MOLECULES MATTER

TURNING THE SCIENCE OF MOLECULAR DIAGNOSTICS IN LUNG CANCER INTO A PRACTICAL SERVICE FOR ALL PATIENTS

UNITED KINGDOM
LUNG CANCER COALITION

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MEMBERSHIP AND ACKNOWLEDGEMENTS

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ABOUT THE UKLCC

The United Kingdom Lung Cancer Coalition (UKLCC) – the country's largest multi-interest group in lung cancer – is a coalition of the UK's leading lung cancer experts, senior NHS professionals, charities and healthcare companies.

Through our campaigning activity we aim to:

- Raise political awareness of lung cancer
- Raise the general public's awareness of lung cancer – and especially encourage earlier presentation and symptom recognition
- Empower patients to take an active part in their care
- Improve lung cancer services

CONTACT DETAILS

The UKLCC is keen to work with all interested organisations and bodies to improve the quality and outcomes of lung cancer treatment and care.

For more information about our work and our partners, please visit our website or contact our secretariat.

www.uklcc.org.uk

The CAG is also supported by leading patient and clinical group members, including:

- British Lung Foundation
- British Thoracic Oncology Group
- British Thoracic Society
- Cancer Black Care
- Cancer Research UK
- Macmillan Cancer Support
- National Lung Cancer Forum for Nurses
- Primary Care Respiratory Society
- Roy Castle Lung Cancer Foundation
- Tenovus Cancer Care

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FOREWORD

There have been rapid advances in our understanding of the biology of lung cancer over the last 15 years. There was a time, not so long ago, when, if you were lucky enough to have a pathologist in your multi-disciplinary team (MDT) meeting, they were only asked two questions: 1) “is it lung cancer?” and 2) “is it a small cell cancer?”. Until 2008, when the first prospective phase III study in non-small cell lung cancer (NSCLC) to show survival differences based on histologic type was published,[1] most clinicians were happy with a simple diagnosis of NSCLC and did not quiz their pathology colleagues too heavily about the sub-type.

Then, with the discovery that drugs can be targeted to block the growth and spread of cancer by interfering with specific molecules that are involved in the growth, progression, and spread of cancer[2,3] the era of targeted therapy for lung cancer began.

EGFR was the first ‘actionable mutation’ discovered in lung cancer but has since been followed by many more (including ALK and ROS-1 gene rearrangements), all of which have a range of major clinical benefits. New targets and agents are being discovered regularly and at a pace that clinicians, pathologists and drug regulators find it difficult to keep up with.

More recently, a better understanding of the immunology of cancers, and lung cancer particularly, has led to the development of a range of immune checkpoint inhibitors (PD-1 and PD-L1). This has given us the ability to be able to identify those patients most likely to benefit from immunotherapies.

So, pathologists are now being asked a range of increasingly complex questions by their oncology colleagues, including: “what is the sub-type of NSCLC?”, “are there any actionable molecular abnormalities in the tumour?” and, “what is the level of PD-L1 expression in the tumour?” At the same time, there is increasing pressure to provide these answers ever more rapidly. All this means that in order to provide lung cancer services of the highest quality and allow all suitable patients rapid access to the most effective treatments, the NHS has to ensure that every provider of lung cancer care in the UK has access to molecular pathology services that are up to the task.

It is not feasible to have the full range of services required to achieve this at every hospital. Only the largest centres with specialist services are likely to have the expertise to carry out every element of what constitutes a full, modern, pathology report for every type of tumour. So, an integrated strategy needs to be developed that deals not only with the scientific and technical issues, but also the logistical and communication problems that such complexity brings.

It has to be said that the NHS has been slow to respond to these developments and, with a few exceptions, much of what has been achieved so far has been based on initiatives from external groups such as Cancer Research UK’s ‘*Stratified Medicine*’ programme and work by the pharmaceutical industry. Considerable investment has been committed to date to the academic activity in this field. However, services are somewhat ‘patchy’ and provide inequity for patients.

Pathologists have not been the only clinical group that has had to respond to the increasing complexity of making a complete diagnosis of lung cancer. Those involved in obtaining the tissue required for making the pathological diagnosis are also crucial to the process. The range of tissue sampling techniques has also been widening in recent years, in particular with the development of endobronchial ultrasound (EBUS) sampling of the mediastinum and wider use of CT guided needle biopsy. The increasing range of pathological tests needs larger, better quality tissue samples and there is strong, though largely anecdotal, evidence of wide variation in the quality of samples being received by pathology laboratories. Those involved in such tissue sampling should therefore probably be subject to a Quality Assurance programme of some kind.

This workshop was convened by the UK Lung Cancer Coalition (UKLCC) to bring together a select group of highly qualified experts in the field to try and define the issues that need to be addressed, and to propose a set of actions to ensure that every lung cancer patient in the UK has timely access to all the pathological detail of their tumour so that they can access whatever treatment is most likely to have a beneficial impact on their outcomes. If the UK wants to achieve the best cancer outcomes in the world,[4] then these issues must be addressed, and urgently!

Professor Michael Peake
Chair, Clinical Advisory Group,
UK Lung Cancer Coalition

INTRODUCTION

In June 2018 the UKLCC convened a meeting of its Clinical Advisory Group, to have a detailed discussion about how we can turn the science of molecular diagnostics in lung cancer into a practical service for all patients.

In lung cancer, molecular diagnostics is now a central part of the diagnostic and treatment pathway. The range and technical complexity of tests is increasing and changing rapidly which provides new hope in delivering improvements in lung cancer outcomes. Without access to these tests, patients cannot access the innovative, personalised treatments that they could benefit from.

However, we know that there is variation around the country in:

- How and when tests are ordered by MDTs
- Whether tests are done locally or regionally
- Turnaround times for test results
- The range of markers available for testing
- The techniques used
- The way results are reported and cascaded through the MDT

There is a lack of a coordinated strategy to ensure that there is a common approach to testing across the country and currently there are no data available on activity, performance or the link between testing, treatment and outcomes.

In October 2018 NHS England launched a network of seven national genomic laboratory hubs (GLHs) which will organise genomic testing in defined geographical areas across England. The GLHs will support the delivery of the Genomic Medicine Service (GMS) which should provide a world class resource for the NHS.

Despite these steps forward rolling out the GMS, which will be of huge benefit to lung cancer patients, there is much which needs to be done to ensure that the service is optimised to deliver current and emerging molecular diagnostic tests in lung cancer in the next 2-5 years. Ultimately, these steps are central to achieving the UKLCC's ambition as set out in our report '*25 by 25 - A ten-year strategy to improve lung cancer survival rates*' of improving the five-year survival rate for lung cancer to 25 per cent by 2025.

We welcome the Government's ambition set out in The NHS Long Term Plan that, by 2028, the proportion of cancers diagnosed at stages one and two will rise from around half to three-quarters. Screening programmes and sufficient diagnostic capacity are key to making this a reality.

It was promising to see the focus in the *Plan* on the importance of molecular diagnostics and the commitment to offering genome testing to all people with cancer for whom it would be of clinical benefit, alongside pledges to support early diagnosis within cancer via screening methods – such as the expansion of mobile CT scanner programme.

This report sets out some considerations and recommendations to ensure that the NHS can deliver a world class molecular diagnostic service, to all lung cancer patients, regardless of where they live in England. We hope that these can be seen in the context of the Government's renewed commitment to putting early diagnosis at the heart of improved cancer outcomes.

This report focusses on the technical, organisational, professional, and data challenges which need to be tackled to realise the potential of molecular diagnostics in improving outcomes and experience for lung cancer patients. It also suggests how the devolved nations can be part of this movement to optimise molecular diagnostics for lung cancer patients across the UK.

We hope that the recommendations set out in this report are a helpful spotlight on some of the current challenges and provide sensible suggestions to policymakers, services and healthcare professionals alike.

IMMUNO-HISTOCHEMISTRY TESTS ARE COMMONLY USED TO DELIVER AN INITIAL DIAGNOSTIC REPORT

MOLECULAR TESTING CAN BE UNDERTAKEN TO GUIDE TARGETED THERAPIES

ABOUT GENOMICS AND MOLECULAR DIAGNOSTICS

Cancer begins in our cells, which are the building blocks in making every part of a human. Inside almost every cell in your body is a copy of your genome, which is made up of DNA. The genome is your body's instruction manual which tells each cell how to operate. The genome tells a cell what type of cell it is and when it should grow, divide and die. Genomics, therefore, is the science of trying to understand this instruction manual.

Sometimes when a cell divides mistakes occur in copying the genome. These are called mutations. Cells can repair mutations in their genome, with most DNA damage being repaired straight away. If the damage is too significant then the cell will self-destruct or be destroyed by the body's immune system. However, in some cases damaged cells multiply out of control and become a tumour.

Once a patient has a tumour, the medical team can use a range of different tests and scans to diagnose the cancer. One of the most important tests is the biopsy, which involves taking a small piece of tissue or cells from the cancerous area which can then be tested in the pathology laboratory. The materials sent to the laboratory for analysis are called 'histology samples' or 'cytology samples'.

Immuno-histochemistry (IHC) tests are commonly used to deliver an initial diagnostic report. These consist of staining a tissue sample, which is then examined under a microscope. IHC testing has a role in diagnosis, prognosis and in identifying markers that inform treatment options.

Molecular testing can be undertaken to guide targeted therapies. Molecular diagnostics is a specific part of laboratory medicine or clinical pathology which uses the techniques of molecular biology to diagnose disease, predict disease course, select treatments and monitor the effectiveness of treatments.

Molecular testing can be done as single gene abnormality testing which focusses on testing for unique, identified gene alterations that have been correlated with an effective targeted therapy (one-gene, one-test) or with panel testing which looks at several different gene alterations.

Since the first sequencing of the human genome, it has become possible to understand a wealth of information about cancers that can help to guide treatment with personalised medicines.

It is still very time consuming and costly to do whole genome sequencing. Using the same technique of next generation sequencing, we can focus on clinically actionable gene alterations in a range of genes, to characterise more of the tumour's genetic profile. This is quicker and cheaper than whole genome sequencing.

SUMMARY OF RECOMMENDATIONS

TECHNICAL

1

NICE and NHS England should assess and approve molecular biomarkers and their associated diagnostic tests regularly to keep pace with the emergence of novel targeted therapies

2

NHS England should ensure that the National Genomic Test Directories, can be updated on an ad hoc basis if a positive decision by NICE impacts on the tests which need to be made available, to ensure patient access to NICE approved medicines, outside of the annual review cycle for the Directories

3

Services should be clear about the circumstances when they would use reflex vs on demand testing. This should be clear and transparent to the whole MDT

4

Services should be clear about the circumstances when they would use NGS panels vs multiple/single gene tests. NGS is more tissue- and cost-effective in a large laboratory testing multiple samples. There should be recognition that some situations will arise where bespoke testing may be preferable

5

We should be encouraging people collecting tissue samples to ensure that, as far as is possible, sufficient material is obtained to maximise the ability of pathologists to make a correct and detailed diagnosis. Samples should be collected according to relevant national guidance, with pathologists using the tissue in a judicious fashion

ORGANISATIONAL

6

Services in England should work towards the goals of the National Optimal Lung Cancer Pathway and other nations should consider adopting similar approaches

7

As a first step to this, process mapping, involving all relevant staff, should be employed to identify where blocks to rapid turn-around are occurring

8

Technical staff in labs should be engaged in identifying how the service can be streamlined so that work can be carried out effectively and efficiently

9

Pathologists should follow the Royal College of Pathologists guidelines for lung cancer

10

Patients should be told as much information as possible regarding the next step in their journey, including the anticipated timeline when test results will be available, before they leave the service

11

Trusts and GMS hubs should ensure there is the rapid and efficient movement of samples. There must be investment in IT infrastructure so that samples can be tracked, and key staff know where they are

12

The movement of samples must be well coordinated and tracked, so that turnaround times can be minimised. Standards should be set for turnaround times which are monitored and publicly reported

PROFESSIONAL

13

Pathologists and NHS England should work to ensure there is a good working relationship between pathology laboratories and the Genomic Laboratory Hubs, so that services are delivered efficiently

14

Lung CNSs should be increased to a level where no Trust has less than two CNSs and the case load is no more than 80 new patients per year. This will ensure patient care is fully integrated and will allow the CNS to be a critical point of communication across the service

15

Budget must be set aside to specifically address the workforce issues in cellular pathology. This could be through ring-fencing posts as set out in the Government's new cancer workforce plan which promises nearly 4,000 extra NHS staff to be in place by 2021, or by other routes

16

Every lung cancer service should review administrative and coordination capacity to ensure that there is sufficient capacity to deliver effective and efficient back office tasks

17

Numbers of biomedical scientists should be reviewed in each area and steps taken to increase capacity where this can be demonstrated to be a limiting factor in turnaround times or quality

18

There should be standards for the training and experience of those involved in taking tissue samples, particularly those doing Endobronchial US, thoracoscopy and image guided needle biopsy

19

Professionals involved in tissue sampling procedures should be required to participate in audit and quality assurance programmes

DATA

20

Standard datasets and reporting templates should be developed locally using the RCPath guidelines, and used for the results of molecular diagnostic tests, to allow data to be collected by cancer registration system and linked to other patient-related data. These data could be collected using a national Laboratory Information Management System (LIMS) or other system

21

Linked data should be used to assess the appropriateness of treatment and outcomes for cancer patients by those providing lung cancer care

22

All MDTs should be providing mandated information to COSD. However, the current level of data completeness is very variable between trusts and for some data fields it is extremely low. This must be monitored, and action taken to ensure that high quality mandatory data is submitted by all MDTs

23

When information on molecular diagnostics is first included in the NLCA report in 2020, this should be used to monitor molecular diagnostic services, to identify trends and to act against unwarranted variations

24

Ongoing work by National Cancer Registration and Analysis Service (NCRAS) to map the molecular diagnostic testing footprint in England should be continued. This should include an investigation of services which are not formally considered to be 'molecular testing laboratories' to capture all molecular diagnostic activity

DIVERGENCE IN THE DEVOLVED NATIONS

25

Scotland, Wales and Northern Ireland should consider aligning lung cancer services to the NOLCP

26

Wales and Northern Ireland should develop a formal plan to ensure that they are able to rapidly implement a Genomic Medicines Service in their country

27

Scotland and Northern Ireland should consider how they audit lung cancer services, to ensure that there is comprehensive information available which can be used to better understanding of lung cancer in these countries. They should consider whether they should adopt all or parts of the NLCA

TECHNICAL

The frontier in pathology and molecular diagnostics is moving at pace. Over the last five years, since the establishment of the 100,000 Genomes Project, demand for genetic tests and the range of identified targets has grown hugely. In lung cancer, pathology and molecular diagnostics unde rpin the successful treatment of a tumour. This rapid change leads to a number of technical considerations which must be made to ensure that systems and structures are able to keep up with the science.

WE MUST ENSURE THAT THE STEPS ARE PUT IN PLACE TO ENSURE THAT **PATHOLOGY AND MOLECULAR DIAGNOSTICS SERVICES** ARE ABLE TO **KEEP UP** AND **ALIGN WITH THE CHANGING TREATMENT** LANDSCAPE

A DIAGNOSTIC LEVEL OF **85 PER CENT** SHOULD BE ATTAINABLE WHEN **DEFINITE ENDOBRONCHIAL TUMOUR IS VISIBLE**

New molecular biomarkers and tests

Research in molecular diagnostics and personalised medicines is developing quickly. This means that there is an imperative for the system to keep pace with the science, so that each patient can have the treatment which their clinician thinks is best for them. If England wants to remain at the forefront of the genomics revolution, then we must make testing and personalised medicines available via the NHS in a timely manner.

One of the potential barriers to patients having rapid access to medicines which require pathology or molecular diagnostics is that the National Genomic Test Directories is only reviewed annually. If this rigid review system remains in place, a medicine approved by NICE could have to wait up to a year to have its diagnostic test added to the Test Directories. This clearly means that it would not be possible to make such medicines available to patients within the required standard timeframe of three months following NICE approval.

We must ensure that the steps are put in place to ensure that pathology and molecular diagnostics services are able to keep up and align with the changing treatment landscape.

RECOMMENDATIONS

1
NICE and NHS England should assess and approve molecular biomarkers and their associated diagnostic tests regularly to keep pace with the emergence of novel targeted therapies.

2
NHS England should ensure that the National Genomic Test Directories, can be updated on an ad hoc basis if a positive decision by NICE impacts on the tests which need to be made available, to ensure patient access to NICE approved medicines, outside of the annual review cycle for the Directories.

Determining the appropriate testing approach

Approaches to testing vary between different services. To a certain extent this variation is valid and there is debate about the extent to which a standardised model should be implemented across the country. However, steps should be taken to ensure that there is a streamlined and effective approach to testing.

Approaches differ as to whether tests will be ordered on-demand or as a reflex test based on agreed protocols. In some areas the rationale for reflex vs on-demand testing is not clear and, therefore, it is challenging to determine
if resources are being used as effectively as possible. Some argue that reflex testing should only be done in patients who are likely to be eligible for personalised treatment (i.e. not in all patients) but there is no clear consensus on this.

NHSE is requiring that next generation sequencing (NGS) gene panels are implemented but it is understood that this may not preclude the use of additional multiple/single gene tests, if appropriate. There is some disagreement about whether it is better to use NGS panels or multiple/single gene testing. The evidence is not sufficiently mature yet to give a clear answer in all situations about the best type of testing. However, there are a number of issues which should be proactively considered. These include:

- Validity of a test
- Clinical usefulness of a test
- Speed of results
- Quality and size of the tissue sample
- Appropriate use of resources (cost and workforce time)
- Re-biopsy

At the very least, all members of the MDT must be aware of the approach taken to testing in their area.

RECOMMENDATIONS

3
Services should be clear about the circumstances when they would use reflex vs on demand testing. This should be clear and transparent to the whole MDT.

4
Services should be clear about the circumstances when they would use NGS panels vs multiple/single gene tests. NGS is more tissue- and cost-effective in a large laboratory testing multiple samples. There should be recognition that some situations will arise where bespoke testing may be preferable.

Tissue availability and sample quality

The amount of tissue available and quality of the sample is important in planning diagnostic tests. If insufficient material is taken initially, it can be difficult to get further samples. The size and quality of a sample can impact on testing capabilities, if multiple tests need to be done.

To ensure that initial and subsequent tests have the highest chance of success, clinicians who are taking samples should take, where possible and safe, as much material as possible, for these diagnostic tests. This can be challenging, particularly in lung cancer, but taking a larger sample of material initially can be vitally important in optimising treatment initially, and at future steps in the pathway.

Where there is only a small sample, it is essential that tests are planned to maximise what can be learnt from the sample. Sometimes tissue is 'used up' in diagnostic tests, which means that more important predictive tests can't be performed in the future. This can then impact on a patient's treatment pathway.

The British Thoracic Society has useful guidelines which should be referred to in order to guide testing. For example, in '*Guidelines for diagnostic flexible bronchoscopy in adults*' for lung cancer states:[5]

- A diagnostic level of 85 per cent should be attainable when definite endobronchial tumour is visible
- At least five biopsy samples should be taken when endobronchial tumour is visible to maximise diagnostic yield and the volume of biopsy tissue and to allow for tumour phenotyping and genotyping
- When endobronchial tumour is visible, brushings and washings can increase the diagnostic yield of the procedure
- A chest CT scan should be performed prior to a diagnostic bronchoscopy in patients with suspected lung cancer
- Sensitivity of EBUS should be 88 per cent and provide adequate tissue for subtyping and phenotyping in >90 per cent

RECOMMENDATION

5
We should be encouraging people collecting tissue samples to ensure that, as far as is possible, sufficient material is obtained to maximise the ability of pathologists to make a correct and detailed diagnosis. Samples should be collected according to relevant national guidance, with pathologists using the tissue in a judicious fashion.

ORGANISATIONAL

Pathology plays a vital role in the diagnosis and treatment of lung cancer. However, there is an increased demand for pathology services, as a result of higher cancer incidence, the growing complexity of referrals and requests, and the introduction of initiatives to increase earlier cancer diagnosis. The organisation of pathology services makes a huge difference to the efficacy of testing. Future-proofing is crucial to ensuring that patients receive a timely diagnosis. We welcome the steps set out in The NHS Long Term Plan to support diagnostic services, such as the roll-out of Rapid Diagnostic Centres (RDCs). We must now look to ensure that pathology services work as effectively as possible, to improve the rate of early diagnosis within lung cancer.

National Optimal Lung Cancer Pathway (NOLCP)

In diagnostics, backlogs can gradually build up – with some teams having to outsource reporting to keep up. With increasing demand for tests, this is not sustainable and work must take place to ensure that patients receive an efficient service wherever they are in the UK.

The NOLCP provides a road map for service providers and commissioners who are aiming to improve their local lung cancer services, to help ensure patients start treatment within 49 days. The NOLCP sets out that initial diagnosis should be within 48 hours and the pathology turnaround time should be three days.

Process mapping is a good first step in thinking about how best to implement the NOLCP. This requires getting everyone who is involved in a lung cancer patient's journey (all MDT members, plus GPs, managers, administrators, porters, etc.) into a room to map every element of the existing pathway. This will help to identify inefficient points in the pathway, which can then be prioritised for action and improvement. This work will help services understand the role of pathology within this process and identify the steps to take to address any inefficiencies.

NOLCP rests on diagnostic tests needing to be planned and timed so that results are available quickly and at key points in the cycle of a service, in order to be discussed and acted upon as quickly as possible. Implementation of the NOLCP also means that centres review how tests can be streamlined, with some looking to bundle some of the initial diagnostic tests where possible and appropriate.

In some centres (for example, Leicester), when a patient is identified as having small cell lung cancer, pathologists are able to refer direct to the oncologist rather than having to go via the MDT (though the MDT is kept informed). This means that time is saved and patients are moved along the pathway more quickly and efficiently.

To support with this, the appointment of a coordinator capacity can help to ensure that patients' specimens are properly tracked and moved in an efficient way from the test site to pathology. This type of coordination has a hugely positive impact across the whole pathway.

As set out by the Royal College of Pathologists (RCPath) the current KPIs for turnaround times for tests are different to what is set out in the NOLCP. These are being reviewed, but the RCPath KPI document states that turnaround times can be agreed locally in relation to linked patient pathways. The RCPath therefore recommends that pathologists work towards the recommendations within the NOLCP at a local and/or regional level.[7]

There is some tension in how long reporting timelines should be in the NOLCP. NOLCP says 'days' and RCPath guidelines say 'calendar days', which is a significant difference. To ensure that timelines are met in relation to data collection, it would be a huge task to retrospectively take out weekend days to see if the target was met. It is important that this issue is resolved, with reporting timelines clarified.

For more information on implementing NOLCP and case studies, please read *Millimetres Matter: implementing the National Optimal Lung Cancer Pathway*.

RECOMMENDATIONS

6
Services in England should work towards the goals of the NOLCP and other nations should consider adopting similar approaches.

7
As a first step to this, process mapping, involving all relevant staff, should be employed to identify where blocks to rapid turn-around are occurring.

8
Technical staff in labs should be engaged in identifying how the service can be streamlined so that work can be carried out effectively and efficiently.

9
Pathologists should follow the Royal College of Pathologists guidelines for lung cancer.

Communication

Effective management of diagnostics in lung cancer could be described as one of the most sophisticated examples of team work, not only across a team, but also between trusts. The importance of effective communication cannot be overstated – both between healthcare professionals and patients, and between professionals themselves.

As our understanding of the complexity of lung cancer increases, more people need to be involved from the request for a test, through to the answer being received.

Individuals must speak to each other throughout this process and ensure that patients are told key information at each step in the pathway. Patients being aware of the timelines in which to expect test results, empowers them in this process. If patients are not aware, they can go from treatable to not treatable, which may have been prevented by clear lines of communication.

RECOMMENDATION

10
Patients should be told as much information as possible regarding the next step in their journey, including the anticipated timeline when test results will be available, before they leave the service.

Movement and integration of samples

There is a significant level of variation from service to service in terms of turnaround times for samples. Delays in this process directly impact patients' chances of effective treatment. Instances of MDTs calling for test results when a sample has not even been received highlight a concerning lack of efficiency.

It is critical that samples are efficiently tracked so that staff know their location – reducing time lost searching while samples are being moved around the system. Achieving the 10-day standard for turnaround times as outlined in the NOLCP, including the time spent from request to initiation of testing, should be the expectation for all services.

At present, there is also no way to calculate how many samples do not get to the lab for testing and the reasons for this. Without this information, it is impossible for labs to work to improve their processes. Patients are potentially missing out on treatment because the testing pathway is not implemented appropriately.

With a major challenge being the way in which samples are received from pathology labs, there is an argument for pathology services to be centralised. However, this will not necessarily save time or money because of the volume of samples that will need to be moved around the country. To support with this, the funding of molecular diagnostics needs to be clarified and transparent, including the transport of samples.

It is also important that local services are provided for people who do not want to travel for testing, or that steps are put in place to support those who need to travel.

More must be done to support integrated reporting of IHC and molecular tests. At the moment, this does not always happen which means a clinician might have to look in multiple databases to get a complete picture before seeing a patient. It would be far more efficient and beneficial to the patient if everything was put into a single report.

RECOMMENDATIONS

11
Trusts and GMS hubs should ensure there is the rapid and efficient movement of samples. There must be investment in IT infrastructure so that samples can be tracked, and key staff know where they are.

12
The movement of samples must be well coordinated and tracked, so that turnaround times can be minimised. Standards should be set for turnaround times which are monitored and publicly reported.

Genomic Medicine Service (GMS)

In March 2017, the NHS England Board set out its ambition to build a GMS, building on the 100,000 Genomes Project work. This included a commitment to developing a national genomic laboratory service through a network of Genomic Laboratory Hubs.[8]

The Royal College of Pathologists suggested that the Genomic Laboratory Hubs should be co-ordinated with NHS Improvement's plans to establish a consolidated network of 29 pathology hubs,[9] emphasising the expertise required to prepare tumour samples for genome sequencing.[10]

However, it is key that the relationship between the centres and the Hubs needs to be agreed. The Hubs also need to determine the best mix and spread of services in their geographical area and how to help deliver efficiencies.

RECOMMENDATION

13
Pathologists and NHS England should work to ensure there is a good working relationship between pathology laboratories and the Genomic Laboratory Hubs, so that services are delivered efficiently.

PROFESSIONAL

A strong workforce is central to an effective diagnostics process. Every year more people are referred for diagnostic tests and services are struggling to keep up with the growing demand. It is also key that new approaches to training and management are introduced which make better use of staff time and skills, so more cancers can be diagnosed earlier – helping more patients to survive.

Diagnostics as a profession

Diagnosing a patient at an early stage is critical to giving them the best chance of survival. As such, diagnostics as a profession deserves recognition which reflects the importance of this.

The clinical role of pathologists now goes far beyond diagnosis. With the introduction of personalised approaches to medicine, those working in this area are increasingly involved in decisions on treatment. Therefore, discussions on the future of cancer workforce and publications, including guidelines, must reflect the importance of this profession. It is key that we also ensure that roles in diagnostics remain attractive to ensure talented individuals continue to take up opportunities in this field.

Capacity

Key to ensuring that diagnostic tests are managed efficiently is reviewing the way in which the capacity and organisation of staff involved in the process. The Royal College of Pathologists Histopathology Workforce Census, published in September 2018, found that only three per cent of departments who responded had enough staff.

The development of new therapies has meant that many patients are now living longer, which should be celebrated. This is, however, also having a direct impact on the workload of healthcare professionals, in particular, lung cancer clinical nurse specialists (CNSs). CNSs are having to look after patients who survive longer as well as taking on new cases.

CNSs can help to drastically improve the quality of life for people with cancer through assisting with decision-making, symptom management and emotional support. They should have 80 new cases per CNS. However, it is often the case that Band 7 nurses are performing administrative roles, just to move patients along the pathway – an ineffective use of their time and expertise which should be focussed on patient care.

More widely, set pathway coordinators – with a clear understanding of molecular diagnostics – are a key way to help ensure patients' tests are streamlined, and results are received as swiftly as possible.

As the complexity of lung cancer as a condition has grown, staff numbers have not necessarily changed to adapt to this and it is key that the many different roles undertaken by staff are acknowledged as well as capacity issues being eased through increasing numbers. It is also important that pathology receives appropriate recognition as a profession. The extent to which pathology is a specialism must be better understood.

RECOMMENDATIONS

14
Lung CNSs should be increased to a level where no Trust has less than two CNSs and the case load is no more than 80 new patients per year. This will ensure patient care is fully integrated and will allow the CNS to be a critical point of communication across the service.

15
Budget must be set aside to specifically address the workforce issues in cellular pathology. This could be through ring-fencing posts as set out in the Government's new cancer workforce plan which promises nearly 4,000 extra NHS staff to be in place by 2021, or by other routes.

16
Every lung cancer service should review administrative and coordination capacity to ensure that there is sufficient capacity to deliver effective and efficient back office tasks.

17
Numbers of biomedical scientists should be reviewed in each area and steps taken to increase capacity where this can be demonstrated to be a limiting factor in turnaround times or quality.

THE CLINICAL ROLE OF PATHOLOGISTS NOW **GOES FAR BEYOND DIAGNOSIS**

Training and quality assurance

One of the biggest challenges to improving diagnostic tests is having sufficient trained staff to make sure that there is capacity in the system to be efficient and streamlined. It is not advantageous to put more budget towards improving cancer diagnostics if there are not trained staff to do the job.

In December 2017, Health Education England (HEE) launched its Cancer Workforce Plan for England, developed with NHS England – providing data on key professions to support Cancer Alliances, HEE and employers agree the actions needed to help recruit, train and retain the staff necessary to deliver improvements in care.

Diagnostics featured prominently within this, with HEE committing to establish a working group with the Royal College of Pathologists to explore ways of expanding reporting pathologists to increase diagnostic and dissecting capacity.

While this is promising, developments in molecular diagnostics and changes in clinical guidelines have increased the complexity of many tests. The community would welcome the setting of guidelines for those involved in taking tissue samples, which would help provide quality assurance. A new service specification and guidelines are expected to be published this year, and NICE should look to publish quality standards in this area.

RECOMMENDATIONS

18
There should be standards for the training and experience of those involved in taking tissue samples, particularly those doing Endobronchial US, thoracoscopy and image guided needle biopsy.

19
Professionals involved in tissue sampling procedures should be required to participate in audit and quality assurance programmes.

DATA

There is huge variation in the structures in place across the country in collecting and using data in pathology and molecular diagnostics. A lack of joined-up working between teams, alongside workforce pressures and a lack of clarity around reporting, means that we do not have a complete picture from the data about what is happening across the country.

In the pathology field more broadly, there is a lack of data on services. Without sufficient data, it is difficult to quantify how patient demand has grown or changed, and difficult to look at whether there are issues with turnaround times or staff resourcing. This must change in order for planning and commissioning of services to effectively take place.

As this new service develops, it is essential for its sustainability that we have consistent and clear data about what is happening.

IT IS ESSENTIAL THAT WE HAVE **CONSISTENT AND CLEAR DATA** ABOUT WHAT IS HAPPENING ACROSS THE COUNTRY

Standard datasets and reporting

Currently only limited data are collected nationally from molecular testing laboratories and there is no national approach to data reporting. This variation across the country in relation to how tests are reported means that it is very difficult to compare the service levels and outcomes between different labs. It also means that if an MDT is receiving information about tests from different outsourced labs, the way these are reported is likely to be different and therefore it is more difficult to make clinical decisions.

Having a national proforma, which is used in every service so that there is a standardised way to write up a molecular diagnostic report, would help to standardise the way that reports are provided. This would make it easier for MDTs to use information from multiple labs. This standardised reporting would also help to build a longitudinal study on the impact of molecular diagnostic testing which will help the service to optimise more quickly.

Having a single Laboratory Information Management System (LIMS), or other standard computer system would make it easier to extract data, map it to make it a consistent format and therefore make it useful.

Having standard reporting and one computer system to hold the information would enable linking with other datasets. As personalised medicines increase in use, the ability to link data and generate rich and meaningful real-world data will be vital. This real-world evidence, about the applications and outcomes of different treatment protocols, will help to optimise the treatment of lung cancer.

RECOMMENDATIONS

20
Standard datasets and reporting templates should be developed locally using the RCPath guidelines, and used for the results of molecular diagnostic tests, to allow data to be collected by cancer registration system and linked to other patient-related data. These data could be collected using a national Laboratory Information Management System (LIMS) or other system.

21
Linked data should be used to assess the appropriateness of treatment and outcomes for cancer patients by those providing lung cancer care

Cancer Outcomes and Services Dataset (COSD)

One route where data are beginning to be collected is through COSD. There are two sections in COSD which require the inclusion of information about germline and somatic testing. This is a national dataset and therefore all MDTs are required to provide information to COSD. This therefore has the potential to start providing empirical evidence about testing. However, to date, we understand that the reporting of these data is low.

RECOMMENDATION

22
All MDTs should be providing mandated information to COSD. However, the current level of data completeness is very variable between trusts and for some data fields it is extremely low. This must be monitored, and action taken to ensure that high quality mandatory data is submitted by all MDTs.

National Lung Cancer Audit (NLCA)

The NLCA has been an instrumental tool in driving up standards, and therefore patient outcomes, in lung cancer patients. The purpose of the audit is to review the quality of lung cancer care, to highlight areas for improvement and to reduce variation in practice. However, until now data collected in the audit has not included pathology and molecular diagnostics. This is now going to change, with some data from 2018 being captured from molecular laboratories and included in the audit which is due for publication in 2020.

RECOMMENDATION

23
When information on molecular diagnostics is first included in the NLCA report in 2020, this should be used to monitor molecular diagnostic services, to identify trends and to act against unwarranted variations.

This is a good first step in building a national dataset to monitor molecular diagnostic services and their outcomes, but it will be important that the data which are collected in this critical area continue to evolve and grow over time, to drive up standards and reduce unwarranted variations around the country.

Mapping diagnostic footprint

A programme of activity is currently underway to map the molecular diagnostic testing footprint in England. This will help to inform the new Genetic Medicines Services. Understanding what testing is being undertaken where is a huge undertaking and a project of vital importance so that we have a clearer picture of what how the service is operating now.

It has been noted that molecular testing is taking place in labs which are not officially classified as 'molecular testing laboratories'. This means that, to build a complete picture across the country, it is vital that the mapping exercise assesses what is happening in all pathology labs, not simply those with the official designation.

RECOMMENDATION

23
Ongoing work by National Cancer Registration and Analysis Service (NCRAS) to map the molecular diagnostic testing footprint in England should be continued. This should include an investigation of services which are not formally considered to be 'molecular testing laboratories' to capture all molecular diagnostic activity.

DIVERGENCE IN THE DEVOLVED NATIONS

The picture for molecular diagnosis differs from nation to nation, and challenges are unique to the policies and structures that are in place. Certain funding models not being rolled-out across the whole of the UK, means – for example – that a patient in England may have access to medicines/testing options that a patient in Scotland might not. However, there are also opportunities to learn from instances of best practice across the devolved nations.

Access to treatment

Historically, there has not been alignment in access to treatment across the devolved nations. In September, the Northern Irish Department of Health confirmed that medicines approved by the Cancer Drugs Fund (CDF) will be considered in line with existing arrangements for Northern Irish endorsement of NICE recommendations and be equally accessible which should be welcomed. In the absence of equal access to date, there has been criticism of the impact on patients living in Northern Ireland. Progress is, however, being made in this area. Wales' New Treatments Fund was launched to help health boards in Wales speed up the availability of new medicines and the Welsh Health Specialised Services Committee (WHSSC) is commissioning new tests and treatments which are CDF-approved.

Funding for diagnostic tests

This lack of alignment across the UK has resulted in a mixed picture of funding for new diagnostic tests in Northern Ireland and Wales. With Northern Ireland not having access to the CDF until recently, patients could not access ROS1 to date. In Wales however, the One Wales system – using a generic panel for solid tumours – has seen a big step forward.

In Scotland, testing has been consolidated into four testing laboratories – based on the genetics consortium – and somatic tumour testing has been in place in Scotland since 2009. Alongside this, a mechanism is in place for reviewing new developments through the Scottish Medicine Consortium by a Molecular Evaluation Panel – working in conjunction with the Scottish Pathology Network. The panel meets several times a year, with communication ongoing between meetings.

Scotland and Northern Ireland sitting outside of the National Lung Cancer Audit (NLCA) does risk a lack of alignment with regards to driving forwards improved standards in this area.

RECOMMENDATIONS

25
Scotland, Wales and Northern Ireland should consider aligning lung cancer services to the NOLCP.

26
Wales and Northern Ireland should develop a formal plan to ensure that they are able to rapidly implement a Genomic Medicines Service in their country.

27
Scotland and Northern Ireland should consider how they audit lung cancer services, to ensure that there is comprehensive information available which can be used to better understanding of lung cancer in these countries. They should consider whether they should adopt all or parts of the NLCA.

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