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Review Article

Embedding new technology into clinical ultrasound practice: Is role extension for sonographers the key to improving patient pathways?

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Abstract

Introduction

MicroUS is a new imaging technique that may have potential to reliably monitor prostate disease and therefore release capacity in MRI departments. Firstly, however, it is essential to identify which healthcare staff may be suitable to learn to use this modality. Based on previous evidence, UK sonographers may be well placed to harness this resource.

Topic

Currently, there is sparse evidence on the performance of MicroUS for monitoring prostate disease but early findings are encouraging. Although its uptake is increasing, it is believed that only two sites in the UK have MicroUS systems and only one of those uses just sonographers to undertake and interpret this new imaging technique.

Discussion

UK sonographers have a history of role extension dating back several decades and have proven repeatedly that they are reliable and accurate when measured against a gold standard. We explore the background of UK sonographer role extension and postulate that sonographers are best placed to adopt and embed new imaging techniques and technology into routine clinical practice. This is of particular importance given the dearth of ultrasound focussed radiologists in the UK. To effectively introduce challenging new work streams, multi-professional collaboration in imaging, alongside sonographer role extension, will ensure precious resources are maximised thus ensuring optimum patient care.

Conclusion

UK sonographers have repeatedly demonstrated reliability in many areas of role extension in various clinical settings. Early data indicate that the adoption of MicroUS for use in prostate disease surveillance may be another role suited to sonographers.

Introduction

Ultrasound imaging has been used widely in clinical practice for over 50 years with many of the earliest applications developed and pioneered by passionate obstetricians and radiologists, supported by radiographers and physical scientists.[1] However, as workforce changes occurred in the United Kingdom (UK) during the late 2000s, and newer technologies developed in radiology, the presence of the pioneer clinicians within the national health service (NHS) ultrasound teams is now rare.

Nevertheless, technological advances in ultrasound continue and a good example is the recent development of 29MHz microultrasound (ExactVu™, Markham, ON, L3R 2N2, Canada) for assessment of prostate cancer. Recent clinical trials have demonstrated that microultrasound (microUS) is a useful addition to multiparametric magnetic resonance imaging (MRI) in detecting clinically significant prostate cancer, with both modalities complementing each other.[2] Early evidence suggests that microUS will play an important role in assessing prostate disease, particularly in those patients in whom MRI is contraindicated.[3] Here in the UK only two sites currently have microUS systems and we believe ours is the only one being used solely by sonographers.

The sparsity of published evidence regarding the use of microUS indicates that this is a novel regime and practitioners undertaking, interpreting, and evaluating the outcomes of such imaging will require significant knowledge and skill development if it is to be a useful reliable tool.[3] As with implementation of any new technology, challenges frequently have to be overcome prior to embedding into routine clinical practice and, in this case, it is the radiology team that has the opportunity to reassess the traditional diagnostic pathway by developing the sonographer workforce to be able to use microUS.

Role extension in healthcare is not a new concept. It was defined within an imaging setting by Hardy and Snaith[4] as involving the development of competence, knowledge and skills beyond those achieved at initial qualification. Locally, role

development has been well supported. There is an extensive history of sonographers in this institution performing prostate biopsies and, more recently, developing a successful and accurate[5] MRI and US fusion prostate biopsy protocol. Currently, we have a team of five sonographers working together to develop their knowledge and skills in microUS in the expectation that this technology will open new avenues for the assessment and surveillance of prostate cancer in the long term. As with the introduction of many new imaging techniques, there is little in terms of academic training in the early stages. Therefore, formal in-house assessment and appraisal of the new service has commenced locally and preliminary indicators suggest that as more sonographers add microUS to their prostate imaging armoury, capacity may increase and workflows could be more effective. Pressure on MRI services for prostate assessment may also be eased. This is vital considering prostate cancer is estimated to affect about 1 in 8 men in the UK.[6]

This paper reviews role extension for sonographers in the wider profession including resistance to, and drivers for, change. It also considers both benefits and risks associated with role extension, particularly for those sonographers working within the UK prostate cancer pathway.

Concepts of skill mix

The importance of finding the optimum balance of staff to ensure cost-effective, high-quality care is accepted.[7] However, the concept of skill mix remains vague, ambiguous, and may be attributed to one or multiple skills. Cunningham et al[8] identify that this lack of understanding can lead to an improvised interpretation and implementation of skill mix within local teams. The definition of skill mix provided by the British Medical Association attempts to offer an unambiguous statement defining the balance between staff groups:

> *"The balance between trained and untrained, qualified and unqualified and supervisory and operative staff within a service area as well as between staff groups."* [7]

This description, however, makes no reference to the roles of the various staff groups changing or extending roles to meet service needs, only that the correct

balance of staff is necessary which then consequently ignores the essential interaction required between differing professional groups.

Relying on skill mix for economic advantage in a bid to prevent attrition, or to fill gaps due to staff shortage, may not always provide benefits for patients or healthcare providers.[9] Although, when combined with role extension, either by enhancing current roles, or by innovation and the creation of new roles for practitioners,[10] skill mix can provide a safe and effective way to deliver service improvements without detriment to patients and provide increased job satisfaction for staff involved.[11]

Concepts of role extension

Role extension is a mechanism to develop and promote a flexible, resourceful, and motivated workforce although, commonly in healthcare, it refers to supplementary skills and responsibilities which are an escalation of those obtained at the point of professional qualification and registration.[4] Alongside skill mix, managers are encouraged to support role extension to avert crisis in the availability of either staff, skills or resources. In addition, allowing the workforce to extend their knowledge and skill base can positively enhance how practitioners consider their place in the team.[12] Roles naturally develop in response to innovations in healthcare. However, there is documented reluctance to empower junior staff[13] and, clearly, promoting role extension whilst maintaining safe and effective practice, for all members of the team, is a fine balance that needs to be considered prior to implementation.

Radiology departments have seen significant changes to technology, particularly as the digital age has embedded in healthcare. As services change, and new technology becomes available, it is inevitable that the role of practitioners has to develop beyond the skills learnt during initial training.[4] For some, this will take the form of advancement beyond learning new technical skills, and will involve the attainment of higher professional knowledge, commonly for sonographers, by undertaking master's level programmes of additional study.[14] Role extension for practitioners will, inevitably, provide options and viable solutions for skill mix and, arguably, can provide a more resourceful and dynamic workforce with transferable skills and attributes[15] that can add resilience into a team.

Historical Clinical Practice

Traditionally, only radiologists or urologists performed diagnostic transrectal prostate biopsy procedures within the cancer pathway. Indeed, on mainland Europe and North America, the idea of a non-medic performing ultrasound-guided procedures remains highly contentious.[16] An emotive position statement by the German Ultrasound Society[17] in response to an earlier editorial by Edwards and Sidhu,[18] raised concerns about the reproducibility of ultrasound imaging by a technician that then precludes accurate interpretation by a third party radiologist or other medic. As such, there remains a belief that accountability for ultrasound examinations and reports should not be delegated beyond the medical profession. However, despite the ongoing argument about who should undertake medical imaging in continental Europe, it has been longstanding good practice within the UK for sonographers to independently perform and report on medical ultrasound examinations.[18]

Independent sonographer practice in the UK has been driven primarily by a chronic shortage of radiologists.[19] In addition, technological and interventional advances have resulted in radiologists extending their own skill set and roles into more complex procedures that have previously been undertaken by other medical specialities, resulting in a void which has been filled by radiographers.[20] UK radiographers and sonographers were encouraged to undertake duties delegated by radiologists and supported by the Royal College of Radiologists (RCR) as early as 1996, to ensure that service demands could be met.[21] This strategy paid off, and over the years, sonographers have proven repeatedly to be safe, reliable and effective in a range of clinical settings.[22-26] Therefore, sonographers may be a suitable workforce to develop the knowledge and skills required to apply the new ultrasound imaging techniques that could enhance the prostate cancer pathway.

Image interpretation

Diagnostic ultrasound imaging within the prostate cancer pathway is niche with few practitioners performing transrectal ultrasound examinations[27] and even fewer have experience of microUS. There is image interpretation guidance[28] for this new modality but no published standards for diagnostic accuracy, which is yet to be investigated. Even with established imaging modalities, there is no quality standard for image interpretation of non-obstetric ultrasound (NOUS) so it is perhaps not surprising that none exists for novel techniques. The RCR suggests a benchmark accuracy of 80% against a known gold standard expert[29] but with no expert in the

team, skill development and role extension will require multi-professional collaboration to determine the appropriate level of agreement achievable.

Sonographer role extension

For most UK sonographers, performing, interpreting, and providing an informed opinion on their findings is standard practice[30]. However, increasingly, sonographers are extending their roles to incorporate more complex procedures, such as ultrasound-guided biopsies, fine needle aspiration, and providing patient management advice.[31] The first instances of sonographer role development into the field of prostate biopsy were reported in 2005 when Wright[32] identified four sonographers who were trained to perform transrectal ultrasound guided prostate biopsies so that

> *"spare equipment capacity could be utilised despite a lack of spare radiologist capacity."*

Sonographers are commonly the first point of contact for patients, particularly for patients attending for surveillance imaging where scans are performed prior to consultation.[33] The intimate nature of prostate imaging requires an innate professionalism and an understanding of the needs of the patients under investigation for suspected cancer. Advanced practice role extension in this field will be successful only if practitioners with these skills, given the sensitivities involved, are used.

Roles and responsibilities for sonographers vary widely across UK NHS trusts.[34,35] A recent review of a small cohort of sonographers identified that only 35% (n = 32 / 98) felt they had extended their role beyond that of initial training; of these only 9% (n = 3 / 32) performed ultrasound-guided prostate biopsy.[31] The more recent, larger cohort study of 300 sonographers undertaken by the BMUS[34] identified that 81% of respondents were practising at an advanced level in terms of clinical duties. On further analysis of the data, it emerged that only 25% of sonographers truly fulfilled the Health Education England criteria for advanced clinical practice.[36] Furthermore, only 3% (n = 8/300) stated that they routinely perform prostate ultrasound examinations and, most commonly, this was done to guide biopsy sampling and not diagnosis.[34] Neither survey is an extensive cohort sample from the sonographer population, although the exact number of sonographers working in the UK is poorly

understood, partly due to the diverse entry routes into the profession and partly due to the fact that sonographer is not a protected title and not identifiable on the NHS staff returns.[37] Neither survey, therefore, may be truly representative but both do indicate that prostate imaging, by sonographers, is rare. The reasons for so little role extension in prostate imaging is not explored in either study. It may be that the demand for such skill development is limited as this skill remains the domain of medical colleagues; equally, it could be that the desire to extend skills in this area is lacking. This may lead to limitations in the development and implementation of new technology given the scarceness of peer support. Whatever the cause for why so few sonographers undertake prostate imaging, Nightingale et al[38] have identified that challenges of staff shortages, high attrition rates and technology advances may well become additional drivers for change in the future.

Drivers for change

Healthcare is becoming more complex and demand for diagnostic ultrasound imaging increases at approximately 5% per annum,[19] although this could increase more rapidly as the effects of the COVID-19 pandemic and subsequent increasing demand for cross-sectional CT and MRI are realised. The 2020 RCR workforce census, identified that the NHS radiologist workforce is currently short-staffed by 33% and this shortfall is predicted to grow to 44% by 2025.[19] Furthermore, fewer radiologists are choosing to specialise in ultrasound. These factors, combined with the aging population presenting with increased incidence of cancer[31] may result in unmet demand and increased waiting lists unless other means of providing essential diagnostic imaging can be found.[39]

There is, however, little published evidence to support the notion that radiologists' capacity is released by radiographer role extension. Indeed, whilst guidance and standards have been published to underpin skill mix,[21,40] Loughran[41] describes the strength of opposition encountered by a minority when radiographer reporting was first proposed. The anecdotal evidence Loughran[41] reports suggests that the introduction of skill mix is a contentious issue, however beneficial to improved activity or patient care that may be. In support of role extension of radiographers, Forsyth and Robertson[42] identified that a large proportion of radiologists they surveyed (82%) were in favour; despite this, a greater understanding of the benefits and risks, particularly in areas of practice using new and developing technologies is required.

Benefits of role extension

Role extension not only benefits patients and provides support to radiologists and imaging services, it also benefits the practitioners. Respondents to Henderson et al's questionnaire[39] describe a feeling of increased job satisfaction and morale within the team due to their input into improving patient care pathways. At a time of workforce supply issues,[37,38] anything that can enhance the wellbeing of staff within teams must be valued and encouraged. Inter-professional learning and development can help strengthen team bonds by increasing mutual respect and breaking down barriers,[43] particularly as new services emerge or there is role extension across professional boundaries. The professional recognition within teams develops over time and with increased confidence and experience, further enhancing the feeling of personal achievement, self-reward, and job satisfaction.[15,35] For service providers, this increased motivation is more likely to lead to staff retention and promote career development for junior staff[44] potentially yielding a further cost saving benefit. However, role extension leading to embedding new interventions and techniques in practice, improvements to services, improved patient care, and potential benefits to practitioners can only be realised with support from multi-professional teams, and with sonographers and radiologists working together with a common goal.[35,40]

Risks of role extension

Any changes in practice have to also be considered in terms of risks to both patients and practitioners. Calafiore[45] describes the perception held by the Royal Australian and New Zealand College of Radiologists (RANZCR) that radiographers do not receive appropriate and relevant education to ensure safe practice. A small survey of eleven radiologists identified a further five key risks that respondents expressed when the issue of radiographer role extension was explored.[42] The risks identified were:

- Impact on specialist registrar (SR) training.
- Dilution of radiologist's own skills.
- Radiographer's recognition of own limitations.
- Lack of clear medico-legal responsibilities.

- Clinical governance issues.

The two risks of impact on SR training and dilution of radiologists' skills have not been further explored and no other published evidence exists to support these survey findings. It is likely that these perceptions may be related to professional protectionism, particularly as a less qualified practitioner undertakes new roles traditionally performed by radiologists.[39]

Limitations to practice

Identifying limitations to practice is key to the delivery of safe and effective patient care, whomever is undertaking the procedure. The perceived lack of education of radiographers, by radiologists, was identified by Loughran[41] as he explored the extended role of radiographers within his own clinical setting. However, he later identified that radiographers undertaking postgraduate training were assessed to a far larger degree than their radiologist colleagues within the narrow scope of practice in which they were being trained.[41] Such is the emphasis on delivering underpinning knowledge and skills that recent policy and practice guidance for radiographers reporting has been published with the aim of establishing and maintaining standards across imaging networks in England[46] and reducing the risk of misdiagnosis.

Clinical governance procedures

Clinical governance procedures are essential if providers are to assure a quality service. Clinical governance in radiology includes using audit and peer review to maintain standards and reduce discrepancy rates in image interpretation.[47] Parker and Byass[48] published details of a peer review tool that could be used to provide a transparent and tangible account of sonographer performance and, thereby, monitor and improve service delivery. Clinical governance procedures are now well established within radiology practice with the process of learning from discrepancy meetings now an advocated standard published by the RCR.[49] Peer review processes, and identifying learning from errors, is a documented requirement for professional practice[30] and are critical as new imaging techniques are deployed in patient care pathways.

Summary

Patient pathways can be improved when a multi-professional approach is utilised. The role of sonographers could be extended to safely develop knowledge and skills in the use and interpretation of microUS. However, the published evidence all review delegated tasks that were previously undertaken by radiologists; there are no known studies reviewing the implementation of new, untested technologies in imaging by non-medics or by a multi-professional group.

Role development of sonographers should be supported to ensure that this new technology can be embedded in the prostate cancer pathway. However, skill mix is essential if services are to be delivered in a safe and sustainable manner, which subsequently benefits patients.

The proposed new technology of microUS has no benchmark standard for performance to be measured against and, as such, further studies are required to determine if such a standard can be identified as expertise within the multi-professional team develops. However, careful in-house assessment and evaluation of the process of embedding technology in practice is required to ensure this is robust and accepted by the multi-professional team delivering patient care.

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