or technical aspects of staining and processing. The level of detail required in a bone marrow report will vary with the indication for which it has been performed, as will the requirement for additional testing including flow cytometry, cytogenetics and molecular testing. The overall objective of a structured bone marrow report is to synthesise all of the available relevant clinical information, the blood film and bone marrow findings into an easily comprehensible report that facilitates accurate classification and ensures that appropriate information is provided to aid in the provision of appropriate therapy to the patient.

Structured reporting aims to improve the completeness and usability of pathology reports for clinicians, and improve decision support for cancer treatment.

Abbreviations

AJCC	American Joint Committee on Cancer
EPG	Electrophoresis
IEPG	Immunoelectrophoresis
ICD-O-3	International Classification of Diseases for Oncology
LIS	Laboratory information systems
RCPA	Royal College of Pathologists of Australasia
WHO	World Health Organization

Definitions

The table below provides definitions for general or technical terms used in this protocol. Readers should take particular note of the definitions for ‘standard’, ‘guideline’ and ‘commentary’, because these form the basis of the protocol.

Additional study	An additional study is any pathology investigation that may form part of a cancer pathology report but is not part of routine histological assessment.
Clinical information	Patient information required to inform pathological assessment, usually provided with the specimen request form. Also referred to as ‘pretest information’.
Commentary	Commentary is text, diagrams or photographs that clarify the standards (see below) and guidelines (see below), provide examples and help with interpretation, where necessary (not every standard or guideline has commentary). Commentary is used to: • define the way an item should be reported, to foster reproducibility • explain why an item is included (e.g. how does the item assist with clinical management or prognosis of the specific cancer). • cite published evidence in support of the standard or guideline • clearly state any exceptions to a standard or guideline. In this document, commentary is prefixed with ‘CS’ (for commentary on a standard) or ‘CG’ (for commentary on a guideline), numbered to be consistent with the relevant standard or guideline, and with sequential alphabetic lettering within each set of commentaries (eg CS1.01a, CG2.05b).
General commentary	General commentary is text that is not associated with a specific standard or guideline. It is used: • to provide a brief introduction to a chapter, if necessary • for items that are not standards or guidelines but are included in the protocol as items of potential importance, for which there is currently insufficient evidence to recommend their inclusion. (Note: in future reviews of protocols, such items may be reclassified as either standards or guidelines, in line with diagnostic and prognostic advances, following evidentiary review).

Guideline	Guidelines are recommendations; they are not mandatory, as indicated by the use of the word 'should'. Guidelines cover items that are not essential for clinical management, staging or prognosis of a cancer, but are recommended. Guidelines include key observational and interpretative findings that are fundamental to the diagnosis and conclusion. Such findings are essential from a clinical governance perspective, because they provide a clear, evidentiary decision-making trail. Guidelines are not used for research items. In this document, guidelines are prefixed with 'G' and numbered consecutively within each chapter (eg G1.10).
Predictive factor	A *predictive factor* is a measurement that is associated with response or lack of response to a particular therapy.
Prognostic factor	A *prognostic factor* is a measurement that is associated with clinical outcome in the absence of therapy or with the application of a standard therapy. It can be thought of as a measure of the natural history of the disease.
Macroscopic findings	Measurements, or assessment of a biopsy specimen made by the unaided eye.
Microscopic findings	In this document, the term 'microscopic findings' refers to histo-morphological assessment.
Standard	Standards are mandatory, as indicated by the use of the term 'must'. Their use is reserved for core items essential for the clinical management, staging or prognosis of the cancer and key information (including observations and interpretation) which is fundamental to the diagnosis and conclusion. These elements must be recorded and at the discretion of the pathologist included in the pathology report according to the needs of the recipient of the report. The summation of all standards represents the minimum dataset for the cancer. In this document, standards are prefixed with 'S' and numbered consecutively within each chapter (eg **S1.02**).
Structured report	A report format which utilizes standard headings, definitions and nomenclature with required information.
Synoptic report	A structured report in condensed form (as a synopsis or précis).

Synthesis

Synthesis is the process in which two or more pre-existing elements are combined, resulting in the formation of something new.

The Oxford dictionary defines synthesis as “the combination of components or elements to form a connected whole”.

In the context of structured pathology reporting, synthesis represents the integration and interpretation of information from two or more modalities to derive new information.

Introduction

Bone Marrow Aspirate and Trephine Biopsy

Benefits of structured reporting

The traditional narrative style used in the histopathological reporting of cancer, in the face of ever-increasing numbers of pathological parameters required for inclusion in a clinically relevant histopathology report, may lead to the omission of critical information necessary for patient management. This has long been recognised[1-3] and has led to the promulgation of minimum datasets[4,5] or comprehensive checklists for the reporting of cancer at virtually all anatomical sites.[6,7] While minimum datasets and checklists are accepted as essential tools for adequate reporting, the presentation of the large amount of information in a user-friendly and useful manner is key. The structured report is a logical extension of minimum datasets and reporting checklists in anatomical pathology. It has already been shown in other organ systems that structured reporting improves the quality and uniformity of information provided in the pathology report.[8-11] Further, accreditation of cancer centres in the United States since January 2004 is linked to the provision of data in pathology reports deemed essential by the College of American Pathologists.[12,13] This approach is readily applicable to the field of haematopathology.[14,15]

Design of this protocol

This protocol defines the relevant information to be assessed and recorded in a pathology report for bone marrow biopsies, but it is sufficiently flexible to allow for recording of diagnostic uncertainty or nuance. Mandatory elements (standards) are differentiated from those that are not mandatory but are recommended (guidelines). Also, items suited to tick boxes are distinguished from more complex elements requiring free text or narrative. The structure provided by the following chapters, headings and subheadings describes the elements of information and their groupings, but does not necessarily represent the format of either a pathology report (Chapter 7) or checklist (Chapter 6). These, and the structured pathology request form (Appendix 1) are templates that represent information from this protocol, organised and formatted differently to suit different purposes.

Key documentation

- *ICSH guidelines for the standardization of bone marrow specimens and reports, Int. Jnl. Lab. Hem. 2008, 30, 349–364*[16]
- *Guidelines for Authors of Structured Cancer Pathology Reporting Protocols, Royal College of Pathologists of Australasia*[17]
- *AJCC Cancer Staging Manual*, 7th edition, American Joint Committee on Cancer 2010[18]
- *The Pathology Request-Test-Report Cycle — Guidelines for Requesters and Pathology Providers,* Royal College of Pathologists of Australasia, 2004[19]
- *WHO Classification of Tumours of Haematopoietic and Lymphoid Tissues*, 4th edition, World Health Organization Classification of Tumours 2008[20]

Changes since the last edition

Not applicable.

Authority and development

This section provides details of the committee involved in developing this protocol and the process by which it was developed.

Protocol developers

This protocol was developed by an expert committee, with assistance from relevant stakeholders.

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Stakeholders

ACT Health
Anatomical Pathology Advisory Committee (APAC)
Australian Association of Pathology Practices Inc (AAPP)
Australian Blood Cancer Registry (ABCR)
Australian Cancer Network
Australian Commission on Safety and Quality in Health Care
Cancer Australia
Cancer Council ACT
Cancer Council NSW
Cancer Council Queensland
Cancer Council SA
Cancer Council Tasmania

Cancer Council Victoria
Cancer Council Western Australia
Cancer Institute NSW
Cancer Services Advisory Committee (CanSAC)
Cancer specific expert groups – engaged in the development of the protocols
Clinical Oncology Society of Australia (COSA)
Department of Health
Health Informatics Society of Australia (HISA)
Independent Review Group of Pathologists
Medical Software Industry Association (MSIA)
National Coalition of Public Pathology (NCOPP)
National E-Health Transition Authority (NEHTA)
National Pathology Accreditation Advisory Council (NPAAC)
National Round Table Working Party for Structured Pathology Reporting of Cancer.
New Zealand Guidelines Group (NZGG)
NSW Department of Health
The Australasian Leukaemia and Lymphoma Group (ALLG)
The Haematology Society of Australia & New Zealand (HSANZ)
The Royal Australasian College of Surgeons (RACS)
The Royal Australian and New Zealand College of Radiologists (RANZCR)
The Royal College of Pathologists of Australasia (RCPA)

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Development process

This protocol has been developed following the seven-step process set out in *Guidelines for Authors of Structured Cancer Pathology Reporting Protocols*[17]

Where no reference is provided, the authority is the consensus of the expert group.

1 Pre-analytical

This chapter relates to information that should be recorded on receipt of the specimen in the laboratory.

Clinical information is a prerequisite for accurate diagnosis. Some of this information may be received in generic pathology request forms; however, the additional information required by the haematologists and / or pathologist specifically for the reporting of Bone Marrow specimens is outlined in Appendix 1. Appendix 1 also includes a standardised request information sheet that may be useful in obtaining all relevant information from the requestor**.**

Collection procedures affect the quality of the specimen and recommendations for appropriate collection are included in Appendix 1.

S1.01 All demographic information provided on the request form and with the specimen must be recorded.

CS1.01a The Royal College of Pathologists of Australasia (RCPA) *The Pathology Request-Test-Report Cycle — Guidelines for Requesters and Pathology Providers* must be adhered to.[19] This document specifies the minimum information to be provided by the requesting clinician for any pathology test.

CS1.01b The patient's ethnicity must be recorded, if known. In particular whether the patient is of aboriginal or Torres Strait islander origin. This is in support of a government initiative to monitor the health of indigenous Australians particularly in relation to cancer.

CS1.01c The patient's health identifiers should include the patient's Medical Record Number as well as a national health number such as a patient's Medicare number (Australia), Individual Healthcare Identifier (IHI) (Australia) or the National Healthcare Identifier (New Zealand).

S1.02 All clinical information as documented on the request form must be recorded.

CS1.02a The request information may be recorded as a single text (narrative) field or it may be recorded as discrete fields.

S1.03 The pathology accession number of the specimen must be recorded.

S1.04 The principal clinician involved in the patient's care and responsible for investigating the patient must be recorded with their contact details.

CS1.04a Knowledge of the clinical presentation is an essential part of the WHO classification yet it may not be available for a number of reasons:

- The clinical assessment and staging may be incomplete at the time of specimen collection.
- The pathology request is often authored by the clinician performing the biopsy rather than the clinician who is investigating and managing the patient.

- The identity of this clinician is often not indicated on the pathology request form.

In practice therefore, it is important in such cases that the reporting pathologist should be able to communicate with the managing clinician for clarification.

CS1.04b For Australia sites, the Australian Healthcare identifiers i.e. Healthcare Provider Identifier - Individual (HPI-I) and Healthcare Provider Identifier - Organisation (HPI-O) should be included, where possible, to identify the principal clinician involved in the patient's care.

G1.01 Any relevant clinical information received in other communications from the requestor or other clinician should be recorded.

2 Specimen collection and handling

This chapter relates to the procedures required after the request has been received in the laboratory.

Collection requirements

- A patient assessment should be undertaken.
  - The operator should make an assessment of the fitness of the patient for the procedure. This will include an assessment based on a blood count and bleeding risk and the need for a platelet transfusion or reversal of anticoagulation.
  - An assessment of comorbidities should be obtained, and this may influence decisions regarding the site from which the biopsy is performed and the chosen method of analgesia/sedation.
  - The site of the procedure should be chosen on the basis of the age and mobility of the patient, and specific enquiry should be made regarding prior radiotherapy to a proposed biopsy site, including the dose and field of radiation.
- Appropriate consent should be obtained.
  - The patient or guardian must provide written consent for the procedure to be undertaken, and must be provided with sufficient information (verbally and/or in writing) to allow him or her to understand the risks and likely benefits associated with a bone marrow biopsy. The patient should have an understanding of the procedure itself, and the methods used to provide analgesia/sedation.
  - Information should be provided to the patient verbally and in writing regarding the care of the site after biopsy and expected levels of pain. The patient should be given instructions regarding whether or not he or she will be able to work or drive following the procedure, and these instructions should be provided in a timely manner to allow the patient to make appropriate arrangements.
  - Where a patient is not fluent in English, an interpreter should be used to ensure that informed consent and patient information is communicated in a language in which he or she is fluent. If the patient is awake for the procedure, the patient and operator must be able to communicate, and this may require the presence of an interpreter. A professional interpreter should be engaged where possible.
  - Specific consent should be obtained for the use of specimens for non-diagnostic procedures such as research, tissue banking, education or quality assurance according to local guidelines and following review by the local Ethics Committee.
- A recent blood count and film should be available.
  - The bone marrow biopsy is interpreted together with a recent blood film (48hr), and the operator should ensure that a recent blood count and film are available. In specific instances, such as the assessment of plasma cell dyscrasia, further laboratory information such as a protein

EPG/IEPG will assist in reporting.

Undertaking the Procedure

- The preferred anatomic site for bone marrow aspiration and biopsy is the posterior iliac crest. Alternative sites are the anterior iliac crest that may be used in immobile patients or where previous posterior field radiotherapy (>25Gy) is a relative contraindication or if more appropriate while the medial surface of the tibia can be used in infants.

- A sternal aspirate may be appropriate if the patient has received radiotherapy to the pelvis or if the aspirate from the iliac crest has yielded a dry tap or where the iliac crest is inaccessible. Sternal aspiration should only be performed by an experienced operator aware of the specific anatomical risks of this procedure, and should usually not be performed where bone resorption may have destroyed the bony cortex (such as in multiple myeloma). A trephine biopsy must never be attempted from the sternum.

- Occasionally, bone marrow biopsy may be performed based on the identification of a focal lesion by diagnostic imaging.

- The aspirate is usually performed first. The trephine biopsy should be performed through the same incision, but slightly away from the aspirate bone cortical puncture site to avoid obtaining a damaged or haemorrhagic trephine biopsy.

- Further discussion regarding details of performing the procedure and sedation is outside the scope of this document. Aspirate slides should be prepared from the first draw of marrow and prepared at the bedside, preferably from marrow free of anticoagulant; at least six smear and two squash slides and imprints are recommended. Additional aspirate may be placed in an appropriate concentration of EDTA to provide material for further smears if required. These should be prepared within two hours. Marrow for other investigations such as cytogenetic examination, flow cytometry, molecular studies, microbiological culture and tissue banking should be placed in tubes containing solutions according to local guidelines. Several smear slides and trephine imprints should be left unstained for possible further investigations (such as immunostains, cytochemistry, FISH or DNA extractions). Slides must be labelled at the bedside with appropriate patient identifiers and date.

- All aspirate tubes should be labelled as bone marrow.

- Aspirate clot sections may be made in the event of an inadequate aspirate, particularly if a trephine biopsy is not taken. These do not require decalcification and can be used to assess marrow cellularity, megakaryocyte morphology or tumour infiltrates, and can also be used for immunohistochemistry or FISH.

- The bone marrow trephine biopsy is generally performed after the aspirate. The length of the core from an adult should optimally be 2cm, particularly if there is suspicion of focal infiltration. A shorter core may contain sufficient diagnostic information, but the larger the amount of tissue biopsied, the greater is the likelihood of detection of a focal lesion. Trephine imprints should be prepared routinely.

- The core specimen should be placed into a container with the appropriate fixative. The container must be labelled at the bedside with the patient

surname, first name, unique patient identifier and date and time of collection.

Slide Preparation

- A Working Party for the Standardization of Bone Marrow Specimens and Reports was formed by the International Council for Standardization in Hematology (ICSH) to prepare a set of guidelines based on preferred best practices[16] and details regarding the techniques for obtaining bone marrow aspirates and trephine biopsies and preparing them for examination are available in that publication.

- In brief, aspirate slides should be stained with fresh acetone-free absolute methanol and stained with a Romanowsky stain, such as May-Grunwald Giemsa (MGG). If required, a methanol-fixed smear and/or a squash slide should be stained with Prussian Blue and counterstained with Safranin-O or Kernecht Red with an appropriate control slide for comparison. All bone marrow smears should be coverslipped. After staining, a permanent label should be affixed to the slide with the patient's identity details, episode number and date of collection.

- Trephine core biopsy or aspirate clot samples are commonly fixed in neutral buffered formalin,[16] although some laboratories use a variety of other fixatives. Individual laboratories need to weigh the pros and cons of each fixative and decalcification method. Morphology has improved clarity with B5 (mercuric chloride, sodium acetate & formalin), AZF (acetic acid-zinc-formalin) and Bouin's solution (picric acid, acetic acid & formaldehyde), however DNA is not extractable using these fixatives while immunohistochemistry may require separate and specific laboratory methods on trephines compared to formalin fixed tissues. After decalcification, the biopsy specimen is embedded in paraffin wax and sections cut on a microtome at a recommended thickness of 2 to 3 microns. Trephine biopsies may also be embedded in plastic for the evaluation of metabolic bone disease and histochemical reactions that are adversely affected by decalcification. Trephine slides should be labelled with the patient surname and first name, a unique identifier and the date of collection.

- Trephine biopsy sections should be stained with haematoxylin and eosin. One section may be stained for reticulin by the silver impregnation (e.g. Gordon & Sweet or Gomori) method, if clinically or histologically appropriate.

Record of Procedure

S2.01 The date of bone marrow specimen collection must be recorded.

S2.02 The identity of the bone marrow specimen operator must be recorded.

CS2.02a It is not essential that this information be included in the final report. However, the information must be readily available in the event that it is required.

S2.03 The anatomical site (including the side) of the aspirate/biopsy must be reported.

CS2.03a Bone marrow specimens are generally obtained from the posterior iliac crest, with biopsies less commonly performed from the anterior iliac crest or aspirates (but not trephine biopsies) from sternum.

G2.01 The ease/difficulty of the aspiration should be described.

G2.02 If used, the method and level (including dose) of sedation should be recorded.

S2.04 The specimen types and slides available for examination must be reported.

CS2.04a The following should be reported unless unavailable:

- Peripheral blood smear
- Aspirate – smear, squash and/or trephine imprint
- Trephine biopsy

CS2.04b A peripheral blood count and smear stained with a Romanowsky stain should always be reviewed in conjunction with the bone marrow aspirate and trephine biopsy. The blood count should ideally have been collected within 48 hours of the bone marrow specimen collection, but the acceptable time lag between the blood count and marrow will vary depending on the indication for the procedure.

S2.05 Additional tests performed on the bone marrow must be listed. The distribution of material for research purposes and tissue banking must be recorded.

G2.03 A descriptive or narrative field should be provided to record any relevant information that is not recorded in the above standards and guidelines.

Peripheral Blood Count and Film

S2.06 The results of the most recent blood count must be reported.

CS2.06a This should include results for haemoglobin, MCV, total and differential white cell count (neutrophils, eosinophils, basophils, monocytes, lymphocytes, and any abnormal cells) and platelet count.

CS2.06b Any relevant features of the blood film should be included. The date of the blood count should be recorded.

3 Morphological findings

This section relates to purely morphological assessment. Reporting of additional testing such as cytogenetics is described in Chapter 4.

Bone Marrow Aspirate

S3.01 The cellularity of particles and trails and any imprints must be reported.

CS3.01a Cellularity of particles and trails may be reported separately if discordant.

CS3.01b Cellularity should be reported as :

- Acellular
- Hypocellular: Reduced with regard to the patient's age
- Normocellular: Normal for the patient's age
- Hypercellular: Increased with regard to the patient's age

The degree of hyper- and hypocellularity may be graded as mild, moderate or marked.

CS3.01c The bone marrow smear and squash preparations should be viewed under low power magnification (x4 and x10 objectives) to determine the number and cellularity of particles, the number of megakaryocytes and to scan for clumps of abnormal cells and for abnormal cells of low incidence. Areas of well-spread marrow in the cellular trails of the bone marrow smear behind the particles should be selected for morphological assessment at higher magnification. The squash preparation may additionally be used for megakaryocyte numbers and focal infiltration and for the detection of abnormal cells of low incidence such as mast cells.

If an aspirate cannot be obtained even after repeated attempts with repositioning of the needle, the sample should be reported as a "dry tap"."When no particles are identified and there are peripheral blood elements only, the sample should be reported as a "blood tap" The bone marrow trephine imprint should therefore be reported, as per the bone marrow aspirate.

When particles are not present, but mature haematopoietic precursors are seen, the sample should be reported as a haemodilute marrow sample. If there are insufficient cells for a quantitative assessment, a qualitative assessment can be made.

S3.02 A nucleated cell differential count must be reported unless it is a blood tap.

CS3.02a A nucleated cell differential count should be performed to compare the proportion of cell lineages, to evaluate the maturity of cells in each lineage, and to quantify any abnormal cells if present. The differential count should be performed in the trails of

the smear behind particles where cells are well dispersed with good cytological detail and where there are the least number of lysed cells.

CS3.02b The total number of nucleated cells counted must be stated. Statistical sampling error is reduced when more cells are enumerated.[21,22] Where the percentage of abnormal cells is critical to decision-making, at least 500 nucleated cells must be counted, including at least two particles preferably on separate slides. In other cases, 300 nucleated cell differential is recommended. Cells to be included in the differential are blast cells, promyelocytes, myelocytes, metamyelocytes, band forms, segmented neutrophils, eosinophils and precursors, basophils and precursors, promonocytes, monocytes, lymphocytes, plasma cells and erythroblasts. The nucleated cell differential count should not include megakaryocytes, macrophages, osteoblasts, osteoclasts, stromal cells, smudged cells or non-haematopoietic cells such as metastatic tumour cells. The counts obtained should be compared with published normal ranges in adults[23,24] or in infants and children.[25,26]

CS3.02c A statement should be made about the presence of lymphoid aggregates, if seen. These should not be included in the differential count.

CS3.02d The myeloid-erythroid (M:E) ratio should be calculated by expressing the ratio of all cells of the granulocytic lineage and monocytes to erythroblasts (at all stages of differentiation). Flow cytometric differential counts should not be used as a surrogate for morphological examination of the smear.

S3.03 The status of erythropoiesis must be reported.

CS3.03a A description of erythroid cellularity should be included.

Cellularity should be reported as :

- Absent
- Reduced (mild to marked)
- Normal
- Increased (mild to marked)

CS3.03b A statement should be made regarding whether erythroid cells are normoblastic, megaloblastic (nuclear-cytoplasmic asynchrony) or dyserythropoietic.

CS3.03c If present, features of dyserythropoiesis should be described, including assessment of severity and the percentage of erythroblasts affected by dyserythropoietic change. These features may include nuclear irregularity or budding, internuclear bridging, karyorrhexis, multinuclearity, megaloblastoid changes cytoplasmic vacuolisation and stippling.

S3.04 The status of granulopoiesis must be reported.

CS3.04a This should include a description of granulocytic cellularity.

Cellularity should be reported as :

- Absent
- Reduced (mild to marked)
- Normal
- Increased (mild to marked)

CS3.04b A statement should be made regarding whether maturation is normal or left-shifted or dysgranulopoietic. Maturation arrest (and the stage at which it has occurred) should be noted if it is present.

CS3.04c An assessment of myeloid morphology should be made. This may be normal, while abnormal features may include nuclear hypolobulation (pseudo Pelger-Huet) or hypersegmentation, and abnormal or reduced cytoplasmic granulation. The presence of any giant metamyelocytes should be noted. The percentage of dysplastic myeloid cells should be reported.

CS3.04d The presence of increased numbers of leucocyte subpopulations such as monocytes, eosinophils or basophils should be noted if present, and a statement made regarding any morphological abnormalities in these lineages.

CS3.04e The presence of increased numbers of mast cells should be noted if present. A statement should be made regarding whether mast cell morphology is normal or abnormal. If abnormal the cytological features should be described.

S3.05 The status of megakaryopoieisis must be reported.

CS3.05a A statement should be made regarding the number of megakaryocytes in the aspirate.

This should be reported as :

- Absent
- Reduced (mild to marked)
- Normal
- Increased (mild to marked)

A squash preparation may be helpful in determining megakaryocyte numbers.

CS3.05b Megakaryocyte morphology should be described including assessment of severity and the percentage of megakaryocytes affected by dysmegakaryopoiesis eg micromegakaryocytes, nuclear hypolobation, and multinucleation.[20]

CS3.05c The presence of large platelet clumps should be reported.

S3.06 The number and morphology of lymphocytes must be reported.

CS3.06a A statement should be made regarding whether lymphocyte numbers are normal or increased. The percent lymphocytes should be reported.

CS3.06b A statement should be made regarding whether lymphocytes are morphologically normal, describe their size, nuclear and cytoplasmic features and degree of maturity and pleomorphism.

S3.07 The number and morphology of plasma cells should be reported.

CS3.07a The percent plasma cells should be reported. Where the number of plasma cells is increased or where there is clinical suspicion of a plasma cell dyscrasia, describe their size, nuclear and cytoplasmic features and degree of maturity and pleomorphism.

G3.01 The presence, number and any morphological features of other marrow cells such as macrophages (histiocytes), osteoblasts and osteoclasts should be noted if they are present in increased numbers.

G3.02 The presence of any abnormal infiltrating cells, including blasts and non-haematopoietic cells should be noted.

CG3.02a Features such as clustering or clumping should be recorded, and describe their size, nuclear and cytoplasmic features and degree of maturity and pleomorphism. For blasts the presence or absence of cytoplasmic granulation, inclusions, Auer rods and faggot cells should be recorded, as should the nuclear-cytoplasmic ratio and the colour of the cytoplasm.

G3.03 Haemophagocytosis should be noted if present, and may be graded as mild, moderate or marked and the cell types ingested.

S3.08 The status of iron stores must be reported.

CS3.08a A Prussian Blue stain should be performed for the evaluation of storage iron and sideroblasts on all marrows at first presentation. The stain can be performed on a smear, squash, trephine imprints or particle clot section. A known positive control should be included in parallel.

CS3.08b The presence or absence of iron stores should be evaluated by examining macrophages in several particles in the smear. Iron stores in smears may be graded subjectively as absent, reduced, normal, increased or markedly increased or scored 0-6 as per Finch.[27] To confirm iron deficiency absence in multiple adequate particles need to be evaluated.

CS3.08c The presence of sideroblasts and the frequency and location (cytoplasmic or perinuclear) of siderotic granules should be noted if relevant. Ring sideroblasts are defined by the presence of five or more siderotic granules encircling one third or more of the nucleus in an iron-stained smear. At least 100 erythroblasts should be evaluated for the percentage of ring sideroblasts, if present.

S3.09 Other significant features such as abnormal background staining,

parasites or other organisms must be recorded.

S3.10 A descriptive or narrative field must be provided.

CS3.10a This should record any microscopic information on the aspirate specimen that is not recorded in the above standards and guidelines.

S3.11 The haematologist / pathologist who has reported the aspirate must be identified.

CS3.11a The name of the consultant and registrar, if relevant, reporting the aspirate must be included including their designation.

CS3.11b The date the aspirate report was issued must be documented including the date of any amendments or alterations.

CS3.11c For Australia sites, the Australian Healthcare identifiers i.e. Healthcare Provider Identifier - Individual (HPI-I) and Healthcare Provider Identifier - Organisation (HPI-O) should be included, where possible, to identify the haematologist/pathologist who has reported the aspirate.

Bone Marrow Trephine Biopsy

S3.12 The unique identifier for the bone marrow trephine biopsy must be included where applicable.

S3.13 The appearance of the trephine biopsy must be reported.

CS3.13a The aggregate length and number of the biopsy cores must be indicated.

CS3.13a A statement regarding the adequacy of the trephine biopsy and any unusual macroscopic appearance should be included. Crush and haemorrhage artefact may impact on the reporting of the architecture.

S3.14 The microscopic appearance of the bone architecture must be described.

CS3.14a Bony architecture including such features as resorption islands, oesteoblastic and osteoclastic activity, new lamellar bone formation should be indicated when they are outside normal.

S3.15 The overall cellularity of the trephine biopsy must be indicated.

CS3.15a The cellularity of the non trabecular marrow should be described as :

- Acellular

- Hypocellular: Reduced with regard to the patient's age
- Normocellular: Normal for the patient's age
- Hypercellular: Increased with regard to the patient's age

The degree of cellularity may be graded as appropriate as mild, moderate or marked and may be described as a percentage,[Tuzuner N, 1994 #1562] that may be obtained by estimating the proportion of cells occupying the total marrow cavity.

CS3.15b The marrow architecture should be described as normal or abnormal such as interstitial, focal, nodular or diffuse infiltrates, or distortion due to fibrosis. If there is a focal process its location (e.g. interstitial, paratrabecular) should be reported.

CS3.15c A statement regarding areas of abnormality (e.g. necrosis, haemorrhage or fibrosis) should be made.

CS3.15d If increased mitotic figures are noted these should be documented under the specific cell lineage.

CS3.15e A statement regarding any changes thought to be artefactual (such as crush artefact) should be made.

S3.16 The status of erythropoiesis must be reported.

CS3.16a This should include a description of cellularity.

Cellularity should be reported as :

- Absent
- Reduced (mild to marked)
- Normal
- Increased (mild to marked)

CS3.16b A statement regarding maturation (left-shifted, normal) should be made.

CS3.16c Any morphological abnormalities noted (such as abnormal size of erythroid islands, features of dyserythropoiesis or megaloblastic maturation) should be described.

S3.17 The status of granulopoiesis must be reported.

CS3.17a This should include a description of cellularity.

Cellularity should be reported as :

- Absent
- Reduced (mild to marked)
- Normal

- Increased (mild to marked)

CS3.17b A statement regarding maturation (left-shifted, normal, maturation arrest or preponderance of immature cells) should be included.

CS3.17c Any morphological abnormalities should be documented including the presence of abnormal localisation of immature precursors.

S3.18 The status of megakaryopoiesis must be reported.

CS3.18a The overall number of megakaryocytes must be reported as

- Absent
- Reduced (mild to marked)
- Normal
- Increased (mild to marked)

CS3.18b A statement should be made regarding megakaryocyte morphology. This may include observations of megakaryocyte size, nuclear segmentation (hyperlobation, normal or hypolobation) and the presence of hyperchromatic or pyknotic megakaryocytes or bare nuclei.

CS3.18c A comment should be made about the location (e.g. interstitial, paratrabecular) and distribution of megakaryocytes in the marrow (eg clustering).

S3.19 A statement must be made regarding lymphocytes.

CS3.19a If relevant a comment should be made about the number of lymphocytes in the trephine biopsy.

CS3.19b A comment should be made regarding the distribution of lymphocytes if their number is increased. A lymphoid infiltrate should be described as interstitial, paratrabecular, nodular or diffuse. A comment should be made regarding the size and number of lymphoid aggregates if present.

CS3.19c In case of a lymphoid infiltrate, a statement must be made regarding the morphology of the lymphoid cells such as size, N:C ratio, nucleoli, inclusions and whether they have round or angular nuclei eg centrocytes, centroblasts and lymphoblasts.

S3.20 A statement must be made regarding marrow plasma cells.

CS3.20a If increased a comment should be made regarding the number of plasma cells in the trephine biopsy expressed as a percentage of nucleated cells. The distribution may be described as interstitial, microaggregate (10-50 cells), nodular (>50 cells), diffuse or other (e.g. paratrabecular).

CS3.20b A statement should be made regarding contributing morphological features of plasma cells such as immaturity (multinuclearity, fine nuclear chromatin, Dutcher bodies and presence of nucleoli) or inclusions.

S3.21 The number and morphology of other cells must be reported.

CS3.21a The number and morphology of any other haematopoietic cells eg histiocytes and mast cells should be described appropriately.

CS3.21b Any non-haematopoietic infiltration should be described appropriately.

CS3.21c Granuloma formation should be noted and described.

G3.04 The reticulin stain should be described.

CG3.04a Reticulin should be graded on a scale of MF-0 to MF-3 for myeloproliferative neoplasms[20,28] and as normal, mildly increased, moderately increased or markedly increased otherwise.

CG3.04b The pattern of increase in reticulin staining should be described as either diffuse or focal.

G3.05 A descriptive or narrative field should be provided to record any microscopic information on the trephine biopsy that is not recorded in the above standards and guidelines.

G3.06 A description of the results of histochemical or immunohistochemical stains should be provided.

CG3.06a Histochemical stains may be used to identify amyloid protein, to highlight mast cells, or to identify infiltrating micro-organisms.

Immunohistochemical testing may be performed to:

- enumerate haematopoietic cells of specific phenotype (e.g. CD34-positive stem cells; CD138-positive plasma cells).
- determine the phenotype and cellular origin of infiltrating non-haematopoietic cells,
- determine the lineage, stage of maturation and phenotypic disease-association of lymphoid cells,
- identify or characterise specific haematopoietic cells (e.g. Reed-Sternberg cells, mast cells),
- identify potential therapeutic targets (eg CD20, CD52)
- identify prognosis-associated antigens (e.g. MYC)
- identify residual disease following therapy

In each case, the appropriate positive and negative controls should be evaluated and available for review, particularly as immunohistochemical stains are not always robust under different condition of fixation and decalcification.

CG3.06b The description of staining should include an assessment of the presence of cells in question, the cell number and the intensity (weak or strong) and cellular location of antigen (nuclear, cytoplasmic, cell membrane). This should be correlated with the H&E stained sections.

S3.22 The name of the haematologist / pathologist who has reported the trephine biopsy must be recorded.

CS3.22a The name of the consultant and registrar, if relevant, reporting the trephine biopsy must be recorded including their designation and acknowledgement of any pathologists whose opinion has been sought.

CS3.22b The date the trephine biopsy report was issued must be documented.

CS3.22c For Australia sites, the Australian Healthcare identifiers i.e. Healthcare Provider Identifier - Individual (HPI-I) and Healthcare Provider Identifier - Organisation (HPI-O) should be included, where possible, to identify the haematologist/pathologist who has reported the trephine.

4 Additional study findings

An additional study is any pathology investigation which may form part of a cancer pathology report but which is not a part of routine histological assessment. Additional studies may be used to determine lineage, clonality or disease classification or subclassification; as prognostic biomarkers; or to indicate the likelihood of patient response to specific biological therapies.

Where practical, the final report should include results from all additional tests.

G4.01 The results of any other investigations performed on the aspirate or trephine biopsy should be provided wherever possible.

CG4.01a In each case, the laboratory number and the identity of the laboratory that performed testing must be clear from the report.

To avoid transcription or interpretive issues the whole report should be linked, attached or included with the final morphological report. If a summary or conclusion has been provided by the author of the additional report eg the cytogeneticist, then the summary may be included at the discretion of the reporting pathologist but the full report should also be referred to.

The final conclusion by the reporting pathologist may include the key diagnostic conclusions from all tests.

CG4.01b The results of flow cytometry performed on the marrow aspirate should be included. The statement must identify the immunophenotype of any clonal or immature population found and must include the percentage of gated cells that are clonal or CD34+ (depending on the reason for testing). If no clonal population was identified, this should also be reported.

CG4.01c The results of cytogenetic analysis performed on the marrow aspirate should be included in the form of a summary (karyotypic report) that includes an indication of the frequency of any subclones.

CG4.01d The results of fluorescent in situ hybridisation testing performed on the aspirate or trephine biopsy should be provided. The probe used should be identifiable and the frequency or absence of cells carrying the abnormality for which testing was performed should be indicated.

CG4.01e The results of molecular testing (e.g. PCR, RT-PCR, sequencing) should be indicated. These may include testing for T or B cell clonality (clonal or polyclonal), molecular testing for a specific abnormality such as a translocation or deletion, or PCR performed to detect a micro-organism.

CG4.01f The fact that microbiological cultures have been performed should be indicated, whether those results are positive or negative, and the result included.

5 Synthesis and overview

Information that is synthesised from multiple modalities and therefore cannot reside solely in any one of the preceding chapters is described here.

In haematological neoplasia, the tumour type, as defined by the WHO classification, is clinicopathological and is derived from a combination of clinical information, microscopic findings and at least some form of additional study such as cytogenetics.

By definition, synthetic elements are inferential rather than observational, often representing high-level information that is likely to form part of the report 'Summary' or 'Diagnosis' section in the final formatted report.

Overarching case comment is synthesis in narrative format. Although it may not necessarily be required in any given report, the provision of the facility for overarching commentary in a cancer report is essential.

Integrated Report

S5.01 The WHO disease subtype must be recorded where relevant (refer to Appendix 4).

G5.01 The 'conclusion' section of the final formatted report should include:

a. A unifying summary of the relevant bone marrow findings. This should include the significant features already described above that support the conclusion or diagnosis. A comment should be made regarding the technical unsuitability of the marrow biopsy for reporting if relevant. The summary should express any diagnostic subtlety or uncertainty.

b. A diagnosis, or differential diagnosis if a diagnosis cannot be made on the available information.

c. The conclusion should reflect the clinical question that has been asked. The findings should be compared to the previous results from the same patient where relevant.

d. Where relevant, the WHO disease subtype and ICD0 disease code must be recorded. Images of the marrow may be appended to the report.

e. The report should indicate that the case has been identified to a Cancer Registry if this is the case.

S5.02 The haematologist / pathologist who issued the integrated report must be identified.

CS5.02a The name and designation of the registrar and consultant issuing the integrated report must be included.

CS5.02b The date the integrated report was issued must be indicated.

CS5.02c For Australia sites, the Australian Healthcare identifiers i.e. Healthcare Provider Identifier - Individual (HPI-I) and Healthcare Provider Identifier - Organisation (HPI-O) should be included, where possible, to identify the haematologist/pathologist who has issued the integrated report.

6 Structured checklist

The following checklist includes the standards and guidelines for this protocol which must be considered when reporting, in the simplest possible form. This provides a fully inclusive dataset for structured reporting of bone marrows. For emphasis, standards (mandatory elements) are formatted in bold font.

S6.01 The structured checklist provided may be modified as required but with the following restrictions:

a. All standards and their respective naming conventions, definitions and value lists must be adhered to.

b. Guidelines are not mandatory but are recommendations and where used, must follow the naming conventions, definitions and value lists given in the protocol.

G6.01 The order of information and design of the checklist may be varied according to the laboratory information system (LIS) capabilities and as described in *Functional Requirements for Structured Pathology Reporting of Cancer* Protocols.[29].

CG6.01a Where the LIS allows dissociation between data entry and report format, the structured checklist is usually best formatted to follow pathologist workflow. In this situation, the elements of synthesis or conclusions are necessarily at the end. The report format is then optimised independently by the LIS.

CG6.01b Where the LIS does not allow dissociation between data entry and report format, (for example where only a single text field is provided for the report), pathologists may elect to create a checklist in the format of the final report. In this situation, communication with the clinician takes precedence and the checklist design is according to principles given in Chapter 7.

G6.02 Where the checklist is used as a report template (see G6.01), the principles in Chapter 7 and Appendix 2 apply.

CG6.02a All extraneous information, tick boxes and unused values need to be deleted.

G6.03 Additional comment may be added to an individual response where necessary to describe any uncertainty or nuance in the selection of a prescribed response in the checklist. Additional comment is not required where the prescribed response is adequate.

Values in italics are conditional on previous responses.

Values in all caps are headings with sub values.

S/G	Item description	Response type	Conditional
Pre-analytical			
S1.01	**Demographic information provided**		
S1.02	**Clinical information provided on request form**	**Text** OR Structured entry as below:	
	Indication	**Text**	
	Clinical details	**Text**	
	Relevant results	**Text**	
	Test requested	**Text**	
S1.03	**Pathology accession number**	**Alpha-numeric**	
S1.04	**Principal clinician caring for the patient and contact details**	**Text**	
G1.01	Other clinical information received	**Text**	

Record of procedure			
S2.01	**Date of the BM specimen collection**	**Date**	
S2.02	**BM Biopsy performed by**	**Text** **OR** **Not known**	
S2.03	**Anatomical site of the aspirate / biopsy**	**Text** **Note:** Include side	
G2.01	Ease/difficulty of the aspiration	**Text**	
G2.02	Sedation	**Text**	
S2.04	**Specimen type(s)**	**Multi select value list (select all that apply):** • Peripheral blood smear • Aspirate - smear • Aspirate – squash prep • Trephine biopsy • Trephine imprint	
S2.05	**Distribution of biopsy material / additional tests requested**	**Multi select value list (select all that apply):** • Flow cytometry • Immunohistochemistry • Cytogenetics • FISH • Molecular studies	

		• Microbiology • Tissue banking • Other (specify)	
G2.03	Additional comments	**Text**	
S2.06	**BLOOD COUNT RESULTS**		
	Date of last FBC	**Date**	
	FBC results	**Numeric for each of the following in units indicated:** • Hb in g/L • WCC in X 10^9/L • MCV in fL • NEU in X 10^9/L • LYM in X 10^9/L • MON in X 10^9/L • EOS in X 10^9/L • BAS in X 10^9/L • Other (specify) • PLT in X 10^9/L	
	Blood film results	**Text**	
Morphological findings			
	ASPIRATE MORPHOLOGY		***Conditional on aspirate being selected in S2.05***

S3.01	***Cellularity of particles/trails***	***Single selection value list:*** • *Acellular* • *Hypocellular: Reduced with regard to the patient's age* • *Normocellular: Normal for the patient's age* • *Hypercellular: Increased with regard to the patient's age* ***OR*** ***Dry Tap*** ***OR*** ***Blood tap*** ***OR*** ***Haemodilute marrow sample*** ***AND (if applicable)*** ***Scant particles for assessment*** ***Note:*** *Report particles and trails separately if cellularity of particles and trails is discordant.*	***If hypocellular, or hypercellular degree may be optionally added.***
	Degree	***Single selection value list:*** • *Mildly* • *Moderately* • *Markedly*	
	Cellularity of imprint *(if required)*	***Single selection value list:*** • *Acellular*	***If hypocellular, or hypercellular degree may be optionally added.***

		• *Hypocellular: Reduced with regard to the patient's age* • *Normocellular: Normal for the patient's age* • *Hypercellular: Increased with regard to the patient's age* ***OR*** ***Dry Tap*** ***OR*** ***Blood tap*** ***OR*** ***Haemodilute marrow sample***	
	Degree	***Single selection value list:*** • *Mildly* • *Moderately* • *Markedly*	
S3.02	***Nucleated differential cell count***	***Inadequate specimen*** ***OR*** ***Total number of nucleated cells counted Numeric:___*** ***AND*** ***List each cell type counted and a numeric value***	

	Lymphoid aggregates *(if seen)*	***Text***	
	M:E Ratio	***Numeric:*** ___:____	
S3.03	***ERYTHROPOIESIS***		
	Cellularity	***Single selection value list:*** • *Absent* • *Mildly reduced* • *Moderately reduced* • *Markedly reduced* • *Normal* • *Mildly increased* • *Moderately increased* • *Markedly increased*	
	Type	***Multi select value list (select all that apply):*** • *Normoblastic* • *Megaloblastic (nuclear-cytoplasmic asynchrony)* • *Dyserythropoietic* • *Other (e.g. giant pronormoblast)(specify)*	***If dyserythropoietic, describe features.***
	Dyserythropoiesis *(including percentage of abnormal cells)*	***Text***	
S3.04	***GRANULOPOIESIS***		

	Cellularity	***Single selection value list:*** • *Absent* • *Mildly reduced* • *Moderately reduced* • *Markedly reduced* • *Normal* • *Mildly increased* • *Moderately increased* • *Markedly increased*	
	Maturation	***Normal*** ***OR*** ***Multi select value list (select all that apply):*** • *left-shifted* • *dysgranulopoietic* • *maturation arrest (specify stage)* • *other (specify)*	***If not normal, describe the leucocyte subpopulations***
	Myeloid morphology *(including percentage of abnormal cells)*	***Normal*** ***Or*** ***Text***	
	Leucocyte subpopulations *(including blasts (where relevant), mast cells - a qualitative and quantitative description)*	***Text***	
S3.05	***MEGAKARYOPOIEISIS***		

	Cellularity	***Single selection value list:*** • *Absent* • *Mildly reduced* • *Moderately reduced* • *Markedly reduced* • *Normal* • *Mildly increased* • *Moderately increased* • *Markedly increased*	
	Morphology	***Normal*** ***OR*** ***Multi select value list (select all that apply):*** • *micromegakaryocytes* • *nuclear hypolobation* • *multinucleation (widely separated nuclei)* • *Other eg pyknotic (specify)*	***If not normal, give the percentage of abnormal megakaryocytes***
	Abnormal megakaryocytes	***Numeric: ___ %***	
	Large platelet clumps	***Single selection value list:*** • *Absent* • *Present*	
S3.06	***LYMPHOCYTES***		
	Number	***Single selection value list:*** • *reduced*	

		• *normal* • *increased*	
	Morphology *(including size and nuclear and cytoplasmic features)*	***Text***	
S3.07	***PLASMA CELLS***		
	Number	***Single selection value list:*** • *normal* • *increased*	
	Morphology *(including size, maturity and nuclear and cytoplastic features)*	***Text***	
G3.01	*Other marrow cells (if required)*	***Multi select value list (select all that apply):*** • *Histiocytes (macrophages)* • *Osteoblasts* • *Osteoclasts* • *Other (specify)*	***For each type record the morphological features if required).***
	Morphological features (if required)	***Text***	
G3.02	*Abnormal infiltrating nonhaematopoietic cells (if present)*	***Text***	
G3.03	*Haemophagocytosis*	***Single selection value list:*** • *mild*	

		• *moderate* • *marked*	
	Cell types ingested	***Text***	
S3.08	***Iron stores***	***Single selection value list:*** • *absent* • *reduced* • *normal* • *increased* • *markedly increased* ***AND/OR*** ***Single selection value list:*** • *0* • *1* • *2* • *3* • *4* • *5* • *6*	
	Sideroblasts *(if relevant)*	***Single selection value list:*** • *absent* • *present*	***If present, record percentage and morphology***
	Percentage	***Numeric: ___ %***	
	Morphology *(eg coarse or*	***Text***	

	ringed)		
S3.09	***Other significant features of the aspirate*** *(if required)*	***Text***	
S3.10	***Other comment on the aspirate*** *(if required)*	***Text***	
S3.11	***Reporting haematologist / pathologist (aspirate)*** *(include designation)*	***Text***	
	Date	***Date***	
	TREPHINE BIOPSY		***Conditional on trephine biopsy being selected in S2.05***
S3.12	***Trephine biopsy identifier***	***Text***	
S3.13	***MACROSCOPIC***		
	Number of cores	***Numeric:*** _ _ _	
	Aggregate length	***Numeric:*** _ _ _ _ _ ***mm***	
	Adequacy	***Single selection value list:*** • *Adequate for examination* • *Inadequate*	
	Description *(if required)*	***Text***	
S3.14	***Trabecular bone architecture***	***Text***	
S3.15	***Cellularity***	***Single selection value list:***	***If acellular, hypocellular, normocellular, hypercellular***

		• *Acellular* • *Hypocellular: Reduced with regard to the patient's age* • *Normocellular: Normal for the patient's age* • *Hypercellular: Increased with regard to the patient's age*	***degree may be optionally added.***
	Degree	***Single selection value list:*** • *Mildly* • *Moderately* • *Markedly* ***AND / OR*** ***Numeric: ___ %***	
	Architecture	***Normal*** ***OR*** ***Abnormal*** ***AND (if abnormal)*** ***Multi select value list (select all that apply):*** • *interstitial infiltrate* • *focal infiltrate* o *paratrabecular* o *nonparatrabecular* o *other (specify)* • *nodular infiltrate*	

		• *diffuse infiltrate* • *distorted due to fibrosis* • *other (specify)*	
	Areas of abnormality *(if present) (e.g. necrosis, amorphous eosinophilic material, serous atrophy, haemorrhage or fibrosis)*	***Single selection value list:*** • *Absent* • *Present (describe)*	
	Artefactual changes	***Single selection value list:*** • *Absent* • *Present (describe)*	
S3.16	***ERYTHROPOIESIS***		
	Number	***Single selection value list:*** • *Absent* • *Mildly reduced* • *Moderately reduced* • *Markedly reduced* • *Normal* • *Mildly increased* • *Moderately increased* • *Markedly increased*	
	Maturation	***Normal*** ***OR*** ***Single selection value list:*** • *left-shifted*	***If not normal, record morphological abnormalities***

		• *other (describe)*	
	Morphological abnormalities	***Single selection value list:*** • *absent* • *present (describe)*	
S3.17	***GRANULOPOIESIS***		
	Celluarity	***Single selection value list:*** • *Absent* • *Mildly reduced* • *Moderately reduced* • *Markedly reduced* • *Normal* • *Mildly increased* • *Moderately increased* • *Markedly increased*	
	Maturation	***Normal*** ***OR*** ***Single selection value list:*** • *left-shifted* • *maturation arrest* • *preponderance of immature cells* • *other (specify)*	***If not normal, record morphological abnormalities***
	Morphological abnormalities *(if required)*	***Text***	

	Abnormal localisation of immature precursors *(if required)*	***Text***	
S3.18	***MEGAKARYOPOIESIS***		
	Number	***Single selection value list:*** • *Absent* • *Mildly reduced* • *Moderately reduced* • *Markedly reduced* • *Normal* • *Mildly increased* • *Moderately increased* • *Markedly increased*	
	Morphology	***Text***	
	Distribution in the marrow *(if required eg clusters)*	***Text***	
S3.19	***LYMPHOCYTES*** *(if required)*		
	Number	***Single selection value list:*** • *normal* • *reduced* • *increased*	***If increased comment on the distribution***
	Distribution	***Single selection value list:*** • *paratrabecular*	

		• *interstitial* • *nodular* • *diffuse*	
	Size and number lymphoid aggregates *(if required)*	***Text***	
	Morphology *(eg size, N:C ratio etc)*	***Text***	
S3.20	***PLASMA CELLS***		
	Number	***Normal*** ***OR*** ***Numeric: ___ % of nucleated cells***	***If abnormal then comment on morphology and distribution.***
	Morphology *(eg immaturity, inclusions)*	***Text***	
	Distribution	***Normal*** ***OR*** ***Single selection value list:*** • *interstitial* • *microaggregate (10-50 cells)* • *nodular (>50 cells)* • *diffuse*	
S3.21	***Other cells*** *(if required)*	***Text***	
	Nonhaematopoietic infiltration *(if required)*	***Text***	

	Granuloma formation *(if required)*	***Text***	
G3.04	*RETICULIN*		
	Grade	***For myeloproliferative neoplasms use:*** ***Single selection value list:*** • *0* • *1* • *2* • *3* ***OR else use:*** ***Single selection value list:*** • *Normal* • *Mildly increased* • *Moderately increased* • *Markedly increased*	
	Pattern	***Single selection value list:*** • *Diffuse* • *Focal*	
G3.05	*Other comment on the trephine biopsy*	***Text***	
G3.06	*(Immuno)histochemical stains*	***Text***	
S3.22	***Reporting pathologist (trephine biopsy)*** *(include*	***Text***	

	designation)		
	Date	***Date***	
Additional test findings			
G4.01	*IMMUNOHISTOCHEMISTRY*	***Text***	
	FLOW CYTOMETRY	***Text***	
	CYTOGENETICS	***Text***	
	MOLECULAR STUDIES	***Text***	
	FISH	***Text***	
	MICROBIOLOGY (including staining cultures and PCR)	***Text***	
	Additional test result	***Text***	
Synthesis and overview			
S5.01	**WHO disease subtype**	**Single selection value list from World Health Organization Classification of Tumours of Haematopoietic and Lymphoid Tissues, 4th edition, 2008**	
G5.01	Conclusion	**Text**	

S5.02	**Reporting haematologist / pathologist (Integrated report)**	**Text**	

7 Formatting of pathology reports

Good formatting of the pathology report is essential for optimising communication with the clinician, and will be an important contributor to the success of cancer reporting protocols. The report should be formatted to provide information clearly and unambiguously to the treating doctors, and should be organised with their use of the report in mind. In this sense, the report differs from the structured checklist, which is organised with the pathologists' workflow as a priority.

Uniformity in the format as well as in the data items of cancer reports between laboratories makes it easier for treating doctors to understand the reports; it is therefore seen as an important element of the systematic reporting of cancer. For guidance on formatting pathology reports, please refer to Appendix 2.

Appendix 1 Pathology request information and collection procedures

This appendix describes the information that should be collected before the pathology test. Some of this information can be provided on generic pathology request forms; any additional information required specifically for the reporting of bone marrow biopsies may be provided by the clinician on a separate request information sheet. An example request information sheet is included below. Elements which are in bold text are those which pathologists consider to be required information. Those in non-bold text are recommended.

Also included in this appendix are the procedures that are recommended before handover of specimens to the laboratory.

Patient and clinician information

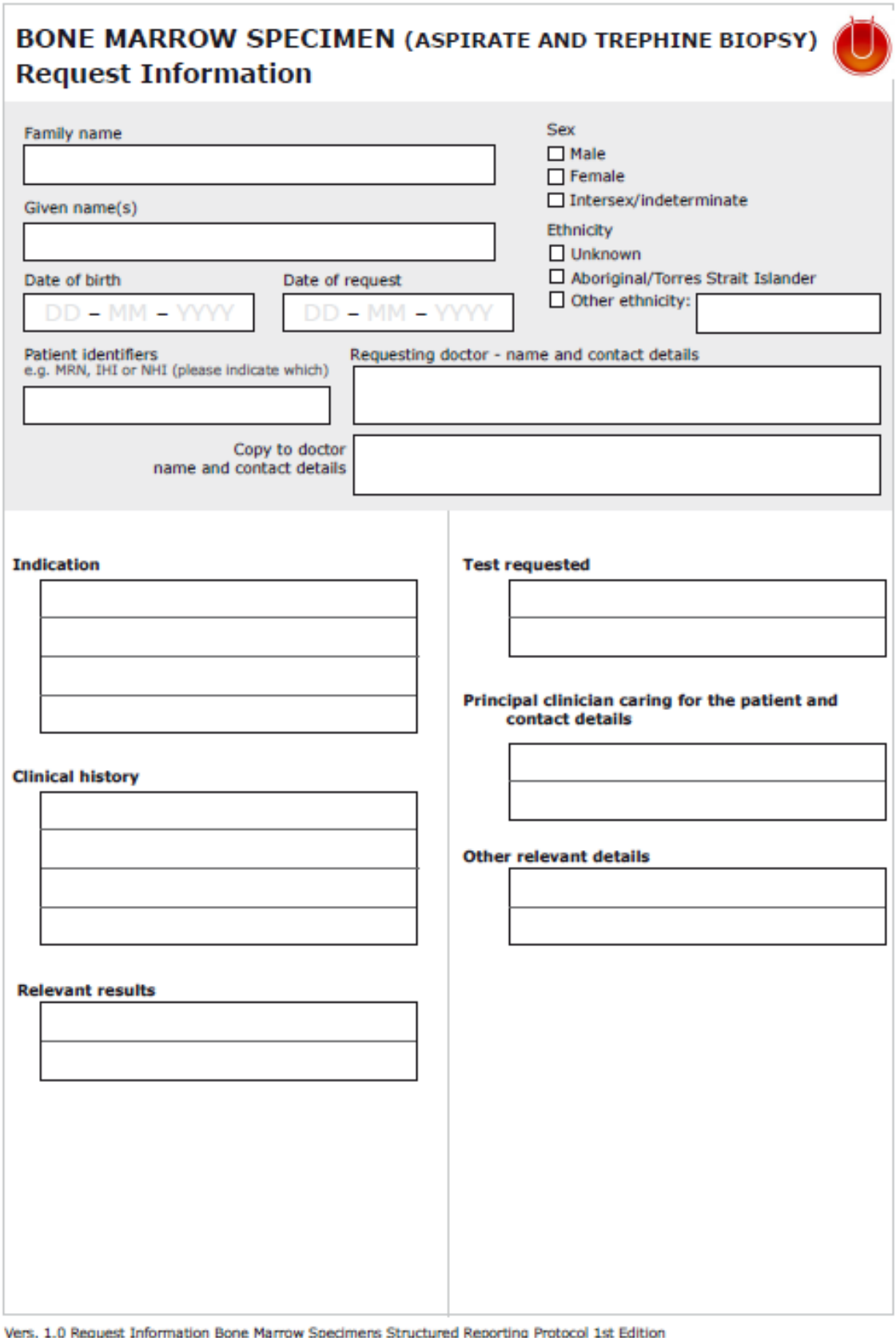
- **Adequate demographic and request information should be provided with the specimen.**
  - Items relevant to cancer reporting protocols include:
    - patient name
    - date of birth
    - gender
    - identification and contact details of requesting doctor
    - date of request
  - A bone marrow biopsy should only be requested by a medical practitioner who should be identifiable from the request form and whose signature should appear on that form. Contact details for the individual requesting the bone marrow biopsy should be provided.
  - The patient's ethnicity should be recorded, if known. In particular whether the patient is of aboriginal or Torres Strait islander origin. This is in support of a government initiative to monitor the health of indigenous Australians particularly in relation to cancer.
- The patient's health identifiers should be provided.
  - The patient's health identifiers may include the patient's Medical Record Number as well as a national health number such as a patient's Medicare number (Australia), Individual Healthcare Identifier (IHI) (Australia) or the National Healthcare Identifier (New Zealand).
- For Australia sites, the Australian Healthcare identifiers i.e. Healthcare Provider Identifier - Individual (HPI-I) and Healthcare Provider Identifier - Organisation (HPI-O) should be use, where possible, to identify the requesting doctor.

Clinical information

Clinical information is a prerequisite for accurate diagnosis, and must be provided on a pathology request form. A bone marrow biopsy is an invasive procedure, and sufficient information must be provided to document the justification for proceeding with the biopsy. A request for a bone marrow biopsy represents a consultation with the haematopathologist, who takes responsibility undertaking the procedure based on an assessment of the risks and benefits of proceeding.

- **The indication for the bone marrow examination should be provided.**
  - Possible descriptors include[16]:
    - Investigation of unexplained anaemia, abnormal red cell indices, cytopenias or proliferation
    - Investigation of abnormal peripheral blood film morphology suggestive of bone marrow pathology
    - Diagnosis, staging and follow-up of malignant haematological disorders (eg acute and chronic leukaemias, myelodysplastic syndromes, myeloproliferative disorders, lymphomas, plasma cell myeloma, amyloidosis, mastocytosis)
    - Investigation of suspected bone marrow metastases
    - Unexplained focal bony lesions on radiological imaging
    - Unexplained splenomegaly or presence of lymphadenopathy inaccessible for biopsy
    - Microbiological culture to investigate pyrexia of unknown origin or investigate specific infections such as miliary tuberculosis or leishmaniasis)
    - Investigation of lipid/glycogen storage disorders
    - Evaluation of engraftment following allogeneic haematopoietic stem cell transplantation.
- Clinical details should be described.
  - The clinical details may include information regarding recent chemotherapy, treatment with cytokines or monoclonal antibodies and a history of irradiation to any sites from which a bone marrow biopsy might be performed.
- Any relevant results should be included.
- The tests required should be indicated.
  - The request form should indicate whether a bone marrow aspirate is to be performed with or without a trephine biopsy. It should be stated if biopsy from a specific site or bilateral bone marrow biopsies are required. It should be made clear whether additional investigations such as cytogenetic analysis, fluorescence in situ hybridisation, flow cytometry or banking of DNA, RNA or cells are required.

Example Request Information Sheet



BONE MARROW SPECIMEN (ASPIRATE AND TREPHINE BIOPSY)
Request Information

Family name

Given name(s)

Date of birth DD – MM – YYYY

Date of request DD – MM – YYYY

Sex
- ☐ Male
- ☐ Female
- ☐ Intersex/indeterminate

Ethnicity
- ☐ Unknown
- ☐ Aboriginal/Torres Strait Islander
- ☐ Other ethnicity:

Patient identifiers
e.g. MRN, IHI or NHI (please indicate which)

Requesting doctor - name and contact details

Copy to doctor
name and contact details

Indication

Clinical history

Relevant results

Test requested

Principal clinician caring for the patient and contact details

Other relevant details

Vers. 1.0 Request Information Bone Marrow Specimens Structured Reporting Protocol 1st Edition

The above Request Information Sheet is published to the RCPA website.

Appendix 2 Guidelines for formatting of a pathology report

Layout

Headings and spaces should be used to indicate subsections of the report, and heading hierarchies should be used where the LIS allows it. Heading hierarchies may be defined by a combination of case, font size, style and, if necessary, indentation.

Grouping like data elements under headings and using 'white space' assists in rapid transfer of information.[30]

Descriptive titles and headings should be consistent across the protocol, checklist and report. When reporting on different tumour types, similar layout of headings and blocks of data should be used, and this layout should be maintained over time.

Consistent positioning speeds data transfer and, over time, may reduce the need for field descriptions or headings, thus reducing unnecessary information or 'clutter'.

Within any given subsection, information density should be optimised to assist in data assimilation and recall. The following strategies should be used:

- Configure reports in such a way that data elements are 'chunked' into a single unit to help improve recall for the clinician.[30]
- Reduce 'clutter' to a minimum.[30] Thus, information that is not part of the protocol (eg billing information or Snomed codes) should not appear on the reports or should be minimised.
- Reduce the use of formatting elements (eg bold, underlining or use of footnotes) because these increase clutter and may distract the reader from the key information.

Where a structured report checklist is used as a template for the actual report, any values provided in the checklist but not applying to the case in question must be deleted from the formatted report.

Reports should be formatted with an understanding of the potential for the information to mutate or be degraded as the report is transferred from the LIS to other health information systems.

As a report is transferred between systems:

- text characteristics such as font type, size, bold, italics and colour are often lost
- tables are likely to be corrupted as vertical alignment of text is lost when fixed font widths of the LIS are rendered as proportional fonts on screen or in print
- spaces, tabs and blank lines may be stripped from the report, disrupting the formatting
- supplementary reports may merge into the initial report.

Appendix 3 Example of a pathology report

This is an example report only, formats will vary with Laboratory System functionality and local design. Many laboratories will issue an interim report and then a final report when all additional information is available.

Malvoy, Geraldine W.
C/O Paradise Close
Wreck Bay Resort
Nar Nar Goon East, 3181

Female

DOB 1/7/1992
MRN M1196785

Lab Ref: **13/P28460**
Referred: 30/8/2013

Copy to: Dr N.G.Chappie
Rainforest Cancer Centre.
46 Smith Road,
Woop Woop, 3478

Referred by: Dr V. Brown
Suite 3, AJC Medical Centre,
Bunyip Crescent
Nar Nar Goon West, 3182

BONE MARROW BIOPSY STRUCTURED REPORT

Conclusion

Acute myeloid leukaemia with t(8;21) RUNX1/RUNX1T1

Supporting Information

CLINICAL

Indication:	Blasts on blood film
Clinical details:	Easy bruising
Test requested:	BM aspirate and trephine; flow cytometry, FISH, cytogenetics, molecular studies, tissue banking

MACROSCOPIC

BM specimen collection:	2nd Sept 2013
BM biopsy performed by:	MK Singh
Anatomical site of the aspirate/biopsy:	Right posterior iliac crest
Ease/difficulty of the aspiration:	Easy
Specimen type(s):	Peripheral blood smear Aspirate – smear Aspirate – squash prep Trephine biopsy Trephine imprint
Distribution of biopsy material :	Flow cytometry Cytogenetics FISH Molecular studies Tissue banking

Blood count results

Date of last FBC: 1st Sept 2013

FBC results:

Hb	77	g/l
MCV	86	fl
WCC	23.6	X10^9/l
Neut	1.2	X10^9/l
Lymph	1.3	X10^9/l
Mono	1.0	X10^9/l
Eos	0.4	X10^9/l
Baso	0.1	X10^9/l
Platelets	47	X10^9/l
Blasts	19.7	X10^9/l

Blood film results: Circulating blasts, thrombocytopenia

ASPIRATE MORPHOLOGY

Cellularity (and degree): Markedly hypercellular: increased with regard to the patient's age

Nucleated differential cell count:

Total nucleated cells counted: **500**

Blasts	73%
Promyelocytes	2%
Myelocytes	2%
Metamyelocytes	1%
Band/neutrophils	4%
Erythroblasts	10%
Lymphocytes	2%
Plasma cells	1%
Monocytes/promonocytes	1%
Eosinophils	4%
Basophils	0%
Mast cells	0%

M:E Ratio: 8.7:1

ERYTHROPOIESIS
- **Cellularity:** Mildly reduced
- **Type:** Normoblastic

GRANULOPOIESIS
- **Cellularity:** Markedly increased
- **Maturation:** Increased blasts
- **Myeloid morphology:** No dysplastic changes
- **Leucocytes subpopulation:** The blasts are large with large oval nuclei and prominent nucleoli. There is plentiful cytoplasm, with prominent cytoplasmic granulation and numerous Auer rods.

MEGAKARYOPOIEISIS
- **Cellularity:** Moderately reduced
- **Morphology:** Normal

LYMPHOCYTES
- **Number:** Normal
- **Morphology:** Normal

PLASMA CELLS
- **Number:** Normal
- **Morphology:** Normal

IRON STORES: Normal
- **Sideroblasts:** Present
  - **Number:** Normal
  - **Morphology:** Normal

Reporting haematologist (aspirate): A Mamoud (registrar), 3/9/13
J Mahoney (consultant), 3/9/13

TREPHINE MORPHOLOGY

Trephine biopsy identifier:	TH53563

MACROSCOPIC

Number of cores:	1
Aggregate length:	15 mm
Adequacy:	Adequate for examination

MICROSCOPIC

Trabecular bone architecture:	Normal
Cellularity (and degree):	Markedly hypercellular: increased with regard to the patient's age
Architecture:	Normal
Artefactual changes:	Absent

ERYTHROPOIESIS

Cellularity:	Mildly reduced
Maturation:	Normoblastic
Morphological abnormalities:	Absent

GRANULOPOIESIS

Cellularity:	Markedly increased
Maturation:	Preponderance of immature cells Reduced neutrophils

MEGAKARYOPOIEISIS

Cellularity:	Moderately reduced
Morphology:	Normal

LYMPHOCYTES

Number:	Normal
Morphology:	Normal

PLASMA CELLS

Number:	Normal
Morphology:	Normal
Distribution:	Normal

RETICULIN:

Grade:	2
Pattern:	Diffuse

(Immuno)histochemical stains:	Not performed
Reporting pathologist (trephine biopsy):	A Mamoud (registrar), 6/9/13 J Mahoney (consultant) 7/9/13

ADDITIONAL TESTS

CYTOGENETICS:	See appended report
FLUORESCENCE IN SITU HYBRIDISATION:	See appended report
FLOW CYTOMETRY:	See appended report
MOLECULAR STUDIES:	Flt3 and NPM1 testing cancelled in view of abnormal cytogenetic result
CANCER COUNCIL REGISTRY:	Yes
ICD-10 CODE	9896/3

Integrated report by Dr A Mamoud (registrar) Authorised 10/9/2013

Appendix 4 WHO classification of tumours of Haematopoietic and Lymphoid Tissues[20]

Incorporating updated ICD-O-3 morphology codes approved by the IARC/WHO committee as at 1 September 2011 and published online at http://www.who.int/classifications/icd/updates/ICDO3Updates2011.pdf

A pathology report of any notifiable haematological condition from any specimen (that is, the condition is regarded as malignant and has a morphology code ending in /3) must be notified to the Cancer Registry.

MYELOPROLIFERATIVE NEOPLASMS

9950/3 Polycythaemia vera
9960/3 Myeloproliferative neoplasm, NOS
9875/3 Chronic myelogenous leukaemia, *BCR-ABL1* positive
9963/3 Chronic neutrophilic leukaemia
9961/3 Primary myelofibrosis
9962/3 Essential thrombocythaemia
9964/3 Chronic eosinophilic leukaemia, NOS
9975/3 Myeloproliferative neoplasm, unclassifiable

Mastocytosis
9740/1 Cutaneous mastocytosis
9740/1 Extracutaneous mastocytoma
9741/3 Systemic mastocytosis
9741/3 Systemic mastocytosis with AHNMD
9741/3 Aggressive systemic mastocytosis
9742/3 Mast cell leukaemia
9740/3 Mast cell sarcoma

MYELOID AND LYMPHOID NEOPLASMS WITH EOSINOPHILIA AND ABNORMALITIES OF *PDGFRA*, *PDGFRB* and *FGFR1*

9965/3 Myeloid and lymphoid neoplasms with *PDGFRA* rearrangement
9966/3 Myeloid neoplasms with *PDGFRB* rearrangement
9967/3 Myeloid and lymphoid neoplasms with *FGFR1* abnormalities

MYELODYSPLASTIC/MYELOPROLIFERATIVE NEOPLASMS

9945/3 Chronic myelomonocytic leukaemia
9876/3 Atypical chronic myeloid leukaemia, *BCR-ABL1* negative
9946/3 Juvenile myelomonocytic leukaemia
9975/3 Myelodysplastic/myeloproliferative neoplasm, unclassifiable
9982/3 *Refractory anaemia with ring sideroblasts associated with marked thrombocytosis*

MYELODYSPLASTIC SYNDROMES

Refractory cytopenia with unilineage dysplasia
9980/3 Refractory anaemia
9991/3 Refractory neutropenia
9992/3 Refractory thrombocytopenia
9982/3 Refractory anaemia with ring sideroblasts
9985/3 Refractory cytopenia with multilineage dysplasia
9983/3 Refractory anaemia with excess blasts
9986/3 Myelodysplastic syndrome associated with isolated del(5q)

9989/3 Myelodysplastic syndrome, unclassifiable
Childhood myelodysplastic syndrome
9985/3 *Refractory cytopenia of childhood*

ACUTE MYELOID LEUKAEMIA (AML) AND RELATED PRECURSOR NEOPLASMS
AML with recurrent genetic abnormalities
9896/3 Acute myeloid leukaemia with t(8;21)(q22;q22); *RUNX1-RUNX1T1*
9871/3 Acute myeloid leukaemia with inv(16)(p13.1q22) or t(16;16)(p13.1;q22); *CBFB-MYH11*
9866/3 Acute promyelocytic leukaemia with t(15;17)(q22;q12); *PML-RARA*
9897/3 Acute myeloid leukaemia with t(9;11)(p22;q23); *MLLT3-MLL*
9865/3 Acute myeloid leukaemia with t(6;9)(p23;q34); *DEK-NUP214*
9869/3 Acute myeloid leukaemia with inv(3)(q21q26.2) or t(3;3)(q21;q26.2); *RPN1-EVI1*
9911/3 Acute myeloid leukaemia (megakaryoblastic) with t(1;22)(p13;q13); *RBM15-MKL1*
9861/3 *AML with mutated NPM1*
9861/3 *AML with mutated CEBPA*

9895/3 **Acute myeloid leukaemia (AML) with myelodysplasia-related changes**

9920/3 **Therapy-related myeloid neoplasms**

9861/3 **Acute myeloid leukaemia, NOS**
9872/3 Acute myeloid leukaemia with minimal differentiation
9873/3 Acute myeloid leukaemia without maturation
9874/3 Acute myeloid leukaemia with maturation
9867/3 Acute myelomonocytic leukaemia
9891/3 Acute monoblastic and monocytic leukaemia
9840/3 Acute erythroid leukaemia
9910/3 Acute megakaryoblastic leukaemia
9870/3 Acute basophilic leukaemia
9931/3 Acute panmyelosis with myelofibrosis

9930/3 **Myeloid sarcoma**

Myeloid proliferations related to Down Syndrome
9898/1 Transient abnormal myelopoiesis
9898/3 Myeloid leukaemia associated with Down syndrome

9727/3 **Blastic plasmacytoid dendritic cell neoplasm**

ACUTE LEUKAEMIAS OF AMBIGUOUS LINEAGE
9801/3 Acute undifferentiated leukaemia
9806/3 Mixed phenotype acute leukaemia with t(9;22)(q34;q11.2); *BCR-ABL1*
9807/3 Mixed phenotype acute leukaemia with t(v;11q23); *MLL* rearranged
9808/3 Mixed phenotype acute leukaemia, B/myeloid, NOS
9809/3 Mixed phenotype acute leukaemia, T/myeloid, NOS
Natural killer (NK) cell lymphoblastic leukaemia/lymphoma

PRECURSOR LYMPHOID NEOPLASMS
B lymphoblastic leukaemia/lymphoma
9811/3 B lymphoblastic leukaemia/lymphoma, NOS
B lymphoblastic leukaemia/lymphoma with recurrent genetic abnormalities
9812/3 B lymphoblastic leukaemia/lymphoma with t(9;22)(q34;q11.2); *BCR-ABL1*
9813/3 B lymphoblastic leukaemia/lymphoma with t(v;11q23); *MLL* rearranged
9814/3 B lymphoblastic leukaemia/lymphoma with t(12;21)(p13;q22); *TEL-AML1* (*ETV6-RUNX1*)
9815/3 B lymphoblastic leukaemia/lymphoma with hyperdiploidy

9816/3 B lymphoblastic leukaemia/lymphoma with hypodiploidy (hypodiploid ALL)
9817/3 B lymphoblastic leukaemia/lymphoma with t(5;14)(q31;q32) *IL3-IGH*
9818/3 B lymphoblastic leukaemia/lymphoma with t(1;19)(q23;p13.3); *E2A-PBX1 (TCF3-PBX1)*

9837/3 **T Lymphoblastic leukaemia / lymphoma**

MATURE B-CELL NEOPLASMS
9823/3 Chronic lymphocytic leukaemia / small lymphocytic lymphoma
9833/3 B-cell prolymphocytic leukaemia
9689/3 Splenic marginal zone lymphoma
9940/3 Hairy cell leukaemia
9591/3 *Splenic B-cell lymphoma/leukaemia, unclassifiable*
9591/3 *Splenic diffuse red pulp small B-cell lymphoma*
9591/3 *Hairy cell leukaemia-variant*
9671/3 Lymphoplasmacytic lymphoma
9761/3 Waldenström macroglobulinemia
9762/3 Heavy chain diseases
9762/3 Alpha heavy chain disease
9762/3 Gamma heavy chain disease
9762/3 Mu heavy chain disease
9732/3 Plasma cell myeloma
9732/3 Asymptomatic (smoldering) myeloma
9732/3 Non-secretory myeloma
9733/3 Plasma cell leukaemia
9731/3 Solitary plasmacytoma of bone
9734/3 Extraosseous plasmacytoma
9699/3 Extranodal marginal zone lymphoma of mucosa-associated lymphoid tissue (MALT lymphoma)
9699/3 Nodal marginal zone lymphoma
9699/3 *Paediatric nodal marginal zone lymphoma*
9690/3 Follicular lymphoma
9690/3 *Paediatric follicular lymphoma*
0000/0 Intrafollicular neoplasia/"in situ" follicular lymphoma
9597/3 Primary cutaneous follicle centre lymphoma
9673/3 Mantle cell lymphoma
9680/3 Diffuse large B-cell lymphoma (DLBCL), NOS
9688/3 T-cell/histiocyte rich large B-cell lymphoma
9680/3 Primary DLBCL of the central nervous system (CNS)
9680/3 Primary cutaneous DLBCL, leg type
9680/3 *Epstein-Barr virus (EBV) positive diffuse large B-cell lymphoma of the elderly*
9680/3 DLBCL associated with chronic inflammation
9766/1 Lymphomatoid granulomatosis
9679/3 Primary mediastinal (thymic) large B-cell lymphoma
9712/3 Intravascular large B-cell lymphoma
9737/3 ALK positive large B-cell lymphoma
9735/3 Plasmablastic lymphoma
9738/3 Large B-cell lymphoma arising in HHV8-associated multicentric Castleman disease
9678/3 Primary effusion lymphoma
9687/3 Burkitt lymphoma
9680/3 B-cell lymphoma, unclassifiable, with features intermediate between diffuse large B-cell lymphoma and Burkitt lymphoma
9596/3 B-cell lymphoma, unclassifiable, with features intermediate between diffuse large B-cell lymphoma and classical Hodgkin lymphoma

MATURE T-CELL AND NK-CELL NEOPLASMS

9834/3 T-cell prolymphocytic leukaemia
9831/3 T-cell large granular lymphocytic leukaemia
9831/3 *Chronic lymphoproliferative disorder of NK-cells*
9948/3 Aggressive NK-cell leukaemia
9724/3 Systemic EBV+ T-cell lymphoproliferative disease of childhood
9725/3 Hydroa vacciniforme-like lymphoma
9827/3 Adult T-cell leukaemia/lymphoma
9719/3 Extranodal NK/T cell lymphoma, nasal type
9717/3 Enteropathy-associated T-cell lymphoma
9716/3 Hepatosplenic T-cell lymphoma
9708/3 Subcutaneous panniculitis-like T-cell lymphoma
9700/3 Mycosis fungoides
9701/3 Sézary syndrome
Primary cutaneous CD30 positive T-cell lymphoproliferative disorders
9718/1 Lymphomatoid papulosis
9718/3 Primary cutaneous anaplastic large cell lymphoma
9726/3 Primary cutaneous gamma-delta T-cell lymphoma
9709/3 *Primary cutaneous CD8 positive aggressive epidermotropic cytotoxic T-cell lymphoma*
9709/3 *Primary cutaneous CD4 positive small/medium T-cell lymphoma*
9702/3 Peripheral T-cell lymphoma, (NOS)
9705/3 Angioimmunoblastic T-cell lymphoma
9714/3 Anaplastic large cell lymphoma, ALK positive
9702/3 *Anaplastic large cell lymphoma, ALK negative*

HODGKIN LYMPHOMA

9659/3 Nodular lymphocyte predominant Hodgkin lymphoma
9650/3 Classical Hodgkin lymphoma
9663/3 Nodular sclerosis classical Hodgkin lymphoma
9651/3 Lymphocyte-rich classical Hodgkin lymphoma
9652/3 Mixed cellularity classical Hodgkin lymphoma
9653/3 Lymphocyte-depleted classical Hodgkin lymphoma

HISTIOCYTIC AND DENDRITIC CELL NEOPLASMS

9755/3 Histiocytic sarcoma
9751/3 Langerhans cell histiocytosis
9756/3 Langerhans cell sarcoma
9757/3 Interdigitating dendritic cell sarcoma
9758/3 Follicular dendritic cell sarcoma
9759/3 Fibroblastic reticular cell tumour
9757/3 Indeterminate dendritic cell tumour
Disseminated juvenile xanthogranuloma

POST-TRANSPLANT LYMPHOPROLIFERATIVE DISORDERS (PTLD)

Early lesions
9971/1 Plasmacytic hyperplasia
9971/1 Infectious mononucleosis-like PTLD
9971/3 Polymorphic PTLD
Monomorphic PTLD (B- and T/NK-cell types) *
9650/3 Classical Hodgkin lymphoma type PTLD *

The italicized numbers are provisional codes for the 4th edition of ICD-O. While they are expected to be incorporated in the next ICD-O edition, they currently remain subject to change.
The italicized histologic types are provisional entities for which the WHO Working Group felt there was insufficient evidence to recognize as distinct diseases at this time**.**
*These lesions are classified according to the leukaemia or lymphoma to which they correspond and are assigned the respective ICD-O code.

References

1 Zarbo RJ (1992). Interinstitutional assessment of colorectal carcinoma surgical pathology report adequacy. A College of American Pathologists Q-Probes study of practice patterns from 532 laboratories and 15,940 reports. *Archives of Pathology and Laboratory Medicine* 116(11):1113-1119.

2 Leslie K, Rosai J (1994). Standardization of the surgical pathology report: formats, templates, and synoptic reports. *Seminars in Diagnostic Pathology* 11(4):253–257.

3 Kempson RL (1992). The time is now. Checklists for surgical pathology reports. *Archives of Pathology and Laboratory Medicine* 116(11):1107–1108.

4 Australian Cancer Network Colorectal Cancer Guidelines Revision Committee (2005). *Guidelines for the Prevention, Early Detection and Management of Colorectal Cancer*. The Cancer Council Australia and Australian Cancer Network, Sydney.

5 Maughan NJ, Morris E, Forman D, Quirke P (2007). The validity of the Royal College of Pathologists' colorectal cancer minimum dataset within a population. *British Journal of Cancer* 97(10):1393–1398.

6 Jaffe ES, Banks PM, Nathwani B, Said J, Swerdlow SH (2004). Recommendations for the reporting of lymphoid neoplasms: a report from the Association of Directors of Anatomic and Surgical Pathology. *Modern Pathology* 17(1):131–135.

7 CAP (College of American Pathologists) (2012-2013). Cancer protocols and checklists. Available from: http://www.cap.org/apps/cap.portal?_nfpb=true&cntvwrPtlt_actionOverride=%2Fportlets%2FcontentViewer%2Fshow&_windowLabel=cntvwrPtlt&cntvwrPtlt%7BactionForm.contentReference%7D=committees%2Fcancer%2Fcancer_protocols%2Fprotocols_index.html&_state=maximized&_pageLabel=cntvwr online text.

8 Chan NG, Duggal A, Weir MM, Driman DK (2008). Pathological reporting of colorectal cancer specimens: a retrospective survey in an academic Canadian pathology department. *Canadian Journal of Surgery* 51(4):284–288.

9 Gill AJ, Johns AL, Eckstein R, Samra JS, Kaufman A, Chang DK, Merrett ND, Cosman PH, Smith RC, Biankin AV, Kench JG (2009). Synoptic reporting improves histopathological assessment of pancreatic resection specimens. *Pathology* 41(2):161–167.

10 Hammond EH, Flinner RL (1997). Clinically relevant breast cancer reporting: using process measures to improve anatomic pathology reporting. *Archives of Pathology and Laboratory Medicine* 121(11):1171–1175.

11 Harvey JM, Sterrett GF, McEvoy S, Fritschi L, Jamrozik K, Ingram D, Joseph D, Dewar J, Byrne MJ (2005). Pathology reporting of breast cancer: trends in 1989-1999, following the introduction of mammographic screening in Western Australia. *Pathology* 37(5):341–346.

12 HHS (Department of Health and Human Services), CDC (Centers for Disease Control and Prevention), NCCDPHP (National Center for Chronic Disease Prevention and Health Promotion) (2005). *Report on the Reporting Pathology Protocols for Colon and Rectum Cancers Project*, HHS, CDC and NCCDPHP, Atlanta, Georgia.

13 Epstein JI, Srigley J, Grignon D, Humphrey P (2007). Recommendations for the reporting of prostate carcinoma. *Human Pathology* 38(9):1305–1309.

14 Murari M, Pandey R (2006). A synoptic reporting system for bone marrow aspiration and core biopsy specimens. *Archives of Pathology and Laboratory Medicine* 130(12):1825–1829.

15 Mohanty S, Piccoli A, Devine L, Patel A, William G, Winters S, Becich M, Parwani A (2007). Synoptic tool for reporting of hematological and lymphoid neoplasms based on World Health Organization classification and College of American Pathologists checklist. *BMC Cancer* 7:144.

16 Lee SH, Erber WN, Porwit A, Tomonaga M, Peterson LC, International Council for Standardization In Hematology (2008). ICSH guidelines for the standardization of bone marrow specimens and reports. *Int J Lab Hematol.* 30(5):349-364.

17 RCPA (Royal College of Pathologists of Australasia) (2009). *Guidelines for Authors of Structured Cancer Pathology Reporting Protocols*. RCPA, Surry Hills, NSW.

18 Edge SE, Byrd DR, Compton CC, Fritz AG, Greene FL, Trotti A (eds) (2010). *AJCC Cancer Staging Manual 7th ed.*, New York, NY.: Springer.

19 RCPA (Royal College of Pathologists of Australasia) (2004). *Chain of Information Custody for the Pathology Request-Test-Report Cycle — Guidelines for Requesters and Pathology Providers*. RCPA, Surry Hills, NSW.

20 Swerdlow S, Campo E, Harris N, Jaffe E, Pileri S, Stein H, Thiele J, Vardiman J (eds) (2008). *WHO Classification of Tumours of Haematopoietic and Lymphoid Tissues*, IARC, Lyon.

21 Rumke CL (1977). The statistically expected variability in differential counting. In Koepke JA (ed) Differential Leukocyte Counting. CAP Conference Aspen, Skokie. IL, College of American Pathologists, 39-45.

22 Vollmer RT (2009). Blast counts in bone marrow aspirate smears: analysis using the poisson probability function, Bayes theorem, and information theory. *Am J Clin Pathol.* 131(2):183-188.

23 Brunning RD, McKenna RW (1994). *Atlas of Tumor Pathology. Tumors of the Bone Marrow. Third Series. Fascicle 9*. Armed Forces Institute of Pathology, Washington, DC.

24 Lewis SM, Bain BJ, Bates I (eds) (2006). *Practical Haematology, 10th edn*, Churchill Livingstone, London.

25 Glaser K, Limarzi LR, Poncher HG (1950). Cellular composition of the bone marrow in normal infants and children. *Pediatrics* 6:789-824.

26 Rosse C, Kraemer MJ, Dillon TL, McFarland R, Smith NJ (1977). Bone marrow cell populations of normal infants; the predominance of lymphocytes. *Journal of Laboratory and Clinical Medicine* 89:1225-1240.

27 Rath CE, Finch CA (1948). Sternal marrow haemosiderin: a method for the determination of available iron stores in man. *J Lab Clin Med* 33:81-86.

28 Thiele J, Kvasnicka HM, Facchetti F, Franco V, van der Walt J., Orazi A (2005). European consensus on grading bone marrow fibrosis and assessment of cellularity. *Haematologica* 90:1128-1132.

29 Royal College of Pathologists of Australasia (2011). Functional Requirements for Laboratory Information Systems to support Structured Pathology Reporting of Cancer Protocols https://www.rcpa.edu.au/Library/Practising-Pathology/Structured-Pathology-Reporting-of-Cancer/Implementation

30 Valenstein PN (2008). Formatting pathology reports: applying four design principles to improve communication and patient safety. *Arch Path Lab Med.* 132(1):84–94.