<u>The Role of the Radiologist in the Year 2040: Discuss.</u>

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(919 words)

It is a typical weekday morning in the year 2040 and the radiologist parks up and plugs in her car. The sun is hot, despite the early hour; the latest weather report promises a summer to beat the legendary heatwave of 2018.

She arrives in the radiology department, which is large and appropriately situated in the nucleus of the hospital. It is bustling with staff who have a wide range of specialist skills – clinical, technical, computer programming, data science, research. Everybody is keenly discussing their bank holiday plans: the royal wedding of Prince George is this weekend.

The morning starts with the usual briefing and there are plenty of duties to delegate. In this hospital, like many in the country, consultant radiologists make up the largest group of the hospital's senior doctors. Over the past twenty years, the economic climate has forced the health service into a hefty restructuring. In the reform, radiology was recognised as the cornerstone of future healthcare and, as a result, gained substantial funding. At long last there were enough radiologists to cope with the demand and the UK was climbing the European league table.

She then attends the Admissions Meeting, where each patient admitted overnight is discussed and assigned to an inpatient team. Here, the radiologist plays a central role. In discussion with her colleagues from other specialties, she discusses the management of the new patients and helps plan what further imaging may be of benefit. In some instances, at this point a radiologist may take over the care of the patient, particularly if they will require an interventional or radiotherapy procedure.

Some of her radiology colleagues will spend the morning managing the Single-Point-of-Access hot desk. Here, they will receive referrals directly from GPs, and together will plan which radiological examinations should be carried out to assist diagnosis and management. In this way, the radiologist acts as a gatekeeper to the hospital's secondary and tertiary services. Depending on the results of these imaging investigations, the radiologist can then refer directly to the appropriate clinical sub-speciality for ongoing management of the patient.

Other colleagues will be working in the interventional suites, performing radiology-guided procedures and giving radiotherapy treatments. There has been a huge expansion in this field, with many surgical interventions now solely performed under imaging guidance and a growing number of therapies utilising radiation and ultrasound. Operations are becoming ever less invasive, seldom requiring an anaesthetic and overnight stay, and thus the morbidity and mortality associated with surgery is declining. There is close liaison between radiologists and the

surgical and medical sub-specialties and patients are often under joint-care. This engenders a continuous, mutual learning environment between the different professionals.

With each technological development, the radiology department is able perform to more examinations, with greater accuracy and efficiency. This in turn enables them to take on a greater workload. Thanks to the embedding of artificial intelligence (AI) programs, the system can manage this demand. AI is now fully operational within the radiologist's reporting platforms; regularly used to triage plain films. It flags up abnormal exams so that they can be reviewed by the radiologist more quickly. If normal, it is also able to report as such, and quantitatively compare many different radiographic features with any previous examinations the patient has had. AI also supports the radiologist to report the more complex imaging modalities identifying, sizing, comparing and quantifying lesions.

Many other aspects of the radiologists job have been streamlined. Time spent discussing referrals has significantly reduced. The active role that the radiologist plays in the care of patients, and the close liaison with different specialty teams, has curtailed the requesting of unnecessary examinations. Furthermore, the software program through which requests are made integrates the patient's clinical history with the results of any previous investigations and rejects requests that are not clinically indicated, based on the latest iRefer guidelines.

Reporting is now much more intuitive. Reports are pre-generated, and so can be completed more quickly and with prompts. This has led to a nationwide standardisation of reporting. All images and reports are uploaded onto a national viewing system, which is accessible on any device. Alongside the clinical report, there is also an automatic report generated for the patient – where clinical language is distilled into layman's terms – which is automatically uploaded into their secure online health record.

The future of radiology lies within the 'deep learning' of AI systems and the evolution of the field of radiomics. Every radiologist plays a role in the growth of these technologies by contributing their clean, accurate, standardised reports to the national mega-database. From this huge data set, computers are able to learn, test themselves and ultimately report more complex images. Radiomic programs are able to mine the data and produce models with which to predict individualised diagnoses and prognoses, with greater accuracy. The era of precision medicine is upon us and the radiologist is a key player.

After an afternoon spent teaching the trainee radiologists and radiographers – of which there is a healthy number – the radiologist goes home. As she puts her feet up and watches the BBC News, she reflects on the changes that have occurred since she started her career as a radiologist. It seems quite remarkable that the health service has come so far, and that technology can now do so much. And at that moment there is a report on the News: 'the machines are going to take over… Radiologists may soon be out of a job'. She smiles to herself – she's heard that one before.